Design Guidelines for Inclusion of Children with Disabilities in school Environments

A DISSERTATION

requirements for the award of the degree
of
MASTER OF ARCHITECTURE

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JUNE 2019

Acknowledgment

Firstly, I would like to express my sincere gratitude to my advisor Dr. Gaurav Raheja, Associate Professor at Indian Institute of Technology, Roorkee (IITR) for the continuous support of my Dissertation study and related research, for his patience, motivation, and immense knowledge. His guidance helped me in all the time of research and writing of this Dissertation. I could not have imagined having a better advisor and mentor for my study.

Besides my advisor, I would like to thank the rest of my department faculty for their insightful comments and encouragement, but also for the hard and constructive questions during dissertation review which incentivize me to widen my research from various perspectives. In particular, I am grateful to Prof. P.S Chani for enlightening me the first glance of research.

My sincere thanks also goes to Ar.Tanuja, Ar. Jinoj and Swapneel who provided me an opportunity to join their team, and who gave access to their research and general knowledge on the subject. Without they precious support it would not be possible to narrow down my research topic.

I thank my fellow classmates in for the stimulating discussions, for the sleepless nights we were working together before deadlines, and for all the fun we have had in the last two years. Also, I thank my friends in the following institution of Indian Institute of Technology, Roorkee (IITR).

Words fall short to thank Sachin V. for being a friend and a confidant at every stage of the course, giving me valuable suggestions at any hour of the day! And also accompanying me on my study trips in Delhi, breaking the language barrier. My friends Ipshita, Indu S. and Japleen deserve heart-warming thanks for accompanying me through all the sleepless nights spent in hostel working, especially my batchmate and roommate Saniya for her enthusiasm and dedication which encouraged me through tough times in working for the dissertation and my Undergrad friends especially Rajesh Reddy in helping me find research study areas. I will always cherish the encouragement and warmth shown by them.

Most of the results described in this thesis would not have been obtained without a close collaboration with few school and organization for CWSN(Children with Special Needs). I owe a great deal of appreciation and gratitude to principals, teachers, employees and staff members, of each and every school/ Organisation.

I would like to take this opportunity to express my love to all the wonderful children who have been part of my study and in the process given me reasons to enjoy working for my dissertation.

Last but not the least, I would like to thank my family: my parents and to my sister for supporting me spiritually throughout writing this dissertation and my life in general. I'm grateful to their eternal support, money and understanding of my goals and aspirations. Their infallible love and support have always been my strength.

ABSTRACT

Design Guidelines for Inclusion of Children with Disabilities in school Environment

The current mandate of free and compulsory education for all children aged 6-14 years in India is based on the principle of inclusive education. Behind this constructive move is the recognition of education as a fundamental right under Article 21A of the Indian Constitution, the Right of Children to Free and Compulsory Education Act, 2009 (RTE) and the 'no rejection policy' of Sarva Shiksha Abhiyan (SSA).

It can be safely assumed that achieving the Education for All (EFA) will be impossible without improving access to and quality of education for children with disabilities. One of the barriers in achieving inclusive education is Physical and environmental barriers of schools. (Singh J. , 2016) Various types of barriers continue to impede their participation in education. Inaccessible transportation to school, as well as inaccessible facilities in schools such as drinking water units, meal areas, and toilets, inappropriate classroom furniture, slippery flooring, and inadequate illumination and ventilation can pose barriers to the education of children with disabilities. Furthermore, teaching and learning practices and materials that do not cater to the needs of children with disabilities, and the prevalence of negative attitudes among parents, communities and teachers, adds to the challenge not just of access, but also of retention and learning of children with disabilities. (Singh D. Y., 2015)

As mentioned by various research studies, it is noticed that there is a clear gap in between implementations to remove physical barriers and requirement. Bringing special children into mainstream requires adjustments that schools need to make in advance. (Blackmore & Victoria. Department of Education and Early Childhood Development., 2011) Guidelines For Inclusive Education For Children with Special Needs (CWSN) by MHRD and NCERT Index for Inclusion publications mentions removal of Architectural Barriers by providing ramps and accessible classroom but is not supported by any survey or field studies. (Ainscow, et al., 2003)

One of the many challenges for inclusion of children with disabilities is that there are no standard practices or established methodology to guide. (Singal, 2005) This study adopts a methodology drawn from analysis of relevant guidance from Indian and international publications and aims to Developing Guidelines for inclusion of children with disabilities in school environment in Indian context. (Srivastava & Noronha, 2016)

A thorough literature review is conducted to understand key principles of inclusive design by various national and international organizations working on inclusivity and derive specific principles for school environment. Since the scope of the study is kept to children with vision, hearing and locomotor disabilities, their spatial needs are studied in reaction to school design as well as to inclusive principles. Best practices or case studies are studied to gain knowledge about Design practices in inclusive schools. An exclusive list of needs for Children with disabilities is derived through these case studies and literature review. These needs form the base of questionnaire surveys, interviews and the analytical framework. for field visits.

Through a certain derived selection criterion, mainstream schools with comparable Children with Disabilities population are identified in the country. Field studies are selected to get a comprehensive idea of current situation of inclusivity in India in particular schools. Various methods like, Observation, Participatory and assessment tools are used to identify, understand and document the children needs, issues and Barriers in built environment.

These field visits are analysed in qualitative and quantitative database along with issues identified. Comprehensive understanding between the issues and inclusion principles is interpreted to draw certain key inclusive principles on which a school to be designed.

The conclusion follows a Design guideline for inclusion of Children with disabilities in a school on basis of considered principles. Further study may include Evolved Framework which gives guidance to the school for taking up School building design assessment and evaluate. Assessment can help in prioritizing the immediate needs and issues of design of already existing schools. and advise a phase wise development plan for mainstream school towards inclusivity.

Key words: *Inclusive Education, Children with Disabilities, Children with special needs, Disabilities, Inclusive Principles, Design Guidelines, Assessment Framework*

This research work sets out guidance on design considerations for an inclusive school in India – all of which will have at least some children or young people with disabilities.

Terminology: Used terms in the Research report

The term 'children' is used throughout this document to cover very young children in early years settings and pupils of primary and secondary school age attending schools.

Definitions:

Environment

This research typically addresses parameters of physical environment of school. Learning environment of school comprises design from site development to details of spaces, including services and infrastructure.

Disability

"A disabled person is someone who has a physical or mental impairment which has a substantial and long-term adverse effect on his or her ability to carry out normal day-to-day activities." Disability Discrimination Act 1995 (Act, 1995)

Impairment

Any loss or abnormality of psychological, physiological or anatomical structure or function (UN.Org, 2003)

Visual Impairment
Visual impairment, also known as vision impairment or vision loss, is a decreased ability to see to a degree that causes problems. Person with Visual impairment is termed as Blind (UN.Org, 2003)

Hearing Impairment
Hearing loss, also known as hearing impairment, is a partial or total inability to hear. A deaf person (Peson with hearing loss) has little to no hearing. Hearing loss may occur in one or both ears. (UN.Org, 2003)

Physical Impairment
Physical Disability means restriction in the movement of the limbs. Strictly speaking Locomotor Disability means problem in moving from one place to another — i.e. disability in legs. But, in general, it is taken as a disability related with bones, joints and muscles. (UN.Org, 2003)

Apart from the above-mentioned disabilities children with multiple disabilities or loss of limbs are also considered in this study
Mainstream Education

Mainstream education is a system where students indulge in a general classroom setting and students are expected to meet certain basis to participate in learning. The students must follow the already existing curriculum which is mostly devised by the state or central education board.

Mainstream Education is education system where students are expected to meet certain criteria to participate in a general education classroom. The student must comply and work along with the existing curriculum.

Special Education:

Special Education is education system where each student is addressed differently according to their needs and requirements, each students' differences are taken into consideration. A school which adopts special education has students of physical or mental disability. Many of these schools involves students of one specific disability and address the needs of those children. The school is systematically planned and adopted with services, equipment's and accessibility accordingly.

Inclusion Design:

'The design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible ... without the need for special adaptation or specialised design.' (Institute, 2005)

The British Standards Institute (2005)

Reasonable Accommodation means necessary and appropriate modification and adjustments not imposing a disproportionate or undue burden, where needed in a particular case, to ensure to persons with disabilities the enjoyment or exercise on an equal basis with others of all human rights and fundamental freedoms. (CRPWD, 2016)

(**Convention on the Rights of Persons with Disabilities** – Article 2, Definitions).

SEN – Special Educational Needs

CWD- Children with Disabilities

SEN and CWD both definitions are used interchangeable

CWDN- Children with Disabilities Need

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Research Proposal

1 RESEARCH PROPOSAL

1.1 Introduction:

Inclusive education (IE) has become an often-used concept over the last few years in International literature of education and school systems. In India it has gained popularity by its usage in government documents, policy making.

IE is about how we develop and design our schools, classrooms, programs and activities so that all students learn and participate together. These schools are termed as inclusive schools.

Vislie (2003) states that since Salamanca 'inclusion' has become a global descriptor, and the international community, by signing the declaration, has adopted its usage; however, this does not mean that there is a formally fixed and stable use of terminology. (Singh J. , 2016)

Inclusive school means that the school and classroom operate on the premise that students with disabilities are as fundamentally competent as students without disabilities. which includes inclusion in physical, cognitive, academic, social, and emotional. For full inclusion students need a least restrictive environment (LRE)

The prime focus is on Education and school-physical environment because, it is perceived to be one of the instruments of social change in all the developing countries. The extent of any social change, the places high choice on the role of education as the most important vehicle of social change[1]. A students personal success and achievements are directly influenced by his/her experience in a school environment. The more positive the experience, the more supportive and accepting the environment, the more likely the student will continue in their education. (Singh D. Y., 2015)

1.2 Research Gaps:

1. As mentioned by various research studies, it is noticed that there is a clear gap in between implementations to remove physical barriers and requirement. Bringing special children into mainstream requires adjustments that schools need to make in advance. It is argued by Dr. Shalini Yadava in his paper Inclusive Education: Challenges and Prospects in India that, focus on physical access to school rather than access to curriculum and equal treatment in the classroom is an additional and one of the major barrier to inclusion and is possibly resulting in dropout in India.[2] (Singh D. Y., 2015)

[2] Dr. Shalini Yadava(2013) Inclusive Education: Challenges and Prospects in India

2. The 2015-16 information from the Delhi-based National University of Educational Planning and Administration (NUEPA) for the District Information System of Education (DISE) shows that only 8.52% of CWSN's main instruction reaches Class IX — a dropout level of 91.48%. Special children's inability to finish secondary college is not unexpected, considering that most of India's 1.4 million colleges are ill-equipped to teach CWSN, with 77 percent having handicapped-friendly bathrooms and 40 percent missing lifts. (Singh D. Y., 2015)

3. Guidelines For Inclusive Education For CWSN by MHRD and NCERT Index for Inclusion publications mentions removal of Architectural Barriers by providing ramps and accessible classroom but is not supported by any survey or case studies.

Apart from Sruti Disability Rights Centre and Child Rights (CRY) research study, there's no substantial information about the current situation of Indian Inclusive schools, there is gap for case studies on Indian schools and form well reinforced guidelines as Designing for the disabled person needs to move beyond ramps and into an effective learning environment in an inclusive school. (Singh J. , 2016)

4. In the "Harmonised Guidelines and Space Standards for Barrier Free Environment for Person with Disability and Elderly Person" the report mentions children only twice by generalising with a full-grown individual in special requirements and there is no mention of school or learning environment design for barrier free access.

One of the many challenges for inclusion of children with disabilities is that there are no standard practices or established methodology to guide. This study also adopts a methodology drawn from analysis of relevant guidance from other Indian and international publications.

1.3 Aim:

Developing Guidelines for inclusion of children with disabilities in school environment in Indian context.

1.4 Research Questions:

1. What are key principles of Inclusivity for a school design?
2. What are the special needs for children with disabilities (C.W.D) in an inclusive school?
3. What are the best design practices around the world for an inclusive school and what is the current situation or ground issues in Indian schools?
4. What is the role of design in addressing the special needs of CWD in an inclusive environment?

1.5 Objectives:

1. To understand the key principles of Inclusivity for a school design and factors contributing to it.
2. To Identify the special needs for children of Disabilities in a school Environment.
3. To conduct field survey or investigation and thereafter identifying the issues and barriers in school environment.
4. To analyse and have comprehensive understanding of linkage between principles and Barriers/Issues.
5. To develop and propose Design guidelines for an Inclusive school with C.W.D

1.6 Scope and Limitation:

This research does not provide detailed technical specifications on accessibility features. The work is focused on secondary school age group and case examples of special schools for inclusive aspects study is confined to visual, hearing, speech and locomotor disability and not include Cognitive, Intellectual Disabilities as these disabilities as the approach towards inclusive is more towards teaching practices and methods rather than architectural.

The study also focuses on developing design guidelines for urban area taking case examples mainly from Delhi and Bengaluru.

Inclusive education also includes opportunities to children to be able to mainstream them in education and as well the infrastructure teaching methods administrative and social support is integral for inclusion and is not covered.

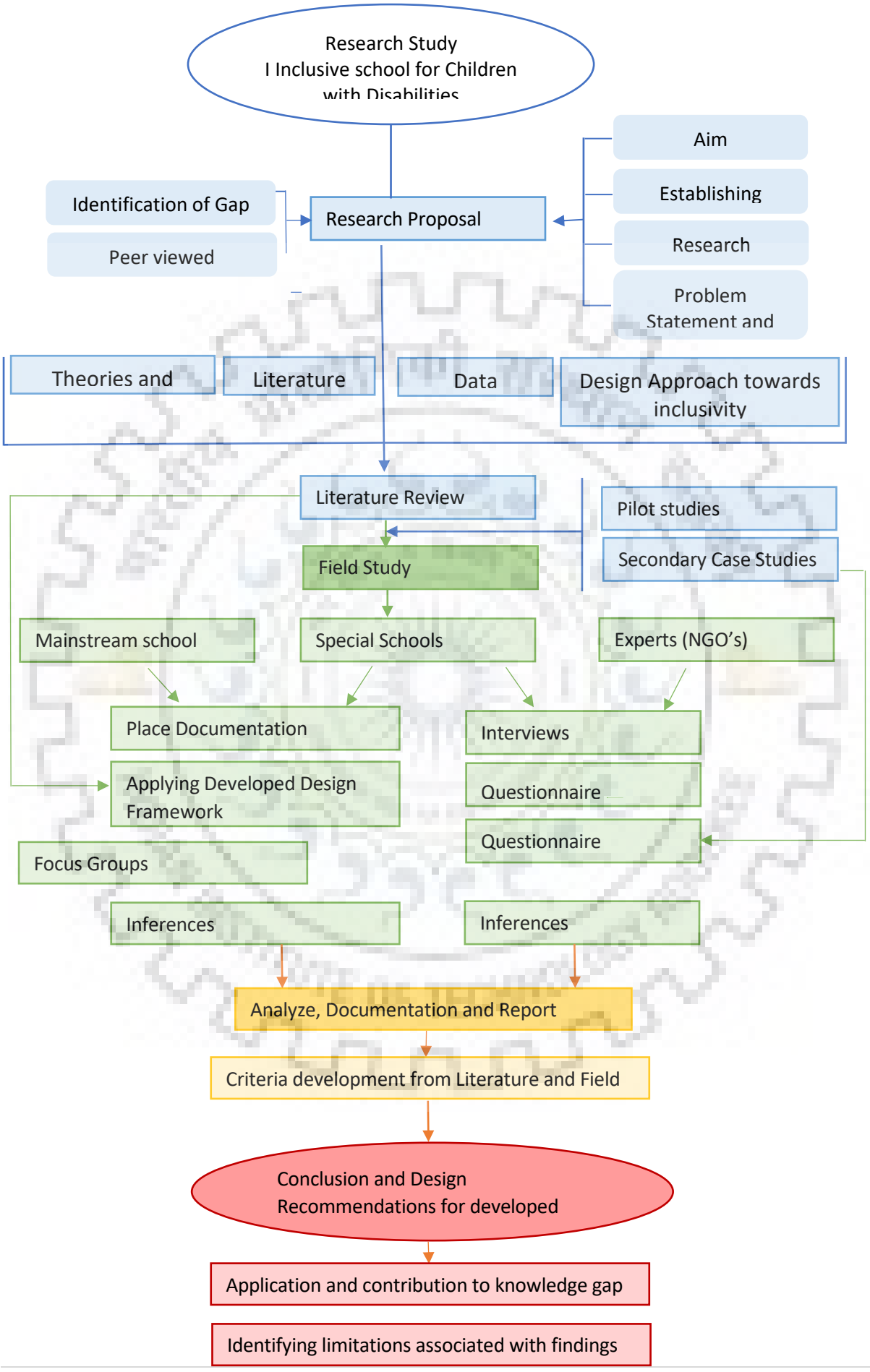
Study focuses on Development of guidelines and will cover ideas of inclusive design in education featuring elements like:

- Selecting an accessible school site
- Planning a school site
- Designing and building (entry, accessibility, circulation,etc…)
- Creating a learning environment (Interior elements)
- School playground and physical education (formal and informal learning spaces)

1.7 Research Methodology:

A systematic plan is drawn on a variety of both qualitative and quantitative research methods, including experiments, survey research, participant observation, and secondary data. Literature study review method helps in understanding the study background and in identification of various elements of

inclusive school. Field study includes both qualitative and quantitative methods. Methods like interviewing, survey of school facilities using tools such as assessment framework and questionnaire.


Research Study
I Inclusive school for Children
with Disabilities
Aim
Establishing
Research
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Questionnaire
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Inferences
Analyze, Documentation and Report
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Conclusion and Design
Recommendations for developed
Application and contribution to knowledge gap
Identifying limitations associated with findings

Figure 1 Research Methodology

1.8 Expected Outcome:

Critical understanding of inclusive education and basic knowledge of policies. Government undertakings and school approach towards designing of an Inclusive school.

Formulating list of elements of school physical environment critical for CWD.

To form assessment tools and methodologies to evaluate school's inclusion

Recommendations for significant changes in classroom design and school-built environment to accommodate mainstreaming of students with disability. Reflections upon essential components of the transition in school design and planning, the appropriate use of space.

1.9 Data Collection Framework

Table 1 Data collection Framework

Table 1 DATA COLLECTION FRAMEWORK						
	Sub Division	**Source**	**Process of Underlying Review of literature**	**Methdology Approach**	**Unit of data**	**Scope of Application**
Conceptual		Classification and coding of disabilities	classification, terminologies and definitions	Study of Guide on Disability Equity from Disability and Health (ICF)	Types, 3 dimensions for change, definitions	Provision of accurate information relevant to particular type.Survey questionnaires should be aligned to reflect these definitions in order to achieve consistency
		National and International Inclusive Education Models	The model includes concept, purpose, content, educational activities, material and learning resource, measurement and evaluation method.	Review of domestic and international literature on inclusive models	Types, model management principles	Provides interesting information of different inclusive models, helps to compare management principles of international and national. Better understanding of Transformation from Mainstreaming toward inclusive education
		policy and practice concerning inclusive education in India	problems and prospects of inclusive education in india	Studying practiced approach towards education in India	Statistics, social aspects of inclusive education	Awareness of human rights in communities
			Key Elements to Building an Inclusive School	Reviewing various literature global approaches and the Whole Schooling Research Projects.	Aspects of Inclusive education	To apply research data to development a children-based research especially observation method.
	Quantitative	Population censuses Sample surveys (either general social surveys or specific health and disability surveys) Administrative collections and registries.	Measurement of disability	targeted approach,	Numbers, percentages	Placement information in relation to enable comparisons using achieved data on existing scenario.
		Student Needs Profile	School-Student Relationships and School Adjustment, Progress and Remaining Challenges.	Consistent Collection of Data on schools students with disability	Percentage and rating	The level of adjustment that students with disability are provided in both the classroom and whole of school context
Theriotical	Qualitative	policy and practice concerning inclusive education in India	Inclusive education in India	chronological approach, tracing the development of this concept.	Understating of situation and objectives formation	Preliminary analysis on the baseline data to find gaps in it
		UNESDOC Database and othe world wide database	Leading Inclusive School Development is part of a set of resources designed to support the development of inclusive education systems	Review of range of working methods	Evaluating progress	Development of guidance tool and Building on existing practices
		Training tools for curriculum development	keys to quality classroom assessment,	Exploring the basic competencies (knowledge, skills, values, attitudes, etc.)	Background information and discussion data	basic conditions and competencies needed to make student assessment more inclusive
		Disability and the Environment	Identifying the environment as a factor in disability	elements of the environment to provide examples of how the environment affects the degree of disability	Aspects of environment	what features of their physical, built, interpersonal, or social environment help or hinder person with disability, data about participation restrictions.

		studies that look at benefits, costs, and specific elements of Inclusive design	Inclusive Design Principles for School	Study of Organizations and researches that embrace and implement a data-based, continuous improvement approach for inclusive practices.	Parameters	Criteria formation for evaluation of spatial design
		Descriptions of practices and strategies of school management system	Identify the practices that reflect those that a range of educators and related services personnel agree are realistic, appropriate and effective	a multisite, mixed method collective case study	spatial and management data to context	investigation into effective building practices for children and students with disability in early childhood education

Chapter 2

Literature Review and Research Methodology

Literature Review

2.1 Understanding Inclusive Education

2.1.1 Inclusive Education Introduction:

Inclusive education is an approach to educating children with disability(CWD) with normal ones under same roof irrespective of their differences and strives to maximize the potential of children. It is about how communities develop and design schools and all learning and activity spaces associated with the school to accommodate all children and their participation.

With the establishment of Salamanca Statement and UN's Universal Declaration of Human Rights (1990) Inclusive Education began to evolve.

“Regular schools with this inclusive orientation are the most effective means of combating discriminatory attitudes, creating welcoming communities, building an inclusive society and achieving education for all; moreover, they provide an effective education to the majority of children and improve the efficiency and ultimately the cost-effectiveness of the entire education system.” (The UNESCO Salamanca Statement, 1994)

The research focuses on to provide a guide for the design of a school in India after critical evaluations of inclusive features of school on various aspects of service and utility by methods derived from literature reviewIt includes parts on the external environment entrances to the school inner circulation, evacuation, other equipment, schools and extra excellent methods for handling the school's accessibility

Therefore, integrating accessibility into school design is a social change that is required to uplift Inclusive Education. Usually this is intercepted as expensive and add to the construction cost. However, in reality when accessibility is interated at the starting stage of planning there is significant difference, it adds very less to the total construction cost as much as just one percent of total cost of project according to World Health Organization’s (WHO) 2011 World Report on Disability.In reference to the research done by HEART (Health & Education & Resource Team) on the cost estimation of school to integrate accessibility at various parts of school they came to a conclusion that it costa one to three percent of total cost of project.

The inclusive educational environment is flexible enough to accommodate any student and is an effort to identify and remove barriers that exclude anyone. The way teaching is experienced is affected by space, light, facilities and even colour. These components can be used by schools to create structures and premises that represent their teachers and students needs and wishes. (Carlsen & Willis, 2007)

Although attitudes, teaching styles, curriculum, and school activities are important components of inclusion, the special needs child's physical environment can help or hinder the process. A significant opportunity exists for schools to improve learning environments and foster inclusive experiences by rethinking the classroom design or any learning space design. The physical space of a school must complement any inclusive learning strategy by creating an environment that works for everyone. Example a change in the class layout, providing centers that appeal different learning styles and being prepared for emergencies.

2.2 Inclusive Education Models:

International Inclusive school Models

- Push in or Full Inclusion Model
- Wang's Adaptive Learning Environment Model (WALEM)
- Team Teaching Model
- Strategies Intervention Model
- Circle of Inclusion Model
- National Inclusive school Models
- SikshitYuvaSewaSamiti (SYYS)
- Sir Shapurji Billimoria Foundation
- Joyful Inclusion Pack ,CBR network

Table 1 Inclusive International Models

International Models	Spatial implications	Teaching Strategies	Remarks
Push in or Full Inclusion Model	Least- restrictive environment	Placement of special-needs children in regular classrooms must be full time	The teaching process depend upon their backgrounds, interests, and abilities
Wang's Adaptive Learning Environment Model (WALEM)	Modification of the environment to accommodate student differences	Highly structured and hierarchically organized learning activities with an exploratory learning component consisting of a variety of learning activities	Instruction is based on diagnostic test results and informal assessments by the teacher
Team Teaching Model	schools with necessary support services and supplementary aids for both children and teachers.	General education and special education teachers join together and teach all students in one class as partners.	CWSN spend a portion of their day alongside their non-special education peers, another portion of their day is spent directly within a

			special education setting to more appropriately meet their needs
Strategies Intervention Model		The model is based on the belief that all students should develop their potential as independent and strategic learners across learning, social, motivational, and executive domains"	Special educators are taught to teach coping technique and learning strategies for acquiring, storing, and expressing content objectives
Circle of Inclusion Model		This is the most "personnel-intensive" model of Inclusion. This model is primarily used in the education of very young children	Frequent meetings are held to review the progress and needs of each child in a Circle of Inclusion classroom.

Table 2 National Inclusive school Models

National Models	Spatial implications	Teaching Strategies	Remarks
SikshitYuvaSewaSamiti (SYYS)	Regular classroom teacher is responsible for any adaptation that may be necessary for students' success in this environment.	Different learning styles and rates of learning by employing a range of teaching methods, including cooperative group learning, peer tutoring, team teachings and individualized instruction. v) Locate appropriate material,	community-based and community mobilization intervention initiative
Sir Shapurji Billimoria Foundation	Regular Classroom environment is adapted to meet the needs of CWD	teachers / students / parents and educationists participate in	Interventions to support need for specialized services

		workshops and access resource material	not a separate education system
Joyful Inclusion Pack ,CBR network	Contribute Resource material, technical support organization	The organization prepares a customized plan for each child and assist school in teaching	Organization works in locally relevant solution to scale up the basic early education services to every child in the State.

2.2.1 Arguments supporting the development of inclusive education:

Three broad arguments have been inferred from various writings in the field of literature on Inclusive Education in India. A shared sense of purpose is seen in all while engaging in finding the reasons for building Inclusive education in the country.

2.2.2 Economic argument

Mukhopadhyay & Mani (2002, p. 100) stated that inclusive education raised as an obligation rather than a option towards the cost effective approach towards bringing more disabled children under educational service.Mani(2001) notes that India because of scares of resources cannot opt for special education system and therefore inclusion is the only option. Similar arguments were raised by Sandhu (2001, p. 4),who states 'special educational programmes are very costly to maintain' supporting inclusive education being more of a compulsion rather than choice. As also noted by Jangira (1997) who argues that specifically in rural areas of India it is important where there's just one school, to cater to all including disabilities and their needs.

2.2.3 Growing disability movement

It is very prominent that strong suppport to inclusive education is growing, which has been lately supported by the passing of legislative act CPWD Convention for Persons with Disabilities Act, 2016.Many reserchers (Mani 2002), Chadha (2000, p. 10) argues that interation education has failed and it did not even serve to 5% of disabled children population. . Both lays the blame on integrated education approach; .Mani(2001) stating'In spite of concerted attempts over the last half of the century, there was restricted coverage of inclusive schooling. It is projected that the present coverage of kids with disabilities is about 1%'. Therefore, both conclude on inclusion is the way to go. Inclusive education is thus viewed as an ideal opportunity for the high numbers of children with disabilities, who have no

access to education. It is especially important for ‘more than 90 per cent of children with disabilities in the rural areas’ (Mani, 2000, p. 3). It is seen as a way of promoting their self-esteem and personal dignity.

2.2.4 Enabling the development of better educational practices

Some critics claim that accepting kids with disabilities in the mainstream school will lead to stronger instructional methods among mainstream educators or teachers. (Mukhopadhyay & Mani, 2002 Such assertions were produced in the PIED assessment. Mani (1994) observed that educators were of the view that by adopting creative approaches, having handicapped kids in schools produced them stronger educatorsSimilarly, the multi-site intervention study initiative (Ahuja, 1996, p. 403) also makes such assertions that it ' promotes [educators] to be more reflective and superior issue solvers not only for meeting the unique requirements of all kids, but also for competent duties related to learning and college organisation in particular 'According to Aggarwal (2001), educators will become ' better educators ' by educating kids with disabilities Commenting on the current situation, he says that educators take care of the requirements of slow students through unique tutoring programs in their schools and that it is the duty of any excellent professor to implement approaches to assist each and every kid in the school. Benefits of inclusive education to students

2.2.5 Benefits for Students with Special Needs

Spending the school day alongside classmates who do not have disabilities provides many opportunities for social interaction that would not be available in segregated settings (Sasso, Simpson & Novak, 1985).

- Children with SEN have suitable behavioral models. Without unique requirements, they can follow and imitate students ' socially appropriate behaviors. (Brown et al., 1983, 1989a)
- The additional facilities and supporting methods used in an integration school can be used by all Students/learners.
- Teachers cause of inclusive education create higher performance standards for SEN students. (Brown et al., 1989)
- In inclusive environments ,because of both general and special students, teachers expect suitable behaviour from all learners.
- Age appropriate material and functions may not be taught to children with special needs in a special school but will be taught in inclusive school (e.g. science, social studies, etc.).
- Attending inclusive schools improves the likelihood that learners with SEN will continue to engage throughout their life in a multitude of integrated environments. (Ryndak & Alper, 1996).

2.2.6 Benefits for Students without Special Needs

1. Students without SEN have a range of possibilities to interact in inclusive classroom environments with their age peers who encounter SEN.

2. They can act as peer tutors during teaching activities (Slavin, 1990).

3. During lunch on the bus or playground, they can perform the part of a special ' buddy '

4. Without SEN, children can discover a lot about tolerance, personal differentiation, and human exceptionality.

5. They learn that students with SEN have many positive characteristics and abilities.

6. Students without SEN have the opportunity to know about many of the sector of human service, including unique schooling, voice therapy, physical therapy, recreational therapy, and professional development. Exposure to these fields may contribute to career decisions for some.

7. Inclusion provides learners without SEN the chance to learn how to interact and cope with a broad spectrum of people efficiently. This also allows them to engage completely in an adult universalist culture ((Ryndak & Alper, 1996).

Source: Position Paper of the National Focus Group on education of children with special needs, NCERT,2011

Inclusive education not only benefits the children with special needs but also it gives an opportunity to a children to participate in all curriculum activities and they get an opportunity to understand each other by supporting each other. The main aim of the teacher should be all the round development of all the children of the class. By using digital recorder for notes, reducing the amount of spelling words adm having enrichment activities prepared and by incorporate sensory elements like visual, auditory, and kinesthetic and writing letters in salt trays can create interest in child in learning

2.3 Inclusive education in India

2.3.1 Statistical data

Being the world's biggest minority community, people with disabilities are looking for services and equipment accessible to non-disabled people and are therefore the least nourished, the least safe, the least trained and the least utilized.

The centrally funded system for Disabled Children's Integrated Education (IEDC) was introduced in 1974, which is presently being introduced in over 90,000 classrooms across the nation. The system was implemented in particular classrooms to provide equal chances and promote their preservation for kids

with disabilities. It supports appointment of special teachers, provision of resource rooms and removal of architectural barriers (MHRD 2009).

Despite the policies like Sarva Shiksha Abhiyan which promises education to all through universal access and promote free and compulsory education for children up till age 18 years, it is noticed about half the population of children with disability are illiterates. Around 28% (6,00,000) children with disability between age 6 to 13 years are out of school according to national survey report (2014), where at the time India has utmost Universal Primary school enrolment.

According to the data obtained in the NCERT's survey, Six States have carried out operations to develop an appropriate physical atmosphere and eight are in the phase of doing so, information acquired in the seventh study. The removal of architectural obstacles, however, continues largely restricted to ramps, railings and bathrooms in a few locations (J D Singh,2016)

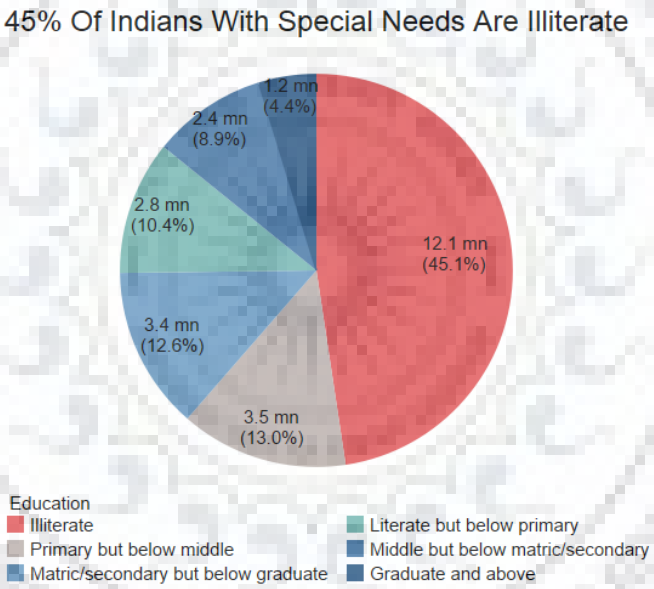


Figure 1 Percentage of Children with Disability in school and out of school

Source: Census 2011

In India volunteers of Sruti Disability Rights Centre and Child Rights (CRY) carried out a study to identify the problems faced by children with disability in a mainstream school, to reveal how inclusive the said school is?. On review of around 30 schools in Kolkata, it is noticed that around 83% of these schools need improvement in infrastructures like lack of ramps or lifts which a makes it a problem for the students with disabilities to access every nook and corner of the school. [1]

While internationally countries like Scotland, a study funded by The City of Edinburgh Council shows that many schools in the country were committed to inclusion at several levels in the physical and social

[1]cry (2007). [Ebook]. Retrieved from http://cry.org/resources/pdf/InclusiveEducation_CRYVol_Kol.pdf

environment, the research also identified schools focuses on factors within the physical environment of the school such as School modifications to contextual elements and inclusive classroom structure, thereby reducing the further efforts by children with disability.*Donald Maciver, Cathleen Hunter, Amanda Adamson, Zoe Grayson, Kirsty Forsyth & Iona McLeod (2018)*

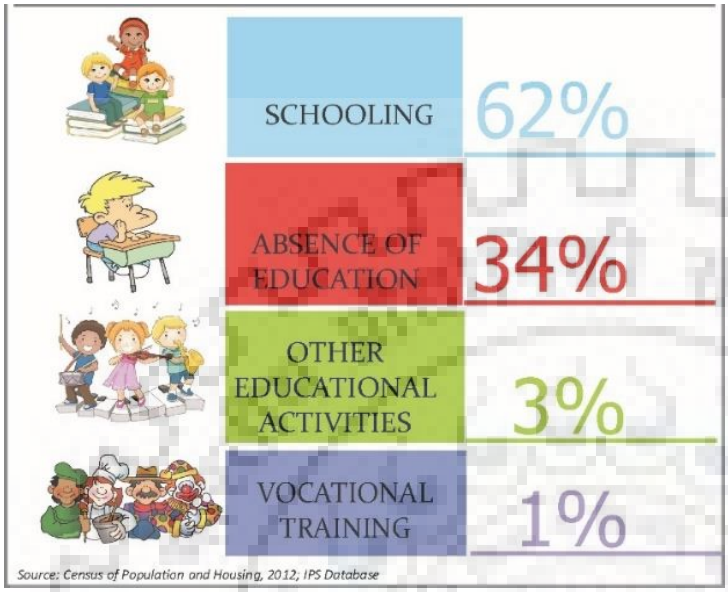


Figure 2: Education Activities of Disabled Children Aged 0-19 years
Source: Census of Population and Housing (2012)

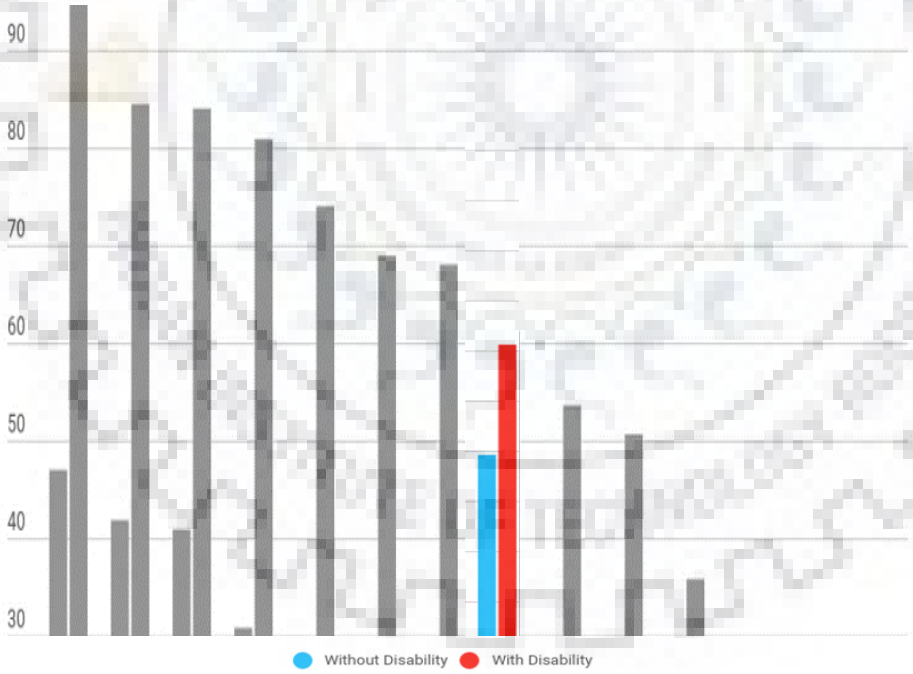


Figure 3 Global *Enrolment gaps for children with Disability in schools*

Source:Unicef Progress in measuring global school enrolment gaps for children with disabilities (2018)

The below figure gives a statistical data of disability type in India and this data helps in forming the focus group of study where The Research work is confined to visual, hearing, speech and locomotor disability

and not include Cognitive, Intellectual Disabilities as these disabilities as the approach towards inclusive is more towards teaching practices and methods rather than architectural.

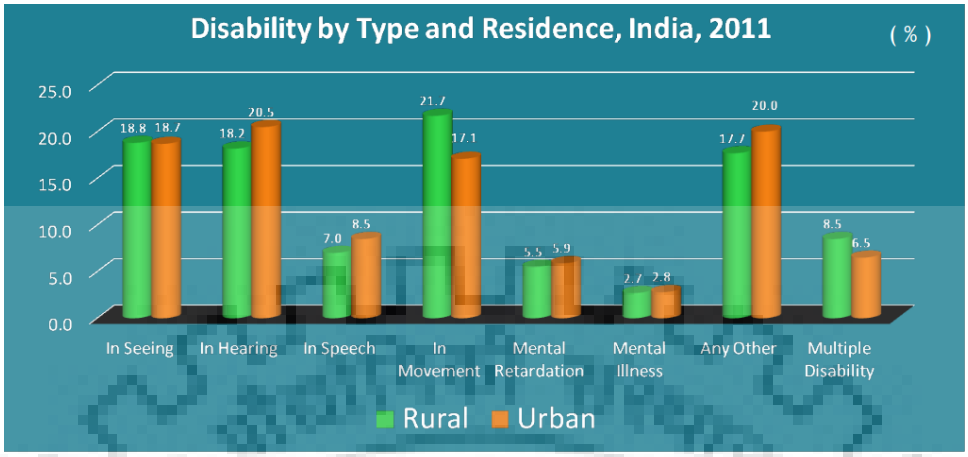


Figure 4 Disabled Population by Type and Residence (%) India
Source: Census 2011

Figure 5: Scope of research_ Disabilities types
Source: Public domain

The confinement of research work is to these disabilities namely visual, hearing and speech as speech impairment is associated with almost all who has hearing disability and Locomotor. The focus is on the three first ones since their needs have the biggest effect on the building and its design. These three groups all have different needs when it comes to accessibility. On three different scales.

2.4 Proportion of various types of Schools in India

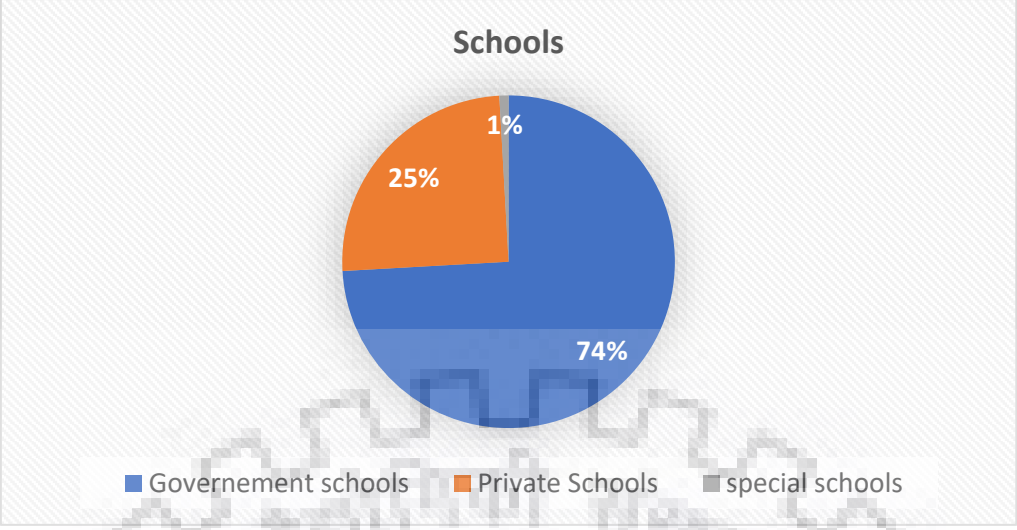


Figure 6 Statistics of types of schools

Data Source: National University of Education Planning & Administration, New Delh,2017 (Website:http://dise.in/)

Total number of secondary schools in India are around 15,16,865 in that 3,75,841 approx. 25% are private schools, 11,27,524 are Government owned schools and apart from the above-mentioned private schools 13,500.

Government is providing facilities for education of children with special needs at various levels of education

- Identification, functional and formal assessment of children with special needs (CWSN)
- Assessment of appropriate education placement
- Preparation of individualised education plan.
- Provision of special aids and appliances
- Transport and escort facilities are provided to CWSN under the programme to facilitate their access to a neighbourhood school.
- Provision of student assistance of 3000rs per annum.

2.5 Existing inclusive education practices in India

In India, numerous organisations are practicing both full-fledged inclusive education programs and pseudo-inclusive programs in multiple types. At the moment, at least 7 integrated education implementation policies are noted in India. They are listed as follows:

1. Models of resources where children with disabilities are studying in state school and staying in hostels intended for kids with no disabilities.

2Resource models where disabled kids study in the nearby special schools ' and stay in general hostels.

3. Resource models where disabled children are studying in general classrooms and staying at home with parents

4. Semi – resource models or collaborative designs in which disabled kids are educated in a separate class in a particular school only by the teacher with special education training.

5. Itinerant model where the child in his / her local school is visited by a resource teacher and the child remains with family members

6. Multi – resource model category where the regular teachers in a specific locality educate handicapped kids of distinct types in a general classroom..

7. Multi-category itinerant model in which one special teacher takes care of the requirements of children with disabilities of distinct types in a specific location.

(V. Madhavi, Ph. D,2017)

2.5.1 Research Stakeholders:

The responsibility to ensure that children with disabilities receive proper and quality education rests on many people. The research is meant to be used by key stakeholders who play an important role in ensuring physical accessibility to schools and school facilities. Having identified the different stakeholders, considerations and inputs from them are taken in the research.

The following stakeholders have been identified:

- Parents
- School administrators and management committees
- Architecture / Education Researchers
- Civil works contractors
- Non-governmental organisations (NGO's)

Parents: Most of the parents have lack of knowledge about their child's disability especially lower income community; this makes them dependent on school administration and teachers.

This research helps Parents in understanding their child needs and to evaluate school, try out the access to the school building and school learning environment.

School administrators and management committees: Meet with school administrators (headmaster/headmistress and block resource teachers) and discuss any barriers faced by the child with respect to accessibility from administrative point of view. Initiate a constructive dialogue on the child's specific needs to help the school administration and staff to understand what can be done to improve the learning. Everyone, including non-teaching staff, is responsible for ensuring that the school is accessible to all children. All persons in the school can use the checklist and assessment tools provided.

Architecture / Education Researchers: This research may help in further research on inclusive topic and inclusive education.

Non-governmental organisations (NGO's): Research inform the NGO Personnel's about the barriers faced by children with disabilities.

Civil works personnel: Civil works personnel undertake construction work as per preapproved drawings received from concerned agencies/ authorities. It is important that they are made aware of specifications for making schools accessible for children with disabilities.

2.6 Children with Disability needs: Correlation with Design Strategies

2.6.1 Children with Disability needs:

Every child has varied requirements and needs and every child is unique, each impairment and disability have particular needs and some are inter-related. There is wide spectrum of needs for children with disability which fall majorly under the following areas

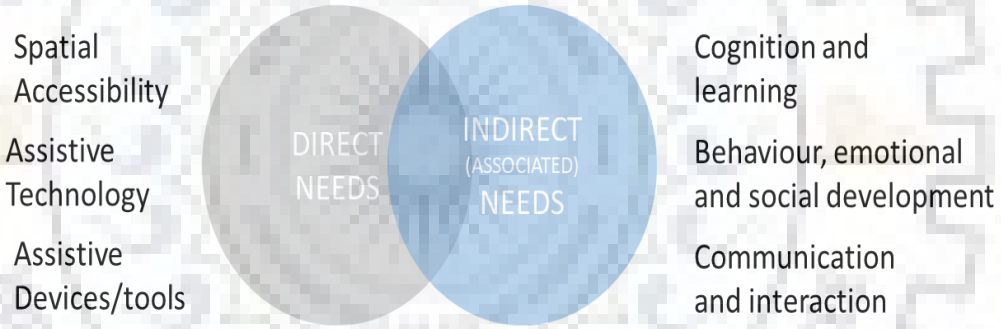


Figure 7 Children with Disability needs

Children with disability may have inter related needs, for example child with sensory need may also have communication and interaction need due to social stigma. There is a wide spectrum of sensory, multi-sensory and physical difficulties. Sensory needs range from profound and permanent deafness or visual impairment through to lesser levels of loss, which may only be temporary. For some children these needs may be accompanied by more complex learning and social needs.

Every child has varied requirements and needs and every child is unique, each impairment and disability have particular needs and some are inter related. There is wide spectrum of needs for children with disability which fall majorly under the following four areas.

- Cognition and learning
- Behavioural, emotional and social

- Communication and interaction
- Sensory and/or physical

Children with disability may have inter related needs where child with sensory need may also have communication and interaction need due to social stigma.

These needs can directly be addressed with architecture, Strategies in Architectural Design. The role of this research is to how to create spaces that meet the needs of the users especially all students in a school environment. Environment- Behaviour studies were incorporated, design of built environment that support and stimulate children development.

2.6.2 Cognition and learning

Children with these requirements need particular approaches to assist them learn and understand. These may include policies to promote linguistic growth, literacy and organizational abilities, as well as practical sensory or physical experiences to promote abstract thoughts and concepts creation.

Limitation: The Research work is focused on school age group and case examples of special schools for inclusive aspects study is confined to visual, hearing, speech and locomotor disability and not include Cognitive, Intellectual Disabilities as these disabilities as the approach towards inclusive is more towards teaching practices and methods rather than architectural.

2.6.3 Behaviour, emotional and social development

Children with behavioural, mental, and social problems may be removed or isolated, disruptive, and unpleasant, and may be hyperactive. They may lack concentration and social abilities that are inactive. Other complicated unique demands may result in challenging behaviour. Children with these requirements may need a organized teaching atmosphere with definite limits for each exercise. To move around and ensure a cozy distance between themselves and others, they may need additional room. They can take severe risks or have explosions and need a secure location to calm down. Behavioural assistance or counselling can occur in a silent setting of assistance.

2.6.4 Communication and interaction

In one, some or all of the fields of expression, vocabulary, and interaction, most children with special instructional requirements have strengths and problems. Children with speech and vocabulary deficiency or delay, children with teaching problems, those with listening deficiency will include the variety of problems.

Children with these requirements need assistance in linguistic development understanding and use, and may need expert assistance, voice and linguistic treatment or linguistic programs, additional and alternative means of interaction, as well as a comfortable location for specialized study

There are a broad range of sensory, multi-sensory and physical problems. Sensory demands vary from profound and minimal deafness or visual deficiency to lower loss rates, which can only be temporary. For some children these needs may be accompanied by more complex learning and social needs.

Children with these requirements need access to all educational fields and may use expert aids, facilities or furnishings. Many will need professional assistance (such as instruction in locomotives or physiotherapy). Children with sensory impairment may require specific conditions of acoustics or lighting. Some may need additional room and additional indications to assist them separately navigate their environment.

According to Press Information Bureau Government of India,MHRD (2017) teacher to student ratio at primary level is 30:1 and at secondary level is 35:1 but grouping of special and inclusive schools suggest a ratio ranging between 12-8 students per teacher.

These ratios define the class room sizes and facilities available.

Table 3 Children with Disabilities Needs

Children Needs	Typical support	Design issues	Space needed in need classroom for...
Cognition and learning	3D learning aids; multi-sensory work; adapted ICT;SpLg therapy; learning & behaviour support; social skills training	Good visibility for supervision; wayfinding to aid independence; good acoustics for SpLg therapy; specialist SEN support; H&S risk assessments; storage & use of mobility/learning aids	Multi-sensory and practical activities; learning aids, ICT; flexible use of FF&E; movement and circulation (some mobility aids)
Behaviour, emotional and social development	Behavioural, cognitive, social skills support; learning mentors; social workers, educational psychologists.	Good sightlines, balance between privacy and ease of overseeing children; secure storage; robust materials, tamper proof FF&E & concealed services; H&S risk assessments; large spaces for social and outdoor activities	Avoiding distraction and conflict; varying layout (e.g. separated or grouped tables); supervision; developing social skills; quiet/informal corner
Communication and interaction	Social skills support; learning & communication aids, synthetic speech production equipment, assistive technology; SpLg therapy; learning and behaviour support.	Easily understood whole school layout with clear signage; good lighting, room acoustics and sound insulation; sound-field systems, extra ICT and associated services	Position of child in class; use of signs, symbols, communication aids and synthetic speech production equipment; SpLg therapy.

Table 4 Children with Disabilities Technological Needs

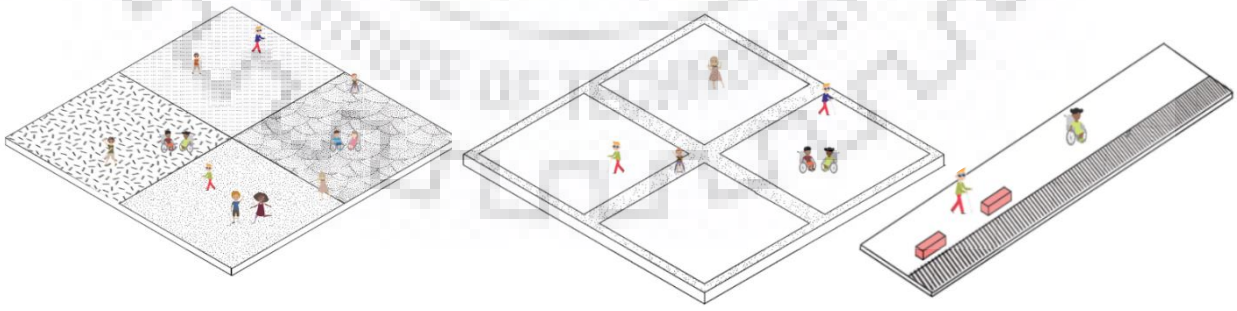
Children Technological Needs	Visually Impaired	Speech and Hearing Impairment	Physical Impairment
Mobile Application	Voice Brief, Ariadne GPS, NantMobile Money Reader	Dragon Mobile Assistant, Z5 Mobile, Proloquo2Go, Speech assistance ACC	Dexteria - Fine Motor Skill Development, TalkBoard, Say Hi ACC
Assitive Devices/TOOLS	Eyeglasses, magnifier, magnifying software for computer White cane, GPS-based navigation device Braille systems for reading and writing, screen reader for computer, talking book player, audio recorder and player Braille chess, balls that emit sound	Headphone, hearing aid Amplified telephone, hearing loop. Communication cards with texts, communication board with letters, symbols or pictures Electronic communication device with recorded or synthetic speech	Walking stick, crutch, walking frame, manual and powered wheelchair, tricycle Artificial leg or hand, leg or hand splint, clubfoot brace Corner chair, supportive seat, standing frame Adapted cutlery and cooking utensils, dressing stick, shower seat, toilet seat.
	Adaptive computer set, Graphic organizers		
Assistive Technology "For most people, technology makes things easier. For people with disabilities, technology makes things possible." —Mary Pat Radabaugh	Optical character recognition, Text-to-speech and audiobooks		
	Text-to-Speech Tools	Voice Carry-Over (VCO) technologies	tecla-e, Sip-and-Puff Systems

2.7 Meeting children's needs: Spatial Design

Understanding the range of ways in which children's needs are met will help ensure that the spaces designed for them as suitable.

Vision impairment

Blind people rely on tactility and sound to be able to navigate and move around and participate. Visually impaired also rely on this but since they usually have some sight left they also rely on contrasts in colours and light/darkness. (SVENSSON E., 2012)



Use of different floor material or using separate material which is anti-slip for

Use of edge material as warning from slippage and contrast coloured furniture

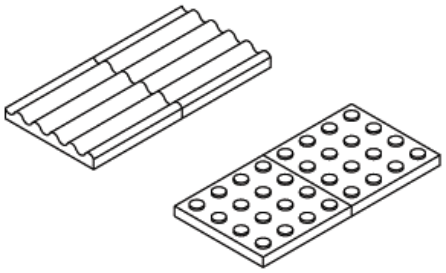
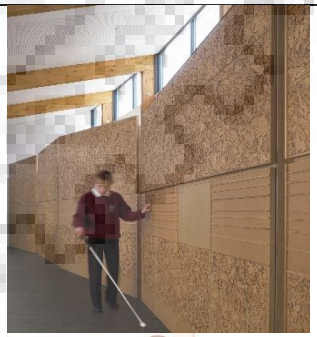


Figure 8 Illustrations of vision Impairment design needs

Images Source: Illustrated by Author

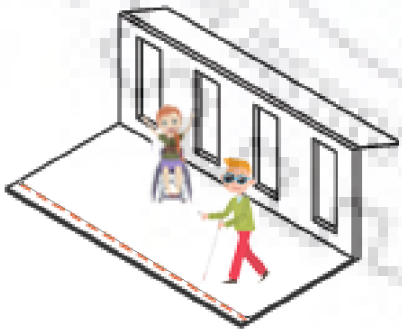
Table 5 Vision Impairment Spatial Needs

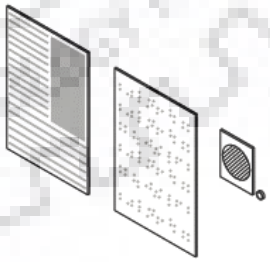
Vision Impairment Spatial Needs	Description	Supporting Sketch/Image
Wayfinding	Careful consideration of how deaf and partly sighted individuals experience the environment should lead to a construction of deliberate architecture that meets the requirements of individuals with visual impairment in a multitude of ways The capacity to orient yourself spatially, decision-making and environmental variables all have an impact on how effectively one find one's route.	 *(Source: Hazelwood.org,2008)*
Non-Visual Architecture (Sensory Reach)	It is obvious through the study of sensory design and non-visual architecture, vision impaired individuals benefit from careful design that speaks through other senses.	  *(Source: Landmark By Crozier.ca,2010)*

safety	Building design should Provide a safe environment for the visually impaired community to serve as a core and a resource. Lack of visual clarity or any deficiencies in our interpretation or understanding of the environment can decrease our capacity to comprehend or navigate the environment securely.	  *(Source: Walden kate,2008)*

Hearing Impairment

Deaf people rely on good visual conditions to be able to communicate, navigate and more around. Also vibration to some extent. Hearing impaired rely on the same but also good acoustic conditions since they normally have some hearing still but are very sensitive to noise.



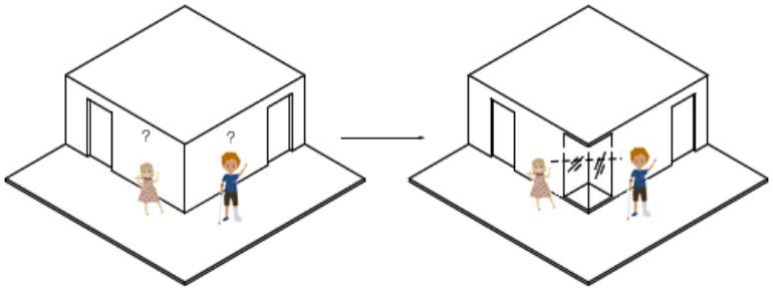


Good lighting and ventilation, colour strip to define edge

Sound is an important directive for people without visual cues. Technology can be built

(SVENSSON E., 2012)

orienting a building to provide optimal light and ventilation, Use of different material to identify the change in spaces and less use of steps at a easily identifiable place. Edge lines to protect person from falling over. Use of braille or auditory systems for information.



Opaque corners or chamfered corners to avoid collision between passengers

Wide corridors than usual 2.4m

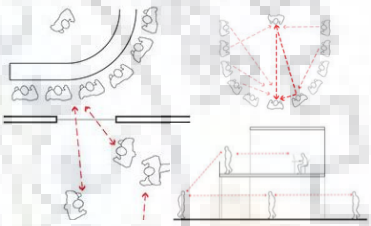
Contrast wall colours, to reduce strain on eyes of deaf students who relay on sight.

Figure 9 Illustrations of Hearing Impairment design needs

Images Source: Illustrated by Author

Table 6 Hearing Impairment spatial Needs

Hearing Impairment Spatial Needs	Description	Supporting Sketch/Image
Space and proximity	A visual-spatial expression needs signers to keep sufficient distance when conversing to adapt the signing space of each other. This requires a typically larger than ordinary room. The layout of furniture and rooms takes into account these characteristics of signed communication	 *(Source: Gallaudet.edu,2009)*

Light and Colour	Indirect daylight avoids glare-controlled reflection on walls, ceilings and floor. Contrast colours can be used to enhance the skin tones in variance to background.	 *(Source: LTL Architects / © Prakash Patel, 2007)*
Acoustics Maintenance	Deaf and hard of hearing person with a certain stage of consciousness may use listening aids or cochlear implants, and these individuals may be distracted by distinct sounds in the environment .The minimization of reverberation and background noise should be a priority when designing spaces used by Deaf people	 *(Source: Gallaudet.edu, 2009)*
Clear sight lines (Sensory reach)	Clear sign lines increase the sensory reach. Built environments can be intended to provide 360 degrees of visual and tactile reach, increase consciousness of the Deaf and facilitate spatial alignment	 *(Source: Gallaudet.edu, 2009)*

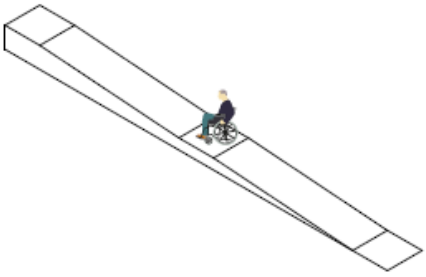
The deaf need clear lines of sight to be able to lip read and read a sign language interpreter Open spaces reduce isolation and enable a clear perspective of all rooms, which can assist to promote visual communication and hearing. For excellent layout, closeness to the room is essential.

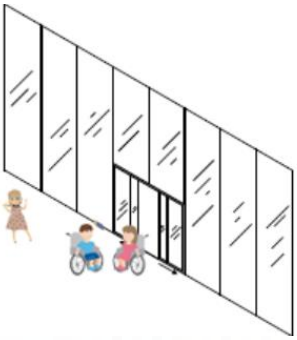
Furniture should be put in such a way that citizens who are deaf and hearing impaired can see what approaches them. Mirrors can be useful to see what's going on behind them or if they're at a gate on their back. It is also crucial how furniture is set up.

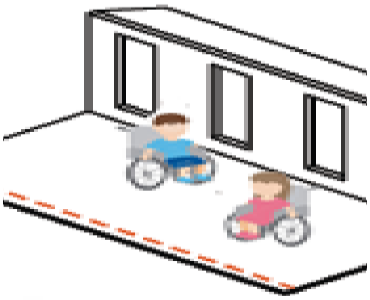
Locomotor Impairment

Locomotor impaired people rely on smooth ground surfaces, short distances and enough space to move around and participate.

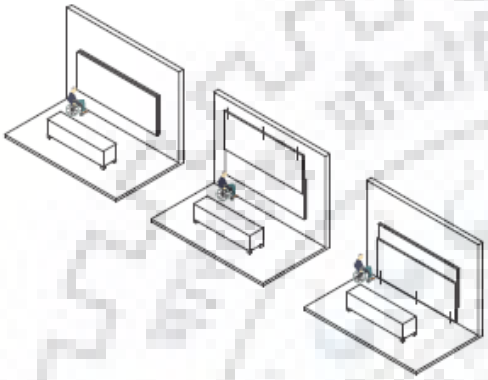
(SVENSSON E., 2012)







Intermediate resting place for a long ramp. Automatic opening doors. Use of edge from stopping wheelchair from slipping.



Adjustable furniture, avoid uneven finish.

Figure 10 Illustrations of Locomotor Impairment design needs

Images Source: Illustrated by Author

Table 7Locomotor Impairment spatial Needs

Locomotor Spatial Needs	Description	Supporting Sketch/Image
Accessibility	Design should allow the structure to be accessible and usable by "as many people as possible. Ramp entrances and manoeuvring trough building without obstructions.	 *(Source: rainrain.ie/blog, 2009)*
Safety concern	Minimizing Risk of harm by robust specialist Materials. Avoiding sudden change in levels, maintaining a simple, flat layout without obstruction in walkway path.	 *(Source: riyul.info, 2017)*

Adaptability	Adapting architecture and environments, we may change the physical, social and cultural barriers. To accommodate the varying needs and assistive equipment's of a disabled person, spatial design should be adaptive.	 *(Source: edutopia.org,2006)*

2.7.1 Classroom Design Issues for Children with Disability

In order to understand how to create inclusive classrooms, especially where children with special needs are present, teachers must develop their knowledge and skills, and an understanding of key strategies critical to achieving success. Successful inclusion practices highlight the significance of not only the presence of children in the class but also the quality of their experiences and their achievement across the curriculum.

Table 8 Classroom Design Issues for Children with Disability

Classroom Needs for Visual Impairment			Classroom Needs for Hearing		Classroom Needs for Physical Impairment	
Typical support	Design issues	Space needed in classroom	Design issues	Space needed in classroom	Design issues	Space needed in classroom
Room Capacity		Class base 6–12 (typically 8)		Class base 6–12 (typically 8)		Class base 6–12 (typically 8)
Room Dimension		50–65 m2		Minimum class size 8 mx6m		enough space between all the furniture to move and maneuver
Seating Layout		uncluttered layout		The format of the arrangement of classes in a circle or U	acoustics and other auditory issues	A well-planned classroom has clearly defined boundaries designating
Classroom Acoustics	acoustics and other auditory issues	Good acoustic separation (min 45 dB) is required for all	acoustics and other auditory issues	Acoustic treatments, such as professional acoustic panels may be	acoustics and other auditory issues	Good acoustic separation (min 45 dB) is required for all teaching spaces and
Windows		widows so that they aren't facing a Seating.		natural light consistent throughout the space (reduces glare) no		A window should have handles/controls at a height that permits use
Doors		doorknobs that contrast in color with doors				adequate doors width for wheel chairs entry
Flooring		No disturbing and confusing patterns				Smooth surface
Colors	colors, patterns and tactile issues	visual contrast between the floor and walls and between the	colors, patterns and tactile issues	colors which can contrast skin tone to highlight sign language	colors, patterns and tactile issues	Walls should be a light neutral color such as white or beige.
Texture				reduce the amount of hard, flat surfaces (i.e. blackboards, windows,		
Lighting	comfort	average day-lighting factor in the range of 4.5 to 5.5%	comfort	Eliminate direct light comfortable face-to-face interaction in all	comfort	Allow natural light into the classroom whenever possible, but be careful to
		special lamp		The needs of a concave mirror above the blackboard/screen	Furniture	adaptable Table, wheelchair accessible

2.8Planning Inclusive School

Inclusive classroom layout extends beyond a one-size-fits-all template, taking into account all users and removing any obstacles that could prevent anyone-kids with special needs and disabilities, people with disabilities and visitors – access to services.

2.8.1 Inclusive Design Principles for School

An appealing classroom atmosphere that is accessible encourages a feeling of belonging and self-worth The following design principles describe the main features that contribute to achieving inclusive environments. Many of these principles overlap with each other and clash in a few instances.

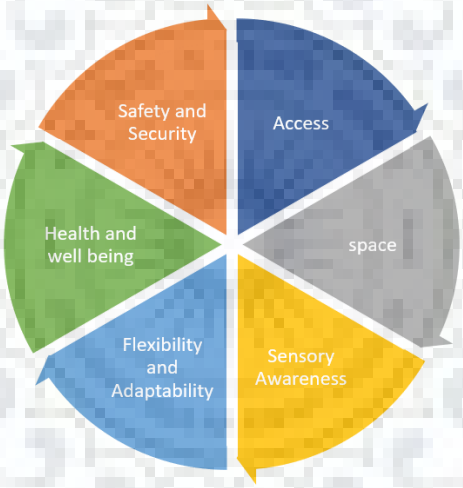


Figure 11 Inclusive Design Principles
Images Source: Illustrated by Author

Access:

Design should have clear layout and navigation which is easily understood by all users especially students. Circulation paths wide enough for wheelchair users, crutch users with accessibility, Fixed with grab bars with specific ergonomic details. Emergency and exit routs with proper signage and information system understood by all children with disability.

Space:

Children with disability need extra scape than normal to move around – some with Locomotor equipment and also personal space.Safe vehicular movement space and clearance around furniture

Addition space in classroom such as support rooms or designated corners- Spaces that are considered as support spaces Storage for equipment and wide range of teaching assistance resource.

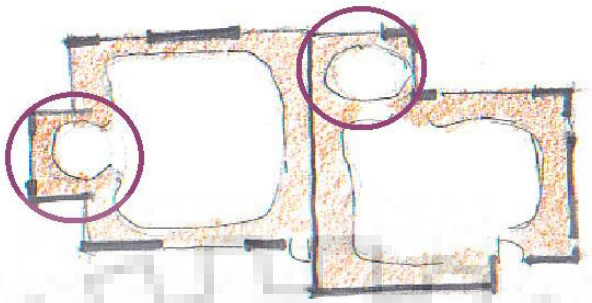
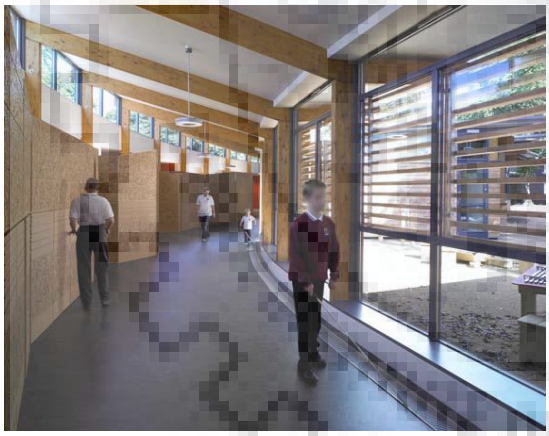


Figure 12 Additional support room in classrooms that are interlocked

Source: Guidance for mainstream and special schools DCSF (2007)

Sensory awareness:

Sensory environment should be considered in design and its impact on children behaviour. Importance to acoustic quality for hearing impaired children, using textures as wayfinding methods for visual as well as good colour contrast. School environment with a calming use of colours , controlled light into spaces with proper glare levels. Sensory awareness can be brought into design by use of light, colour, acoustics and touch (Material texture)



Texture and surface

Modulation on walls and floor markings can all assist visually impaired kids find their way around the school

Figure 13 Andrew lee school of Disability _ Sensory Awareness
Source: Guidance for mainstream and special schools DCSF (2007)

Flexibility and Adaptation

To reach the future requirements of kids in classroom construction and built environment it is necessary to develop and adapt according to period and it should also be versatile for different uses on a daily basis.

Non-designated spaces that modify according to moment (after college hours, calm corner into storage room) Use mobile partition to create rooms merge or split and have access to distinct room dimensions.

Ability to change micro-level atmosphere, lighting and temperature control within the schoo lReducing the need for fixed furnishings and the use of versatile furnishings and enabling the school design to be rearranged according to various activities. In order to promote potential adjustment, structural members and service core are designed with future use in mind.

Health and well being

By creating pleasant and comfort spaces schools promote wellbeing of child Thermal and visual comfort by maintain good level of ventilation, Promote natural ventilation. Minimising disturbance from outside and surroundings Accessibility to facilities in the school grounds at convenient distance, and special facility rooms designed according to the standards.

Safety and Security

The need for safety and felling secure is utmost priority in any school. Providing good sight lines to all

spaces particularly to spaces which involve risk activities Zoning of different school functions and activities strategically according to priority and usage supervision over entry and exit of school.

2.9 Inclusive Design Principles_ Various Research sources

These principles were extracted from various sources and works on inclusive school at international and national level. Every source is a research work of various schooling and education department of that country.

UNICEF: The *Child-Friendly Schools Manual* was developed during three-and-a-half years of continuous work, involving UNICEF education staff and specialists from partner agencies working on quality education. It benefits from fieldwork in 155 countries and territories, evaluations carried out by the Regional Offices.

UNICEF

- Pedagogy and design → School design layout must match the usual growth stages of children. At varying stages of development design of school should address these changes.
- Locating schools or learning spaces → The size of classrooms, their location and how they are organized influence the teaching process and how children connect to each other, parents and the society.
- Design with involvement of all / Community → Understanding the needs of community and meeting issues of community, benefits the design. Involvement and active participation from early stage of design is essential.
- Schools as protective environments → Depending on location and context, the enclosure and boundaries of schools can vary in form and function. School need to create a healthy, safe and protective environment through the provision of school-based health, nutrition, water and sanitation services,

The **European Association of Service providers for Persons with Disabilities** (abbreviated: **EASPD**), based in Brussels, Belgium, is an umbrella organization that represents approximately 16,000 support service providers for persons with disabilities from 33 European countries at a European level.

EASPD

- learning environments → Creating adaptable learning environments related to spatia l planning and use with input from educationalists in pedag ogy.
- Community → Design that promotes the co-location of services and a sense of community cohesion.
- Movement → The spatial design and locating a school must be born out of the need for movement control. It is necessary to align inclusiveness and control while taking into account the security of pupils.
- Tangibility → The practical and theoretical issues of design should address the varying changes, transformable furniture and versatile classroom layout.

CABE was the government's advisor on architecture, urban design and public space in England. Its job was to influence and inspire the people making decisions about the built environment. It championed well-designed buildings, spaces and places, ran public campaigns and provided expert, practical advice. It worked directly with architects, planners, designers and clients.

CABE

Diversity and difference → Inclusive design involves the diversity of people and eliminates barriers. Environmental design where it exceeds minimum technical specifications and inspire users.

Flexibility and Adaptability → Spaces that are designed to adapt and change with user's demand. Design which understands how a space/building will be used and by whom.

Convenient environments → Easy-to-use environments involve signage, lighting, visual contrast and materials. Ensure that this ' intellectual ' and ' emotional ' access provides sufficient information to make users feel confident enough to access a building or space.

GIZ is a German development agency works on a public benefit project. Offers consulting and capacity building services in a wide range of areas, including management consulting, rural development, sustainable infrastructure, security and peace-building, social development, governance and democracy, environment and climate change, and economic development and employment.

Inclusive Education and Accessibility- GIZ

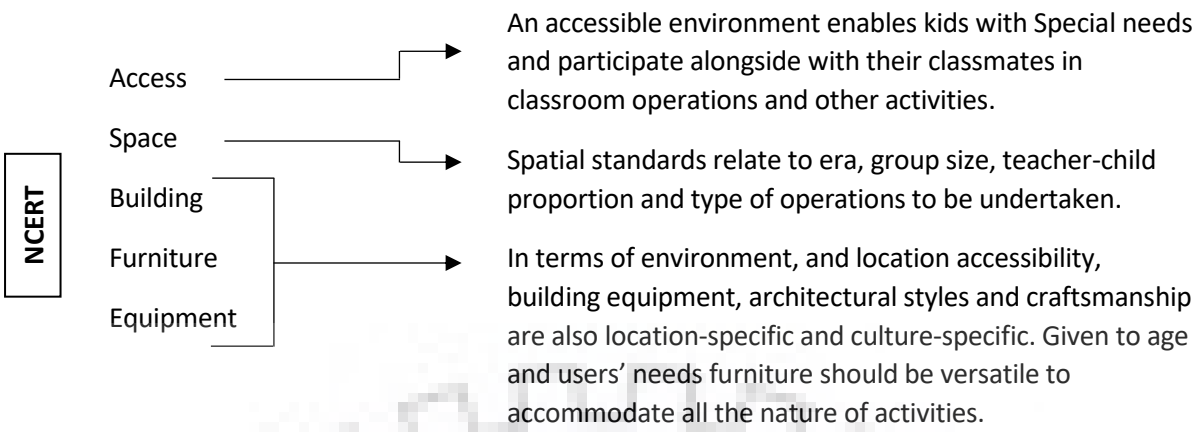
Availability → 'Availability of services for all Diverse users. More flexible room, like a traditional school, has a bigger future than a strict one.

Ease of Wayfinding → High-contrast door signage etc. allows for secure and unassisted orientation for visually impaired individuals.

Sensory Awareness → An overall education teaching setting and its physical environment designed to promote all students ' sensory intelligences.

Safety and usability → As per the availability theory, it is not enough to be prepared to "physically get into a space." More than that, it must be feasible for individuals, without extra effort or aid, to use this space for what it is meant to do in the popular manner.

The National Council of Educational Research and Training is an autonomous organisation of the Government of India. The NCERT was established with the agenda to design and support a common system of education which is national in character and also enables and encourages the diverse culture across the country.



2.10 Design Strategies: Key Elements to Building an Inclusive School

Accessibility is often over-simplified, such as believing that all availability requires within a school will be addressed by offering a ramp. Accessibility should be regarded at every point of a child's trip from home to their classroom and within the school for every exercise. Providing a ramp, for instance, will not assist a kid with sight or hearing impairment.

Design specifications to be regarded from the conceptual stage of building layout preparation to the point of detail design of a door knob, including all design components between these ends. Figures illustrates this design philosophy, identified as the Accessibility Continuum. The Accessibility Continuum could be seen as a chain of events or a traveling path from the home of a child, through the community, into the school, then into the classroom.

Like all ties, the chain will be crushed if one connection is breached. The chain must be full to meet the requirements of disabled kids and their relatives to attend collegeLocal school building schemes in Solomon Islands (Source: UNICEF) 16 Webinar 10 — Companion Technical Booklet classroom, but the gate to the classroom is too tight for a wheelchair to pass through, then the chain is broken and the child is unable to attend

2.10.1 Initial design strategies: Accessibility Continuum:

The Accessibility Continuum could be seen as a chain of events or a traveling path from the home of a child, into the school, then into the classroom. Like all ties, the chain will be broken if one connection is breached. The chain must be full to meet the requirements of disabled kids. This concept is floated by GAATES (Global Alliance on Accessible Technologies and Environments), it is an international organization devoted to the promote accessibility in built

and virtual environment by providing Guidelines and Principles on Accessibility for the CRPD (United Nations Convention on the Rights of Persons with Disabilities).

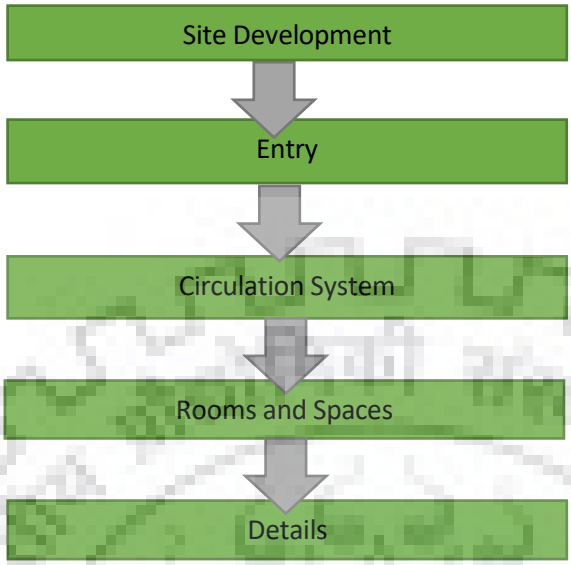


Figure 14 Accessibility Continuum

- **Site Development and Zoning:**

The school should be located at a place with good transport links and a convenient place and in relation with other community facilities. The site should be levelled ground ideally but split level can be taken to advantage to accommodate by facilitating good accessibility. Regulation towards accessibility of play areas and into school grounds too. The zoning of inclusive school is in accordance with minimising travel distance and allotting central region to common facilities. The diagram below shows typical room relationships for an all age school, where spaces according to similar function are grouped together.

Key points:

Lobby and admin office are close to the main entrance and spaces accessed by parents and others for meeting are also placed nearest to entrance Large spaces that can be used by community are given direct external access and are used to separate teaching from admin.

Shared spaces are located at centre and give easy access. Progression of spaces from young to older children. Toilets are evenly distributed for minimal travel distance from any location.

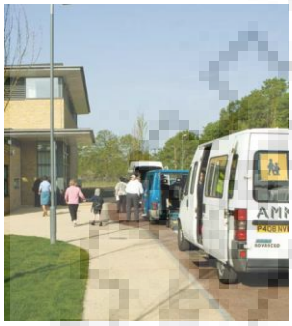
Planning one to two courtyards segregate the function of use and children age group.

- **Entering to school:**

The entrance of school should be easily identifiable by its design and colour from a distance, appropriate signage and location. Tactile signs are not needed for external use.

Vehicular circulation making provisions for emergency. Designated pedestrian route towards school from main road. Levelled and ramped entrance with non-slippery material, well drained and without trip hazard Sufficient and suitable parking with well-lit external lighting, clear legible signage and sensory wayfinding's. Safe covered canopy with a threshold for drop off, pickup and waiting. Access to pavement to transfer children to vehicles.

Easily openable doors or automated mechanism. Good visual connection between outdoor and indoor. Supervision like CCTV Sufficient space at the entrance to gather and wait and sufficient at the entrance large to hold the crowd and avoid congestion.



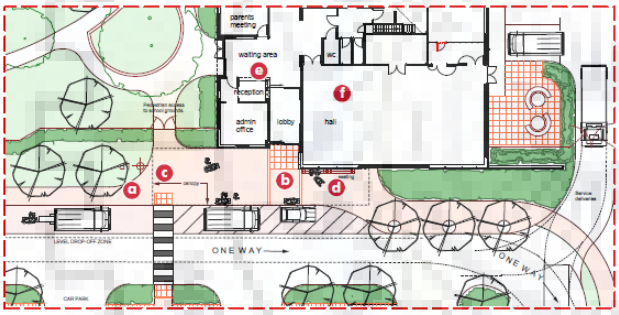


Figure 15 Plan and images showing the vehicular and pedestrian approach to Hollywater School.
Source: Guidance for mainstream and special schools DCSF (2007)

Lobby and Entrance area:

A welcoming lobby which is attractive, friendly and welcoming, with identifiable reception counter which is height accessible for wheelchair user.

Waiting and seating with sufficient space for wheelchair movement and resting area supported by tactile and visual information. Appropriate lighting and ventilation, with well organised display of children works. Toilets and storage of disability equipment storage nearby.

- **Circulation:**

The planning a circulation revolves around the main idea of minimising the travel distance and number of times. Use of Locomotor and help aids impact the spatial planning and design of corridors or circulation routes should support.

Use of various wayfinding techniques (Annexes A) such as colours, sound and tactile ques and objects for reference.

Outdoor circulation – Horizontal

Rational and clear planning of routes with minimal gradient to address the needs of students. There should be resting area like seating at every 50m along the pedestrian routes.

Ramps designed with tactile (Annexes A) Wide path with 1200mm to 1500mm away from busy routes. Good sightlines for safety of children overseeing.

Outdoor circulation – Horizontal

Children with disability need more space than usual cause of use of helping aid and many children learn to use of aid. Children with hearing impairment need space for sign gestures.Inclusive schools need overall 25% of gross floor area than usual

All circulation spaces should be wide enough for wheelchair users with corridors spanning 1800mm,However a clear two meters is preferred for corridors loaded on both side with classrooms and 2.7m to 3 m clear width at junctures and major circulation areas.

Circulation spaces should have:

• Clear signage with easily understood contrast, signs and symbols at an appropriate height

• Tamper-proof fittings, no projection points, and hazards clearly identified

• Good lighting and views but avoiding glare, broad enough windows and doors, excellent visibility on both ends, not directly opposite or too near to other opening, to prevent congestion (Annexes A)

• robust, easily maintained finishes and good acoustics

Vertical Circulation

Design of Ramps, steps, stairs and lifts need to meet the needs of disability. (Annexes A)

Lifts fitted with tactile information and Waiting space outside a lift should take account of nearby door openings and passing traffic.

Figure 16 Accessible Lift fitted with Tactile Information

Source:Building brighter futures DCSF 2007

- **Spaces _ Learning and Social spaces and supporting spaces**

Learning and Social spaces:

Early Years: At this age and children, learning through game is particularly essential. Learning takes portion in a variety of experiences rich in play-based interactionEnvironments for very children need room for circulation and expert staff using heavy facilities, but also sufficiently spacious to enable distinct layouts for a variety of operations, games and play materials. For one to one assistance space, each classroom should have a tiny, quiet space.

Playing rooms should be flexible places with excellent outdoor visual and physical links.

Figure 17 Learning through play

Figure 18 Primary Flexible Learning spaces

Source:Building brighter futures DCSF 2007 and
Source:child-friendly schools manual Unicef (2009)

Nursery	Area
Typical space to support about 6-12 children	65–75 m2

A covered area directly outside the play space provides children with a broader range of activities and experience.

Figure 19 Classroom opening to play area

Source:Building brighter futures DCSF 2007 – http://www.teachernet. gov.uk/educationoverview/ briefing/currentstrategy/ childrensplan

Ground floor accommodation allows safe, level, easy access to the outdoors, preferably reached directly from indoor play areas.

Supporting spaces

The following are associated to support inclusion:

- A soft play space
- An additional quiet room or semi enclosed space for support or therapy
- Storage for Locomotor equipment
- A medical room

Primary Years: Spaces are widely similar to those for mainstream schools and special schools, but with some extra factors. Especially due to the higher percentage of kids using teaching aids and Loco motor equipment and the higher amount of staff to help them, more room is required.

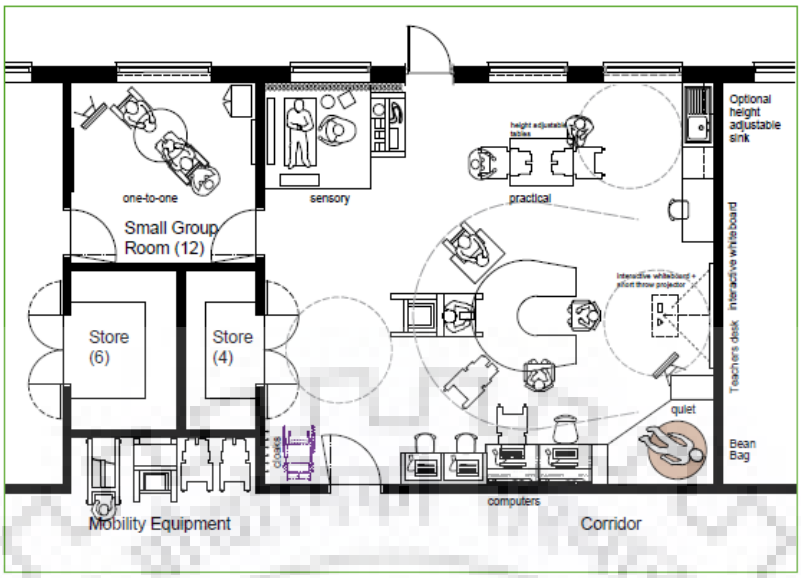


Figure 20 Typical classroom layout

Source: Unicef report on Access to School and the Learnin Environment 2014

This layout shows:

- A sensory corner, which can be set up on a temporary basis
- A quiet corner where a child can rest or calm down
- computer workstations.

Secondary Years:

children of secondary school age, have needs which are likely to have been identified and the most suitable provision decided upon.

Nursery	Area
Class base 6–12 (typically 8)	50–65 m2

This layout classroom can be adapted to accommodate needs of children with disability because of flexible layout and furniture.

Usual arrangement involves a flexible class structure zoned for a variety of operations, which involves: casual tiny group work or gathering

Figure 21 Flexible furniture in classroom

Source:Building brighter futures DCSF 2007 – http://www.teachernet.gov.uk/educationoverview/ briefing/currentstrategy/ childrensplan

Support spaces:A typical range of support spaces are needed for an inclusive school. Requirements of these spaces vary according to the school and its children needs.

Space	Area m2
Medical room	15–25
Speech and language therapy	12–15
Sensory room	12–24
Hydrotherapy	85
Locomotor training room	20–50
Toilet	4 (Each Cubical)

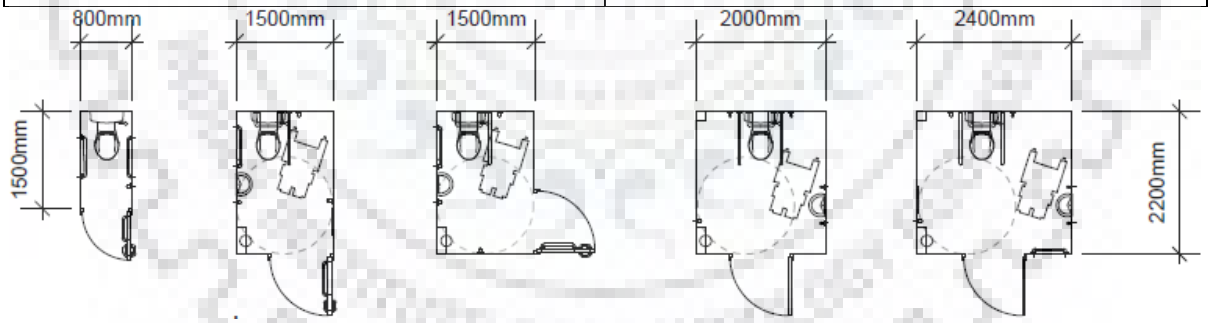
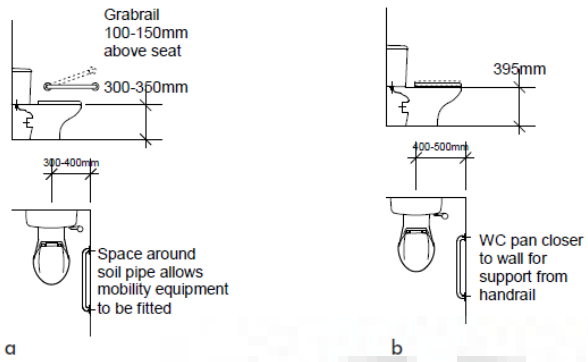


Figure 22 Plans showing key dimensions around the wc pan in accessible toilets (Various types and alterations)



(Figure 19) (Figure 20)

Figure 23 Sections showing key dimensions around the wc pan in accessible toilets

Figure 24 Adjustable height wash basins

- **Detail Provision**

Elements, materials and finishes

Smooth non-abrasive products are less probable to cause damage if a kid drops or pushes against the wall, if boisterous conduct occurs, or if there are accidents. Walls need to be covered in some spaces (e.g. calming rooms) with soft but strong, impact-resistant, non-abrasive fabrics or linings to decrease the danger of self-harm by a child.

With regulated texture and color of the fabric. While extremely decorated or modeled surfaces are uncomfortable for individuals with visual deficiency, color changes can be used for wayfinding.

Internal and external ramps

1200mm minimum –1800mm preferred

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

Steps and stairs:

Rise 150mm–170 mm (150 mm preferred for schools) Going at least 250 mm (280 mm preferred for schools) Clear width between handrails at least 1200 mm (1600 mm preferred) Handrails On both sides, extending 300 mm past each flight's top and bottom.

For children under the age of 12, 40mm–45 mm, at a height of 600 mm from the step or floor level pitch row. Minimum length of landings 1200 mm.Landing:1200mm minimum

Lifts:

Minimum lift size:1400 mm x 2000 mm with a door width of 1100 mm. For a secondary college, this may be appropriate. Users of wheelchairs can spin 180 degrees and may include another user of wheelchairs or Locomotor aids individual

Doors and door openings

Compliance with the Building Regulations. Usually, on a corridor width of 1500mm–1800 mm a clear door opening width of 900 mm. Vision panels with safety glass between 500 mm and 1500 mm elevated should be supplied for visibility and supervising in doors.

Chapter 3

Secondary Case studies/ Pilot study

3 Secondary Studies International:

3.1 International Case study 1: Hazelwood School

Figure 1 Aerial image of Hazelwood School

Source architizer.com, project, 2008

3.1.1 Introduction:

The project is committed to build a school that respond to range of children needs with various abilities. The architects carried on the project with a view of ' studies and growth, ' which set a high bar for advanced approaches to a complex brief and planned the school and its facilities that Hazelwood Head Teacher described The school design also includes a small life skill house (150 square meters). School is set in a parkland site where the building snakes through with gentle curves around the already existing trees of land. The total building is one story in height with built in natural materials to accentuate the sensory design part, building has a series of small garden spaces which are ideal for small classes and also maximizes the potential for more intimate outdoor teaching and learning opportunities.

Location: Glasgow, Scotland, UK

Area: 2,660 Square Meters

Students strength:150 Students

Students: Primary and secondary school (2-18 years old)

The design team worked closely with Head teacher, teacher, Disability Discrimination Act (DDA) advisor, parents and students in all phases of design process. The school serves students who have visual limitations, hearing limitations and physical disabilities In order to satisfy this unusual collection of requirements as well as the limitations of the site, Hazelwood architects had to go far beyond the requirements of affordable classroom layout and invent technical alternatives in collaboration with teachers students and parents

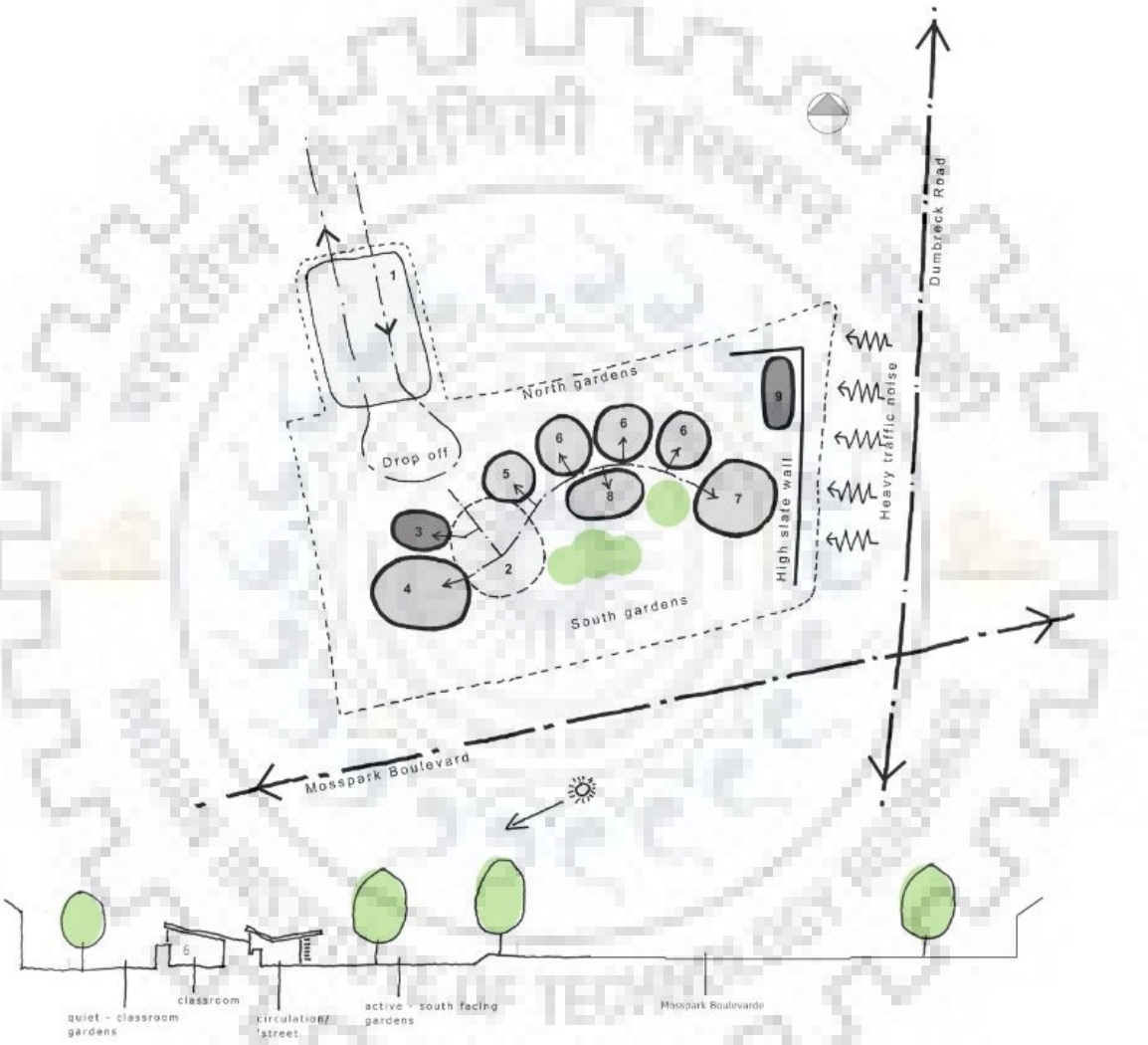


Figure 2 Diagrammatic zonal plan and section of school

Source: architizer.com, project, 2008)(https://universaldesigncasestudies.org/education/primary/hazelwood-school)

3.1.2 Principles: Accessibility Continuum Assessment

- Site Development

The building sits on a site closely bordered by major roads. Since the building is set in a residential area the design reflects the neighbourhood buildings in scale and height. The brief required to retain the existing trees in site since the site is at the edge of Bellahouston Park. In collaboration with teachers students and parents Hazelwood's architects required to go far beyond affordable classroom architecture demands and invent creative alternatives.

- Entry

Children's arrive to schools by Mini bus or car. The entrance zone of the school was intended as a loop scheme to enable cars to pick up in a specific fall off region. The primary entrance zone opens up to a big dining room that serves as the primary space for assembly.

Figure 4 Main Entry drive way of school

Figure 3 Building Entrance

Image Source: architizer.com, project, 2008 (https://architizer.com/projects/hazelwood-school/)

- **Circulation:**

From within, the building's curved shape reduces the main circulation spaces ' visual scale. A large cork-clad storage wall houses the central circulation space to accommodate the equipment of the children. A unique "trail rail" is integrated into this wall, providing the children with tactile indications to navigate the building clearly and safely. Each sensory trail wall bay is shaped individually. This helps children to orient the length of the school's circulation space, this layout has proven to be an effective device for all kinds of students to navigate independently. The design of corridors as streets help with manoeuvrability, Locomotor and orientation.

Figure 5 Corridor space with sensory Trail rail

Source:(niversaldesigncasestudies.org, 2019

- **Spaces:**

The building has been developed for simple orientation as a sequence of space clusters.

In a single-story building, the school has eleven (11) classrooms, offering primary school through high high school (secondary education). The primary learning rooms are situated on the quiet northren border of the site to prevent immediate sunshine. Large classrooms at the back of the room are equipped with ample built-in storage space and adaptable areas between classrooms. Some rooms offer staff views to school without the obstruction of children and disturbance, these spaces serve as viewing space for visitors too thus serving two purposes and acting as a quiet place too in need.

Classrooms face north are designed to take benefit of a lighter intensity and open up to the quiet portion of the premises, i.e the classroom's garden areas. At the back of each school, storage' boxes' were intended to provide the kids with a strong wall and prevent visual distraction from the outside.

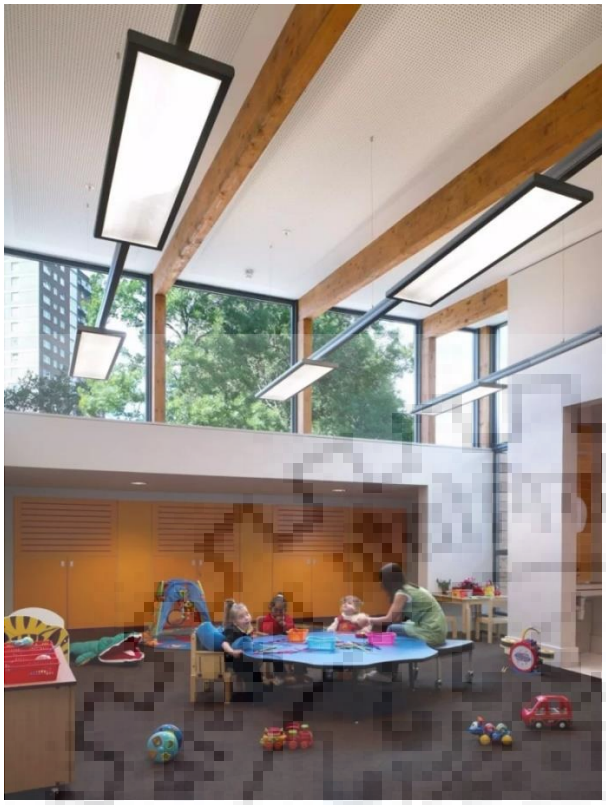


Figure 8 Hydrotherapy Pool

Figure 7 Primary classroom

Figure 6 Cafeteria

Image Source: architizer.com, project, 2008 (https://architizer.com/projects/hazelwood-school/)

Game hall design, trampoline area and hydrotherapy pool created opportunities for children to explore, expand their skills and gain trust by engaging in relatively independent activities.

The external environment is perceived as an external classroom. In order to facilitate the school to participate in the design and development of future sensory gardens, areas were left unplanted.

- **Details:**

The wall of the trail rail is clad in cork, which has a warm feel and provides tangible or tactile signs to help the children through the school with orientation and navigation and avoid collision. Thoroughly translucent circulation space faces south and overlooks large gardens with daylight.

Material study on elevation

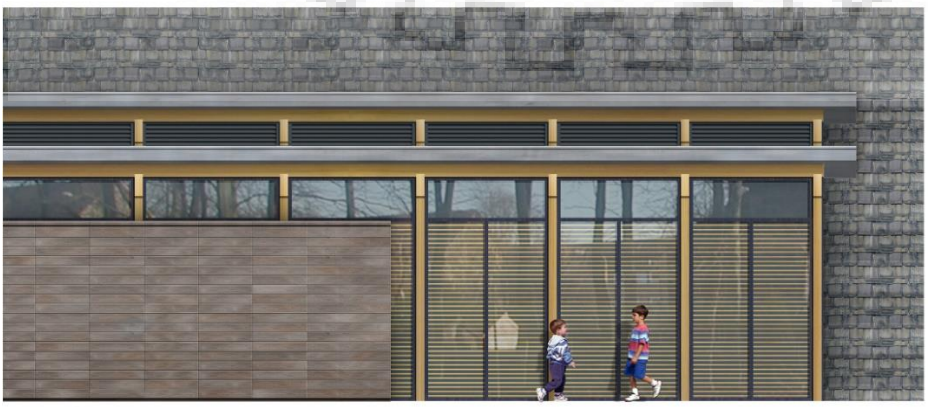


Figure 10 slate Tiles

Figure 9 Larch and Timber Boarding

Figure 11 Tactile and textural cladding materials

Image Source: architizer.com, project, 2008 (https://architizer.com/projects/hazelwood-school/)

Sensory aspects:

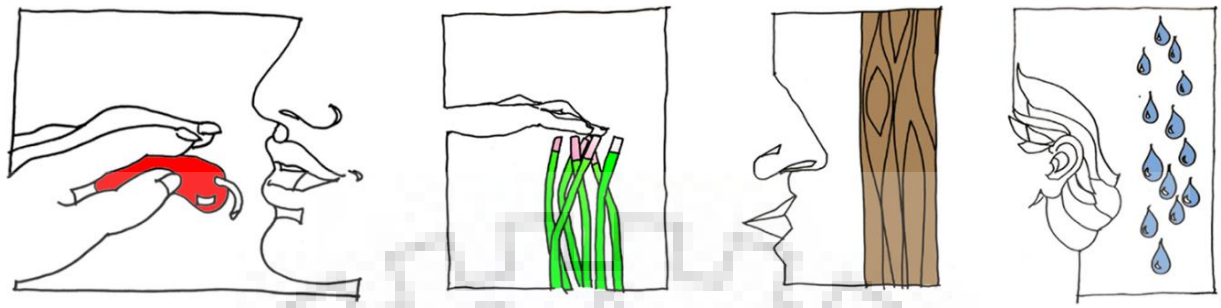


Figure 12 Four sensory aspects in design of school

Image Source: architizer.com, project, 2008 (https://architizer.com/projects/hazelwood-school/)

- **Inferences:**

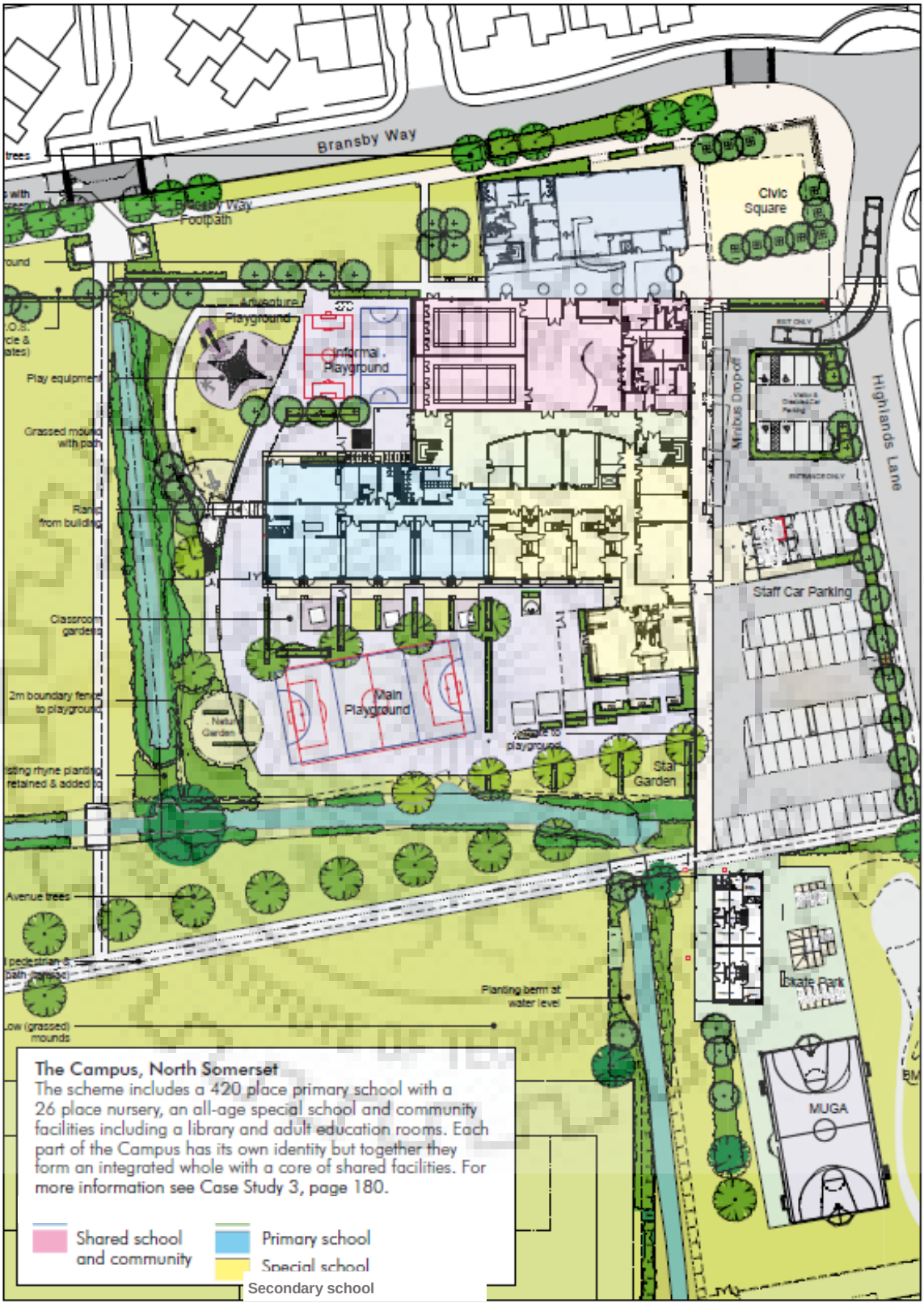
Table 1 Hazelwood school Children needs and Associated principles

Children Needs	Space Needed	Associated Inclusion Principles
Cognition and learning	Supporting spaces like focus learning rooms and quite spaces in classrooms. Have a "life skills House". External environment as learning spaces. Cork cladding, provides tactile cues. Rooms have Acoustic ceilings.	Flexibility and adaptability, Availability of space
Behaviour, emotional and social development	Cluster free classrooms encourage calming atmosphere. hydrotherapy pool, games hall and trampoline area help in developing in extending their skills. subtle colours, contrast, and adaptable lighting elements maximize use of children's residual vision as well as indicators of change in function and transition.	Accessibility, Health and wellbeing, Availability of space
Communication and interaction	Signage throughout the school is made up of simple letters including lines and curves as a simpler form. All aids for navigation and Locomotor are integrated in the integral part of design. A network of paths around the school vary in finish, to differentiate the feel.	Ease of Wayfinding, Safety, Perception of information
Technological needs	Assistive devices storage is considered in design, corridors and classrooms are equipped with storage.	Availability of space, Sensory reach, Safety

	Visual cues and signages are places as alarms in classroom and other areas. Automatic blinds are used to control amount of glare and light. Smart systems and boards are used for teaching in classroom	and security, Perception of information

These sketches represent the sensory aspects used by children with disabilities. Elements of design were developed at the early stage of design process and are followed throughout the design development on how the school architecture should relate to its users. Contrasting and neutral colours are used as transitional and storage space visual indicators.

3.2 Case Study 1: International: Bay Tree Community School



The Campus, North Somerset
The scheme includes a 420 place primary school with a 26 place nursery, an all-age special school and community facilities including a library and adult education rooms. Each part of the Campus has its own identity but together they form an integrated whole with a core of shared facilities. For more information see Case Study 3, page 180.

Figure 13 Site plan of Bay Tree Community School

Source: altoschool.org ,2014

3.2.1 Introduction:

Type: Community special school for children and young people with Mild learning disabilities (SLD) and profound.

Location: Highlands Lane, United Kingdom

Age range of students: 3–19 Years (Primary and Nursery school students)

Students strength: 446

Context: Developed as an integrated part of the campus, including the primary school of Herons Moor and community amenities including a library.

3.2.2 Accessibility Continuum Assessment

- **Site plan:**

The external space is intended to enable both the children and the community to have easy access. There are two primary exits to the building – one for community services and one for classroom use. The roof overlays a lengthy entry wall to offer the eight fully equipped mini-busses a protected drop-off that brings the children of the special schoolThere are multi-use sports areas outside, skate park, bicycle path, wildlife garden, adventure zone, and playgrounds.

Source:.ase.org.uk, 2012

Seating alcoves are designed corridors, these seating spaces in circulation areas provide a place for informal one-to-one support.

Teaching spaces provide a comfortable work environment with, designed with flexible layout and adjustable furniture, fitted with ample storage area and has quite corner spaces for alone solitude time for a special child.:

- Good room acoustics and sound insulation to aid concentration
- Good quality low-glare lighting
- Underfloor heating to free up wall space

Source: altoschool.org (2014)

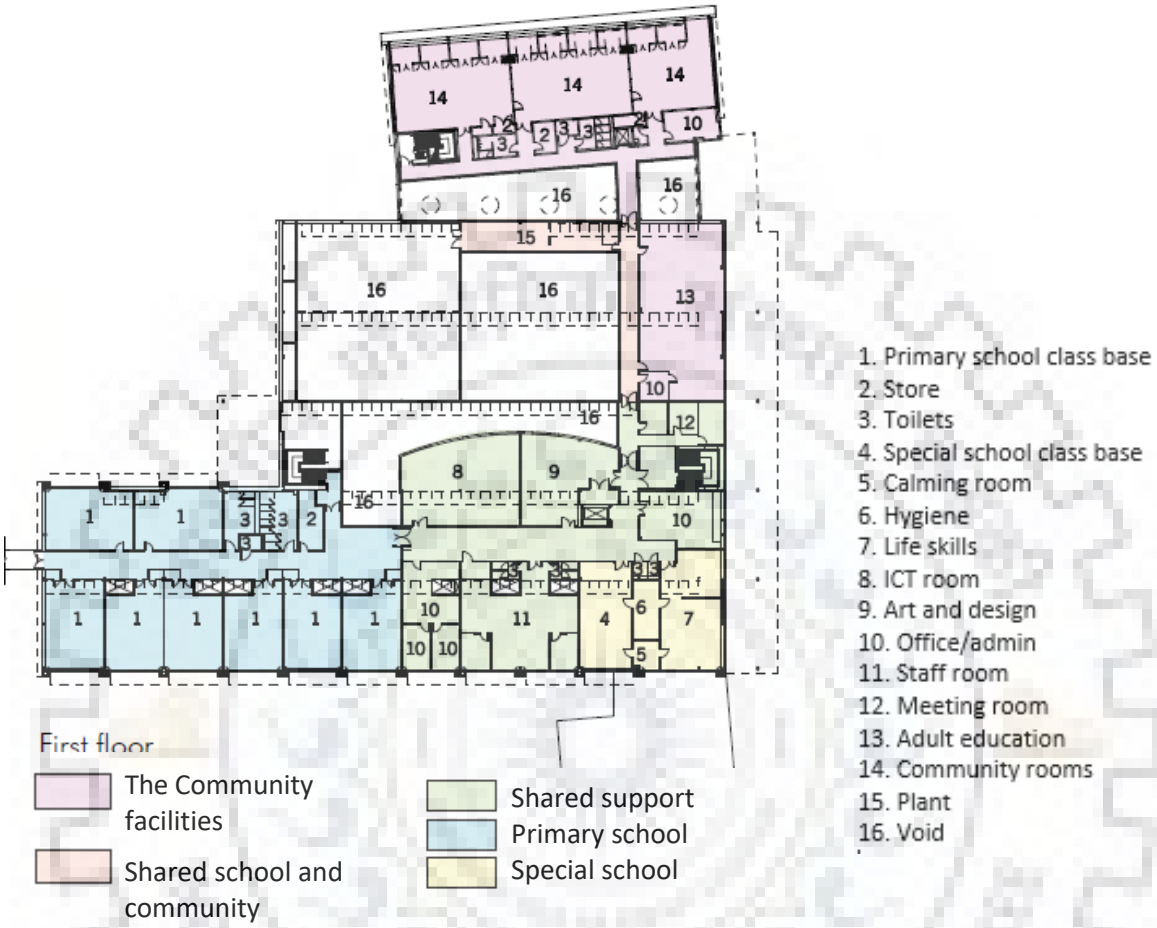


Figure 14 Building plan of Baytree Community school

Source: altoschool.org ,2014

Since school also shares its spaces with local community, The zoning of school was done in a way to clutter community spaces to one zone and school to other zone where shared spaces between community and school forms the bridge between them. Open spaces are accessed from both sides.

- **Access and circulation**

Circulation spaces are well proportioned and routes simple: the building forms a 'T' shape without any interrupting fire doors.

- **Building Design:**

North Somerset Community always believed that 'a school should be a community building that just happens to be used for education'. Influence of this can be observed in both the brief and the building design The campus facilities are designed such that, both the school children and the surrounding

community can utilize them to the maximum extent possible. The school and community facilities can expand and contract based on the requirement or according to the time of day/week. This is achieved by the shared areas which form the link between the secondary school and the primary school and between the schools and the community facilities

The building is perceived as three related wings of accommodation. .At the heart of the building lies a top-lit open plan dining hall which is shared by both the schools and the community. A careful timetabling is implemented to ensure that the school has priority over any shared space. The flexible space is constructed with moveable walls which enable it to serve for multiple purposes like dining, assembly, and also as a foyer to the main hall for large gatherings or after-school activities. The design and placement of halls and the hydrotherapy pool are done to provide easy access for others visiting the school also. Keeping in mind the security and privacy of the school pupils, different areas of the school are zoned. Each pair of special school class bases shares a small group room and a hygiene room.

Table 2 Baytree Community school Children needs and Associated principles

Children Needs	Space Needed	Associated Inclusion Principle
Cognition and learning	Flexible learning spaces, with adaptable furniture with accommodation of 8 – 12 students. Positive atmosphere is designed that promotes well-being. With elevated quality, solid designs that can resist wear and look nice, the atmosphere is warm and colourful internally.	Flexibility and adaptability, Availability of space, Sensory awareness,
Behaviour, emotional and social development	Calm spaces, alcoves and niches along corridor are provided for counselling children in case of behaviour extreme. Facilities like Hydro pool and audio rooms are present for special needs of children. Informal open spaces provide interaction between community and school helping social development	Health and wellbeing, Availability of space
Communication and interaction	Movable walls and flexible social spaces between community and school encouraging interaction.	Adaptability, flexibility

Technological	Classroom atmosphere is maintained by inbuilt floor heating system, light warning systems are used for emergencies apart from sound, Smart boards for teaching	

3.3 Case Study 2: Secondary Case study Indian: Yellow Train School

3.3.1 Introduction

Type: Community special school for children with severe learning disabilities and mild Disabilities.

Location: Coimbatore , Tamil Nadu, India

Age range: 3–15 (Primary to Secondary schoolig)

Number on roll: 12 average per year (120 in total)

Santhya Vikram the founder of Yellow school said “Special children need to be educated with an aim of equipping them to live their daily life”. She aspires to educate as many as special need children as possible and is at an attempt of accommodating them in her school.

Context: . The construction and the design are a perfect blend of the Waldorf system of Education and the bye-laws laid by the Tamil Nadu Board of education Waldorf system stresses greatly on child-centric education that is mental, spiritual, physical, and psychological aspects of learning.

The site: The buildings were oriented to make the most of the site and form an intimate relationship with the countryside. At the southern edge, the general teaching classrooms have views of the farmland, shaded by mature treesThe overall schools at the northern border have views of the landscape, the grown-up natural border garden is obscured by mature trees, and the new construction includes an indoor play zone separated into hard paved and grassed play fields with a completely available adventure and sensory arts playground.

Figure 15 Yellow Train School Exterior view

Source: biome environment, 2017 (www.archdaily.com,yellow-train-school-biome-environmental-solutions)

3.3.2 Accessibility Continuum Assessment

- **Building design:**

A ramp is built connecting the school building and the playful spaces. The building is equipped with accessible toilets.

We can observe a progression aspect from early years to primary at one end to secondary on the other end. A meticulous selection of colours is done to create a calming ambiance that distinguishes various facilities and age groups: warmer, softer colours for children of reception and infancy, cooler and more restrained colours for secondary.

While conventional classrooms are provided, there is ample space and additional details to accommodate and encourage activity-based group learning, making the kindergarten and primary wing, which is the present first phase. An individual classroom has three spaces, one space where the teacher leads with blackboard and seating, two circled areas where group activity occurs with walls provided with a facility to hang children's works and lastly alcoves that allow individual reflection and concentration. The building is fully accessible through a ramp. It is passively day-lit and ventilated.

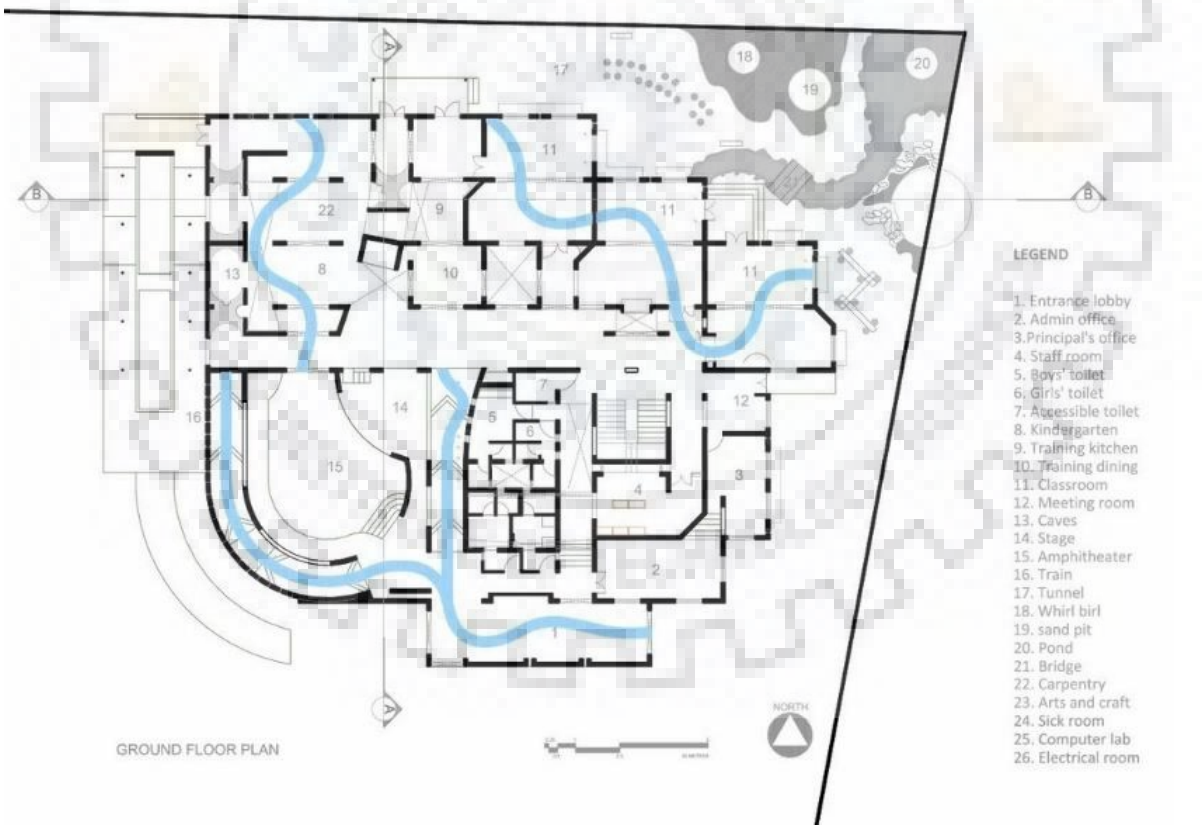


Figure 16 Yellow school First floor plan

Source: www.archdaily.com,yellow-train-school-biome-environmental-solutions

Not just academic development factors of learning but the physical and psychological factors of the child development are also given equal priority, making the design child-

centric. The spacious classrooms are designed to contain separate areas for teaching, individual study, and storage space.

. Making the play space available to the kids at all moments is a significant element in the design. The construction included consideration of climate to create a warm weather play space. The Classrooms are open with constrasting clours and are supported with additional spaces (Calm Areas)

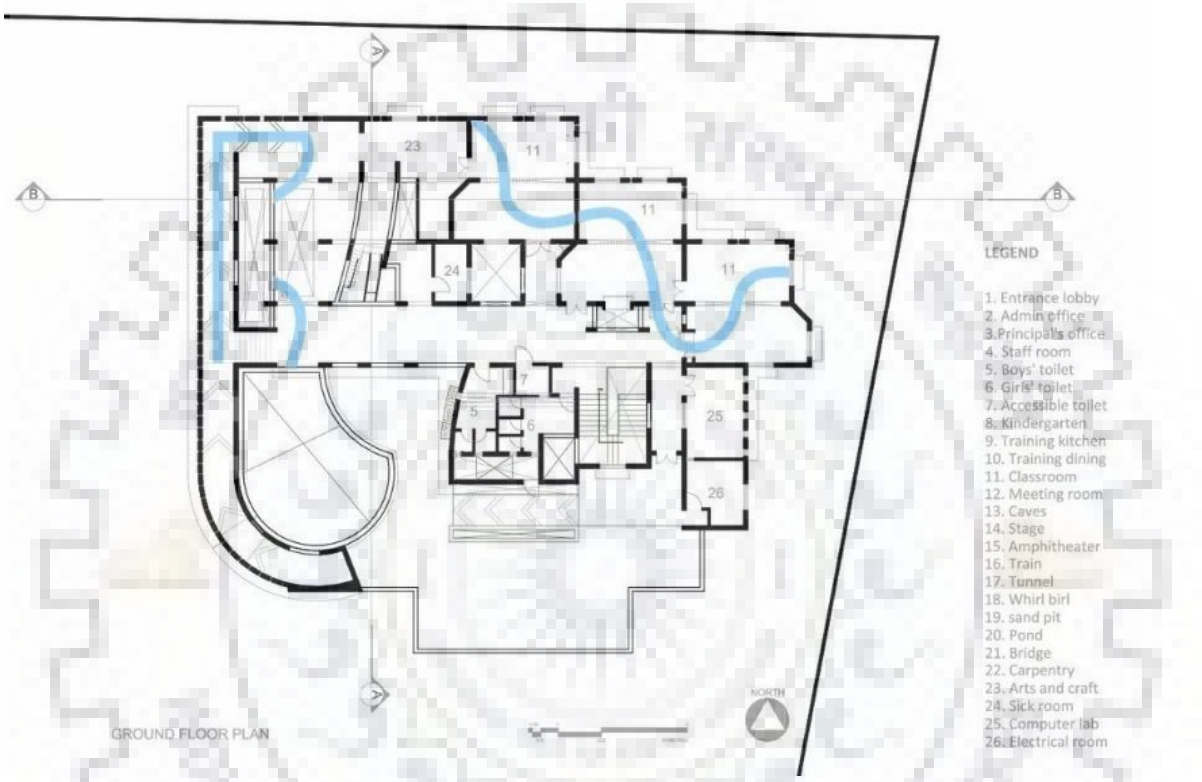


Figure 17 Yellow school Ground floor plan

Source: Biome Environmental Solutions, 2017

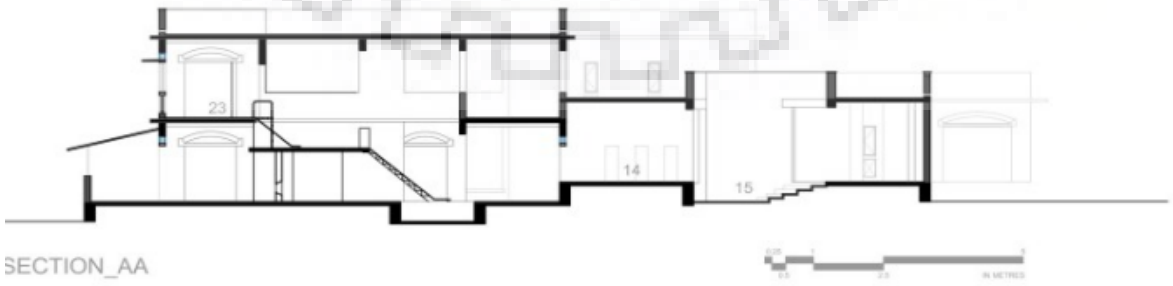


Figure 18 Aection AA

Source: Biome Environmental Solutions, 2017

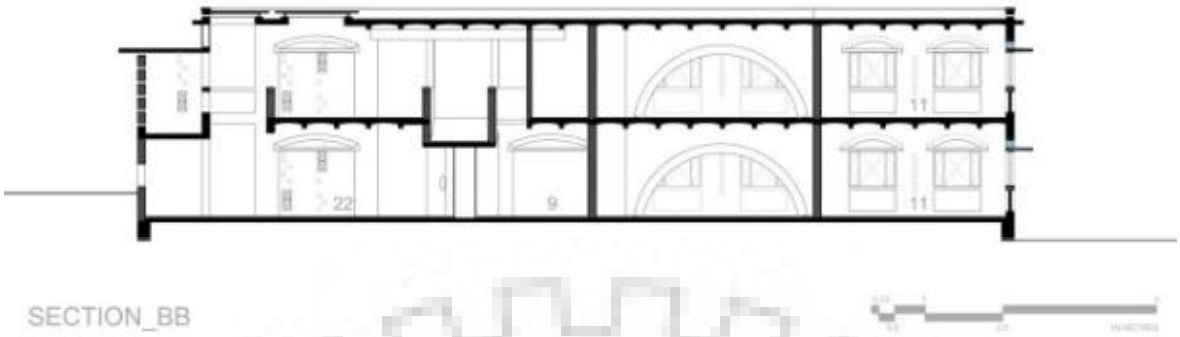


Figure 19 Section BB

Source: Biome Environmental Solutions, 2017

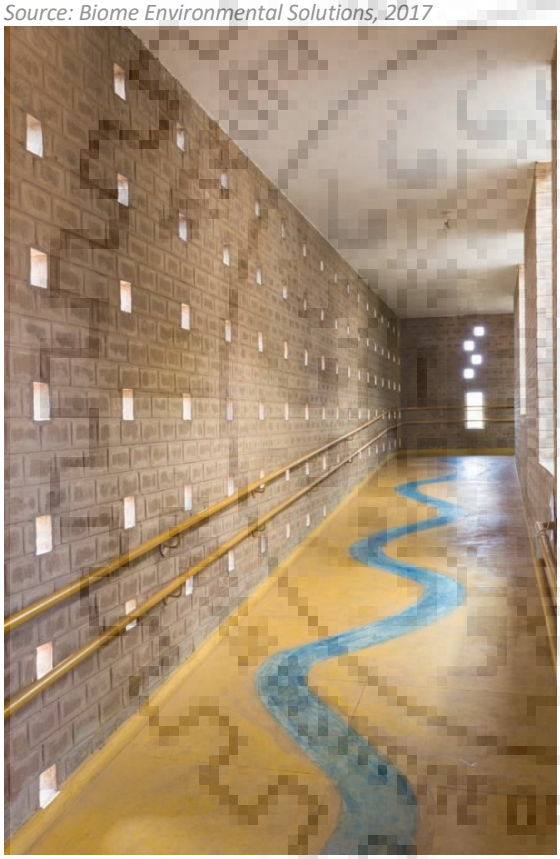


Figure 21 Quite Caves_Interiors

Figure 20 Primary

Figure 22 Interiors of Yellow school

Source: www.archdaily.com,yellow-train-school-biome-environmental-solutions

Caves are designed with jails to be lit allowing children to explore and for creative development growth. Interior open-air theatre encourages theatre and import act from children. Design considerate ecological issues and is deliberated to expand boundaries from enclosed walls.

Table 3 Yellow school Children needs and Associated principles

Children Needs	Space Needed	Associated Inclusion Principle
Cognition and learning	Open plan classroom with movable furniture. Outdoor spaces open into learning areas, Niches and caves are used as playful learning spaces. No solid partitions are used to segregate spaces, they were separated by use of arches or by flooring colour.	Flexibility and adaptability, Availability of space (Usability),
Behaviour, emotional and social development	Bright colours are light is used to create warm environment, local bricks were used to create texture to walls as act as learning spaces for children, informal spaces live caves were created to increase sociability among students and teachers.	Health and wellbeing, sensory reach (light and colour)
Communication and interaction	Entire school building can be accessed through ramp, Interiors and exterior play spaces flow into one another blurring the boundaries of school. Signages were used at emergency exits.	Accessibility
Technological	For ecological purposes and to educate children sustainable practices are followed in school like solar and water harvesting.	

The materials are non corrosive and skid free with ample allowance of natural light into the rooms. Rain water harvesting system is fitted t collect water and reuse.The entire building can be accessed with a ramp.

3.4 Case study Observations:

Table 4 Cumulative observation of Case studies

Categories		**Hazelwood School**	**Bay Tree Community School**	**Yellow Train School**
Site Area (Sq. Meters)		2660	2400	1334
Number of Students		150	420	120
students with disability (Approx.)	Visual	(30)	(25)	
	Hearing	(10)	(10)	(7)
	Locomotor	(5)	(15)	(5)
	Others	(12)	(20)	(3)
Inclusive Principles Observed		Sensory reach, wayfinding, Accessibility, Flexibility and adaptability, Availability of space, Health and wellbeing, Safety and security, Perception of information.	Accessibility, Adaptability, flexibility, Health and wellbeing, Availability of space, Sensory awareness.	Accessibility, Flexibility and adaptability, Availability of space, Health and wellbeing, sensory reach

Severe Mild Minimal

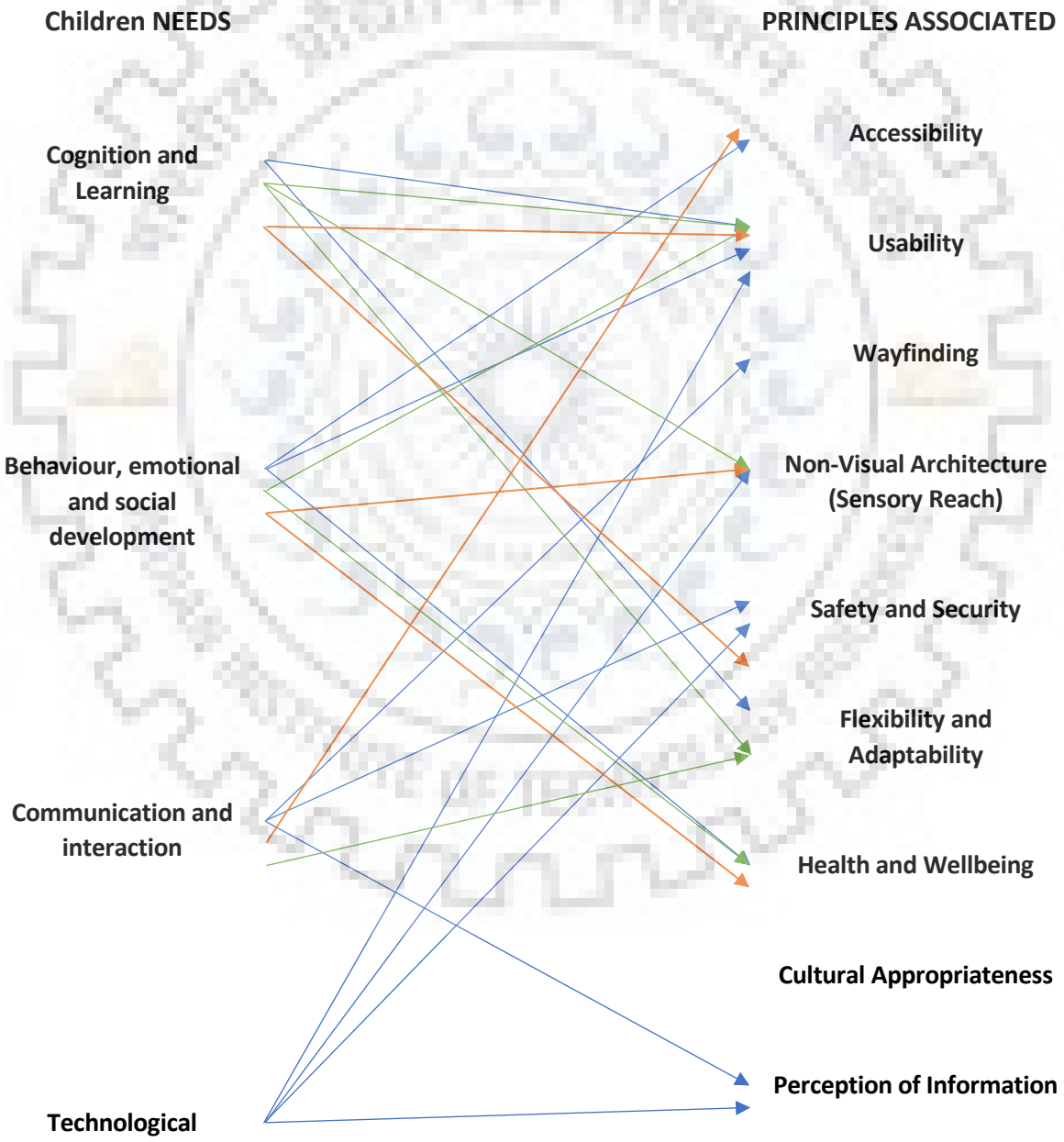
3.4.1 Inferences from Secondary Case Studies

Architects/ Designers collaborated extensively with school staff to create a building that feels more personal and local than institutional with a positive warm environment that promotes well-being.. With elevated quality, solid designs that can resist wear and look nice, the ambiance is warm and colorful from within. For groups of six to eight kids, teaching rooms are specifically designed.

Common spaces of a small hall for PE, a dining/meeting room and music space are used on a timetabled basis. These spaces are grouped together near the visitors' entrance, for easy access and to support opportunities for extended school and community use.

Each classroom has, resource areas and small rooms for quiet time or one-to-one work with staff. The youngest primary age children are on the ground floor, with their own library and food room. The older pupils are based on the first floor where they also have access to practical spaces for science, art, design and technology.

Architects addressed the special education needs of children through design. Cognition and Learning Behaviour, emotional and social development, Communication and interaction, Technological and Sensory needs of children. Instead of following conventional layouts and planning. local community and users are included at design phase, as well as local materials are utilized as wayfinding technique and to bring sensory awareness for children. Typical classroom layout is not followed, movable walls and furniture made the schools more flexible and usable. Each school is responding to climate and involves cultural aspects for example Hazelwood school design considers residences living near the site to give visual access to the park beyond school, Baytree school linkage and sharing amenities/space with community and how yellow train school induced Indian play or games featuring the walls and flooring)



Above diagram shows how CWSN at school environment of studied case examples are directly related to some Inclusive Principles. This establishes the link between needs and inclusive principles.

Case Study 1: Hazelwood School

Case Study 2: Bay Tree Community School

Case Study 3: Yellow Train School

Chapter 4

Pilot study, methodology development and Field visits

4 Pilot study, methodology development and Field visits

4.1 Participation study:

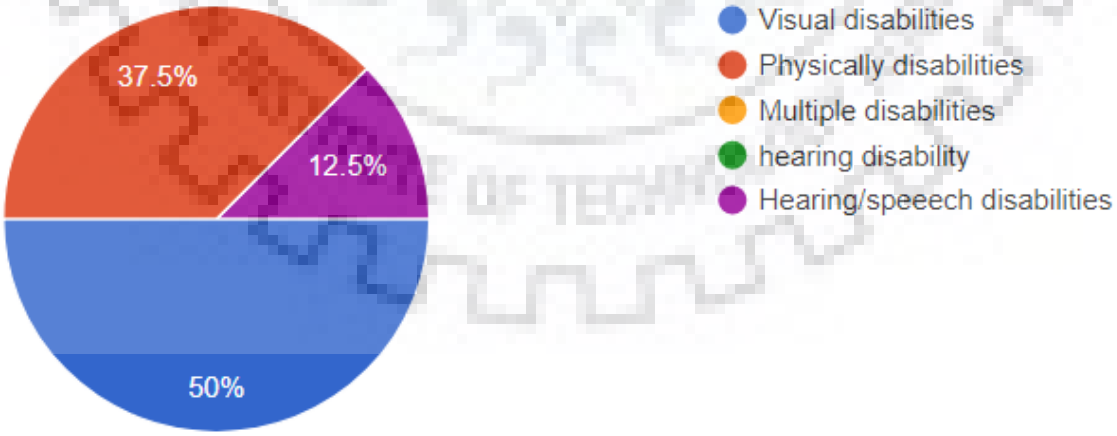
This Participation study includes a sample size of 25 individuals who are disabled(moderate) and is conducted as pilot study to get an understanding of mainstream schools. All the students who participated, studied in mainstream schools and the focus of this study on school built environment and what are the barriers they faced during schooling.

The sample constituted of fairly young, educated persons along with an even distribution among the asset index quintiles.

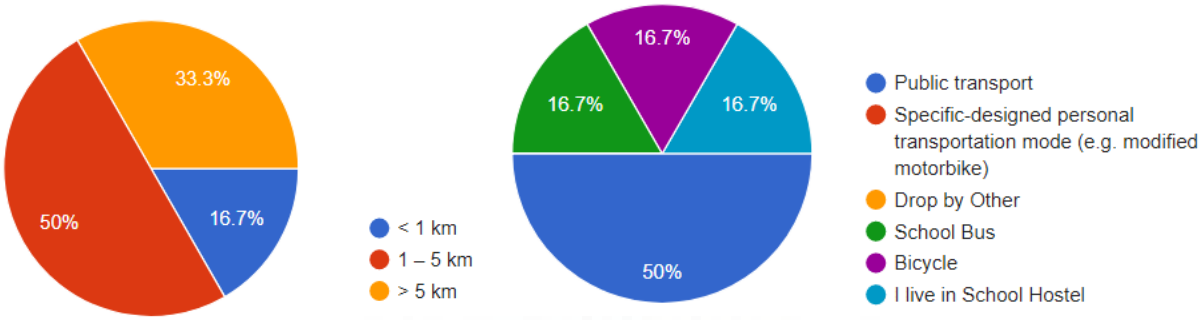
Here the sample size selected is IIT students who's experience as a student of disability in a mainstreams school is collected through questionnaire. Where these general social surveys are cyclical, it is very useful to have a disability module or a small set of disability questions added on.

The purpose of this research was to assess the connection between handicap and access to school at different educational stages, from main to secondary school in India. Encouraging inclusive schooling is essential in enhancing involvement and inclusion of kids with disabilities, as well as possibilities for potential jobs and social involvement. In addition, school is a protective factor against potential child labour-related impairment and hazardous working circumstances. At last, having all kids in school allows for training for - and addressing needs connected with-disability, especially teaching or mental disability as shown in other situations.

Percentage person with disability involved in survey



Distance to school and how do you get to school?



The causal link between disability and access to school is not a simple linear relationship but multidimensional and includes multiple factors.

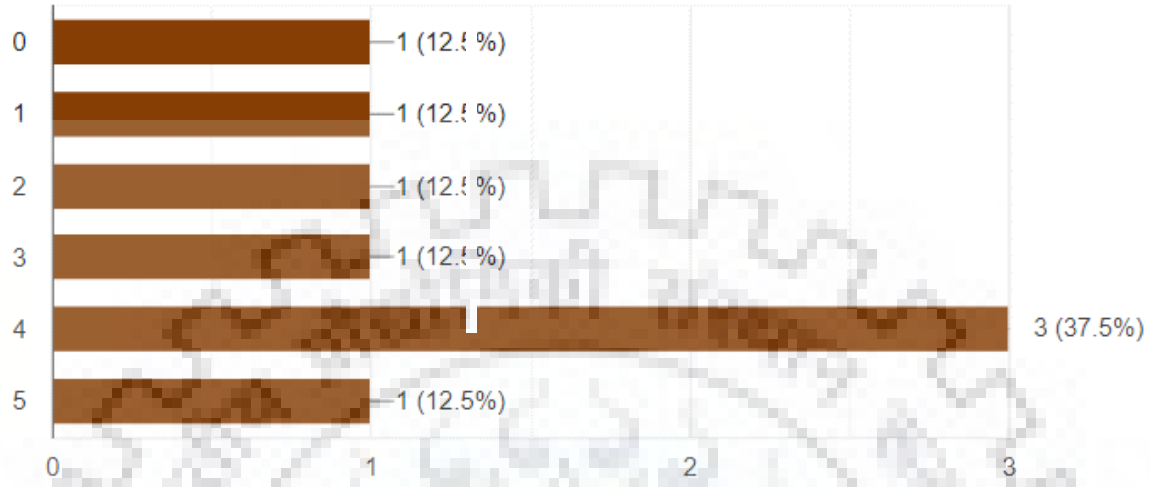
In your experience, what resources, tools, or policies help to promote early engagement by persons with disabilities in educational decisions and planning?

(Expected Outcome: Better understanding of requirements and steps needs to be taken for inclusive engagement of students from students with disability perspective)

Results: Some of the responses

- Educating the society about disables and ask them to behave with disables like normal persons.
- tools are many to be used properly
- Getting to know your future prospects to guide career in that way.
- Inclusive design
- Counselling is the best way to engage a disabled person. As we are disabled, we have less places to go and usually most of us don't know what type of job we are capable of. It is best to educate a disabled person about the field of study or a job he is going to take, and tell him about all the shortcomings he might face, beforehand. It is important for him to know that there are jobs where he can excel and there are various disciplines of engineering or any other subject where he won't be reminded of the limitations he is going to face.
- Spreading the word, talking about it Understanding of disability by children, parent and the teacher on the same foot is necessary. Training of teacher for educating kids with different abilities is also necessary. Policies by government and their proper implementation. Equal treatment of students with different abilities and support.

Does the school shows a strong commitment to ensuring the equal treatment of all its pupils. (rating scale 0-5)



c Type of the school you attended?

1 2 3 4 5 6 7

1. Resource models where children with disabilities study in general school and stay in hostels meant for non-disabled children.

2. Resource models where children with disabilities study in general schools and hostels of the nearby special schools.

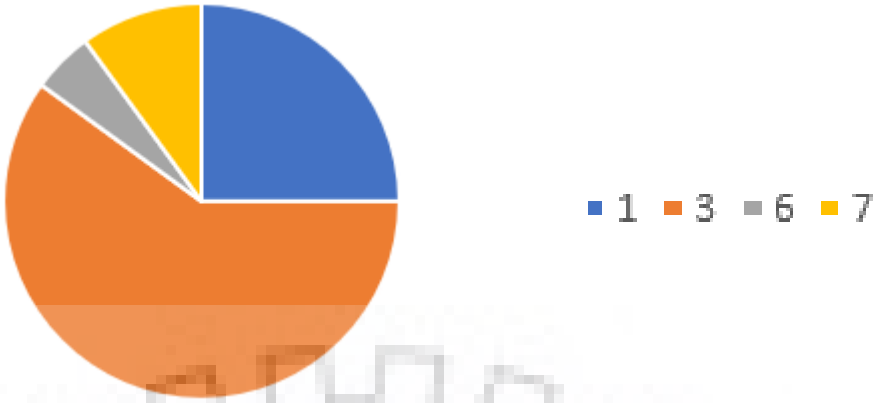
3. Resource models where children with disabilities study in general schools and stay with parents at home.

4. Semi – resource models or cooperative models where children with disabilities are taught only by the resource teacher in a separate class in a general school.

5. Itinerant model where a resource teacher visits the child in his/her local school and the child stays with parents.

6. Multi – category resource model where disabled children of different kinds are educated in a general school by the regular teachers and a particular locality.

7. Multi-category itinerant model where one special teacher attends to the needs of disabled children of different categories in a particular locality.



d. In your school, is there any facility that accommodates your needs as a person with disabilities?

Yes **No**

e. Which following area of school do you feel needs more attention in addressing to disability.

1 School access (School location, site development)

2 Entry to school

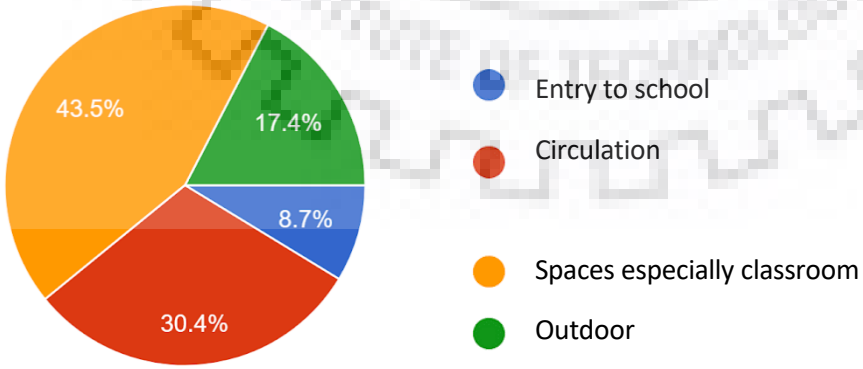
3 Circulation (corridors, access to upper floors, circulation in and around school)

4 Spaces (classroom, labs, other facilities)

5 Outdoor

6 Other

Results: 25 Respondents



Responses are

Questions were kept strictly architectural oriented and when enquired about opinion on which space needs more attention in addressing disability, Most responses related their experience with classroom activities which are related to physical as well as social barriers such as difficulty in seeing board, wrong furniture, attitude of peers, Understanding teacher and keeping in pace with other students.

d . What challenges do students with disabilities face when accessing above mentioned area in your school? (ex: Challenges in involvement of person in classroom activities)

It is nothed from the responses that children with disability who are placed in mainstream setting tend to be rejected or neglected more than their typically developing peers and are involved more with the adults in the classroom than with their peers. These children are most often rejected due to the fact that they cannot socialize in a physical way (running, climbing, jumping, skipping, hopping), which is customary to most school aged children.

Research points out In typically developing young children, the rate of rejection by other children is about 10% (Sonja de Groot, 2005). However, the rate of rejection goes up to 33% for children who are labelled as special needs students (Sonja de Groot, 2005).

- **Inferences:**

These points of view are important as they shift the focus away from the child's requirements, the need to fit her / him into an integrated environment, a critical review of the educational system, and an examination of the many other exclusionary influences within culture of our society and its schools. When teachers take the moment to build secure and united schools and acknowledge the centrality of student interactions, each part of the school will have a feeling of belonging.

It is decided that the interactions of the students are the main characteristic of the school experience of the students and create a separate contribution to the engagement motivation and accomplishment of the students

Further study focuses on how to build regular school and classroom environments that suit, nurture and promote each attending student's educational and cultural requirements by creating periodic school a space where everyone lives, is welcomed, endorsed and encouraged by their classmates and other school administration and staff members.

4.2 Pilot Study: Sylvia Wright Ray of Hope school

4.2.1 Introduction:

Sylvia Wright Ray of Hope school is a charitable organization which has a special school for children of all disability. The school has diverse children with multiple disabilities from around the community. Especially deaf children the school started as a NGO helping for deaf.

Students profile

- Number of students:215
- Number of teachers:15 trained teachers
- Site Development:

Figure 1 Panoramic view

Source: Author

4.2.2 Accessibility Continuum Assessment

- Design Aspects:

central green space, Efficient Visual Connection, Proper area division, aesthetically pleasing Easy movement. The building has lower plinth height and is accessed by a ramp, stairs are avoided and ramp is used in its place.The side is not on a plane terrain and has a contour where the back of the school buildings is at a height of 1.5m from the ground level and opens as balcony.

- **Entry:**

Figure 3 Main entry

Figure 2 Interior courtyard

Image Source: Author

The entry of the building is wide and open there no gate all the room entries are 2.1 wide and floor level is flushed with the corridor, Entries have push bar and are fully glazed

- **Circulation:**

The plane of the building is circular, this gives an visual connection the entire school and at every level difference only ramps are used instead of any staircase. The building constitutes of only ground floor and corridor runs along the entire length of the building and is 2.4m wide, the corridor has railing at a height of 0.8m but only on one side.

Figure 4 Building plan

Image Source: Author

Bright colors / textures are used as flooring to indicate and highlight routes, as they attract attention easily.

- Spaces:

Varied Height Classroom Furniture.

Figure 6 classroom spaces

Figure 5 Computer lab

Image Source: Author

Spill out areas, An airy alternative for one on one interaction. The center courtyard acts as a playground for students and the furniture is also designed with needs of children in mind. Classrooms were spacious and furniture used is colorful and versatile. Classroom opens into an spill out area outside for seclusion for any child acts as getaway spaces.

Figure 7 Spill out area

Image Source: Author

- **Details:**

Figure 9 Toilet Fittings (grab bar), Ramp

Figure 8 Assistive devices storage

Images Source: Author

Toilets are equipped with grab bars and each classroom is facilitated with ramp and there's a store for assistive devices in the classroom.

All the spaces of the following school are assessed on the basis of Design Principles attained form literature study and accordance with Accessibility Continuum. The spaces were marked as acceptable if following the principle of inclusive design and not acceptable if it not.

Limitation:

This study is solely concentrated on spatial quality evaluation, as it a pilot study, to gain better understanding of spaces and draw criteria of spaces which are more susceptible to neglect while considering implementation of design principles.

4.2.3 Accessibility continnum Framework

Table 1 Observation study of spatial quality evaluation

Accessibility Continuum	Design principles of inclusive school		Sylvia Wright Trust
Site Development	Access	Physical	
		Information	
		Communication	
	Space		
	Sensory Awarness		
	Flexibility and Adaptability		
	Health and well being		
	safety and security		
Entry	Access	Physical	
		Information	
		Communication	
	Space		
	Sensory Awarness		
	Flexibility and Adaptability		
	Health and well being		
	safety and security		
Circulation	Access	Physical	
		Information	
		Communication	
	Space		
	Sensory Awarness		
	Flexibility and Adaptability		
	Health and well being		
	safety and security		
Spaces	Access	Physical	
		Information	
		Communication	
	Space		
	Sensory Awarness		
	Flexibility and Adaptability		

	Health and well being		
	safety and security		
Details	Access	Physical	
		Information	
		Communication	
	Space		
	Sensory Awarness		
	Flexibility and Adaptability		
	Health and well being		
	safety and security		

Acceptable
Not Acceptable
Best/ Recommended

Source: Author

4.2.4 Inferences:

It is noticed that more importance is given to spaces (classroom) design as it follows most of the Inclusive design principles.

The classrooms are adaptable in nature with movable furniture and has a capacity of 8-12 students, this is in accordance to following government regulation on number of students per class in a school for disability.

Table 2 Sylvia Wright Ray of Hope school Children needs and Associated principles

Children Needs	Space Needed	Associated Inclusion Principle
Cognition and learning	Entire school environment is easily accessible, classrooms are designed with flexible furniture and have calming colours. Wall are decorated with student works and learning material. Formal classrooms extend to outdoor play area which also serves as learning environment	Accessibility, Flexibility and adaptability, Personalization, Sensory reach
Behaviour, emotional and	Each class room is designed to have a spill out area and an attached toilet with grab bars. Independent movement is allowed cause of	Availability of space, Accessibility, sensory reach (light and colour)

social development	grab bards all along the corridor and level differences are accessed by ramps throughout the school	
Communication and interaction	Quite spaces and spill out area from formal classrooms act as interaction spaces	Availability of space
Technological	Entire school building is under surveillance. Hydro pool and computer lab are equipped to meet needs of children. Light and sound emergency systems are fitted in classrooms.	Safety, health and wellbeing

4.3 Case study selection criteria and methodology

4.3.1 Criteria of Selection:

Government schools especially with CBSC Board were selected for the study, like Kendriya Vidyalaya school. Schools under this organisation follow the same policy across India. So that it was able to draw a comparison between the resources for selected case study schools. schools respond to student diversity is different.

However, aspects of inclusion related to curricula, instructional, evaluation and infrastructural changes are centrally decided and followed in the Central schools across India.

The study work plan required an in-depth evaluation of schools on basis of inclusion and further forming guidelines for Design. The cases selected strategy is information oriented, to establish credibility and to demonstrate a characteristic or an attribute of interest.

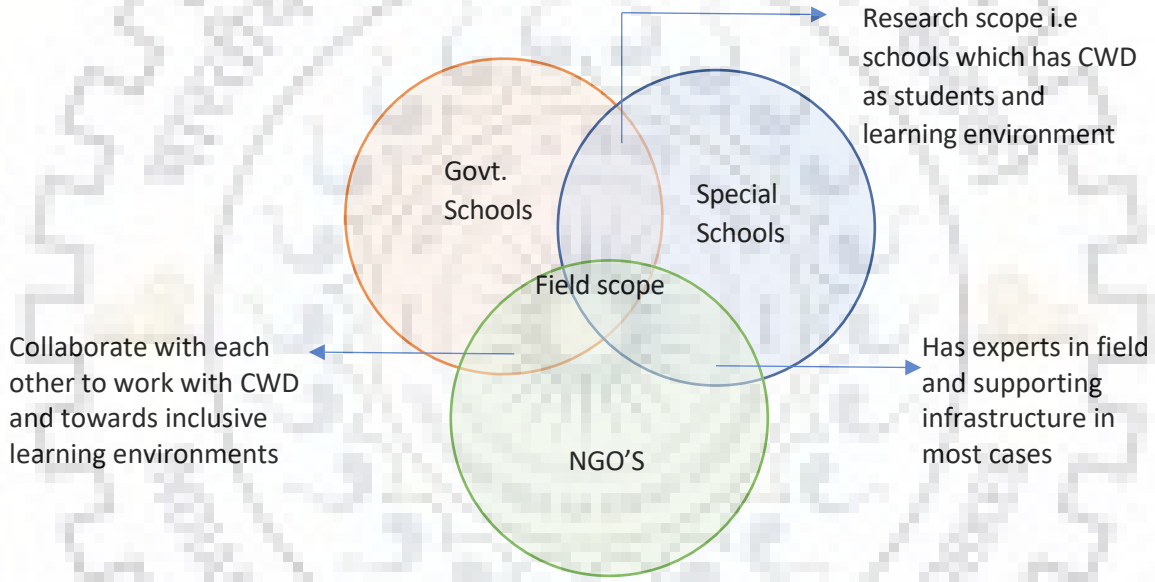
Context: The location, is priority in selection, the topology of selection is in urban context

Facts about the case – At least a percentage of 3 children with disability to total is considered in section criteria, as this percentage is nominal in establishing the Inclusivity of school in Population sense. The type of disability and level also forms the basis for criteria. Age range of school is another important indicator in selection of cases.

Challenges encountered –Indian cases are evaluated on basis of availability and extent of usage of facilities and provision.

Criteria	KV Visakhapatnam	KV Rajahmundry	Govt. School
Proportion of CWD	14 out of 843	3 out of 746	35 out of 1259

Student disability type	V, H, L, I	H, L, I	V, H, L
Disability Index	Mild to Minimal	Mild to Minimal	Severe to Minimal
Location context	Urban		
Identifies as inclusive school	YES		
Board of education	CBSC		



Source: Author

Inclusive Education models of school forms the basis for selection of case studies as the teaching methods as this eliminates the possibility of curriculum barrier and other barriers of education apart from physical. Parallel lines are drawn with international relevant model of inclusion.

Special schools and NGO with similar context as school (Location and disability profile) is chosen to understand the learning environment and inclusive practices better.

"Special schools for children with visual impairment, hearing impairment, and locomotor disabilities are streamlined to follow a curriculum that is almost in line with the general education curriculum.

" EDUCATION OF CHILDREN WITH SPECIAL NEEDS ncert paper"

4.3.2 Study areas/ Case studies selected:

- **Govt. Schools**

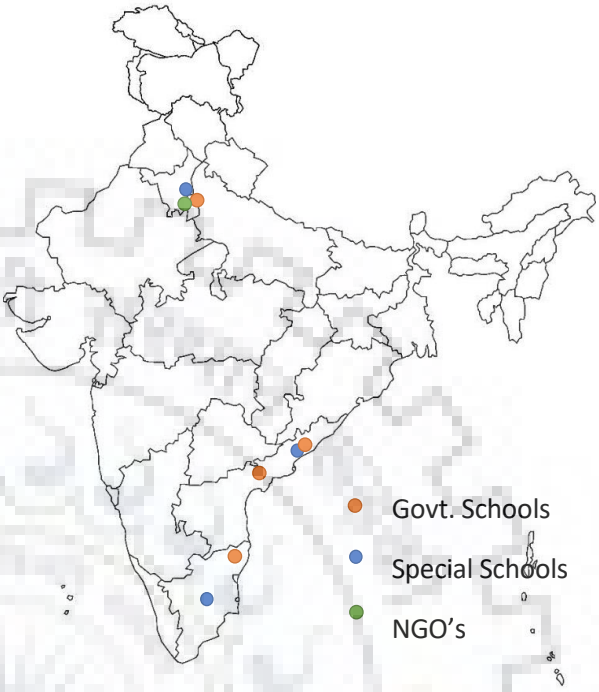
1. Kendriya Vidyalaya school – Visakhapatnam
2. Kendriya Vidyalaya school – Rajahmundry
3. Government Boys and Girls secondary high school - Delhi

- **Special schools**

1. Arunodaya Special School, Visakhapatnam
2. Silviya wright school for disabled - Chennai

- **NGO'S:**

1. Tamana organisation - Delhi
2. ASTHA Organisation – Delhi
3. Samarthyam – Delhi



4.4 Research Methodology and tools used:

Methodology used:

The focus of this research is on investigating the inclusive practices adopted by schools that claimed to be inclusive schools.

practices in so-called inclusive schools were complex and hence needed to be portrayed

from many dimensions, rather than focusing on a narrow field. Thus, the emphasis was placed on observing the practices and also on listening, understanding and interpreting views of stakeholders with regard to inclusive practices in schools. With this in mind, Observation and participatory methods of data collection were used.

Figure 10 Methodology process

Source: Author

Table 16 Methodology and Tools

Child Centred Research	Types	Sub Division	Target Group	Aim	Survey	Data Collection Methods	Objective to be fulfilled	Data Collection Tools	Limitations	Analysis	Data Presentation	Expected Outcome
	Observation	Naturalistic Observation(Quantitative)	Students(disabled / non disabled)	Drawing Comparative analysis of children with disabled to non disabled		enquiry, counting	To understand the ratio of pupil and class dynamics	Framework, camera, Measuring tools	nil		Bar diagram, pie charts, ranking(pupil strength and special assessment)	Students peer support ratios
			School spaces	Targeted to know Types and number of services provided		Schematic plans, space segregation and categorize and measurements	To Understand the special needs of children		All spaces may not be accessible due to permissions issue			Resultant of Policy ensuing
		Naturalistic observation (Qualitative)		understand Spaces and Inclusion design Principles		Rating, Assessment tables, Project Based Learning Experience (ref framework 1), Accessibility checklist	To understand the efficiency of learning environments.	Camera , prepared framework or assessment table	The rating is in perspective of researcher and her/his judgement of spaces		Description of spaces, framework frames	Qualitative analysis of spaces and services
		Participant observation Method	children with disability	Access Physical environment factors		Visual Methods, Child - Led Tours	To understand the accessibility of school from children perspective	Camera, Maps, External Observation by researcher, Mobility Maps	Success depends on relationship between child and researcher-		plans, drawings, essays	Child's perception of space, Use of space for the child and how they use it and Their interaction with the space
	Participatory	Qualitative	One representative of children with disabilities of each type, Children with minimum level of comprehension	To discover the extent of children's mobility and physical movement within and outside their community		Questionnaire and semi structured Interviews,	Insight into children's perception of life situations and understanding their school environmental needs	Reports by Family Members, Teachers, and Peers	Difficult to compare results across individuals		Essay, narratives	Description of spaces and environment from students perspective
						Children's Drawings and Maps		Drawing, Cameras and audio recorder	Possibility of wrong interpretation of drawings by researcher		Graphical	Analysing the graphic characteristics, Insight into children's perception of space and distance
			Groups of children with disabilities and parents			Focus Group Discussions		Narratives and discussions	Lack of understanding on the part of children, Reliability of answers: based on experience		Essays and narratives	

			Disabled individual with minimum level of comprehension	Get idea about children Experiences with school environment		Questionnaire and framework	Comparative developmental assessment, Conversation analysis from interviews	Assessment framework	Not suitable for children with inadequate social skills and language abilities Children lacking verbal, writing or drawing		Diagrammatic presentation	Child's physical and social network
		Quantitative	Groups of children with disabilities and parents					Focus group discussions	Lack of understanding on the part of children, Reliability of answers: based on experience and Not applicable for deaf/ mute, unlettered children			

4.5 Data collection:

Observation Method

The research observation method involves observing and collecting evidence on the barriers in classroom, playground, surrounding environment etc.., the methods used were naturalistic observation which involves just the researcher observing learning environment to understand the effectiveness of space , school accessibility assessment, to observe student's usage pattern and their behaviour study. Later the spaces were evaluated on basis of the existing assessment framework's from NCERT and UNICEF.

4.5.1 Participatory Methods

The other method involves children with disability participation in observation, where CWD is asked to guide the school tour for the researcher to see the school environment usage from child perspective.

Participatory methods include all the methods in which children have to be actively involved in the research process. These are the most effective methods to conduct successful studies with children. Most of the participatory methods require additional tools, for instance semi-structured questionnaires, for analysing the data collected during the process. These additional tools help in appropriate interpretation of the collected data.

4.5.2 Limitations of the study:

In naturalistic observation all spaces may not be accessible due to permission and security issue, and the understanding and assessment of spaces is based completely on the judgement of the researcher. The study was

While in participatory observation of school tour by Child with disability, the success depends up the efficiency of child and researcher relationship. All the above study was done with keeping time as a constrain

4.6 Assessment of school:

4.6.1 Qualitative:

Qualitative research is a source of universal methods for assessment of whole objects, as well as selected elements of the building: zones, interiors, outdoor spaces, and above all, it provides recognition of users' opinion. The basic establishment is that the built environment is a direct source of valuable information about design, in other words it is the knowledge about buildings and users.

Theoretical analyses were based on literature studies and conducted by the authors' quality evaluations on spaces with different functions. Given research was performed as: qualitative (in terms of technical, functional, organizational, behavioural qualities), observations, surveys, interviews (with users, stakeholders, experts)

4.6.2 Quantitative:

Quantitative method is used to draw comparison in ratio of CWD Students to normal children in various schools and factors affecting them. NCERT school for all physical environment indicator rating system is used to produce assessment of environment. Quatitative research helps in Comparative developmental assessment, Conversation analysis from interview.

4.6.3 Assess Inclusion aspects schools (Selected Mainstream Schools)

Each school is assessed on Accessibility continuum, physical elements of school starting from site development to Details are observed and documented. On the following levels, field visits are studied.

- **Site development**
- **Entry**

Entrance, Gate and Doors

- **Circulation**

Horizontal, Vertical Circulation

- **Spaces**

Social and Learning spaces

Formal- Classrooms, Labs

Informal – Multipurpose hall, Open spaces, Play ground

Supporting Spaces

Office, Administration, Health room

Toilets, Services

- **Details**

Chapter 5

Primary Field Study and Findings

5 Primary Field Study

5.1 Field Study 1: Kendriya Vidyalaya Visakhapatnam

Figure 1 Ariel view (Satellite image)

Source: Google Earth

- Location: Kendriya Vidyalaya, Waltair, Visakhapatnam
- Area: 9.643 Sq meters and 6,369 Sq.meters of playground
- Access: Two road lead to school NH-5, Akkayypalem 80 feet Road
- Services: School has 3% reservation for CWD
- Primary school and secondary school in two different buildings.

Class standards: 1st to 12th standard
Students strength: 843
Children with Disability: 14 students from mild to minimal Disability
Faculty: 26 teaching faculty
Staff/Administration: 29 office staff / Maintenance staff

Figure 2 Inclusion depiction Art at entrance

Source: Author

- Topography: No terrains, Flat land.
- Access: Situated near by two Main roads, and can be easily accessed: Bus stop -0.5 kms
- Services provided: has 3% reservation for CWD

5.1.1 Introduction

kendriya Vidyalaya (KV) schools in India are central institutes which comprises of around 1,199 school in india and three abroad.KV is one of the worlds largest school chains. There is uniform curriculum and standards followed all through these schools. Scince KV schools come under MHRD (Ministry of Human Resource Development), they respond and abid to follow Govt. policie's but it should also be noted that each schools response to diversity is different.Irrespective of this aspects of inclusion all across these schools is decided centrally and followed specifically aspects related to curricula, instructional, evaluation and infrastructural changes.

Figure 3 Main Entrance gate

The entrance has drain cover which is metal tubes as hinderance.

Figure 5 Building Entrance

The slope of the ramp is 1:8 where a person on wheelchair needs assistance to go up the ramp.

Figure 4 corridors

The corridor of the school is 2.4 wide but effective width is only approx. 2 meters.

Images Source: Author

The school follows CBSC syllabus and teachers are trained, the school at Visakhapatnam has a diverse student population because of naval base in the city, where children from different background study. The school management describes the school as inclusive in terms of opening their doors to children with disability and from various socio-economic backgrounds. The school has 9 students who are categorised as partially disabled and one severely disabled child.

5.1.2 Accessibility Continuum Assessment

- Site Development

The site of school is located at waltair which is relatively plain terrain and school is easily accessed from one main 60ft roads and one internal road 20ft.

- **Site Access**

The approach to the site for students is throught bus or private vehicles, two main roads lead to the site main and back entrances but roads lack information about school location and route.

- **Entry**

School has bus service but CWD prefer coming by private or own vehicles because of ease of transportation which is lacking in school buses, these private vehicles are allowed into the school nearer to building entrance unlike school buses which stop in the ground.

- **Circulation**

The corridors were wide enough for a wheelchair user 2meters and verticle but suggested corridor width for a school is 2.4 meters.School aadministration is planning for a 1.5m wide ramp to first floor.

- **Spaces**

Formal spaces: learning spaces like Clasrooms, labs and others are fitted with furniture and crowded leaving no to less space for flexibility. Libraries have a very organized setting of seating and all seating are not height adjustabledy, there no silent or quite corner for solitude study.

Laboratories are built in typical platform at a height of 0.8 meters, where instrumentrs and equipments are placed upon, there no height variation for young children and for wheelchair users.School is equipped with laboratories, medical room and other extracirricular activity spaces like music, dance rooms.

Figure 7 Library

Figure 6 Classroom

Images Source: Author

Informal Spaces:

School lacks much of informal spaces, shaded spaces under tree in and around playground are used as leisure spaces during break, the interior courtyard lack pupil even though it has seating and shade, this

is due to proximity to administration and staff rooms. Students prefer areas away from formal learning spaces to spend leisure time.

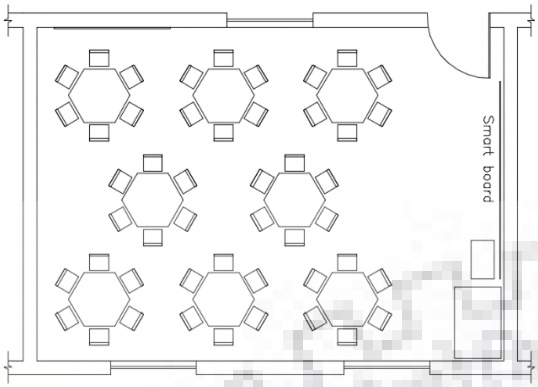


Figure 8 Primary classroom

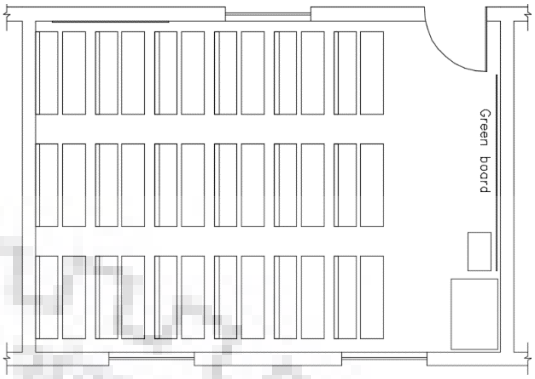


Figure 9 secondary classroom

Images Source: Author

Classrooms:

The classrooms side is 6m X 8m and accommodate usually 48-35 (Primary and secondary respectively)

students giving an average of 1.06sqmts for each student which is less than advised (pre school 2sqmts, primary and secondaary 1.2sqmts), The organization of benches were traditional rows and columns seating, whereas primary classroom seating is arranged as group seating or clustered of 6 students.There is no storage space except for a wardrobe and gives little to no possibility of flexibility in arrangement of clasrrom furniture because of a smaller room side and larger class student strength.There should be a minimum of $2m^2$ usable space per student based on international standards.

Open spaces:

The open space surrounded by school is paved and is unobstructive, but the outdoor open space adajacent to school building is leveled and not covered with grass as per requirment and the equipment used for playing are also not disable friendly.

Figure 10 Open spaces

Images Source: Author

Materials used for paving open spaces are non-smooth and contrast in colour.Theres no ramp for the stage access.Theres a gutter all along the edge of corridor and level diiference of 300mm from ground to corridor which is not ramped. Stage doesn't have a disabled friendly access.

Details:

Details in interiors such as for classroom lack personalised space and a quite corner (get away space), overcrowding the classroom with benches leaves less room for adaptation for different activities.There is no space provided for a wheelchair user, he/she expected to sit in a normal bench. No personlised storage space for children.

Even tough classroom doors are open prior to school working hours, handles design are non lever type and doors don't have vision panel.no special acoustic treatment is done to classroom as school is surrounded with tall ashoka trees on periphery away from major traffic noise.There is no tactile path giving directions.

Figure 12 Staircase

Figure 11 Services Drinking water points and Washbasins

Images Source: Author

The staircase

Staircase doesn't have handrails on both sides and material used before slippery after years of wear and tear.

Washbasins

Washbasins are designed on pedestal and have no gap for a wheelchair user. All the washbasin heights are ranging from 0.6m to 0.8 meters making it inconvenient for small children.

Barriers/ Hindrances:

Barriers like doormat and gutter along the corridor cause hindrance to the movement and these are unnoticed by the administration, teachers and others and are considered as miniscule.


Figure 13 Barriers

Images Source: Author

Toilets:

Girls and boys have separate toilets. Each toilet block has one disabled toilet with grab bars and sliding door. Toilets have poor drainage system and one toilet block on each floor has disabled friendly toilet.The flooring of toilet cubicle is not anti-skid and has no washbasin inside.

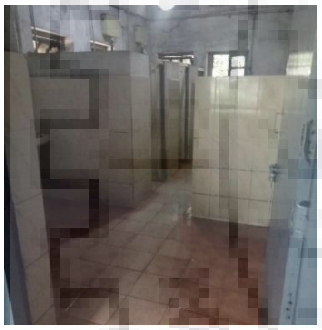
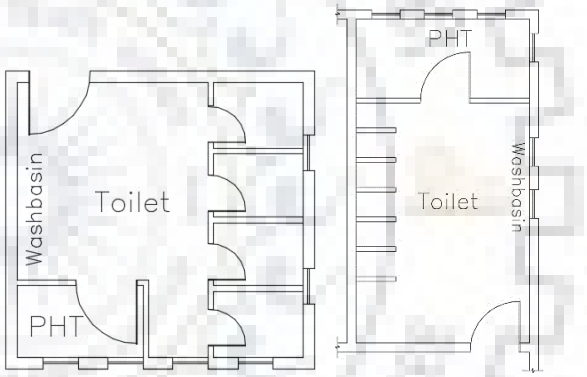



Figure 15 Toilets Figure



14 Diagrammatic Toilet plans

Images Source: Author



Figure 16 Fire and Assistive equipment

Images Source: Author

The emergency

Emergency equipment is centrally located for easy access and exits directions are marked at staircase, as well equipment for necessaries like wheel chair are located at entrance.

5.1.3 Qualitative Assessment

Table 1 NCERT Assessment (Qualitative)

School Accessibility Checklist			
Entry/exit	**Yes**	**No**	**Remarks**
Are kerb ramps provided at all level differences, between the road surface and footpath level:			Footpath arenot leveled around school
a) Pedestrian crossings in and around the school?			Has pedestrain crossing only at NH-5 road, the other side road has less traffic
b) Parking spaces in and around the school?			Minimum parking (6 car,15 bikes)
c) Building entrances?			Entrances are paved with tactile tiles but less ratio sloped ramps
Is it ensured that there are no obstructions (for example parked vehicles, manholes, potted plants) allowed outside the gate			

blocking the gate/ entrance/exit to the school?			
Is the approach to the school well maintained with a level surface?			Not leveled and has drinage hinderence
Ramps	**Yes**	**No**	**Remarks**
Is there a ramp next to the stairs?			Proposal of floor to floor ramp, entrance steps and ramp are together.
Is the location of the ramp clearly identifi able with a sign?			
Is the ramp gradient no steeper than 1:12?			The slope of the ramp is 1:8
Is the width of the ramp a minimum of 1200mm?			
Are there continuous handrails, on both sides, at a height of 760mm-900mm from the floor?			The ramp design does not provide individualised movement of PWD
Is there a landing of 1500mm x 1500mm at the turning of the ramp?			
Is the surface of the ramp anti-slip/matte fi nish?			The surface is laid with tactile flooring.
Is there an edge protection on both sides of the ramp to prevent wheelchairs from falling off?			
Staircase	**Yes**	**No**	**Remarks**
Is the location of the stairs easily identifi able with a sign?			
Is the width of the stairs a minimum of 1200mm?			
Are there continuous handrails, on both sides, at a height of 760mm- 900mm from the fl oor?			Only on one side
Are handrails easy to grip with a diameter of 38mm-45mm?			
Are the handrails painted in colours contrasting with the wall colour to be easily identifi able by children with low vision?			For a wall with blue colour railing is painted with red colour
Is it ensured that stairs do not have a nosing (extension of step edges for beautification)?			No nosing, but stairs have sharp edge
Are the step edges of a different colour or texture to be easily identifiable by children with visual impairments?			
Is the location of emergency (fi re escape) stairs clearly identifi able with a sign?			language of sign is telugu and english
Is it ensured that there are no open gaps in between the step risers?			
Is the step riser 150mm or less?			colour of the steps not distingushable

If there is an open space under the staircase, is it blocked off?			
Corridors	**Yes**	**No**	**Remarks**
Is the minimum unobstructed width of corridors at least 1200mm?			the columns are intruding into the clear column space
Is it ensured that there are no objects protruding more than 100mm from the walls in the corridors?			Windows of classroom are openable into the corridor
Are all over hanging obstructions mounted above a minimum height of 2200mm from the floor, giving head clearance?			
Signage	**Yes**	**No**	**Remarks**
Is there signage indicating the floor level on each floor?			The building consists of only one floor
Is there signage indicating the locations of classrooms and other school facilities?			The clour of sign bords is not so distinguishable
Are all signs in Braille, text and using pictograms?			
Are signs hung at a height of 1000mm-1600mm from the floor?			The signages are at a height of 2100mm and non pictorial.
Are there signs for girls' and boys' general toilets?			Not pictorial
Are there signs for girls' and boys' accessible toilets?			
Doors	**Yes**	**No**	**Remarks**
Can the doors be easily opened and closed by children?			Almost all the doors of rooms usually used by children are open during working hours
Are glazed doors marked with a colour band at the eye level for children with visual impairments?			Classroom doors are not glazed
For double leaf doors, is the width of one of the leaves at least 900mm to allow wheelchair users to enter/exit without opening the other leaf?			Doors have 1000mm clear width
Are manual door accessories/hardware (handles, locks, pulls, etc.) located at a height of 800mm-1000mm from the floor?			Yes, but the hardware is not inclusive
Are doormats flushed/embedded in the fl ooring and edges secured to the fl oor?			
Is the threshold (door sill), no more than 10mm high and bevelled (merged with gentle slope)?			No threshold, but doormats form obstacle
Boards	Yes	No	Remarks
Do the classrooms have green boards?			
Is it ensured that the lower edges of green/black boards are not above 500mm			

from the fl oor so that children using wheelchairs can access them?			
Windows	Yes	No	Remarks
Do the windows open into classrooms and other rooms and not out to corridors/hallways?			Windows open to outside and corridor windows are mostly closed or doent have shutters.
Is the height of windows between 600mm (bottom edge) and 1450mm (top edge), enabling children to see outside while seated?			
Are there grills/wire meshes on the windows to safeguard children from falling outside?			
Flooring	Yes	No	Remarks
Is the flooring of the school skid-proof/ anti-skid?			Doen't have tactile flooring
Is the toilet flooring skid-proof?			
Is there a drain in the fl oor in the toilet for all excess water, so that it can be kept dry?			but the floor is not leveled.
Toilets	Yes	No	Remarks
Is there a ramp provided to the accessible toilet cubicles?			Not needed, Accessible toilet cubicle is at the same level as entrance
Are there separate toilet cubicles (one each in boys' and girls' toilets) for children with disabilities?			
Is the size of the accessible toilet cubicle a minimum of 2000mm x2200mm?			
Is there suffi cientwheelchair manoeuvring space of 1500mm x 1500mm around the toilet and washbasins?			
Is the washbasin mounted at a height of 700mm-800mm from the floor (top edge)?			But access to toilet by wheelchair user is difficult because of verticle barrier.
Is the lower edge of the mirror positioned at a height of 1000mm from the floor?			
Are there transfer grab bars (L-shape on the wall side and U shape on the open side of the toilet) installed near the toilet?			
Are all the grab bars at a height of 700mm-800mm from the floor?			
Is the toilet equipped with an emergency alarm system?			
Can the doors be locked from the inside and unlocked from outside in emergency situations?			
Is the toilet flush easy to operate?			

Does the toilet door have a clear width of 900m or more?			
Does the toilet door open outwards?			Toilet has a sliding door
Is the WC (western commode seat) at a height of 450mm-480mm from the floor?			
Playgrounds	Yes	No	Remarks
Is the playground level?			Ground is leveled, but not wheelchair friendly
Is the playground covered with grass?			
Does the playground have a paved pathway with a minimum width of 1800mm, which can be used as a track by wheelchair/crutch/walker users?			Theres a paved pathway leading to playgroud, but ground has no equipments for CWD
Emergency preparedness	Yes	No	Remarks
Are emergency exits clearly marked with directional arrow signs?			language of sign is telugu and english
Are there both audio and visual emergency alarms in all areas?			

Source: Author

5.1.4 Quantitative Assessment

Normal students to student with Students with special needs ratio is 60:1, CWSN constitute of about 1.6 percentage of school pupil strength.

Students to teacher's ratio 29:1 Where for a mainstream school it is advised to be 21:1 and for a special school it is at 8:1

Spaces accessible by students: Child led tour

Child Name	Class / Age	Disability
Karthik	VI / 13 Years	Locomotor_ Uses wheelchair

Figure 17 Site plan

Images Source: Author

Table 2 NCERT Assessment (Quantitative)

NCERT School for All "Physical Environment" Rating				
Sl no	**Indicator**	**Rating / Response**		
1	The school is fully accessible to all children including CWSN	3	2	**1**
2	The School doors have handles fixed at appropriate level and not too high	**3**	2	1
3	The school toilets have adequate doors taking care of privacy, especially for girls/children who need help in toileting?	**3**	2	1
4	The classroom settings in the school enable children to move freely or sit with a friend when required	3	**2**	1
5	The blackboards are fixed at a proper height in the class to be accessible to all children, including those who want to come near the board to read it.	**3**	2	1
6	The classrooms have adequate daylight and extra light when necessary	**3**	2	1
7	The noise level in the classes is minimised for avoiding distraction	3	**2**	1
8	The school takes measures to provide adequate transport facilities to CWSN	3	2	**1**
9	The school has a resource room or special room for additional teaching if required	3	2	**1**

10	The school is equipped with science labs and equipment for mathematical activities including the adapted versions	3	**2**	1
11	The school has adequate sport facilities for all children	3	2	**1**

Source: Author

5.1.5 Participation Research

The age of the students who are considered for interviews are between ages of 10 till 18years for comprehension but below is the list of students who have special needs.

Profile of student sample from the school.

Table 3 Profile of student sample from the school

Name of the student	Gender	class	Number of years spent in school	Special needs	Academic performance
Sridhar	Male	III	2 years	Hearing Impairment	Below Average
Komal	Male	IV	3 years	Handicapped (no left hand)	Above Average
Saranya	Female	V	4 Years	Locomotor	Above Average
Gaman	Male	V	4Years	Temporary Disability(Wheelchair user)	Average
Bhavya	female	VI	4 years	Muscular dystrophy	Average
Vamsi	Male	VI	6 Years	Colour Blind (Deuteranomaly)	Below Average
Lalitha	Female	VII	6 Years	Hearing Impairment	Average
Karthik	Male	VIII	3 Years	Epilepsy	Above Average
Ananya	Female	VIII	7 Years	ADD	Below Average
Sruthi	Female	VIII	4Years	Low Vision	Average
Aakarsha	Female	IX	4 Years	Partial Blindness	Average

Gaman	Male	X	6 years	Temporary Disability(Broken left Arm)	Above Average
Raju	Male	X	8 years	Locomotor Disability(Limp)	Above Average
Prasanna	Male	XII	6 Years	Uses crutches	Average

Source: Author

Figure 18 Interviewed children

Images Source: Author

5.1.6 Questionnaire:

Students with disabilities or their parents may feel that they are required to repeatedly advocate for accommodation and cannot rely on their school, to have the necessary knowledge base.

Introductory questions:

Names: Class: Disability:

- **Focus Group Discussion:**

The questionnaire is focused on children with disability in school and formed a group discussion

1. *What challenges do students, instructors, staff and the public (Parents and others) with disabilities face in navigating their educational built environment?*

Students are facing challenges navigating older buildings designed and constructed before current accessibility requirements were established. If schools include accessibility features throughout the built environment, from the classroom or student workspace to the building and exterior grounds, students with disabilities can participate in a shared educational experience with other students

Especially in navigating the school grounds and exterior environment. Wheelchair usage in classroom was a difficult, students with wheelchair were expected to be carried from corridor to classroom.

2. *What challenges do students with disabilities face when accessing supports, programs, or services in their school?*

Educational spaces, from classrooms to laboratories, difficulty in using assistive devices that help in navigating around the space. Students with locomotor disability are confined to library during physical activity period.

Even in classroom an extra time of10-15 mins allotment for the CWSN is preferred by parents and students

3. *In your experience, what resources, tools, or policies are most effective to promote better awareness of available supports and facilitate appropriate accommodations?*

Students without disabilities and their parents also feel that they lack an understanding of accessibility and disability, limiting their ability to create an inclusive school

Parents suggest students may benefit from additional guidance to teachers on how to create an inclusive educational environment for all their students, such as how to adapt the principles of universal design (also known as “design for all people”) to the physical layout of the classroom.

4. *What challenges do students with disabilities face when planning for employment, for post-secondary education or training?*

No special treatment apart from pushing them to acquire a disability certificate. Secondary school students may not have fully benefited from supports and tools available to help them successfully transition to employment or to post-secondary education or training.

Teachers/Admiration: The attitude of teachers and administration is, will provide/ think about when in needed

- **Accessibility Discussion:**

There were 15 individuals participated in this questionnaire, Children with comprehensive skills, this is a mix of students who are disabled and normal.

Here the sample size selected is mix of students, teachers and few parents who are willing to participate.

This study aimed to measure the association between disability and access to school at various stages of accessibility continuum and in forming a priority order of principles of inclusivity from student's perspective.

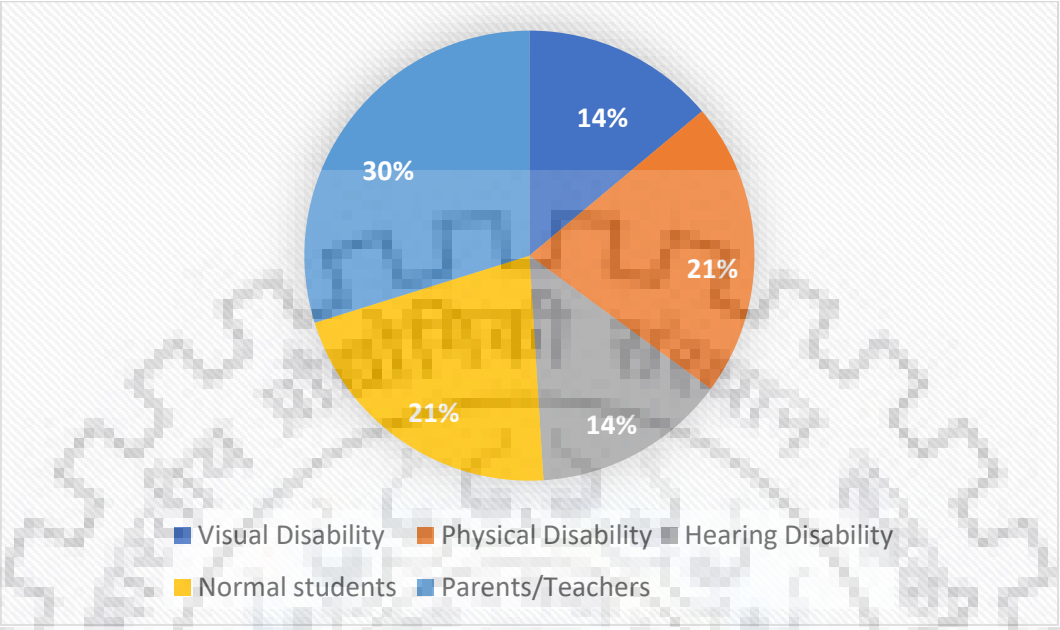


Figure 19 Percentage person with disability involved in survey

Images Source: Author

The group involves a mix of users and inputs were taken regarding school accessibility

- **Hierarchy of Principles of Inclusion**

Group is asked to make a hierarchy list of Principles of Inclusion, each principle is explained at prior to the group along with its importance in design. This will help in prioritizing the principles which suggesting phase wise design consideration for school building. A cumulative Hierarchy list is acquired.

- **Access**
- **Spaces**
- **Health and Well being**
- **Safety and Security**
- **Flexibility and Adaptability**
- **Sensory awareness**

It should be noted that parents and teachers preferred health and safety as major concern, while children were more forthright about spaces such as playgrounds, toilets and other.

Which following area of school do you feel needs more attention in addressing to disability.

- School access (School location, site development)
- Entry to school

- Circulation (corridors, access to upper floors, circulation in and around school)
- Spaces (classroom, labs, other facilities)
- Outdoor
- Other

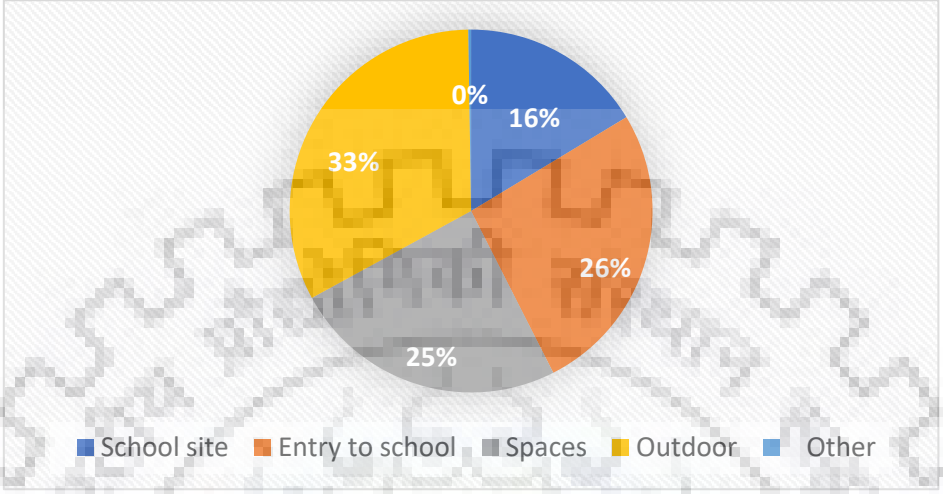


Figure 20 Area of school which needs attention in design

Images Source: Author

The causal link between disability and access to school is not a simple linear relationship but multidimensional and includes multiple factors.

- **Responses:**

Questions were kept strictly architectural oriented and when enquired about opinion on which space needs more attention in addressing disability, most responses related their experience with classroom activities, play activities which are related to physical as well as social barriers such as difficulty in seeing board, wrong furniture, attitude of peers, understanding teacher and keeping in pace with other students and social interactions which will be strengthened in informal area like playground. Apart from that students also talked about barriers such as not being able to use services and discomfort in choosing different path and route because of disability.

5.1.7 Inferences

Table 4 Case study Inferences

Category of issue	Issues	Description
Planning Related	Zoning of spaces	No assigned zone for parking, No proper cluttered form is followed in zone spaces of same function together, labs, library are scattered and assigned any room which is large enough and vacant room.
	Location of services	Water coolers locations are not evenly distributed thought out school as these are new installation
	Underutilization of informal open spaces	Inner courtyard is not used by students due to its close proximity to headmaster's office and teacher's staff room
Design Related	Lack of flexibility in classroom layout	Secondary classrooms are cluttered with furniture, due to high number of students (Average 40 per class)
	Longer routes for locomotor disability students	Corridor doesn't have ramps at strategical location to cross inner courtyard and access other side of building, Ramp to access plinth level is present at only one location (nearer to building entrance)
	Absence of lift or ramp to upper floors	Work for ramp to upper floor is under process.
	Restricted independent movement for CWD	Materiality or the surface used for informal spaces (Inner courtyard) is not wheel chair friendly, Playground doesn't have grass and is untreated earthen and gravel material .
	Lack of Attention to details	Toilet room door is narrower than Accessible toilet cubicle door is though Awareness of existing barriers
Staff Development/ Teaching methods	Teachers/Administration attitude	Classroom which have students with disabilities are shifter rather than removing barriers for them, acceptance by teachers that CWD don't perform well in academics
	Conventional Teaching methods/ Curriculum	No special program or modifying teaching methods to include CWD in class.

Resources	No Professional Opinion for retrofitting	New ramp for upper floors is supervised by local mason and administered by school staff instead of getting professional opinion on its design
	Lack of trained teachers for SEN	Only one teacher in school is trained in special education and there's no effort to implement or teach fellow teachers.
	Lack of assistance for disabled	Due to relatively very less percentage of students with disabilities school doenot have any medical facilities to cater to students with any disability need, no audio books in library, no visual cues for emergency for deaf.

Images Source: Author

5.2 Case study 2: KENDRIYA VIDYALAYA RAJAHMUNDRY

Figure 21 Ariel view (Satellite image)

Source: Google Earth

5.2.1 Introduction:

Location: Kendriya Vidyalaya, ONGC colony, Rajahmundry

Area: 1461 Sq. Meters

Access: One main road through residential leads to the school.

Services: School has 3% reservation for CWD

Primary school and secondary school present together.

Number of children with disability:3

Number of students:687

Number of teachers:21

Staff and Administration: 29

- Topography: No terrains, Flat land.
- Access: Situated near the main artery roads, and can be easily accessed.
- Services provided: has 3% reservation for CWD

Class standards: 1st to 12th standard

Students strength: 746

Children with Disability: 3 students from mild to minimal Disability

Faculty: 24 teaching faculty

Staff/Administration: 19 office staff / Maintenance staff

The school is set in Ongc colony of rajahmundry city,Due to its location in an nation wide company it has a diverse background students,the school has few students of disability.The school haas only 3 disabled children out of them one student is of temporary disability.One has colour blindness and one has low vision.

Figure 22 Main Building Entrance

Images Source: Author

5.2.2 Accessibility continuum Assessment:

- **Site Development**

The location of the school in inside a grid planned ONGC employee residence community, It is abutted by 12m wide road.

- **Entry**

The main gate is wide enough for one bus to go through, and the pedestrian gate is 2.4m wide, the entrance to the school is sloped down from road, the entrance is not paved so it poses as a barrier for wheelchair users.

- **Circulation**

The road from entrance leads to parking first and then moves towards school building. The entrance is of the school for a wheel chair user is from side of the building. The width of the corridors is 2.4m, the school does not have a ramp to its first floor and the school has a courtyard type of construction.

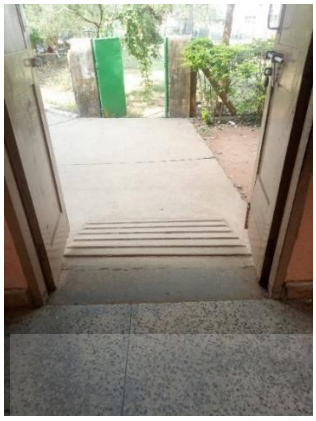


Figure 23 Ramp Side Entrance to building

Figure 24 Room Entrances

Figure 25 Vertical circulation steps

Images Source: Author

The wayfinding of the school is very easy, the directions and signages were written everywhere, the staircase of the building is doglegged and each flight is 2.4m wide. The corridors have protruding pillars, the corridors are chamfered makes it idea of deaf children. School doesn't have ramp to the first floor. School administration shifts the class of any student who has inconvenience with climbing up.

Figure 26 Circulation Corridors

Images Source: Author

- **Spaces**

Formal spaces like classrooms are 6mX7.8m in dimensions and benches were staked in row colour arrangement, there's no space left for a wheelchair user. Each bench holds 2 students and each classroom has approx. 45 students.

The distance between the first bench and teachers' desk is not to standard (2.4m min), adjacencies like medical room has separate examining room.





The informal space at the centre of school is used as an assembly space, the space is leaf barren and has no seating. The biggest of these courtyards is covered and is shaded. There's a stage at one side of the open space.

Figure 27 School spaces (classroom, medical room, interior courtyards)

- Details

The handicapped toilet is 0.7m wide and is not to the standard and the washbasins and coolers were higher for a wheelchair user. washbasins doesn't have leg space. The flooring material at the open spaces is concrete layer which makes it difficult to be used by a wheelchair person.

Figure 29 Medical room


Figure 28 water cooler and others services

School keeps one wheelchair at the entrance lobby for emergencies, The school has minimum barriers in accessing the ground floor as the whole floor is on level and also paved with non slippery material.The doors for classrooms doesn't have vision panel.school uses non contrasting colours on walls.There no emergengy signage in the school.Each room is mentioned its name on top of its door frame.

Figure 30 Outdoor spaces, playground

Images Source: Author

The playground is not covered with grass and all the equipment in the school is not accessible friendly.

5.2.3 Qualitative:

Table 5 NCERT Assessment (Qualitative)

School Accessibility Checklist			
Entry/exit	**Yes**	**No**	**Remarks**
Are kerb ramps provided at all level differences, between the road surface and footpath level:			There's no footpath around the school
a) Pedestrian crossings in and around the school?			Footpath is along the lenth of entry road.
b) Parking spaces in and around the school?			There's very less parking space, around school, only for motor bikes,but school has 10 car and 40 Motor bike spaces
c) Building entrances?			The entrance is accessed with a gentle slope

Is it ensured that there are no obstructions (for example parked vehicles, manholes, potted plants) allowed outside the gate blocking the gate/ entrance/exit to the school?			
Is the approach to the school well maintained with a level surface?			The road outside school is not well maintained, it has lot of potholes.
Ramps	**Yes**	**No**	**Remarks**
Is there a ramp next to the stairs?			New ramps were constructed for every plinth
Is the location of the ramp clearly identifiable with a sign?			The location is not shown by signage
Is the ramp gradient no steeper than 1:12?			
Is the width of the ramp a minimum of 1200mm?			
Are there continuous handrails, on both sides, at a height of 760mm-900mm from the floor?			Only one side the ramp has handrail
Is there a landing of 1500mm x 1500mm at the turning of the ramp?			The entrance ramp has a landing but after a length of 15m
Is the surface of the ramp anti-slip/matte finish?			
Is there an edge protection on both sides of the ramp to prevent wheelchairs from falling off?			
Staircase	**Yes**	**No**	**Remarks**
Is the location of the stairs easily identifiable able with a sign?			The staircase is also the fire escape for the building so its direction is shown with signage.
Is the width of the stairs a minimum of 1200mm?			The width of old building staircase is not to standard
Are there continuous handrails, on both sides, at a height of 760mm- 900mm from the floor oor?			Only on one side
Are handrails easy to grip with a diameter of 38mm-45mm?			
Are the handrails painted in colours contrasting with the wall colour to be easily identifiable able by children with low vision?			The wall colour is not in contrast to the skin
Is it ensured that stairs do not have a nosing (extension of step edges for beautification)?			
Are the step edges of a different colour or texture to be easily identifiable by children with visual impairments?			Beige are used to colour.
Is the location of emergency (fire escape) stairs clearly identifiable able with a sign?			language of sign is only in Hindi
Is it ensured that there are no open gaps in between the step risers?			

Is the step riser 150mm or less?			
If there is an open space under the staircase, is it blocked off?			
Corridors	**Yes**	**No**	**Remarks**
Is the minimum unobstructed width of corridors at least 1200mm?			The width of new building corridors is 2.4m wide
Is it ensured that there are no objects protruding more than 100mm from the walls in the corridors?			Windows of classroom are openable into the corridor
Are all over hanging obstructions mounted above a minimum height of 2200mm from the floor, giving head clearance?			
Signage	**Yes**	**No**	**Remarks**
Is there signage indicating the floor level on each floor?			The building consists of only one floor
Is there signage indicating the locations of classrooms and other school facilities?			The Sign boards are on top of the classroom
Are all signs in Braille, text and using pictograms?			
Are signs hung at a height of 1000mm-1600mm from the floor?			The signages are at a height of 2200mm and non pictorial.
Are there signs for girls' and boys' general toilets?			Not pictorial
Are there signs for girls' and boys' accessible toilets?			
Doors	**Yes**	**No**	**Remarks**
Can the doors be easily opened and closed by children?			The Doors are double leafed in old building
Are glazed doors marked with a colour band at the eye level for children with visual impairments?			Classroom doors are not glazed
For double leaf doors, is the width of one of the leaves at least 900mm to allow wheelchair users to enter/exit without opening the other leaf?			Doors have 1000mm clear width
Are manual door accessories/hardware (handles, locks, pulls, etc.) located at a height of 800mm-1000mm from the floor?			The fixtures used are not handicapped friendly, handles are used rather than levers
Are doormats flushed/embedded in the floor ooring and edges secured to the floor ?			
Is the threshold (door sill), no more than 10mm high and bevelled (merged with gentle slope)?			
Boards	**Yes**	**No**	**Remarks**
Do the classrooms have green boards?			All classroom have green boards but except old building classroom

Is it ensured that the lower edges of green/black boards are not above 500mm from the fl oor so that children using wheelchairs can access them?			The boards at primary classes cannot be accessed by children
Windows	Yes	No	**Remarks**
Do the windows open into classrooms and other rooms and not out to corridors/hallways?			Windows open to corridors
Is the height of windows between 600mm (bottom edge) and 1450mm (top edge), enabling children to see outside while seated?			
Are there grills/wire meshes on the windows to safeguard children from falling outside?			
Flooring	**Yes**	**No**	**Remarks**
Is the flooring of the school skid-proof/ anti-skid?			Doesn't have tactile flooring
Is the toilet flooring skid-proof?			
Is there a drain in the floor in the toilet for all excess water, so that it can be kept dry?			but the floor is not levelled.
Toilets	Yes	No	Remarks
Is there a ramp provided to the accessible toilet cubicles?			Not needed, Accessible toilet cubicle is at the same level as entrance
Are there separate toilet cubicles (one each in boys' and girls' toilets) for children with disabilities?			
Is the size of the accessible toilet cubicle a minimum of 2000mm x2200mm?			But the entrance to the toilet is not enough only, 0.75m
Is there sufficient wheelchair manoeuvring space of 1500mm x 1500mm around the toilet and washbasins?			But the fixtures are ill maintained
Is the washbasin mounted at a height of 700mm-800mm from the floor (top edge)?			
Is the lower edge of the mirror positioned at a height of 1000mm from the floor?			There's no mirror
Are there transfer grab bars (L-shape on the wall side and U shape on the open side of the toilet) installed near the toilet?			But the fixtures are ill maintained
Are all the grab bars at a height of 700mm-800mm from the floor?			
Is the toilet equipped with an emergency alarm system?			
Can the doors be locked from the inside and unlocked from outside in emergency situations?			

Is the toilet flush easy to operate?			
Does the toilet door have a clear width of 900m or more?			
Does the toilet door open outwards?			
Is the WC (western commode seat) at a height of 450mm-480mm from the floor?			
Playgrounds	**Yes**	**No**	**Remarks**
Is the playground level?			Ground is levelled, but levelled in cement material
Is the playground covered with grass?			
Does the playground have a paved pathway with a minimum width of 1800mm, which can be used as a track by wheelchair/crutch/walker users?			The playground is one big open area with seating on one side.
Emergency preparedness	**Yes**	**No**	**Remarks**
Are emergency exits clearly marked with directional arrow signs?			language of sign is only in Hindi
Are there both audio and visual emergency alarms in all areas?			

Source: Author

5.2.4 Quantitative

Normal students to student with Students with special needs ratio is 248:1, CWSN constitute of about 1:0.4 percentage of school pupil strength. Students to teacher's ratio 31:1 Where for a mainstream school it is advised to be 21:1 and for a special school it is at 8:1

Figure 31 Site Plan

Table 6 NCERT Assessment (Quantitative)

NCERT School for All "Physical Environment" Rating				
Sl no	**Indicator**	**Rating / Response**		
1	The school is fully accessible to all children including CWSN	**3**	**2**	1
2	The School doors have handles fixed at appropriate level and not too high	3	2	1
3	The school toilets have adequate doors taking care of privacy, especially for girls/children who need help in toileting?	**3**	2	1
4	The classroom settings in the school enable children to move freely or sit with a friend when required	3	2	**1**
5	The blackboards are fixed at a proper height in the class to be accessible to all children, including those who want to come near the board to read it.	**3**	2	1
6	The classrooms have adequate daylight and extra light when necessary	**3**	2	1
7	The noise level in the classes is minimised for avoiding distraction	**3**	2	1
8	The school takes measures to provide adequate transport facilities to CWSN	**3**	2	1
9	The school has a resource room or special room for additional teaching if required	3	**2**	1

10	The school is equipped with science labs and equipment for mathematical activities including the adapted versions	**3**	2	1
11	The school has adequate sport facilities for all children	3	2	**1**

Source: Author

5.2.5 Participatory Research:

The questionnaire is focused on children with disability in school and formed a group discussion

1. *What challenges do students, instructors, staff and the public (Parents and others) with disabilities face in navigating their educational built environment?*

The main entrance does not have ramp, the location of ramp is to the side of the building. First floor doesn't have a ramp to access. Wheelchair user needs to take longer paths than an average normal user. There's no tactile flooring. The entrance from main gate to building is not paved rather cement finished unevenly. Playgrounds are one of the inaccessible spaces for children with disability.

2. *What challenges do students with disabilities face when accessing supports, programs, or services in their school?*

When accessing facilities like toilets, it causes difficulty as there's only one toilet for handicapped which is ill maintained and grab bars are not hygienic and rusted. water coolers location is at the one corner of school and is at lower level, a person in wheelchair can't access without help. Has no programs or help services for children with disability, Physiotherapy and other medical assistance is taken from private physicians and doctors

3. *In your experience, what resources, tools, or policies are most effective to promote better awareness of available supports and facilitate appropriate accommodations?*

Understanding and sensitivity towards CWD and providing basic services like toilets and water which are inclusive in nature. Only one trained teacher is there to address the issues Disabled children. Schools needs a strict policy in making them inclusive in sense of curriculum design and physical environment, this promotes the inclusivity of school.

Attitude of teachers towards helping should be changed and involvement of parents is needed for school administration to understand the needs better.

- **Accessibility:**

There were 10 individuals participated in this questionnaire, Children with comprehensive skills,teachers/parents , this is a mix of students who are normal. One of the physically disabled child has

temporary disability (broken arm) and hearing impaired child has moderate hearing loss and uses machine.

This study aimed to measure the association between disability and access to school at various stages of accessibility continuum and in forming a priority order of principles of inclusivity from student's perspective.

- **Percentage person with disability involved in survey**

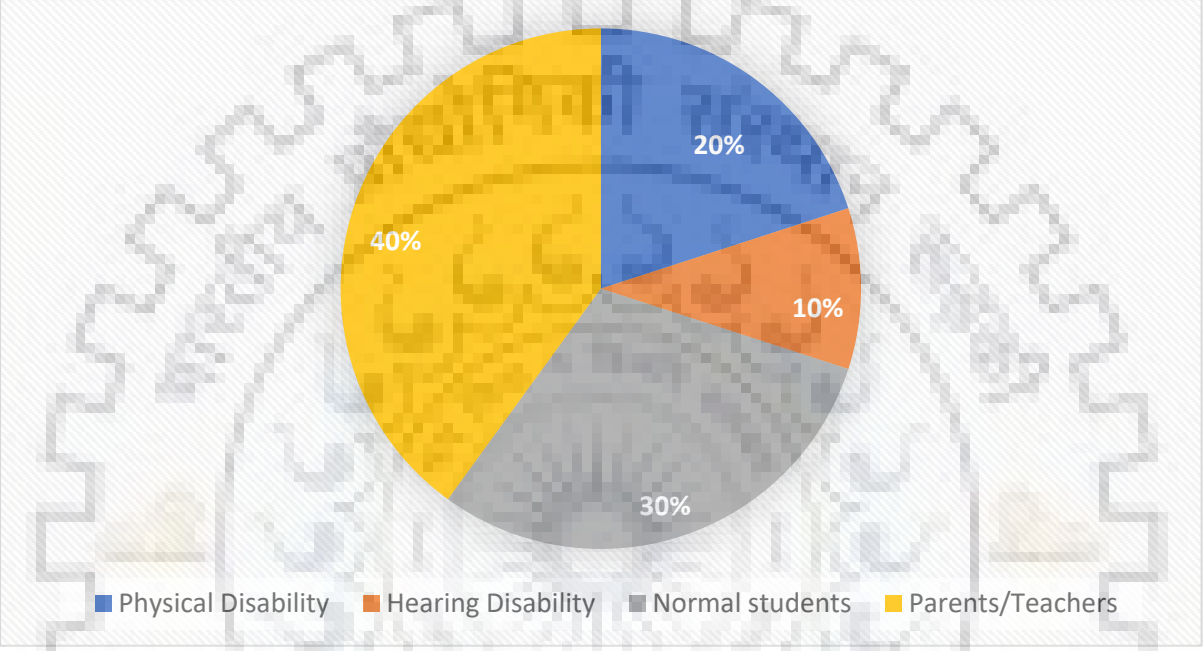


Figure 32 Percentage person with disability involved in survey

Source: Author

The group involves a mix of users and inputs were taken regarding school accessibility

Hierarchy of Principles of Inclusion

Group is asked to make a hierarchy list of Principles of Inclusion, each principle is explained at prior to the group along with its importance in design. This will help in prioritizing the principles which suggesting phase wise design consideration for school building. A cumulative Hierarchy list is acquired.

- Access
- Health and Well being
- Safety and Security
- Availability of Spaces
- Flexibility and Adaptability
- Sensory awareness

Since the sample side consists of more adults safety and health were given priority. Even normal Children mentioned that classrooms needs to more spacious and require storage space.

Which following area of school do you feel needs more attention in addressing to disability.

- School access (School location, site development)
- Entry to school
- Circulation (corridors, access to upper floors, circulation in and around school)
- Spaces (classroom, labs, other facilities)
- Outdoor

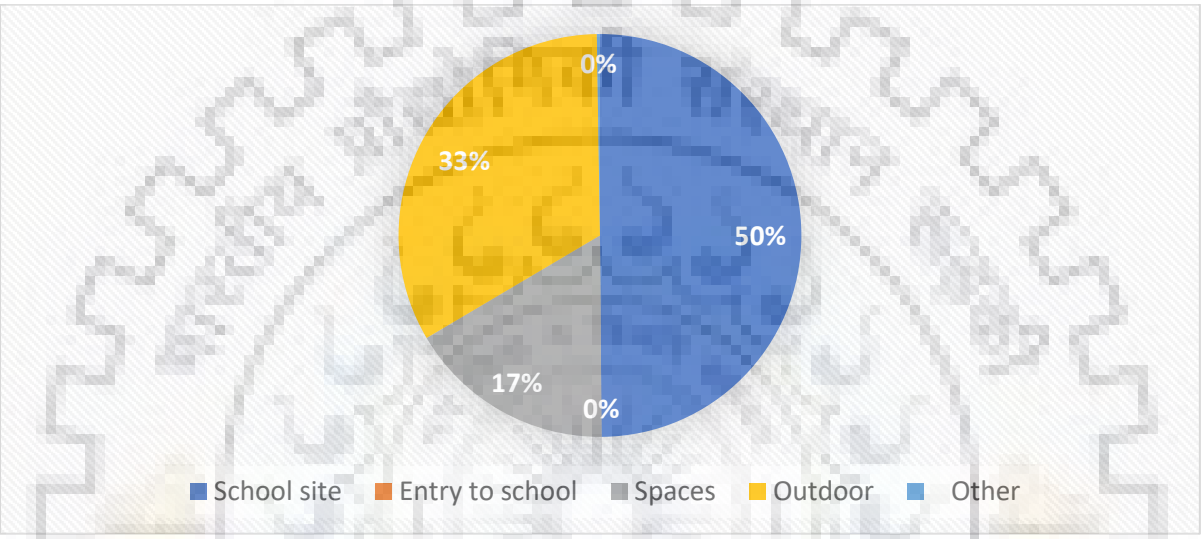


Figure 33 **Area of school which needs attention in design**

The causal link between disability and access to school is not a simple linear relationship but multidimensional and includes multiple factors.

- **Responses**

Questions were kept strictly architectural oriented and when enquired about opinion on which space needs more attention in addressing disability, most responses showed concern towards site planning as parents feel that the location of school is at the main road and needs more safety measures and also pointed out that outdoor playground needs proper case as children are prone to hurt themselves if its not maintained properly.

5.2.6 Inferences

The percentage of children with disabilities population is very less in this study, this lack of strength can be observed in approach to design, students and teachers' attitude and effort to remove physical barriers.

Table 7 Case study Inferences

Category of issue	Issues	Description
Planning Related	Irregular site shape	This allows for formation of corners and edges which become difficult to maintain and fall to ill maintenance
	No Planning for future demands	School has no ramp for upper floors and in case of student with disability has a class on upper floors, his/her classroom is shifter to ground floor
Design Related		
	Under-utilization of Play ground	Lack of safety due to ill maintance and inaccessibility by CWD
	Lack of diverse play facilities	Playground has infrastructure of few swings and slides, no play spaces or game facilities for CWD
	Lack of Space Availability	Classrooms are cramped with seating furniture, no access to wheelchair inside the classroom or labs
	No approach to sensory design	Design of school doent have any sensory aspects for children with visibility or Hearing issues
	Location of facilities	Location of toilets and water facilities are inaccessible
	Accessibility Awareness	Accessibility is later thought aspect as location of entry ramp is on other side of building and Disabled friendly toilets are later fitted into normal toilets
Staff Development/ Teaching methods/ Attitude	Students attitude	Since only 3 students have disabilities, they are isolated by peer groups
	Trained teachers	Due to compulsion by Government, only one teacher with training is present
Resources		
	Lack of Assistive devices	School doesn't have any assistive devices that may aid CWD in learning (audio systems or smart boards)

Table Source: Author

5.3 Case study : GOVT. BOYS/GIRLS SENIOR SECONDARY SCHOOL, Okhla Phase II

Figure 34 Panoramic view
Images Source: Author

Govt. Boys/Girls Senior Secondary School has started in 2005. With the student teacher ratio being 35:1 the primary medium of instruction is Hindi and English as secondary medium.

Location: GOVERNMENT BOYS/GIRLS SENIOR SECONDARY SCHOOL Okhla Phase II, Harkesh Nagar, Okhla Industrial Area, New Delhi

- Area: 11,924 Sq. meters of site area and 9,929 Sq. Meters of playground/Open space (Approx.)
- School built up area 6,476 sqmts
- Access: Harkesh Nagar main market Road
- Services: School has 3% reservation for CWD
- Topography: No terrains, Flat land.

Class standards: 1st to 12th standard
Students strength: 1259
Children with Disability: 35 students from severe to minimal Disability
Faculty: 52 teaching faculty
Staff/Administration: 32 staff

5.3.1 Introduction:

The school follows CBSC syllabus, curriculum and standards set by the board. School abides to the rules of government in terms of policies and regulations. There are separate buildings for primary and secondary education, School recently installed ramps and made sure every floor has a handicapped toilet with grab bars. Since the location of school is in an economically weaker area, diverse background children were admitted. School has a 3% reservation for disabled but only 5 students were present on the day of study. It is also observed that school has low attendance on children from secondary standard.

5.3.2 Accessibility Continuum Assessment:

- **Site Development**

The site location is on flat terrain, even though School guidelines suggest aa regular shaped plot area, school boundary is defined by surrounding housing and metro line.

A new construction of two building blocks which are 3 storied can be observed which now accommodates the secondary school. There is no playground fit with equipment's and furniture an open area in front of school building is used as such.

- **Entry**

The entrance to the school is approx. 5m wide for vehicular traffic and has a gentle ramp from road to school without any hurdles, Pedestrian gate is 1.2 meters wide where earlier threshold is over constructed with a gentle slope.

Since school has old and new construction working together, a difference in door entry sizes and services is observed. Old building has a double leaf door total width of 1.2m. New construction has a similar detailing with door width 0.9m.

Figure 35 Site Entrance _ Gate

Images Source: Author

- **Circulation**

Figure 36 Vertical circulation_ Ramp

Images Source: Author

Ramps with 1:12 slope were constructed for every building entrance and hand rail was installed, but a grab bar or handrail is at a height of 1.2m.The handrAIL is only on one side of the ramp.All the corridors are 2.4 meters wide.

- **Spaces**

Figure 37 Space _ Laboratory and classroom

Images Source: Author

Other spaces like offices and medical room are acessible.Informal spaces like courtyard at the center of school can be seen used by teachers and has very less presence of students, students prefer to use space at the back of school building which is also the assigned playground.Formal spaces like classrooms are filled with regular benches leaving very less possibility for flexible arrangement and Laboratories are ill-equipped and height of the counter is not adjustable.

Figure 38 Informal open spaces and Corridor

Images Source: Author

- **Details**

Figure 39 Lack of Attention to details _ Barriers

Images Source: Author

Hurdles in form of level difference and gutter along the side of the old building pose as a barrrier especially for locomotor disability students as they have a choose a longer path to acess classrooms.

- **Toilets**

Figure 40 Toilet current situation

Toilets lack maintenance and subjected to vandalism. One toilet block doesn't have ramp. The height of the washbasins is not optimal. It is also observed that school lacks signage and direction information.Since the school is regularly planned, wayfinding is not a problem. School provides information about disability and shows sensitivity towards.

- **Services / Students Attitude**

Figure 41 Services Provided

Images Source: Author

School provides wheelchair and has a one trained teacher regarding the special needs of children.

Accessibility tour of school was conducted to get better understanding of barriers faced by children.

Parked wheelchair out the classroom as the layout of classroom doesn't allow space for the manoeuvring of wheelchair, no specific space is provided in classroom for wheelchair parking.

Images Source: Author

Figure 42 Participation study Qualitative

5.3.3 Quantitative Assessment

Figure 43 NCERT Assessment (Qualitative)

School Accessibility Checklist			
Entry/exit	**Yes**	**No**	**Remarks**
Are kerb ramps provided at all level differences, between the road surface and footpath level:			The footpath kerb slops at the entrance of school.
a) Pedestrian crossings in and around the school?			Has pedestrian crossing only at NH-5 road, the other side road has less traffic
b) Parking spaces in and around the school?			Minimum parking (6 car,15 bikes)
c) Building entrances?			
Is it ensured that there are no obstructions (for example parked vehicles, manholes, potted plants) allowed outside the gate			

blocking the gate/ entrance/exit to the school?			
Is the approach to the school well maintained with a level surface?			There's no level difference in ground floor
Ramps	**Yes**	**No**	**Remarks**
Is there a ramp next to the stairs?			Entrance ramp is to the side of the building
Is the location of the ramp clearly identifiable with a sign?			The location is not shown by signage
Is the ramp gradient no steeper than 1:12?			
Is the width of the ramp a minimum of 1200mm?			The ramp has no side rails and no edge bar too
Are there continuous handrails, on both sides, at a height of 760mm-900mm from the floor?			
Is there a landing of 1500mm x 1500mm at the turning of the ramp?			
Is the surface of the ramp anti-slip/matte finish?			
Is there an edge protection on both sides of the ramp to prevent wheelchairs from falling off?			
Staircase	**Yes**	**No**	**Remarks**
Is the location of the stairs easily identifiable able with a sign?			The staircase is also the fire escape for the building and is
Is the width of the stairs a minimum of 1200mm?			
Are there continuous handrails, on both sides, at a height of 760mm- 900mm from the floor oor?			Only on one side
Are handrails easy to grip with a diameter of 38mm-45mm?			
Are the handrails painted in colours contrasting with the wall colour to be easily identifiable able by children with low vision?			The wall colour is not in contrast to the skin
Is it ensured that stairs do not have a nosing (extension of step edges for beautification)?			The staircase doesn't have nosing, but the edges rounded off because of prolonged use
Are the step edges of a different colour or texture to be easily identifiable by children with visual impairments?			Shades of pink are used to colour.
Is the location of emergency (fire escape) stairs clearly identifiable able with a sign?			language of sign is telugu and English
Is it ensured that there are no open gaps in between the step risers?			

Is the step riser 150mm or less?			
If there is an open space under the staircase, is it blocked off?			
Corridors	**Yes**	**No**	**Remarks**
Is the minimum unobstructed width of corridors at least 1200mm?			But there's a ridge rise at the junctions of corridor, posing a threat to trip.
Is it ensured that there are no objects protruding more than 100mm from the walls in the corridors?			Windows of classroom are openable into the corridor
Are all over hanging obstructions mounted above a minimum height of 2200mm from the floor, giving head clearance?			
Signage	**Yes**	**No**	**Remarks**
Is there signage indicating the floor level on each floor?			The building consists of only one floor
Is there signage indicating the locations of classrooms and other school facilities?			The Sign boards are on top of the classroom
Are all signs in Braille, text and using pictograms?			
Are signs hung at a height of 1000mm-1600mm from the floor?			The signages are at a height of 2200mm and non pictorial.
Are there signs for girls' and boys' general toilets?			Not pictorial
Are there signs for girls' and boys' accessible toilets?			
Doors	**Yes**	**No**	**Remarks**
Can the doors be easily opened and closed by children?			the height of the door handle is higher
Are glazed doors marked with a colour band at the eye level for children with visual impairments?			Classroom doors are not glazed
For double leaf doors, is the width of one of the leaves at least 900mm to allow wheelchair users to enter/exit without opening the other leaf?			Doors have 1000mm clear width
Are manual door accessories/hardware (handles, locks, pulls, etc.) located at a height of 800mm-1000mm from the floor?			
Are doormats flushed/embedded in the floor ooring and edges secured to the floor ?			
Is the threshold (door sill), no more than 10mm high and bevelled (merged with gentle slope)?			
Boards	**Yes**	**No**	**Remarks**

Do the classrooms have green boards?			All classroom have green boards but are old and loosing colour
Is it ensured that the lower edges of green/black boards are not above 500mm from the fl oor so that children using wheelchairs can access them?			The boards at primary classes cannot be accessed by children
Windows	**Yes**	**No**	**Remarks**
Do the windows open into classrooms and other rooms and not out to corridors/hallways?			Windows open to corridors
Is the height of windows between 600mm (bottom edge) and 1450mm (top edge), enabling children to see outside while seated?			
Are there grills/wire meshes on the windows to safeguard children from falling outside?			
Flooring	**Yes**	**No**	**Remarks**
Is the flooring of the school skid-proof/ anti-skid?			Doesn't have tactile flooring
Is the toilet flooring skid-proof?			
Is there a drain in the floor in the toilet for all excess water, so that it can be kept dry?			but the floor is not levelled.
Toilets	Yes	No	Remarks
Is there a ramp provided to the accessible toilet cubicles?			Not needed, Accessible toilet cubicle is at the same level as entrance
Are there separate toilet cubicles (one each in boys' and girls' toilets) for children with disabilities?			
Is the size of the accessible toilet cubicle a minimum of 2000mm x2200mm?			
Is there sufficient wheelchair manoeuvring space of 1500mm x 1500mm around the toilet and washbasins?			
Is the washbasin mounted at a height of 700mm-800mm from the floor (top edge)?			Washbasins don't have leg space
Is the lower edge of the mirror positioned at a height of 1000mm from the floor?			
Are there transfer grab bars (L-shape on the wall side and U shape on the open side of the toilet) installed near the toilet?			
Are all the grab bars at a height of 700mm-800mm from the floor?			

Is the toilet equipped with an emergency alarm system?			
Can the doors be locked from the inside and unlocked from outside in emergency situations?			
Is the toilet flush easy to operate?			
Does the toilet door have a clear width of 900m or more?			Toilet has a swing door which can be opened with a lever handle.
Does the toilet door open outwards?			
Is the WC (western commode seat) at a height of 450mm-480mm from the floor?			
Playgrounds	**Yes**	**No**	**Remarks**
Is the playground level?			Ground is levelled, but not wheelchair friendly and filled with sand and has no paved path
Is the playground covered with grass?			
Does the playground have a paved pathway with a minimum width of 1800mm, which can be used as a track by wheelchair/crutch/walker users?			There's a paved pathway leading to playground, but ground has no equipment's for CWD
Emergency preparedness	**Yes**	**No**	**Remarks**
Are emergency exits clearly marked with directional arrow signs?			language of sign is Telegu and English
Are there both audio and visual emergency alarms in all areas?			

Source: Author

5.3.4 Quantitative Assessment

Normal students to student with Students with special needs ratio is 62:1. Students to teacher's ratio 21:1 , this ratio is in accordance with the standards.

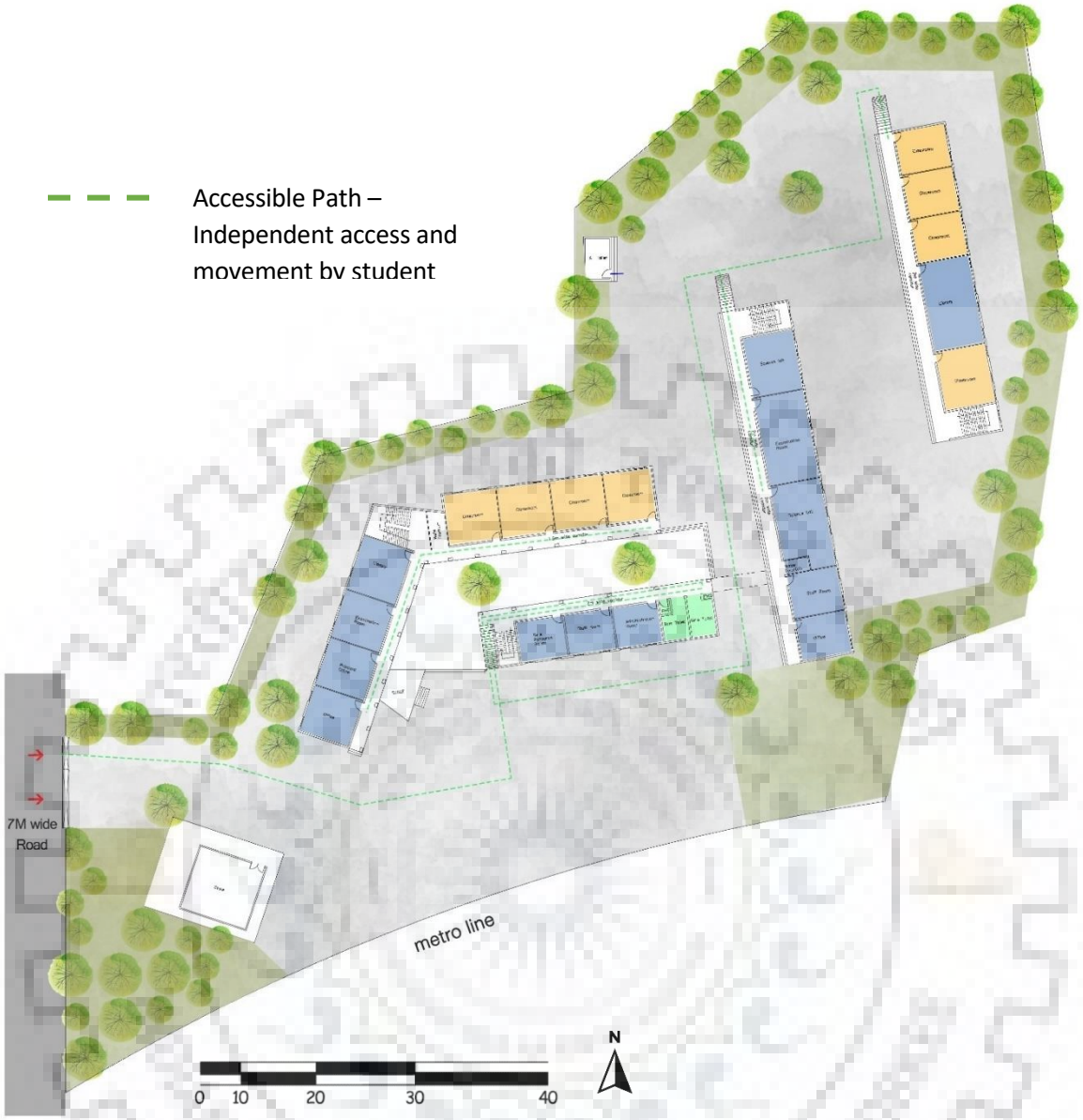


Figure 44 Site plan

Image Source: Author

Figure 45 NCERT Rating (Quantitative)

NCERT School for All "Physical Environment" Rating				
Sl no	**Indicator**	**Rating / Response**		
1	The school is fully accessible to all children including CWSN	**3**	2	1
2	The School doors have handles fixed at appropriate level and not too high	3	**2**	1
3	The school toilets have adequate doors taking care of privacy, especially for girls/children who need help in toileting?	**3**	2	1
4	The classroom settings in the school enable children to move freely or sit with a friend when required	3	2	**1**

5	The blackboards are fixed at a proper height in the class to be accessible to all children, including those who want to come near the board to read it.	3	**2**	1
6	The classrooms have adequate daylight and extra light when necessary	**3**	2	1
7	The noise level in the classes is minimised for avoiding distraction	**3**	2	1
8	The school takes measures to provide adequate transport facilities to CWSN	**3**	2	1
9	The school has a resource room or special room for additional teaching if required	3	**2**	1
10	The school is equipped with science labs and equipment for mathematical activities including the adapted versions	**3**	2	1
11	The school has adequate sport facilities for all children	3	2	**1**

Source: Author

5.3.5 Participatory Research:

The questionnaire is focused on children with disability in school and formed a group discussion

4. *What challenges do students, instructors, staff and the public (Parents and others) with disabilities face in navigating their educational built environment?*

Especially in navigating the school grounds and exterior environment. Wheelchair usage in classroom was a difficult, students with wheelchair were expected to be carried from corridor to classroom. Ramps cannot be used independently due to the absence of railing.

5. *What challenges do students with disabilities face when accessing supports, programs, or services in their school?*

Services like accessible toilets and ramps cannot be used independently because of ill maintenance and improper planning. Minor marries like a doormat also causes problem for accessibility. In classroom teachers attitude towards children with disability and their lack of training because problem for student to fully access the education.

6. *In your experience, what resources, tools, or policies are most effective to promote better awareness of available supports and facilitate appropriate accommodations?*

Students suggest, Awareness in the special needs for children especially in curriculum and making in all facilities accessible just not providing ramp. Awareness program for children with experts organized by school would be helpful. parents are much likely wanted to be involved in these awareness programs and educating then about available policies and how to avail them.

Parents suggest involvement of community in school decision making and planning.

- **Accessibility:**

There were 16 individuals participated in this questionnaire, Children who are disabled and with comprehensive skills, two teachers. this is a mix of students who are disabled and normal.

Here the sample size selected is mix of students, teachers who are willing to participate. Group has around 5 physically disabled children, muscular entropy, limb abnormality or any temporary physical disability is considered as Physical disability.

This study aimed to measure the association between disability and access to school at various stages of accessibility continuum and in forming a priority order of principles of inclusivity from student's perspective.

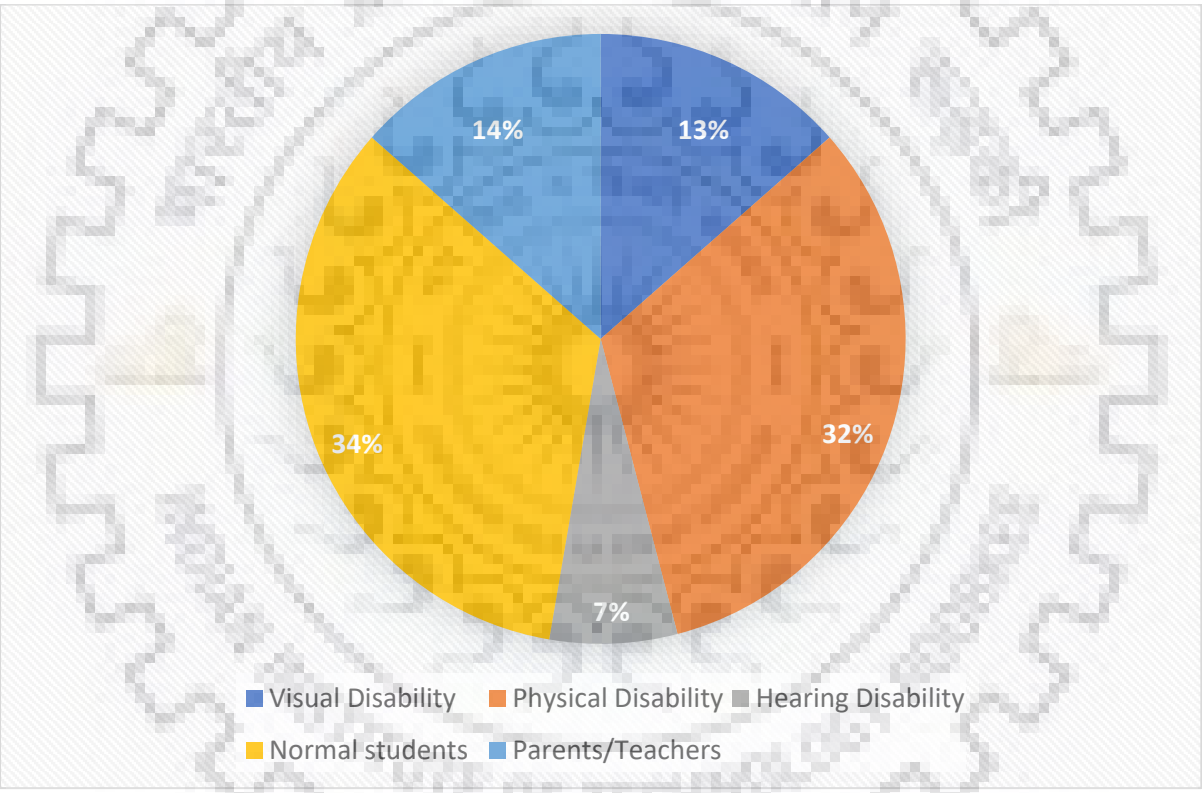


Figure 46 Percentage person with disability involved in survey

Source: Author

The group involves a mix of users and inputs were taken regarding school accessibility.

Hierarchy of Principles of Inclusion

Group is asked to make a hierarchy list of Principles of Inclusion, each principle is explained at prior to the group along with its importance in design. This will help in prioritizing the principles which suggesting phase wise design consideration for school building. A cumulative Hierarchy list is acquired.

- Access
- Spaces
- Health and Well being
- Safety and Security
- Sensory awareness
- Flexibility and Adaptability

It is noted that student who have locomotor disability had to take longer paths which is not advised and also some spaces like labs and upper floors don't have access through ramp. Students also feel the need for a trained teacher who understands the needs of children with disability.

Which following area of school do you feel needs more attention in addressing to disability.

- School access (School location, site development)
- Entry to school
- Circulation (corridors, access to upper floors, circulation in and around school)
- Spaces (classroom, labs, other facilities)
- Outdoor
- Other

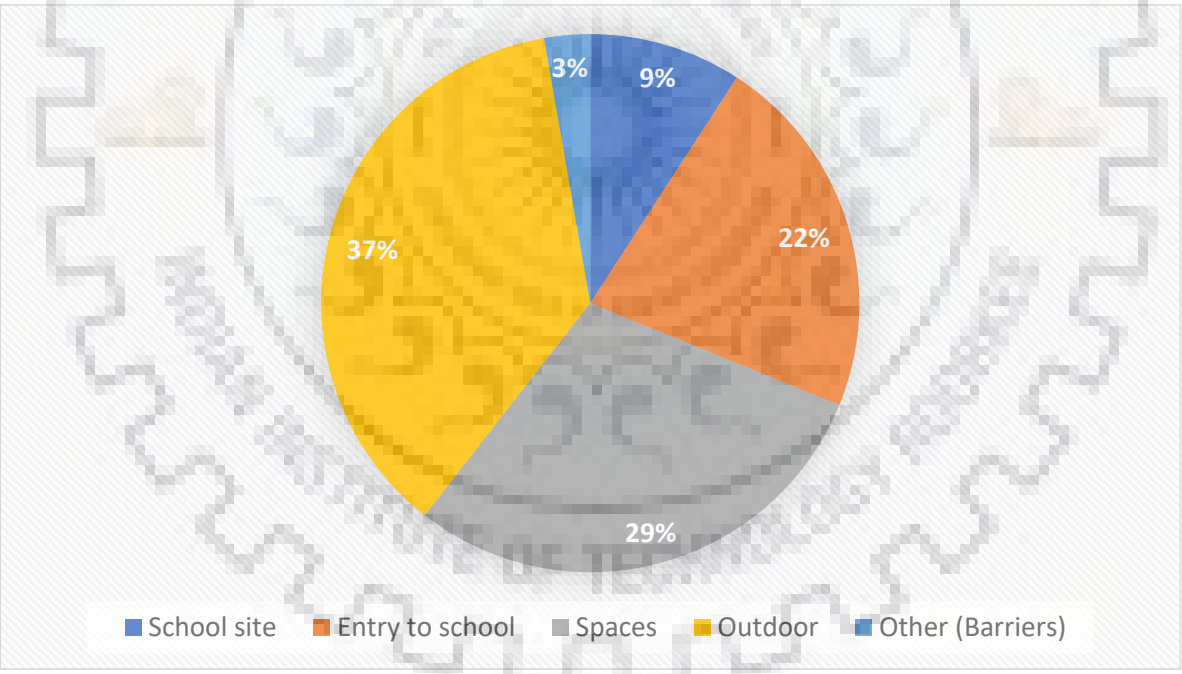


Figure 47 Area of school which needs attention in design

Source: Author

The causal link between disability and access to school is not a simple linear relationship but multidimensional and includes multiple factors.

- **Responses**

Questions were kept strictly architectural oriented and when enquired about opinion on which space needs more attention in addressing disability, most responses related their experience outdoor activities and inaccessibility to some of the spaces of school. Students also pointed out barriers in school like a gutter and use of slipper material in some classrooms which makes walking with a clutch a difficulty.

5.3.6 Inferences

The analysis conducted in tabular form shows the summarization of above field study into issues identified and their description in particular school. These issues are categorized into four groups, planning of school building, Design related, Teachers and staff development and Resources. Some issues overlap.

Table 8 Case study Inferences

Category of issue	Issues	Description
Planning Related	Community involvement,	Ground space was shared by surrounding community, but this leads to misuse of property.
	No Planning for future demands	School has no ramp for upper floors and in case of student with disability has a class on upper floors, his/her classroom is shifter to ground floor
	No phase wise development	New building under construction has no phase wise development and prioritization, accessibility is added as a later thought feature
Design Related	Inadequate Availability of space	Number od students per each classroom is on average 45 for secondary classes, this leaves no room for flexibility . Student with wheelchair is expected to leave her chair outside class and is helped by fellow classmates to reach her table.
	Absence of some support spaces	Even though school has significant students with disabilities doesn't have medical room or storage facility with assistive aids
	Lack of flexibility and	Smaller classroom usage by high number of students.

	Adaptability in spaces	
	Under-utilisation of available informal open spaces	Informal space enclosed by building cannot be accessed by wheelchair user as it has gutter running along the sides.
	Furniture	Classroom furniture is fixed and not adaptable
	Superficial accessibility	Door size of toilet is smaller than standard size due to lack of space availability, as these changes were made recently and not thought as a prerequisite
	Attention to removing barriers/ Maintainability	Toilets were ill maintained and accessible toilets are locked
Staff Development/ Teaching methods	Teachers attitude and social / Emotional support	Acceptance by teachers that CWD don't perform well in academics. Fellow Students cater to the needs of CWD
	Conventional teaching methods	No special program or modifying teaching methods to include CWD in class.
Resources	Temporary resolution of Problem	Classroom or labs shifted down in case of student with disability in that class, Due to Govt. compulsion ramps were constructed but without proper handrails, or only on one side
	Lack of teachers trained in special Education	Only one teacher in school is trained in special education and there's no effort to implement or teach fellow teachers.

	Lack of infrastructure to assist disabled	Doesn't have any medical facilities to cater to students with any disability need, no audio books in library, no visual cues of emergency for deaf.

Table Source: Author

5.4 Case Study 4: Special School

5.5 Arunodaya Special School, Visakhapatnam

Figure 48 Satellite Image

Source: Google Earth

5.5.1 Introduction:

Location: Visakhapatnam

Area: 3350 sq.m

Topography: No terrains, Flat land.

Access: Situated near by two Main roads, and can be easily accessed.

Bus stop -0.5 kms

Services provided: For children suffering from all mental disorders, especially Cerebral Palsy and Spasticity.

- **Site and Environment**

Accessible and well within the community. Surrounding the school premises there is a haphazard growth of LIG settlements through-out times. Change in land use of surrounding areas has been observed.

- **Shape and Orientation**

All the buildings are oriented in N-S direction as ideal for Visakhapatnam climate. South facing corridors and openings has been mostly avoided. Predominant wind direction being S-E most of the year

(Located nearer to sea) and S-W for rest, built forms surround the open spaces located centrally that are oriented accordingly.

- **Structure:**

Zoning and site plan:

- The overall layout of the site is not a well-planned one, since the built-forms have no coordination with each other. Even though the layout within itself is flexible and has good connectivity and path finding pattern, there is lack of sense of visual connectivity, unity, and balance followed.
- The buildings are zoned in a regular pattern adopting a simple design with due consideration to climatic factors. There is no symmetry followed within the site layout or among the different buildings.
- No buffer spaces were left between the buildings. The built forms are not specifically built for children with intellectual and physical disabilities.
- Though the circular therapy room with sloped roof partially becomes a focal point with main entry as a Vantage point, there are two similar structures located at the other entry.
- Hierarchy of spaces has been maintained with N-E entry being the main entry.

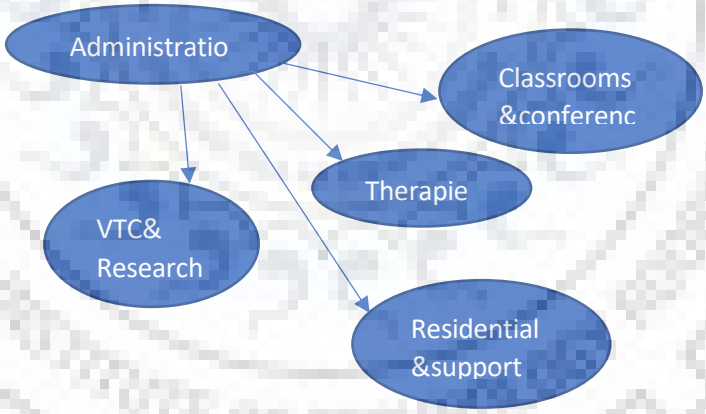


Figure 49 Spaces interconnection

Source: Author

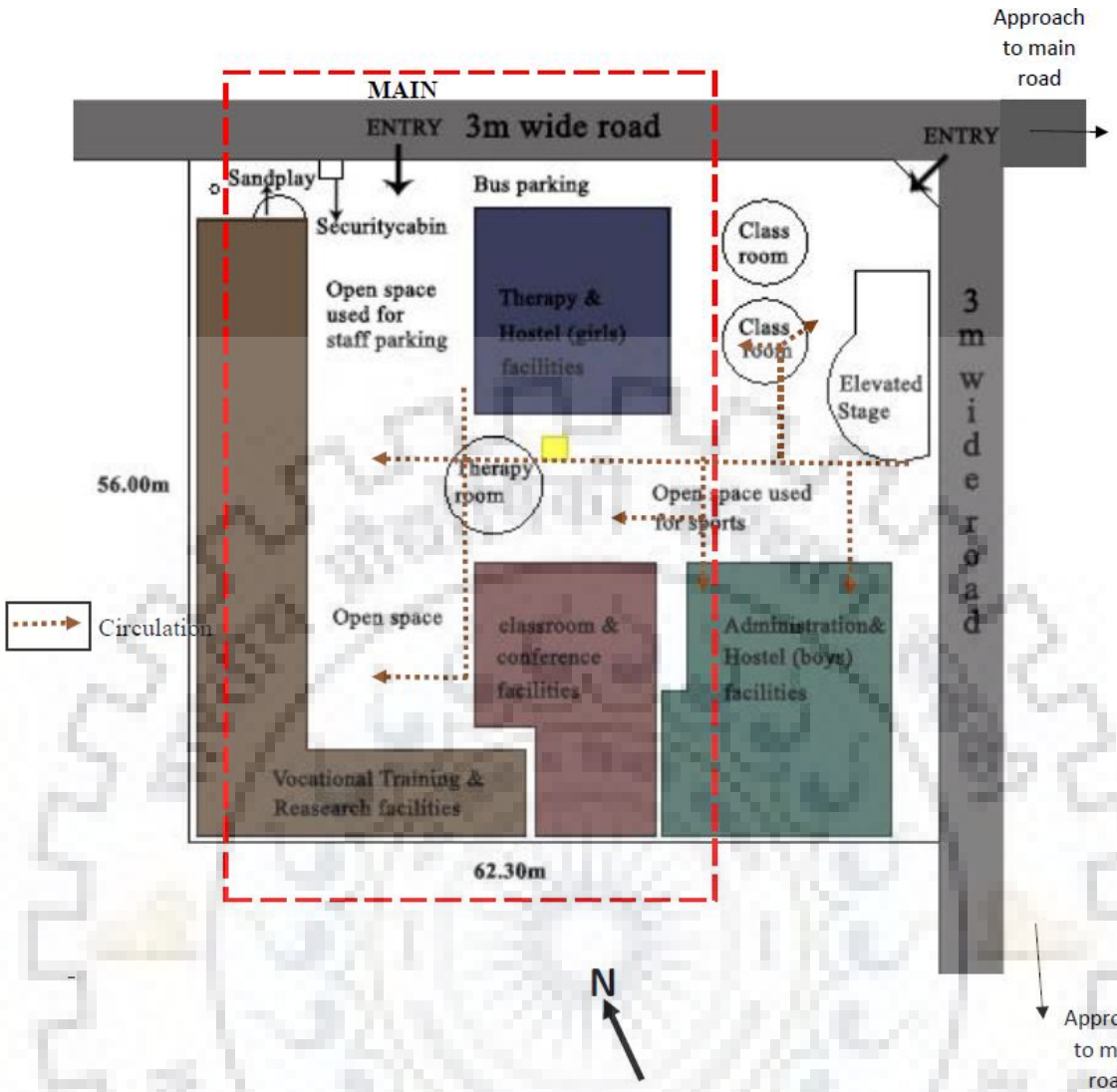


Figure 50 Diagrammatic plan

Source: Author

- The section marked in the site plan visually has certain design principles as Asymmetrical Balance, symmetry, and proportion with central focal point.

5.5.2 USER-BEHAVIOR AND FACLITIES

- School has a structured routine which has been followed by the caretakers and teachers of the school to train a pupil.
- It offers facilities for a strength of 400 students (250 boys & 150 girls)

  110 staff (48 teaching& 62 non-teaching)
- It has good teacher to student ratio of 1:8
- It includes – 1) Day Care Centre

2) Therapy Facilities

3) Vocational Training Facilities

4) Residential and support facilities

5) Parent & Sibling Training facilities

DAYCARE	ACTIVITY		SPACES	
Blossom Buds	Play therapy	Skill training like self-help, toileting, self- cleaning	Indoor play areas created within classrooms	Classrooms Library (pictorial)
Elementary& Educable Groups	Group therapies – training in sports and improvisation in social behaviour	Behavioral modification and correction of Behavioral disorders Education	Compartmentalization of a single classroom is seen	
Severe	Special care taken to improve their condition And to prevent them from hurting themselves& others	Main focus is to improve self-help within them and skill training	Separate classrooms	Special therapy areas
Profound			Classrooms without corners or sharp things – only activity based 24hr music/ art/ play therapy conducted	

6) Research facilities.

Table 9 Research Facilities

Vocational Training Centre	Spaces required
1) Tailoring 2) Candle making 3) Wool making 4) Carpentry	No specialized spaces provided. All the activities are taking place in a long and spacious room. No defined spaces exists for different activities.
5) Book Binding 6) Envelop& paper bags making	Activities are taking place in one room. No defined spaces exists for different activities.
7) Computer education	Computer lab
8) Phenyl making	Taking place in a corridor in front of the VTC training room
9) Pre-Vocational training Centre- identification and testing for inclusion in VTC	Included in VTC room itself.
Residential - For boys(55) and girls(32)& Younger boys(17)	Spaces required
A place to stay – skill training and Habit improvisation.	All the activities takes place in Dormitories with attached bathrooms. Sometimes common open spaces are utilized.
Food/Dining facility	Kitchen/ Dining area
Therapy facilities	Spaces required
1) Yoga 2) Music /Dance therapy (tiger dance therapy) 3) Art therapy 4) Physio -therapy 5) Drill/PT	Every therapy facility has separate spaces/rooms available PT takes place in central open space.
Parent & sibling training facility	Spaces required
Interaction facilities and Co-curricular activities	Open spaces and elevated stage
Training sessions for them to manage the child	Conference halls

Research facilities	**Spaces required**
Research on Behavioral Modification in various disabilities in child offered by GILDA	Research halls Guest accommodations
Administration	**Spaces required**
Principal/ Founder Staff/ Teachers	Staff room Teacher's resource Centre Ticketing room etc.

Figure 51 Open spaces

Source: Author

Figure 54 Rotunda

Figure 53 Classroom for Profound Disability

Figure 52 Tiger Dance Therapy

Source: Author

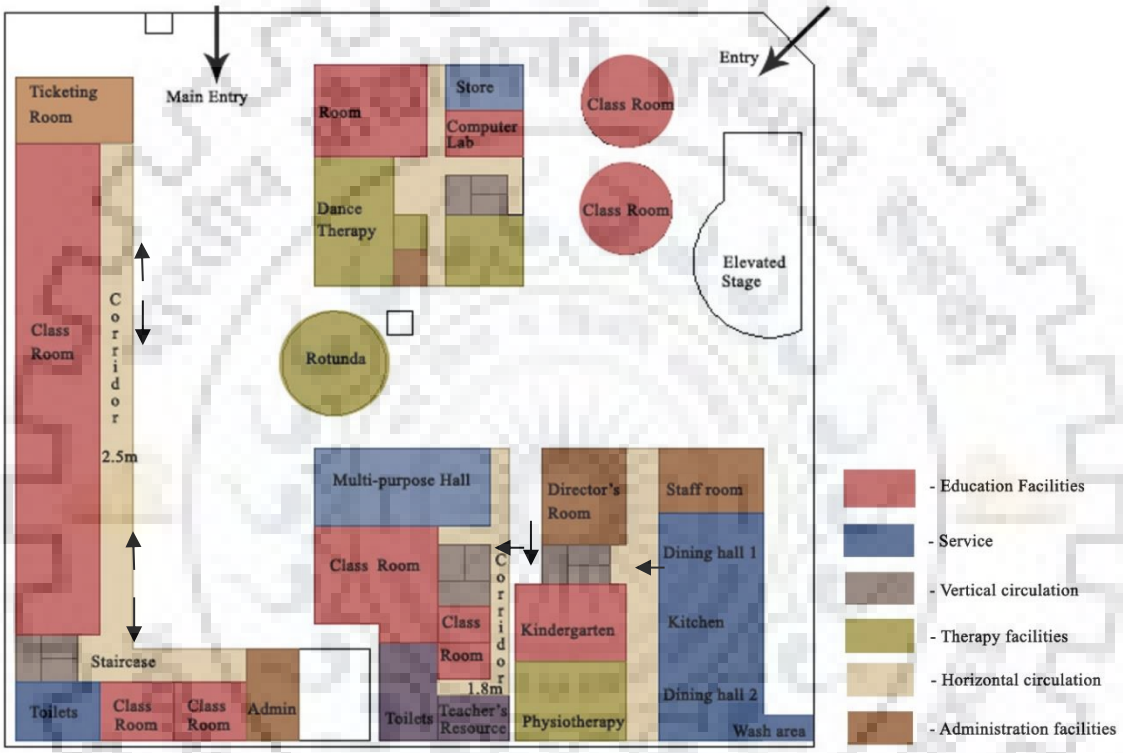


Figure 55 Zoning of Ground Floor

Source: Author

Figure 58 Dining

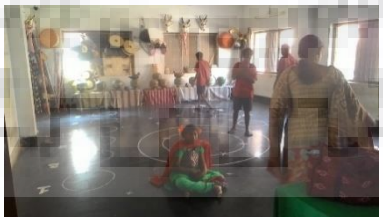


Figure 56 Dance Therapy

Figure 57 Teacher's Resource centre

Figure 61 Dining

Figure 60 Physio therapy

Figure 59 Kindergarten

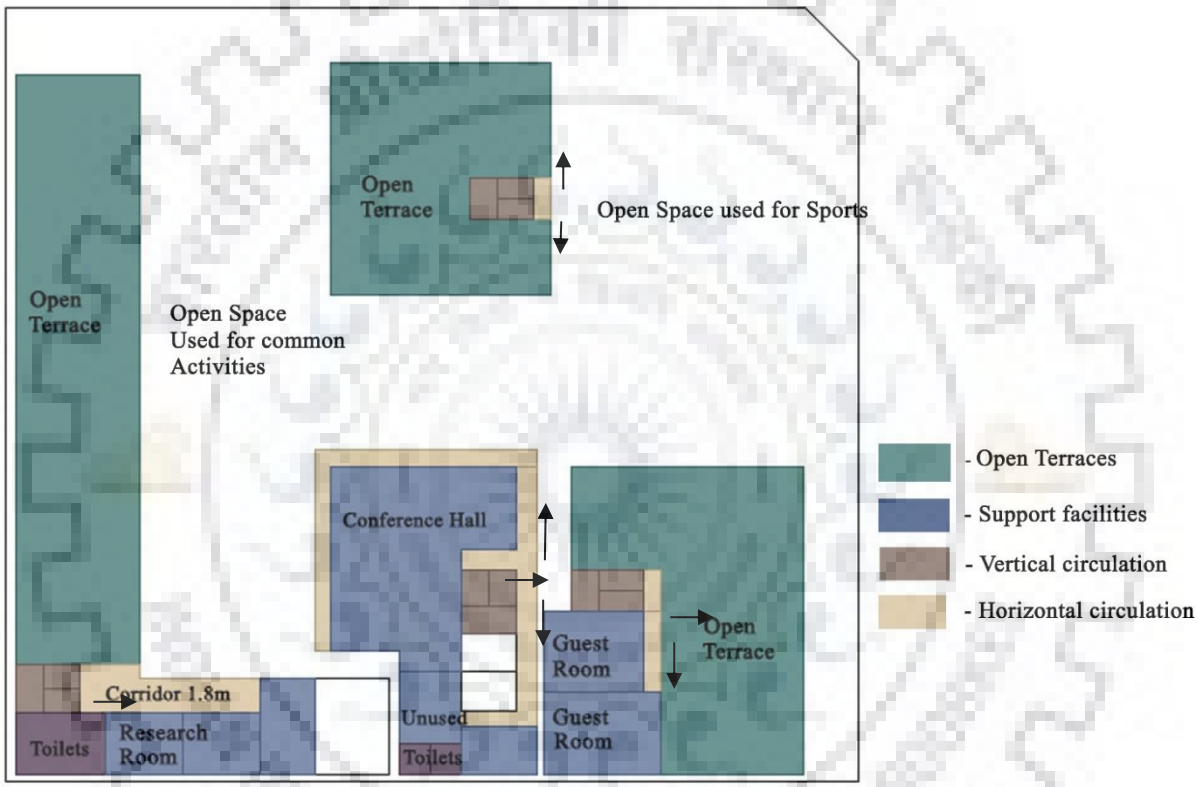


Figure 62 Zoning of First Floor

Figure 65 Classroom

Figure 64 Audio lab

Figure 63 Pre- Primary Classroom

Images Source: Author

Figure 68 Primary Classroom

Figure 67 Toilet

Figure 66 Computer lab

Images Source: Author

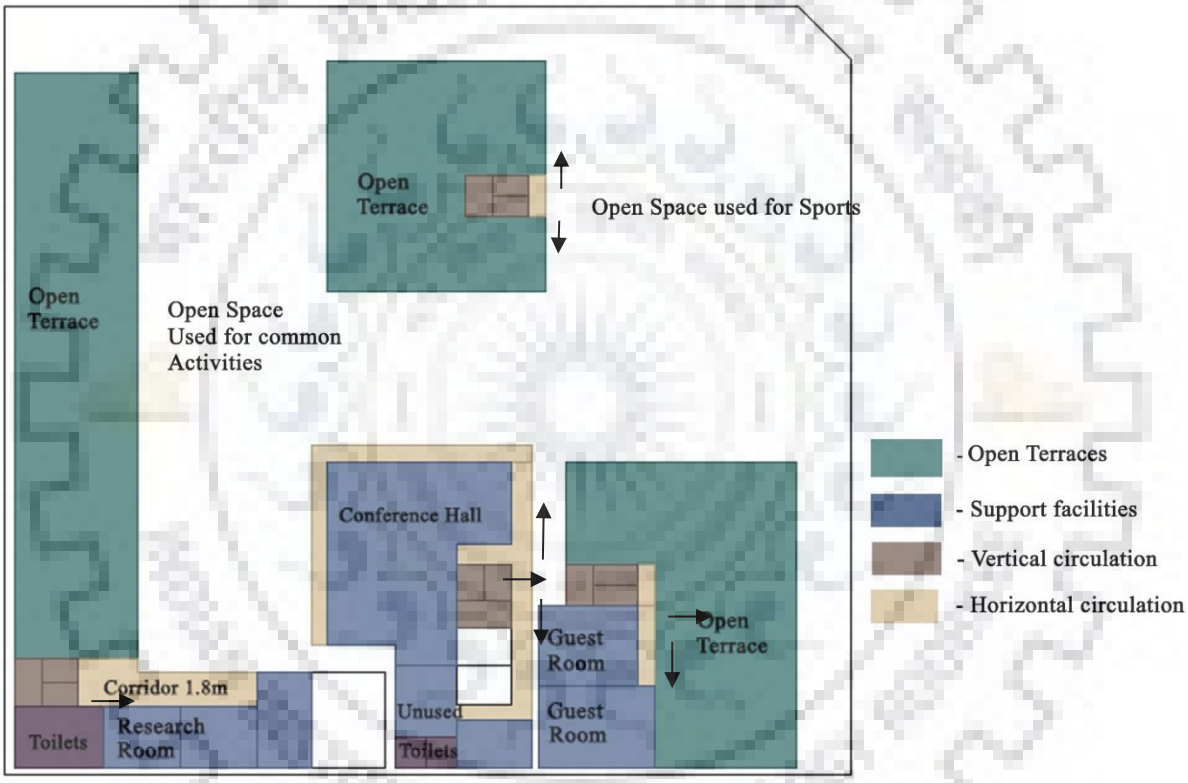


Figure 69 Zoning of Third Floor

Images Source: Author

Form & Function

To study the functioning of spaces and its effect on the Built-form, the inter-related aspects between them in order to understand the Design concept adopted.

Built-form

Conventional concrete structured buildings with rectangular plans and cantilevered corridors have been adopted - no specific architectural style observed in built forms. Sloped roofs for therapy facilities were adopted (in order to eliminate the feeling of enclosure within the pupil).

Building for Vocational Training facilities is a long L-shaped with corridor running throughout the length of the building.

Scale and Proportion

The overall form of different buildings has no Symmetry / Unity among them. The Scale and Proportion of these buildings doesn't show a "Sense of Place" within the zone.

Building Elements, Style and Structural Details

Significant Building elements such as plastered brick masonry, RCC lintels/beams, long corridors, Stairways etc. were some of common features. No pronounced Architectural features/style were observed. No portico's or Entrance lobbies were present in any building.



Figure 70 Built forms

Images Source: Author



Figure 71 Landscape and open spaces

Images Source: Author

Landscape and Open Spaces

Referring from site plan, 52% of area has been used for construction and rest are open spaces. Poor ratio of open spaces to built – forms maintained within the site. Open spaces are not organized for effective utilization. Landscape wasn't given due consideration.

Entry Points

The school has two main entrances, one on N-E and the on North. The entry on N-E is not being used since area on N-E of school site has maximum activity and is been easily accessed by Profound group students (classroom located on this side).

The Main entry on Northern side is being currently used where bus parking is located at the entry itself. The building entrances were oriented in different directions according to open spaces available.

Horizontal and Vertical Circulation

Sufficient corridor widths

Every building has centrally located staircase that leads to upper floors.

No ramps were found for access to upper floors.

Building Services

such as provisions for Fire alarm or Fire-fighting systems, HVAC weren't present. Simple Water supply system with a motor pump and elevated tanks.

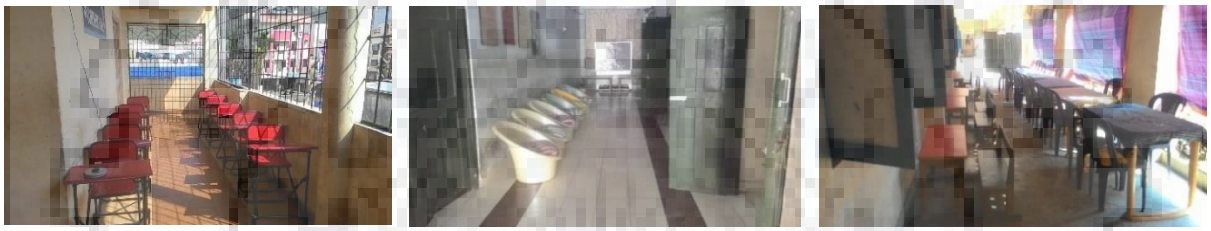


Figure 72 Circulation Spaces *Images Source: Author*

Figure 73 Barrier free Access

Images Source: Author

Barrier Free Environment_and access was created only up to ground floor of all buildings with proper ramps. Plinth height of all the buildings was maintained to be 60cm. No ramps/ lifts ere available for access to upper floors.

Parking was sufficient for 2 Mahindra buses whereas staff parking/ parking for users (parents of students) wasn't provided.

Vehicular and Pedestrian Traffic The road widths surrounding the school being 3m wide weren't sufficient for vehicular/ pedestrian traffic near school at peak times. The vehicles weren't allowed within the school premises. No proper parking facilities available for user's vehicles.

- **lighting and ventilation:**

All the circulation spaces are well ventilated, some of the indoor utilizations areas such as, classrooms, therapy areas, recreational spaces have adequate ventilation. Rooms with no proper ventilation are being used as storage spaces or left unused.

- **Colours and Textures**

All the walls are plain textured, with single color. No decorative elements or pictures for teaching children. The kindergarten sections have been decorated with toys and some elements whereas no distinctive or attractive areas were created for children.

- **Acoustics**

No acoustical treatments were done to any room. All the primary sections, and other classrooms creates lot of hustle, distracting the child. Therapy sections being in another building are not affected by the sound distractions.

- **Semi – Open Play Areas**

There are no such spaces created within school for low functioning children. Corridors are being used as their play spaces. All the corridors in the upper floors are covered with full length MS grills for safety measures.

5.6 Experts Review: Interview at NGO's

5.6.1 ASTHA (Alternative Strategies for the handicapped) Organization

Introduction: ASTHA is one of the few cross-disability organizations working actively with children and persons with disabilities in urban slums of Delhi and neighbouring states, for more than 25 years.

Location:

- **Services and strategies:**
    - Participation of Persons with Disabilities
    - Research and critiquing of policies
    - Raising awareness of the value of persons with disabilities to society and the economy
    - Community Mobilisation
- **Introductory**

Name: Pratik Agarwal Position: Director

What kind of disabilities do you address here?

Children with all kinds of disability, Autism, Deaf-Blindness Deafness, Developmental Delay Hearing Impairment, and Multiple Disabilities. There is a high number of children with Intellectual and learning Disability

Age of children that the organization work with?

Mostly 6- 18 years old, we have community service on early intervention and inclusion into mainstream school for children at young age.

Do you work along with schools and therapy centres?

The organization works along with government 4 schools around the community and conduct weekly workshops or community service. Does not work in hand in hand with therapy centres as many families of this community cannot afford therapy but there is physiotherapist who visits organizations and some other professional

Do you enhance specific skills and what is the programme like (teaching techniques) and what are the requirements of CWSN?

The curriculum is mostly based on play based and teaching are associated with games. The organization works on a 3month goal period schedule and assessment and process of children progress is registered and further plans are drafted accordingly. We have a certain step by step teaching methods for children

of different (ref image x) age but ultimately each programme is flexible and personalised according to particular kid.

- **Architecture Related Questionnaire**

What is inclusive school in your own words and what are the components?

Inclusive schools are the ones which are prepared in every aspect to take a child with any sort of disability and teach along with normal students. As per RTE Act all private schools needs to reserve 25% of seats to children which will be reimbursed d by the state.

The main components are school policy or administration, teaching methods and school infrastructure.

What's the role of school's infrastructure in inclusive school?

The foremost adaptability a school can do to show they welcome all students of different backgrounds and different abilities is by improving their infrastructure and making it accessible to all. Our organization works closely with neighbourhood schools and helps them in improving classroom standards and providing assistance in preparing timetable for CWD.

What are the most important aspects while putting a CWD in mainstream school?

Acceptance of school and administration are most important and change in teaching methods along with change in teachers' attitude. The school-built environment hinders children physical and social development as still many schools perceive accessibility in terms of ramps and access to toilet. Especially school playgrounds are the most inaccessible places for CWD, administration should concentrate not just on entry and exit but also to other areas of school.

Why is it important to have inclusive schools?

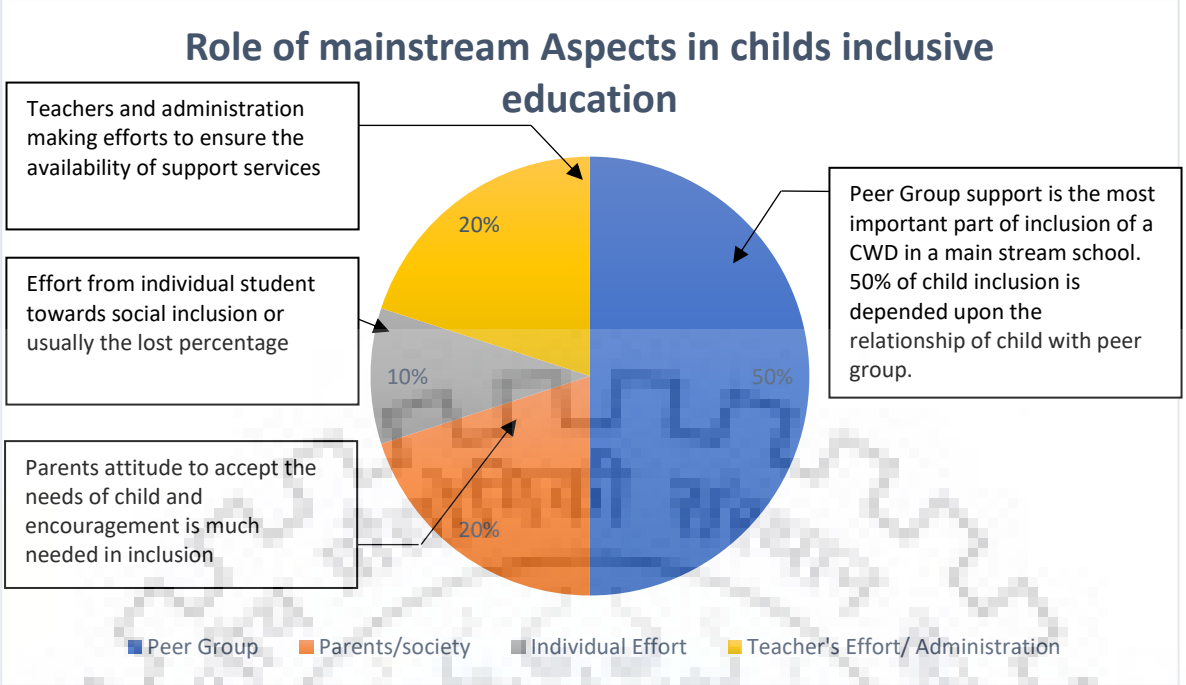


Figure 74 Inclusive aspects in CWD life

Images Source: Author

Peer groups: Each child with Disability is encouraged to develop a friend/group of friends who he or she can tag along and associate in school activities as a normal child. Our organization also educates classmate of the child about the child needs. Teachers also assign a child with good knowledge of subject to help the CWD in understanding, the organization advises schools to have 15mins extra allotment time in each class period just for the child with disability.

In working with schools, it is also observed that children at young have less attitude barriers towards a person with disability and this behaviour is taken by them forward through years if they have a classmate of disability.

Teachers and administration: Administration should make changes to Curriculum, examination and evaluation accordingly to the needs and abilities of diverse students. It is observed that many teachers do not have positive attitude towards inclusion, this should change, teachers should enhance classroom management skills and make modifications to include all.

5.6.2 Samarthyam NGO

- **Introduction**

Samarthyam is a civil society and research organization founded by persons with disabilities in 1994. Organization undertakes a Project named National Centre for Accessible Environments, this project

involves in evaluating, developing, and in promoting universal accessibility in built and outdoor environments, transportation systems, information communication technology and products.

- **Questionnaire**

Name: Anupriya Position: Director

What kind of disabilities do you address here?

Organization is personally not involved in working with disabled population but helps in betterment of environment and making it accessible on varied scales from streets to buildings.

Do you work along with schools and therapy centres?

Making Schools Accessible to Children with Disabilities by conducting audits and awareness programmes.Samarthyam directly doesn't work with school or therapy canters. Samarthyam conducts policy advocacy and research to harmonize existing laws, guidelines and access standards with UN CRPD and achieve the goal of inclusive communities and sustainable infrastructure for research.

What is inclusive school in your own words and what are the components?

Design for All, Access to School and the Learning Environment.Creating barrier free and accessible elements in the schools to mobilize children with disabilities to access 'all' facilities and not just few is one of the main component of inclusivity. Components are discussed below

- Removal of Architectural / structural Barriers
- Removal of Attitudinal Barriers (attitude of the parents, teachers and peer group)
- Proper training of teachers and support staff
- Creating an appropriate Curriculum and Examination System

What's the role of school's infrastructure in inclusive school?

For children school becomes a second home, as they spend most of their day in school environment, schools infrastructure takes a major role in how a child sees the world. It's proven that overcrowded and stressful environment can affect the learning capabilities of children. So an inclusive environment not only projects socialization among all children it also helps them in boosting their confidence to making them learn without any barriers.

What are the most important aspects while putting a CWD in mainstream school?

Eliminating all barriers, like attitudinal, physical, information and environmental in schooling system. Recognising that inclusion in education is one aspect of inclusion in society. A key ingredient in the success of any inclusion program must involve addressing the social environment in the classroom

Why is it important to have inclusive schools?

Students with disabilities add to the diversity of the classroom as well as strength. Students with disabilities do better when in a setting where more is expected of them. Our Research conclusively demonstrates supported inclusive education is favoured by most stakeholders: students with special needs, students who are developing typically, parents of students with disabilities, parents of students who are not disabled, general education teachers, special educators, other direct service providers, and educational administrators.

Chapter 6

Field Visits Analysis and Findings

6 Field Visits Analysis and Findings

6.1 Cumulative Analysis of Mainstream schools

The assessment system used on evaluating the spaces of school is NCERT, which was published by the board as an indicator for" School for All" publication and used currently to evaluate schools. The analysis revealed that assessment framework lacks prioritisation and doesn't follow accessibility continuum. The evaluation doesn't assess the inclusive principles followed by school or not. And there's no in-depth evaluation of spaces especially classrooms and other learning spaces.

Observation and interviews in the schools revealed that the concept of inclusion was reserved only to admitting students with perceived 'easy' disabilities. Though children from diverse backgrounds were admitted to the schools, there were no changes made in infrastructure, curriculum, marking scale or examination system to accommodate the needs of these diverse children.

The disabilities of these students vary from mild to moderate the attitude of teachers and administration is not so understanding related to issues pertaining to accessibility. administration looks at resolving the issues with temporary solutions rather than a permanent one like shifting the classroom for the child with locomotor disability nearer to ground floor and nearer to washroom.

Inclusive practices: The findings of this case study have highlighted that inclusive education has turned out to be more of an ornamental name to create an impression of inclusion rather than any sincere effort to follow inclusive practices. Guidelines regarding inclusive education keeping in mind the cultural and socio-economic conditions in the country need to set. Further, for inclusive education to succeed, teachers need to change their attitude, beliefs and value systems by not resorting to ability labelling of students.

For example, the case in KV Visakhapatnam is, no structural changes were made even in the school; however, the headteacher had altered the classroom allocation for a child with muscular dystrophy. During the interview she highlighted the changes she incorporated to enable easy access of classroom to this student by explaining that

"Actually, I have to allot sixth class upstairs (first floor) but I made her class downstairs (ground floor) near the entrance door. And for playing and all, I gave chess board and whatever else he could play with in the class itself or she visits library."

All these schools follow guidelines laid down by the CBSE board on curriculum, examination system and marking scale. Data collected through interviews with head-teachers and teachers revealed that no guidelines were in place to allow schools to make these modifications for students who were diagnosed/perceived to have disabilities or were from economically weaker sections of society.

When asked if students with disabilities were provided with any extra support for project work, co-curricular activities, etc., the head-teachers responded in the negative and stated that these considerations were not made for any student.

6.1.1 Field visit Observations and Inferences

		KENDRIYA VIDYALAYA VISAKHAPATNAM	KENDRIYA VIDYALAYA RAJAHMUNDRY	GOVT. BOYS/GIRLS SENIOR SECONDARY SCHOOL, Okhla Phase II
Site Area (Sq.Mts)		9,643	4,615	6,476
Number of Students		(14)	(4)	(35)
students with disability	Visual			
	Hearing			
	Locomotor			
	Others			
Percentage of CWDN		1.7	0.4	2.7
Student Teacher Ratio		1:29	1:31	1:21
NCERT Assessment	Infrastructure	42 out of 66 Rating	42 out of 66 Rating	47 out of 66 Rating
	Emergency			
NCERT Quality Rating	Rating (School for All)	22 out of 33 Rating	27 out 33 Rating	21 out of 33 rating

Severe Mild Minimal

The below pyramids present continuum of children/ student population diversity in school. This data is culmination of all field visits

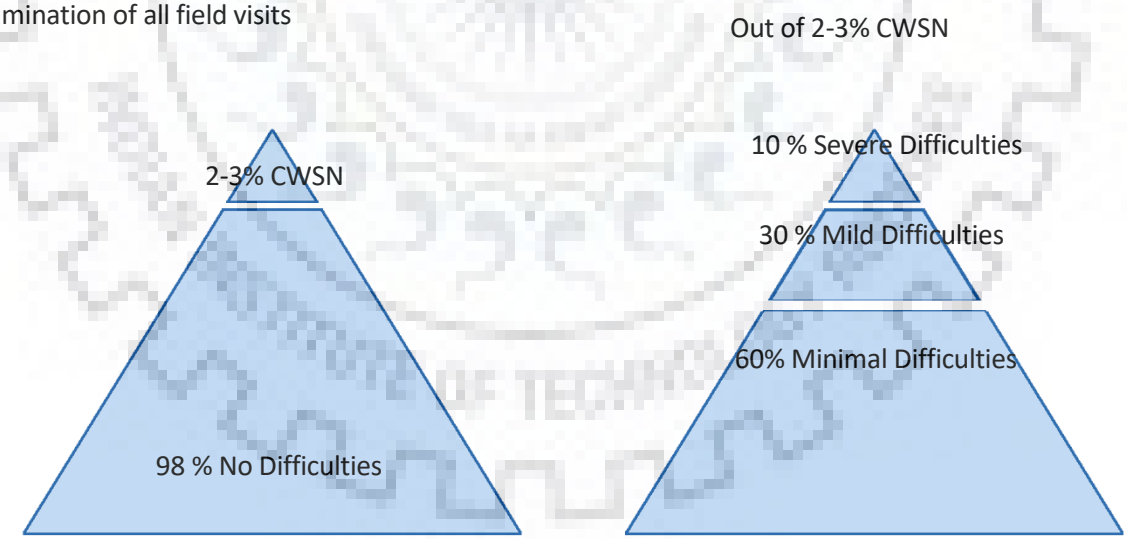


Figure 1 Pyramid of Students Diversity in School

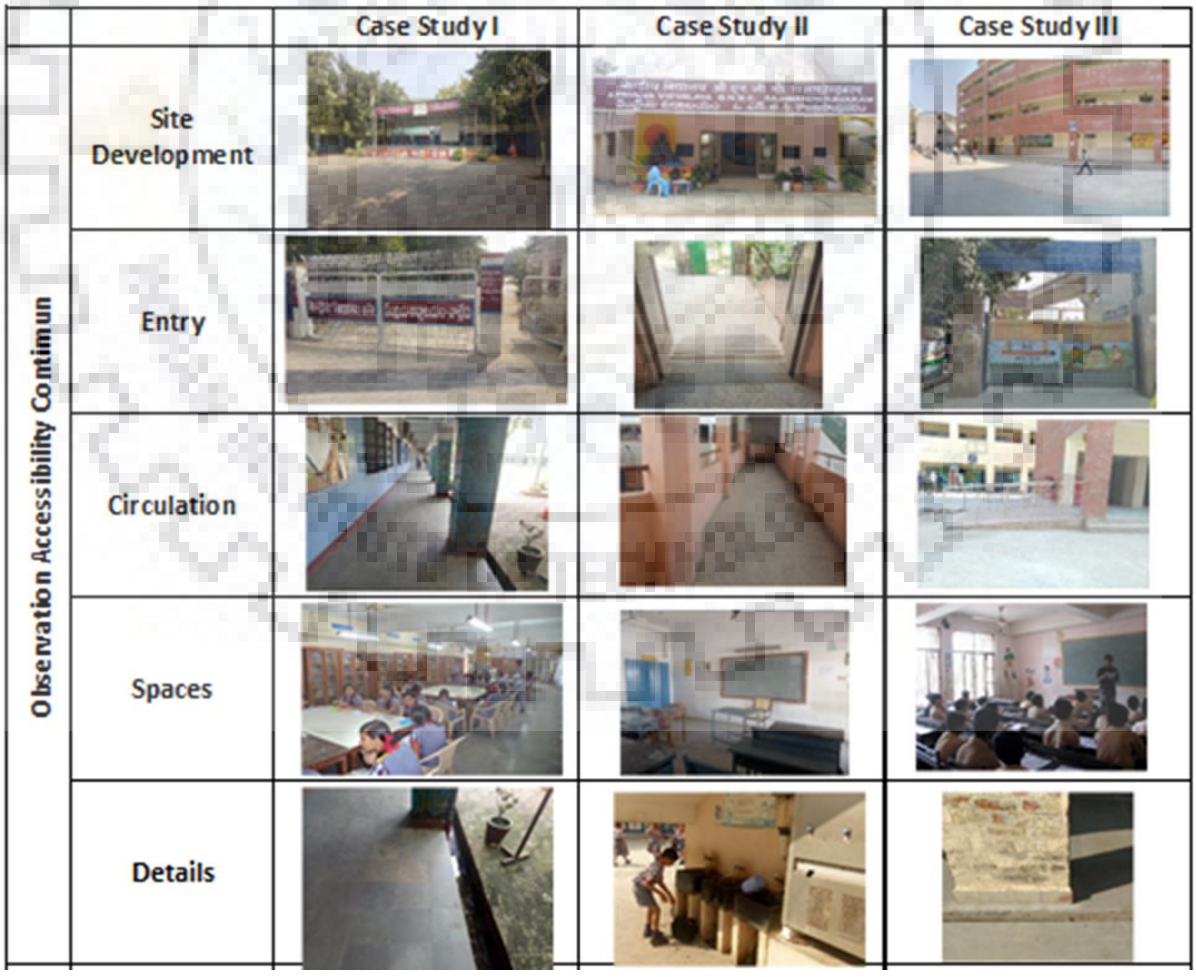
Source: Author

Even though all schools have 3% free education reservation for children with Disabilities, it is observed that population of Disabled students is very less, especially in KV school example when compared to Government boys and Girls Secondary school in Delhi, this is due to KV schools being restrictive and selective in selecting their students.

The population of students with disabilities vary in diversity, but range of disability is observed from minimal to mild, very few students (Most likely one or two) can be categorised as severe. This is due to popular opinion in parents of Disabled children that mainstream schools can't cater to their children needs, they lack in professionals to deal with special educational needs and most importantly school education system follows specific set of teaching methods and examination system which may not be appropriate for Child with disability. Parents are also reluctant to place their special child in mainstream schools, as teachers' attitude in educating a special child is not appreciable as observed through group discussions.

Children with hearing and Locomotor (Mild-minimal) Disabilities can be seen in schools as their educational needs can be overcome with hearing aid or other assistive devises which does not place any responsibilities on school teaching staff or administration.

All studied schools strive to implement accessibility in their schools or at least alter school system like changing class which has CWD to ground floor. Half-hearted approach towards inclusivity is observed in school-built environment, this resulted because of not taking up intervention from earlier stage without having view for the future needs and also due to lack of taking professional opinion in retrospection.



6.2 Field visit Inferences

Issues observed in each field visit are categorised into four part, planning of school building, Design related, Teachers and staff development and Resources. Some issues overlap. Issues of each field study can be related to one or other, in some case many inclusive principles and lack of their consideration in design or school-built environment. Frequency of occurrence of each principle can be observed in below table

With the help of below table, it can be inferred that some principles consideration in design is more important, hierarchy of principles is analysed and these principles form the basis of design guidelines conclusion of the research.

6.2.1 Understanding the linkage between Issues and Inclusive Principles

				Accessibility	Wayfinding	Perception of information	Adaptability	Usability	Health and Well being	Culture Appropriatene	Safety and Security	Maintainability
Planning Related	KENDRIYA VIDYALAYA Visakhapatnam		Zoning of spaces		●							
			Location of services	●				●			●	
			Underutilization of informal open spaces					●		●		●
	KENDRIYA VIDYALAYA Rajahmundry		Irregular site shape				●	●				
			No Planning for future demands	●			●	●				
	GOVT. Boys/Girls Senior Secondary School		Community involvement,							●		
			planned with disability not in mind	●							●	
			Improper Zoning	●	●							
			No phase wise development	●				●				
Design Related		KENDRIYA VIDYALAYA Visakhapatnam	Underutilization of informal open spaces					●				●
			Lack of flexibility in classroom layout	●			●					
			Longer routes for locomotor disability students						●			
			Absence of lift or ramp to upper floors	●								
				●			●	●	●			

			Accessibility	Wayfinding	Perception of information	Adaptability	Usability	Health and Well being	Culture Appropriatene	Safety and Security	Maintainability
		Restricted independent movement for CWD	●			●	●	●			
		Lack of Attention to details					●			●	
	KENDRIYA VIDYALAYA Rajahmundry	Lack of Space Availability	●			●	●		●		
		Under-utilization of Play ground					●		●		●
		Lack of diverse play facilities				●					
		Inappropriate material finishes		●	●					●	
		No approach to sensory design		●				●			
		Location of facilities	●				●			●	
		Accessibility Awareness	●								●
	GOVT. Boys/Girls Senior Secondary School	Inadequate Availability of space					●				
		Absence of some support spaces									●
		Lack of flexibility and Adaptability in spaces				●					
		Superficial accessibility	●				●			●	
		Attention to removing barriers/ Maintainability									●

6.3 Deriving Inclusion Design Principles for School Environment:

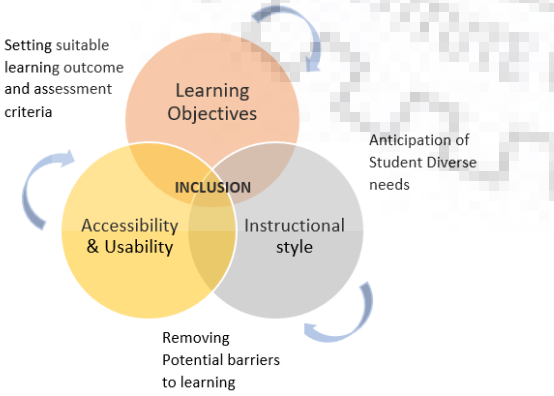
Inclusive Principle criteria for Design Guidelines:

Frequency of related principle helps in establishing its importance in design, therefore becomes the consideration for deign guidelines, Followings principles form the criteria of each assessible element (Site Development to Detail) of Design Guidelines for this research.

- **Accessibility** Accessibility is the design of products, devices, services, or environments for people with disabilities.
- **Usability** The degree to which something is able or fit to be used. Space and dimensions are involved
- **Wayfinding** Wayfinding encompasses all of the ways in which people orient themselves in physical space and navigate from place to place.
- **Perceptible Information** The design communicates necessary information effectively to the user
- **Flexibility and Adaptability** Adaptability is the ability of space or designl, to organisation to adjust or change itself to best meet the needs of the user or environment.
- **Health and Safety** Health and safety consideration in design for children in school
- **Cultural Reference** Respecting and reinforcing cultural values, and the social and environmental contexts of any design project
- **Technological Aspect** Any technological devise usage in design

6.4 Difference between a mainstream school and Special school

The difference between these help in understanding the core places where mainstream school is lagging behind in achieving inclusivity. This helps in prioritizing the physical environment changes that needs to be done.



Inclusion Cycle

The differences were categorised by the Inclusion circles (forming a Venn diagram shown below) provides a basic view of how inclusion should be central to the creation of learning objectives that need to take into account.

Figure 2 Inclusion cycle

Source:http://www.equalityanddiversity.co.uk/samples/edi-design-planning-delivery-teaching-learning.pdf

is of the of design elements and Inclusion principles between Mainstream school and Special

Design Elements and Principles		Mainstream School	Special Schools
Inclusion Elements	Site Development	The school are abutting at least 12m road and site is plain terrain more than 1acre.The school building is centrally placed with open ground around, The ground is not covered with grass in any of the schools. Schools were rectangular is shape with central courtyard and corridors were single loaded. Parking is next to the entrance and	All special schools were circular in plan or have a central courtyard with visual access to the entire school. Building is centrally located and Primary classroom opens to playground.
	Entry	The main gate in all schools is appxo.4m wide and has a separate pedestrain gate.Schools have gentle slopes for entry but the use of material is not wheelchair friendly. Classroom doors are not openable . Many CWD use private transport to get to school.	The entrance to most of these schools is open type and not restricted.All the children use school transport to get to school and doors and entries to interior spaces are either have vision panel or transparent and also have push bar for ease of handling.
	Circulation System	Schools are planning for ramped vertical circulation. All schools have single loaded corridors and more than or equal to 2.4m wide. Ramps don't have railing on both sides and no edge protection.	The width of the corridor is 2.m wide and Sigle loaded, Upper floors have ramps and ramps have railing on both the sides.Even though some schools lack in ramps they have lifts for circulation and material and colours used are soohing and non slippery.
	Rooms and Spaces	Classrooms were staked with furniture and net space for each student is less than advised.Classrooms have row and column layout.	Classrooms have no fixed layout and amount of net space for each student is more than 2sqmts.Formal spaces and informal spaces merge together .Offices and administrationare zoned to one side of building.
	Details	Lack of attention to detaling is observed in planning and design. Detailing of fixtures and furniture like washbasin and study chair are not inclusive.	Attention to details in toilets is to standards and classrooms adopt flexible furniture.
Inclusion Principles	Access	Very little part of school is open to independent movement by a child with disability. A All schools were planning for a ramp to upper floors, but for convenience s class who has CWD were being shifted to ground floor. Access to most of the spaces require a person to take longer route than a normal person would take. Access to school for most CWD	All spaces were assessible free and use of staircase is kept to minimal, Ramps were used in all possible level change. Toilets can be used independently even by a disabled user, Doors and handles were disabled friendly and levelled flooring no barriers.
	Space	No school has space in the classroom for a wheelchair user. The classroom size in most schools is around 6MX8M with usually a strength of 40-45 students this gives 1.2 to 1 sqmts of area for each student which is less than the standard.	Every space is planned with keeping users especially children with disability in mind. Class room sizes were
	Sensory Awareness	Design does not involve much of other senses, No tactile flooring or path guidance. No class was acoustically treated. Use of sensory elements like colour and textures were not focused in design.	All spaces were segregated by change in the flooring material and rich colours were used on surfaces, green for classroom flooring gives a calming sensation and non slippery material was used in the corridors and walls
	Flexibility and Adaptability	Classroom and spaces have fixed furniture and packed giving very less space for flexibility. Learning spaces don't adapt according to the change in the activity especially spaces like classroom. Informal spaces have very rigid furniture/seating as long seating bench or seating around the tree.	spillout areas provide extra space for flexibility and can be adapted according to the needs.

ACCESSIBILITY

INSTRUCTION STYLE

Inclusion Principles	Safety and security	Emergency routes were not friendly for a independent movement. Many of the schools have staircase marked as emergency exit which are also used as general staircase and they open into courtyard rather than outside. Only entrances and office rooms were cctv surveilled. Class	The entire school is under cctv surveillance except for toilets and some private office rooms.Emergency escape routes are marked and has audio anouncement too.Consious use of materials.No protruding elements from wall for safety of low vision students.
	Barriers as per Interviews	Barriers as discussed and arised from interview were lack of proper acessibility to all spaces in the school, especially plyground. Strick classroom layout and problem of taking longer paths to reach a place in school.	School administration tries to remove all possible barriers.
	Curriculum	School Follows cirriculam set by the board and examination system accordingly. No special treatment or consideration for CWD.	Schools have very flexible ciriculum,the system trys to test knowledge and skills rather than applying same method of testing for everyone.Only 12th standard has board exams and all other standards have one exam at the end of year, where grades were not marked.Ciricullam follows clarity of outcome and fairness of meaasurment.
	Teaching style	It is observed that use of technology is very less in schools only few classrooms have smart boards.	The teaching style is open and participatory, where digital and different tools were used to explain.Most special schools concentrate on livelyhood skills teaching.But teachers believes in maximum usage of technology and assistive tools for helping in learning.
	Teachers Attitude	Teacher's attitudes towards inclusion vary across the education field.majority of the teachers surveyed had strong negative feelings about inclusion and felt that the decision makers were out of touch with classroom realties	Acceptance of teachers towards the needs of children is high but Teachers' attitudes appear to vary with their perceptions of the inclusion according to teaching experience.
	Students attitude	Students are friendly and helpful towards the CWD and ready to help.It is observed that many of the students with locomotor issues seek the help of other students and peers to go around the school.	present are special children no behaviour change is observed but it is noted that inclusion of CWD is difficult in a normal setting if early interventions are followed, children become more comfortable with peers and attain introvert personlaity as said by on of the teachers
	Inclusive assessment	The assessment tools available for only by NCERT and by CBSC board, these assessment tools don't take many of the needs of children into consideration.	Since all of the special schools were private owned and follows their own ciriculam, there no assessment system but still certain subjects and skills and spaces set by education department are nessessary to be followed by a school to regard as an educational institute.

INSTRUCTION STYLE

Learning Objective

It is noted form the following study that all these schools were ready to make changes, but there's a gap found in guidance. There's no proper guidelines or handbook to suggest the changes needs to be done in an already existing school building. Government guidelines like NCERT, CBSC Board suggest changes in Instruction style, staff development, Design and planning but not in a phase wise manner and doesn't prioritize. The differences noted will help in understanding the features of inclusive school from CWD perceptive and are implemented in design guidelines.

Chapter 7

Conclusion and Recommendations

7 Conclusion and Recommendations

7.1 Design Recommendations:

This report showcases existing issues of Indian main stream schools in including children with disabilities, and provides guidance about how inclusion can be achieved more broadly. The guiding point of research is to make Inclusive Education (IE) a compulsory norm set by Indian government for all schools. One of the key principles of IE is about how we develop and design our schools, classrooms, programs and activities so that all students learn and participate together.

This research is supported by field visits of Mainstream schools selected under derived criteria. Criteria for assessing inclusivity in these schools is formed on basis of analysis of literature study and case studies.

The study revealed the key issues in attaining inclusion and each issue can be linked to one or many inclusive principles absence or inconsideration. All related Inclusive principles are listed and few (Most occurrence) were listed in forming the base of Design Guidelines, based on those inclusive design guidelines for school are formed.

The design recommendations/ Guidelines have been suggested after analysis of field studies and parameters are drawn from literature and field studies.

The principles of Design determine the key characteristics that helps in achieving an inclusive Environment for a school. Many of these principles overlap and in a few cases conflict, so designers need to take a holistic and coordinated approach to the design solution.

The following Design recommendation are discussed in Table 26 (G*uidelines criteria for Designing Inclusive school for children with Disabilities)*

Table 26 Guidelines criteria for Designing Inclusive school for children with Disabilities

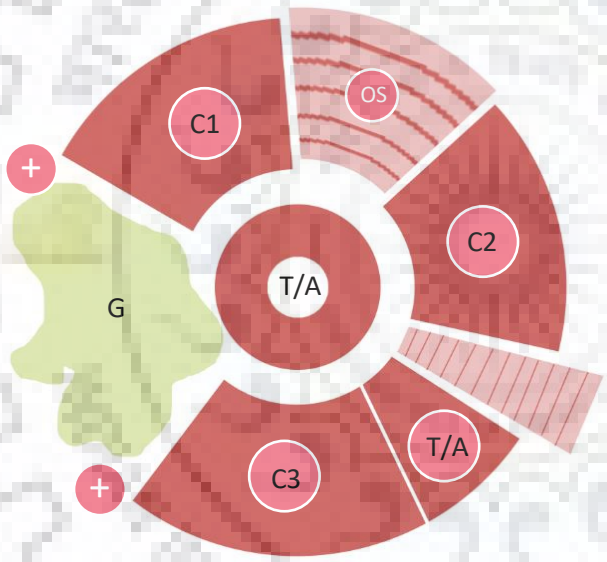
	Disability Type	Harmonised Guidelines and Space Standards for Barrier-Free Built Environment for persons with Disability and Elderly Persons (2016)		Accessibility	Usability	Wayfinding	Perceptible Information	Flexibility and Adaptability	Health and Safety	Cultural Reference	Technological Aspect
Site Development	Visual	Each building and its site should be planned and designed as an integral unit from the very beginning with Tactile guiding blocks.	Inclusive Design	The school should be conveniently located, with good transport links. The site should ideally be relatively level but changes in level can be exploited positively for split-level two storey school accommodation	Initial design strategies, The planning of the school should be seen not merely as a grouping of rooms listed in the schedule of accommodation but as a complex of spaces permitting the optimum degree of variety in use.	Rational room relationships help the whole school function well for students. Zoning the school help children in wayfinding	Orientation of inhabited spaces to make optimal use of light and ventilation. Use of natural settings of site to maximum. Visual contrast and texture, which can be used for sensory wayfinding in Site and Building planning. Planning around one or more courtyards can provide calm, quiet and protective spaces.	Schools need to be flexible for everyday use and adaptable over time to meet the current and future needs.	Quite and learning spaces zoned away from traffic (formal and informal, different users spaces for very young children and older) . Levels of security required - Surveillance (Refer Figure 134, 135 Zoning)	School location decisions must r equire participants of the society , including students, Teachers and the community. A standardized and universal approach to a place without responding to cultural characteristics of a place could isolate it from community. Play area or informal spaces away from office spaces, these become gathering spaces for students.	Inclusive signage and lighting can be used in planning exterior environment.
	Hearing	Many aspects of the built environment can be designed to facilitate spatial awareness “in 360 degrees” and facilitate orientation and wayfinding.									
	Loco-motor	The external space is designed to allow easy access by the children avoiding Irregular surfaces and maintaining minimum width of pathways 1.8m									
	Disability Type			**Accessibility**	**Usability**	**Ease of wayfinding**	**Perceptible Information**	**Flexibility and Adaptability**	**Health and Safety**	**Cultural Reference**	**Technological Aspect**
Entry	Visual	The accessible entrance(s) should be the main entrance(s), and not side or back entry, intended for use by the public. Width of the door 900mm. Gradient not exceeding 1:2, Entry min1800mm to 1500mm	Inclusive Design	Separate entrance(Gate) for pedestrian and vehicular 1.2 and 3.5M respectively. Interior doors have at least 900mm clear width and either sliding . Refer figure 159 for manoeuvring details	Access should be an integral part of the design and should not require a person with a reduced level of ability to take a separate route from those with normal ability	The school building should be located near to the main site entrance and clearly visible from that entrance. Building entrance leading to lounge and reception area. Pathway from Main gate to building entrance should have direction cues.	Easily identified from a distance by its design, location, lighting and signage.(tactile signs are generally not recommended for external use).	Sliding main gate to accommodate and adapt to the amount of traffic flow.	A level threshold with a safe, level drop-off zone that has, ideally, only shallow gradient ramps. Good visual connection inside and out from lounge. Interior doors (classroom, labs) should have vision panels	Separate entrance for school buses and private vehicles (less traffic area)larger gathering place for private vehicles. A canopy or covered access to the pavement for children transferring to or from buses or Private Vehicles.	Automatic building entrance is advised with clear glass. Interior doors fitted with automatic closer system.
	Hearing										
	Loco-motor										
				Accessibility	**Usability**	**wayfinding**	**Perceptible Information**	**Flexibility and Adaptability**	**Health and Safety**	**Cultural Reference**	**Technological Aspect**
Circulation	Visual	Tactile block indicates a correct path/route to follow for a person with visual impairment (Figure 5-3). It is recommended to install one/two rows of tactile guidance tiles along the entire length of the proposed accessible route	Inclusive Design	All circulation areas should be wide enough for wheelchair users to pass safely in different directions	Circulation acts as Social Areas and is generally calculated as 18% of the total area . Designers should make use of natural lighting, space and colour in the circulation areas to make circulation usable.	sensory wayfinding to help, Using trail rail for interior corridors. A simple, easily understood layout, which relates to the movement patterns dictated by the curriculum activities, makes circulation around the school easier.	use varied wayfinding techniques, such as signs, symbols, colour, sound, tactile cues and objects of reference to help them negotiate their environment Independently.(Refer Appe 7.1.5 Details)	In schools circulation spaces may also act as gathering spaces, niches can be provided at equal intervals to accommodate students activities. Wide steps are used as seating and should open into large area to avoid congestion	Avoiding conflicting routes between. Safe and easily navigable surfaces (wheelchair accessible), with safe changes in level or transitions between surfaces - both ramps and steps1 are needed where level access is not possible (Refer 7.3 APPENDIX A for steps and Ramp Details) Designs also need to take account of emergency escape procedures.	In designing wayfinding signages or routes cultural interpretation should be taken into consideration. Placing signage boards with information faced on to the left of on ward traffic.	Lifts are not encouraged in school for circulation, only in case of space constrain lift can . Audio voice installed in lift can assist CWD.
	Hearing	Doors in general circulation areas should be provided with vision panels giving a visibility from a height of 800 mm to 1500 mm.									
	Loco-motor	Minimum width of the walkway should be 1800mm									

			Harmonised Guidelines and Space Standards for Barrier-Free Built Environment for persons with Disability and Elderly Persons (2016)		Accessibility	Usability	wayfinding	Perceptible Information	Flexibility and Adaptability	Health and Safety	Cultural Reference	Technological Aspect
Spaces	Learning and Social Spaces (Primary Classrooms)	Visual	A rod/rail (could be made of thin bamboo) is fi xed at a height of 750mm in the classroom and other areas for children with visual impairments to use for support in navigating their way around.	Inclusive Design	For primary younger children Ground floor accommodation allows safe, level, easy access to the outdoors, preferably reached directly from indoor	Students taught most of their time in class, so small class bases are not advised, class size to be enough for all curricular activities, accommodating one or more child using mobility aids and a wheelchair, with access to some or all of the space, depending on the layout.	Simple standard layout in classroom, either U shaped or standard row and column furniture layout. Leaving enough space around the classroom for manoeuvring	Signage, vision panels and door handles (where appropriate) need to be low enough for young children to reach.	Fixed furniture can be minimised so staff can re-arrange it as needed, classroom becomes more flexible	Changes of level may pose risks for some children, So level to be avoided. Avoid furniture with sharp edges and corners.	N/A	Smart boards as teaching aids for CWD, Emergency Signage(Refer 7.1.5 Details)
		Hearing	All activity/internal areas are well-lit (300-500 lux) to facilitate reading and other activities. This would benefit t everyone, including children with low vision and also children with hearing impairments who practice lip reading									
		Loco-motor	**All classes and teaching facilities for children with locomotor impairments/those using mobility aids are located on the ground floor,**									
					Accessibility	**Usability**	**wayfinding**	**Perceptible Information**	**Flexibility and Adaptability**	**Health and Safety**	**Cultural Reference**	**Technological Aspect**
	Learning and Social Spaces	Visual	Same as Primary	Inclusive Design	Classrooms (which may open onto a shared area) that allow flexibility in learning and teaching.	Large teaching spaces are especially suitable for children with Disabilities and disabilities, since they provide enough room to accommodate one or more children	There should be sufficient space around equipment and machines in practical spaces for those using mobility aids or specialist/adapted equipment	Teaching board at lower height for wheelchair users and other facilities	The potential for arranging different groupings and activities (for example, sitting in a circle, around a table or for individual work) and for zoning activities and separating noisy and quiet	Avoid furniture with sharp edges and corners. No change in levels in classroom	N/A	Smart boards as teaching aids for CWD, Emergency Signage (Refer 7.1.5 Details)
		Hearing										
		Loco-motor										
					Accessibility	**Usability**	**wayfinding**	**Perceptible Information**	**Flexibility and Adaptability**	**Health and Safety**	**Cultural Reference**	**Technological Aspect**
	Support Spaces	Visual	N/A	Inclusive Design	The location of the Library/General Resource Area, and its distance relative to the distribution of Classrooms must be considered by the Design Team in the planning of the building.	Libraries to be fitted with flexible furniture and varied types of seating. Laboratories counters with access space for wheelchairs and lower height counters for wheel chair user	Simple layout and ample circulation space in resource rooms	Mirrors can be fitted on top of teachers desk at labs for clear view of teachers desk during experiments	When designing the Library/General Resource Area, due consideration should be given to the room furniture layout so that a number of flexible layout options are available	In the interests of safety sharp angles and projections should be omitted in the General Purpose Room.	N/A	, these devices can be equipped in resource rooms
		Hearing										
		Loco-motor										
					Accessibility	**Usability**	**wayfinding**	**Perceptible Information**	**Flexibility and Adaptability**	**Health and Safety**	**Cultural Reference**	**Technological Aspect**
Details		Visual	N/A	Inclusive Design	disabilities are likely to be adversely affected if materials and construction details are poorly specified and installed.	Wrong or Improper detail of a fitting will render the space or facility useless. Attention to door handles, avoiding hindrance in levelled flooring	Materiality used for wayfinding. Changes in colour and texture may be used for wayfinding	The size, colour and shape of information should be according to the specifications	Having minimal but versatile FF&E may appear bare but can enable teachers to use stimuli from teaching materials more effectively.. Partition walls can be used in between classroom and room can be combined for group activity.	Floors should be smooth and slip resistant in both dry and wet situations. Trip hazards need to be avoided and changes in level clearly identified with stark colour edging	N/A	School staff use ICT for internal communications, management and administration, monitoring progress, and preparing and targeting differentiated learning resources.
		Hearing										
		Loco-motor										

Site Development:

The size of each school and the layout and organization of the learning spaces and environments should be based on physical and curricular needs. Schools and school grounds should be an integral part of the learning process. The size of schools, where they are placed and the way they are arranged influence learning and how children relate to one another, adults and the community. The purpose of site development planning is to anticipate the future needs and development of a school in terms of physical facilities and to contribute towards conducive teaching- learning environment.

- A school site development plan shows the following improvements: Improvements of school buildings including the position of existing and proposed buildings.
- Arrangement of circulation elements, and utilization of open areas.
- Important principle in zoning is to create the proper visual, physical and functional zones



C	Classrooms
T/A	Teachers/Administration
+	Intermediate Space
G	Garden/Playground
OS	Open stage/ Secondary Play area

Source:Author

Figure 1: SPATIAL ARRANGEMENT

Zonning:Zoning helps in making wayfinding easier for children and zoning reflect deiifent fuctions of school building and its users. For example

• Accessible open areas and more secure areas

• Noisy and quiet areas

• Formal and informal uses

• Areas for very young and for older children

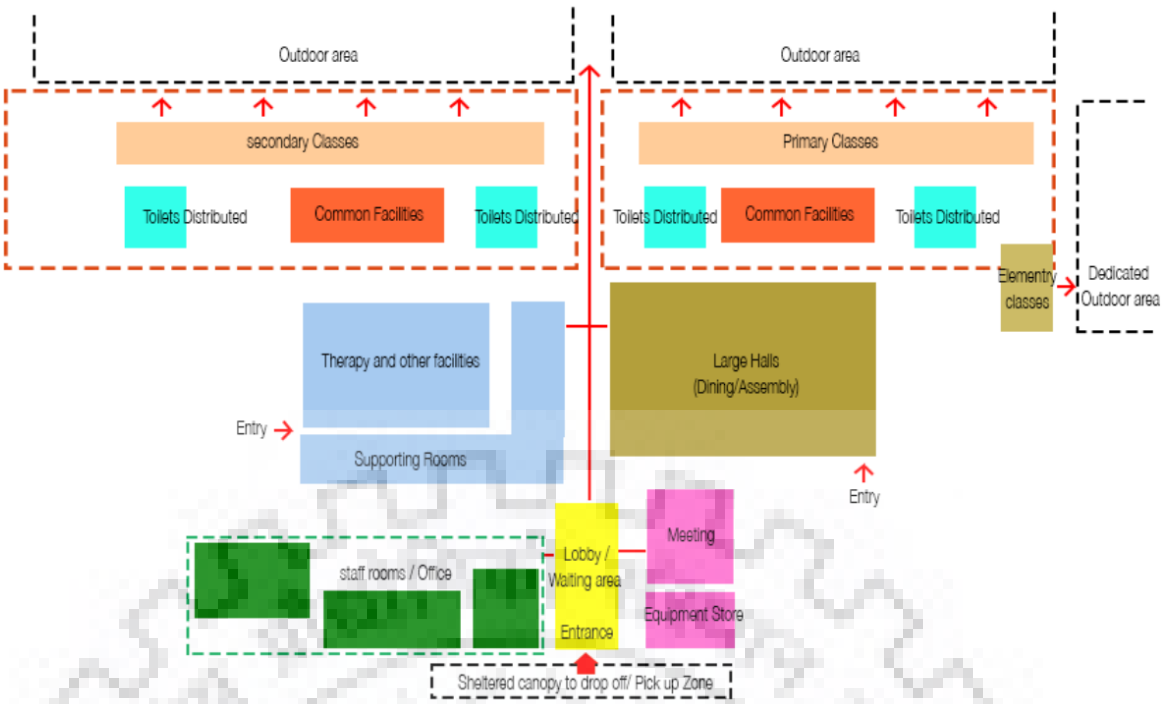


Figure 2 The Schematic zoning of inclusive school

Source: Author

Diagramatic Site Planning of Primary and Secondary school for children with a broad range of needs

Figure 3 Diagrammatic Site Planning

Illustrated by: Author

Site should be regular shape with an area over 2 acres for a city with more than 25 lakhs population and 1 acre of an area if it's less.

1. Shelter belt of trees and shrub planting along the site boundaries and the area of Red dotted line denotes walls and fencing for safety and security. The recommended setback of the school from the street line is five (5) meters to sufficiently reduce intrusive noise.

2.School building zoned according to functions and level of access. (Accessible open areas and more secure areas) Minimum distance between buildings laid out is 8meters for proper ventilation.

3. Covered play area for much younger children/ nursery students.

4.Hard surface game ground.

5.Green covered play area with wheelchair accessible nature trail. Tree Sheltered play area away from office spaces.

6.Staff and visitors' car parking. As well as for school bus parking

7. Footpath to school entrance separated from access road.

8. Outdoor extension of class bases/ Grass covered, adjacent to primary (younger student classes). Fenced (movable) from another playground.

9.Extended canopies as drop off/Pick up points for buses, cars etc…

7.1.1 Entry: Gate, Entrance and Door

Compliance of the following is required for doors, doorways, and Gates providing user passage on accessible routes. The exact requirements will depend on the school's particular arrangements and who will be permitted to the school. The school main entrance area should have a strong sense of arrival and space.

Access road: It is crucial to work out the road layout for vehicles bringing non-ambulant children to the school entrance door and Footpath to school entrance separated from access road by planting. Though a shaded entrance under canopy, location of ramp and stairs should be next to each other the building entrance should lead to lobby space.

- **Entrance**



Figure 4 Building entrance incorporating Ramp

Figure 5 Covered entrance at drop off- pick up zone

Figure 6 Entrance lobby

Source: Cast 'Research & Development, Inariyama Special Education School.com,2006

Figure The entrance has a large space to ensure safety of the children of the schools who arrive and leave around the same time. This is also a place for exchange for accompanying parents.

Internal Doors:

Manoeuvring clearance

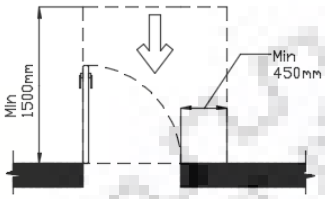


Figure 7 Entry Door detail_ Front Approach Door pull side

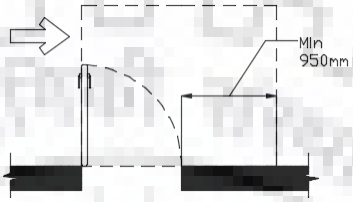


Figure 8 Entry Door detail_ Side Approach Door pull side

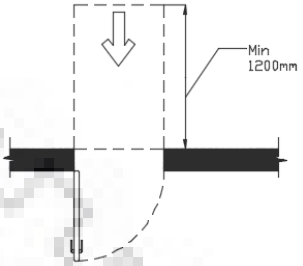


Figure 9 Entry Door detail_ Front Approach push side

Illustrated by: Author

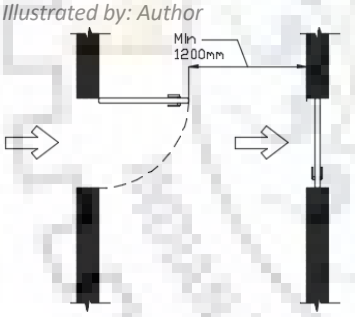


Figure 10 Entry Door detail_ Door to door min gap

Figure 11 Kick plate 120mm

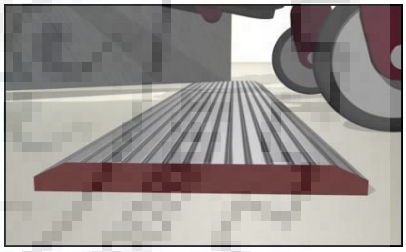


Figure 12 Threshold max. 12mm

Illustrated by: Author Figure 142, 142 sources: ADA,1992

7.1.2 Circulation:

Convenient travel routes and distances make life easier for people with SEN and disabilities, especially for those with mobility aids, sensory disabilities. The exact requirements will depend on the school's particular arrangements

Movement and travel are part of a learning process for many children who are developing independence skills, and they should be able to move around alongside their peers. The aim is to plan

for circulation that minimises travel distances and times. There should be a choice of routes to avoid congestion, conflict, difficult or long travel, and waiting.

Access Route: Designated safe pedestrian routes – some people have less awareness of the risks of traffic. easily accessible, level or ramped slip-resistant and well-drained surfaces along the route, without trip hazards and with an accessible stepped route nearby to give a choice.

- **Outside Circulation:**

Outdoor circulation needs to have a clear rationale and provide a variety of accessible routes to the whole range of children, minimising gradients so that they can easily access all outdoor facilities.

Wide pedestrian paths with defined edges, well away from outward opening windows (1200mm, preferably 1500mm and 1800mm for busy routes with passing places as required) with seats every 50m on long pedestrian routes.

- **Internal circulation: Routes within a Building**

Horizontal: Corridors

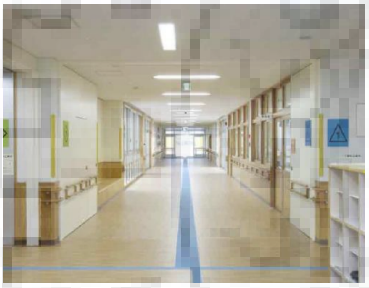


Figure 14 Corridor in Blind Disable School

Figure 15 Corridor in Deaf School

Figure 13 Corridor in Loco-Motor

Source: (Ueno, 2012)

Figure 145: Lines on the corridor floor are wide on the central part and narrow on branches to help positional recognition. In the School for the Blind, grey rubber with patterned indented surfaces that children can feel under their feet is attached on both sides of the corridor floor, and handrails are installed on the walls.

Figure 146: A curved mirror is installed at each corner of the corridors of the School for the Deaf to prevent bumping. In addition, there are many displays in the school to visually convey a variety of information."

Figure 147: Corridors are 3.5m-wide so that wheelchairs placed in front of the classrooms do not hinder traffic.

The ideal width of a corridor for an inclusive school is 2400mm, allows flow of students even with a wheelchair.

Figure 16 Continuous Handrail

Figure 17 Corridor with Niche

Source: (Ueno, 2012)

Benches for rest are installed in corridors in a way that they do not get in the way of other children. Handrails are installed also on doors so that the handrails on corridor walls continue seamlessly for children who walk holding on to them.

Vertical: Refer to Appendix A for Key dimensions for Ramps, Stairs and Lifts

Figure 19 Staircase used for seating

Figure 18 Stairs materiality

Figure 151: staircase adapts into seating, Width and riser of staircase are modified to serve dual purpose.

Figure 152: The boundary between the floor and the wall is highlighted by a dark baseboard and blue antiskid rubber is attached to stairs so that children with visual impairment can easily recognize and use them safely.

7.1.3 Spaces:

Design of an inclusive learning space, like classroom vary according to number of CWD students present and teaching methods adopted by teacher. Below are some of the recommendations, supported with norms. Classroom spaces that support flexible teaching approaches that meet the sensory, mobility, learning, and cultural needs of all students.

Typical classroom Details:

	Area per student Sq. Meters	Max. number of students	Classroom size Sq. Meters (Min.)
Primary School	2.5 (1sqmts)*	20-25 (40)	50 (48)
secondary school	2.5 – 3 (1.5 sq mts)*	20-25 (40)	60 (48)

(Data)* Norms issued by CBSE

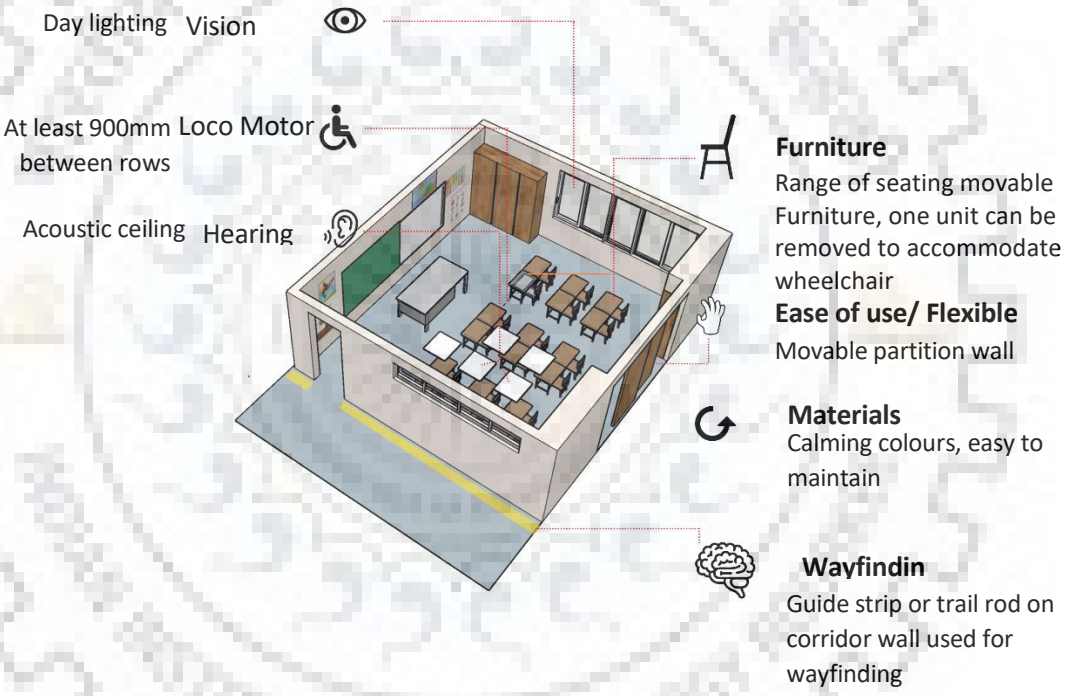


Figure 20 Typical inclusive classroom layout (20 students/class)

Source: Author

- **Social and learning space_ Primary and Secondary Classrooms**

In primary education, children are grouped in classes in a class base (open plan or semi-enclosed) or classroom (enclosed) and are taught most of the time by their class teacher,

Figure 22 Classroom layout

Figure 21 Movable doors

Source: (A Collection of Exemplary Design of School Facilities for Special Needs Education, 2012)

Figure 154: Large sliding doors of classrooms of Akita Kirari School for the Physically Challenged are designed for smooth entrance and exit of multiple wheelchairs and as well as extend room in to hall Halls before the classrooms are used for various small group activities such as gathering of children of the same grade.

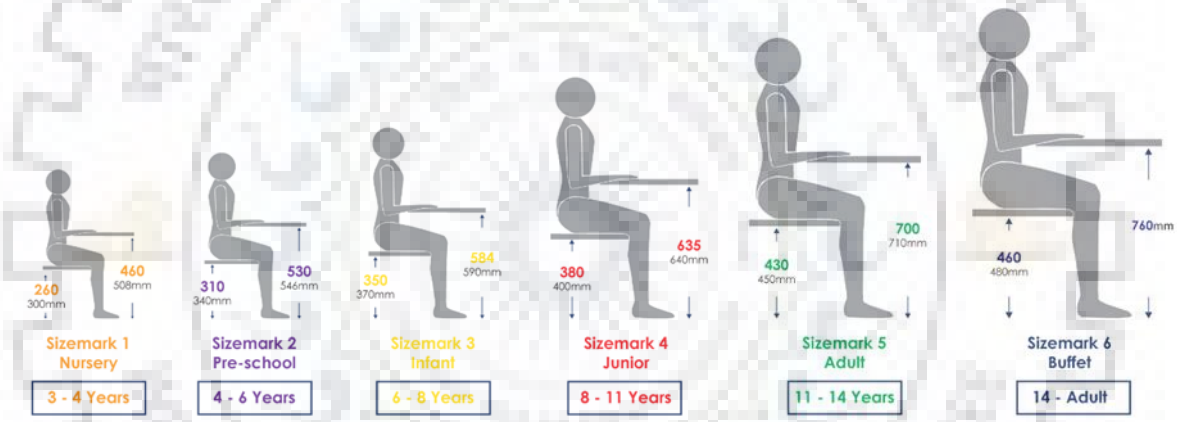


Figure 23 Recommended chair and table dimension guide

Source: (EN Guide, 2012)

- **Social and learning space_** (Laboratories / Libraries other resource spaces)

Figure 25 Diverse Seating furniture in Library

Figure 24 science Laboratory

Source: (A Collection of Exemplary Design of School Facilities for Special Needs Education, 2012)

Figure 157: In the science laboratory, a mirror is installed over the teacher's desk so that children can see well how the teacher is working. Desks/counters are adjustable

Exterior spaces: Playground and Informal open spaces

The Teachers/Staff Room may be located adjacent to the younger children play area. It may also be located so as to overlook the play areas for supervision purposes. Play areas designed with accessibility path around and incorporating CWD friendly play equipment's in Play ground

Figure 26 Inclusive playgrounds with Disabled friendly equipment's

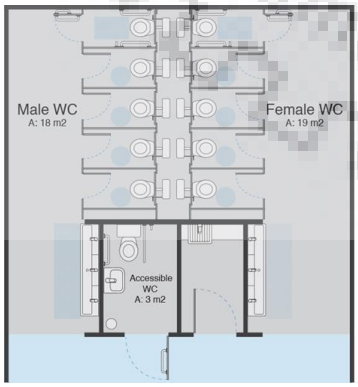
Source: parentsactive.org.uk,2012

Informal spaces are to be places away from staff / Teachers' rooms as they become more socio-spatial for students.

A resource room designated for CWD, depending on the numbers of children in mainstream school and range of needs, the total area required for support facilities may be 75–150m2. (Refer APPENDIX B)

- **Support spaces: Toilet, Water coolers**

At least one accessible toilet should be present and to be accessed from pathway rather than accessible cubicle in toilet. There should be enough room for non-ambulant children to move and park wheelchair when using toilet.



Fixtures and fittings should be robust and at an appropriate height (some may need to be height adjustable) and within easy reach of users. For wheelchair users, wash hand basins may be adjustable height or fixed height with a knee recess.

Figure 27 Location of Accessible toilet

Source: Standard Specifications, Layouts and Dimensions (SSLD)

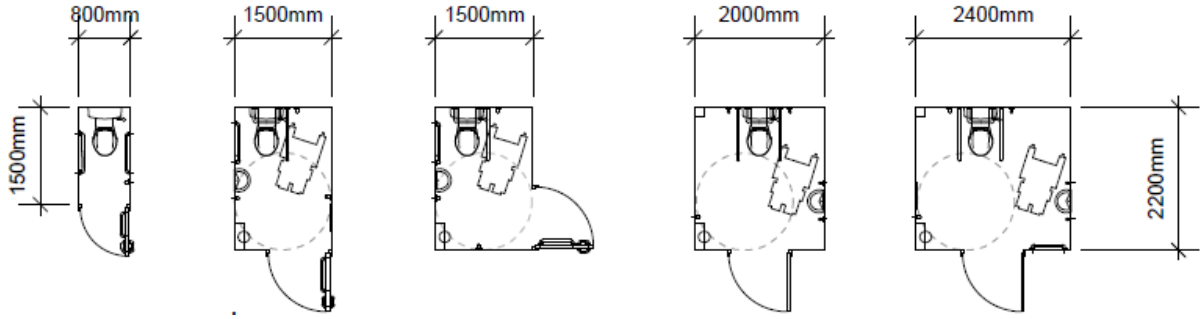
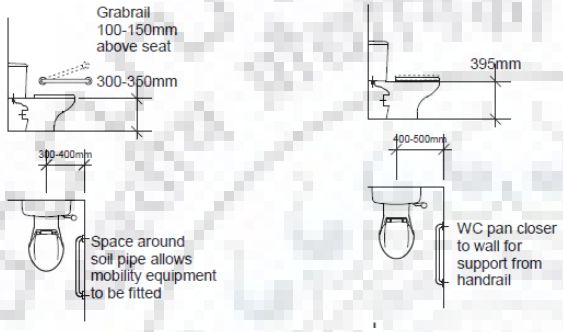


Figure 28 Plans showing key dimensions around the wc pan in accessible toilets (Various types and alterations)

Source: (teachernet, 2011)



The layout, fixtures and fittings should reflect the age of the children using.

Figure 29 Toilet fixtures and key dimensions

Source: (teachernet, 2011)

7.1.4 Details: Elements (FF&E), Materials and Finishes

- **Furniture, fittings and equipment (FF&E)**

Providing appropriate furniture, fittings and equipment helps to ensure full access to teaching, learning and social activities, regardless of children's disability.

The brief should outline the FF&E needed for each space in relation to its function, spatial needs and ergonomic design.

FF&E can increase the flexibility of a space. Furniture that is easy to move around or that can be used for more than one purpose can allow for a variety of activities and layouts.

- **Fire evacuation**

The means of escape may need more illumination than Illuminated exit signs. Good signage or colour coding of escape routes will be helpful for some people.

Some people with SEN and disabilities may be confused or have longer reaction times, so travel distances and door widths may be different from those in mainstream schools – escape routes should be wide enough for two wheelchairs side by side.

Normal circulation routes should be used as emergency evacuation routes and should be accessible at all times.

- **Colour, texture, acoustics, lighting and sound**

Colour, texture, acoustics, lighting and sound, as well as landmark features such as seating or plants, can all help people orientate themselves on their journey around the school. Views to the outside and through to other parts of the building and site can also help people find their way.

Colours:

- Defining routes with contrasting colour or tone on walls
- Bright colour in large areas, or busy patterns, can confuse or over-stimulate. Pastel subdued colours can be soothing.
- Colour or tonal contrast can be used to identify objects such as light switches against a wall or utensils or tools on work surfaces or possible hazards such as step edges.
- Change in colour signifies change in function of building

Figure 30 Transition space in school

Source: bsi-global.com/shop,2005

- **Light and sound**

Chimes consisting of colour lamps are placed over the blackboard in classrooms so that children can visually grasp the situation. Signs showing the pronunciation are added to posters and pictograms so that children can learn how to pronounce them.

Figure 31 Emergency signal

Source: bsi-global.com/shop,2005

- **Signage:**

Figure 32 Signage with pictograms and Objects

Source: The Sign Design Guide published jointly by JMU Access Partnership and the Sign Design Society – http:// www.signdesignsociety. co.uk/

Signs should be easy to understand. Words, symbols and objects can all be used.

Glazed door panels at different heights help people to orientate themselves and enable them to see if anyone is approaching from the other side. Placing signs at junctions or in long passageways to indicate direction or position. make clear distinctions between signs that offer directions and those that indicate arrival.

7.2 Scope for future work

The core differences between special school and mainstream school in Design factors helps in drawing out the gaps where mainstream school is missing out in meeting full inclusion. This also helps in further research where advised design considerations have to meet all the principles of inclusion and to follow accessibility continuum.

Evolved Framework which gives guidance to the school for taking up design considerations for inclusivity. This framework consists of school assessment and design guidelines.

Assessment helps in prioritizing the immediate needs and issues of design of already existing schools. Design considerations gives out a phase wise development plan for mainstream school towards inclusivity.

A student-centred design model provides more value and opportunities for deep understanding when compared to earlier approach to design. It should be noted that for the deaf student, the importance of direct and deliberate communication is required to meet key academic milestones. With a student-centred model these goals become easier to achieve and provide significant value to not only deaf or blind students or physical disability, but to each student.

Inputs from experts from NGO's and special schools help in understanding the effect of supporting factors in IE apart from Infrastructure like importance of instruction style and Inclusive education objectives.

7.3 APPENDIX A

Table 2 Key dimensions for Ramps

Clear width (between walls/	Gradient	Landings
1200mm minimum –1800mm	• 1 in 12 for 2m length • 1 in 15 for 5m length • 1 in 20 for 10m length	Intermediate landings of 1800x1800mm

Source: un.org,2004 ([www.un.org/esa/socdev/enable/designm/AD2-01.htm)](www.un.org/esa/socdev/enable/designm/AD2-01.htm)

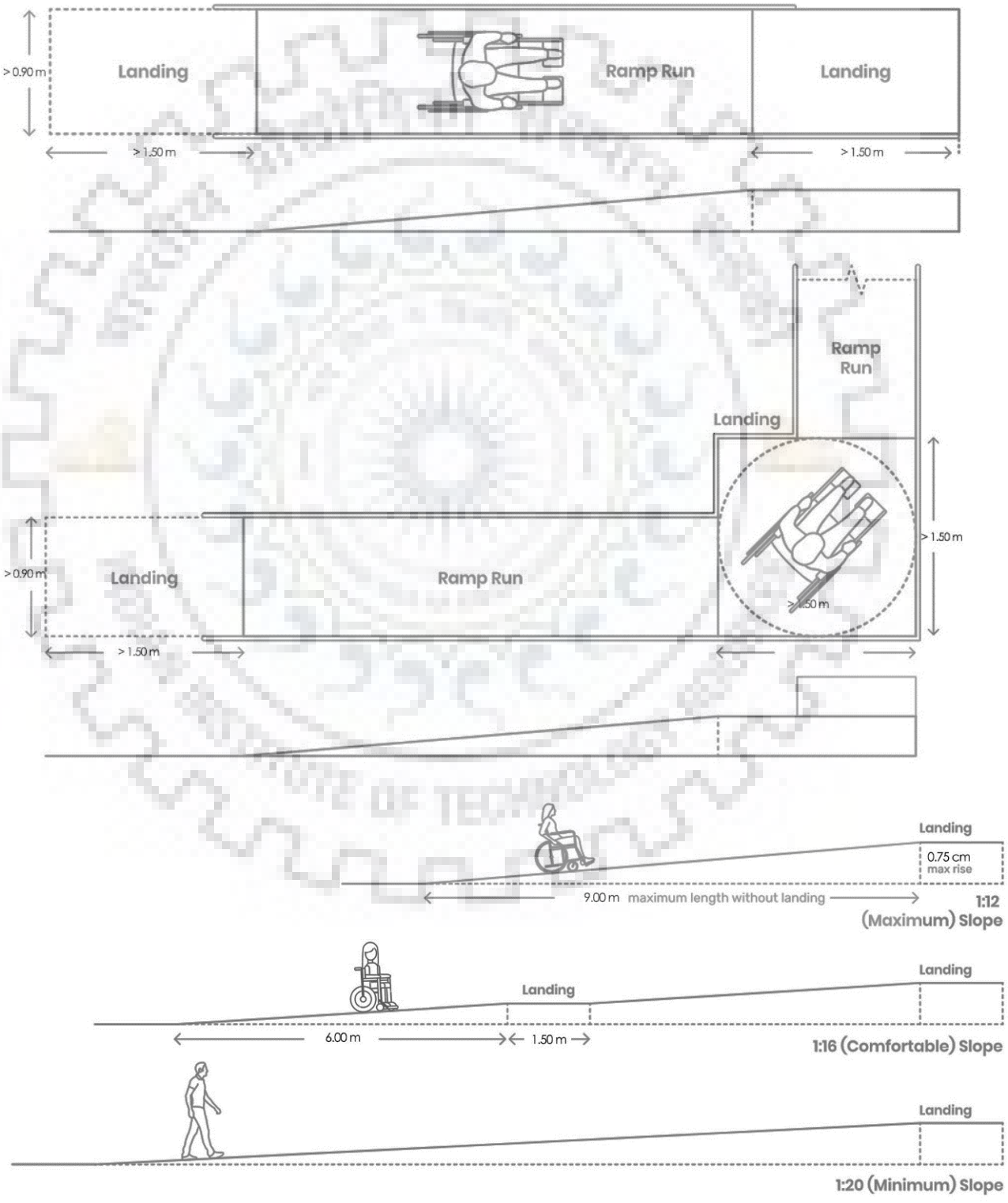


Figure 33 Ramp details

Table 3 Key dimensions for steps and stairs

Rise	Thread	Clear width between handrails	Handrails	Landings
150mm–170mm (150mm preferred for schools)	250mm minimum (280mm preferred for schools)	1200mm minimum (1600mm preferred)	To both sides, extending 300mm past the top and bottom of each flight. (For children under use, 40mm–45mm diameter, at a height of 600mm from the pitch line of the stair or ground level.)	1200mm width min.

Source: un.org,2004 (www.un.org/esa/socdev/enable/designm/AD2-01.htm*) and Standard Specifications, Layouts and Dimensions (SSLD)*

Key standards for lifts:

In general lifts are not encouraged in schools, in case of space constrain or no other option lifts may be installed for circulation.

Minimum lift size to all storeys gives access for a wheelchair user and a support worker (evacuation standard): 1100 x 1400mm with 900mm wide door. This may be suitable for a primary school.

- 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 – positioned to help children who cannot turn their wheelchairs around – to 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 installed.

7.4 APPENDIX B (Refer Table 29)

The 13 dimensions measured were taken from Damon et al. (1971), modifying and adding with Indian children anthropometry data. The subject posture and the definitions of each anthropometric parameter were based on standard procedures as stated by Hertzberg (1968). See Fig. 167, Fig. 2, Fig. 168 for the anthropometric parameters taken in this study, which correspond to the one appearing on following Table .

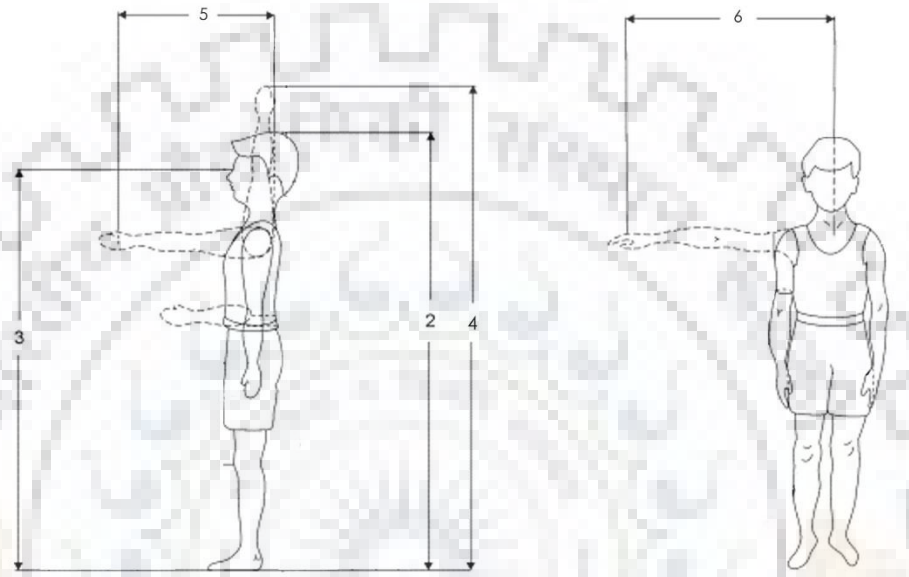


Figure 34 Anthropometric measurements of standing posture

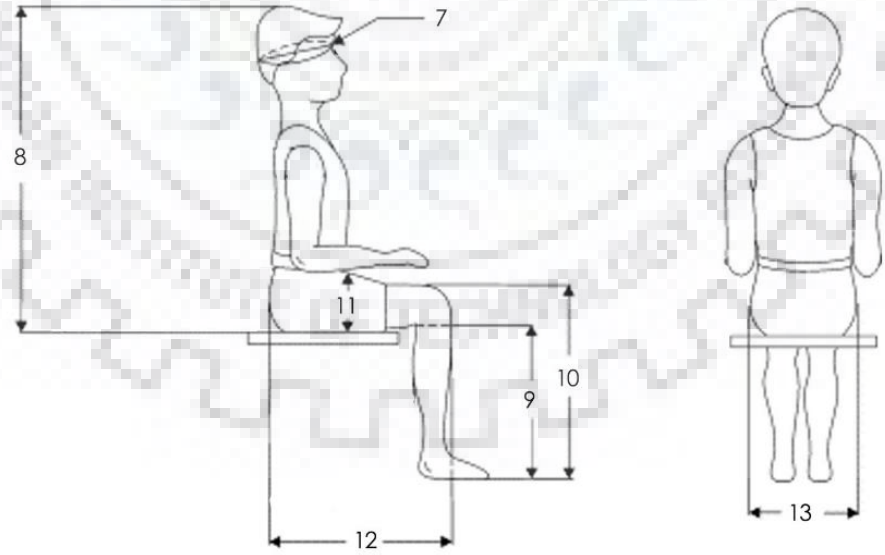


Figure 35 Anthropometric measurements of sitting posture.

Image source: Hertzberg (1968)

Table 4 Anthropometric data of children from age 5- 17

Table 29 Anthropometric data of children from age 5- 17

Anthropometric measurements of **Female** children (Weight, stature, Standing and Sitting Measurements in mm) mean and SD(Standard Deviation)

		Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
	Dimensions	**5**		**6**		**7**		**8**		**9**		**10**		**11**		**12**		**13**		**14**		**15**		**16**		**17**	
1	Weight (kg)	18.5	3	22.4	4	25.1	5	28.4	6	32.3	8	36.3	8	42.3	10	45.3	8	46.1	8	49.5	8	53.5	8	55	8	56	8
2	Stature (Height)	1087	47	1167	54	1218	54	1269	62	1318	75	1399	67	1457	71	1484	78	1541	84	1584	70	1620	64	1621	61	1625	59
3	Eye Height	1035	45	1064	53	1114	52	1166	59	1226	62	1294	66	1353	67	1370	66	1430	69	1473	70	1510	65	1511	63	1516	58
4	Vertical Grip reach	1261	70	1384	77	1456	82	1539	91	1623	90	1707	98	1781	98	1815	96	1906	102	1919	116	1973	89	1973	95	1981	73
5	Frontal Grip Reach	424	34	442	37	468	40	493	38	518	41	544	43	570	42	618	37	645	42	651	37	667	37	668	43	676	38
6	Lateral Grip Reach	497	30	508	32	530	33	558	34	583	36	617	36	646	39	821	45	863	51	877	45	903	40	903	40	911	39
7	Eye Height (Sitting)	488	25	500	26	544	29	573	31	598	30	607	30	638	38	654	35	692	32	711	38	740	37	739	30	743	32
8	Upper body height	576	25	626	28	649	29	671	32	695	34	702	28	728	39	755	38	806	41	825	38	848	36	854	32	859	33
9	Seating Height	280	22	295	18	330	22	355	22	367	25	371	32	380	30	400	32	412	30	420	27	433	22	440	18	440	10
10	Knee Height (Seating)	320	20	336	18	369	22	388	22	415	24	433	24	457	30	472	26	485	25	490	27	495	27	498	26	496	26
11	Thigh Clearance	81	2	90	5	100	11	109	14	116	12	118	15	123	16	127	14	132	16	138	12	140	16	142	12	146	16
12	Butt to Knee Width (Seating)	329	19	350	22	392	26	413	24	440	26	461	29	488	35	508	33	529	30	541	30	548	28	552	27	555	26
13	Hip Width	197	9	200	16	229	21	243	22	253	23	264	25	278	32	292	31	310	31	324	26	336	23	341	23	347	27

Anthropometric measurements of **Male** children (Weight, stature, Standing and Sitting Measurements in mm) mean and SD(Standard Deviation)

		Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
	Dimensions	**5**		**6**		**7**		**8**		**9**		**10**		**11**		**12**		**13**		**14**		**15**		**16**		**17**	
1	Weight (kg)	18.5	3	22.8	4	25.8	5	29.3	6	32.8	7	36.3	9	40.6	9	42	8	45	9	51	9	57	10	66	10	69	10
2	Stature (Height)	1087	47	1175	54	1228	57	1279	46	1334	61	1381	67	1437	68	1493	70	1551	70	1613	87	1664	87	1745	78	1759	60
3	Eye Height	1035	45	1067	54	1120	55	1171	57	1226	59	1272	64	1327	66	1350	65	1440	68	1500	70	1570	72	1640	68	1645	62
4	Vertical Grip reach	1261	70	1398	74	1471	102	1558	94	1634	89	1690	97	1764	98	1817	112	1904	111	1973	101	2029	94	2129	99	2131	89
5	Frontal Grip Reach	424	34	443	34	471	36	500	40	519	36	540	42	563	41	623	37	652	47	680	43	689	37	726	42	734	43
6	Lateral Grip Reach	497	30	513	30	537	32	564	33	588	33	612	35	640	35	715	50	868	58	903	55	929	49	978	57	994	54

7	Eye Height (Sitting)	488	25	520	29	543	27	570	27	589	34	603	30	612	16	647	30	672	45	711	43	738	49	785	45	804	25
8	Upper body height	600	25	633	30	654	29	676	31	698	31	714	37	726	34	763	35	823	48	855	53	901	48	915	31	919	36
9	Seating Height	280	22	310	20	350	22	365	18	377	25	381	32	390	30	410	32	422	30	430	27	443	22	450	18	450	10
10	Knee Height (Seating)	320	20	340	20	377	22	399	24	420	25	438	28	454	22	478	28	497	33	518	33	531	31	552	30	552	29
11	Thigh Clearance	81	2	96	10	102	13	107	13	113	15	118	15	121	10	128	12	129	14	140	15	139	16	146	14	154	16
12	Butt to Knee Width (Seating)	329	19	360	22	390	22	412	25	436	24	457	27	476	25	498	31	519	33	545	33	561	32	585	31	588	28
13	Hip Width (Sitting)	197	9	214	16	224	21	235	19	248	27	260	33	266	27	274	26	287	22	301	26	317	28	332	24	336	23

7.5 APPENDIX B

- **Support spaces:**

A typical range of support spaces are needed for an inclusive school if the population of students with disabilities is significant. Requirements of these spaces vary according to the school and its children needs.

Table 5 Support resource rooms Area Dimensions

Space	Area m2
Medical room	15–25
Speech and language therapy	12–15
Sensory room	12–24
Hydrotherapy	85
Mobility training room	20–50

7.6 APPENDIX C

Questionnaire Development: (Regional Language)

PART 1- BASIC INFORMATION OF CHILDREN WITH DISABILITIES

a. Name :

b. Gender :

c. Age :

d: class:

PART 2 – LOCATION

a.Distance to schools: < 1 km 1 – 5 km > 5 km

b. Mobility option: How do you get to school?

Public transport

Specific-designed personal transportation mode (e.g. modified motorbike)

Drop by Other: : _____

please specify: _____

PART 3 - DISABILITY PROFILE

a. Type of Disability :

Physically disabilities Visual disabilities Hearing/speeech disabilities Multiple disabilities

b. Do you require any assistive device? If yes, specify : _____

If yes, have you had it: _____

c. In your school or place of work, is there any facility that accommodates your needs as a person with disabilities?
Yes No

PART 5 - ACCESS TO HEALTH SERVICE

Where do you usually get medical treatment?

No treatment

Hospital

Community health center

Polyclinic Physician

Does your school provide medical treatment to accommodate your disabilities?

Yes No

PART 6 - ACCESS TO COMMON FACILITIES IN THE SCHOOL

a. Do you ever use the school lab facilities?

b. Do you ever use the school toilets?

PART 7 - EXPERIENCE OF BEING DISCRIMINATED

Have you ever got experienced discrimination?

Yes No

If yes, please explain: _____

Implementing the survey

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