Human centered Accessibility and Ergonomic Design Strategies in Indian Institutional Architecture: A Study of Orphanage–Old Age Homes

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Abstract- ***This study provides human-centered accessibility and ergonomic design in Indian institutional architecture, focusing on integrated and convenient orphanage–old age home centers. This study is done by comparing Indian standards (CPWD, NBC) with international standers (ADA, ISO) along with architecture standers Neufert Data-Edition (by-Ernst Neufert). This research compares and identifies the gaps, additional data and propose the ergonomic guidelines for Indian building designs along with convenient accessibility for all age groups. Providing detailed architecture solution on accessible toilet and bathroom blocks, functional room layouts, ergonomics fixtures are implemented to support users with physical and cognitive needs. Barrier free circulation, adaptable furniture, required fixtures along with planned openings and Corridor. This study emphasizes connectivity and adaptive design strategies***

Indexed Terms- ***Accessibility, ergonomic design, Universal design standards, Indian design standards, architecture standards, old age, Orphanage, Circulation Challenges and barrier free designs solutions, age-based furniture, User behavior, Architecture, Community-Impact, Awareness***

I. INTRODUCTION

Architecture is more than just designing the building. It includes strategic planning, interactive spaces and room functionality as per the age group. Standard architecture solutions mirrored study of human behavior, circulation, design barrier and different age-based planning.

Ergonomics design focus on easy functionality, ensure user comfort and minimize physical strain for all age groups, it works on room functionality, regular user requirement and management of design. While accessibility designs work on easy navigation and circulation of all user groups also helps to utilize spaces and blend Idea of easy navigation in designs.

Ergonomics and accessibility are not only limited to furniture placements or ramps and handrail It also works on ability to participate for all age group and for all user groups independently in day-to-day life

NEED OF HUMAN CENTERED ACCESSIBILTY AND ERGONOMICS DEISGN STARTERGIES IN INDIAN ARCHITITCTURE

SIGNIFICAN OF HUMAN CENTERED ARCHITECTURE DEISGN

Human-centered architecture designs need understanding, wellbeing, experience and studied user needs at the core of design process

A. Functionality and Comfort

Human-centered designs are designed as per the human needs and comfort. This research considers ergonomics, minimize physical discomfort, ensure accessibility as per the usage of these age group

B. Impact on Quality of Life

These designs reduce barrier in daily activity (e.g. accessible toilets, door handles etc.) enhancing the self -sufficiency for children, old age and disable people. These designs reduce physical discomfort through planning, ergonomic features and good accessibility features

II. USER NEED AND DIVERSITY

A. Inclusive design for all user group

Indian guidelines emphasize the need of environment that is friendly for people with disabilities, elderly, children and other vulnerable groups including those with illness or disorder to make sure their safety and comfort

B. Focusing on user need along with comfort

This factor goes beyond technical standards by understanding user daily experience, physical ability and dependency and emotional well-being It emphasizes: ergonomics and safety, psychological dependency, accessibility and user engagement. The moto is to improve the dependency rate provide dignity and high-quality life to all occupants

III. NEED OF INCLUSIVE DEISGN IN INDIAN

A. Cost effective and Future proofing

Designing investment from the outset is more cost effective than redesigning and retrofitting later. It increases the potential usability, circulation and value of the building. Making them adaptable for all the property users

B. Social and legal responsibility

India's population is highly diverse, including children, elderly, and persons with disabilities. Traditional designs often overlook the required needs of these groups, leading to dependency and discomfort. Inclusive design ensures that public spaces, institutions, and homes are favorable to all age group and all user group.

C. Cultural value of India

Indian culture and its roots values respect for elders, community, and diversity. Inclusive design in architecture upholds these values by creating spaces that are welcoming and usable for all generations and abilities. Where every user group is welcomed and valued in the environment

IV. UNDERSTANADING THE DEISGN ACCESSIBILTY

Designing accessibility for old age and children comes with the understanding various factors that contribute in comfort, usage and circulation of the user group. These age groups come with physical restriction and limitation Both mentally-physically, age and emotions

Fixings	*Details*
Door	accessible for wheelchair and walker
Window	Different height as per ergonomics
Ramp	Ramp ratio 1:12 with side railings
Lift	accessible for wheelchair and walker
Toilets	Non-slippery floor, handrails, and accessible-separate dry area
Bathroom	Non-slippery floor, handrails, and accessible-separate wet area
Switch	Bed side switch for emergencies
Handrail	Not standardized, different heights and diameters
Corridors	Accessible for walker, wheelchair,
Level surface	Even floor level to avoid accident
Clear signs	navigate spaces independently
Material	Non slippery surfaces and smooth walls

V. UNDERSTANADING THE DEISGN ERGONOMIC

Designing ergonomic for old age and children focus on creating space and factors that line up with human body dimensions and their abilities. It enhances comfort, usability, functionality and safety in there day to day life. It provides low physical activity, easy moment and reduce body stretch and problems. It works on factors like body comfort, moment, usability, movement and need for daily exercises

Requirements	Details
Non-slip Flooring	Prevent accident and slipping off
Furniture Height	Age-appropriate designs
Round edges	Reduce injury risk
Reach range	Accessible height storage
Low Beds	Easy daily usage
Light Placements	Avoid glare and shadow

	for clear vision
Sink and counter height	Designed as to reduce body strain
Toilet	Avoid excessive squatting
Bathroom	Required support
Toilet Grab Bars	Ergonomically placed for safe support
Study table	Designed as per the age group
Chair	Designed as per the age group
Armrests	For elderly need
Tactile Surfaces	Guide through touch if needed

VI. CASE STUDY AND ANALYSIS

A1. Old age home case studies

A1] Indian old age home: Park side Retirement home -Year 2018

A2] International old age home: Elderly Residential Home-Year 2017

Name	Site area	Architect
Park side Retirement home Bangalore /India	278709m^2	Vinay.K Chadha & Pravesh Ghai
Elderly Residential Home-France/Paris	29000m^2	Atelier Zündel Cristea

B. Orphanage case studies

B1] Indian Orphanage: Maher Ashram- Orphan School Design-2018-19

B2] International Orphanage: Econef Children's Center-2018

Name	Site area	Architect
Maher Ashram-Orphanage-Pune /India	1121.00 SQ.M	PBA Studio
Econef Children's Center-Tanzania/Africa	650m^2	Asante Architecture& Design

VII. OBSERVATION AND COMPARATIVE ANALYSIS

Examining case studies gives information of the required data obtained from comparative analysis between Indian and international design standards. Where Neufert is used to obtained required standard for designs. Here we studied two architecture projects one from Indian and other is international project that justify the need of additional design standards for these specific age group

VIII. OBSERVATION AND COMPARATIVE ANALYSIS – ACCESSIBILTY DESIGN

Description	Old age home		Orphanage		Neufert standard
	A1	A2	B1	B2	
Door	YES – (≥ 1000mm ≤ 2000mm)	YES – (≥ 1000mm ≤ 2000mm)	YES– (≥ 750mm ≤ 1250mm)	YES – (> 900mm ≤ 2000mm)	Room + Wc door ≥ 900mm ≤ 1150mm (pg-113)
Window	YES – (As per	YES – (≥ 900mm	YES - Sill level	YES - Sill level	Room ≥ 750mm-≤

	the user need)	≤ 1500mm)	900mm / lintel level 2100mm or full height window)	900mm / lintel level 2100mm or more in bedroom)	1000mm-Sill level (pg-96)
Ramp	NA	YES – (Ratio 1:12)	NA	YES – (At random no standard measurement)	1:12 max slop (pg123) 1:16 comfortable slop with mid landing
Lift	YES – (two lift each floor 1000mm X 1000mm)	YES – (four lift each floor)	NA	NA	Lift internal ≥ 16700 x1660mm or more (Pg-128)
Toilets	YES – (internal movement 1250mm X12500mm)	YES – (internal movement 1500mm X15000mm)	NA	YES - (850mm X 1500mm)	Internal movement area ≥ 1500 x 1500mm (Pg-23)
Bathroom	YES – (internal movement 1250mm X12500mm)	YES – (internal movement 1500mm X15000mm)	NA	YES - (1500mm X 1500mm)	Internal movement area ≥ 1500 x 1500mm (Pg-23)
Switch	NA	NA	NA	NA	Should be placed conveniently for emergency usage
Handrail	YES– (As per the user need)	YES – (As per the user need)	NA	NA	≥ 900mm ≤ 1120mm height from floor level (pg-122)
Corridors	YES - (≥2000mm width)	YES – (≥2000mm – ≤ 3000mm width)	YES – (≥1000mm ≤ 2000mm width)	YES – (1000mm to 2000mm width)	Corridors longer than 15m must have width of 1800mm for 2 wheelchairs(pg-22)
Level surface	YES – To create O.A.T and recreational spaces	NA	NA	NA	Avoid multiple level difference to avoid injury and incidents
Clear signs	YES – (Lifts and navigations sign)	YES – (Lifts and navigations sign in corridor)	NA	NA	Helpful for user with lower eye sights

VIII. OBSERVATION AND COMPARITIVE ANALYSIS –ERGONOMICS DESIGN

Description	Old age home		Orphanage		Neufert standard
	A1	A2	B1	B2	
Non-slip Flooring	YES	YES	NA	YES – local stones and local soil flooring along with cement)	To avoid the injury and accidents specially for old age group
Chair Height	YES - not age friendly – regular chair 930mm height/430mm width)	YES - not age friendly – regular chair 930mm height/430mm width)	YES – not age friendly – regular chair 930mm height/430mm width)	YES – (670 mm height / 390mm width)	≥ 335mm (for kids) ≤ 480mm (Pg-28)
Table Height	YES - (≥ 760mm height)	YES - (≥ 760mm height)	YES – (≥ 760mm height)	YES – (480 mm-750mm height)	≥ 335mm (for kids) ≤ 800mm (Pg-174)
Round edges	NA	NA	NA	NA	≥ 20mm- ≤ 50 mm
Maximum reach range	NA	YES – (≤ 2100mm)	YES – (≥ 2000mm to ≤ 2200mm)	YES – (750mm 1200mm)	≤1220mm (for Wheelchair person) ≥ 1450mm - ≤1850mm (age 1-19) ≤ 2200 mm (age 60+)
Beds	YES – (1900mm X1350mm)	YES - (1900mm - 900 mm-single bed)	YES – (1900mm -900 mm-single bed)	YES – (Bunk bed -1778 mm height)	≥ 200mm- ≤440 mm (comfortable for old people) height
Light Placements	YES – (Use of both natural and artificial light)	YES - (Use of both natural and artificial light)	YES – (Based on natural light while artificial light is used for night time)	YES – Based on natural light while artificial light is used limitedly during night time)	Avoid darkness and shadow - also avoid excessive light to avoid eye irritation
Light Placements	YES – (Use of both natural and artificial light)	YES - (Use of both natural and artificial light)	YES – (Based on natural light while artificial light is used for night time)	YES – Based on natural light while artificial light is used limitedly during night time)	Avoid darkness and shadow - also avoid excessive light to avoid eye irritation
Sink and	NA	NA	YES – (≥ 850mm	YES – (≥	750mm-900mm (for

counter height			/900mm)	750mm)	Wheelchair person)
Bathroom	NA	NA	NA	NA	Handrails ≥ 900mm (as per the requirement and comfort)
Toilet Grab Bars	YES – (≥ 790mm)	YES – (As per the user requirement)	NA	NA	Handrails > 900mm (as per the requirement and comfort)
Study table	YES - (≥ 850mm /900mm)	YES - (≥ 850mm /900mm)	YES – (≥ 850mm /900mm)	NA	≥ 660mm ≤ 750mm for wheelchaired people), ≥ 355mm ≤ 800mm
Armrests	NA	NA	NA	NA	445mm wide (for old age people)
Tactile Surfaces	NA	NA	NA	NA	For user with low contact sense

CONCLUSION

The analysis reveals major design flaws in Indian orphanages and old age homes, particularly in accessibility and ergonomics. Key features like ramps, lifts, grab bars, and accessible toilets are often absent or inconsistently applied. Furniture and fixtures rarely meet age-specific ergonomic needs, leading to discomfort and safety risks. Vital safety elements—non-slip flooring, rounded edges, tactile surfaces, and emergency switches—are underused, limiting independence. Standardized circulation dimensions, age-appropriate furniture, and sensory-friendly aids like good lighting and clear signage are essential. These steps can create more inclusive, barrier-free spaces that support overall well-being.

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