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Analysis of universal design parameters in existing residential buildings by retrofitting, & providing guidelines through case study, Pune.

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Abstract

Universal design aims to create spaces that are accessible and can be used by everyone, regardless of age, ability, or circumstance. Implementing universal design parameters in existing residential buildings is crucial for ensuring that these spaces are accessible and can be used by everyone. This is particularly important given the aging population and the increasing prevalence of disabilities. New construction of residential buildings has incorporated universal design principles, however, there is a lack of research on how to retrofit existing residential buildings to make them more accessible and usable. There is a significant knowledge gap in the field of universal design, particularly with regards to retrofitting in existing residential buildings. This gap highlights the need for further research in this area. This research describes parameters to implement universal design in existing residential buildings. This research aims to provide practical solutions for making these spaces more accessible and usable Some comprehensive guidelines will help builders, developers to implement universal design parameters in existing residential buildings, so that these spaces can be made more accessible and usable for everyone.

Keywords- Universal design, retrofitting existing residential buildings, accessibility, design for all, universal design guidelines

Introduction

The design for all has to be applied everywhere. They are to address the needs of people. However, retrofitting in existing residential buildings need to be implemented with universal design parameters. Unlike new buildings where universal design can be integrated during the design phase, existing structures may have limitations due to their original layout or structural constraints.

The paper focus on how existing residential buildings can be made more accessible to all. Retrofitting projects may use universal design concepts to improve the accessibility, for all. The guidelines will ensure that the retrofitting will be helpful to all users. This study reviews existing residential buildings and propose methodologies for modifying typical residential structures to accommodate universal design features. It also examines case studies where universal design has been successfully implemented in older homes.

highlighting both the benefits and potential obstacles faced during these projects. Ultimately, this research aims to provide practical solutions for architects, planners, and homeowners, supporting the vision of creating inclusive environments in existing residential contexts.

AIM

To analyze & provide guidelines for existing residential structures by retrofitting techniques, to improve accessibility.

OBJECTIVE

To analyze and formulate guidelines that will enhance the accessibility and inclusivity through barrier free planning ensuring usability for all in current residential structures.

Objectives of the research paper are-

1. To analyze the current design of existing residential buildings through case studies.
2. To identify the accessibility barriers that hinder usability for individuals with disabilities.
3. To provide design guidelines in existing residential buildings in Pune for all residents, regardless of age or ability.

SCOPE

1. The focus is on existing residential buildings in Pune.
2. The paper analyses if the principle of universal design are applied in existing residential buildings.
3. Comparison and analysis as per various parameters are provided to the existing residential structures.

LIMITATION

1. This paper is limited to existing residential projects within Pune, India.
2. It is limited only to universal design principles for existing residential buildings.
3. Existing residential buildings up to 15 years are considered.

METHODOLOGY

The methodology includes a mixed methods approach to develop solutions. this study will analyze a selection of existing residential buildings in Pune, where Universal Design can be implemented into existing residential buildings and thus the existing residential building can be made more accessible. The research is completely based on the observations done during the case studies as to where retrofitting can be done. Guidelines are formulated after analyzing the observations.

Data Collection Methods

1. Literature Review various parameters are identified through theories and guidelines of Universal Design principles.
2. Various city planning guidelines on universal design and government publications are reviewed.

Few live case studies are discussed

Case study 1 - Nisarg Residency, Ravet, Pune. Nisarg Residency is a residential building that has been in existence for 14 years. Nisarg Residency in Ravet, the structure does not adequately fulfil the accessibility needs of all users with disabilities, particularly in relation to the principles of Universal Design (UD).

The following is a comprehensive analysis of how Nisarg Residency fails to meet the accessibility standards required for individuals with disabilities:

1) Step free Entrance:The primary entrance to the building apartment are not fully accessible for individuals with mobility challenges. As per Universal Design standards, entrances should be provided with ramps for people using wheelchairs or walkers. obstacles are created for elderly or disabled residents, if these features are not provided.

2) Tactile flooring-There is no tactile flooring provided anywhere inside the premises.

3) Insufficient Elevator Design:Although the building includes elevators, their design may not effectively support wheelchair users. For instance, the interiors of elevators should be spacious enough to allow a wheelchair to turn around, and control panels should be positioned at a height accessible to all users, including those who are seated. Additionally, the absence of voice-guided controls or braille for visually impaired individuals are absent.

Fig 1 - Lift car which is insufficient for wheelchair accessibility(0.9x0.9m)

There is a 56mm level difference between the flooring and the lift causing difficulty for the people with disabilities.

4) Constricted Hallways and Doorways: The hallways and doorways within the building are not constructed to facilitate smooth movement for individuals utilizing wheelchairs, walkers, or other mobility aids.

Ideally, corridors should measure at least 48 inches in width, and doorways should be a minimum of 36 inches wide; however, the design of Nisarg Residency does not adhere to these recommended specifications. This results in challenges for individuals with mobility impairments when navigating both private and communal areas. There are obstructions observed in the movement of wheelchair.

Fig 2 - 1.2m wide passage

5) Lack of Universal Bathroom Features:The bathrooms in Nisarg Residency do not incorporate essential Universal Design elements such as grab bars, roll-in showers, and adjustable sinks. These features are crucial for individuals with disabilities to ensure safe and independent use of bathroom facilities.

6) Inadequate Illumination in Shared Areas:The illumination in corridors, staircases, and other communal spaces is insufficient for residents with visual impairments. To eliminate accidents, it is important to have well-lit environment, so adequate lighting is essential for visibility and safety. Furthermore, the absence of clear and easily readable signage, featuring larger fonts and high contrast, complicates navigation for individuals with limited vision.

7) Insufficient Accessible Parking:While parking facilities are available, there are no designated accessible parking spots situated near the entrance. These spaces should be wider than standard parking spots and positioned close to the building's entry points to accommodate accessible vehicles and facilitate easy access for individuals utilizing wheelchairs.

8) Irregular Pathways:The pathways leading to the building are uneven and lack appropriate handrails or smooth surfaces, posing tripping hazards and hindering safe movement for residents using wheelchairs or walkers. The staircase does not have any grooves or textures at the edge of every step for better accessibility of people with visual disability. The staircase doesn't have any continuous handrail which causes inconvenience.

9) Absence of signage's-There are no signage's inside the premises to guide the users Summary -

Although Nisarg Residency is modern and w ell-situated, it does not adequately cater to the accessibility needs of residents with disabilities. Essential features such as step-free access, spacious hallways, accessible restrooms, and adequate lighting are not fully integrated. Thus the building is difficult to navigate for individuals with mobility, visual, or cognitive impairments. To align with Universal Design principles, substantial modifications would be required to ensure that all users, regardless of their abilities, can access the facility comfortably.

Discussion and surveys with the residents of Nisarg residency, led to the conclusion that there is a need for retrofitting of the structure. Hence few guidelines can help all the users of the structure for better accessibility.

Case study 2 - Apartment Galaxy, Ravet, Pune

Galaxy Apartment in Ravet, Pune offers modern amenities and smart home features, but when assessed from a Universal Design (UD) perspective, it shows areas where accessibility and inclusivity could be enhanced. Absence of tactile flooring was observed all around the premises

The following is a comprehensive analysis of how Galaxy Apartment, meets the accessibility standards required for individuals with disabilities:

1) Step-Free Entrances and Pathways:The entrance door of every flat was at a height of 46mm hence there was a difficulty observed for accessibility. Passages were wide enough for the movement of two wheelchairs at the same time. There were no handrails provided in the passage area which can be done for better usability.

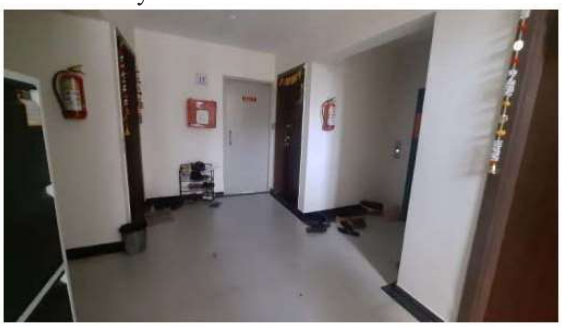

Fig 4 -Wider Passages with signage's everywhere

Fig 5. Lift with no level difference

2) Wide Corridors and Doorways:
The building's corridors and doorways are wide enough(1.2m) to comfortably accommodate individuals using wheelchairs, walkers, or other mobility aids. This design ensures smooth movement through both common areas, a key aspect of Universal Design. More Positive observations –

a) Accessible Elevators: The presence of spacious elevators with low-mounted controls ensures that residents of all abilities can easily access different floors of the building. The elevators are designed to accommodate wheelchair users and provide ample room for movement. There was no level difference between the passage and the lift opening hence the wheelchair could easily use the lift.

b) Bathroom Accessibility: Bathrooms in Galaxy Apartment are designed with accessibility in mind. The spacious layout allows for easy navigation, reducing the risk of accidents or falls.

c) Lighting and Visual Accessibility: Adequate lighting in common areas, along with clear signage, helps individuals with visual impairments navigate the building safely. The use of high-contrast colors and large fonts makes it easier for everyone, to find their way around, particularly those with low vision.

d) Smart Home Integration: The intelligent home features provided in Galaxy Apartments, such as smart lighting and automated systems, enhance the accessibility and convenience for residents with disabilities or mobility impairments. Voice-activated controls and automated door systems can be for the future use.

e) Staircase- The steps had grooves at the edge of every step to guide the users with visual disabilities. The railing design was better for usability of the elderly people as it was continuous without any break Tactile flooring could be added in future as there was no tactile flooring provided anywhere inside the premises.

Fig 6 - Staircase with continuous railing

Case study 3 - Legacy Fortune Exotica, Mukai Chowk, Ravet, Pune

Legacy Fortune Exotica in Ravet, near Mukai Chowk, is a modern residential project designed with luxury and convenience. Spanning across 2 acres, this development offers 2 BHK and 3 BHK apartments, ranging from 635 to 1051 square feet. The structure is recently constructed (completed in 2023).
The following is a comprehensive analysis of how Legacy Fortune Exotica fails to meet the accessibility standards required for individuals with disabilities:

1) Step-Free Entrances and Accessibility:Entry to the individual units have a level difference of 44 mm which is inconvenient for wheelchair users.

2) Wide Corridors and Doorways:The strategically constructed layout suggests attention to creating accessible living spaces, with wider hallways (2M wide).

Fig 7 -Entrance to individual units

Fig 8. Lift entry with minimum level difference

3) Elevators and Mobility Assistance:The elevators follow standard design features to ensure ease of use by elderly residents and individuals with disabilities and are spacious enough to accommodate wheelchair along with 2 users at a time.

4) Outdoor Pathways and Parking:Parking and common areas are designed to facilitate movement and interaction, but specific provisions for accessible parking spaces close to entrances are not provided.

5) Common Amenities:Amenities like the swimming pool, children's play area, gymnasium, and jogging tracks are present. To align with Universal Design, these facilities could be improved by ensuring that pathways leading to them are step-free and easily accessible for people with disabilities. There is no lift or ramp provided to enter the recreational area which is a major drawback found in the design.

6) Signage's-There are no signage's provided anywhere in the premises.

7) Tactile flooring-There is no tactile flooring provided anywhere inside the premises.

8) Staircase-The fire staircase, steps have grooves at the edge of every step to guide the users with visual disabilities.

Summary -

While Legacy Fortune Exotica incorporates several modern design features, considering Universal Design principles, additional provisions such as ramps, accessible parking spots, and assistive technologies (like automated systems for lighting or doors) could be enhanced to ensure inclusivity for all residents, especially the elderly and people with disabilities.

3) Elevators and Mobility Assistance:The elevators follow standard design features to ensure ease of use by elderly residents and individuals with disabilities and are spacious enough to accommodate wheelchair along with 2 users at a time.

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Comparative Analysis for the 3 case studies

Table -1 Comparison of 3 case studies

Criteria	Nisarg Residency	Galaxy Apartments	Legacy Fortune exotica
Age of the structure	14 years	2 years	1 year
Location	Ravet, Pune	Ravet, Pune	Ravet, Pune, near Mukai Chowk.
Step-Free Entrances	Lacks step-free entrances and ramps. Poor accessibility.	Step-free entrances available but could be improved further.	Better in terms of accessibility. Ramps are provided but needs retrofitting to make it accessible to all.
Elevator Accessibility	Basic elevator, lacks advanced accessibility features. Wheelchair user cannot use the lift.	Elevators are spacious enough for wheelchair users.	Elevators present, possibly needs retrofitting for better accessibility.
Doorway and Corridor Width	Narrow doorways and corridors, challenging for mobility aids	Spacious corridors and wide doorways support wheelchair access	Spacious corridor and wide doorways.
Bathroom Accessibility.	Lacks grab bars, roll-in showers, and accessible features.	Bathrooms can be retrofitted with grab bars, roll-in showers.	No specific mention of accessible bathrooms.
Lighting and Visual Aids	Inadequate lighting in common areas. No tactile flooring provided.	Well-lit with large windows. No tactile flooring provided.	Well-lit with large windows. No tactile flooring provided anywhere.
Parking and Pathways	No designated accessible parking, uneven pathways.	No designated accessible parking	No designated accessible parking
Common Areas	Standard amenities, no mention of inclusive features.	Ramps are provided at necessary areas. Better accessibility.	Ramps are provided but not the whole premises is accessible for wheelchair users.
Smart Home Technologies	No smart home features.	Smart home integration present (lighting, security systems).	Smart home integration is present but can be better in terms of security of the users.
Universal Design Challenges	Major retrofitting needed for accessibility.	Relatively aligned with UD principles, though further improvements possible.	Relatively aligned with UD principles, though further improvements possible.
Overall Suitability for UD	Requires significant retrofitting for Universal Design compliance.	Fairly aligned with Universal Design, though some areas need improvement.	Basic compliance with potential for retrofitting.

Inference

This study on incorporating Universal Design (UD) principles in existing residential buildings has uncovered significant results concerning the constraints and enhancements needed to improve access and inclusiveness in these environments. The success in applying UD principles varies among the Nisarg Residency, Galaxy Apartment, and Legacy Fortune Exotica case studies, demonstrating the challenges presented by existing structures. One key finding from the study is the uneven implementation of Universal Design in existing residential structures. Older buildings such as Nisarg Residency need extensive retrofitting to comply with fundamental UD standards. However, Galaxy Apartment and Legacy Fortune Exotica, despite being newer constructions, encounter difficulties in meeting all Universal Design standards, especially in bathrooms, common areas, and parking.

Guidelines

Certain guidelines are provided for Retrofitting Universal Design in Existing Residential Buildings based on the analysis and findings are proposed.

1. Step free entrances and ramps:Ensure all building entrances are step-free or equipped with ramps. Ramps should have a gentle slope (1:12 gradient) and be wide enough for wheelchair users. Portable or modular ramps can be retrofitted in areas with small elevation differences.

2. Wider Doorways and Corridors:Doorways should be at least 900mm wide, and corridors should be at least 1200m wide to accommodate mobility aids such as wheelchairs and walkers. Expanding door frames and clearing corridor obstructions can improve accessibility. Providing grab bars in the corridors can be beneficial for elderly people.

3. Accessible Bathrooms: Retrofit bathrooms with grab bars, roll-in showers, and adjustable sinks. Adequate turning space should be provided, and bathroom layouts should allow for independent use by individuals with disabilities.

4. Smart Home Integration: Install smart home technologies such as voice - activated lighting, security systems, and automated door systems to enhance accessibility for individuals with cognitive or mobility impairments. These features can be retrofitted in newer and older buildings alike.

5. Lighting and Visual Aids:Improve lighting in common areas, stairwells, and corridors. Install tactile flooring and high-contrast signage to assist individuals with visual impairments. These features should be retrofitted in both public and private spaces within the building.

6. Elevator Accessibility:Retrofit elevators to be spacious enough for wheelchairs and ensure control panels are accessible for seated users. Voice-guided systems and braille controls should be added to make elevators usable for individuals with visual impairments.

7. Accessible Parking:Create designated accessible parking spots close to building entrances. These spots should be wider than standard parking spaces and clearly marked with accessible signage.

8. Inclusive Common Areas:Ensure that amenities such as gyms, swimming pools, and playgrounds are accessible for individuals with disabilities. Retrofitting common areas with ramps, wider paths, and tactile guides can significantly enhance inclusivity.

9. Continuous Handrails and Staircase Modifications: Install continuous handrails along staircases and add grooves or tactile markers at the edge of each step to assist individuals with visual impairments. This will improve safety and navigation throughout the building.

Careful consideration of these suggestions will be helpful for developers, builders and residential owners, and societies, planners who can incorporate them in the existing buildings as per their requirement and apply these Universal Design principles.

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