In India, increasing urbanization has aggravated the complex problems of escalating property prices and increasing housing shortage. To solve this housing crisis, the government housing authorities are engaged in providing mass housing solutions, which often fail to fulfill the expectations of the millions of people living in these housing colonies. As a result, homeowners often choose to update their dwelling units, whether legally or illegally, to suit their changing needs. It is thus critical to understand this process of transformation and more importantly, to assist people in providing better housing solutions within the context of their reality.

This thesis examines the development of housing transformations among the growing middle-class in New Delhi and offers guidance to the people who are willing to improve their lives by modifying their homes. Study and analysis of three Middle Income Group (MIG) housing projects, Dilshad Garden, Janakpuri and Munirka in New Delhi, helped to identify the diverse aspects of this process. This study underlines some inherent factors and problems that govern residential modifications at all levels and aims to help homeowners gain maximum returns from their investment. It provides professional support to people enabling them to undertake efficient, safe and organized housing transformations, thereby contributing to the improvement of the standard of housing in New Delhi.
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Chapter 1

Introduction
In many Third World countries, a substantial amount of housing stock is provided in the form of government built housing. Increasing urbanization and unregulated development has resulted in housing shortage in the public and private sectors, steady growth of slums and informal settlements, increasing congestion and overcrowding in small houses and this has exerted severe pressure on civic infrastructure. Due to the increasing housing shortage in these countries, housing professionals including architects, planners and housing officials are engaged in responding to this challenge by setting housing goals in terms of numbers. They are trying to reduce this housing gap by providing faster and cheaper houses in the form of mass housing solutions. For multiple reasons, these repetitive dwelling units often fail to fulfill the expectations of people. For many years and in their own way, inhabitants of such dwelling units have been engaged in transforming their houses to suit their changing needs.

In India, housing transformations have changed general housing development and increased the overall housing stock. Considering the rising cost of land and building materials, and the skyrocketing economic inflation, housing today is beyond the reach of most and is limited to the affluent. Although this process of transformation is evident in almost every part of the country, its importance is yet to be acknowledged. Therefore, this thesis aims at bringing this grave issue to the forefront and focuses on the development of housing transformations of New Delhi's government housing for the growing Middle Income Group (MIG) and the diverse factors associated with this phenomenon. The question underlying this research is:

- How can understanding the existing process of transformation assist in providing better housing solutions?
To understand housing transformations in the context of New Delhi, this thesis is formulated in six chapters:

- Chapter 1 reviews housing transformations taking place all around the world and provides background information of the sociocultural, technical, financial, political and bureaucratic aspects of housing which are governing this phenomenon in the Indian context. It elaborates the current urban housing scenario and transformation in New Delhi and provides an overview of this process of transformation in the larger context.
- Chapter 2 explains the research objectives and methodology adopted for conducting this research.
- Chapter 3 presents case study findings and analyzes a variety of factors as well as individual and collective trends of transformations based on first hand information obtained by visiting the case study sites and interviewing residents.
- Chapter 4 explains the important hidden factors, which govern housing transformations in New Delhi. It covers the diverse issues affecting this process, the role of various players and the reasons of the popularity of housing transformations.
- Chapter 5 demonstrates the need of professional guidance for undertaking additions and alterations in New Delhi's context. It proposes transformation recommendations and guidelines to educate homeowners wishing to modify their houses as well as to guide housing professionals working in this field to carry out organized, efficient and safe transformations.
- Chapter 6 presents the conclusions inferred from the interpretations of the previous chapters.
1.1 Housing Transformations: The Global Scenario

Across the globe, housing transformations have been instrumental in increasing the overall housing stock as well as in changing housing dynamics. This process of transformation has been widely documented by many scholars and housing experts working in housing research and development. The high-density residential architecture in Hong Kong\(^1\) and the worker’s housing at Pessac designed by Le Corbusier,\(^2\) demonstrate this process of transformation undertaken by people over time. A.G. Tipple extensively examines various characteristics, advantages and disadvantages of user-initiated transformation in Dhaka (Bangladesh), Kumasi (Ghana), Cairo (Egypt) and Harare (Zimbabwe), and establishes the fact that this process of transformations does not constitute building slum. In fact, it is significant in determining housing stock in most part of the world. Tipple points out that it is seen in various countries such as Nigeria, South Africa, Zambia, India, Kenya, Ethiopia, Guinea, Venezuela, Bahrain, Malaysia, Indonesia and the Philippines.\(^3\) It involves intervention of different players acting at various levels under diverse circumstances for varied reasons. In the study of housing transformations in Cairo and Alexandria in Egypt, Salama rightly states,

"User transformation of public housing projects should not be considered as a simple space enlargement process, but rather a result of a complex set of inter-related determinants associated with both context and dwelling characteristics."\(^4\)

This phenomenon provides housing to millions of people who do not have sufficient resources to buy a new house and its widespread popularity is evident throughout the developing world. Other countries where housing transformations have been observed and documented include Israel,\(^5\) Zambia\(^6\) and Brazil.\(^7\) This process has changed the entire housing dynamics in many parts of the world and is continuing to do so even today.
1.2 Housing Transformations: The Indian Scenario

Being a Third World country, India faces many problems due to urbanization and unregulated development, including increasing housing shortage, increasing congestion and overcrowding of small houses and skyrocketing property prices making housing unaffordable. In the Indian context, this process of housing transformations is not a recent phenomenon. For many years, people have been engaged in transforming their houses to meet their needs. In his doctoral research project, Dasgupta analyzed the transformation of two refugee housing complexes built in Kalkaji, New Delhi in the 1950's. Both of the two storey blocks showed horizontal as well as vertical extensions rising up to four or five storeys. The new rooms, balconies, balustrades, windows and other building elements were camouflaged with the original building in such a way that it becomes difficult to differentiate the new from the old one.

![Image removed due to no copyright permission](image)

Figure 1.3 Extensions to two storey housing in Kalkaji, New Delhi
In addition, the government housing in Chandigarh, designed by Pierre Jeanneret, Edwin Maxwell Fry and Jane Beverly Drew in the 1950's, has been transformed tremendously due to increasing population density and changing user needs. In his design for a housing sector in Belapur (New Bombay), Correa has successfully incorporated this process by ensuring incremental growth and providing space to the dwellers to extend their dwelling units over time as per their growing needs. Similarly, the site and services approach adopted by Doshi for Aranya housing near Indore, is notable as it allows user-participation in construction of the dwelling units.
1.3 Housing Transformations in New Delhi

According to the doctoral report of Ranjana Mital, New Delhi attracts about 500,000 migrants a year, of which approximately 25% end up as squatters or in slums. From 13.7 million in 2001, Delhi's population is expected to increase to 30 million by 2021. The various reasons for migration are categorised as family ties (50%), employment (38%), education (3%), and other reasons (9%). At present, Delhi has a net housing shortage of about 100,000 dwelling units. By 2021, the housing stock required will be about 2.4 million dwelling units including an estimated backlog of 400,000 dwelling units. Due to excessively high rents and accelerating real estate prices, the economically weaker sectors as well as for the middle-income class face major housing problems.

Since economic liberalization in the early 1990's, the Indian housing industry has been undergoing a rapid change. Though many real estate builders are coming into the housing scene with the sole aim to earn extra profits by stacking houses one above the other, even today the majority of housing in the city is provided by the government body, the Delhi Development Authority (DDA). However, the major concern of the government housing officials is to reduce the housing shortage by providing more repetitive dwelling units. Mass housing is generally considered the only solution in today's circumstances. In his criticism of mass housing, Habraken has correctly pointed to the lack of user participative architecture. He says,

Mass housing in its original conception was never meant to house the entire community. It was merely an emergency measure, which was seized upon when the normal process fell short. But our problem began when this emergency measure....became the norm.
Ideal House x 10,000 ≠ Ideal Community

Charles Correa

To builders, mass housing is easier to build as it involves imitating one built form to build the other. To architects, it means less effort is needed because of repetitive designs. To government officials, one house constructed means one number reduced. However, for an average income person in India buying a house is a dream, an investment of an entire lifetime, socially, culturally and financially. Without considering his/her actual spatial, sociocultural and financial needs, a unit is designed for him as 'best-fit' according to the professionals. There is a great disparity between what the users expect and what the government provides. Under these circumstances, when their needs change, the only two choices left with them are to move to some other place or to alter their dwelling units.

In a country like India, moving is not a very feasible solution. Various factors such as joint families, sense of belonging to a home, overall unaffordability due to increasing property prices and legal hassles in transferring a property make it difficult to move. As buying a new house can be financially difficult, the only choice left with the user is to alter his house as per his requirements, whether legally or illegally. Even transforming houses by adding or altering existing structures is not always an easy option as it involves extra expenditure on an already tight budget. If the homeowner tries to sanction these transformations legally through the authorities concerned, he has to go through series of painstaking measures, which might take years for approval and may include a lot of mental, physical and financial trouble. Without approval, he is under the constant fear of having his construction termed illegal or having it demolished. Considering the fact that illegal additions and alterations increase the market value of the property and are always more economical
than buying some other property, such transformations are very popular. They satisfy current housing needs socially as well as economically. Although transformations mean an extra added expenditure on an already tight budget and coping with unscrupulous housing officials and contractors, people still add or alter their dwelling units, thus demonstrating how necessary and inevitable these transformations actually are. Government housing provided by the DDA will continue to transform and evolve in order to provide more economical and adequate housing solutions within limited available resources.

1.4 The Middle Income Group

This research focuses on the middle class because:

- Currently, it forms 48% of New Delhi’s population and is still growing.
- They have the capital to invest in housing.
- The majority of the housing in the formal sector is being built for this class.

Due to steady economic growth, India’s National Council of Applied Economic Research has defined the Indian middle class as the people with resources to buy their own home and/or a car, to invest in private and higher education for their children and to make their own savings provision for old age.

Sixty years ago at the birth of independent India, the Indian middle-class was less than 10% of the population. Due to the economic reforms started in the early 1990’s, there has been a rapid growth in the middle class population. According to the council, India has a middle class of 300 million-plus, which is still growing. This class earns an annual income between US$1,300- $6,000. Today, it is one of the largest in the world, equal to the population of the United States. Projecting this growth rate into the future, India’s income will double every ten years and almost 50% of India’s population could become middle-class, diminishing poverty to 15% within a generation. According to Hindustan Times
survey, people of New Delhi are classified into six categories from very poor to rich, primarily based on their assets. It states that nearly 6% people in Delhi would be considered as very rich and another 12% as rich. The middle class constitutes 48% of the population. 28% of the people living in Delhi are poor and another 6% very poor. The middle class of New Delhi is divided into upper middle class and lower middle class. The upper middle class constituting 28% of the population live in a Higher Income Group (HIG) or Middle Income Group (MIG) flat and have a scooter or car, a refrigerator, a color TV and at least one telephone. The lower middle class constituting 20% of the population in Delhi live in Lower Income Group (LIG) flats, Janata flats or temporary mix houses. They have at least two among the following assets - scooter, refrigerator, radio, color or black and white TV or telephone. 

Due to the increasing housing shortage, escalating property prices and other multiple reasons, not every MIG person owns a house. Those who own, have mostly added or altered their dwelling units.

1.5 The Demolition Drive

Due to various constraints and lack of effective efforts on the part of government housing corporations, there have been periodic attempts to address this issue of housing transformations. In the wake of the demolition drive in March 2006 by the Municipal Corporation of Delhi (MCD), all the illegal structures were being demolished, including unauthorized construction and extensions to existing buildings. Demolition of these illegal structures had changed the overall cityscape of New Delhi. Strikes and protests by traders and owners of illegal structures against this demolition drive had upset the life of the Delhites. Due to the increasing disorder within the city, the government has slightly relaxed their norms for unauthorized constructions on residential properties. Recently,
the MCD has started a self-assessment scheme in December 2006 to regularize illegal constructions in residential properties. For extra coverage or for building beyond the current construction bylaws, property owners are now required to pay a betterment levy. In accordance to this scheme, the MCD is accepting revised building plans from property owners certified by an authorized architect along with photographs of the property. For structural safety, every applicant seeking approval of additional floor area and/or height is required to submit a certificate issued by an engineer.

This latest measure by the MCD implies that the number of such additions and alterations is going to increase. More people would opt for modifying their dwelling units by paying a nominal fine. New additions and alterations will keep springing from existing houses as well as the upcoming ones.

1.6 Empowering the Architect

Then, what is the moral advantage in not acting, in merely watching passively the slow degeneration of life all around?

Charles Correa

Architects in the Third World face various challenges in providing housing solutions as they have very limited resources. Considering various social, cultural, financial, technological, political and bureaucratic constraints at all levels, most architects choose to ignore these problems. Those who care, are working for providing innovative designs and technology for new housing projects. However, if we concentrate our focus on new upcoming buildings, what will happen to the existing buildings that already provide accommodation to millions of people in India? If we ignore the existing buildings, will the standard of housing improve? Carmon justifies this fact by indicating,
Salvation cannot come from construction of new housing which is almost always very expensive. A possible solution is facilitation of user-controlled process of updating the old housing units occupied by such households.⁴³

Therefore, to improve the standard of housing quality within our limited resources, it is extremely essential to concentrate our focus on updating existing dwelling units to make them functional, safe, livable and hence, sustainable. As Rafik Salama argues, the process of transformation is not a mere space enlargement process.⁴⁴ By extending rooms, adding a balcony or altering other features, homeowners exercise their right to satisfy their needs. It represents an opportunity for homeowners to invest in their houses for an improved lifestyle by transforming and upgrading them within their limited resources. It is an attempt to make life more comfortable. Many scholars who are tracking the development of housing transformations throughout the world agree that governments should change their policies to acknowledge this process. On one hand, people invest in this process for an improved standard of living and on the other hand, there is no professional support provided those who have undertaken transformations or who are willing to do so. In the Indian context, this process is still underestimated by homeowners who transform their dwelling units, by contractors and masons who undertake this construction activity as well as by housing officials who provide housing.

As Wojtowicz suggests, governments should offer free professional support to owners and builders of illegal additions to improve the housing conditions,⁴⁵ this thesis seeks ways to guide the homeowners as well as the housing professionals in carrying out transformations. Hence, this thesis takes on an added responsibility of proposing guidelines and recommendations for future housing transformations and making this knowledge available to everyone.
Notes
1 Jerzy Wojtowicz, Illegal Facades (Hong Kong: Privately Published, 1984).
12 Ranjana Mital, Not Homeless but Houseless in Delhi, Design Philosophy Papers 3 (2005).
13 The Delhi Development Authority (DDA) was formed in 1957, under the provisions of the Delhi Development Act to promote and secure the development of Delhi.
17 David H. Wells, Milestones: a road map to the Indian Middle Class (APF Reporter Vol. 20# 1).
19 The Municipal Corporation of Delhi (MCD) was formed in 1958 under the Parliament Act to provide civic services to a population of more than 15 million in the capital city. It is one of the largest municipal bodies in the world.
21 Mrs. Gupta, Delhi Scoop: Get ready to pay more for an extra floor, New Delhi, November 24, 2006.
25 Jerzy Wojtowicz, Illegal Facades (Hong Kong: Privately Published, 1984).
Chapter 2

Research Objectives and Methodology
2.1 Research Objectives

- To study and understand the development of housing transformations of the Middle Income Group (MIG) in New Delhi, considering architectural, sociocultural, legal, technological, financial aspects of housing in an integrated manner.

- To analyze the resultant patterns of housing transformations by taking into account MIG family setups as well as the space availability and to document these transformations properly so as to arrive at guidelines for the actual transformation process.

- To educate homeowners wishing to undertake housing additions and alterations by proposing guidelines for existing as well as future dwelling units of the Middle Income Group of New Delhi.
2.2 Research Methodology

2.2.1 SOURCES OF INFORMATION

Library Research
During the formulation of the thesis proposal, the literature review of various information sources available at the University of British Columbia (UBC) libraries and reading rooms played an important role in understanding various aspects of housing in the global as well as the Indian context. Books, e-journals, conference papers, research reports, thesis reports and architectural magazine articles were helpful in gaining knowledge and getting acquainted with current housing issues. Prior to this, more information was gathered from the School of Planning and Architecture (SPA) library in New Delhi in May-June 2005 and also during the field trip to India in July 2006. The SPA library contains most of the information related to the history of New Delhi, architecture, housing typologies, urban design and planning. The library also has records of all research reports regarding New Delhi’s architecture and development.

Internet Research
Due to the fact that limited information is available about the Indian housing industry and housing transformations in India, internet research proved to be the most effective way of acquiring information based on user-participative housing transformations concerning various architects working on transformations, projects, published journals and conference papers on user modified dwelling units all over the world. In addition, internet research through online daily newspapers about the current developments in New Delhi’s housing industry helped in preparing background work for the field trip to India in summer 2006.
Delhi Development Authority (DDA)

Information about DDA’s various MIG housing projects in New Delhi was obtained directly from the people involved with the DDA Housing Department at Vikas Minar in New Delhi. Discussions with the Chief Executive Officer and Directors of DDA’s Housing Department helped in finalizing case-study sites based on the following criteria:

- The case study should be a DDA housing colony in the Delhi NCR (National Capital Region) for the Middle Income Group.
- It should be about 15-20 years old so that this time span would allow some kind of transformation while keeping traces of the original building.
- It should be 3-4 storeys high to allow horizontal as well as vertical transformations.

Based on the above selection criteria and the varying dwelling unit areas, Dilshad Garden, Janakpuri and Munirka were selected as the case study sites to understand the process of housing transformations. Out of these three case-studies, Dilshad Garden has compact dwelling units having a built-up area of 60-65 sq.m. per dwelling unit while Munirka has comparatively spacious dwelling units with a built-up area 100 sq.m. per dwelling unit.

Photocopies of the architectural drawings of Dilshad Garden and Janakpuri MIG housing were obtained from the DDA Housing Department but those of Munirka could not be procured as they were misplaced. The City officials from the Housing Department at Vikas Sadan were interviewed to get background information on the case-study projects. As the officials were involved in DDA’s various projects ranging from housing for Higher Income Group, Middle Income Group, Lower Income Group and Economically Weaker Section, their experience and knowledge about various DDA colonies, with either legal or illegal residential modifications, proved a valuable and reliable source of information in formulating this research. Additional data regarding New Delhi’s modified Building Bylaws and DDA...
permitted additions and alterations were obtained from the same office.

However, it is important to mention that due to terrorists’ threats, admission to the DDA buildings at Vikas Minar and Safdarjang Enclave offices was not an easy task. Security personnel performed strict security checks on everyone and allowed few to enter, only after producing valid photo identity cards and genuine documents and without a camera or any electronic equipment. Even after acquiring approval from DDA's Chief Executive Officer on the very first day to secure information, due to DDA's overall time-consuming way of working, it took almost three weeks to obtain a few drawings from the office.

Case Study Site Visits

Before the actual survey, initial visits to all the case-study sites of Dilshad Garden, Janakpuri and Munirka were helpful in gaining familiarity with the sites and their various sectors. Preliminary interviews with residents were useful in preparing a survey questionnaire. Permission was obtained from the Presidents of Block 'A' in Dilshad Garden and Block 'A1A' in Janakpuri individually after producing valid student status proofs and documents, to study housing transformations in those blocks. However, no permission was granted to study Munirka site in the wake of MCD's recent demolition drive.

Detailed observations were carried out during the next few visits to each site. As this study was conducted in the months of July and August 2006 when the Municipal Corporation of Delhi was undertaking demolition of all illegal structures within the city, the majority of the residents were hesitant in participating in the survey due to fear of getting their illegal construction demolished. However, some residents cooperated in the survey and even gave verbal consent to take pictures and draw sketches of their houses for this research. This consent was very important considering the illegal residential constructions
in those case-study sites. Hence, case study houses were selected randomly upon approval of homeowners. For each site, 8-10 households were selected for detailed study and their homeowners were interviewed to understand this overall process based on the survey questionnaire. A sample format of the survey questionnaire is as follows:

Case Study No.: 
- House Owned By: 
- Built in: 
- Locality: 
- Built-Up Area: 
- Family Structure: 
- Family Background: 
- Original features: 
- Changes made: 
- Room Sizes and Usage: 
- Reasons for Transformations: 
- Current and Future Requirements: 
- Other Remarks:

2.2.2 DATA COLLECTION

The survey was primarily based on the original drawings obtained from the DDA and on-site observations and interviews. Each session was divided into two parts, an interview with the homeowner and a graphical documentation of the dwelling unit and plot through photographs and sketches. Each individual interview session took 15-20 minutes while photographing and sketching took 30-45 minutes depending upon the transformations done. A total 27 case study houses were studied in 8 days in all the three case study sites.
In addition, more site photographs of Dilshad Garden and Munirka were obtained in January 2007 with the help of a few friends in New Delhi. However, due to MCD's ongoing demolition drive of illegal structures, those friends got unfavorable responses from residents as they were thought to be DDA or MCD officials.

2.2.3 DATA ANALYSIS

As no photographs of the original buildings were available, housing transformations undertaken by homeowners in all case studies were studied by comparing the original plans obtained from the DDA, current site photographs, sketches and interviews. The study primarily focused on changes done by the residents over time considering social, cultural, financial, technical and bureaucratic aspects in an integrated manner. The factors observed were dwelling unit layout, built-up area, dwelling growth, building materials and construction, family set-up and life cycle. The survey illuminated various hidden factors responsible for these transformations at individual user level and at community level.

All these factors were instrumental in understanding housing transformations in a better way and thus helped to identify key areas requiring immediate attention and to formulate guidelines for future transformations. Various trends of transformations found during the site visits to Dilshad Garden, Janakpuri and Munirka, are discussed in detail in the following chapter.
Chapter 3

Case Studies
Case Studies: Delhi Development Authority (DDA) Housing Colonies
Dilshad Garden, Janakpuri and Munirka DDA Middle Income Group Colonies

Figure 3.1 New Delhi Map

Image removed due to no copyright permission
The case studies selected were low rise housing apartments in Dilshad Garden, Janakpuri and Munirka areas, built for the Middle Income Group (MIG) in Delhi by the Delhi Development Authority. MIG apartment housing was chosen because these middle income families have a greater need of housing transformations than those living in middle class single family houses. Due to their limited resources, they have access to smaller apartments or plots and thus resort to a more gradual extension of their required space. Low rise housing apartments were selected because the scale of transformations is greater in two to three storeyed buildings since both the ground floor and upper floor residents have opportunities of accessing adjacent space to add or alter their dwelling units. Consequently, they exhibit profuse transformations.

TRANSFORMATIONS IN MIDDLE INCOME HOUSING

Transformations undertaken by the homeowners, whether legally or illegally, in the case study sites Dilshad Garden, Janakpuri and Munirka could be categorized as:

- **Horizontal and Vertical**
  - Horizontal: Ground floor extensions and upper floor extensions,
  - Vertical: Terrace or roof-top extensions.

- **Exterior and Interior**
  - Exterior: Rooms, Balconies, Openings, Canopies etc.
  - Interior: Space alteration, Partitions, Storage, Finishes etc.

These transformation trends are discussed in detail in the following case studies of Dilshad Garden, Janakpuri and Munirka colonies built by the Delhi Development Authority for the growing middle class of New Delhi.
3.1 Case Study 1: Dilshad Garden, Pocket A

Dilshad Garden is located in East Delhi, close to Shahdara. The Middle Income Group Housing was built in 1983-84 to accommodate the increasing number of MIG population in this suburb of East Delhi. Today, due to the new underground Delhi Metro network service opened in 2005 up to Shahdara, it is considered as a favorite residential neighborhood in
neighborhood in East Delhi and there has been a considerable increase in the overall housing prices within the area. Dilshad Garden is divided into several pockets consisting of MIG housing. This study of housing transformations was conducted in Pocket A which consists of a total of 492 dwelling units as per the original site plan. Each building module consisted of four units each on the originally constructed ground and upper two floors. Each dwelling unit was approximately 65-70 Sqm in size and consisted of a living room, kitchen-dining, one bedroom and bath-WC. Access to every building was from the two sides abutting the roads. Since its construction in 1984, there has been considerable changes in the overall built form provided by the DDA. Today, with only a few exceptions, homeowners have transformed almost all the units due to their changing needs with time.

3.1.1 TRANSFORMATION TRENDS

Rooms
- Considering the changing socioeconomic patterns, in most cases the front courts were converted into rooms that were used for income generating activities such as small shops, offices, cottage industries, clinics etc.
- Rooms were constructed in both the front and rear courts, thus blocking existing openings which provided light and ventilation of the interior rooms.
- To increase the internal floor area, sometimes inner walls were demolished and new extended walls were constructed. Mostly, all the new rooms were constructed unanimously by the owners of all the floors.
- In many cases, two corner plots were acquired by one family. This allowed them more flexibility in terms of spaces and design for transforming their dwelling units.
- Construction of extra floors above the original floors was also a common feature.

Generally, ownership of the terrace lies with the owner of the top floor. To acquire more floor

Figure 3.4 Newly added shops on the ground floor
space, new floors were often added above the existing structures, ignoring the structural stability of the building, which was not meant to carry such huge amount of loads.

- The new floor units also covered the courtyard spaces along with projecting the new balconies beyond the building line in the public area.
- The corner units or those abutting the roadside, had a distinct advantage in terms of spaces available for transformation. On the other hand, units which were surrounded on two or more sides were not that advantageous due to a lack of open space around them.
Bedrooms were generally the most required areas for which people transform. (Figure 3.6)
• Except for minor alterations such as combining separate bath and WC units into one, service areas such as kitchen and washroom were not altered, often due to difficulty in changing the plumbing and sewer lines.

Balconies
• The first addition to existing spaces was often by the conversion of existing balconies into habitable rooms such as bedrooms or study rooms. Sometimes balconies were extended beyond the original one, projecting into the front courtyard.
• Another common feature was the construction of new balconies all along the sides, to acquire more floor space. In most cases, such overhanging balconies were projected three to four feet into the public area beyond the building line over the road.
• These transformed balconies were generally used for various purposes such as bedrooms, study rooms, outdoor sitting, for drying clothes, planting and storage.

Openings
• New window/door openings were created and existing openings were increased in size.
• Many homeowners had constructed new rooms in the front and rear courts originally intended for parking, thus blocking existing openings providing light and ventilation to the internal rooms.

Canopies
• Canopies or sheds over balconies or courtyards for weather protection were commonly found.
• Various materials were used for their construction, such as translucent acrylic sheets, asbestos cement sheets, concrete, fabric curtains etc.
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Staircases
- For the newly added floors, mostly the common staircases were used. But in many cases, homeowners had built internal staircases within their units to have direct access to their upper floor units.

Miscellaneous
- In addition to the above categories, other forms of additions and alterations were:
  - Commercial signage
  - Metallic stands at the windows for air-coolers and air-conditioners
  - Air conditioning units
  - New doors and windows
  - Decorative elements
  - Added glass panes
  - Colored and textured facades
  - Display boards
  - Vegetation
  - New boundary walls
  - Shading devices, sun-screen devices
  - Laundry

3.1.2 CASE STUDY HOUSES: DILSHAD GARDEN
3.1.2.3 Case Study House No. 3
- Transformations:
  - Living room was converted into a bedroom and the bedroom was converted into a living room.

Figure 3.9 Case Study House 1, Dilshad Garden
- Exterior wall of the living room was demolished and a new wall with a wider opening was constructed.
- New wooden doors and windows were installed in that opening.
- A bedroom was constructed in the rear court blocking light and ventilation of the interior rooms. (Figure 3.6)
- Bath and WC were combined together.
- Open front court was converted into a covered court with canopy overhangs.
- New boundary wall was constructed and new entrance gate was erected.

- Reasons of transformations:
  - Increasing space requirement due to increasing family size.
  - Upgradation of standard of living.

- Future transformation possibility:
  - Construction of new room in the front court, adjacent to the existing living room.

3.1.2.2 Case Study House No. 2

- Transformations:
  - Exterior wall of the master bedroom was demolished to extend it.
  - A new room was constructed on the front side.
  - New balconies were constructed all along the unit.
  - The old balcony was demolished and replaced with new balustrade design to match with the new balconies.
  - Canopy was provided for weather protection.
  - New windows and sliding doors were installed in the balconies due to lack of space.
  - New wooden doors and windows are installed in that opening.
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Figure 3.11 Case Study House 3, Dilshad Garden

- Reasons of transformations:
  - Increasing space requirement due to increasing family size.
  - Upgradation of standard of living.

- Future transformation possibilities:
  - Construction of a new room in the rear court.
  - Enclosure of a balcony to extend master bedroom.

### 3.1.2.3 Case Study House No. 3

- Transformations:
  - The open front court was converted into a cyber cafe.
  - Rolling shutters were provided for its wide openings.
  - A small room was constructed into the rear court, adjacent to the master bedroom.
  - Kitchen was extended in the side setbacks.
  - AC unit was installed.
  - New boundary wall was constructed and new entrance gate was erected.

- Reasons of transformations:
  - Increasing space requirement due to increasing family size.
  - To earn extra income through commercial activity.

- Future transformation possibilities:
  - Construction of new room in the front court, adjacent to the existing master bedroom.
  - Conversion of covered court into a room.
Janakpuri is considered as one of the best middle class residential colonies in West Delhi. It was once the largest planned residential colony in Asia. It is divided into four major blocks namely A, B, C and D which are further divided into sub-blocks. This well planned residential colony consists of several green-pockets and has at least one local market in
Figure 3.15 Newly added top floor unit

each block, religious places like temples, gurudwaras and churches. It is well connected to the other parts of the city by metro trains and has good network of roads. The District Center of Janakpuri consists of a multiplex, restaurants, shops, retail outlets, offices and courts and has become one of the most favorite shopping destination in the region. Today, Janakpuri is known as the commercial hub of West Delhi.  

This case study was carried out in the Middle Income Group Colony Block A-1-A.

3.2.1 TRANSFORMATION TRENDS

Rooms
- New rooms were built in the front courts as an addition to the existing units.
- They were used as a part of the dwelling units and also for income generating activities such as small shops, offices, cottage industries, clinics etc.
- In some units, bedrooms were extended by demolishing the exterior wall and constructing a new wall in alignment with the living rooms, thus increasing the habitable floor areas. In such cases, light and ventilation of the rooms were not affected.
- Occasionally, along with the horizontal extension, some units were also extended vertically by adding extra floors above the original floors.
- Most of the units in Janakpuri were placed adjacent to each other in a row surrounded by other units on both the sides. Hence transformations were seen mostly in the front as it was the only direction available for extension.
- Corner units have distinct advantages due to their location. Owners of such units have mostly extended their units by adding new rooms in the front and side setbacks.

Balconies
- Existing balconies were often extended to acquire more floor area. In many units, these balconies were converted into bedrooms, study rooms, kitchens or store areas.
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As most of the units were placed with only one direction available for extension, in the front court, most new balconies were constructed in the front yard.

Such overhanging balconies were projected three to four feet beyond the building line in the front court within the setbacks.

Openings

- Often original units were extended by adding new rooms in the front or rear courts, thus blocking light and ventilation of the interiors. These rooms had poor quality of light and ventilation and the indoor air quality was affected due to no cross-ventilation within the rooms.

Canopies

- Different types of canopies were constructed in the front courts and terraces for weather protection so that they could be used year-round.

Staircases

- Access to such floors was generally provided by the common staircases.
- New internal staircases were constructed in a few units by homeowners for direct access to their new units above.

Miscellaneous

- To create individual identity for their units, users had used a variety of materials, colors, exterior finishes, designs etc.
- Miscellaneous: In addition to the above categories, there were other forms of additions and alterations, such as:
  - Commercial signage
  - Metallic stands at the windows for air-coolers and air-conditioners

Figure 3.16 Balconies projecting into the front court and construction of a new floor
3.2.2 CASE STUDY HOUSES: JANAKPURI

3.2.2.1 Case Study House No. 1

- Transformations:
  - Exterior wall of the living room was demolished and new wall with a wider opening was constructed.
  - New wooden doors and windows were installed in that opening.
  - Master bedroom was extended to acquire more floor area.
  - New opening was provided between the living room and extended master bedroom.
  - Open front court was converted into covered court with a roof on the top and its plinth was raised up to the original unit height.
  - Original mosaic flooring was changed to expensive marble flooring.
  - New boundary wall was constructed and new entrance gate was erected.

- Reasons of transformations:
  - Increasing space requirement due to increasing family size.
- Upgrading of standard of living.

**Future transformation possibilities:**
- Construction of new room in the front court, adjacent to the existing master bedroom.
- Conversion of covered court into a room.

### 3.2.2.2 Case Study House No. 2

**Transformations:**
- New study room was constructed in the open front court.
- Window of the master bedroom, the only source of light and ventilation was blocked and closed due to construction of the study room. Therefore, there was no natural light and ventilation in the master bedroom.
- Interiors of the living room were completely changed and was treated with new wood work.

**Reasons of transformations:**
- Increasing space requirement due to increasing family size.
- Upgrading of standard of living.

**Future possibility:**
- The whole unit might be sold or rented out.

### 3.2.2.3 Case Study House No. 3

**Transformations:**
- An additional upper floor consisting of a bedroom, a living room and a washroom was added.
- Spiral staircase was provided to access the upper floor directly from the unit.
- New balconies were added on the front and rear side of the unit.
- The original ceiling was treated with plaster of paris.
- The interior of the house was completely renovated.
  - Reasons of transformations:
    - Upgrading of standard of living.
    - To have a separate home office.
  - Future possibility:
    The owners are planning to use the upper floor bedroom as a home-office and to convert the upper floor living room into a study room.
3.3 Case Study 3: Munirka, Pocket A

Munirka is a middle-class colony located in South Delhi. It was once an old village consisting of many monuments of the early 16th century Lodi era. Today, it is a home to multicultural people from various parts of India. Munirka's residential colony is divided
into several pockets A, B, C etc. and consists of a huge open-air market on the Outer Ring Road. DDA has constructed many apartments in Munirka, namely Munirka Enclave, Munirka, Munirka Vihar and SFS (Self Finance Scheme) Flats.  

This case-study was conducted in Pocket A of Munirka in July 2006 when the Municipal Corporation of Delhi was undertaking an initiative to demolish all illegal structures within the city. Therefore, the residents of Munirka did not participate in the research survey at all as they were afraid of their construction being reported and demolished. Hence this case study is primarily based on the site photographs showing transformations undertaken by the homeowners.

3.3.1 TRANSFORMATION TRENDS

Rooms
- Ground floor units were often extended by adding rooms in the front courts and occasionally in the rear courts depending upon location of the unit. Such rooms were used as a living room, bedroom, kitchen, shop or office, according to the owner’s requirements.
- Upper floor units were extended by demolishing internal walls and adding more rooms as per space availability.
- Mostly, all the new rooms were constructed unanimously by the owners of all the floors. If the owner of the ground floor did not agree, generally columns were erected from the ground, by the upper floor owners to support the upper-storey additions. (Figure 3.24)

Balconies
- The original balconies were often extended to acquire more floor area.
- Open balconies were often enclosed and converted into study room, bedroom etc. Sometimes, they were integrated with the interior rooms for added floor space.
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- New balconies were constructed in the front court as it was the only direction available for expansion of the units.
- The balcony overhang was usually three to four feet within the setback in the front court.

Canopies
- A variety of canopies was provided by the homeowners for weather protection in the form of front entrance canopies or window overhangs.

Staircases
- Most of the time, the common staircase was used to access newly constructed upper floors. But some owners have also constructed internal staircases within their units to have direct access to their newly constructed upper floor rooms.

Miscellaneous
- Miscellaneous additions and alterations found in Munirka case study include:
  - Commercial signage
  - Metallic stands at the windows for air-cooler and air-conditioners
  - Air conditioning units
  - New doors and windows
  - Decorative elements
  - Added glass panes
  - Colored and textured facades
  - Display boards
  - Vegetation
  - New boundary walls
  - Shading devices, sun-screen devices
3.3.2 CASE STUDY HOUSES: MUNIRKA

3.3.2.1 Case Study House No. 1
- Transformations:
  - Exterior walls and slab were demolished to construct new rooms in the front court.
  - An existing balcony was enclosed into a room and a new balcony was added.
  - A new room on the ground level was constructed in the front court for commercial purpose.
  - An upper floor consisting of two bedrooms, a living room and a washroom was added.
  - Two air conditioning units were installed.

3.3.2.2 Case Study House No. 2
- Transformations:
  - Two rooms were added on the ground floor in the front court for commercial purposes and were used as a shop and a doctor's clinic.
  - New upper storey additions were used as bedrooms and study rooms.
  - Information display boards were provided.
  - A variety of materials were used for new construction, such as aluminium frames, brick masonry walls as well as curtain wall glazings.

3.3.2.3 Case Study House No. 3
- Transformations:
  - Soft-storey construction (a structure constructed on raised columns only) on ground floors for parking was added and a room was constructed above it. This type of construction built on columns having no walls, was widely seen in many dwellings units in all the case studies.
  - Wider windows on ground floors with safety grills were provided.
  - Two new rooms on the terrace on the front side were added.
- Various doors and window were installed with canopies having variety in sizes, designs, materials and colors.
- AC units and air cooler units were provided by puncturing the exterior walls.

3.3.2.4 Case Study House No. 4

- Transformations:
- A new column was erected and an existing beam was extended in the front yard for proposed new rooms which were under construction.
- New glazed rooms were added on upper floors.
- The terrace was enclosed and was used as a room.
- AC units and air coolers with metal stands were added.
- New openings were created in the brick masonry walls for those AC units.
- A new boundary wall was constructed in the front yard to demarcate property of the owner.
3.4 Library of Existing Transformations

Figure 3.31 Rooms: Ground Floor Transformations
Figure 3.32 Rooms: Ground Floor Extensions for Retail Activities
Figure 3.33 Rooms: Upper Floor Extensions
Figure 3.35 Balcony Transformations
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BALCONIES
Chapter 3

BALCONIES
Figure 3.36 Door Additions and Alterations
OPENINGS: WINDOWS - VENTILATORS

Figure 3.37 Window/ Ventilator Additions and Alterations
OPENINGS: WINDOWS - VENTILATORS
Figure 3.38 Canopy Additions and Alterations
Figure 3.39 Staircase Additions

Figure 3.40 Boundary Wall Additions and Alterations
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MISCELLANEOUS

(a) Air coolers and metal stands  (b) Air Conditioning Units  (c) Decorative Elements  (d) Swings on Terrace

(a) Sun Shades  (b) Seats in open areas  (c) Loft for storage  (d) Information Display Boards

Figure 3.41 Miscellaneous Additions
3.5 Morphosis

The existing process of housing transformations is explored further with the help of one case study building in Dilshad Garden which was transformed over time. This process of building transformation is relevant to other case study examples in Dilshad Garden, Janakpuri and Munirka.

Over time, a building undergoes different stages of "completion" while adapting
itself to the needs of the inhabitants. People add and alter as their needs change. These additions and alterations are done gradually by different homeowners. This process of transformation continues to increase the built form with every passing day. It involves not only addition or construction of new building portions, but also demolition of existing structural members, walls and other building elements. Thus, one building undergoes construction or demolition process at different times or even simultaneously.
Stage 1: Original
Stage 2: Portion which was demolished
Stage 3: Once demolished
Stage 4: Latest transformed building

Figure 3.46: Various stages of a building during transformations
Notes

26 Wikipedia: the free encyclopedia, Janakpuri.

27 Wikipedia: the free encyclopedia, Munirka.
Chapter 4

The Housing Transformation Process
This chapter explains the important factors responsible for residential additions and alterations in New Delhi. It covers the diverse aspects governing this process of transformation at individual level as well as at broader level.

4.1 Transformation Issues

4.1.1 ARCHITECTURAL

Although housing transformations often increase the market value of the property, it may decrease its functionality and market value due to lack of architectural and construction expertise on part of the homeowners who undertake these additions and alterations. The construction of an extra room in the rear court of Case Study House No. 2 in Janakpuri (Refer Figure No. 3.19 and 3.20) has adversely affected the functionality of the original room due to the poor quality of light and ventilation. In the case study examples, it was observed that these additions and alterations grew haphazardly on the original buildings, thus making them aesthetically worse with every new addition.

Most of the time, no drawings are made for the required changes. Addition and alteration works are executed directly on-site as per instructions of the contractor or masons hired by the homeowner. In the case of problems in the design or construction, the newly constructed portion is demolished and constructed again. This exerts more pressure on the already tight budget of the homeowners due to wastage of time, money and energy. It is the homeowners who have to bear all such extra expenses of building materials, labor payment along with the overall delay in the construction process.

Also, considering the increasing cost of building materials, any delay in construction results in unnecessary added expenditure. Under such circumstances, the construction is carried on only if the homeowner agrees to pay for the overall increase. But under
unfavorable circumstances where there is a dispute over monetary issues, either the contractor resigns or another contractor is hired by the homeowner thus halting the construction process either temporarily or permanently. These delays and their associated costs remain the sole responsibility of the homeowners who suffer financially and emotionally as a result.

4.1.2 STRUCTURAL

Transformations to the original parent building often include demolition of existing walls, structural members such as columns, beams and slabs. Existing concrete beams and columns are chiseled to anchor new reinforcement bars to the existing ones during transformations. New additions and alterations are then constructed in the form of new balconies, rooms, canopies etc. As such transformations are done by various homeowners over time as per their requirements, the overall structural stability of the building is jeopardized by the repeated alterations and the increasing building weight.

Even though Delhi falls in Seismic Zone IV, which is known as a High Damage Risk Zone, no attention is paid to earth-quake safety measures or India’s National Building Code By-Laws during transformations. Thus buildings become more sensitive to earth quake and fire. These buildings, which are built to carry only gravity loads, often fail when they are harmed beyond their structural limit.

Recent building collapse disasters in the New Delhi region show that illegal construction was the main reason behind their collapse. In absence of technical expertise, these illegal additions were often made by ignoring all building bylaws and thus compromising the structural stability of the buildings. Poor quality of building material, poor workmanship, water
scarcity, wrong design and incorrect placement of structural members such as columns, beams, footing foundations and slabs, are some of the different reasons for a building collapse. Even though the percentage of such building collapses is small as compared to the number of building transformations taking place every year in New Delhi, such additions and alterations without technical expertise always pose a threat to human life.

4.1.3 FINANCIAL

Transformations made to the original unit for extra floor space are often more economical than buying a totally new house having the same floor area or upgraded amenities, within the same locality. Dwelling unit additions are considered ways to increase the overall market price of the property. Commercialization of residential space in the form of shops or offices in the ground floor increases the market value of the property significantly because of the monetary returns associated with it. Due to these reasons, the value of ground floor units is usually greater and decreases with the increasing number of floors.

Despite the fact that people invest actively in these transformations every now and then, there is no financial support from the government, banks or any other housing agencies for housing transformations. People have to invest from their own savings or assets due to limited available financial resources.

4.1.4 LEGAL

Even though there is a hidden market for illegal properties, illegal additions and alterations are not officially recognized or approved on paper. The homeowners of such units are under constant fear of getting their illegal construction demolished. As such additions are illegal, the homeowners often face problems in selling them, as prospective buyers are usually hesitant to buy illegal properties. If they succeed, they face difficulties in getting bank finance or housing loans in absence of official original documentation.
4.2 Role of Various Players

4.2.1 THE HOMEOWNERS/ USERS/ RESIDENTS

'Homeowner' refers to the person who officially holds the title of the property. The words 'user' and 'resident' refer to the person/s who uses the dwelling unit on an ownership or rental basis. For transformation or adaptation of a dwelling unit, the homeowner acts as the decision maker. Usually, a tenant has to obtain permission from the homeowner before making any minor change to the property. An owner may refuse to allow any transformation if he does not agree with it. Thus the issue of owning plays a very important role in housing transformations. Usually a tenant is not keen on investing and extending somebody else’s property on a short term, unless it is essential. Most of the time, once an owner’s permission is sought, transformations are done with mutual agreement where the owner pays for the new alteration of his property.

During a major housing transformation, the homeowner usually moves temporarily to a different place. For minor transformations, he/she mostly prefers to stay in the same house as it is more economical than moving to some other place. In such a case, often the transformation process is organized in such a way that the functionality of the household is not disturbed while upgrading the dwelling unit. Considering various circumstances and changing financial priorities of the household, transformation works can be discontinued at any given time in order to redirect resources towards some other priority of the family.

4.2.2 DELHI DEVELOPMENT AUTHORITY (DDA) HOUSING AGENCY/ DDA ARCHITECT

Even though the DDA Housing Agency provides housing for millions of people, it plays no role in the process of transformation once the dwelling units are handed over to residents. DDA has their own in-house architects to design various buildings including
housing for different income groups such as EWS, LIG, MIG and HIG. Housing designs are generally based on previous projects carried out by DDA with slight modifications as per the site requirements. One or two dwelling unit designs are typically repeated several times. The DDA architect is responsible for designing housing projects by utilizing maximum permissible built-up areas for creating the maximum number of dwelling units satisfying the minimum standard room sizes as prescribed by the Delhi Building Bye-laws. His/her role ends once the newly built dwelling units are handed to the homeowners. During the whole process of transformation, the original architect who designs dwelling units for housing agencies such as DDA, is kept out of the picture.

4.2.3 ARCHITECT
To save the professional fees given to an architect for his/her advice, owners usually do not consult an architect. In rare cases, a new architect is hired for designing additions and alterations for a dwelling unit or when the owner needs some professional advice when something goes wrong with a housing transformation. The design process is mostly carried out by contractors often lacking architectural expertise and creativity.

4.2.4 CONTRACTOR
Once a decision is made to add and to alter a dwelling unit, the homeowner hires a contractor or sub-contractor to carry out transformations of the dwelling unit either on a daily wages or a lump-sum basis. Generally, works are awarded to the contractor with the lowest quotes and who agrees to finish the required work on a minimum budget within the time limit. The contractor/s then supervises the on-site construction work with a team of masons who are usually hired on daily wages.
4.2.5 FINANCING BODIES

If transformations are legally sanctioned by government agencies, then they are usually eligible for bank finance in the form of housing loans. Now-a-days many national banks such as the State Bank of India, ICICI, and HDFC offer housing loans at low interest rates for buying new houses. But if the additions are not legal, then the homeowner has to spend his/her own savings and assets. In the absence of any bank finance and when savings are exhausted, the homeowners usually borrow money from relatives or friends to continue construction.

4.2.6 NEIGHBORS

In the case of apartment buildings and attached dwelling units, neighbors play an important role in housing transformations. Generally, consensus is sought amongst neighbors who share common walls or areas for horizontal and vertical extensions of their dwelling units. As long as the new additions and alterations do not affect their dwelling units, privacy and security, transformations are generally done unanimously. In a few case-study examples, the cost of foundations for new rooms in a vertical stack was shared by all their homeowners.

4.3 Factors Responsible for Design and Materials Selection

4.3.1 COST

Cost is the most important factor that governs all the other factors. Depending upon the funds available, homeowners prioritize their requirements to transform accordingly. If sufficient funds are available, they may opt to build a more built-up area by extending their dwelling units, hire experienced architect and contractors), use good quality building materials and complete the addition/alteration on time. As a house is considered a symbol of social status, a homeowner may opt for an upgraded standard of living to create an individual
identity of his own in the form of his house. When funds are limited, he usually builds to fulfill his basic minimum requirements at that time and may upgrade in the future as funds become available. In such cases, careful planning is important on the part of the homeowner, architect or contractor in terms of construction and money to avoid delays in the on-going construction due to lack of funds.

In a few case study examples, due to lack of technical expertise and proper guidance, many ongoing construction projects were stopped by the owner as funds were exhausted. This resulted not only in wastage of time, energy and money, but also in mental frustration and anger for the homeowners/residents.

### 4.3.2 SKILL OF LABOR

As transformations often include the demolition of existing building elements and the addition of new elements to the existing ones, sound knowledge of building construction and technology is required. Hence often masons are hired based upon their skills in building construction. Manpower is divided as per the expertise and experience of the masons. Some masons are specialized in tying reinforcement of the new construction to the existing structural members; some are good in laying brick-work, while others with no special skills are allotted the job on transferring building materials on site.

Money plays a very significant role as the homeowner usually hires a contractor and his team of masons who agree to work with minimum wages or minimum budget. Sometimes, to save money, unskilled masons are hired resulting in sloppy construction quality.

### 4.3.3 BUILDING MATERIALS

Building materials are selected based upon the requirements, budget, skill of masons and their availability within the surrounding. To reduce the cost of building material and hence
the overall cost of construction, often locally available building materials as used as they are cheaper and require low transportation expenditure. As innovative building material and technology needs specialized masons, it increases the overall cost of construction. In New Delhi, as most of the construction is Reinforced Cement Concrete (RCC) framed with brick infill walls, cement, sand, bricks and aggregate are preferred over other expensive building materials such as wood, glass and aluminum partitions. Due to the same reason, as labor is very cheap in India, prefabricated building technology for minor additions and alterations is not popular as it requires heavy initial investment and highly skilled masons.

### 4.3.4 PERSONAL TASTE

Design of a new addition or alteration varies with the requirements and personal tastes of homeowners. To give their dwelling units an individual identity of their own, homeowners often modify the interior design and exterior facade of their dwelling units. Some owners prefer to camouflage the new changes with the original building while others prefer to create a contrast between their newly modified unit and the original one. Variety is seen in terms of design, material and colors of rooms, openings, doors, windows, canopies, staircases, boundary walls etc.

### 4.3.5 TIME

As time moves ahead, requirements of a family change. A growing family needs more space due to their increasing spatial requirements. A two bedroom unit which is sufficient for a family of four consisting of husband, wife and two kids, becomes small for them as the kids grow up. Then it is time for them to extend their dwelling unit by adding more rooms or enclosing balconies into rooms. Similarly, when grown up children move away to another
place, elderly parents often divide their unit and rent out some rooms to earn extra income. As time changes, spatial requirements of a family change and thus the housing design is altered accordingly to satisfy the requirements of the users at that given time.

4.3.6 TRENDS IN THE SURROUNDING

Designs and material selection for a new addition or alteration are often governed by the on-going trends within the surrounding. Although people transform their dwelling units in their own unique way, various trends in design, materials and colors are often found to be imitated in the surroundings. If a homeowner transforms his unit as per his requirements and personal taste and if it is appreciated by others, similar additions and alterations appear in the proximity. Glazed balcony enclosures, construction of long new balconies all along the building periphery, conversion of rear courts into rooms, installation of decorative elements and balustrades having similar designs and materials, are a few examples found in the case-studies conducted in Dilshad Garden, Janakpuri and Munirka.

4.4 Reasons of Popularity

Considering the various factors discussed in this chapter, various reasons for the popularity of housing transformations are:-
- It may be economical at that time.
- The homeowner may not have to move out to some other place.
- It helps to provide personal identity to the dwelling unit.
- It requires no highly skilled or specially trained masons.
Notes
Chapter 5

Transformation Recommendations and Guidelines
5.1 The Need

From the previous chapters, it is clear that housing transformation is a very common phenomenon in middle class housing of New Delhi. As the Municipal Corporation of Delhi has started a scheme to legalize currently illegal residential construction, the number of such transformations is going to increase. Though the Delhi Development Authority’s Building Bye-Laws provide information about addition and alteration permit application forms for DDA flats, it does not elaborate various important aspects related to housing transformation that can be useful to homeowners.

Homeowners often undertake housing transformations without the assistance of a building professional. Considering the numerous bureaucratic hassles of getting a building approval, most homeowners often depend upon contractors and masons who prefer to work in their own way, without actual drawings and specifications. On one hand, contractors carry out such residential additions and alterations at the expense of homeowners. On the other hand, some homeowners insist on making major changes to their houses without paying heed to experienced contractors’ suggestions. As a result, the architectural and construction quality as well as the structural stability of the whole building is often jeopardized. With the increasing housing shortage, the skyrocketing prices of building materials and unaffordability of properties due to escalating prices, there is a need to provide more responsible guidance to homeowners so that they understand the importance of various factors involved in housing transformations and get maximum returns from their investment.
5.2 Design Objectives

- To educate the homeowners wishing to undertake housing transformations about various important aspects of building additions and alterations, and to offer them professional support in order to ensure that their housing transformation will be economical and of good quality.
- To incorporate housing transformation trends and processes in proposed housing transformation guidelines and solutions for additions and alterations of existing as well as future dwelling units.
- To provide technical assistance to various players of the housing industry, students and researchers by proposing housing transformation guidelines and solutions after taking into account the architectural, structural, financial, sociocultural and climatic aspects of housing in an integrated manner and thus improve to some extent the overall housing quality in New Delhi.

5.3 Precedents of Guidelines for Housing Transformations

The guidelines are primarily based upon the study and analysis of case studies consisting of DDA's Middle Income Group housings in Dilshad Garden, Munirka and Janakpuri. Various transformation trends were found such as balconies, rooms, canopies and staircases having a variety of design, material, functionality, color and form. While building additions and alterations increase market value of a property, they can also decrease its value if they are not done in the right way. Homeowners often fail to understand their own spatial requirements and financial limitations. The lack of planning and organization among homeowners, contractors, suppliers, and architects, and the deteriorating standard of architectural and construction quality, were identified as the key areas that need attention. Hence, there is a strong need to educate homeowners and offer professional support by
providing pre-design guidelines, architectural recommendations and construction guidelines.

- **PRE-DESIGN GUIDELINES:** To ensure that homeowners understand their own requirements before initiating alterations along with their responsibilities, budget, working relationships with contractors and masons, in order to get maximum benefits from their investment.

- **ARCHITECTURAL RECOMMENDATIONS:** To improve architectural quality in terms of design, functionality, aesthetics and cost, by providing design recommendations and design illustrations.

- **CONSTRUCTION GUIDELINES:** To ensure the structural stability of buildings and the safety of occupants.

5.4 Pre-Design Guidelines

As homeowners do most of the housing transformations on their own without consulting any building professional, it is important to educate them about various aspects related to additions and alterations, which they should understand and consider during the planning stage. Thoughtful planning is important for successful transformation of any dwelling unit. Usually, lack of planning ahead of the actual construction results in wastage of time, energy, money and mental fatigue for homeowners. In addition, a detailed inspection of the existing house is equally important to rectify existing maintenance problems. Hence, important decisions made beforehand by setting realistic goals can help homeowners get the most from their investment for an improved lifestyle.
5.4.1 FOR A SUCCESSFUL HOUSING TRANSFORMATION, HOMEOWNERS SHOULD:
1. Write down their requirements- all the things they wish/need to change in their house.
2. Give top priority to maintenance works to avoid future problems.
3. Consider their current and future needs, so that the transformation can accommodate those changes later.
4. Write down a wish list, the things that they would like to accommodate if the budget allows.

Homeowners should explore information available in the market about current design trends, building materials, their costs and availability, and required workmanship by conducting a brief market survey. In addition, conducting a literature review, asking quotations from various building material suppliers, attending housing seminars and exhibitions, as well as acquiring information about residential transformations done by friends and neighbors, may also prove beneficial. These initial steps will help homeowners to prioritize their goals in a pragmatic manner before contacting a building professional.

5.4.2 NEW ADDITION AND ALTERATION FACTORS
- Room Layout and size: Before deciding on a new extension of an existing room, it is advisable to evaluate if rearrangement of an existing space or furniture can provide the desired change. Often homeowners are not aware of their actual space requirements, which leads them to spend beyond their financial capacity during the actual construction phase. Therefore, it is important to calculate the actual space requirements for any new addition and its integration with the existing unit. During the planning stage, homeowners should consider the needs of everyone in the household, including anyone with special needs or guests. They should also check if the addition would affect light and ventilation of the interior rooms and as well as access to the outdoors. Drawing up a furniture layout in the proposed changes, can be of great help.
• **RCC Structure**: Most of the additions and alterations require demolition of existing building elements and construction of new features and structural changes to foundations, beams, columns or slabs. Before any actual demolition or construction work, it is important to rectify any structural deficiency in the existing dwelling unit immediately so that it does not affect the new changes or lead to the structural failure of the building. The efficient design of new structural members such as the foundation, column, beam or slab and their connections with existing structural members are important in order to support all loads properly and transfer them to the ground safely. Improper structural design can lead to unexpected costs and delays during construction as well as future structural problems, which may result in a building collapse.

• **Fixtures**: New addition to any existing unit may consist of new mobile or built-in fixtures such as sanitary wares or hardware fixtures. Hence, it is vital to consider these fixtures during the planning process. By exploring product options available in the market, homeowners should select new fixtures based upon their suitability, size, space requirements, cost and efficient placement within the layout.

• **HVAC System**: It is important to consider installation of an HVAC system so as to upgrade the current standard of living and facilitate human comfort. If such a system is already installed, it may not have sufficient capacity to handle the increased demand. Poor ventilation can result in poor indoor air quality and persistent unpleasant odor in the interior rooms as seen in a few of the case-study houses.

• **Electrical and Plumbing fittings and fixtures**: Due to new additions and alterations, existing electrical and plumbing systems may need to be upgraded to match the increased needs. Due to an addition of a new room or an extension of a balcony, existing electrical
services may not be adequate. Therefore, sufficient numbers of outlets and circuits must be provided for current and future requirements which may include telephone, computer, TV or other instruments. An improper electrical service may pose a fire hazard due to circuit overloads and inadequate plumbing may become health hazard.

5.4.3 COSTING THE PROJECT

Although additions and alterations to an existing house can increase its market value, they may not be worth the overall expenditure of transformation over the short term. Successful transformation of any dwelling unit is possible only if the expectations of the homeowners match their budget. Homeowners should be practical about their actual requirements and financial limitations. To undertake new additions and alterations smoothly without any delay or halt in the progress of their completion, it is advisable to prepare a detailed chart of funds available by considering all options, including:

- Savings/ Cash
- Personal/ Housing loan from financial institutions
- Mortgage
- Credit available
- Other sources of financing

This will give homeowners a fair idea about the total funds available for undertaking any new additions and alterations efficiently. Simultaneously, it is very useful to know the tentative expected expenditure. They should calculate the approximate cost of construction per square foot in the neighborhood, or add the cost of required building materials and labor charges after consulting a contractor and conducting a brief market survey in regards to the cost of building materials. In addition, it is important to add about 15-20% on top of the resulting number for unexpected expenditure. This will give homeowners a general idea about their total probable expenditure.
5.4.4 HIRING THE RIGHT CONTRACTOR

For housing transformations of any kind, finding a good contractor who has the necessary technical knowledge, organizational and interpersonal skills and experience with similar projects, is very important. A good contractor knows what materials and skills are required for a variety of transformation works, is privy to the various problems that may arise during construction and is experienced in preventing or rectifying them. For specialized jobs involving HVAC, electrical or plumbing systems, homeowners should hire specialized contractors. On the other hand, for addition and alteration work requiring more than one activity, a general contractor having expertise in all aspects of work, may be hired.

Before making a final hiring decision, homeowners should interview all prospective contractors and discuss their project details to get an idea about their experience, time expectancy, financial aspects, projects completed and a few references. Contractors should never be hired based on lowest quotes as they may be too inexperienced to provide a proper construction estimate. In such cases, most of the time, they tend to look for ways to curtail the cost of construction by using poor quality materials, hiring unskilled masons or leaving the job unexpectedly, thus adding unwanted expenditure to homeowner's budget.

Getting drawings made beforehand from the contractor is very crucial so that homeowners can keep a close watch as the actual construction proceeds. To avoid any dispute with the contractor(s), homeowners should get a written contract before the construction or demolition starts. The contract should be complete and signed by both the parties describing the nature of work to be done, the cost, the time expectancy and the material specifications in detail. Homeowners should make sure that they get a fair estimate from their contractor(s) and check it thoroughly to ensure everything that they have asked for has been included. As residential additions and alterations may have hidden problems, the addition of extra expenditure for contingencies to cover these hidden costs is always
beneficial. Homeowners should not hire contractors who are hesitant to provide written contracts or those who ask for huge down payments. They should only pay for completed work and never for the full work in advance. Paying by check also helps to keep a proper record of the payment made and services which homeowners have paid for.

5.4.5 HIRING THE RIGHT ARCHITECT

Depending upon the scale of the project, homeowners may hire an architect to prepare architectural drawings for submitting a permit application to the appropriate authorities. Along with the preparation of architectural drawings, their professional services can be availed to look after the project, which may include getting all necessary approvals, hiring contractor(s) and conducting site supervision of the project. For complex projects, efficient design and meticulously detailed working drawings are important for maximizing space utilization and minimizing problems that may arise afterwards.

Hiring a good architect or interior designer is equally important as hiring a good contractor. He/she should have the necessary expertise and experience to understand a homeowner’s requirements and be able to bring them into reality. As transformations often involve demolition and construction, he/she should be able to integrate new additions and alterations with existing dwelling units without adversely affecting their architectural quality. Homeowners should communicate their design ideas and requirements to the architect clearly and seek information about similar projects he/she may have completed. It is important to discuss the professional fee of the architect or designer beforehand, along with the extent of the architectural services that may be required such as:

- A complete design and material specification
- Obtaining approval from the appropriate authorities on the homeowner’s behalf.
- Site inspection and supervision
Frequent discussion with the architect or designer on the progress of the project is very important. For a successful transformation, any problems or disputes arising during the process should be resolved immediately. Even if a good contractor or architect is hired, homeowners must understand the overall process itself; including the design, budget, quotations and building contracts, in order to protect their interests. At the same time, it is the responsibility of the homeowners to provide adequate funds in a timely fashion as per agreement between themselves and the contractor or the architect.

5.4.6 STAYING DURING THE TRANSFORMATION

If the homeowners are considering a major transformation of their dwelling units, then they may opt to move to some other place for a while. However, for minor jobs, they may choose to remain in their own units, as it is more economical than moving. Therefore, homeowners should talk to their contractor(s) about time expectancy of the project including their daily work schedule. They should inform the contractor about the days or times they do not want to be disturbed. A good contractor will be considerate of their privacy and at the same time, would need access to toilets, water or telephone.

Housing transformations can lead to lot of mess in the house. If the homeowners are planning to stay in their house, it is advisable to remove furniture and personal belongings to give the contractor a clear workspace without obstructions. Also, they should cover fixed or heavy furniture items to protect them from dust, water and other building materials.

5.4.7 SAFETY DURING THE TRANSFORMATION

A transformation project of any kind consists of various hazards. Homeowners should take proper care right from the beginning of the project until its completion to avoid any accident or injury to family members, contractors or masons. It is necessary to inform
people in the vicinity of the construction site about various hazards to prevent accidents. Homeowners should also talk to their contractors and masons to keep the site as hazard free as possible. It is extremely important to seal hazardous materials in clearly marked containers and to dispose them properly. Also, safely locking all hazardous materials and the construction site at the end of the day can prevent unwanted accidents. Thus, awareness can prevent any accident and eventually save homeowners from lawsuits.

5.4.8 INSPECTING THE PROGRESS

Understanding the overall process of transformation including the design, budget, contracts is very crucial in getting things done in the right manner. At the same time, it is equally important to keep a close watch on the ongoing construction, even if an experienced contractor or architect is hired. Homeowners should discuss construction progress, on-site design changes and problems on a daily basis with their contractor to prevent miscommunication, which may result in major problems later. If they are not satisfied with the justification of the contractor, they should consult an experienced architect for a further opinion. From time to time, homeowners should keep track of the project progress, review budget and make revisions accordingly and thus save lot of mental fatigue, anguish and financial trouble at a later stage.
Table 5.1 is provided to help homeowners to assess their required transformation priorities so that they can set a realistic goal within their available budget. Only general categories are provided here. Homeowners are free to expand these categories depending upon the scale of the transformations.

<table>
<thead>
<tr>
<th>For: (Room, Balcony etc.)</th>
<th>Transformation Requirements</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed Space Addition: Area/ Size</td>
<td></td>
<td>□ High □ Medium □ Low □ Nil</td>
</tr>
<tr>
<td>Walls and finishes</td>
<td></td>
<td>□ High □ Medium □ Low □ Nil</td>
</tr>
<tr>
<td>Flooring</td>
<td></td>
<td>□ High □ Medium □ Low □ Nil</td>
</tr>
<tr>
<td>Ceiling</td>
<td></td>
<td>□ High □ Medium □ Low □ Nil</td>
</tr>
<tr>
<td>Windows and Doors</td>
<td></td>
<td>□ High □ Medium □ Low □ Nil</td>
</tr>
<tr>
<td>Artificial Lighting and Ventilation</td>
<td></td>
<td>□ High □ Medium □ Low □ Nil</td>
</tr>
<tr>
<td>Electrical Fittings and Fixtures</td>
<td></td>
<td>□ High □ Medium □ Low □ Nil</td>
</tr>
<tr>
<td>Plumbing Fittings and Fixtures</td>
<td></td>
<td>□ High □ Medium □ Low □ Nil</td>
</tr>
<tr>
<td>Exterior Finishes/ Paint</td>
<td></td>
<td>□ High □ Medium □ Low □ Nil</td>
</tr>
<tr>
<td>Furniture</td>
<td></td>
<td>□ High □ Medium □ Low □ Nil</td>
</tr>
<tr>
<td>Storage Cabinets/ Shelves</td>
<td></td>
<td>□ High □ Medium □ Low □ Nil</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>□ High □ Medium □ Low □ Nil</td>
</tr>
</tbody>
</table>

Table 5.1: Transformation Assessment Job-Sheet
5.5 Architectural Recommendations

The purpose of architectural recommendations is to improve the quality of the built environment through good architectural design for the safety and interest of residents. Existing transformations are being done for different reasons under different circumstances in different ways. Hence, it is difficult to propose fixed design recommendations for new additions and alterations. These recommendations are primarily based upon various trends of transformations found in the case studies conducted in Dilshad Garden, Janakpuri and Munirka MIG housing colonies. The various criteria considered for proposed architectural recommendations are as follows:

- Functionality and usability
- Design
- Material
- Form/ Shape
- Exterior finish and color
- Light and ventilation
- Location
- Building bulk
- Cost
- Structural consideration

These factors are considered for various building elements such as rooms, balconies, door-windows and canopies. Architectural recommendations are proposed for the same elements to assist homeowners in designing additions and alterations of their units. In addition, a number of design catalogue illustrations are proposed to support these design
recommendations and guidelines. Homeowners can select any design option as per their requirements.

SECTION 1

This section consists of proposed design recommendations and existing guidelines for various building elements, supported by a number of catalogues of design illustrations.

5.5.1 ROOMS

Bedroom

Programming

- Before adding or altering a bedroom, it is important to calculate space requirement according to the actual usage of the room, i.e. to sleep, study, watch TV or work. Hence, it should be designed to satisfy the various functions it will serve.

Environmental

- Provide good quality natural light and ventilation into the newly added or altered bedroom.

Space Planning

- After addition or alteration, place bedroom furniture to ensure clear movement pattern and good connectivity with other rooms, exit to balcony/terrace, toilet blocks or backyard if it is on ground floor.
- The modified bedroom should have sufficient storage space. Use storage space under beds and loft space to store items not needed on a daily basis.
- An existing balcony can be enclosed to extend a bedroom if all structural requirements are met and a good quality of natural light and ventilation is provided.
- In smaller bedrooms, use light furniture to free up space. If bulky furniture is already
provided, replacing it with light furniture may provide the desired extra space and save unnecessary expenditure due to new transformations.

- For a newly added or altered bedroom, design furniture items such as beds, wardrobes and dressing tables ergonomically and place them as per room size, layout and its connectivity with other rooms.

Miscellaneous

- Allow inclusion of accessories and upholstery in a modified bedroom.
- In a newly constructed or extended bedroom, provide sufficient power points or outlets as existing electrical fittings and fixtures may be inadequate.
- Color, wall finishes and lighting in bedrooms should create a calm and soothing effect.
- Assessment Job-sheet for bedrooms- Check for:
  - Walls and finishes
  - Flooring
  - Ceiling
  - Openings (doors, windows and ventilators)
  - Cabinets/ shelves
  - Furniture
  - Electrical fittings and outlets
  - Color
  - Natural and artificial light and ventilation
  - Upholstery
  - Other
Living Room

Programming

- Living rooms can be used to serve various functions such as sitting, eating, studying, watching TV or working. Hence, they should be designed to satisfy traffic or usage patterns while also serving as living rooms or a multi-purpose rooms.
- While extending or altering an existing room, measure the proposed space accurately so that all existing and proposed furnishings fit in properly.

Environmental

- Provide good quality light and ventilation. If existing windows are not sufficient, provide more openings.
- Along with natural light and ventilation, provide good quality artificial lighting and ventilation so that the living room is usable in all seasons.

Space Planning

- Newly added or altered living room layouts should have a clear movement pattern. It should integrate well with the existing dwelling unit.
- Living rooms should have good connectivity with other rooms, exit to balcony/terrace or front-yard if it is on ground floor. New modifications should not worsen the existing room facilitation.
- Existing balconies can be enclosed to extend living rooms if structural requirements are satisfied and a good quality natural light and ventilation is maintained.
- In small living rooms, use light furniture that can be moved easily and avoid oversized furniture to have more free space.
- While extending or altering a living room, provide sufficient storage space such as cabinets and shelves that make maximum use of the space. Use sliding door cabinets and shelves to save space.
- Keep accessories and artwork to a minimum.

**Miscellaneous**
- Allow inclusion of accessories and upholstery.
- In newly constructed or extended living rooms, provide sufficient power outlets for TV, computer or electrical appliances as existing electrical fittings and fixtures may not be adequate.
- Use lighter colors as they make spaces appear larger and avoid dark colors as they make spaces appear smaller.
- Assessment Job-sheet for Living room- Check for:
  - Walls and finishes
  - Flooring
  - Ceiling
  - Openings (doors, windows and ventilators)
  - Cabinets/ shelves
  - Furniture
  - Electrical fittings and outlets
  - Electrical appliances
  - Color
  - Natural and artificial light and ventilation
  - Other

**Kitchen Programming**
- Give top priority to repair works to prevent further damage. Replace all deteriorated structural components, damaged finishes due to moisture and repair plumbing leaks as
soon as possible.

- Before adding or altering kitchens, it is important to calculate area requirement and mark desired changes for the proposed kitchen additions or alterations.

**Environmental**

- Newly transformed kitchens should have good quality natural light and ventilation.

**Space Planning**

- Layout of a kitchen primarily consists of a cooking stove, storage and sink. Positioning them in a triangle will improve work efficiency.\(^{31}\) (Figure 5.1)
- Distance between all the three in the triangle should not be more than 7 meters in total.\(^{32}\)
- If modifying kitchen layouts, provide enough workspace on both sides of the cooking top, next to sink and refrigerator. Do not provide it in a corner as it tends to be less efficient.
- For narrow kitchens, 'L' shaped designs having good storage space and minimized distance between the work triangle, are most suitable. (Figure 5.2)
- Other recommended layouts for narrow kitchens are shown in Figure Nos. 5.3, 5.4 & 5.5.
- If workspace is not adequate, reorganization of the space may solve some drawbacks.
- Workable height of a cooking counter is 0.79-0.96 m.\(^{33}\) and width is 0.63-0.66 m.\(^{34}\)
- Provide sufficient storage space for utensils, gas cylinder, dust-bin and electrical kitchen appliances such as a refrigerator, mixer, juicer, toaster and microwave oven.
- Use loft space if storage is not sufficient. If possible, add space from adjoining areas to make kitchen spacious.
- Provide cabinets and shelves to maximize efficient use of the existing or modified space for storage purpose.
- For corner units, lazy Susan storage trays can be provided to make efficient use of the space.\(^{35}\) (Figure 5.6)
Figure 5.2: 'L' Shaped Kitchen Cooking Counter

Figure 5.3: One Sided Kitchen Cooking Counter

Figure 5.4: Two Sided Kitchen Cooking Counter

Figure 5.5: 'C' Shaped Kitchen Cooking Counter
Miscellaneous

- If replacing existing finishes, use easy to clean finishes and anti-skid floorings to avoid accidents due to wet and slippery floors.
- Assessment Job sheet for Kitchen- Check for:
  - Walls and finishes
  - Flooring
  - Ceiling
  - Openings (doors, windows and ventilators)
  - Cabinets/shelves
  - Cooking platform
  - Sink
  - Plumbing electrical fittings
  - Electrical appliances
  - Other

Bathroom

Programming

- Give top priority to bathroom maintenance works. Replace or repair damaged finishes and plumbing leaks as soon as possible to prevent further damage.

Environmental

- Provide good quality light and ventilation into the newly added or altered bathroom.

Space Planning

- During the planning stage, it is important to determine types of product needed according to the use and users of the bathroom/WC. The various types of water closets (WC)
commonly used in India are Indian style Orissa pan WC, Anglo-Indian WC and European WC.

- Depending on requirements of the homeowners, provide separate bathrooms and WC’s or combine them together into one unit.

- The minimum area for a bathroom should not be less than 1.8 sq.m. with a minimum width of 1.2 m. The minimum area for a WC should not be less than 1.1 sq.m. with a minimum width of 0.9 m. For a combined bathroom cum WC, the area should not be less than 2.8 sq.m. and minimum width should be 1.2 m. (Delhi Building Bye-Law No. 14.5.1).  

- Bathroom/ WC should not directly open in a kitchen. One of its walls should open to the exterior and the minimum size of the opening should be 0.37 sq.m. (Delhi Building Bye-Law No. 14.5.3 (a)).

- To maintain privacy of bathrooms/ WC’s, position ventilators as shown in the Figure 5.7.

- If a new bathroom shares a wall with an existing bathroom or kitchen, then extending plumbing to the new bathroom can save money.

- In a combined bathroom, position products for maximum utilization of space.

- Considering the upgrading standard of living, if possible, provide space for washing machine.

- Provide sufficient space for everything including the products, storage, accessories, door, window or ventilator.

- Provide sufficient storage for clothes, toiletries and cleaning supplies.

- While upgrading an existing bathroom or adding a new one, provide properly designed plumbing, including water supply and waste disposal.

- During the planning stage, consider the location of existing and new accessories such as...
mirror, soap-dishes, towel rail, holders and other electrical appliances such as geysers.

- Select sanitary fixtures such as WC, washbasin, water taps, shower roses or bathtub carefully depending upon the users, usage, size, placement, and cost.
- To reduce the risk of electric shock, install electrical fittings such as lights, exhaust fans and power outlets so that they do not come in direct contact with water.
- Provide glass shelves with mirror to save space.

Finishes

- Provide easy-to-clean and impervious finishes for walls, ceilings and anti-skid flooring to prevent accidents due to wet and slippery floors.
- Full height glazed ceramic tiling may be provided to keep the walls dry.
- Assessment Job-sheet for Bathroom- Check for:
  - Walls and finishes
  - Flooring
  - Openings (doors, windows and ventilators)
  - Cabinets/ shelves
  - Electrical fittings and outlets
  - Plumbing
  - Sanitary fittings and fixtures
  - Drainage
  - Natural and artificial light and ventilation
  - Other
General Recommendations

- New rooms should not block light, ventilation or view of the interior rooms or adjoining dwelling units. (Figure 5.8)
- Follow the setback rules as per the site requirements for construction of a new room. (Delhi Building Bye-Law No. 12.4 (a) and (b)). Do not construct any room in the corner of any plot ahead of setback lines so as to maintain visibility and to avoid accidents due to blind turnings (Figure 5.9)

- Cupboard above and below the window can be provided. It is exempted from the Floor Area Ratio (FAR) calculation (Delhi Building Bye-Law No. 14.7.3). (Figure 5.10 and Figure 5.11).
Figure 5.10: Cupboard projection sizes exempted from Floor Area Ratio

Figure 5.11: Cupboard exempted from Floor Area Ratio provided above and below the window
Homeowners can select among the following design catalogue options according to their requirements.
5.5.2 BALCONY

Programming

- During the planning stage, balcony space requirement should be calculated according to the actual usage of the balcony in all seasons, i.e. to sit, relax, store or dry clothes. Hence, it should be designed for all the functions it will serve.

Structural

- Before any addition or alteration, check the building for structural loading capacity for the proposed new balcony or extension of an existing one.

Safety

- It may be provided with a metal grill for safety reasons.
- For emergency evacuation in case of a fire, the balcony enclosure windows or grills should be easily openable from inside.
- While adding a new balcony or extending an existing one, for the safety of children, avoid horizontal balustrade designs as children find it interesting to climb. If a vertical balustrade design is provided, then the railing bars should be very closely spaced as a wider gap gives children a wider space to climb. (Figure 5.13)

Figure 5.13: Horizontal Balustrade Designs
In vertical balustrade design, keep spacing between two vertical railing bars not more than 0.75 m. to protect children from falling down. (Figure 5.14)

![Figure 5.14: Vertical Balustrade Spacing](image)

Environmental
- Balcony enclosures should not block view, light and ventilation of the adjoining dwelling units and their balconies.
- Provide balcony enclosures with adequate openings to ensure proper light and ventilation of the interior rooms. (Figure 5.15)
- Enclose balcony with clear glazing instead of solid enclosure to decrease potential building weight and to admit natural light into the interior space.
- Avoid glazing on south and west facade to minimum heat gain from the summer sun.

Space Planning
- A newly added or altered balcony should have good connectivity with interior rooms and should act as an emergency exit in case of fire.
- It should have clear movement space.
- It may be enclosed so that it is useful in all seasons provided all the structural requirements are met.
Design the new balcony to maintain privacy of the existing dwelling unit as well as that of the adjacent ones.

The modified balcony may be used to create small garden space with seating and lighting so that it can be used during nighttime.

It may be designed to have storage space for gardening tools and loft space may be used to store items not needed in everyday life.

It may be provided with wide french doors to carry the indoors out.

For seating, light furniture that is easy to move, may be provided.

Materials

To limit the increasing building bulk due to new balcony additions and alterations, use lightweight materials as compared to traditional building materials such as reinforced cement concrete or bricks.

A variety of materials such as concrete, bricks, glass or metal, may be used for balconies and balustrades depending upon the personal taste and requirements of the homeowners.

Miscellaneous

In a newly constructed or extended balcony, provide efficiently designed artificial lighting or plumbing as per the requirements of the homeowners.

Provide balcony with a proper slope for drainage so that water does not accumulate.

It should have provision for drying clothes in the form of bars, rack or hooks.

Assessment Job-sheet for Balcony- Check for:
- Balcony size
- Location and type of openings
- Connectivity with other room(s)
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- Provision of overhangs or shading devices
- Anti-skid flooring
- Natural and artificial light and ventilation
- Balustrade
- Materials
- Storage
- Balcony furniture
- Electrical and plumbing fittings
- Safety and privacy
- Other

Guidelines pertaining to the Existing Building Bylaws

- New balcony overhangs in setback within one’s own land and courtyard should be limited to 0.90 m in width. (Delhi Building Bye-Law No. 12.6.1(c)).

Figure 5.16: Balcony projection within the plot setbacks
Design Catalogue (B) for Balconies

Figure 5.17
5.5.3 OPENINGS: (DOOR, WINDOWS AND VENTILATORS)

Programming

- During the planning stage, it is important to determine the purpose of the opening, i.e. an interior opening or an exterior opening.
- An exterior opening provides access to the outdoors, maintains visual continuity, protects the indoors from varying weather conditions and acts as a means of egress during fire. An interior opening provides access between two rooms and maintains visual continuity. Therefore, it should be designed accordingly. Hence, design the new opening to satisfy the various functions it will serve.
- Give top priority to repair works to prevent further damage. Repair or replace all deteriorated components especially that of exterior openings as soon as possible.

Environmental

- The newly added or altered window openings should provide good quality of natural light and ventilation. (Figure 5.18)
- Do not block existing window openings providing light and ventilation to the interior rooms for any reason. However, they can be relocated provided the quality of natural light and ventilation inside the room is not compromised.
- Provide new openings with clear glazing to decrease potential building bulk and admit natural light into the interior space.
- Avoid south or west facing windows to reduce heat gain from direct summer sun. If provided, protect them with wide overhangs or shading devices. (Figure 5.19)

Space Planning

- Before adding or altering any openings, measure room dimensions and consider traffic patterns of the room.
- Depending upon the requirements, location, size and cost, select new door, window or ventilator according to its use and the users of the household.

- Window openings should be located to facilitate cross ventilation within the room. (Figure 5.20)

- For efficient use of space, locate new doors to have clear movement patterns and good connectivity with other rooms, exit to balcony or terrace, toilet blocks or backyard if it is on ground floor. New door locations should not deteriorate existing movement patterns, but rather improve it. (Figure 5.21)
Safety and Privacy
- With respect to the surrounding dwelling units, locate new windows to maintain the privacy of both dwelling units by avoiding overlooking windows. (Figure 5.22)
- Exterior windows may be provided with safety grills for security reasons.
- Depending upon the location, provide sliding or folding panels to save space or provide wider opening for balcony or terrace to bring the outdoors inside.

Aesthetics
- As far as possible maintain vertical continuity of the door and window openings and place them in the same position on every floor. (Figure 5.23)

Miscellaneous
- Allow inclusion of accessories and upholstery for newly added or altered openings.
- Assessment Job-sheet for Openings- Check for:
  - Room dimension
- Room layout
- Room Furniture
- Opening size
- Type of door, window or ventilator
- Natural light and ventilation
- Ceiling, sill and lintel heights
- Material
- Easy to clean finishes
- Provision of shading devices
- Hardware fixtures such as latches, handles, knobs etc.
- Safety and privacy
- Other
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Design Catalogue (C) for Openings

(C1) (C2) (C3)

Figure 5.24
Doors- Windows

Front View
Front View
Front View

Perspective
Perspective
Perspective
5.5.4 CANOPIES

Structural
- Before adding or altering any canopy, check building for structural loading capacity of the proposed new canopy or extension of an existing one.
- Design new canopy additions and alterations, whether cantilevered or simply supported, to transfer loads properly to the ground. Anchor them firmly to the building or ground.
- Design them efficiently so that structural members in the building can transfer all loads to the ground.
- Depending upon the requirements of the homeowner, a fixed or movable canopy can be provided.
- Provide canopies with lightweight material, fabric or glazing to decrease potential building weight.

Environmental
- New or modified canopies should not block view, light or ventilation of the interior rooms as well as that of the adjoining dwelling units.
- For wider openings, provide wider canopies for protection from direct summer sun. (Figure 5.19)
- Design canopies based upon their purposes such as weather protection, shading and aesthetics.
- Provide canopy additions and alterations fitted with water drainage systems for proper rainwater disposal.
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Materials
- Various materials like concrete, glass, asbestos sheets, galvanized iron sheets or flame retardant fabric with metal frame may be used.

Miscellaneous
- Use light colors as they trap less heat as compared to dark colors.
- Assessment Job-sheet for canopies- Check for:
  - Canopy length, width and projection
  - Type of canopy
  - Opening size
  - Headroom and canopy height
  - Structural stability
  - Anchorage
  - Materials
  - Water drainage
  - Color
  - Other
Chapter 5

Design Catalogue (D) for Canopies

(D1) Front View

(D2) Front View

(D3) Front View

Perspective

Perspective

Perspective

Figure 5.25
Window Canopies
Entrance Canopies

(D10)

Front View

Perspective

(D11)

Front View

Perspective

(D12)

Front View

Perspective
5.5.5 STEPS/STAIRCASE

- Design new staircase addition or alteration based upon its location, space availability, purpose, staircase space requirement, aesthetics, cost and the building by-laws.

- Calculate space requirements for different types of staircases and actual space available on site, as homeowners often underestimate total area required for staircases.

- Before adding or altering any staircase, check building for structural loading capacity of a proposed new staircase.

- Staircases can be enclosed or open and external or internal. (Figure 5.26 and 5.27)

- New staircase additions and alterations, whether cantilevered or simply supported, should be designed efficiently to transfer loads properly to the ground. (Figure 5.28)
• Provide existing or new staircase with an opening for natural light and ventilation.
• External staircases may be enclosed or covered with overhangs for weather protection.
• For internal staircases, measure the room size and consider traffic/usage pattern of the room.
• In case of space limitation, new spiral or space saver staircases may be provided for efficient use of the existing space. (Figure 5.29 and 5.30)
• Use space below the staircase for storage. (Figure 5.31 and 5.32)

Various materials like concrete, glass, timber, steel can be used for staircase balustrade.
• Use anti-slip material for treads to avoid accidents.
• Safety grills may be provided for security reasons.
• Front steps can be provided with planters and seating.
Assessment Job-sheet for staircases - Check for:
- Canopy length, width and projection
- Types of staircase
- Space availability
- Staircase size
- Structural stability
- Tread, riser and width of flight
- Headroom
- Balustrade
- Materials
- Other
Design Catalogue (E) for Staircases

(E1)  
Perspective

(E2)  
Perspective

(E3)  
Perspective

(E4)  
Perspective

(E5)  
Perspective

(E6)  
Perspective
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Front Steps

(E13)
Front View
Perspective

(E14)
Front View
Perspective

(E15)
Front View
Perspective

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5.5.6 BOUNDARY WALL

- Boundary or compound walls are meant to demarcate plot boundaries clearly. Hence, provide them within the property lines.
- To avoid problems or legal disputes between neighbors, build common or shared boundary wall centrally, half way on both sides of the common plot boundary.
- Provide RCC or load bearing boundary wall as per the design and site requirements.
- Boundary walls should not be too high to block natural light and ventilation of any dwelling unit.
- They should not be too high to cast shadows on adjacent dwelling units. (Figure 5.34)

![Figure 5.34: High boundary walls casting shadows](image)

- Design them for privacy and safety considering aesthetics and visual impact within the surroundings.
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- They should not be too high to cast shadows on adjacent dwelling units. (Figure 5.34)

Figure 5.34: High boundary walls casting shadows

- Design them for privacy and safety considering aesthetics and visual impact within the surroundings.
- Locate entrance gate of boundary wall so that the front door of the ground floor dwelling unit is visible.

(a) (b) (c)  

Figure 5.35: Entrance gate locations

(a) Front door not visible from the entrance gate, (b) and (c) Front door visible from the entrance gate

- Vegetation along boundary walls softens the streetscape. Hence, encourage ground vegetation or potted plants.
- Provision of artificial lighting on boundary walls for nighttime, may help in crime prevention.
Assessment Job-sheet for boundary walls - Check for:
- Plot dimensions
- Length and height of boundary wall
- Loss of day light
- Shadow impact
- Visual impact
- Location of front door of dwelling units
- Frontage and corner plots
- Entrance Gate
- Lighting
- Vegetation
- Others
SECTION 2
5.5.7 TESTING PROPOSED DESIGN RECOMMENDATIONS AND CATALOGUE ILLUSTRATIONS

This section consists of the application of the proposed design recommendations and the design catalogue illustrations that explore various possibilities in terms of design, color, shape, form etc. Existing guidelines and proposed recommendations were studied after considering few hypothetical scenarios. Recently, DDA has allowed construction of extra one floor and has provided few additions and alteration guidelines for DDA flats such as:41
- Raising balcony or parapet wall with grill or glazing up to 5 feet height.
- Converting existing barsati into a room having 115 mm thick wall.
- Providing grills and glazing in verandah.
- To provide 2 feet wide sunshade projections.

Considering the latest encouraging stand by the Delhi Development Authority and the Municipal Corporation of Delhi allowing residential additions and alterations, various hypothetical scenarios were examined for one building in Dilshad Garden.
5.5.7.1 Hypothesis No. 1: Transformations as per the DDA by-laws

If the DDA by-laws had been strictly followed, then the transformations would have been limited to those shown in Figure 5.37, allowing one more floor, an enclosed balcony and no balconies overhanging all along the building in the public areas. But Figure 5.38 shows that people have transformed more that the actual permitted additions and alterations with two more floors, several balconies and other additions to the original building.
5.5.7.2 Hypothesis No. 2: Transformations Conforming to the original building

If DDA allows homeowners to transform their dwelling units conforming various factors such as design, color, form and materials to the original building, then the transformations would look devoid of any variety as shown in Figure 5.40, unlike the additions and alterations observed in case study examples. It looks similar to the original building, providing no scope for expansions or personal identity to individual dwelling units which was one of the reasons of transformations.
5.5.7.3 Hypothesis No. 3: Transformation Color Conforming to the original building

If DDA allows homeowners to transform their dwelling units as per their designs, forms or materials, but colors conforming to the original building, then the transformations would look similar to various options representing Figure 5.42 or Figure 5.43. Even though these options offer variety of design, materials or forms, it lacks variety of color as seen in case study examples. If proposed architectural recommendations and guidelines are very rigid, they will be flouted, as are DDA's existing building guidelines for additions and alterations.

![Figure 5.41: Original Building (1983)](image)
![Figure 5.42: Transformed Option 1](image)
![Figure 5.43: Transformed Option 2](image)
5.5.7.4 Hypothesis No. 4: Freedom of Design, Color, Form or Materials

In Figure 5.45 and 5.46, dwelling units were modified by providing flexibility to homeowners where they can select designs, colors, forms, shapes or building materials for their dwelling units of their own choice, thus allowing personal touch. These examples show that homeowners should have the freedom to add or alter as per their requirements. However, the structural stability and functionality of any dwelling unit or building should not be sacrificed at any cost due to additions and alterations.
5.6 Construction Guidelines

In urban India, most of the buildings are constructed with reinforced cement concrete (RCC) frame and brick infill masonry walls. Additions and alterations of such buildings often consist of the demolition of existing building elements and construction of new ones. Demolition of any existing portion should be carried out carefully without compromising the structural stability of the existing building. Existing load bearing structural members, such as columns and beams, are often chiselled which may weaken the entire structure. Due to this, it is very important to support the structure adequately so that it does not fail during the demolition or construction process. Similarly, the integration of new structural members with existing ones is equally important so that the overall building does not disintegrate, but rather acts as a monolithic structure in transferring dead and live loads properly to the ground. Most of the structural failures resulting in building collapse are due to several reasons, such as inability of structural members to carry loads due to their improper design, wrong methods of demolition or incorrect placement of structural members such as columns and beams. Therefore, it is important to educate not only homeowners but also contractors and masons through construction guidelines. As New Delhi falls in Seismic Zone IV, earthquake safety measures as per the National Building Code should be followed.

Considering the recent building collapses in New Delhi, these guidelines are meant to help homeowners as well as building professionals with new construction, or additions and alterations of the existing ones.

This section is divided into two parts:

- Basic guidelines for Reinforced Cement Concrete (RCC) framed structure with brick masonry infill walls
- Alternative building solutions
5.6.1 BASIC GUIDELINES FOR RCC FRAMED STRUCTURE WITH BRICK MASONRY INFILL WALLS

5.6.1.1 RCC Beams

- Under no circumstances remove or demolish existing beams unless recommended by a licensed structural engineer.
- Each beam should have at least two reinforcement bars at the top and two reinforcement bars at the bottom. Use deformed steel bars of minimum 10 mm sizes.
- In any case, width of the beam should not be less than 200 mm (8 in.). The width of the beam should be at least 1/3 of the height of the beam. E.g. for a beam having 900 mm (3 ft.) depth, the width should be more than 300 mm (1 ft.).
- In any case, spacing between two stirrups throughout the beam should not exceed 300 mm (1 ft.).
- Provide covering of 25 mm in beams to protect reinforcement bars from weathering and fire.
- Avoid point loads from columns on beams.
- In no case chisel beams or columns for electrical wiring or plumbing.
- To carry increased loads, strengthen a beam by enlarging its cross section area.
- Plumbing or electrical pipes must never pass through structural concrete members such as columns or beams. E.g. If necessary, provide pipes in beams such that reinforcement bars are straight and not bend around the pipes as shown in the Figure 5.52.
- When pouring concrete for new beams, columns, slabs or foudations, roughen the cold concrete surface slightly and provide anchored reinforcement.
5.6.1.2 RCC Columns

- Under no circumstances remove or demolish existing columns.
- Each column should consist of at least four bars in each corner. Use deformed steel bars not less than 12 mm size. 44
- In no case should column size be less than 200 mm (8 in.).
- Provide at least 300 mm size column if the next column is spaced more than five meters away. 45
- The width and depth ratio should not be more than 1:2.5. E.g. if one side is 200 mm (8 in.), the other side should not be more than 500 mm (20 in.). 46
- Spacing between stirrups should be 200 mm and not more than 300 mm (1 ft.). 47 (Figure 5.50)
- Tie stirrups as shown in the figure so that all reinforcement bars are held properly in place. (Figure 5.51)
Connect columns at every level with RCC bands. (Figure 5.53)

Avoid stilt columns (columns not supported by walls) as such soft storeys are always vulnerable to earthquake damage. (Figure 5.54, 5.55 and 5.56)

Do not leave reinforcement bars in columns for future construction exposed. Protect them from corrosion by providing a sufficient cover of 5 cm for weather protection if they are
going to be exposed to weather for a long time. (Figure 5.57)

- Do not construct a room, balcony or canopy on exposed columns unless recommended by a structural engineer as they tend to corrode and become weak and incapable to carry any load over time. (Figure 5.58)

- Before demolition, support structural members, walls or other building elements adequately.

- To carry increased loads, strengthen a column by enlarging its cross section area.

- Buildings fail when beams are thicker than columns, making them insufficient to transfer all the loads to the ground. Hence, beams should not be thicker than columns.49

![Figure 5.57: Concrete Cover for Reinforcement]

![Figure 5.58: Avoid construction on exposed corroded columns]

![Figure 5.59: Column Enlargement]

![Figure 5.60: Column and Beam Thickness]
5.6.1.3 Beam and Column Joints

- Lap joints (two reinforcement bars joined side by side in a beam or column) should not be very close to the junction of a column and beam. There should be a minimum distance of twice the depth of the beam between the junction and the lap. (Figure 5.61)
- Keep the reinforcement bars straight and do not bend them to accommodate other reinforcement bars. (Figure 5.62)

For addition or extension of an existing building, tie new reinforcement bars of new structural members properly to the reinforcement bars of the existing structural members.
- While adding a new beam, bend reinforcement bars of the beam ending in an external column into the column as shown in Figure 5.63. Bend bottom bars upwards and top bars downwards.
- While extending an existing beam or column, provide sufficient reinforcement embedment into the existing beam or column.
- If rebars are badly corroded, remove loose rust before construction.
- Before pouring concrete, apply cement paste to the old concrete so that it integrates with new concrete.

5.6.1.4 RCC Foundation

- Soil type within a region varies greatly. Hence, select foundations based upon the type of soil.
• Never place a foundation on loose soil but on hard and leveled ground.
• Before undertaking demolition of an existing foundation, support foundations adequately by underpinning, racking and shoring.

5.6.1.5 Brick Walls
• Use good quality burnt bricks of standard size (230 mm X 115 mm X 75 mm). Homeowners can use custom made burnt bricks or hollow concrete blocks depending upon their requirements and budget.
• Strengthen brick walls with RCC bands at sill and lintel level and if possible at every three feet level.
• Always break vertical perpends (vertical mortar joints) to avoid cracks in walls. (Figure 5.64)

Figure 5.64: Vertical Perpends

• Always support walls below to transfer loads properly to the ground. (Figure 5.65)
• Use fresh mortar mix 1: 3 (1 part cement and 3 parts sand) which has not started to harden, for bonding bricks. It should about 10-12 mm in thickness.
5.6.2 ALTERNATIVE BUILDING SOLUTIONS

As additions and alterations often increase the building weight, homeowners should use lightweight materials such as lightweight concrete, fly-ash bricks, Galvanized Iron sheets and metal partitions. Several lightweight materials are available in the market for walls, roofs, slabs, balconies, canopies, doors or staircases.

In India, local companies such as Indospark\textsuperscript{50} and multinational companies such as Hilti\textsuperscript{51} have started offering innovative building solutions. These companies provide high tech professional services for additions and alterations. Instead of the conventional practice of demolishing or chiseling existing structural members for their extension during transformations, now beams, columns or slabs can be extended without harming the structural stability of the building. Reinforcement bars are inserted into the existing structural members with the help of special drills and chemicals. Considering the risks involved during the demolition of any building element, these new technologies are a boon as they make this demolition and construction process more safe and reliable. Hence, homeowners should explore innovative materials and technological solutions within their area.
5.7 Summary of Transformation Recommendations and Guidelines

5.7.1 PRE-DESIGN GUIDELINES

Before Transformation:
Requirements
5.7.1.1 Write down the desired changes.

Budget
5.7.1.2 Calculate funds available from all the sources and set a transformation budget.
5.7.1.3 Talk to a building professionals to know the approximate cost of construction. Add 15-20% on top of it for contingencies.
5.7.1.4 Provide adequate funds in a timely fashion. Keep a record of the payments made.

Building By-laws
5.7.1.5 Go to the DDA Office and check the government building bylaws for proposed transformations.

Exploring Information
5.7.1.6 Attend housing exhibitions, workshops and seminars.
5.7.1.7 Review architectural magazines, newspapers and internet articles.
5.7.1.8 Visit building material shops. Check prices from few material suppliers.
5.7.1.9 If possible, sketch the desired changes. Ask family and friends for suggestions.

The Hiring Process
5.7.1.10 Ask suggestions from people who have transformed their house recently and inquire about good contractors.
5.7.1.11 Hire contractor(s), architect and masons based on their experience and not on lowest quotes.
5.7.1.12 Get all the drawings, estimates and contracts beforehand. Check if everything that you have asked for, is included.

During Transformation:

On-site Inspection
5.7.1.13 Discuss on-site problems with contractor(s) on a regular basis.
5.7.1.14 Clear the work area and keep the site as hazard free as possible to avoid accidents.
5.7.1.15 Inspect the overall progress, review budget and make revisions accordingly on a regular basis.

5.7.2 ARCHITECTURAL RECOMMENDATIONS

Area Calculation
5.7.2.1 Calculate existing space availability and space requirement for the proposed changes. Cross-check if sufficient funds are available for those changes.

Setback Rules
5.7.2.2 Follow the setback rules as per the site requirements specified in the Building By-Laws and do not construct outside the setbacks.

Light and Ventilation
5.7.2.3 Provide good quality natural light and ventilation. Allow cross-ventilation in the rooms.
5.7.2.4 Do not block openings providing light and ventilation to interior rooms.

Openings and Glazings
5.7.2.5 Avoid wider windows and glazing on the south and west facades to minimize heat gain from the summer sun.
5.7.2.6 Provide shading devices to minimize direct heat gain.
Fire Safety
5.7.2.7 For emergency evacuation in case of fire, provide easily openable window or balcony grills from inside.
5.7.2.8 Every room should have access to outdoors in case of emergency.

Layout and Movement Patterns
5.7.2.9 Locate new rooms, openings and place furniture to ensure clear movement patterns.
5.7.2.10 Draw a layout of the existing dwelling unit with proposed changes to scale or ask anyone who knows how to draw it.
5.7.2.11 Draw a furniture layout in it to check if the new changes integrate with the existing unit. Show it to the contractor.

5.7.3 CONSTRUCTION GUIDELINES
Demolition
5.7.3.1 In no case demolish an existing column.
5.7.3.2 Do not demolish existing beam or slab unless recommended by a structural engineer.
5.7.3.3 Before demolition, support structural members, walls or other building elements adequately.
5.7.3.4 In no case, chisel existing beam or column for electrical wiring or plumbing.

Reinforcement
5.7.3.5 Do not construct on columns having reinforcement bars corroded due to exposure to weathering conditions.
5.7.3.6 Provide sufficient cover for reinforcement bars in columns meant for future construction.
5.7.3.7 Provide proper column and beam joint where the reinforcement bars are tied properly together.
5.7.3.8 Provide sufficient reinforcement embedment where one column or beam meets another to ensure bonding with the original ones.

**Strengthening**

5.7.3.9 To carry increased loads, strengthen beams or columns by enlarging their cross-sectional area.

5.7.3.10 Avoid open 'soft' storey additions (building structure constructed only on columns).

5.7.3.11 Plumbing or electrical pipes must never pass through structural members.

**Materials**

5.7.3.12 Use good quality building materials.

5.7.3.13 Use light-weight materials to reduce building bulk.

5.7.3.14 Check innovative building solutions and materials available in the market.
The following table 5.2 provides a general methodology to use the summary listed above. It will help homeowners to organise their additions and alterations in a proper way. However, as housing transformations are site specific and depend upon the actual requirements of the homeowners, the sequence mentioned here can be modified or some points can be added or deleted to match the actual requirements of the homeowners.

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Table 5.2 Methodology to Use the Summary of Transformation Recommendations and Guidelines
5.8 Disadvantages and Advantages

The proposed housing transformation recommendations and guidelines may not be applicable to each house as they are dependent upon the specific requirements of homeowners and various factors such as site, adjacent dwelling units, location, cost, building material, labor skills. However, they can be applicable to cover wide range of housing additions and alterations from replacing a window to adding a new room. Also, innovative technology offered by companies such as Indospark and Hilti or use of alternative building material such as lightweight material for slab may not be very popular in India considering overall expenses, high cost of transportation or required skill labor. Nevertheless, in a longer run, they may be more economical, functional and safe as compared to the existing unsafe demolition practise.

Homeowners can refer to the proposed recommendations and guidelines while undertaking transformation of their units. Design catalogue options proposed in Chapter 5, are not limited to only those design illustrations. Unlimited permutations and combinations are possible by altering design, size, form, shape, color, material or usage of any building element. Thus, only one’s imaginations can limit design options.

The proposed housing transformation recommendations and guidelines will be useful to wide range of audience ranging from homeowners, contractors, masons, architects, interior designers, builders, students, researchers to city officials. These recommendations and guidelines will not only help in reducing mental fatigue of the people involved, but also make each dwelling unit more efficient in terms of cost, functionality, aesthetics and structural stability.
Notes


37 Nabhi's Board of Editors, Compendium. 2003: 29.


39 Nabhi's Board of Editors, Compendium. 2003: 30.

40 Nabhi's Board of Editors, Compendium. 2003: 25.


49 C.V.R Murty, AT RISK (California, 2006).


Chapter 6

Conclusions
The phenomenon of housing transformations is global and evident in many developing countries like India where a substantial amount of housing is provided in the form of government built housing. In New Delhi, where there is a current net housing shortage of 100,000 dwelling units, the major concern of the government housing authorities is to bridge this gap by providing more repetitive mass housing solutions. In the past 25-30 years, the Delhi Development Authority (DDA) has been engaged in providing same typical housing designs to people. Due to this, the actual spatial, sociocultural and financial requirements of the people are often underestimated. As a result, many families have undertaken housing additions and alterations of their dwelling units, either legally or illegally, to fulfill their needs.

The recent demolition initiative by the Municipal Corporation of New Delhi (MCD) to demolish illegal structures within the city not only changed the cityscape, but also upset the lives of those who have already transformed illegally, as the future of their properties remains uncertain. As the MCD has recently started a scheme to legalize such illegal constructions, the number of such additions and alterations is going to increase. To a common person in India, buying a house is a life’s dream, an investment of an entire lifetime. Due to various circumstances, when his needs change, he has two options, to move to some other place or to alter his dwelling unit. Considering the sky-rocketing cost of land and building materials and the bureaucratic hassles related to buying a new house, most choose the more economical option of altering their houses. Although this process of transformation means extra added expenditure on an already tight budget and often coping with unscrupulous housing officials and contractors, people still add or alter their dwelling units, demonstrating how necessary and inevitable it actually is.

In addition, transformation has been instrumental in increasing the overall housing stock as well as in changing housing dynamics. Today, residential activities are overlapping with commercial activities to make the maximum efficient use of the space as well as the
resources available. Although housing transformation exerts pressure on the civic and physical infrastructure of the city, it helps in reducing urban sprawl by accommodating more people within the same building footprint.

Transformation represents an opportunity for homeowners to invest in their houses for an improved lifestyle by transforming and upgrading them, as sufficient resources for the purchase of a new house may not be available. Housing additions and alterations demonstrate housing improvement and increase the market value of the property. Despite the reality that people actively invest in this phenomenon, there is no technical or financial support from the government or any housing agency for additions and alterations. It is therefore even more crucial to educate homeowners to ensure a maximum return from their investment. Hence, the government should consider housing transformation as a feedback in terms of housing needs and offer technical assistance and financial support. Moreover, as these transformations are mostly undertaken unofficially through informal low-skilled labourers, they are hardly on official records. This implies that if the government takes effective measures, untapped potential in the form of unauthorized construction and employment opportunities in the informal sector due to these transformations can be explored.

Consequently, this thesis aimed to study and understand the development of housing transformation among New Delhi’s Middle Income Group and the various factors associated with them and to guide homeowners wishing to add or alter their dwelling units by proposing guidelines and recommendations for future housing transformations. The middle-income group was chosen as it forms 48% of New Delhi’s population, has the capital to invest in housing, and most of the housing stock in the formal sector is being built for this group.

Extensive library and internet research helped to prepare the background work for the field trip to India in July 2006. The field trip included acquiring information from the School of Planning and Architecture library in New Delhi, obtaining architectural drawings and housing
data from the DDA offices and interviewing the DDA authorities who were responsible for providing the government built housing in New Delhi. Research on identified case studies in three DDA middle class colonies in Dilshad Garden, Janakpuri and Munirka, helped to get insight knowledge of this process. Homeowners and other residents were interviewed to get first hand information on the actual overall housing transformation process. Various trends of transformations were found for different building elements such as rooms, balconies, door-window openings, canopies and staircases, having varied designs, colors, forms and materials.

Based on the study and analysis of these case studies, a few key areas requiring immediate attention were identified to help homeowners with the addition and alteration of their dwelling units. The 'Pre-Design Guidelines' were devised so that homeowners understand their own requirements and limitations, and to educate them regarding various factors associated with housing transformation, ranging from hiring a contractor or an architect, checking their budget and contracts to inspecting the overall process thoroughly. The 'Architectural Recommendations' provide guidance to homeowners who are willing to add or alter their dwelling units and to encourage them to consider various designs, room layouts, traffic patterns, colors, materials, furniture, accessories and most importantly, structural stability of their building in an integrated manner. Design tips and illustrations were proposed for various building elements such as rooms, balconies, openings, canopies and staircases. Similarly, considering the recent deaths in New Delhi due to building collapses, construction guidelines were provided to educate homeowners, building contractors, builders, architects and masons about the basics of RCC frame construction.

These housing transformation guidelines and recommendations are meant to guide homeowners, contractors and masons in carrying out additions and alterations in an organized and safe manner by reducing their mental stress and wastage of time, energy and
money. This will make the overall housing transformation process as well as the individual houses more efficient in terms of functionality, cost, aesthetics and structural stability. These guidelines will not only help the homeowners get maximum benefits from their investment but will also improve the standard of housing in New Delhi to some extent.

Despite the fact that housing transformation is not a recent phenomenon in India, this user-participative architecture has not received the attention it requires. Thus, the gravity of the problems associated with this phenomenon remains underestimated, as the end-result of this process does not meet people’s needs. On an individual user scale, the transformation of one’s home relates to the aspirations of one’s family; on a larger scale, it relates to improving or deteriorating the standard of housing quality. By documenting New Delhi’s current housing scenario, housing transformations undertaken in DDA’s MIG housings, their reasons, trends and consequences, this research aimed to bring this grave issue to the forefront. The overall intention is to outline the importance of this issue which needs to be acknowledged by homeowners undertaking additions and alterations as well as by the housing professionals who are involved in providing housing.

Even though the MCD has started a scheme to legalize illegal construction and the DDA has published a small booklet allowing few addition and alteration changes within DDA flats, a lot needs to be done in this context due to the increasing scale of this process of transformation within the city. By proposing guidelines and recommendations for housing transformations, this thesis aims to provide the much-needed technical support to homeowners, contractors, masons, architects, interior designers, builders, building engineers, students, researchers and city officials who are working in this field. At a later time, these guidelines will be made available to the public in the form of a website and a booklet. The guidelines and recommendations suggested in this thesis are not limited to New Delhi itself, but can be applied elsewhere to housing transformation of any scale.
As this research was carried out in New Delhi in July 2006 when the Municipal Corporation Delhi was undertaking a demolition drive to demolish illegal structures within the city, the frustration and anger of the owners of such properties against the government affected this study to a great extent as many owners were unwilling to participate in the survey. The case study observations included in this research are limited to the three DDA middle class housings in Dilshad Garden, Janakpuri and Munirka. As trends of transformation vary in each context depending upon different housing layouts, reasons or circumstances, more research of comparable sectors in other locations will be beneficial. This will help the professionals working in housing research and development by providing a broader scope and perspective in improving the quality of housing.

As the migration of people to New Delhi is increasing, housing transformation will also continue to accelerate. Government housings, either for the Economically Weaker Section, Lower Income Group, Middle Income Group or Higher Income Group, will continue transforming and evolving to provide more economical and adequate housing solutions to those who have limited or no options. More research is required on such user-participative housing designs to match the requirements and affordability of the buyers. As the increasing cost of land and building materials is a major factor governing this phenomenon to a large extent, it would be useful to study how transformation priorities are set and how this cost factor affects their housing designs. This knowledge might be useful for designing efficient housing designs and for establishing these housing transformations as potential investment for improving future housing quality better suited to the user's actual preferences and requirements.
BOOKS


<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Publisher/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contemporary architecture of Delhi: a photo series</td>
<td>School of Planning and Architecture, New Delhi and Desai, Prasanna A.</td>
<td>New Delhi: School of Planning and Architecture, 1983</td>
</tr>
<tr>
<td>Housing and building technology in developing countries</td>
<td>Strassmann, W. Paul</td>
<td>East Lansing: Division of Research, Graduate School of Business Administration, Michigan State University, 1978</td>
</tr>
<tr>
<td>One-stop approval for minor residential renovations</td>
<td>Tasker-Brown, Julie et al.</td>
<td>Ottawa: Canadian Home Builders' Association, 1999</td>
</tr>
<tr>
<td>Affordable, adaptable housing</td>
<td>Teasdale, Pierre</td>
<td>Ottawa: Canada Mortgage and Housing Corporation, c2000</td>
</tr>
<tr>
<td>Extending themselves: user-initiated transformations of government-built housing, in developing countries</td>
<td>Tippie, A. Graham</td>
<td>Liverpool: Liverpool University Press, 2000</td>
</tr>
<tr>
<td>Illegal Facades</td>
<td>Wojtowicz, Jerzy</td>
<td>Privately published, Hong Kong, 1984</td>
</tr>
<tr>
<td>A Place to live: More effective low-cost housing in Asia</td>
<td>Yeung, Yue-Man &amp; International Development Research Centre (Canada)</td>
<td>Ottawa: International Development Research Centre, c1983</td>
</tr>
</tbody>
</table>

**ONLINE CONFERENCE PAPERS AND REPORTS**


with Masonry Infill Walls, World Housing Encyclopedia Tutorial, Earthquake Engineering Research Institute, Oakland, California, 2006


Patel, Shirish. RCC Construction: Guidelines for use of steel rods in RCC construction.

Portela, Maria Del Carmen. Settlement Patterns in Unplanned Areas: Case Study San José de Chirica, Ciudad Guayana, Venezuela. M.Arch Thesis, McGill University, Montreal, August, 1992


http://iaps.scix.net/cgi-bin/works/Show71202bm1024, November 06, 2006.


Shekdar, Dilip and Adusumilli, Uma. Regulatory Guidelines for Affordable Shelter -The Indian Case Study, Navi Mumbai India


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Das, Partha Ranjan, India 2000: a mirror of stagnation, Low Income Housing, Belapur, New Mumbai (Charles Correa).

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The Hindu Online Edition, One long day of demolitions and defiance in Delhi, December 25, 2005.

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NDTV.com: Delhi, Woman dies in Delhi Building Collapse,


The Hindu, Authorities caught napping, New Delhi, 2005

The Times of India, Five of family buried in wall collapse, New Delhi,
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