

# Optimizing The Spatial Configuration of Existing Micro-Apartment Designs in Developed Countries

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**Abstract:-** As need for shelter increases day by day and the land available for construction of new buildings decreases, need for efficient and economical shelter increases. Micro apartments will make way for cheaper and smaller individual residences within the same super built up area compared to the existing standard apartments. The prime motive of the research is to establish a set of standards in order to optimize the spatial configuration of existing micro apartments considering different aspects irrespective of the climatic conditions. The spatial configuration of any habitable space is influenced by a number of factors such as furniture, area, openings, plants, etc. and these factors become critical with decreasing footprint of the overall house/apartment. The review understands the aspects of spatial configuration by comparing and analyzing different cases, to draw out a set of standards for optimizing the existing standards such that the micro-living units are well suited for the millennial population living in high rent cities where space comes at a premium. It is sound that it is necessary to develop the interiors and the spatial configurations of micro apartments in such a way that it gives more comfort to the inhabitants and not increase their stress. The study report suggests that in-order to develop a set of standards for micro sized apartments, it is important to alter the existing anthropometric standards set for human habitation. As a result, standards are set for a relatively easier design and development of micro apartments, in terms of interiors and spatial configuration.

**Keywords:** *Micro-apartments; Affordable housing; Anthropometry; Collapsible furniture; cramped apartment;*

## 1. INTRODUCTION

The existing building codes and standards for typical apartments and similar high-rise residential developments has evolved throughout the years that there are a number of options to choose from, huge amounts of ideas, interiors elements etc. to work around, but in case of micro apartments which are not so popular and which are emerging as an acceptable residential model, there aren't too many options to choose or get inspiration from.

The design of micro apartments i.e., the ones with lesser square feet, holds a challenge to achieve a completely working spatial configuration similar to the larger homes with more area designated for different functions.

**Aim:** To develop a set of standards for optimizing the spatial configuration of existing micro apartment designs in developed countries.

The subject studies what micro apartments are and why they are developed lately. It manifest different aspects making up the spatial configuration of a micro apartment; like furniture, openings, and plants etc.

The study also comprises of different case studies to study and compare existing micro apartment designs and their spatial configurations, in order to draw out the ideal standard for the micro apartment design. A detailed study on the furniture systems used in micro apartments and the various innovations (technological and functional) in the same are done in order to set standards for a relatively easier design and development of micro apartments in terms of the interiors and the spatial configurations.

In the year 2017, according to the Joint Center for Housing Studies of Harvard University 30% of income was spent by a full third of families. Hike in purchase rate increased the area of houses. The area of a new home in the US gained 1000 square per feet concluding a 62% increment range in the year from 1973 to 2015. (J Sparshott, 2016). Simultaneously occurring population changes have reduced the average number of people per household (US Housing and Urban Development, 2015). This creates a quandary situation; Growth in the purchasing cost of the unit can load a suitable population size despite the number of inhabitants. This comes with sumptuous payment amount for the opportunity.

Micro home construction has established a greater attention during the last few years. Modernization in ideas for micro accommodation have begun to emerge in many urban dwellings around the world. It even allure media, and more articles titled "Want to be happier? Live in a small home" (The Week, 2017) and "Are tiny houses and micro-apartments the future of urban homes?" (The Guardian, 2014) have begun to appear in several publications. Supporters of this trend propose numerous benefits of building and living small, like increased affordability, sustainability, and flexibility. Modernity in terms of lifestyle in terms of settling down in life is considered as the best client for such models. At the same time, the increase of the sharing economy and the simultaneous cultural shifts have allowed urban inhabitants to live with far fewer physical assets (Infranca, 2014). The notion of Micro-housing would justify the present scenario.

## 2. REVIEW OF LITERATURE

Micro housing typologies is undergoing a revival of sorts. Small apartments were a result of inadequate living situations, higher residential density in a small area and slum-like accommodation by the end of 12<sup>th</sup> century (Hall, 2002). After decades of advocating urban consolidation policies as an alternative to urban sprawl by Australian planners and policymakers (Randolph, 2006). Optimum living standards have started becoming more popular and the connection between small apartments and poor living conditions is dissipating. A new process of conversation regarding small dwelling types, including micro-apartments, has begun as a result of shifting attitudes and increased acceptance of apartment living in cities. Architects, who have long been intrigued by buildings that demonstrate feats of revolutionary design in the face of challenges such as limited floor space, are driving interest in micro-apartments. This is reflected in contemporary architectural awards, which honour practitioners who achieve high standards of amenity in small spaces. It's no wonder, then, that architectural spheres are currently focusing on micro-apartments and other compact dwellings. Smaller dwelling types are often discussed in architectural magazines and newspaper real estate pages, both in print and online. (Duke 2015).

## 3. MICRO APARTMENT

The basic unit of society and the primary unit of human habitation is the apartment or house (Dr. Sudhi Mary Kurian and Dr. Ashalatha Thampuran, 2011). One of the most important aspects of people's lives is having adequate housing, which is a major component of their material living conditions (Streimikiene, 2015)

### 3.1. What are Micro apartments?

Micro apartments have the approximate dimensions and are just what their name implies: small homes. They're also being recognized as a worthy derivation to the affordable housing shortages affecting many big cities (Ravenscroft, 2017). Micro units are usually 350 square feet in size, but they can vary from less than 250 square feet to 500 square feet depending on city building codes. They do not have separate bedrooms; sleeping and living areas are mixed, but they do have completely equipped bathrooms and kitchens. Outside of the units, micro-unit communities put a strong focus on amenities like common gathering areas that promote socializing and cultivate a sense of community (Riggs, 2014)

### 3.2. Need for Micro apartments

There are three major factors that affect the acceptance and growth of micro apartments; Affordability, Location and Lifestyle.

Micro Apartments are based on the idea that by constructing smaller dwellings, more apartments can be built as part of a construction, lowering the per unit selling price of an apartment (Ravenscroft, 2017).

The micro unit's appeal is primarily economic, along with location and privacy. Many who are willing to dwell in micro units are looking for a way to cut their rental costs (the units usually rent for 20 to 30 percent less); they are also attracted to the fashion "hip" neighborhoods where micro units are typically located, as well as the opportunity to live alone (Riggs, 2014).

### 3.3. Habitation in Micro apartments?

Micro units' target demographic is primarily young adult singles, typically below 30 years old and earning less than \$40,000 a in the span of 12 months, with males marginally outnumbering females. Couples, older single empty nesters, and transient consumers are among the other consumer segments. Singles who are actually sharing a room with roommates are the most involved in switching from a conventional home to a smaller home. (Riggs, 2014).

While the target user group for micro apartments is primarily the younger generation with a busy lifestyle and a majority of singles, there is another user group – middle-income senior citizens who want to live in the city. These clutter-free and practical micro homes are, in their opinion, a much superior alternative to traditional country retirement homes/mansions located far from the city.

According to Kevin Deck, AIA, of SFCS Architects, a company that specializes in senior housing, "The key advantage of micro-apartments for seniors is reducing the amount of stuff you have to take care of." "There is no yard to repair in congregate settings, and upkeep is done by the community." Other advantages include easier access to transportation, more social opportunities, and lower average housing costs. With less things and a simpler home to manage, you can devote more time and energy to living a fulfilling life (Resource Furniture, n.d)

Micro-apartments have increased in popularity over the last five years. The micro-apartment model is evolving from a niche architectural-based design challenge to a viable housing option for several major international cities.

### 3.4. Micro-apartments of New York City

A micro-apartment pilot project in New York is fuelling this growing interest in small apartments. New York City, like many other global cities, is grappling with persistent housing affordability problems and an increase in single-person households. (New York City Department of Housing Preservation and Development, 2012).

Many of these single-person households have shown an interest in living near the city centre. However, due to a scarcity of suitable existing housing stock, this is unlikely to happen. In response to these concerns, Michael Bloomberg, the (then) Mayor of New York City, launched the 'adAPT NYC' initiative in 2013, a set of housing initiatives that included a pilot project to encourage the construction of micro-apartments. On a government-owned property, the project eliminated zoning regulations to allow the construction of 55 micro-apartments, each measuring less than 35 square metres. This project, now known as Carmel Place, drew widespread international attention and sparked the idea that micro-apartments could be a viable housing choice in global cities where larger apartment typologies are the norm. More significantly, it decoupled the typology from notions of deplorable living conditions and reimagined micro-apartments as an aesthetically pleasing and attractive living choice (New York City Department of Housing Preservation and Development, 2012)

### 3.5. Micro-apartments in Sydney

Sydney, like New York, is grappling with housing affordability problems, which is why the Carmel Place project has piqued the attention of some Sydney-based architects, designers, and policymakers. Sydney has gone through a number of systemic reforms over the last 40 years that have led to existing housing affordability problems and changed household composition. The dramatic increase in the number of people living alone has been one of the most significant changes in Sydney's household composition (de Vaus, D & Qu, 2015). In 2016, one out of every five households in Greater Sydney were single person households, but only one out of every thirteen existing dwellings were studios or one-bedroom dwellings, a housing style that meets the needs of this population without the 'luxury' of extra space (Australian Bureau of Statistics, 2017)

In Sydney, housing cost inflation has outpaced wage growth for a long time, putting many families in a financial bind and leaving them with little money to spend on necessities (Fox, R

& Finlay, R, 2011) As a result, higher-cost housing appears to cluster around job-rich areas, resulting in the phenomenon of spatial mismatch. Economic change has concentrated high-paying jobs in the city's core, driving up demand for housing near these areas. As land supply tightens, low- and moderate-income households are forced to look for housing further away from job centres, limiting economic opportunity and compounding disadvantage (van den Nouwelant, 2016). The interaction of these factors results in single-person households, which are more likely to encounter housing stress, being unable to find appropriate or affordable housing near key job centres. With the number of single-person households expected to rise, (de Vaus, D & Qu, 2015). With high housing prices expected to continue, new approaches to provide affordable housing options, such as micro-apartments, are being considered.

### 3.6. Emerging interest

Interest in micro-apartments is coming from various built environment sectors. Developers are interested in micro-apartments in the wider context of the roll-back of amenity-based planning controls such as the Apartment Design Guide (ADG) to reduce development costs (Property Council of Australia 2015; Urban Taskforce Australia 2017). Planners and some academics have started to discuss micro-apartments in forums searching for housing affordability solutions, but acknowledge that further investigation is required (Let's Hack Housing 2016; Co. Lab 2017; Designing Affordability Symposium 2016). Most notably, protocol makers are answerable for setting the housing and planning policy agenda are contemplating smaller housing typologies. In 2017, the New South Wales (NSW) Government announced a housing incentive for affordable housing directly indicating the marketing of micro-units.

The inclusion of compact apartments as part of the NSW Government's housing affordability package signals a clear political interest in small dwelling forms. However, discussions about micro-apartments are still in their infancy, so limited consideration has been given to date as to how such dwellings can be accommodated within the existing planning framework.

## 4. KEY ASPECTS IN SPATIAL CONFIGURATION OF MICRO APARTMENTS

The spatial configuration of any habitable space plays an important role in making the space usable and functional. So is the case of micro apartments where every element plays a key role in making the whole singular space functional and fulfil different

purposes. There are a lot of aspects which influence the spatial configuration of micro apartments, certain selected aspects are discussed here.

#### 4.1. AREA

The size of micro-units could vary between 400 square feet to 200 square feet housing a kitchen platform, a bathroom and precise storage area although the size may vary as per the standards of a particular area or a region.

#### 4.2. FURNITURE

Furniture plays a key role in the spatial arrangement and functionality of a micro apartment. Micro apartments usually consist of furniture units that are room saving, multipurpose, sturdy and maintenance free. Although each micro apartment's furniture is custom designed and made, the following are some of the most commonly used furniture systems:

##### a) Murphy Bed



Figure 1: Nuovoliola 10 Murphy Bed by Resource Furniture (source: thespruce.com)

Dynamic furniture like suggested in the above picture could relatively increase the available space in the interiors. (AphroChic, 2018).

##### b) Expanding Table



Figure 2: The Goliath Expanding Table by Resource Furniture (source: thespruce.com)

Other perfect example of a dynamic furniture is the Goliath table transforming into a magnanimous dining table with available specifications. (AphroChic, 2018).

**c) Hidden storage**

Figure 3: Staircase made of cupboards by French architects Schema (source: Dezeen.com)

Minimalistic approach in terms of furniture turns out to be space-maker for smaller rooms. An alternating-tread staircase doubles as storage cupboards in this tiny Paris apartment (Dan Howarth, 2014). This type of storage is effective in case of apartments with high ceilings which makes way for a loft space.

**d) Compact Kitchens**

Figure 4: GE Micro Kitchen by Ryan Diener (source: ryandiener.com)

Amalgamation of kitchen entities (Refrigerator, a working sink etc.) in one single unit points out the idea of all in one without compromising the luxurious kitchen feel which depends upon the manufacturer. (Housely, n.d).

The GE Micro Kitchen is a full appliance suite that fits into six linear feet, all under the counter. Three 24" modules responsible for cooking, cooling and cleaning. Designed to blend seamlessly into compact settings, the micro kitchen delivers the power of full-sized appliances in a pint-sized package. All appliances are housed in drawers including a microwave oven, conventional oven, convertible refrigerator and freezer, dishwasher and an induction cooktop. A downdraft hood and kitchen sink with disposal complete the full kitchen experience (Ryan Diener, n.d)

**4.3. PLANTS**

Plants are an important factor in the spatial arrangement of a micro apartment for a variety of purposes, from purifying the air to making the room more inviting and alive. Growing plants in a micro apartment's small space with insufficient sunshine, on the other hand, poses a challenge. Low-maintenance plants and space-saving growing techniques include:



**a) The low maintenance plants**

*Figure 5: The snake plant (source: makespace.com)*

Sansevieria trifasciata AKA viper's bowstring hemp AKA the snake plant, an intriguing species native to tropical West Africa. Snake plants can grow tall, even in the part where light does not extremely penetration is one of the least maintenance houseplants and one which can have the biggest effect on the air quality of the apartment. Other plants that love low light have a similar effect on the apartment: Philodendron, spider plants, and peace lilies top the list of species to ward of pollutants without the requirement of bulky light amount. , (McFarlane, 2016). These plants can be grown in small pots as small as the size of a large tea cup.

**b) Wall Planters**

*Figure 6: Trigg wall planters by west elm (source: makespace.com)*

A replacement to plants requiring larger amount of sunlight and shade, these species have a dual use of wall-art cum plant. (McFarlane, 2016).

#### c) Climbing Vines



Figure 7: Plant table by JAILmake Studio (source: makespcae.com)

The Plant table pictured below, statically supports vine growth signally to avoid separate climber supports Pathos and Swedish ivy can sit on any shelf and crawl down or across it in a few months (McFarlane, 2016).

### 4.4. OPENINGS

Swinging doors and windows in regular homes need a certain amount of space for the swing to complete (whether inwards or outwards). Such areas must be considered in micro apartments, where every square inch counts. To get enough space in a micro apartment, you'll need smarter doors and windows that give you more elbow room.

In the case of micro apartments, which are constructed in tightly packed layouts inside the available spaces in cities, being well lit is considered a premium. As a result, windows must be smart in order to accommodate enough light and provide adequate ventilation without jeopardizing the privacy and protection of the residents.

#### a) Sliding Pocket Doors

Although sliding doors are used in standard homes for purposes other than main doors, it's a big space saving design element in case of micro apartments. The area which is used for the swing action of normal doors can be saved by using sliding doors.

#### b) Classic Japanese sliding doors

The classic Japanese door is also known as shoji doors (The History of Japanese Sliding Doors, n.d) that slide along the wall consists of wooden framed doors with internal

divisions as windows made from paper instead of glass or wood. This turns out to be an excellent space saver and also cost effective which is another crucial element in case of micro apartments. These doors are generally used as privacy screens or a separation between spaces within a micro apartment.



Figure 8: Shoji doors used in interiors (source: pareti scorrevoli, pinterets )

#### c) Large windows

Most of the existing micro apartments consists of one single full height window in the living/sleeping area that acts as both as source of natural light as well as an opening to a balcony. This makes it easier to clean and access.

### Qualitative Study

#### 4.5. STUDY AREA

This study is based on data pertaining to micro apartments/micro living developed in accordance with the lifestyle of the urban population in developed countries namely UK, USA, and Australia.

The **millennial population**, the young working class and the gen-z, who are likely to marry later in life and have fewer kids than previous generations, are the user groups considered for the study.

The criteria for analysing spatial configuration are limited to the four aspects; **furniture, openings, plants, area** with secondary data from books, journals and previous studies.

#### 5. CASE STUDIES

Micro-Units in disguise feature a community feel with plenty of common areas and high-end amenities including gyms, recreation areas, spas and bike valets for giving them a bigger arena and are designed to be space-efficient as well LEED certified. (Bowman, 2018).

##### 5.1. Carmel Place, NYC

Carmel Place (formerly known as My Micro NY), is the winning proposal in the adAPT NYC an initiative launched as part of former Mayor Michael Bloomberg's administration's New Housing Market place Plan to house the city's growing small household population. The project was established with the help of the New York City Department of Housing Preservation and Development. It was backed by the real estate company Monadnock Development.



- **Location:** Kips Bay, Manhattan, New York
- **Total built up area:** 35,000 square feet (3,250 square meters)
- **Total number of units:** 55 (ranging from 250 sq. ft – 370 sq. ft)
- **Average monthly rent:** \$950 (median rent for one-bedroom apartment in Manhattan being \$3,400 (Carmiel, 2015), (Kaysen, 2015)).

Micro apartments house low to middle income tenants without compromising the luxurious feel.



Figure 9: Carmel Place west facade (source: nArchitects, 2015)

### 5.1.1. Design and construction

“nARCHITECTS designed the exterior and interior spaces of Carmel Place as a repeatable and systemic new paradigm for housing in NYC and other cities with similar housing challenges” (nArchitects, 2015).

### 5.1.2. Individual Units

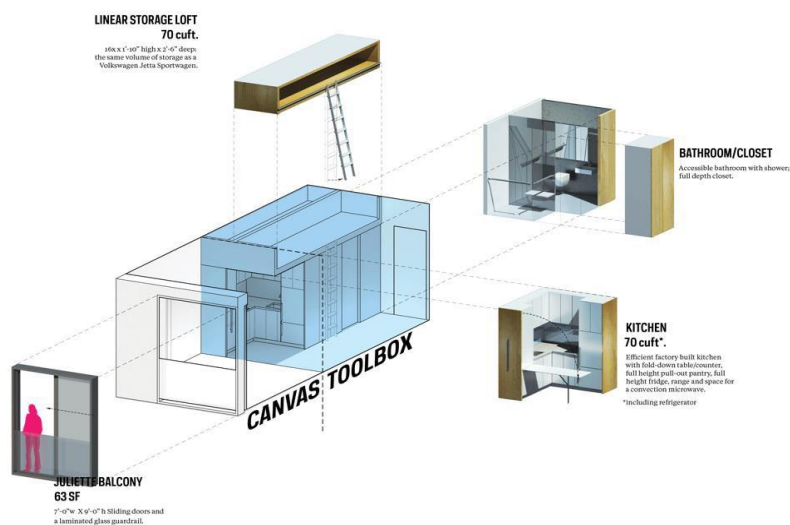


Figure 10: Micro Unit diagram (source: Dezeen, nArchitects, 2016)

The architects' prime aim was to provide facilities in bunk in such type of accommodation. To achieve this goal, the architect-developer team increased the size of everything except the floor area: 9'-8" ceilings result in a volume that is close to or exceeds that of a regulation 400sq.ft apartment, which, housed with the adequate daylight made possible by 8' tall sliding windows and Juliet balconies, maximize the perceived volume of space.

The building offers five basic micro-unit types which differing in dimensions and configuration, thereby widening the array of options for small family households.



Figure 11: Typical Floor Plan (source: Deezen, nArchitects, 2015)



Figure 12: Unit Types – typical floor (source: Deezen, nArchitects, 2015)

The office in collaboration with the company Resource Furniture to create a built-in piece of furniture that combines a sofa, bed and storage, so the living room can be turned into a bedroom.

To summarise within a compact footprint, the team prioritised providing residents with as much volume, light, air and views out to the neighborhoods as possible.



Figure 13: Typical Unit - day time configuration (source: Dezeen, nArchitects, 2015)

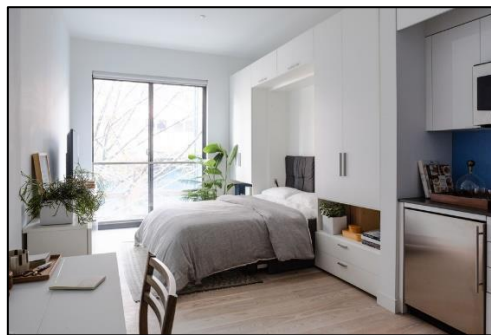


Figure 14: Typical Unit - night time configuration (source: Dezeen, nArchitects, 2015)



Figure 15: Typical Unit – Kitchen and Dining (source: Dezeen, nArchitects, 2015)

### 5.1.3. Amenities

Carmel Place's common requirements are handy to all residents. Neighbourhood interaction is encouraged with scattering of such requirements and eventually strengthening the community. Shared amenities house a gym, lounge, community room, and roof terrace.

The provision of common amenities reduces the requirement of each and every function of a large home such as gym, garden, lounge etc inside the micro units. This in turn helps in expanding the living spaces for the inhabitants.

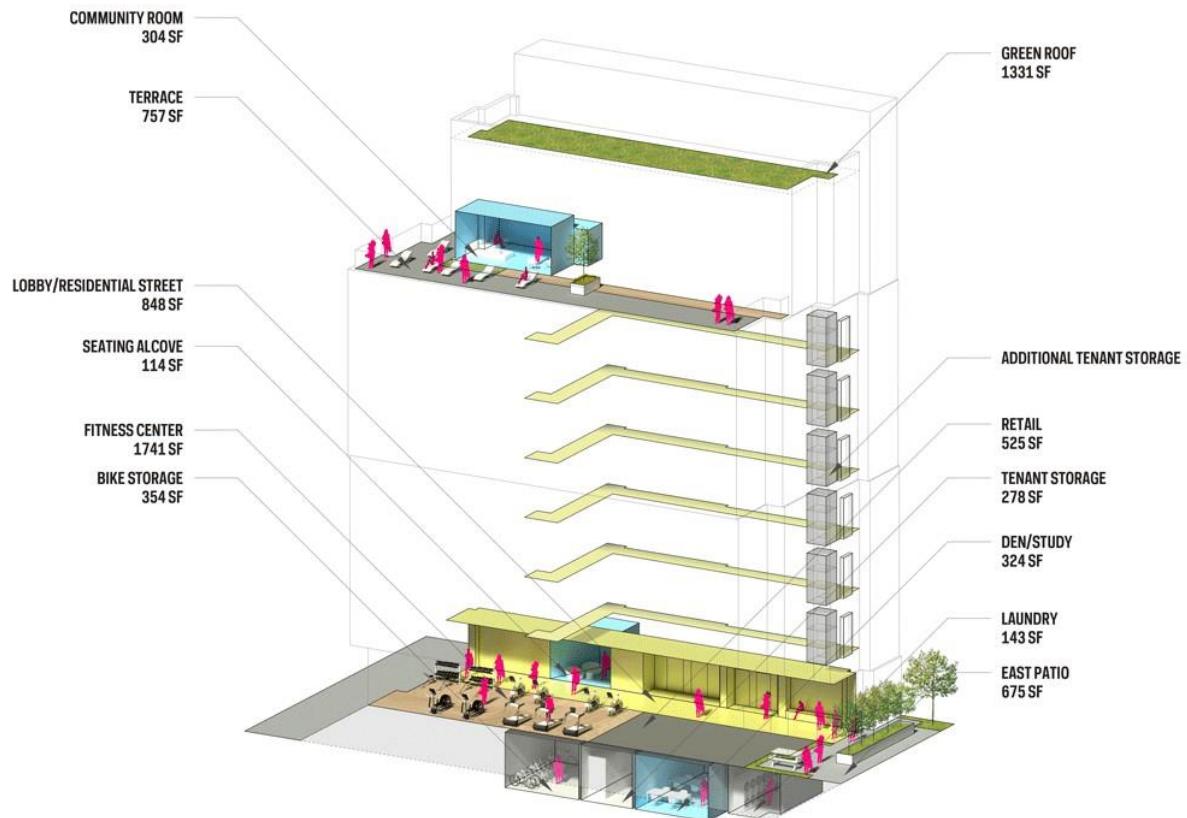


Figure 16: Amenities diagram (source: Dezeen, nArchitects, 2015)

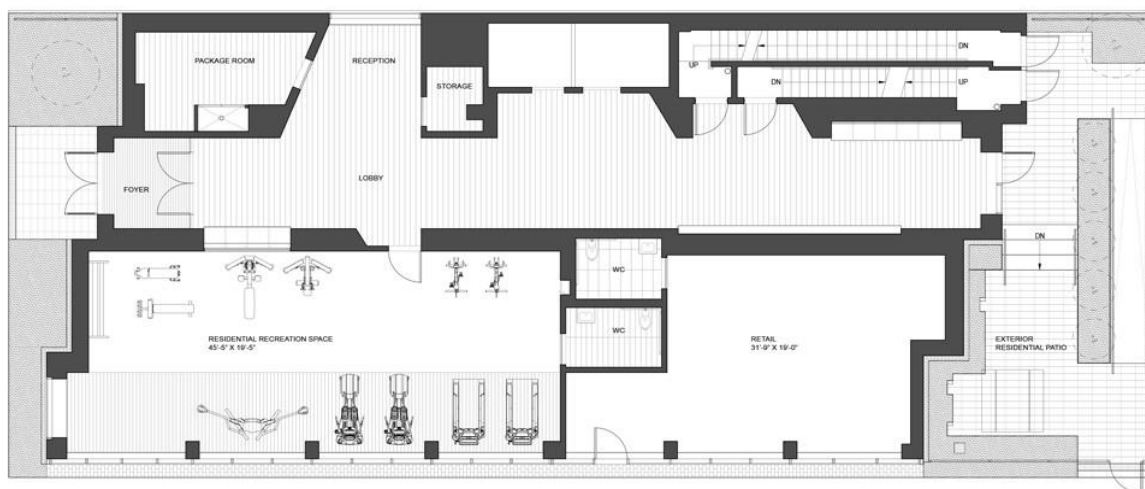


Figure 17: Ground floor plan (source: Dezeen, nArchitects, 2015)

#### 5.1.4. Spatial configuration - Analysis

##### 5.1.4.1. Area

There are seven types of apartments in this complex. The areas of different types are shown below:





Figure 18: Areas of different units (source: Dezeen, nArchitects, 2015)

#### 5.1.4.2. Openings

Manhattan has a humid subtropical climate which is characterized by hot and humid summers, and cool to mild winters. All of the units in this apartment are linear in shape and consists of only one large room without any partitions. Thus, the single large full height window which is 8' tall in most of the units are enough for light, ventilation and to provide thermal comfort to the inhabitants.

#### 5.1.4.3. Furniture

The furniture used in the apartments are by Resource Furniture. It consists of a Penelope Sofa wall bed designed in Italy by Clei, a Mini coffee table that converts into a work table or dining table, and Pocket Chairs.

- The Penelope 2 Sofa is a vertically-opening, freestanding wall bed featuring a 2-3 seat sofa and queen-size bed (Resource Furniture, 2016).
- Cost ranges from \$4000 - \$5000.

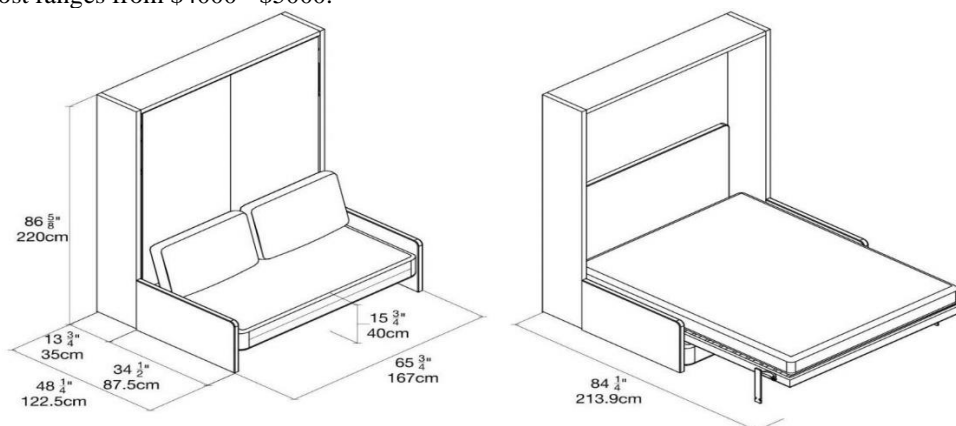


Figure 19: Penelope Sofa Wall Bed (source: Resource furniture, 2016)



- The modern Petite coffee table lifts up to dining table height and uses a patented folding leaf mechanism to convert it from a petite coffee table into a full-size dining table that can comfortably seat a party of four (Resource Furniture, 2016).

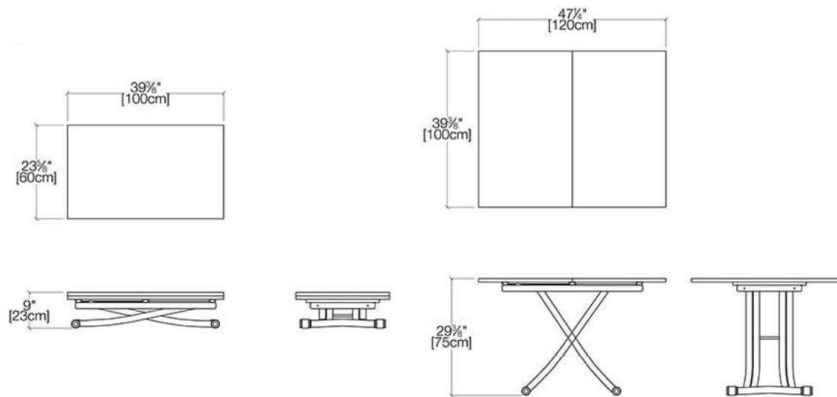


Figure 20: Petite - Transforming Coffee table (source: Resource furniture, 2016)

- The Pocket Chair is named for its pocket-sized dimensions. This compact, functional chair is classic in design and folds to be just 3/4" deep.

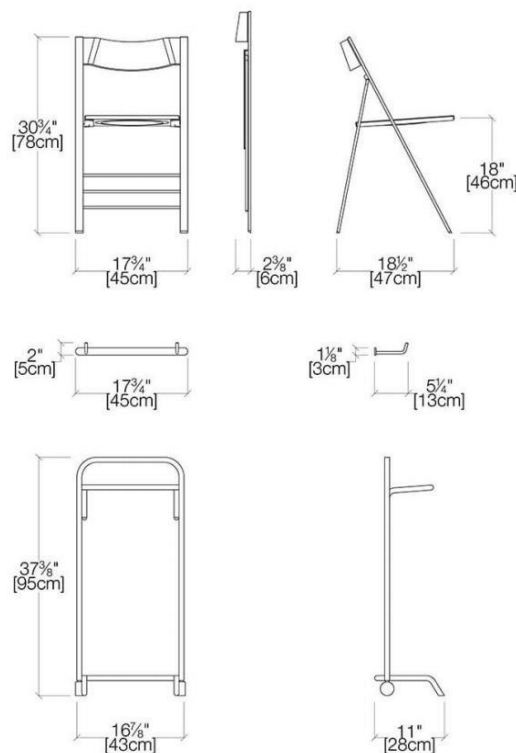


Figure 21: Pocket folding chair (source: Resource furniture, 2016)

#### 5.1.4.4. Plants

There is enough space near the window to accommodate a cluster of potted plants. Depending on the orientation of the building and sunlight availability through the respective window, potted plants and succulents can be used. The plants used in this apartment include:

- **Bird of paradise – Strelitzia**



The distinctive Strelitzia (bird of paradise) is one of the best known of all the tropical flowers and is a relative to the banana. The plant is a vigorous, rapidly growing indoor plant. Their growth is marked with its straight leaves penetrating directly from the soil; there is no trunk. The large leaves range between 12 and 18 inches long and the plant reaches heights of 5 to 6 feet tall. The trick to successful growth indoors is providing lots of bright light with some direct sun, regular watering and warmth. (Vanzile, 2019)

Figure 22: *Strelitzia Nicolai* (source: waitrosegarden.com)

- **Pencil Cactus - Euphorbia tirucalli**

Pencil is an flawless cactus houseplant variety that provides a distinctive shape within an indoor landscape. The plants have slender, slightly toothed stems without any foliage growth. It is named after its branches, which are about the diameter of a pencil. The pencil cactus prefers bright, full sun.



Figure 23: *Pencil Cactus* (source: the spruce, 2018)

A sunny windowsill is the absolute spot for this plant. It sustains under mild, warm temperatures, ranging from 65 F to 70 F. The watering care for this succulent is very easy. It only needs water every two to three weeks in the summer, and no water is needed in the winter (Vanzile, Houseplant basics : How to Grow Pencil Cactus (Euphorbia tirucalli) at , 2018).

## 5.2. Darlinghurst apartment, Australia

Whilst this apartment was initially one room, the concept was to re-instate a public and private divide to define two distinct zones: A public living, dining, and kitchen space was formed by relocating the kitchen to create open plan living. A minimalist design approach was then taken to the interior design of the room to maximise the feeling of space and light (Archdaly, 2015).

- Area: 290 sq.ft. (27 sqm)
- Location: Darlinghurst, New South Wales, Australia
- Architects: Brad Swartz Architects

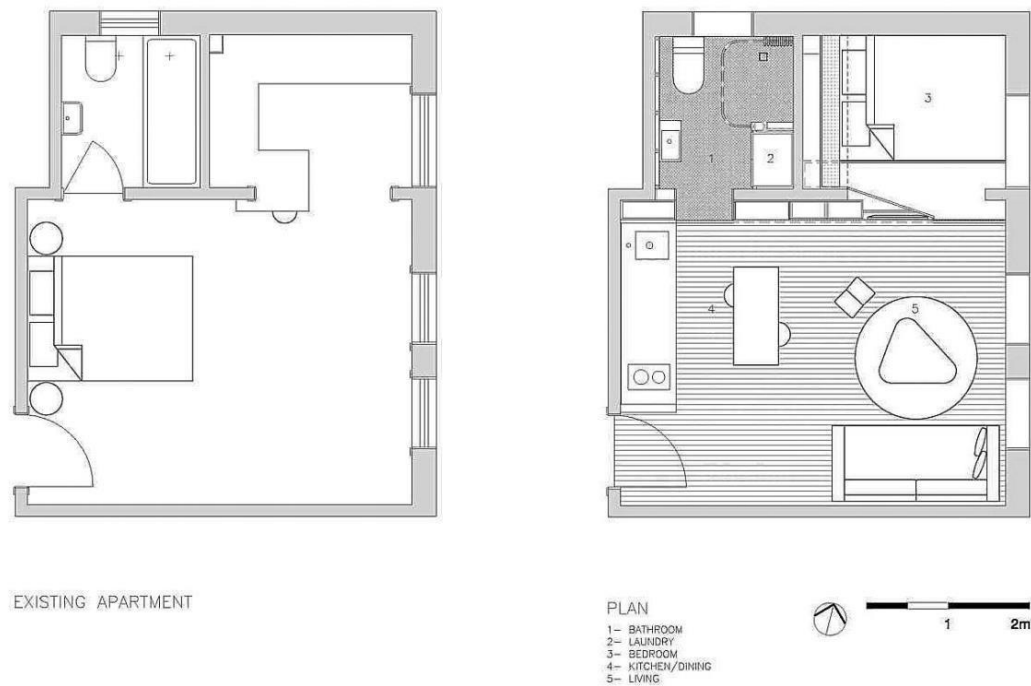


Figure 24: Floor plans - Existing and new (source: Archdaily, 2015)

This apartment is an east facing one, so the two windows up front will bring sufficient amount of sunlight and heat into the completely white - themed apartment interiors. The white colour scheme is followed on the walls, ceilings and door – window joinery. Wooden flooring and the black kitchenette unit in the living area breaks the monopoly of white and brings in a contrast.



Figure 25: Living room, Kitchen unit (source: Archdaily, 2015)

Depository necessities were given a thought and the bedroom striped back to basics, primarily just housing the bed. The depository and bed were then piled and inserted over each other like Tetris pieces to inflate the necessities in the most minimal space. This area is carefully hidden behind a white joinery unit (Archdaily, 2015).



*Figure 26: Bed space (source: Archdaily, 2016)*

The apartment has 3 decent sized windows – originally 1 in the kitchen, 1 for bed/Livingroom. After the partition, the windows still fulfil the purpose in their respective positions.

Tiny succulents are used to bring in plant life into the micro apartment.

The different combinations and utilities of the multiutility wall fitted with a large storage unit can be interpreted from the series of images above. The 2-door sliding shutter system is inspired from the Japanese shoji door system. This wall acts as a public private segregator on either ends with doors closing on bed space and washroom on the other end (Archdaily, 2015).

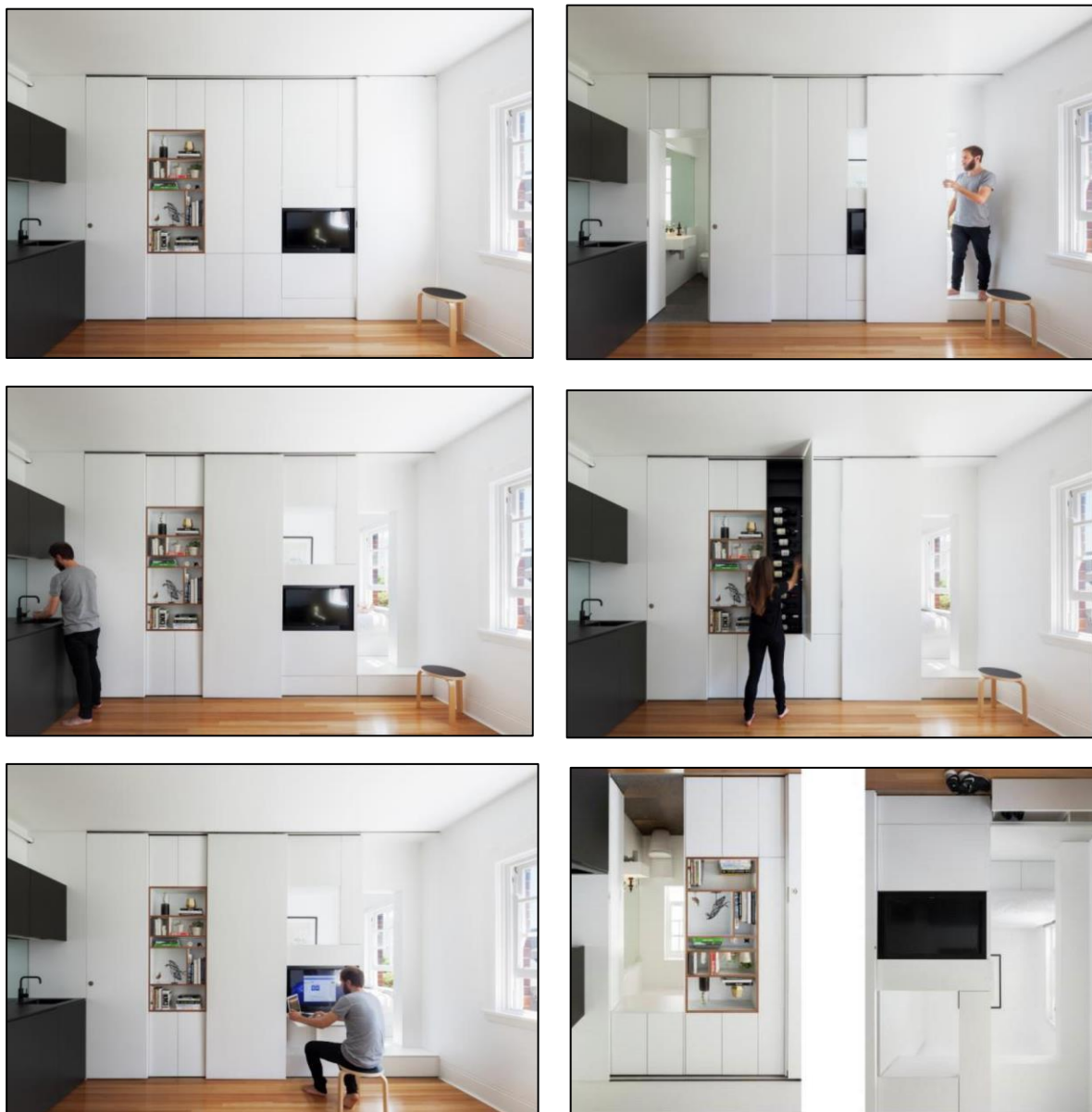


Figure 27: Storage wall (source: Archdaily, 2015)



## 6. ANALYSIS AND SOME STANDARDS

## 6.1. Case study – comparative analysis

Whilst maintaining the square feet area below 400 sq. ft, both the apartments pack two different sets of furniture and spatial configurations.

Table 1: Spatial configuration – comparative analysis

PARAMETERS	SUB PARAMETERS	Carmel Palace, NYC	Darlinghurst Apartment, AUS
<b>Area</b>		250 sq. ft to 370 sq. ft (excluding toilet, foyer)	290 sq. ft
	Bed space	38.4 sq. ft	51 sq. ft
	Living	183 sq. ft	102 sq. ft
	Kitchen/Dining	150 sq. ft	90 sq. ft
	Toilet	71 sq. ft	34 sq. ft
<b>Furniture</b>			
	Sofa	167cm x 87.5cm	200cm x 91 cm
	Bed	213.9cm x 87.5cm	200cm x 154cm
	Dining	120cm x 100cm	120cm x 55cm
	Coffee table	120cm x 60cm	32sq.cm circular
	Chairs	foldable pocket chairs	35cm dia. circular
<b>Openings</b>			
	Main door	120cm x 210cm	92cm x 210cm
	Toilet door	120cm x 210cm	70cm x 210cm
	Internal door	none	Bed space - 80cm wide
	Main window	243cm x 210cm	110cm wide
	Other window	none	80cm wide x 2 no:s

Both the case studies are in humid subtropical climate which bears some similarity with the tropical climatic conditions in terms of the humidity and temperature. Thus, a spatial layout with more openness is desired.

- The area comparison suggests that the Darlinghurst apartment is more spacious than the Carmel place. Although smaller in overall sq. ft area, the Darlinghurst apartment gives a feel of openness and privacy compared to the single room feel of Carmel place.

- The furniture is used according to the spatial layout in both cases. Yet the furniture systems used in the Carmel place is a bit more innovative and functional as a whole. Darlinghurst apartment features minimal furniture and has a larger storage unit.
- The Darlinghurst apartment has got an additional door inside. This gives a feel of segregation of space, cutting short the openness; but the architects managed to give a feel of openness by keeping only minimal furniture in the living area. On the other hand, the Carmel place has only one door and one large window making it a more airconditioned type of apartment.
- The windows in Darlinghurst apartment manages to bring in sufficient amount of light and air into the spaces and also helps in cross ventilation. Carmel place has only one large window in most of the units. Thus, cross ventilation is minimised.

## 6.2. Micro Living standards defined by BPF

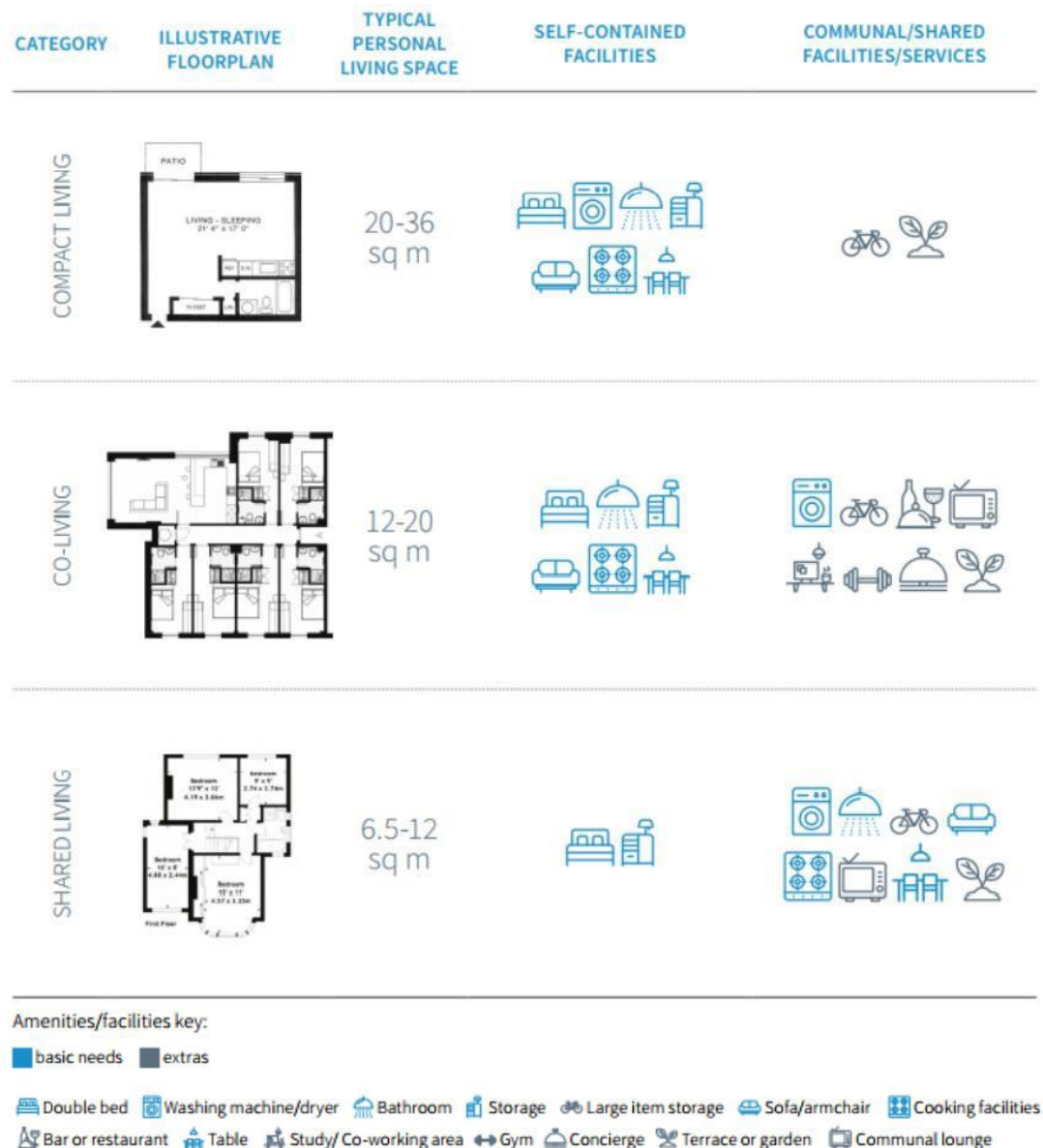


Figure 28: Micro Living standards by BPF (source: BPF & JLL, 2018)

According to a report by the British Property Federation (BPF) in collaboration with Jones Lang LaSalle (JLL), Micro living is defined as “the provision of homes that do not conform to current minimum space standards”. There are three micro living product types:

01. Compact living – self-contained smaller homes
02. Co-Living - Purpose-built and managed developments including a combination of personal and shared amenity space
03. Shared living – Converted or subdivided houses

Following was concluded after the interviews with developers, tenants, policy makers and planners to provide the following facilities/amenities should be available in all homes, no matter the size (BPF & JLL, 2018)

1. Bed, 2. Washing machine, 3. Toilet, 4. Shower, 5. Sink, 6. Storage, 7. Sofa/ arm chair, 8. Cooking facilities, 9. Fridge, 10. Table

Micro apartments will largely fall under the first category; that is compact living, and co-living in some cases.

These standards are applicable in the United Kingdom where the climate is cool and often cloudy and high temperatures are rare also known as the temperate oceanic climate.

- A single window would be enough in these regions just to let in light and act as a ventilation.
- Almost all the facilities are self-contained in case of the compact unit which makes it a working design solution for better spatial configurations.

### 6.3. International Residential Code by ICC

The International Residential Code (IRC) formulated by the International Code Council (ICC) defines minimum areas, ceiling heights as:

- R304.1 Minimum area: Habitable rooms shall have a floor area of more than 70 square feet (6.5 m<sup>2</sup>). Exception: Kitchens (International Code Council, 2018).
- R304.2 Minimum dimension: Habitable rooms shall be more than 7 feet (2134 mm) in any horizontal dimension. Exception: Kitchens (International Code Council, 2018).
- R305.1 Minimum height: Habitable space, hallways and portions of basements containing these spaces shall have a ceiling height of more than 7 feet (2134 mm). Bathrooms, toilet rooms and laundry rooms shall have a ceiling height of more than 6 feet 8 inches (2032 mm) (International Code Council, 2018). Exceptions:
  - For rooms with sloped ceilings, the required floor area of the room shall have a ceiling height of more than 5 feet (1524 mm) and more than 50 percent of the required floor area shall have a ceiling height of more than 7 feet (2134 mm).
  - The ceiling height above bathroom and toilet room fixtures shall be such that the fixture is capable of being used for its intended purpose. A shower or tub armed with a showerhead shall have a ceiling height of more than 6 feet 8 inches (2032 mm) above an area of more than 30 inches (762 mm) by 30 inches (762 mm) at the showerhead.
  - Beams, girders, ducts or other obstructions in basements containing habitable space shall be permitted to project to within 6 feet 4 inches (1931 mm) of the finished floor (International Code Council, 2018)

## 7. FINDINGS

### 7.1. STANDARDS FOR OPTIMISING THE SPATIAL CONFIGURATION OF MICRO APARTMENTS

A micro apartment is definitely an affordable housing solution for those who seek to live in the vicinity of the city and enjoy an active lifestyle, but there are certain psychological and other physical health concerns posed by the same.

- Although, a micro apartment might have all the necessary facilities for a comfortable day to day life, living in small spaces with lots of adjustments happening to the furniture, shared amenities etc., might increase the stress levels of already stressed-out working professionals.
- Lack of space for relaxation and enjoyment within the home can be an adverse factor in psychological health of the inhabitants.

There can be much more of health issues posed by the life in micro apartments, therefore keeping in check the user group i.e., the millennials and working professionals, it is necessary to develop the interiors and the spatial configurations of micro apartments in such a way that it gives more comfort to the inhabitants and not increase their stress.

### 7.1.1. General

- White theme for the whole/major parts of interiors (ceilings, walls, floors) not only gives a spacious feel to the apartment, it has many psychological benefits on the inhabitants living in a small space.
- Storage is a critical aspect which makes a micro apartment functional and liveable. Fully furnished storage units similar to those used in normal homes would consume a considerable amount of space if used in a micro apartment, thus innovative storage solutions such as built-in storage within sofas & tables, full height vertical shelves etc., should be used.

### 7.1.2. Openings

Light, air and volume are important elements in case of micro apartments as they compensate for the smaller space compared to larger homes.

- In spaces where windows/doors cannot be used for cross ventilation, openings in the form of small pocket windows (of a decent size and not compromising privacy and security) shall be given in the lower and /or upper portions of the wall.
- Partitions in the interiors (if any) should not block air movements. In other words, a provision for air movement or cross ventilation in the entire apartment should be provided with respect to all the partitions.
- High ceilings can be given so as to increase the volume of the smaller space and appropriate openings in the form of clerestory windows shall be given for the hot air to move out and cold air to come down i.e., to take benefit of stack effect.
- Windows shall be given an additional leaf or shutter in the form of mosquito net which helps maximise ventilation and helps in night time cooling.
- Balconies are considered a luxury in micro apartments, but it's costly to specifically allot space and build a balcony into each unit, therefore Juliet balconies or bay windows can be incorporated as they help the residents open their units to the outdoors without affecting the overall floor area or the cost.
- Japanese shoji doors shall be used for internal partitions (if any) so as to eliminate the area required for swing door and give a home like feel to the space by allowing the light to pass through the translucent material.

### 7.1.3. Plants

Plants that are tolerant of the humidity/cold which varies throughout the year shall be incorporated into the interiors. Also, the plants which do not grow very long or require lot of care should be chosen. Some examples include:

- **Pothos – Epipremnum Aureum** is a climbing plant with purifying qualities. It requires bright but indirect sunlight and can survive in high humidity.
- **Bird of paradise – Strelitzia** is among the popular tropical flowers. It requires bright along with direct sunlight in controlled amounts. Soil needs to be moist year-round.
- **Peace Lily – Spathiphyllum Wallisii** is one of the favourite indoor potted plants. This plant requires less light and moist warmth conditions.
- **Spider Plant – Chlorophytum Comosum** can grow in low light and requires water throughout the year.

### 7.1.4. Furniture

- The furniture systems used should be multipurpose and space saving in general. Maintenance free systems like the gas pistons shall be used in foldable furniture systems because they are lighter and easier compared to older spring systems.
- Units which are of daily use should have soft open/close systems so as to prolong the life of the unit as well as to make the experience smoother to the user.
- Furniture systems with storages incorporated should be sealed with melamine or similar moisture resistant materials so as to check the life and usability of the same with the changing climate.
- Furthermore, technologically advanced systems such as the robotic furniture by 'Ori systems' in association with MIT Media Lab can be used. The smart-furniture developed by Ori include:



**Ori Pocket closet** - Takes up the space of two wardrobes, yet it can serve as a walk-in closet, desk, entertainment centre, or dining bar. It is installed on a robotic rail. It unfastens and seals using a built-in controller, a smartphone, or voice control. (Tuohy, 2019).

Figure 29: Ori Pocket Closet – Configurations (source: oriliving)

**Ori Cloud Bed** – It is convertible into a sofa and coffee table setup with a voice command. The Cloud Bed lowers from the ceiling at night and rises in the morning to reveal a modern sofa.



Figure 30: Ori Cloud Bed – Configurations (source: oriliving)

**Ori Studio Suite** – Transforms into living room, bedroom, walk-in closet, and office. Hidden at the bottom of the unit is a full- or queen-sized bed that can be deployed to convert the space into a bedroom. On the same side, plentiful storage and a concealed desk serve as a closet and home office. On the other side, a media center boasts further shelving and a pull-out surface that can act as a coffee table.



Figure 31: Ori Studio Suite – Configurations (source: oriliving)



## 8. CONCLUSION

The spatial configuration of micro apartments is greatly influenced by many factors including the ones discussed in this research. Even the minutest details, dimensions, colour, functionality of anything used within the space affect the overall usability, look and feel of the micro apartment.

The study sketched 'What, Why and Who lives' with respect to micro apartments, and in defined context of Sydney and New York.

Minimalistic design approach can resolve many space issues. Along with this another recurring is the slogan for Micro-Unit marketing "trading in quantity for quality." This design philosophy is the reason behind the failure of many projects. Though micro-housing reduces the required space but compromises with the quality factor. This quality could be separated in several ways. At the planning level it could be utilized with usable communal kitchens or enjoyable common outdoor spaces. At the detailing level it could be included via huge, function-able windows or a well-designed envelope by an architecture team that's actually concerned with balance and visual harmony.

The study draws out several standards for optimising the spatial configuration of micro apartments, in terms of openings, plants, furniture's and other general features of the space. And rather than just the quoted housing crisis solution, micro apartment co-opts and neutralises the anti-capitalist housing model.

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