IMPLEMENTING BIOPHILIC DESIGNS IN INTERIORS OF THEATRE ROOM OF SELECTED RESIDENCE

JUNE 2021 **RUTVIK CHAPANERI**

IMPLEMENTING BIOPHILIC DESIGNS IN INTERIORS OF THEATRE ROOM OF SELECTED RESIDENCE

A Dissertation

Submitted To

The Maharaja Sayajirao University of Baroda, Vadodara

In Partial Fulfilment For

The Degree of Masters in Family and Community Sciences

By

RUTVIK CHAPANERI

Department of Family and Community Resource Management

Faculty of Family and Community Sciences

The Maharaja Sayajirao University of Baroda

Vadodara

June 2021

CONTENTS

LIST OF FIGURES

24	Top 3D View of Theatre Room	
25	3D View of Proposed Wall “AB” of Theatre Room	
26	3D View of Proposed Wall “BC” of Theatre Room	
27	3D View of Proposed Wall “BC”,”EF” and “GH” of Theatre Room	
28	3D View of Proposed Wall “FG” and “HA” of Theatre Room	
29	3D View of Theatre Room From Corner “A”	
30	3D View of Theatre Room From Corner “B”	
31	3D View of Theatre Room From Corner “F”	
32	3D View of Proposed Flower Shaped Chairs	
33	3D View of Proposed Recliner Sofas	
34	3D View of Proposed Storage Design	
35	Proposed Furniture Layout For Theatre Room (Option -3)	
36	Proposed Flooring Layout For Theatre Room (Option -3)	
37	Proposed Wall Elevation AB (Option -3)	
38	Proposed Wall Elevation BC (Option -3)	
39	Proposed Wall Elevation CH (Option -3)	
40	Proposed Wall Elevation DA (Option -3)	
41	Proposed False Ceiling Design (Option -3)	
42	Proposed False Ceiling Working Drawing (Option -3)	
43	Proposed Electrical Drawing (Option -3)	
44	Proposed Flower shaped Chair Design	
45	Proposed Storage Design (Option -3)	

LIST OF TABLE

LIST OF PLATES

INTRODUCTION

CHAPTER 1

INTRODUCTION

> "In every Walk with nature one receives far more than one seeks….."
>
> Muir (1877)

> "We will never achieve an ethical architecture that is beautiful and sustainable until nature is integral and at the core and at the substance and being of the architecture, not added on. If it is not beautiful, it cannot be sustainable. Buildings must shelter and inspire"
>
> Kieran (2005)

Since the Industrial Revolution, the built environment and urban areas have exploded at an unprecedented rate not seen in any other time in human history. Buildings are newcomers on the evolutionary. The sun provided warmth and light as well as information about time of day. Large trees provided shelter from the midday sun and places to sleep at night to avoid terrestrial predators. Flowers and seasonal vegetation provided food, materials, and medicinal treatments (Heerwagen, 2009). In average the western society individual spend about 90% of its time indoors. Cities and indoor environments are dominated by manmade objects. Many traditional design strategies that ignore nature can lead to negative impacts on human health, child development, and community safety and worker satisfaction (Browning, 2012). In view of such large number of people who live in urban areas, people may find themselves separate from nature, the matter that has become negative on man's behavior, mental and physical lifestyle.

Gillis and Gatersleben (2015) claims that this isolation is due to societal trends such as urbanization, building design and life style. In terms of urbanization and building design, Joye (2011) pointed out that increasing urbanization and typical geometrical modern buildings are replacing nature. The resultant proliferation of geometrical forms and volumes seems to be of an entirely different category

than nature's forms (Gillis and Gatersleben, 2015). Kellert and Calabrese, (2015) add that the dominant approach to modern building and landscape design generally treats nature as either an obstacle to be overcome or a trivial and irrelevant consideration. This approach has increased the disconnect between people and nature in the built environment and is reflected in inadequate contact with natural light, ventilation, materials, vegetation, views, natural shapes and forms, and, in general, beneficial contact with the natural world (Kellert and Calabrese, 2015). Furthermore, according to Kellert and Calabrese (2015), a growing body of scientific study increasingly reveals that "most of our inherent tendencies to affiliate with nature continue to exercise significant effects on people's physical and mental health, performance, and wellbeing". The efforts to foster the connection between nature and people become ever more important as the world population continues to urbanize (Browning et.al, 2014).

Therefore, architects and planners are looking forward to a solution for the built environment that comprehends society's urban lifestyle while integrating meaningful natural attributes such as fresh air, daylight, vegetation, and views of nature which could enhance human health and well-being (Rhodesly, 2019). While the modern built environment has largely separated humans from the natural elements in which one evolved, there is a growing body of research pointing to the benefits of returning to the basic tenets of biophilia as a means to increase health and productivity (Browning et al., 2012). Hence, biophilic design focuses significantly on enriching this vital relationship between people and nature within the built environment (Rhodesly, 2019).

The biophilia hypothesis taken together with the positive physiological effects on the human body and brain observed during contact with nature have led many to suggest that Biophilia could actually be used and applied to different sectors of the built environment and human life in order to improve health, well-being, and productivity.

Kellert et.al, (2008) defined the term Biophilia as

> “an approach to designing the built environment in a way that emphasizes the necessity of “maintaining, enhancing and restoring beneficial experience of nature” and establish two main dimensions of biophilic design (organic or place-based) that then can be applied to six biophilic design elements that are continued to be explained in more than 70 attributes”

> “The concept of biophilia implies that humans hold a biological need for connection with nature on physical, mental, and social levels and this connection affects our personal wellbeing, productivity, and societal relationships”
>
> Dias, (2015)

Biophilia is an innate human inclination to affiliate with nature, especially life and life-like features of the nonhuman environment, that even in the modern world continues to be critical to people’s physical and mental health and well-being (Wilson 1986, Kellert and Wilson 1993, Kellert 1997**,** 2012). The Biophilian hypothesis suggests that humans need to connect to the living structure in environment, not merely based on simple liking or aesthetics value but also physical requirement quite unlike the need for food, water and air. Biophilia is not limited to introducing living beings and features into the living spaces; rather quite a lot of other factors also come into play. The design/aesthetics of the building, appreciation of the building come in through various other factors such as inclusion of human health oriented design. The human perception of the built environments is based on the ability to interpret adjacent environmental forces that affect in bodily senses. The actual contact with environmental features in the built environment includes natural light, water, animals, and landscapes and furthermore, is termed as direct experience. The indirect experience of nature is through representations or images of nature, the transformation of nature from its actual form, the experience to certain forms and procedures found in the natural world. And third is the experience of space and place, which is spatial features that characterize the natural world.

Biophilia is the deep-seated need of humans to connect with nature. Browning et.al, (2014) demonstrate how increased human wellbeing through nature exposure relates to specific Biophilic design strategies. Biophilia, and consequently Biophilic design, tend to consider the causes of health and wellbeing, rather than the causes of disease. The application of connecting humans to nature within the manmade world has been termed biophilic design (Browning et.al, 2014). Biophilic design establishes the relationship between nature, human biology and design of the built environment (Mishra, 2019).

Biophilic architecture has emerged as an attempt to eliminate the gap between modern architecture (today) and the human needs to connect with the natural world. Biophilic design is an innovative approach that emphasizes the importance of maintenance, enhancement and restoration of useful experience on the use of nature in the built environment. (Pollack, 2006). Biophilic design incorporates natural materials, natural light, vegetation, nature views and other experiences of the natural world into the modern built environment (Blomberg, 2015).

The term “Biophilic design” was coined by Stephen Kellert, Professor of Social Ecology at Yale University. It emerged from the translation of the concept of applying Biophilia into design and the built environment. Further, the term “built environment”, referring to human-made places and spaces ranging in scale to provide the human activities of live, work and recreate, itself distinguishes the built from the natural environment (Ojamaa, 2016). Bio means “life or living things”, philia means “love”. Biophilia can be translated to Love to life. It was first used by Erich Fromm in 1964 to describe a psychological orientation of being attracted to all that is alive and vital. But the term became popular when Edward Osborne Wilson wrote the book "Biophilia" in 1984. This book proposed the deep affiliations that humans have with nature and that they are rooted in biology. Unlike phobias and fears that people have of things in the natural world, philias are the attractions and positive feelings that people have toward certain habitats, activities, and objects in their natural surroundings. (Heerwagen 2009). The term was further developed by social ecologist Kellert and others (Kellert and Wilson 1993, Kellert 2005, Kellert et al. 2008).

The goal of Biophilic design is to construct environments imbued with positive experiences that can promote human health and well-being from the contact between people and nature (Kellert et.al, 2008; Heerwagen, 2009). Environmental psychologist Judith Heerwagen argued that the human brain is constantly reverting back to its survival instincts of seeking out the things and places that help survival such as - food (plants, flowers, and animals), shelter, light, water and fire. It is important to understand what attracts people to these types of features so that they can be introduced into the built environment (Heerwagen, 2009). “Biophilic design seeks to create good habitat for people as a biological organism in the modern built environment that advances people’s health, fitness and wellbeing”. According to Kellert (2008), Biophilic design is based on the Biophilia hypothesis, which Beery et.al, (2015) acknowledged as a significant theory of human connectedness with nature.

> “Biophilic design” has been defined as “the deliberate attempt to translate an understanding of the inherent human affinity into the design of built environment,” and the strategy of Biophilic design is to “incorporate natural features and systems into the built environment”
>
> Kellert (2005)

The multiple patterns of biophilic design have been divided into three main categories as taken from Terrapin Bright Green’s 14 Patterns of Biophilic Design (Browning et al., 2014). First, nature in the space or direct experience with nature entails both bringing nature indoors (i.e. water features, plants, courtyards, dynamic light, variable/natural ventilation etc.) and providing occupants the means to connect with the outdoors from within, typically via views through glass or fresh air from operable windows or doors. The second category includes natural analogues or the indirect experience with nature. This entails the use of natural materials and structural forms or artwork and patterns which represent or echo those found in nature. These natural analogues can elicit the same positive physiological responses as direct contact with nature. Finally, the way in which spaces are configured can also evoke certain

responses in people as a result of having developed biologically in certain types of landscapes. As research suggests, due to the fact that the human species evolved in savanna environments (open landscapes dotted with tree clusters), surroundings that provide people with both a “prospect,” the means to have wide views to many settings, and a “refuge,” areas that appeal as safe and secure, are ideal. (Browning et al., 2014)

Importance of Biophilic Designs

The importance of biophilic design has been pointed out by several researchers. Biophilic design is argued to have a wealth of benefits for building occupants and urban environments. Ryan, et al. (2014) found that elements such as nature sounds, improved mental health 37% faster than traditional urban noise after stressor exposure. Another study by Gillis and Gatersleben (2015) found that the inclusion of plants in interior environments reduce stress and increase pain tolerance, the use of water elements and incorporating views of nature are also mentally restorative for occupants. When researching the effects of biophilia on hospital patients, Soderlund and Newman (2015) found that by increasing vista quality in hospital rooms depression and pain in patients is reduced, which in turn shortened hospital stays from 3.67 days to 2.6 days. Further, Dannenberg, et.al, (2011) also found that children growing up in green neighbourhoods are seen to have lower levels of asthma; decreased mortality rates and health disparities between the wealthy and poor were also observed in greener neighbourhoods. By adding physical natural elements, such as plants, trees, rain gardens, and green roofs, to the built environment, buildings and cities can manage storm water runoff better as there are less impermeable surfaces and better infiltration. Adding greenery also reduces carbon emissions, the heat island effect, and increases biodiversity. Carbon is reduced through carbon sequestration in the plant's roots during photosynthesis. Green and high albedo rooftops and facades, and shading of streets and structures using vegetation can reduce the amount of heat absorption normally found in asphalt or dark surfaces this can reduce heating and cooling needs by 25% and reduce temperature fluctuations by 50% (Soderlund and Newman, 2015)

Biophilia may have slightly higher costs due to the addition of natural elements that require maintenance, higher priced organic items, etc., however, the perceived health and environmental benefits are believed to negate this. Newman et.al, (2015) found that by adding biophilic design and landscapes, cities can see large savings due to increased worker productivity and reduced crime expenses. They also found that storefronts on heavily vegetated streets increased foot traffic and attracted consumers that were likely to spend 25% more; the same study showed that increasing day lighting through skylights in a store increase sales by 40%. Properties with biophilic design also benefit from higher selling prices, with many selling at 16% more than conventional buildings. On the urban scale, Beatley (2013) believes that biophilic design will allow cities to better adapt to stresses that occur from changes in climate and thus, local environments. To better show this, he created a biophilic cities framework, where pathways can be taken to increase the resilience and sustainability of cities. This includes three sections: Biophilic Urbanism, the physical biophilic and green measures that can be taken to increase the resilience of the city, Adaptive Capacity, how the community's behaviors will adapt as a result of these physical changes, and Resilient Outcomes, what can happen if both of these steps are achieved.

Implementing biophilic design

Biophilic design often can be implemented quite simply and inexpensively through a variety of means, such as the use of colour, fabric patterns and textures that mimic those found in nature, and artistic representations or simulations of nature such as photographs, paintings, and some abstract forms of art. Making such changes in an office setting, for example, might be restrictive due to existing furniture and budget concerns, but it is important to note that even very limited exposure to nature can create a positive effect (Ulrich, 1986; Kaplan & Berman, 2010). Exposure to the variety of design uses and applications that bring people closer to nature in order to encourage

physical and mental wellbeing. Ulrich theorized that partaking in even small-scale experiences with nature, through the use of design can have a significant positive impact on human health (Kaplan, 1993; Ulrich, 1986). Observing fish in simulated natural environments has been shown to reduce stress and anxiety (Friedman et. al., 2010). Biophilic design technique, providing access to views of nature or representations of nature, use of colours, patterns, and textures found in nature, use of plants, and proximity to other living beings such as the fish tanks, and the sound of water from water features, can be successfully modified and implemented for use in office or residential settings (Green, 2012).

Biophilic design has received increasing interest from the building industry around the world in recent years. Two building rating systems that originated in the United States but are being promoted globally incorporate Biophilic design directly; these are the Living Building Challenge (Living Building Challenge, 2015), which incorporates it through the Biophilia Imperative, and the new WELL Building Standard (WELL Building Standard Resources, 2015), which incorporates it through the Biophilia Precondition and Biophilia Optimization. Consulting firms have also championed the concept, notably Terrapin Bright Green, who have published various white papers on Biophilic design Terrapin Collaborates (2015) and Interface flooring, who have created a Human Spaces (2015) to encourage discussion around Biophilic design.

Theatre Room

Home theatre is an audio and video equipment configuration in your home that emulates the movie theatre experience. A good theatre room setup might provide a more impressive experience than many small multiplex cinema screens. A home theatre provides an entertainment option suitable for watching TV and movies at home with a little extra excitement. For many, going to the local cinema is a distant memory. One can stream relatively new movies and binge-watch TV shows in comfort. Borrowing from the image and sound technology of theatres and adapting them to the home environment, TV and audio manufacturers have provided the ability to approximate the movie theatre experience at home (Silva, 2020).

In the 1950s, playing home movies became popular in the United States with middle class and upper-class families as Kodak 8 mm film projector equipment became more affordable. The development of multi-channel audio systems and later Laser Disc in the 1980s created a new paradigm for home video, as it enabled movie enthusiasts to add better sound and images to their setup. In the mid-1980s to the mid-1990s, a typical home cinema in the United States would have a Laser Disc or VHS player playing a movie, with the signal fed to a large rear-projection television set. Some people used expensive front projectors in a darkened viewing room. During the 1990s, watching movies on VHS at home became a popular leisure activity. Beginning in the late 1990s, and continuing throughout much of the 2000s, home-theatre technology progressed with the development of the DVD-Video format (higher resolution than VHS), Dolby Digital 5.1-channel audio ("surround sound") speaker systems, and high-definition television (HDTV), which initially included bulky, heavy Cathode Ray Tube HDTVs and flat screen TVs. In the 2010s, affordable large HDTV flats screen TVs, high resolution video projectors (e.g., DLP), 3D television technology and the high resolution Blu-ray Disc (1080p) have ushered in a new era of home theatre.[1]

In the 2010s, the term "home cinema" encompasses a range of systems meant for movie playback at home. The most basic and economical system could be a DVD player, a standard definition (SD) large-screen television with at least a 27-inch (69 cm) diagonal screen size, and an inexpensive "home theatre in a box" surround sound amplifier/speaker system with a subwoofer. A more expensive home cinema set-up might include a Blu-ray disc player, home theatre PC (HTPC) computer or digital media receiver streaming devices with a 10-foot user interface, a high-definition video projector and projection screen with over 100-inch (8.3 ft; 2.5 m) diagonal screen size (or a large flat screen HDTV), and a several-hundred-watt home theatre receiver with five to eleven surround-sound speakers plus one or two powerful subwoofers. 3D-TV-enabled home theatres make use of 3D TV sets/projectors and Blu-ray 3D players in which the viewer’s wear 3D-glasses, enabling them to see 3D content. [1]

Entertainment rooms and home theatres have turned out to be extremely popular recently (Sebring, 2020). The home theatre experience is becoming the integrated entertainment component of today's homeowner-centric smart home that includes security, lighting, heating and cooling, and convenience (Riha, 2020).

A home theatre room is more than just a sofa and a screen. Certain requirements, like controlling outside light and the ability to cast a large enough picture, should be met in order to call this a proper home movie theatre. Requirements apply both to video projectors and screens as well as to large, flat-screen TVs (Wallender, 2021). Home theatres have become a popular feature in all types of homes, and there are several important considerations to keep in mind if you'll be building a home theatre any time soon (Rauh, 2020). Private home theatre rooms are designed and constructed to replicate the experience of viewing movies and TV shows in a commercial theatre in a smaller, more comfortable environment. Most have viewing screens of 16 to 18 feet long with elaborate sound systems and comfortable seating.

Home theatre rooms, whether designed for the sole purpose of watching movies or the full range of video and audio experiences, require specific electronic components. The first one is one or multiple Screens where some owners create a video wall while others prefer one large screen configured to handle different feeds that are presented simultaneously in different areas of the screen. The second one is Smart TV or HD Projector, Television screens are available in sizes greater than 100 inches which are very costly and therefore 80-inch HDTVs or 55-inch HDTVs can be opted. HD projectors, similar to the projectors used in commercial theatres are often preferred for viewing on a large screen. A critical factor in deciding whether to opt for a TV or a screen is resolution, or the number of pixels per unit of area. The number of pixels affects the ideal distance between the screen and the viewer for maximum detail. The lower the resolution, the closer the viewer must sit to the screen. Movie directors understand that big sound is more important than big picture in making a viewing experience memorable. The minimum components for a home theatre room sound system are a source (cable box or satellite

system, DVD, or game system), an audio/video receiver or preamplifier/processor with a multichannel amplifier, and five or more multichannel speakers. A standard 5-to-1 sound system consists of left, center, right, surround left, and surround right speakers with a subwoofer for the bass response. A 6-to-1 or 7-to-1 system adds one or two speakers on the rear wall behind the listener. Other equipment needed to make home theatre room complete include a Universal Remote**,** Surge Protectors and Wiring or Wireless Connection (Lewis, 2018).

Simply connecting a set of electronic devices does not make a home theatre room. Interior design, including layout and furnishings, is crucial for a fully functional home entertainment space that creates the desired ambiance, whatever the activity. A minimum area of 10 x 16 feet for a home theatre room is recommended. The size of screen and its resolution affect the ideal distance needed between viewer and screen to get an immersive effect similar to a theatre, while still allowing viewers to see most of the screen without moving their heads. Sitting at a distance where the screen fills up a minimum of 30 degrees of field of vision for an enjoyable experience. Acoustic treatments can make average equipment sound great, and great equipment sound amazing. The right acoustics and ambiance are the difference between a good experience and a great experience. Soundproofing your home theatre room is also essential to maintain peace with spouses and neighbours, especially in apartment buildings. Lighting variety is crucial in home theatre rooms that will be used for different activities. For example, one level of lighting is needed for watching a movie, and another for watching TV. A combination of recessed lighting around the ceiling perimeter and 18 inches above the floor is recommended. Wall sconces add style and ambiance. Table and standing lamps should be avoided as they create a glare on the viewing screen. An integrated, present dimming system eliminates the need to manually readjust the lights to fit a new activity. Furniture, wall and floor coverings, and window treatments create great first impressions (Lewis, 2018). It has been seen all kinds of furniture in the home theatres but chairs to large comfy couches are recommended for home theatre rooms.

Justification

People spend the majority of their time indoors surrounded by drywall, concrete, and steel. The indoor built environment unconnected to the nature on the other hand, sometimes poses problems. It tends to be full of demanding, stressful, under stimulating or boring features. With a diminished connection to nature, the increasing pressure on urban space and the ubiquitous technological presence, there is less opportunity to recuperate mental and physical energy. Incorporating direct or indirect elements of nature into the built environment have been demonstrated through research to reduce stress, blood pressure levels and heart rates, whilst increasing productivity, creativity and self-reported rates of well-being. Using inspiration from local natural environment and vernacular cultural expressions are critical to create a sense of place in Biophilic design. The Biophilic design is a deliberate attempt to translate an understanding of the inherent human affinity to affiliate with natural systems and processes into the design of the built environment. It has been revealed by various studies, that human beings are deeply affected, both physically and psychologically, by association with nature which is reflected through performance and wellbeing, the contact with nature has a profound impact on the fitness and quality of life. The fundamental objective of biophilic design is to extract a positive valued experience of natural and built environment.

More and more people are eager to recreate the movie theatre experience at home. Having a home theatre brings a family together to watch movies, TV show, or sometimes playoff game. Having movie nights at the comfort of home is a rewarding experience after a long day at work. Biophilic designs in home theatre room can enhance the experience and health of the users. Hence, the present study aims to redesign a home theatre room considering Biophilic designs keeping in view need and preferences of the clients and the assessment of the existing home theatre room.

The market survey of the products available in the market will help in the cost estimation for redesigning a home theatre room. Therefore, an attempt was

made to find out the availability of products and materials related to Biophilic designs and home theatre room in the local market.

Several studies were found through review of literature focusing on areas such as “Relationship between nature views and day lighting on employees productivity, health benefits and performance of employees in Biophilic designed offices”, “Health and wellbeing benefits of Biophilic designs”, “Biophilic designs and noise perception”, “Potentials of Immersible Virtual Environment for Biophilic design”, “Biophilic approach to architecture”, “Awareness assessment of Biophilic design”, “Connecting with nature through Biophilic designs”, “Biophilic designs and energy use optimisation”, “Application of Biophilic designs in various buildings”, “Biophilic design and architecture, “Nature inspired designs, “Impact of Biophilic designs on psychological health”, and “Identifying the aspects of Biophilic designs corresponding to learning environment”. Researchers related to home theatre room were also found which focused on “Developing sensory information framework for 4D home theatre system”, “Developing system capable of assisting users in setting up a home theatre”, “Designing and implementing Pneumatic Motion base for 4D home theatre and intelligent media centre for home”. There was dearth of researchers conducted in India related to home theatre room or its designing. The researchers related to designing of home theatre room considering Biophilic designs were hard to find in India as well as outside India. Therefore, the present design project was undertaken.

The finding of the present study will provide platform to apply Biophilic designs and methodologies to the theoretical knowledge. The information gathered through the present research would widen the data base and will help in strengthening the curriculum of the Department of Family and Community Resource Management, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda. This study will help the students of Interior Design Specialization to gain insight into the upcoming and much needed concept of Biophilic Designs in interior spaces. The present study will motivate several stakeholders to undertake interior projects promoting Biophilic Designs which can enhance the productivity and well-being of the innate.

Statement of problem

The present study aims to redesign interiors space of Theatre room of selected Residence considering the Biophilic Designs.

Objectives of the study

1. To conduct market survey of materials used in redesigning theatre room of selected residence.
2. To ascertain the need and preference of the client for theatre room.
3. To assess the existing interiors of the theatre room of selected residence.
4. To redesign the interior space of theatre room considering the Biophilic Designs and provide detailed working drawings with cost estimation.

Delimitation

The present study was limited to redesigning interior spaces of theatre room of the selected Residence from Vadodara City.

Review of literature

`

CHAPTER 2

REVIEW OF LITERATURE

The review of literature is an essential part of any research. It is a condensed version of an exhaustive literature survey (Kamath and Udipi, 2010). It helps to understand the problem and to place it in its proper perspective. To go through the related theoretical write ups and to carefully review the researches done on the related themes provide an insight for identifying the need for the research that can further be conducted (Kerlinger, 1973). The review of literature provides the basis to understand the importance of undertaking research in the chosen area to obtain knowledge on the methodology used in past researches and to identify the need for future research (Kothari, 2012). For the present study literature was thoroughly reviewed to gain knowledge for the execution of the venture as it calls for a clear perspective of the overall field of study. To provide clear and better understanding of the literature reviewed for the present study the chapter is presented under sub heading:

2.1Theoretical orientation

- 2.1.1 Need of Biophilic Designs
- 2.1.2 Concept of Biophilia
- 2.1.3 Biophilic Designs
- 2.1.4 Patterns of Biophilic Design
- 2.1.5 Benefits of Biophilic Designs
- 2.1.6 Home Theatre Room

2.2 Related Researches

- 2.2.1 Researchers conducted Outside India
- 2.2.2 Researchers conducted within India

Conclusion

`

2.1.1 Need of Biophilic Designs

Rapid urbanisation is resulting in dense, overpopulated built environments dominated by buildings and the hard infrastructure that services them. One of the negative outcomes of urbanisation is the exclusion of living elements, nature informed cultural landscape within the Anthropocene epoch, with the result that humans are increasingly disconnected from living elements, with devastating effects on wellbeing and health, both for humans and remaining living environments. People spend 90% of their time indoors, but with growing world population and urbanization, even the time not spent indoors are spent in designed environments (Ojamaa, 2016). People spend their time in artificial built environments and human designed habitats (Kellert, 2012). The contemporary built environment has increasingly isolated people from the beneficial experience of nature (Nyrud, et al. 2014). Four-fifths of the people in developed countries reside and/or work in urban cities, man-made environments that weaken the opportunity for human-nature connectedness. As such, modern urban environments are filled with ecological and sensory deprivation, hazardous chemicals, and artificiality resulting in loss of this human-nature connectedness. Ironically, these environments are viewed as standard places of living and working, 'natural habitats' by much of society (Kellert, 2012). And as a result of the increased population in urban environments, green spaces are continuously under threat of being converted into businesses and housing areas. This has brought about a limitation of the outdoor places necessary for physical activity, interaction with nature, and mental restoration (Stigsdotter et.al, 2010). (Kellert and Calabrese,2015) add that the dominant approach to modern building and landscape design generally treats nature as either an obstacle to be overcome or a trivial and irrelevant consideration. This approach has increased the disconnect between people and nature in the built environment and is reflected in inadequate contact with natural light, ventilation, materials, vegetation, views, natural shapes and forms, and, in general, beneficial contact with the natural world (Kellert and Calabrese, 2015). Moreover, construction and development of urban environments such as these account for "one-fifth of the nation's pollutants, one-quarter of its

`

wastes, one-third of its greenhouse gas emissions, and nearly forty percent of the country's consumption of fossil fuel and water resources" (Kellert, 2012).

In Last Child in the Woods, Louv (2008) highlighted that as a result of city living the 'nature disconnect' is effecting children and that today's kids are suffering from 'nature deficit disorder'. Children in cities have little or no access to 'nature' and cannot explore outdoors, resulting in the majority of their formative lives being spent indoors, in front of a TV or computer, resulting in overweight, sedentary children, physical health issues, and various psychological disorders. Despite this acknowledged problem, modern building and engineering accomplishments have fostered the perception that humans do not need 'nature' and living systems, and that humans are 'above nature' (echoing anthropocentrism), resulting in the belief that humans can transcend their natural and genetic heritage (Roös, 2016). This dangerous illusion is giving rise to a global civilisation where the design and construction of the built environment encourages technologically driven over-exploitation and the separation of people from 'natural' or living systems as the habitat strategy of the modern world. The actual result is an urbanised world of unsustainable energy and resource consumption, extensive air and water pollution, widespread climate alteration, waste generation, unhealthy indoor and outdoor environments, and an increasingly unhealthy global population (Kellert et.al, 2008). Increasing population, and consequently, increasing demand for energy consumption, reduced fossil fuel resources, increased air pollution, exacerbating the phenomenon of global warming and its side effects are some of the factors which lead-off modern societies to support the clean, sustainable and renewable energy (Douglas and Gordon, 2010).

"Only a deliberate and knowing process of design and development, especially of urban areas, can restore a world that nurtures and enriches the human body, mind, and spirit through its beneficial association with the natural world" (Kellert, 2012). Psychologists and biologists have posited that not only are human beings innately drawn to natural settings and elements but that having contact with nature (whether it be direct, indirect, or symbolic) within the built environment results in increased productivity, health, and overall well-being

`

(Lerner and Stopka, 2016). Furthermore, according to Kellert and Calabrese (2015), a growing body of scientific study increasingly reveals that “most of our inherent tendencies to affiliate with nature continue to exercise significant effects on people’s physical and mental health, performance, and wellbeing”. The efforts to foster the connection between nature and people become ever more important as the world population continues to urbanize (Browning, et.al. 2014). In view of such large number of people who live in urban areas, people may find themselves separate from nature, the matter that has become negative on man’s behavior, mental and physical lifestyle. Therefore, architects and planners are looking forward to a solution for the built environment that comprehends society’s urban lifestyle while integrating meaningful natural attributes such as fresh air, daylight, vegetation, and views of nature which could enhance human health and well-being. Hence, biophilic design focuses significantly on enriching this vital relationship between people and nature within the built environment (Rhodesly, 2019).

Biophilic design seeks to create a positive connection between people and the environment as well as promoting health and well-being (Kellert, 2005). It is important to note that biophilic design is not a design fad or trend but a design philosophy based on biological theory and supported by data from both psychological and health research. It is imperative to understand that the concept of biophilia coupled with harnessing the connection to nature covers a range of benefits relating to psychological well-being, stress reduction, cognitive functioning, productivity, human development and social behavior (Heerwagen, 2000).

2.1.2 Concept of Biophilia

Biophilia is “the inherent human inclination to affiliate with nature” (Kellert and Calabrese, 2015). The term biophilia originates from the Greek words bio (“life”) and philia (“affinity”) (Browning and Cooper 2015). The word biophilia means "love of life or living systems" (Fromm, 2010). A German-born American social psychologist, Erich Fromm, introduced this term in his book, “The Heart of Man: Its Genius for Good and Evil” (Fromm, 1964). Biophilia highlights the psychological orientation of being engaged to all species (Fromm, 2010). At its

`

base, the concept of biophilia is straightforward and explains that humans are innately drawn to associate with natural systems and processes. This is a direct result of how humans evolved. As shown in the simple timeline of human evolutionary history, it is only within the last few thousand years that humans have begun to separate themselves from natural surroundings. In fact, for 99% of species' history, humans' biological development has resulted as adaptive responses to natural environments which included features such as light, sound, color, wind, water, vegetation, and landscapes (Kellert and Calabrese, 2015). A term first coined by social psychologist Erich Fromm in 1964 and later put into use by biologist E.O. Wilson in 1984, biophilia is defined from the Greek root meaning love of nature (Browning et al., 2012). In 1984, an American biologist, Edward O. Wilson, popularized the term Biophilia (Wilson, 1984). Later in 1993, Wilson introduced the biophilia hypothesis (kellert and Wilson, 1993).

> "Biophilia is the innately emotional affiliation of human beings to other living organisms. Life around us exceeds in complexity and beauty anything else humanity is ever likely to encounter"
>
> Wilson (1984)

> "Biophilia is not a single instinct but a complex of learning rules that can be teased apart and analysed individually."
>
> Wilson (1993)

2.1.2.1 The Biophilia Hypothesis

Humans are nature and, as living beings, their need to be connected to nature is to be a part of the greater process of life. The term biophilia may be a relatively new one, but the concept is not. Upon breaking down the word, one arrives that bio- is "of or relating to life," and -philia is "denoting fondness, esp. an abnormal love for a specified thing" (Stevenson and Lindberg, 2013). Biophilia is defined at its simplest meaning as the love of life. Thus, people have been intuitively aware of it since ancient times, where natural objects, shapes, and patterns have often acted as a source of inspiration for architects all over

`

the history. As well, definitions of biophilia has been developed by three influential scientists as following:

- **Erich Fromm:** The constructing and coining of the term has its base in science, as one would suspect. The psychologist, Erich Fromm, first puts the root in his book “The Heart of Man” in 1964. Recognizing the innate connectedness humans share with the natural environment, German social psychologist Eric Fromm introduced the term “biophilia” as a psychological orientation of attraction to all things living (1964, 1973). He defines biophilia as a “tendency to preserve life and to fight against death” (Fromm, 1964). The inverse of biophilia is necrophilia, which is simply defined as the love of death. Fromm further explores biophilia nearly a decade later in “The Anatomy of Human Destructiveness”book in 1973 and redefines it as “the passionate love of life and of all that is alive” and furthermore “the wish to further growth, whether in a person, a plant, an idea, or a socialgroup” (Fromm, 1973). Not only is biophilia a personal preference inside one’s mind; it manifests itself in the physical world and provokes an action on others. The cultivating of biophilia will improve not only one's own character, but also the character of those others around the biophilic person and the general environment surrounding them (Young, 2008).

- **Edward O. Wilson:** Following up on Fromm’s work, Harvard University Professor of Science and biologist Edward O. Wilson popularized and developed the “biophilia hypothesis”. Edward O. Wilson, though never relating his work to Fromm, takes the word and develops it in the field of biology, particularly sociobiology, a few years later. Wilson first uses the term biophilia in a 1979 article aptly titled “Biophilia,” defining it as “the rich, naturalpleasure that comes from being surrounded by living organisms, not just other human beings but a diversity of plants and animals that live in gardens and woodlots, in zoos, around the home, and in the wilderness”(Wilson, 1979). For Wilson biophilia gives something back to humans for everything they put into living

`

relationships; it is not a one-sided relationship. Humans should desire to create biophilia in their lives because of the benefits of such a transformation. Wilson then goes on to develop the concept in an entire book dedicated to biophilia in 1984, once again titled Biophilia. He begins by defining it as “the innate tendency to focus on life and lifelike process” (Wilson, 1984). Wilson is interested in thinking about how these positive feelings towards nature are inborn in human beings. He feels that there is a reason to believe that all humans truly want nature, though it is sometimes hidden within a person. Almost another decade after his first biophilia book in 1993, Wilson teams up with Stephen R. Kellert to edit a book, entitled The Biophilia Hypothesis, of a collection of articles about the subject from other researchers. He redefines it a third time in his own article as “the innately emotional affiliation of human beings to other living organisms” (Kellert & Wilson, 1993). This time Wilson’s definition is closer to Fromm’s because of the focus on the emotions. Both Fromm and Wilson are interested in what is going on in humans’ psyche, though for slightly different reasons.

- **Stephen R. Kellert:** Stephen Kellert, Professor Emeritus of Social Ecology, Senior Research Scholar at Yale University, and co-editor of Wilson’s later text The Biophilia Hypothesis. Kellert describes the difference between Fromm and Wilson’s point of view of biophilia in his 1997 book, “Although Fromm describes biophilia as a love of life, ‘whether in a person [or] a plant,’ his work focuses almost exclusively on human interactions. The emphasis of [Kellert and Wilson’s work] is on people’s need to connect with the whole realm of living diversity” (Kellert, 1997).

Young (2008) indicates that Fromm focuses solely on improving humans first and not intentionally improving other parts of nature as a result. Wilson and Kellert, on the other hand, focus on improving nature first but also intentionally improving humankind as a result because the two are interconnected. Fromm

`

puts much energy into the human view, while it is Wilson and Kellert's passion to see the earth sustain its biodiversity.

The biophilia hypothesis continues to be supported by an increasing amount of theoretical and empirical research, and its foundation has become more complex. The biophilia hypothesis foundation is not singular but instead involves an intertwined set of "learning rules" of culture and emotional responses that could be analyzed individually for greater understanding (Wilson, 1984). Several expressions that examine fundamental human inclination aspects affiliated with nature are included in this defined set of learning rules. Learning expressions illustrate the theory that the evolution of man has been dependent on the natural environment for a sense of overall well-being since the beginning on mankind (Kellert, 1993).

2.1.3 Biophilic Designs

Biophilic design is a method of designing the places in which one live and work in such a way that satisfies once deep and fundamental need to be connected with nature (Kellert, 2008). The idea behind this is that exposure to natural environments and features have positive effects on human health and wellbeing, which has been supported in a wealth of research (Kellert, 2005). According to the Biophilia hypothesis, these positive effects of exposure to nature originate in a biological bond between humans and the natural world (Kellert, 2008). While biophilia is the theory, biophilic design as advocated by Kellert et.al, (2008) and Beatley (2010) internationally involves a process that offers a sustainable design strategy that incorporates reconnecting people with the natural environment.

The role of biophilic design can be discerned historically by analysing examples of built form and landscape design that demonstrate biophilic sensibilities or eliciting biophilia- informed responses. The early protagonists of biophilic design made extensive use of historic examples to illustrate their various contentions about the ways in which human artefacts, as well nature itself, could create a positive sense of connection with 'nature' and the natural

`

processes (Wilson 1984). Yet biophilia remains a relatively new, if rapidly growing, field of study. The literature indicates that by nurturing connections between people and their environment, biophilia might function as an educational tool for helping to build ecologically viable urban environments. Kellert et.al, (2008) proposes that combining “the biophilic desire to harmonize with nature” together with the design of the built environment results in “some degree of deliberate refashioning of nature to satisfy human needs, but in ways that celebrate the integrity and utility of the natural world”. Accordingly, biophilic design has the potential to enrich nature and humanity. Apart from being connected to the natural environment, it is important for people to be interactive with nature. As explained by Frumkin (2016), this interaction makes an individual feel part of the wider system and develop empathy for the natural system. Biophilic design applies to any type of space that promotes health by creating a human connection with nature. According to Engineer et.al, (2018), biophilic design provides a long-term solution to designs that degrade the natural system. Biophilic design appears to also have a restorative effect on humans. Studies on human-environment relationships reveal that living spaces have a significant impact on the way individuals respond to and cope with day-to-day activities (Frumkin, 2016).

Biophilic design emphasizes the human connection with nature; however, it is vital to understand that it is not based solely on the simple addition of trees and greenery within the built environment. Instead, biophilic design focuses extensively on humanity’s relationship within nature and nature’s place within society culturally and sustainably. It is essential that Biophilic built environments actively promote a relationship with nature that is mutual, respectful, and enriching to human well-being (Kellert and Heerwagen, 2008). Illustration of animals and plants has a long history in architecture. There are many cases in the world’s oldest civilizations that show a human tendency to nature. Some examples include the gardens of Babylon and the leafy filigrees of Rococo design (Browning et.al, 2014). As such, design that encourages the human-nature relationship is necessary in order to re-establish optimal human well-being. Kellert, (2012) further explains that an antagonistic approach to rebuilding this relationship would provoke greater environmental degradation

`

and isolation from biological habitats and natural elements in urban environments.

Kellert et.al, (2008) define biophilic design as

> "The expression of the inherent human need to affiliate with nature in the design of the built environment. In addition, biophilic design can be implemented in a variety of ways within the built environment. It can connect its users directly, indirectly or symbolically through a building's exterior features, interior space, decoration and exterior landscapes."

Kellert and Calabrese (2015) have identified fundamental conditions for the effective practice of biophilic design, comprising:

- Biophilic design requires repeated and sustained engagement with nature;
- Biophilic design focuses on human adaptations to the natural world that over evolutionary time have advanced people's health, fitness and wellbeing;
- Biophilic design encourages an emotional attachment to particular settings and places;
- Biophilic design promotes positive interactions between people and nature that encourage an expanded sense of relationship and responsibility for the human and natural communities; and,
- Biophilic design encourages mutual reinforcing, interconnected, and integrated architectural solutions.

Human interaction with nature is often lacking in modern day societies (Kellert, 2005) due to societal trends such as urbanization, building design, and lifestyle. Urban environments tend to be full of demanding, stressful, under stimulating or boring features. The fundamental objective of biophilic design is to extract a positive valued experience of natural and built environment. Biophilic design

`

has received increasing interest from the building industry around the world in recent years. Practitioners must realize that biophilic design intervention must benefit humans and nature needs. Using inspiration from local natural environment and vernacular cultural expressions are critical to create a sense of place in Biophilic design. Hence, the biophilic design arises to remedy this modern disconnect with nature and fulfil the longing that humans have to be immersed in the natural environment.

Providing opportunities for interaction with nature through interior and exterior design, Biophilic design relies on an inherent connection between humans and their natural environment as an integral and foundational component of architecture, interior, and landscape design. It is, therefore, a valuable resource when creating residential, office and commercial spaces that not only serve their intended functions, but increase the physical, psychological and emotional health of the occupants (Kellert et.al, 2008). Biophilic design has been acknowledged in the last decade with the publication of the “14 Patterns of Biophilic Design” by Terrapin. Biophilic design is also being incorporated into several building rating systems, including the Version 4 of the LEED rating system, Version 1 of the WELL Building Standards, and Version 3 of the Living Building Challenge.

According to Kieran (2005), One can never achieve an ethical architecture that is beautiful and sustainable until nature is integral and at the core and at the substance and being of the architecture, not added on. If it is not beautiful, it cannot be sustainable. Buildings must shelter and inspire.

2.1.4 Patterns of Biophilic Design

Since the publication of the Biophilia Hypothesis and a ‘Typology of Biophilia Values’ (Kellert and Wilson 1993), as noted by Söderlund and Newman, 2015 there have been a number of attempts to summarise elements, attributes and patterns of biophilic design in a tabulated form (Söderlund and Newman 2015). Inherently oriented to practice, this concern in effect seeks to provide a ’toolkit’ for biophilic design. More recently, in the USA, Browning et.al, (2014) have

`

proposed ‘14 Patterns of Biophilic Design’ within a framework for relating the human biological science and nature to the design of the built environment offering tools for understanding design opportunities, and avenues for design applications as a way to effectively enhance health and well-being for individuals and society. These Patterns offer, in effect, series of tools for understanding design opportunities, and avenues for design applications that may enhance individual and societal health and well-being. Despite recent academic and senior practitioner research on biophilic design, there is a media, public and built environment practitioner misapprehension that biophilic design is solely about introducing vegetation (eg. green roofs, green walls, water sensitive urban design) to the built environment in contrast to eliciting biophilia responses as part of the overall experience of the built environment. This experience includes elements that are not plants, as the 14 Patterns listed in demonstrates, whereby some biophilia effects can be achieved with no physical tangible link to ‘nature’ or living systems at all (Downton et.al, 2016). Indirect experiences of ‘nature’ or living systems, including purely artistic representations of nature and illusions of nature can generate biophilic psycho-physiological responses. Biophilic effects are measurable in un-natural environments like hospital rooms, when people are exposed to images or illusions of nature such as artificial sky. Such illusory, or virtual, systems are part of the suite of biophilic design tools, valuable for environments, such as rooms buried deep inside large buildings, that cannot easily accommodate real biological systems (Downton et.al, 2016).

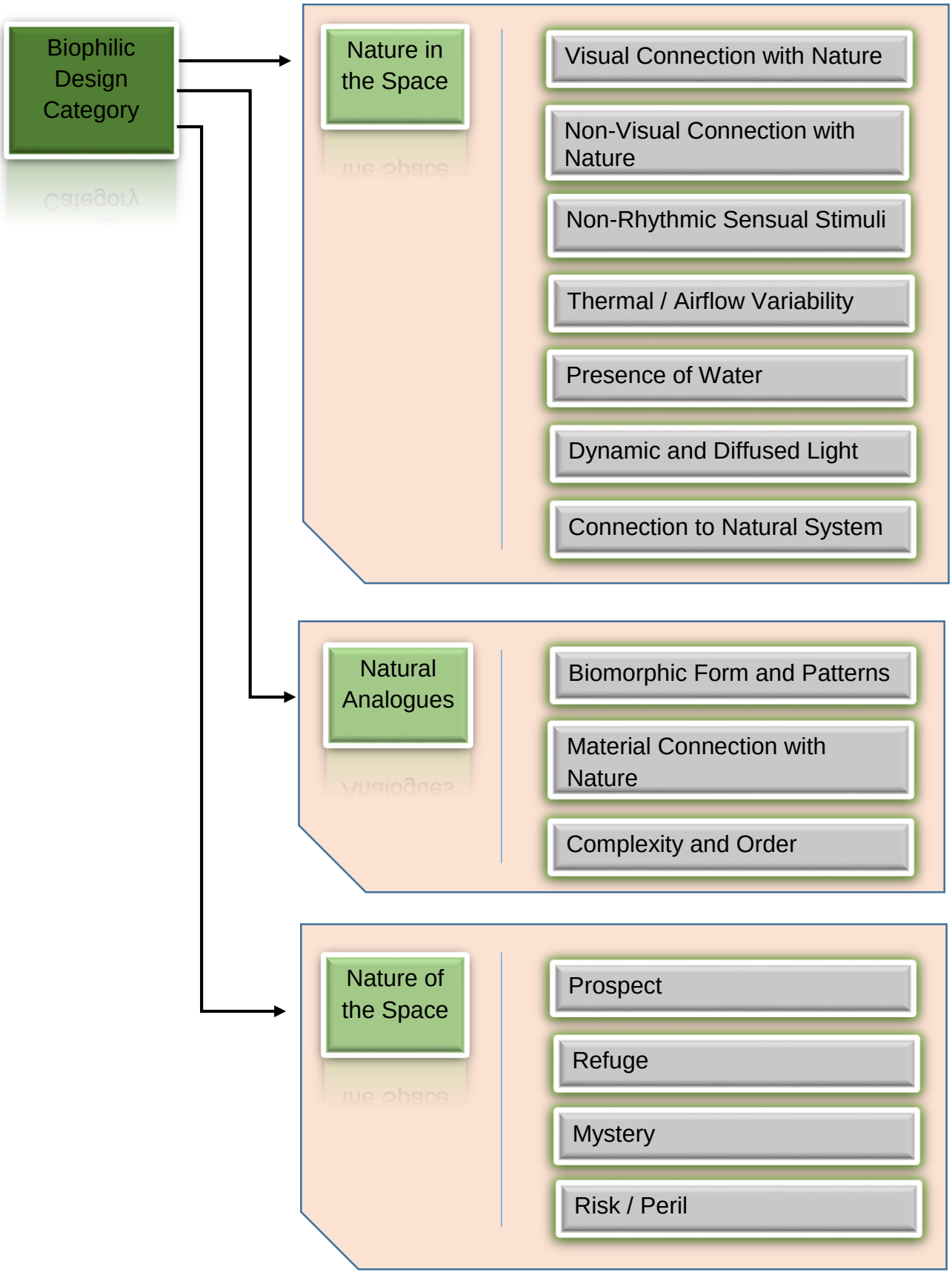
Terrapin Bright Green, an environmental consulting firm, has suggested “14 Patterns of Biophilic Design” to articulate the relationships between nature, human biology and psychology, and the design of the built environment which could help designers to reach a successful implementation or evaluation of biophilic design (Browning et.al, 2014). Additionally, this consulting firm has organized the 14 patterns into three categories – Nature in the Space, Natural Analogues, and Nature of the Space. In fact, these patterns represent a collection of tools for realizing design opportunities in a certain environment.

`

2.1.4.1 Nature in the Space

Nature in the Space addresses the direct, physical and ephemeral presence of nature in a space or place. This includes plant life, water and animals, as well as breezes, sounds, scents and other natural elements. The strongest Nature in the Space experiences are achieved through the creation of meaningful, direct connections with these natural elements, particularly through diversity, movement and multi-sensory interactions. Nature in the Space encompasses seven biophilic design patterns: Visual Connection with Nature; Non-Visual Connection with Nature; Non-Rhythmic Sensory Stimuli; Thermal & Airflow Variability; Presence of Water; Dynamic & Diffuse Light; and Connection with Natural Systems (Browning et.al, 2014).

- **Visual Connection with Nature:** A Visual Connection with Nature is a view to elements of nature, living systems and natural processes (Ryan et.al, 2014). A space with a good Visual Connection with Nature makes one feel whole, it grabs one's attention and can be stimulating or calming. It can convey a sense of time, weather and other living things (Browning et.al, 2014). The Visual Connection with Nature pattern has evolved from research on visual preference and responses to views to nature showing reduced stress, more positive emotional functioning, and improved concentration and recovery rates. Stress recovery from visual connections with nature have reportedly been realized through lowered blood pressure and heart rate; reduced attentional fatigue, sadness, anger, and aggression; improved mental engagement/attentiveness, attitude and overall happiness. There is also evidence for stress reduction related to both experiencing real nature and seeing images of nature.



Source: *Browning et.al, (2014), 14 Patterns of Biophilic*

`

- **Non-Visual Connection with Nature:** Non-Visual Connection with Nature is the auditory, haptic, olfactory, or gustatory stimuli that engender a deliberate and positive reference to nature, living systems or natural processes. A space with a good Non-Visual Connection with Nature makes one feel fresh and well balanced; the ambient conditions are perceived as complex and variable but at the same time familiar and comfortable, whereby sounds, aromas, and textures are reminiscent of being outdoors in nature (Browning et.al, 2014). The Non-Visual Connection with Nature pattern has evolved from research on reductions in systolic blood pressure and stress hormones; impact of sound and vibration on cognitive performance; and perceived improvements in mental health and tranquillity as a result of nonvisual sensory interactions with non-threatening nature.

- **Non-Rhythmic Sensory Stimuli:** Non-Rhythmic Sensory Stimuli are stochastic and ephemeral connections with nature that may be analysed statistically but may not be predicted precisely. A space with good Non-Rhythmic Sensory Stimuli makes one feel as if he is momentarily privy to something special, something fresh, interesting, stimulating and energizing. It is a brief but welcome distraction (Browning et.al, 2014). The Non-Rhythmic Sensory Stimuli pattern has evolved from research on looking behavior; eye lens focal relaxation patterns; heart rate, systolic blood pressure and sympathetic nervous system activity; and observed and quantified behavioral measures of attention and exploration.

- **Thermal and Airflow Variability:** Thermal & Airflow Variability can be characterized as subtle changes in air temperature, relative humidity, airflow across the skin, and surface temperatures that mimic natural environments (Ryan et.al, 2014). A space with good Thermal & Airflow Variability makes one feel refreshing, active, alive, invigorating and comfortable. The space provides a feeling of both flexibility and a sense

`

of control (Browning et.al, 2014). The Thermal & Airflow Variability pattern has evolved from research measuring the effects of natural ventilation, its resulting thermal variability, and worker comfort, well-being and productivity; physiology and perception of temporal and spatial pleasure (alliesthesia). The impact of nature in motion is on concentration; and, generally speaking, a growing discontent with the conventional approach to thermal design, which focuses on achieving a narrow target area of temperature, humidity and air flow while minimizing variability.

- **Presence of Water:** Presence of Water is a condition that enhances the experience of a place through the seeing, hearing or touching of water (Ryan et.al, 2014). A space with a good Presence of Water condition makes one feel compelling and captivating. Fluidity, sound, lighting, proximity and accessibility each contribute to whether a space is stimulating, calming, or both (Browning et.al, 2014). The Presence of Water pattern has evolved from research on visual preference for and positive emotional responses to environments containing water elements; reduced stress, increased feelings of tranquility, and lower heart rate and blood pressure from exposure to water features; improved concentration and memory restoration induced by complex, naturally fluctuating visual stimuli; and enhanced perception and psychological and physiological responsiveness when multiple senses are stimulated simultaneously.

- **Dynamic and Diffuse Light:** Dynamic & Diffuse Light leverages varying intensities of light and shadow that change over time to create conditions that occur in nature. A space with a good Dynamic & Diffuse Light condition conveys expressions of time and movement to evoke feelings of drama and intrigue, buffered with a sense of calm (Browning et.al, 2014). Lighting design has long been used to set the mood for a space, and different lighting conditions elicit differing psychological responses. The impact of daylight on performance, mood and well-being has been

`

studied for many years, in a variety of environments, and as a complex field of science and design, light has been extensively studied and written about. Recent research has focused more heavily on illuminance fluctuation and visual comfort, human factors and perception of light, and impacts of lighting on the circadian system functioning.

- **Connection with Natural Systems:** Connection with Natural Systems is the awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem. A space with a good Connection with Natural Systems evokes a relationship to a greater whole, making one aware of seasonality and the cycles of life. The experience is often relaxing, nostalgic, profound or enlightening, and frequently anticipated (Browning et.al, 2014). There is limited scientific documentation of the health impacts associated with access to natural systems; this pattern is suspected to enhance positive health responses. Kellert et.al, (2008) frame this as “Natural Patterns and Processes”, whereby seeing and understanding the processes of nature and can create a perceptual shift in what’s being seen and experienced. This pattern has a strong temporal element, which can be expressed culturally.

2.1.4.2 Natural Analogues

Natural Analogues addresses organic, non-living and indirect evocations of nature. Objects, materials, colors, shapes, sequences and patterns found in nature, manifest as artwork, ornamentation, decor, and textiles in the built environment. Mimicry of leaves, decoration with organic shapes, and natural materials that have been processed or extensively altered, each provide an indirect connection with nature; they are analogous of the items in their ‘natural’ state. The strongest Natural Analogue experiences are achieved by providing information richness in an organized and sometimes evolving manner. Natural Analogues encompasses three patterns of biophilic design: Biomorphic Forms & Patterns; Material Connection with Nature; and Complexity & Order (Browning et.al, 2014).

`

- **Biomorphic Forms and Patterns:** Biomorphic Forms & Patterns are symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature. A space with good Biomorphic Forms & Patterns makes one feel interesting and comfortable, possibly captivating, contemplative or even absorptive (Browning et.al, 2014). Biomorphic Forms & Patterns has evolved from research on view preferences, reduced stress due to induced shift in focus, and enhanced concentration. Nature abhors right angles and straight lines (Thompson, 1917). People have a visual preference for organic and biomorphic forms. While human brain knows that biomorphic forms and patterns are not living things, people may describe them as symbolic representations of life (Vessel et.al, 2012).

- **Material Connection with Nature:** A Material Connection with Nature is material and elements from nature that, through minimal processing, reflect the local ecology or geology to create a distinct sense of place. A space with a good Material Connection with Nature makes one feel rich, warm and authentic, and sometimes stimulating to the touch (Browning et.al, 2014). While scientific documentation on the health impact of natural materials is limited, available research is beginning to shed light on opportunities for informed design. As such, the Material Connection with Nature pattern has evolved from a limited body of scientific research on physiological responses to variable quantities of natural materials, and the impact of natural color palette, has on cognitive performance.

- **Complexity and Order:** Complexity & Order is rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature (Ryan et.al, 2014). A space with good complexity & order makes one feel engaging and information-rich, as an intriguing balance between boring and overwhelming (Browning et.al, 2014). The Complexity & Order pattern has evolved from research on fractal geometries and preferred views; the perceptual and physiological responses to the

`

complexity of fractals in nature, art and architecture; and the predictability of the occurrence of design flows and patterns in nature. In such fractal environments, our body automatically dampens its response to stress induced by intensive tasks and reaction to external forces (Salingaros, 2012). This implies that spaces with convenient complexity & order are healing, or at least buffer us from life's stresses.

2.1.4.3 Nature of the Space

Nature of the Space addresses spatial configurations in nature. This includes humans' innate and learned desire to be able to see beyond their immediate surroundings, their fascination with the slightly dangerous or unknown and obscured views and revelatory moments. The strongest Nature of the Space experiences might be achieved through the creation of deliberate and engaging spatial configurations commingled with patterns of Nature in the Space and Natural Analogues. Nature of the Space encompasses four biophilic design patterns: Prospect; Refuge; Mystery; and Risk/Peril (Browning et.al, 2014).

- **Prospect:** Prospect is an unimpeded view over a distance for surveillance and planning (Ryan et.al, 2014). A space with a good Prospect condition conveys the feeling of openness and freeing, yet imparts a sense of safety and control, particularly when alone or in unfamiliar environments (Browning et.al, 2014). The Prospect pattern has evolved from research on visual preference and spatial habitat responses, as well as cultural anthropology, psychology and architectural analysis. Health benefits are suggested to include reductions in stress, boredom, irritation, fatigue and perceived vulnerability, as well as improved comfort.

- **Refuge:** Refuge is a place for withdrawal, from environmental conditions or the main flow of activity, in which the individual is protected from behind and overhead. A space with a good Refuge condition makes one feel safe, providing a sense of retreat and withdrawal for work, protection

`

and rest or healing. A good refuge space also makes one feel separate or unique from its surrounding environment; its spatial characteristics can convey feels of contemplative, embracing and protective, without unnecessarily disengaging. The Refuge pattern has evolved from research on visual preference research and spatial habitat responses, and its relationship to Prospect conditions. Refuge conditions are important for restoration experiences and stress reduction, which can be realized through lowered blood pressure and heart rate (Browning et.al, 2014). Other benefits of Refuge are suggested to include reduced irritation, fatigue and perceived vulnerability, as well as improved concentration, attention and perception of safety.

- **Mystery:** Mystery is the promise of more information achieved through partially obscured views or other sensory devices that entice the individual to travel deeper into the environment (Ryan et.al, 2014). A space with a good Mystery condition has a palpable sense of anticipation, or of being teased, offering the senses a kind of denial and reward that compels one to further investigate the space (Browning et.al, 2014). The Mystery pattern is largely based on the idea that people have two basic needs in environments: to understand and to explore (Kaplan and Kaplan, 1989) and that these 'basic needs' should occur 'from one's current position' in order to engender a sense of mystery (Herzog and Bryce, 2007). The Mystery pattern has evolved from research on visual preference and perceived danger, as well as pleasure responses to anticipatory situations.

- **Risk/ Peril:** Risk/Peril is an identifiable threat coupled with a reliable safeguard (Browning et.al, 2014). A space with a good Risk/Peril condition makes one feel exhilarating, and with an implied threat, maybe even a little mischievous. One feels that it might be dangerous, but intriguing (Ryan et.al, 2014). Risk can be generated by a learned or biophobic response (fear of nature) triggered by a near and present danger (Browning et.al, 2014). This danger, however, is inert and unable

`

to cause harm due to a trusted element of safety. Having an awareness of a controllable risk can support positive experiences that result in a strong dopamine or pleasure responses.

These design patterns give industry professionals a roadmap for creating cohesive and effective biophilic environments. Good Biophilic design is more than bringing potted plants and artwork into the space. Good biophilic design is thoughtfully planned such that elements of nature are incorporated into every surface. Incorporating natural elements into multiple surfaces or dimensions in the workplace creates a more diverse and interesting built environment and increases the frequency of exposure to nature.

2.1.5 Benefits of Biophilic Designs

The man has always been a nature lover since the beginning, and Biophilia is the attempt made by man to replicate or introduce nature and its various forms in the built environment. The recent scientific researches highlight that inherent ability to exercise nature is due to its noticeable benefits. This is also evident from the preferences of the construction and design industry to integrate nature into the built environment or building in and around nature (Abbas and Jawaid, 2017). In research conducted by Clark and Chatto in 2014, Biophilic architecture strategies are evaluated to enhance the sense of health and productivity of individuals (Clark and Chatto, 2014). In the study conducted by Ryan et.al, (2014) Biophilic design pattern was evaluated to emerge nature according to parameters of health, wellbeing and mental patients in the built environment of departments. Several benefits of Biophilic designs are discussed as below:

- **Economic benefits:** The economic benefits of reconnecting people to nature are often miss consider because of the difficulty of quantifying the variables associated with the positive outcomes. By assigning value to a variety of indicators influenced by biophilic design, the business case for Biophilia proves that disregarding humans' inclination towards nature is

`

simultaneously disclaiming the potential for positive financial growth (Newman, 2010).

Work place - when well-designed, spaces can reduce deficient productivity, absenteeism, loss of focus, negative mood, and poor health. (Kellert, 2008).

Hospitals - incorporating natural elements into the healthcare industry can reduce the cost of both patient care and staffing while improving medical outcomes.

Retail Spaces -the psychologically soothing and calming effect of nature can draw shoppers into stores with biophilic elements can boost sales compared to those without.

Education – classrooms can be strategically designed with Biophilic elements to foster better test scores, optimal health, and increased learning rates. Schoolyards with natural elements can trigger mental restoration, better behaviour and enhanced focus in students (Wolf, 2014).

However, the evidence above suggests that biophilic design is a financially beneficial way to invest in employees as increasing staff satisfaction and output while reducing costs. The economic gains to be made from environmental benefits such as reduced energy costs, extended building life, and decreased water management costs are apparent. Biophilia in building design could play an important role in employee recruitment and retention (Bliss, 2015).

- **Increased Productivity:** While employers hope their employees are productive every hour, functioning at 100% efficiency is unlikely. Understanding the drivers of absenteeism and the resulting direct and indirect costs of deficient employee productivity however, can positively influence strategies for workplace design and strengthen an organization’s ability to attract and retain workers. The incorporation of biophilic design elements into the built environment has been demonstrated to produce an abundance of physical and physiological benefits, which, in turn, powers a more productive and innovative

workplace. Browning et.al, (2014) supported this further by pointing out that “today productivity costs are 112 times greater than energy costs in the workplace,” and that by day lighting schemes in offices can “save over too much per employee per year in office costs”. Feeling good often equates to being able to do more.

- **Environmental Benefits:** Alteration of natural systems inevitably occurs as a result of major building construction and development. Moreover, all biological organisms transform the natural environment in the process of inhabiting it. The question is not whether ecological change occurs, but rather will the net result over time be a more productive and resilient natural environment as measured by such indicators as levels of biological diversity, biomass, nutrient cycling, hydrologic regulation, decomposition, pollination, and other essential ecosystem services. The application of biophilic design can alter the environmental conditions of a building or landscape in the short term, but over the long run, it should support an ecologically robust and sustainable natural community.

- **Improved Physiological Health:** Physiological responses encompass human aural, musculoskeletal, respiratory, circadian systems and overall physical comfort. Physiological responses triggered by connections with nature include relaxation of muscles, as well as lowering of diastolic blood pressure and stress hormone levels in the blood stream (Park et al, 2009). Short term stress increases in heart rate and stress hormone levels, such as caused by encountering an unknown but complex and information-rich space, can probably be beneficial to regulate physiological health (Kandel et.al, 2013). The physiological system needs to be tested regularly, but only enough for the body to remain resilient and adaptive. Physiological responses to environmental stressors can be buffered through design, allowing for the restoration of bodily resources before system damage occurs (Steg et.al, 2012). There have been measured physiological and neurological effects of nature on the human body and the brain. For example, neuroscientists have

studied the effects of different types of scenery on the visual cortex in the brain. When subjects shown views of complex, dynamic, natural scenes, interactions of the mu (opioid) receptors processed in the rear portion of the visual cortex increased significantly which indicated a more pleasurable experience. Scientists observed more physiological changes in the human body when immersed in natural versus artificial settings. The human body has also demonstrated positive responses to isolated aspects of Biophilia such as daylight. For example, the balance of our circadian rhythm has been partially linked to the changing color of daylight (yellow light in the morning, more blue tones in mid-day, and turning to reddish hues in the afternoon). Exposure to this natural color and light pattern helps to control the equilibrium of our daily cycle of hormonal activity including serotonin, the hormone associated with mood, and melatonin, which regulates sleep (Browning et.al, 2012).

- **Improved Psychological Health:** Psychological responses encompass concentration, and emotion and mood. This includes interactions to nature that impact restoration and stress management. For instance, empirical studies have reported that experiences of natural environments provide greater emotional restoration, with lower instances of tension, anxiety, anger, fatigue, confusion and total mood disturbance than urban environments with limited characteristics of nature (Alcock et.al, 2014; Barton and Pretty, 2010; Hartig et.al, 2003). Psychological responses can be learned or hereditary, with past experiences, cultural constructs and social norms playing a significant role in the psychological response mechanism (Browning et.al, 2014). Psychological benefits range from increased satisfaction and motivation, less stress and anxiety, to improved problem solving and creativity. The positive behavioural change includes better coping and mastery skills enhanced attention and concentration, improved social interaction, and less hostility and aggression.

`

Biophilic design is heavily centered on well-being because it poses benefits for a variety of users in a variety of environments, regardless of age, abilities, and economic status (Heerwagen, 2009). In fact, creative constructions of the human built environment can be either a positive facilitator or a harmful impediment to the biophilic need for ongoing contact with natural systems and processes. Besides, a growing body of knowledge supports the role of contact with nature in human health, well-being and productivity. This argument is discussed by Kellert (2005) and summarized that contact with nature has been found to enhance healing and recovery from illness andmajor surgical procedures, including direct contact (e.g., natural lighting, vegetation), as well as representational and symbolic depictions of nature. People living in proximity to open spaces report fewer health and social problems, and this has been identified independent of rural and urban residence, level of education, and income. Even the presence of limited amounts of vegetation such as grass and a few trees has been correlated with enhanced coping and adaptive behaviour. Office settings with natural lighting, natural ventilation, and other environmental features result in improved worker performance, lower stress, and greater motivation. Contact with nature has been linked to cognitive functioning on tasks requiring concentration and memory. Healthy childhood maturation and development has been correlated with contact with natural features and settings. The human brain responds functionally to sensory patterns and cues emanating from the natural environment. Communities with higher-quality environments reveal more positive valuations of nature, superior quality of life, greater neighbourliness, and a stronger sense of place than communities of lower environmental quality. These findings also occur in poor urban as well as more affluent and suburban neighbourhoods. Hence, biophilic design is a contemporary philosophy of architecture that supports these tendencies and seeks solutions for sustainability in nature, not by replicating the natural forms, but by understanding the rules governing those forms (Ramzy, 2015).

`

2.1.6 Theatre Room

The theatre room impacts the reallocation of leisure time. For example, theatre room leads to an increase in time spent at home and with the family (Levy, 1987, 1989; Lindlof and Shatzer, 1990) and to an associated decrease in movie theatre attendance and other leisure activities (Henke and Donohue, 1989; Lin, 1992; Noh and Grant, 1997). There is also significant social utility from theatre room, in terms of its impact on family communication patterns. Video viewing is a social activity that promotes family togetherness (Gunther and Wober, 1989; Levy and Gunther, 1988; Lin, 1992, 2001). Holman (2000) attributed the growth of the theatre phenomenon to its ability to connect people. According to Holman, “A whole group of family and friends can share something at home that, while taking each of them away from the cares of the day, nevertheless provides a link between individuals that comes about in few other ways”. Rubin and Bantz (1987) suggested that theatre room is a functional alternative to interpersonal communication. The motives for interpersonal communication are pleasure, escape, and relaxation, which can be linked to theatre room use (Lin, 2001; Rubin and Rubin, 1989).

The discourse about theatre room technologies, particularly the discourse of the industry itself, has created an “aristocracy of culture,” one that possesses “a certain cultural capital in the entertainment world that bestows ‘titles of cultural nobility’ on the viewers who use them” (Roger, 2001).

Holman (2000) defined home theatre as

> “The combination of high-quality video and sound presentation in home. What distinguishes home theatre from mere television, however, is largely sound quality”

Wilson and Harris (2001) defines Home theatre as

> “A home theatre system is a combination of electronic components designed to recreate the experience of watching a movie in a theatre”

`

A home theatre is a dedicated room in house built for the purpose of enjoying movies, television, sports, and gaming. These rooms are designed to provide a true cinema experience, they’re typically a closed room (to give complete control of light and sound) and feature a front-projector instead of a TV. [2]

Home cinema, also called home theatres or theatre rooms, are home entertainment audio-visual systems that seek to reproduce a movie theatre experience and mood using consumer electronics-grade video and audio equipment that is set up in a room or backyard of a private home. In the 2000s, technological innovations in sound systems, video player equipment and TV screens and video projectors have changed the equipment used in home cinema set-ups and enabled home users to experience a higher-resolution screen image, improved sound quality and components that offer users more options (e.g., many of the more expensive Blu-ray players in 2016 can also "stream" movies and TV shows over the Internet using subscription services such as Netflix). The development of Internet-based subscription services means that 2016-era theatre room users do not have to commute to a video rental store as was common in the 1980s and 1990s. In the 2020s, a home cinema system typically uses a large projected image from a video projector or a large flat-screen high-resolution HDTV system, a movie or other video content on a DVD or high-resolution Blu-ray disc, which is played on a DVD player or Blu-ray player, with the audio augmented with a multi-channel power amplifier and anywhere from two speakers and a stereo power amp (for stereo sound) to a 5.1 channel amplifier and five or more surround sound speaker cabinets (with a surround sound system). Whether theatre room enthusiasts have a stereo set-up or a 5.1 channel surround system, they typically use at least one low-frequency subwoofer speaker cabinet to amplify low-frequency effects from movie soundtracks and reproduce the deep pitches from the musical soundtrack. [3]

Equating technology with art, theatre room enthusiasts use big-screen and projection televisions, surround-sound stereo equipment, and high-quality playback components to reproduce the theatrical movie-going experience,

`

creating a domestic version of the old movie palaces and generating in the process “a new film culture within the home, a culture that requires not only specific pieces of equipment but a change in viewing attitudes.” In sharp contrast to “glance theory,” in which the experience of viewing television is defined primarily in terms of an inability to focus on the visual experience as one would in a darkened movie theatre due to the presence of distractions within the domestic space, theatre room “‘rescues’ the domestic television from what detractors depict as its lack of spectacle and technological refinement” (Stuart, 1997).

Theatre room, according to Holman (2000), comprises source components (including VCR and DVD players), power amplifiers or audio–video receivers, multichannel loudspeakers, and a video display (TV or screen projector). Following are the interior components of a theatre room. Theatre room designs and layouts are a personal choice and the type of theatre room a user can set up depends on their budget and the space which is available within the home. The minimum set of requirements for a theatre room are, a large television set or good quality video projector CRT, LCD, Digital Light Processing (DLP), plasma display, organic light-emitting diode (OLED), Silicon X-tal Reflective Display (SXRD), Laser TV, rear-projection TV, video projector, Standard-definition television (SDTV), HDTV, or 3D-TV at least 27 inches (69 cm) measured diagonally, an AV receiver or pre-amplifier (surround processor) and amplifier combination capable of at least stereo sound but preferably 5.1 Channel Dolby Digital and DTS audio, and something that plays or broadcasts movies in at least stereo sound such as a VHS HI-FI VCR, Laser Disc player (no new stand-alone models of either are available; VHS VCRs are usually bundled in combo decks with DVD players), a DVD player, a Blu-ray disc player, cable or satellite receiver, video game console, etc. Finally a set of speakers, at least two, are needed but more common are anywhere from six to eight with a subwoofer for bass or low-frequency effects.[4]

Theatre rooms, whether designed for the sole purpose of watching movies or the full range of video and audio experiences, require specific electronic components. These are discussed as below:

`

- **One Screen or Multiple Screens:** Multiscreen systems are popular, especially with sports enthusiasts who like to watch several games simultaneously. Video gamers are also increasingly employing multiple screens that give each player a personal perspective of the game. Some owners create a video wall that includes security cameras and baby monitors. Others prefer one large screen configured to handle different feeds that are presented simultaneously in different areas of the screen. The key to an enjoyable experience is seamless source switching and simple controls that are correctly configured and installed. [5]

- **Smart TV or HD Projector:** Television screens are available in sizes greater than 100 inches, but they can cost more. By contrast, 80” HDTVs and 55” HDTVs are available in the market. HD projectors similar to the projectors used in commercial theatres, are often preferred for viewing on a large screen (100 inches and up). A critical factor in deciding whether to opt for a TV or a screen is resolution, or the number of pixels per unit of area. For viewers with 20/20 vision, the number of pixels affects the ideal distance between the screen and the viewer for maximum detail. The lower the resolution, the closer the viewer must sit to the screen. An HDTV is a better option for most people when adding a theatre room. [5]

- **Surround Sound System:** Movie directors understand that big sound is more important than big picture in making a viewing experience memorable. The minimum components for a theatre room sound system are a source (cable box or satellite system, DVD, or game system), an audio/video receiver or preamplifier/processor with a multichannel amplifier, and five or more multichannel speakers. A standard 5 to 1 sound system consists of left, center, right, surround left, and surround right speakers with a subwoofer for the bass response. A 6 to 1 or 7 to 1 system adds one or two speakers on the rear wall behind the listener. [5]

`

- **Computer or Game Console:** Video game enthusiasts can use either a beefed-up computer or a specialty console such as an Xbox One, PlayStation, Apple TV, or Nvidia Shield to play a variety of different games. Most gaming zealots prefer a PC based system if they have the funds to afford one. Both sources can utilize the TV and sound system installed in a media room. [5]

- **Ancillary Equipment:** Other equipment needed to make theatre room complete includes:

    - **Universal Remote**: One of the more frustrating consequences of combined electronic components can be the need to use multiple remote controls. Having a single remote that turns the electronics on and off, changes source inputs, adjusts sound levels, and controls your smart home technology is a necessity.[5]

    - **Game Controllers**: While a single joystick may be sufficient to operate many games, players can choose from a variety of control devices to maximize their experiences. Steering wheels and flight yokes, gear shifters, switches, and foot pedals can be combined with a variety of flight panels and dashboards to replicate the feel of driving a Grand Prix race car or flying a Warthog aircraft. Headsets that track your head or eye movements, as well as haptic gloves with tactile feedback, are also available. [5]

    - Surge Protectors: Surge protectors are crucial for expensive electronic equipment since you never know when a power outage might occur. Most devices work by shifting excess voltage to a ground circuit, often with a built-in resistor that breaks the circuit as the last option. Buy protectors with warranties that reimburse you for the cost of equipment if the protectors fail. [5]

`

- Wiring or Wireless Connection: Few people want the appearance and risk of unseemly wires throughout a theatre room, so plan on installing low-voltage, 14/4 or 16/2 speaker wire with a CL2 or CL3 rating between each speaker and the sound source. Before drilling holes in your walls, consider which wireless system will meet your needs. Sonos is a popular system for media rooms and can be expanded to include every room in the house. HDMI (High-Definition Multimedia Interface) cables are necessary to connect video sources to TV screens and audio/visual receivers. Experts recommend Premium High-Speed HDMI Ethernet cables due to the increased use of 4K video transmissions. While they cost more, Ethernet connections will provide better speed, lower latency (length of time required for a signal to move from one device to another), and more reliable connections. [5]

Other Considerations for a Theatre Room

Simply connecting a set of electronic devices does not make a media room. Interior design, including layout and furnishings, is crucial for a fully functional home entertainment space that creates the desired ambiance, whatever the activity, consider the following:

i. **Room Size:** Designers recommend a minimum area of 10 x 16 feet for a theatre room. The size of screen and its resolution affect the ideal distance needed between viewer and screen to get an immersive effect similar to a theatre, while still allowing viewers to see most of the screen without moving their heads. It is suggested that sitting at a distance where the screen fills up a minimum of 30 degrees of field of vision for an enjoyable experience. For example, the ideal viewing distance for a 60', 1080p TV is slightly less than 8 feet; viewers who sit more than 12 feet from the screen will not be able to benefit from the higher resolution. The optimal viewing distance from the screen is between 1.2 and 1.7 times the size of the screen. In other words, viewers should sit 5.5 to 8.5 feet away from a 60', 1080p screen for maximum benefit. [5]

`

ii. **Acoustics:** The right acoustics and ambiance are the difference between a good experience and a great experience. Soundproofing theatre space is also essential to maintain peace with spouses and neighbours, especially in apartment buildings, whether enjoying a battle between the Auto bots and Deceptions or the explosions in “Grand Theft Auto 5.” Acoustic materials and panels must needed in theatre room for sound absorbent purpose. Others materials like wood, upholstered panel and thick curtains could be design for sound absorbent. [5]

iii. **Lighting:** Light variety is crucial in theatre rooms that will be used for different activities. For example, if one need one level of lighting for watching a movie, another for watching TV, and another for entertaining friends. A combination of recessed lighting around the ceiling perimeter and 18 inches above the floor is suggested. Wall sconces add style and ambiance. Table and standing lamps, which create a glare on the viewing screen should be avoided. An integrated, present dimming system eliminates the need to manually readjust the lights to fit a new activity. [5]

iv. **Furniture:** For seating furniture, mostly recliner sofa, plain sofa, upholstered chairs and Bean bag chairs are preferred for seating. High-backed chairs can interfere with the sound path throughout the room so chairs should be design with low-back. Many people find a reclining position with their feet elevated more comfortable when viewing a movie than stationary seating. A recliner is versatile and gives seating options. Recliner sofas with an end table between them make it easy to set snacks and drinks down in a smaller room without theatre seats.[6]

v. **Walls:** The Theatre room designs avoid straight parallel walls due to the way sound bounces off the surfaces. For avoid strait parallel, Adding columns or other wall features are best option to break up long walls. Light coloured paint must avoided in theatre room and dark coloured paint must be preferred for wall finish, because dark colours absorb the light coming from projector screen and won't reflect light.[6]

`

vi. **Floor:** Floor was must be treated with sound absorbent materials like carpet, carpet tile, wood and wooden laminate. Carpeted floors help control theatre room sound. Carpeted floors are generally considered to be the best option. They absorb sound and prevent excess reverberation around the room. Either wall-to-wall carpeting can be done or carpet tiles to help clarify the sound from speakers as it travels throughout the room. Carpet is essential for the space between the front speakers and the listener to absorb the first sound reflections.[7]

vii. **Ceiling:** The colour and design of a theatre room ceiling tile can play a major role. The more height of theatre room helps to sound surround in room. Up and down ceiling design help to block sound. Acoustic material like perforated board acoustic panel and wood can be design as a ceiling. The ceiling should be painted using a dark colour, to help reduce any light reflections from screen. It is also widely accepted that the mood that is created by the design in a theatre room can change how client experience the movie. The hard surface of ceiling will help transfer the surround sound across theatre room. Almost every single theatre room should include overhead lighting. This is by far the best and easiest way to completely light a room. These will need to be fully lit in order for everyone to get situated, clean the room, etc. The lighting needs to have dimmers and indirect to accommodate watching the movie.[7]

Now that large-screen HDTVs (high-definition televisions) have achieved widespread acceptance, many consumers are expanding their electronics collection to include components for a complete theatre room system. Theatre room in a box (HTiB), sound bars, and audio/video receivers (AVRs) enhance the user experience with superb audio while complementing the HDTV video performance. The ability to extract and process high-fidelity audio signals is a key differentiator among the hardware choices on the market today. Theatre room systems can now offer all the latest features of the High-Definition Multimedia Interface (HDMI)—seamlessly integrated within the equipment (Beavers et.al, 2011).

`

2.2 Related Researches

2.2.1 Related researches conducted outside India

Elzeyadi (2011), made attempts to quantify relationship between views of nature and day lighting in the workplace and their impacts on sick leave of employees in administrative offices of a Northwest University Campus. This research reports on a three-phase long-term study. In phase I, employees' preferences and ratings towards natural and urban human-made views were investigated. For this phase of the study a qualitative sorting task technique was employed, followed by in-depth interviews on a cross-sectional sample of office employees (n=98). In phase II of the study, physical office conditions, lighting qualities, and quantities inside120 office spaces and cubicles in an office building were systematically evaluated covering 175 employees participating in this study. This included day lighting availability (window shape, properties, glazing properties, area, and its distance from employees' desks); Day lighting quality (luminance, glare analysis, room materials, reflections, orientation, brightness patterns, etc.), and quality of outside views (type of view, pleasantness rating, and preference rank) according to the view metric developed earlier in phase I of the study. In phase III of the study, employees' health conditions were surveyed using an on-line questionnaire and physical health screening forms. In addition, we compiled employees' actual sick leave days from their payroll records as well as in aggregate format based on their office locations, views, floor level, and area of the building they occupy. A multi regression and Pearson correlation statistical analyses tests were performed on the data set. Standard bivariate regression and correlation were used to examine the relationship between sick leave hours and ratings of lighting quality and views. In both cases, the relationships are in the predicted direction and statistically significant. Workers in offices with poor ratings of light quality and in offices with poorer views used significantly more sick leave hours. Taken together, the two variables explained 6.5% of the variation in sick leave use, which was statistically significant.

`

Asdrubali et.al, (2012) conducted “A review of Sustainable Materials for Acoustic Applications”. The purpose of this was to review the existing and emerging recycling technologies for the production of more sustainable acoustic solutions. The review presents an updated review on the acoustical properties of sustainable materials, as well as an analysis of the main methodologies for sustainability assessment, and is completed by a wide selection of recent related bibliography. It is clear that there is a growing interest in the acoustic performance of sustainable products made from natural and recycled materials. These products are a valid alternative to traditional synthetic materials. They generally have a lower environmental impact than conventional materials. The total energy demand for manufacturing and installation of these materials is generally lower. Some of these materials are currently available on the market at competitive prices, but many others are still at a prototypal stage. Airborne sound insulation of natural materials such as flax or recycled cellulose fibres is similar to the one of rock or glass wool. Many natural materials (bamboo, kenaf, sisal, coco fibres) show good sound absorbing performance, while cork or recycled rubber or polymers layers can be very effective for impact sound insulation. These materials also show good thermal insulation properties. They are often light and can be less harmful to human health. Composite materials, for example materials made of both natural fibres and recycled polymers, represent an interesting challenge.

Park et.al, (2012) presented a framework of Sensory Information for 4-D Home theatre System based on MPEG-V standard. The authors of the 4-D content construct the sensory effect metadata using MPEG-V Part 3, in synchronization to the content. The authored sensory effect metadata and AV content are delivered to the user terminal. Then the user terminal analyses the sensory effect metadata through Part 3. The devices around the user environment are detected using SSDP and the device capabilities are written using MPEG-V Part 2. The adaptation engine, then, generates a sequence of adequate device commands using MPEG-V Part 5, so that the devices can generate the sensory effects properly, creating 4-D effects. This framework provides an almost complete guideline to start building 4-D theatre room system.

`

Bercher et.al, (2015) in their paper titled “Plan, Repair, Execute, Explain—How Planning Helps to Assemble Your Home Theatre” presented a domain-independent architecture to implement plan-based assistance systems. It integrates planning capabilities with advanced dialog and interaction management components, which enable multi-modal communication skills of such systems. The approach offers a high degree of flexibility by involving plan repair mechanisms to assist users in cases where unexpected execution failures occur. Based on the architecture, they implemented a prototype system capable of assisting users in the task of setting up a complex home theatre. They demonstrated the acceptance and usefulness of this system in an empirical evaluation.

Gary and Birrell, (2014) conducted a longitudinal study on “Are Biophilic-Designed Site Office Buildings Linked to Health Benefits and High Performing Occupants?” in Australia to ascertain the broad health benefits of specific types of biophilic design for workers in a building site office. A bespoke site design was formulated to include open plan workspace, natural lighting, ventilation, significant plants, prospect and views, recycled materials and use of non-synthetic materials. Initial data in the first three months was gathered from a series of demographic questions and from interviews and observations of site workers. Preliminary data indicates a strong positive effect from incorporating aspects of biophilic design to boost productivity, ameliorate stress, enhance well-being, foster a collaborative work environment and promote workplace satisfaction, thus contributing towards a high performance workspace.

Bercher et.al, (2015) in their paper titled “A Planning-Based Assistance System for Setting up a Home Theatre” presented a system that assists a human user in setting up a complex home theatre consisting of several Hi Fi devices. The system’s capabilities include plan generation, plan execution, plan repair, and plan explanation. The task to solve is encoded as a planning problem given in advance. To obtain a fully general system, they wanted to enable to user to specify the given hardware and the task to solve. They also wanted to extend the domain model to allow unplugging cables. Concerning plan repair, demo system only allows specifying broken cables as execution

`

failure. However, the plan repair approach is more general and allows handling arbitrary state changes.

A survey conducted by **Cooper (2015)**, on “The Global Impact of Biophilic Design in the Workplace”. The focus of this survey was on the potential benefits to be gained by satisfying humans’ biophilic needs in the workplace, as well as the issues that surround working in environments that do not provide a connection with the natural world. The data were collected online from 16 countries around the world where 7600 office employees from 16 countries across the world - United Kingdom (UK), France, Germany, Netherlands, Spain, Sweden, Demark, United Arab Emirates (UAE), United States (US), Canada, Brazil, Australia, Philippines, India, China and Indonesia participated in this survey. The results indicated that those who work in environments with natural elements, such as greenery and sunlight, reported a 15% higher level of well-being, 6% higher level of productivity and 15% higher level of creativity than those with no connection to natural elements in the workplace. Across the world, 33 % of the respondents reported that the design of an office would affect their decision to work for that organization. Incredibly, design was even more vital in India (67%), Indonesia (62%) and the Philippines (60%) where two thirds of office workers were significantly influenced by workplace design. Given positive impact of Biophilic designs, surprisingly large numbers of employees reported having little or no contact with nature in their workplace where 47% report having no natural light in their workplace and 58% report having no natural greenery (live plants). The research showed that when people enter a workplace that incorporates nature, they are more likely to feel happy and motivated for the day ahead. Considering the benefits achieved by bringing natural elements indoors, employers wanted to create better work environments and strengthen relationships between colleagues have an opportunity here to increase employee outcomes.

Gillis and Gatersleben, (2015) conducted “A Review of Psychological Literature on the Health and Wellbeing Benefits of Biophilic Design”. It focused on the three Biophilic design categories as proposed by Stephen Kellert and Elizabeth Calabrese in “The Practice of Biophilic Design”. Psychological, peer

`

reviewed literature supporting the benefits of Biophilic design was searched for through the lens of restorative environments. Results indicate that there exists much evidence supporting certain attributes of Biophilic design (such as the presence of natural elements), while empirical evidence for other attributes (such as the use of natural materials or processes) is lacking.

Kim et.al, (2015) in their paper titled “Design and Implementation of Pneumatic Motion Base for 4D Home Theatre” attempted to build Home Entertainment system which makes users feel realistic contents by developing 4D systems for Home Entertainment rather than before. The 4D system was designed and simulated around weight, power, noise and user’s convenience considering that it is used at home. The pneumatic system design which is excellent in terms of weight, power and maintenance was suggested so that users can easily enjoy the 4D contents at home, and the user-cantered program was proposed where the 4D effects can be controlled. The motion effect in the suggested system which is a pneumatic simulation is excellent in noise and power consumption compared to the hydraulic and electric methods, and beneficial in terms of home management. In addition, it is different from the method which accepts the existing 4D contents in that it provides an input and an edit mode for the content play, 4D seat motion and all the motions of special effects like light and air, and makes an instant response (synchronization) to a user’s input. This increases the number of cases in choosing the 4D contents, and enables users to experience a unique and individualized 4D by manufacturing customized content unlike general content. The proposed home sensory simulation device and software is expected to improve the accessibility to the 4D contents.

Đurić et.al, (2016) designed an Intelligent Home Media Center. The primary goal was to increase the quality of life with the use of ambient intelligence in smart homes. The solution presented here uses client-server architecture with network-attached storage for storing all multimedia contents. Sensors are used to identify person’s presence and ambient intelligence techniques to recommend the most suitable multimedia content to end-users. Comparing to a DVD player or a theatre room, Intelligent Home Media Center offers more

`

comfort in using by allowing users to control the system over multiple devices (such as mobile phone, laptop, TV remote, etc...). Self-built solution offers a possibility to stream almost any content. Comparing to a Smart TV, Intelligent Home Media Center is cheaper, with a richer set of features and it is open for communication with any device over the REST server. The intelligent home media center was developed to satisfy the personal needs of the end-user. Intelligent Home Media Center is very scalable and it is easy to add more components such as clients, servers and other devices. It is inexpensive to build, fast and intelligent. It uses sensors to detect person's presence and concepts of ambient intelligence to recommend appropriate media to the user. It is easily maintainable, devices can be replaced or upgraded and additional software features can be implemented

A research was undertaken by **Guo, (2016)** on "The effects of biophilic design in interior environments on noise perception: Designing a person-centered biophilic space for older adults". The aim of this study is to analyse how the visual characteristics of an interior space can influence the subjective loudness and annoyance of noise in older adults. Data were collected by conducting visual and audio-visual experiments and by analysing content analysis, ANOVA and correlation techniques. This study investigates the effects of major interior-related factors on the assessment of perceived loudness and noise annoyance. The study created virtual scenarios and presented these to participants by means of computer and audio speakers to provide an environment with auditory and biophilic design features of a dining place. The study produced a null result but data did suggest that positively rated interior spaces led to lower perceived loudness and annoyance. In addition, the limitations of small sample size, audio-visual testing device and setting needed to be addressed. Finally, this study develops design guidelines to aid design decisions of designers and administrators for older adults in long-term care environment. Based on the proposed design guidelines, redesigning an existing dining space was suggested with design visualizations.

Sharifi and Sabernejad, (2016) reviewed and analysed the design principles based on Biophilic architecture in design performance to meet the objectives of

`

sustainable development. Survey-based method was used where first the most important design topics with this approach are studied, and its different patterns have been detected, and then using the Analytic Hierarchy Process (AHP), the approaches and identified patterns of this type of architecture are prioritized. The results showed that in three main approaches of design based on Biophilic architecture, means (1) the presence of nature in the location patterns, (2) the presence of natural analog elements and patterns in the environment and (3) fluidity of spatial patterns, respectively the patterns of visual connection with nature, materials connection with nature in the environment and natural landscape environment has higher degree of importance in the performance design of a Biophilic architecture based space.

A research was conducted by **Chen, (2017)** on "The Impact of Biophilic Design on Health and Wellbeing of Residents through Raising Environmental Awareness and Nature Connectedness". It aimed to measure the impact of biophilic design on environmental awareness and nature connectedness, and prove whether this impact can enhance human health and wellbeing or not. For this purpose, a mixed-methods, concurrent triangulation approach that includes both qualitative and quantitative analysis was designed and applied in Serenbe, an intentional community of biophilic design in southwest of Atlanta. The result demonstrated a significant positive correlation between health and wellbeing, environmental awareness, and nature connectedness. It supports the idea that the presence of biophilic features have a significant beneficial effect, and nature should no longer be neglected as an important source of health and wellbeing.

Miller, (2018) conducted a research on **"**Implementing Biophilic Attributes in Elementary Schools". This study investigated the effects of biophilic attributes of water, plants, animals, natural materials, color, light, and air in elementary school classrooms with fourth and fifth-grade students. The quasi-experimental study included a pre-test, followed by the implementation of biophilic attributes in the two classrooms a week later, and a post-test five weeks after the implemented biophilic attributes remained in the classrooms. The expectation was that the presence of the biophilic attributes in the day to day environment of these classrooms would improve students' awareness of nature. Findings

`

showed that the implemented biophilic attributes did alter the awareness of nature in one of the classrooms, while the other classroom was not influenced after the post-test.

Yassein and Ebrahiem, (2018) carried out a systematic review on Biophlic Design in the Built environment to Improve Well-Being with an aim to systematically review and address the current practices of biophilic design in interior spaces where people spend most of their time. The review protocol consisted of five stages outlining the search strategy, study selection, study quality assessment, data extraction, and data synthesis. The systematic review of 142 studies over the last ten years seeks to articulate a growing body of research and emerging design application in the built environment. The twenty-four attributes of biophilic design and their related three experiences are partly adopted in empirical studies and explored in descriptive others. It was found that there has been little research on how all these different attributes might work together, or how to measure and quantify their human, environmental, and economic outcomes. Biophilic practices were mainly found in evidence documents related to the following building types: healthcare (16), workplaces (15), and residential (7). There is also an ascending trend in the total number of studies published per year in a wide range of disciplines. Research methods used were surveys, experiments, interviews, and case studies/longitudinal studies. Biophilic practices were grouped into clusters based on descriptive similarities within each cluster. The results of these practices were mostly positive physiological, psychological, and cognitive well-being outcomes. The three themes emerged from the design practices presented in the reviewed studies: design and building management; occupants' needs; and technology. These themes have a certain degree of overlap and are related to both 'sustainability and 'biophilic interior design'.

A research was conducted by **Emamjomeh, (2019)** on "Understanding the potential of Immersible Virtual Environment (IVEs) for Biophilic Design". The research intends to determine the capability of immersive virtual environment (IVE) to support building design by comparing the psychological and cognitive responses to natural elements in an interior environment (*In-Situ*) and IVE.

`

Thirty-five LSU students from undergraduate and graduate levels participated in this experiment. A wearable heart rate monitor was used to measure heart rate variability in each condition. Individuals performed working memory tests after being exposed to each environment (In-Situ and IVE). After completing the working memory tests, they were asked to fill out the PANAS survey. The PANAS survey is about the participant's mood at that moment. Additionally, if they were doing the IVEs part of the experiment, they were asked to answer the IPQ survey. The IPQ survey is about their presence in each virtual reality environment. The results demonstrated that participants had a less negative mood, a more positive feeling, and a better cognitive performance in a biophilic environment in In-Situ. Furthermore, the results indicated that individuals had significantly fewer negative moods in a biophilic environment in IVEs. Our results also show that individuals had more positive moods in a biophilic environment in IVEs but not at 95% level of significance. Additionally, the results showed that biophilic design's effect on cognitive performance is not statistically significant.

Mustafa and Yaseen, (2019) carried a case study on "Towards the Application of Biophilic Parameters in Local Buildings: A case Study of Bilkent School, Erbil City-Iraq". This study aims to examine the availability of these patterns in Bilkent School in Erbil city, which was selected as a case study. A quantitative approach based on a survey questionnaire was used to achieve the objectives. The results show that 13 out of 14 biophilic design patterns were available in the building. Eight patterns achieved availability of more than 75%, while five other patterns ranged between 50 and 75%. Three main categories of biophilic patterns, namely "Nature in Space", "Natural Analogues" and "Nature of Space", achieved 75%, 68.33% and 61.25%, respectively. Therefore, the school can be considered as a biophilic design building. Based on the findings, modifications or arrangements can be made in other local schools by applying these patterns. Moreover, this particular building can be used as a model to evaluate biophilic design criteria in other types of building.

`

Rhodesly, (2019) undertook a research on “Biophilic Approach to Architecture: Case of the Alhambra, Al-Andalus”. The aim of the research was to demonstrate that the Alhambra architecture manifests a successful biophilic design, which may allow for a positive impact on human health and well-being. Therefore, this research attempts to correlate the architectural heritage with the health sciences in context of biophilic design by exploring the biophilia hypothesis and biophilic design; interpreting the dialogue between nature and the Alhambra’s cultural and structural features; realizing the likely effects of the “14 Patterns of Biophilic Design”, proposed by Terrapin Bright Green consulting firm, on human health and well-being; and investigating the presence of these patterns in the Alhambra architecture in addition to five examples of its analogues around the world. Case study method was used for the present research and the data were gathered through observation of physical environment. The results of the study show that the Alhambra architecture manifests a successful biophilic design. It is found that the Alhambra in Granada is an excellent example for fulfilling the 14 patterns of biophilic design. It addresses the direct, physical and ephemeral presence of nature that contain plant life, water and animals, as well as breezes, sounds and scents. Common examples of this include courtyard gardens, fragrant plants, fountains, water features and natural ventilation. Besides, the Alhambra handles organic, non-living and indirect evocations of nature. Forms, materials, colors, shapes and proportions found in nature, appear in the Alhambra as geometric ornaments, epigraphs, stuccoes walls and wooden ceilings; each provide an indirect connection with nature. Moreover, the Alhambra treats spatial configurations in nature which includes humans’ innate and learned desire to be able to see beyond their immediate surroundings, their fascination with the slightly dangerous or unknown and obscured views and revelatory moments. In addition, the architecture of the Alhambras around the world reveals how the biophilic essence of the Alhambra architecture in Granada has a universal impact, which may evidence that the original Alhambra reflects dynamic architectural heritage values that do not expire by the end of their historical period.

`

A research was conducted by **Tahoun, (2019)** on “Awareness assessment of biophilic design principles application”. The aim of this research was to assess awareness about the Biophilic design and its impact on employees and their wellbeing in Egypt. This investigation has been performed through a qualitative applied approach, depending on questionnaire to collect the needed information to be analysed and measured and the literature review of biophilic design and its benefits. Online survey has been publicized over a population of comprising of student of architecture department, developer, government officer, project executives and also academicians within the construction discipline. The total number of respondents participated in this survey is 70. The results showed that the appearance of the Biophilic design elements in the completed projects can be applied to other workspaces. The survey findings reflect that academicians are the highest group of the respondents that has awareness about the Biophilic design movement. Professionals involved in the construction of workspace need to be aware more about importing Biophilic design in workspaces and how it can impact employees’ health.

Zari, (2019) undertook a research on “Understanding and designing nature experiences in cities: a framework for biophilic urbanism”. This research defines a unique biophilic urbanism framework for analysing and mapping biophilic urban elements. Thirty characteristics of biophilic cities were identified and then used to map Wellington, New Zealand. Observations arising from the research include: 1/while access to wild nature might be an important characteristic of a biophilic city, planned design interventions are also significant; and 2/when identified biophilic elements form part of a larger interconnected spatial experience through time, positive effects may be enhanced. This can enable identification of strategic locations for biophilic interventions in the wider urban fabric to facilitate more effective urban nature experiences. This suggests that biophilic urbanism must encompass a wide range of human sensory information, and should be designed from a four-dimensional (i.e. including time) perspective.

`

Algamdi, (2020) conducted a research on “Connecting Elders to Nature: A Study of Using Biophilic Design to Foster Successful Aging at Home in Saudi Arabia”. This study explores whether biophilic design buildings and spaces that allow for a human connection with nature, and which are widely credited with promoting positive physical and mental wellbeing may contribute to creating empathetic, healthy, supportive, and culturally agreeable home environments for elders in Saudi Arabia. The study is based on interviews conducted with 27 residents (50 years or older) in Jeddah, KSA, and relies on content analysis methods to identify culturally relevant biophilic design patterns that support dimensions of wellness for successful aging. The study established 11 biophilic design strategies that satisfy cultural preferences and create wellness opportunities foraging in place.

Matai and Zimunya, (2020) carried out a research on “Connecting Biophilic design to Neighbourhood Energy Use Optimisation in Rural Towns: The Case of Birchenough Bridge”. The research examined the relationship between nature integration in residential neighbourhoods and the cooling energy requirements. The study adopted a qualitative approach to guide the collection of data. Documents review was used to address the research objectives. The findings revealed that the Biophilic design reduces energy consumption for cooling by modifying the microclimate. There is little appreciation by authorities of the potential of Biophilic urbanism in reducing temperatures of neighbourhoods.

2.2.2 Related Researches conducted in India

Gautam, (2017) undertook a research on “Biophilic Design in Architecture”. The aim of the research was to generate a framework that would bridge the gap between Biophilia and Architecture. Inferences and contributions from the literature around were used to generate a unified pattern. The present research provided a comprehensive literature review of Biophilic design and fields specifying recent developments in human-nature research. The research unifies the present diverse literature under a well-defined network of Biophilic patterns highlighting their attributes and applicability into Architectural design

`

process. A detailed framework was presented representing the ways architects can adopt this concept into their design process.

Verma and Punekar, (2017) wrote a review paper on "Nature Inspired Design — A Review from an Industrial Design Perspective". The paper examines various systematic methods developed by researchers and finds that they are strongly function oriented while methods adopted by industrial designers are based on observation of natural systems for nature inspired design. Literature review indicated that researchers and designers work under different environments and constraints, and further finds that the approach taken by designers face criticism as well as support to their methods. The paper highlighted that existing researches are dominantly focused on functional aspects while aspects that deals with the form are not sufficiently explored for nature inspired products. It also suggested the importance for the design community to extrapolate methods that are based on design science principles in seeking creative solutions for nature inspired products.

A research was conducted by Modi, (2018) on "A Study of Biophilic Design for Restorative Learning Environment in Urban Schools." The aim of the research was to identify the aspects of biophilic design corresponding to learning environments to analyze and evaluate in urban (primary) schools. The data were collected through observations and interview with the educators and students. The Biophilic attributes pertinent to learning spaces were evaluated in a school interior through case study. Two primary schools were identified which were built with different approaches and didn't have large expanse of land and were located in a dense urban locality of Ahmedabad. A matrix was developed through analysis based on observation of presence and absence of the aspects of Biophilic attributes. It was concluded that design is a more a result of the intended approach rather than the monetary or space constraint. While most of the schools considered efficient light and air, sensory stimulation in indoors and place attachment value is not considered as much. Though site location plays an important role, it is not a decisive factor in achieving biophilic design. The elements stimulating natural features when implemented to deliver a kinesthetic experience in interior can also achieving biophilic space. It was

`

also concluded that it is not necessary to have all the features but even if one or two features if implemented in an efficient way can enhance the experience of the space and learning.

Asim and Shree, (2019) conducted a research on "The impact of Biophilic Built Environment on Psychological Restoration within student hostels". The objective of the research was to investigate possible associations between Biophilic Environment Variables (BEVs), Emotional Stability (PEWM) and Perceived Restorativeness (PRS). In order to investigate this, student hostel rooms at two institutes (105 km apart) situated in the foothills of the Himalayas, were surveyed using the variables: Nature in the Space, Natural Analogues and Human Nature Relationship. These were correlated with the resident students' response to Plutchik's emotional stability wheel and some specific aspects of Perceived Restorativeness: Being Away, Fascination, Extent and Compatibility. The results indicate that the students in hostel rooms which have higher qualitative and quantitative scores in terms
of biophilic environment variables (connection with nature) report greater Perceived Restorativeness and also possess better self -reported emotional stability. Thus the results indicated that the emotional stability represented by PEWM plays a significant role in the perception of hostel rooms as psychologically restorative environments when there is quantitative and qualitative presence of BEVs in them. The BEVs are strong proponents of creating restorative environments but their impact is significantly influenced by the emotional state of the resident students. The data further suggests that BEVs Visual connection with nature, Non-visual connection with nature, Material connection with nature and Prospect and Refuge have direct influence on the emotional stability of the students.

The review paper written by **Mishra, (2019)** aimed to study the "Green Elements of Biophilic Architecture" that improves the indoor and outdoor environment in terms of aesthetics, quality of work environment and urban form. He concluded that the fundamental concept of improving space quality and work environment is achieved by Human-nature connection in daily urban life. The green aspect of Biophilic Architecture has multiple benefits like improving

`

productivity, creating sustainable built environment, reducing pollution and energy consumption with increased economic benefits.

Mohanty, (2019) carried out a research on “Elderly Housing in Bhubaneswar”. The aim of the research was to understand the psychology of the elderly associated with the spaces, and design those spaces so that they live a comfortable life and increase social interaction. The methodology involved the survey and analysis of literature case studies from various secondary sources. Based on the researches and various case studies inferences, and insights were drawn and a tentative area programming was carried out. After this site activities and functions are observed. The usage of various spaces was also recorded. The information from both primary and secondary studies were analysed which gives rise to the final area programming. The final area programming along with the requirement of the project gives the total required area by the project. After the site was selected, the site and climate analysis of the place was done. The climate of the place also decides the climatic consideration to be taken in the project. The structure, sections and proper elevation were finalised and 3D models were prepared accordingly. It was concluded that design approach through which one can deal with psychological problems is Biophilia, i.e. connection with nature. In order to fulfil this design approach a site far away from the city chaos was chosen. The planning and site planning was done in such a manner that it is barrier free as needed by the senior citizens. The landscaping is done so as to agree with the biophilic approach of the design.

Conclusion

The review of literature collected focused on the need of Biophilic Designs, Concept of Biophilia and its origin was explained, concept and definition of Biophilic Designs was discussed, Patterns of Biophilic Design as stated by authors were reviewed, Benefits of Biophilic Designs for human health, environment, economy and productivity were, and importance of theatre room and its requirements were reported. On the basis of the extensive review of literature, it was evident that researcher conducted outside India focused mostly relationship between nature views and day lighting on employees productivity,

`

health benefits and performance of employees in Biophilic designed offices, health and wellbeing benefits of Biophilic designs, Biophilic designs and noise perception, potentials of Immersible Virtual Environment for Biophilic design, Biophilic approach to architecture, awareness assessment of Biophilic design, connecting with nature through Biophilic designs, Biophilic designs and energy use optimisation, and application of Biophilic designs in various buildings. Few technical researchers were also found related to theatre room which focused on developing sensory information framework for 4D home theatre system, a system capable of assisting users in setting up a theatre room, designing and implementing pneumatic motion base for 4D home theatre and intelligent media centre for home.

However, the related researchers carried out in India focused on Biophilic design and architecture, nature inspired designs, impact of Biophilic designs on psychological health, and identifying the aspects of Biophilic designs corresponding to learning environment. There was dearth of researchers conducted in India related to theatre room or it's designing. The researchers related to designing of theatre room considering Biophilic designs were hard to find in India as well as outside India. Therefore, the researcher was interested in undertaking present research.

Methodology

`

CHAPTER 3

METHODOLOGY

Research methodology is a science to study how research is done systematically and scientifically (Kothari, 2014). The operational definition of the terms used in the study, tool for data collection, locale of study, unit of Inquiry, selection and construction and description of the tool and design development and cost estimation are explained briefly in this chapter. The present study was undertaken to assess the existing interiors of the theatre room of selected residence and redesign it based on the need and preference of the client. The study also aims to conduct market survey for finding out the trends and materials available in local market related to Biophilic designs. The present chapter is sub-divided in to the following sections:

3.1 Design Project Method

3.2 Operational Definitions

3.3 Locale of the Study

3.4 Unit of Inquiry

3.5 Selection, Development and Description of the Tool

3.6 Establishment of content validity of the Tool

3.7 Data collection

3.8 Design development

3.9 Cost estimation

`

3.1 Design Project Method

For the present study, Design Project method was adopted as the research design. A Design Project is a strategic organization of ideas, materials and processes for the purpose of achieving a goal. The Design Project is managed by the design project manager who is responsible for all aspects of planning, budgeting and execution of the project. The design project manager consults the clients regarding their available space, needs and style preferences. Then, the design project manager uses their in-depth knowledge of design principles, concepts, and best practices to create a project plan that includes detailed layouts, technical models and drawings, and estimates for cost and material. Once the plan is approved, the design project manager coordinates with other project leaders and other project team members to implement the plan.

3.2 Operational definition

Biophilic Designs: It was operationally defined as designs which incorporate natural materials, natural light, vegetation, nature views and other experiences of the natural world into the theatre room to maximize functioning and health of the users.

Theatre Room: It was operationally defined as a room that is outfitted with a large flat-screen television, surround sound and cozy seating where family and friends assembles to watch movies together at home.

3.3 Locale of the study

The study was conducted in selected residence of Manjalpur area of Vadodara city.

3.4 Unit of inquiry

The client of selected residence was the unit of inquiry for the present study.

3.5Selection, Development and Description of the Tool

`

3.5.1 Selection of the tool

In light of objectives framed for the present study, two data collection tools were developed viz. Interview and Observation Schedule. Interview schedule was developed to find out the needs and preferences of client for theatre room. Observation schedule was prepared for assessment of existing interior spaces of theatre room of selected residence and redesign it.

i. **Interview Schedule:** An interview schedule had been thought to be the best suited tool for collection of data since it involves presentation of oral-verbal stimuli and reply in terms of oral- verbal responses (Kothari, 2014). The interview schedule has following advantages:

- More information in greater depth can be obtained.
- Sample can be controlled more effectively as there arises no difficulty of the missing returns, non-response generally remains very low.
- The interviewer can collect supplementary information about the respondent's personal characteristics and environment which is often of great value in interpreting results.

ii. **Observation Schedule:** Observation schedule is the most commonly used method, in studies relating to behavioural sciences. It is a scientific tool and the method of data collection for the researcher which was used for observing the theatre room of selected client of Vadodara city. The observation schedule has following advantages:

- The subjective bias is eliminated, if observation is done accurately.
- The information obtained under this method relates to currently situations.
- This method is independent of respondents' willingness to respond and as such is relatively less demanding of active cooperation on the part of respondent.

`

3.5.2 Development of the tool

Based on the information gathered through review of literature, interaction, guidance of the experts and personal observation, interview schedule was prepared to find out the needs and preferences of client for theatre room. A care was taken to include all questions that would elicit the information needed attain the objectives of the study. An observation schedule was also prepared for assessing the existing interior spaces of theatre room of selected residence.

3.5.3 Description of the tool

The various sections of the tools developed for the study is described in detail as follow:

3.5.3.1. Interview Schedule for client: The interview schedule comprised of 2 sections which are described as below:

Section I- Background Information of the Client: This section contained personal, family and situational information of the respondent viz. age (in year), address, contact number, e-mail address, educational qualification, occupation and experience in the field, monthly personal income (in Rupees), number of family members, composition of family, use of theatre room, activities performed in theatre room, and duration of time spent in theatre room (in a day). Questions related to a familiarity of client with biophilic design and there interest in biophilic design were asked.

Section II- Need and preference of client for theatre room: This section elicited information regarding need and preference of client for theatre room. The interior components for theatre room considered were type of flooring, wall treatment, ceiling, window treatment, door, furniture, storage, acoustic material, accessories, artificial lighting and color scheme.

3.5.3.2. Observation Schedule: It included the assessment of various components of interior spaces of existing theatre room. The components of interior spaces assessed were windows, doors, floor, walls, ceiling, lighting,

`

fans and air conditioner, projector & screen, speakers, furniture, acoustic treatment, provision for cross ventilation and accessories.

3.6 Establishment of content validity of the tool

Validity indicates the degree to which to which a tool measures what it is supposed to measure (Kothari, 2012). The tools prepared by the researcher for the present study were given to a panel of 9 judges comprising the experts from the Interior Design, Higher Payment Programme, Department of Family and Community Resource Management, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda, Vadodara and practicing Architects, Interior Designers and Civil Engineers. They were requested to check the clarity and relevance of the content. They were also requested to state whether the listed items fell under each category it was listed. A consensus of 80% among the judges was taken as yardstick for the final tool. The valuable suggestions given by the experts were incorporated and the tools were modified and finalized for the data collection.

3.7 Data collection

The data were gathered by the researcher in the month of December. The interview and observation schedule were used for data collection. The purpose of the study was explained and rapport was built so as to get the true responses. The investigator personally interviewed the respondent. The observations were recorded in the observation sheet by the researcher.

3.8 Design development

Design a theatre room considering Biophilic design is a very crucial task. The need and preference of client for redesigning interior space of theatre room was gathered through interview schedule and existing status of theatre room was noted through observation schedule. The proposed design included the following schedule of two dimensional drawings made with the support of AUTOCAD software version 2019, goggle sketch up and lumion10 software. The architectural scale in default was used for the proposed drawings. Redesigning of a theatre room included the following schedule of drawings:

`

1. Furniture Layout
2. Flooring Layout
3. Wall Elevations
4. False Ceiling Design
5. Working Drawing of Ceiling
6. Electrical Layout
7. Furniture Drawing
8. 3D Views of Selected Option

3.9 Cost estimation

In successful planning and implementation of any research in the field of interior designing, cost estimation plays an important role. Thus, cost estimation considering the actual price and labour cost of the proposed design of the selected theatre room was prepared.

`

FINDING AND DISUSSION

`

CHAPTER – IV

FINDING AND DISUSSION

An attempt was made to conduct market survey of materials used in redesigning theatre room of selected residence, to ascertain the need and preference of the client for theatre room, to assess the exiting interiors of the home theatre room of selected residence and to redesign it considering Biophilic designs. This chapter deals with presenting, interpreting and discussing the finding obtained through the analysis of the data collected through interview and observation schedule. The chapter has been divided into the following:

4.1 Market survey of materials used in redesigning theatre room of selected residence

4.2 Background information of the client

4.3 Need and preference of the client for theatre room

4.4 Assessment of existing interiors of theatre room of selected residence

4.5 Redesigning interior space of theatre room considering Biophilic Designs

4.6 Cost estimation

4.1 Market survey of materials used in redesigning theatre room of selected residence

Market survey of materials used in redesigning theatre room of selected residence was conducted in different markets of Vadodara city namely Alkapuri, Akota, Nizampura, Fatehganj, Karelibag, Dabhoi road and Chhani during January to February 2021. The materials viz. acoustic material, rugs, fabrics, glass, floor tile, laminate flooring, recliner sofa, plywood, laminate, sponge foam sheet, wall paint, indoor plant plants were surveyed.

`

4.1.1 Acoustic materials

Market survey conducted by the researcher, revealed that printed Polyester acoustic panel were available with different natural patterns with local manufacturer. The cost of printed polyester acoustic panel of 4’ × 8’ size ranged between ₹ 450 to ₹ 550 per sq.ft. Polyester acoustic panel were available in tranquil brand of 4’ × 8’ size with 9mm to 12 mm thickness at ranged between ₹ 110 to ₹ 160 per sq.ft. Fabric wrapped acoustic panel were available with local manufacturer (Table-1). The cost of fabric wrapped acoustic panel of 2’ × 2’ size ranged at ₹ 150 per sq.ft. Wooden acoustic panel were available with different cut out pattern in the local market. The cost of wooden acoustic panel of 2’ × 2’ size ranged between ₹ 450 per sq.ft. Perforated Wooden acoustic panels were available in eco wood brand of 4’ × 8’ size at ₹ 198 per sq.ft. Glass wool material was available in local market having good sound absorbent quality and thermal insulation. The cost of glass wool material of 18 running meter size with 50mm thickness ranged between ₹ 300 per sq.mt. Perforated gypsum boards were available with design in local market. The cost of perforated gypsum board of 2’ × 2’ and 6’ × 4’ size ranged ₹ 35 per sq.ft.

4.1.2 Rugs

Rugs were available with different natural patterns and colors of acrylic fiber material with local manufacturer. The cost of acrylic rugs of 5’ × 7’ size ranged between ₹ 15,000 to ₹ 28,000 per piece (Table-2).

4.1.3. Fabrics for curtains, wall panel and upholstery

Fabrics materials for curtain, wall panel and upholstery were available in different natural prints and colors in the local market and prestigious textile brand (Table-3). The materials of the fabrics cotton polyester mix, cotton and velvet. The cost of the fabrics ranged between ₹ 830 to ₹ 3150 per sq.mt.

4.1.4. Window tinted and transparent glasses

Window tinted and transparent Glasses were available in different colors in the local market. The color of the glasses were brown, aqua blue, sapphire blue, blue and dark blue. The available size of glasses were 3’ × 7’ and 4’ × 8’ with

`

thickness between 3.5mm to 5 mm. the price of this glasses ranged between ₹42 to ₹70 per sq.ft. (Table-4).

4.1.5. Carpet tiles

Carpet tiles were available with different patterns viz. natural, relay and urbane with Welspun flooring manufacture. These carpet tiles have good sound absorbing quality. These carpet tiles were available in 50cm × 50cm size and thickness of 6mm to 7mm. The cost of these carpet tiles ranged between ₹ 250 to ₹ 700 per sq.ft. (Table-5).

4.1.6. Laminate flooring

Laminate flooring were available with wooden pattern with the Quick step brand. Scraped oak gray brown laminate was available in 1380mm × 190mm size and thickness of 8mm costing ₹305 per sq.ft. White varnished oak laminate was available in 1380mm × 156mm size and thickness of 8mm costing ₹ 255 per sq.ft. Bleached White oak laminate was available in 1200mm × 190mm size and thickness of 8mm costing ₹ 230 per sq.ft. (Table-6). Golden oak laminate was available in 1200mm × 190mm size and thickness of 8mm costing ₹ 230 per sq.ft. Virginia oak brown laminate was available in 1200mm × 190mm size and thickness of 7mm costing ₹ 205 per sq.ft.

4.1.7 Recliner sofa

Recliner sofas of manual and battery operated type were available in Hindustan brand. The Manual recliner sofas ranged between ₹ 24,400 to ₹ 30,400 and battery operated recliner sofas ranged between ₹ 36,900 to ₹ 47,400 (Table-7).

`

Table 1: Market survey of acoustic materials available in the local market.

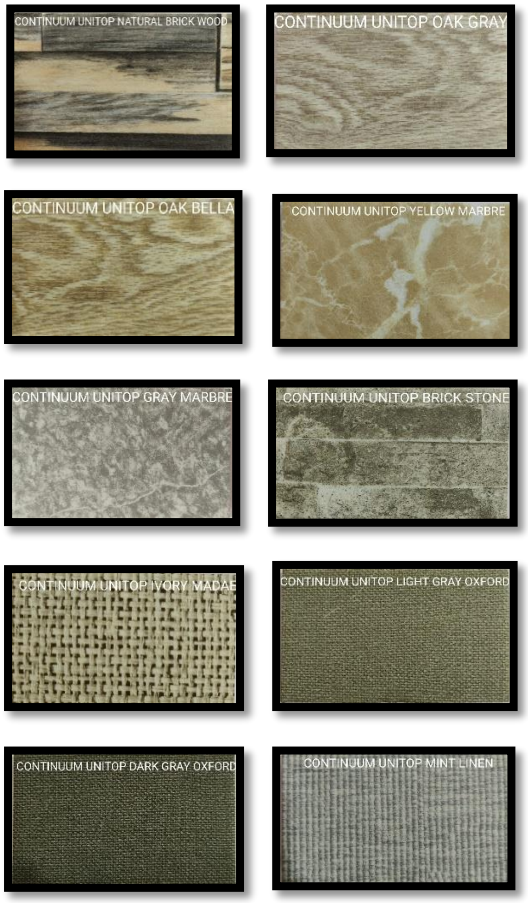
Sr. No.	Name of Products	Picture of products	Brand/ Shop	Available size of product	Cost of the products
1.	Polyester acoustic panel		**Shop** : Digital Sound box, Sb7, Silver coin Complex, Shankheshwer Parshwanath Marg,Haripura, Vadodara	4’ × 8’	₹ 450 to ₹ 550 per sq.ft. (Cost vary according to prints)

Table 1 Contd…….

`

Table 1 Contd…….

2.	Polyester acoustic panel		**Shop** : Brahmani Enterprise, 141/8 Baroda Mosaic & Marble Compound Dharamsinh Desai Marg Opp.Water Tank, Chhani, Vadodara **Brand**: Tranquil	Size-8'×4'. Thickness-9mm.	₹ 110 per sq.ft.
3.	Fabric wrapped acoustic panel		**Shop :** Digital Sound box, Sb7, Silver coin Complex, Shankheshwer Parshwanath Marg,Haripura, Vadodara	Size-2'×2'. Thickness-12mm.	₹ 150 per sq.ft.

Table 1 Contd…….

`

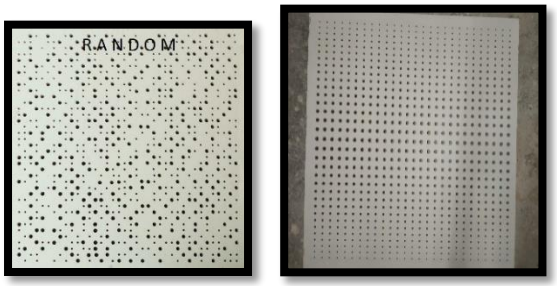
Table 1 Contd…….

4.	Wooden acoustic panel		**Shop :** Digital Sound box, Sb7, Silver coin Complex, Shankheshwer Parshwanath Marg, Haripura, Vadodara	Size-2'× 2'	₹ 450 per sq.ft.
5.	Wooden panel	 	**Shop** : Brahmani Enterprise, 141/8 Baroda Mosaic & Marble Compound Dharamsinh Desai Marg Opp.Water Tank, Chhani, Vadodara **Brand**: Eco wood	Size -4'× 8'. Thickness-12 mm	₹ 198 per Sq.ft.

Table 1 Contd…….

`

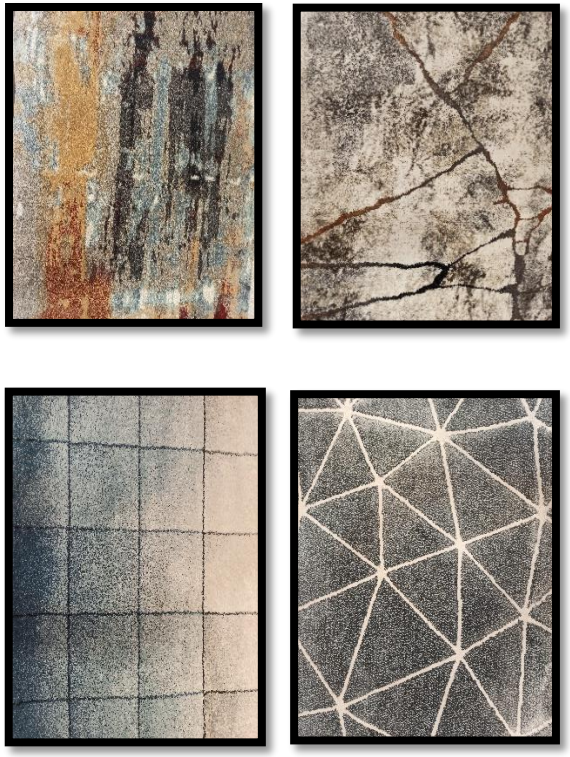
Table 1 Contd…….

6.	Glass wool		**Shop :** Digital Sound box, Sb7, Silver coin Complex, Shankheshwer Parshwanath Marg, Haripura, Vadodara	Thickness- 50mm Size- 18 sq.mt.	₹300 per sq.mt.
7.	Perforated Gypsum board		**Shop :** Digital Sound box, Sb7, Silver coin Complex, Shankheshwer Parshwanath Marg, Haripura, Vadodara	Size- 2'×2' & 6'× 4'. Thickness- 12.5 mm.	₹35 per sq.ft.

(Market survey was conducted during January to February 2021)

`

Table 2: Market survey of rugs available in the local market

Sr. No.	Name of Products	Picture of products	Brand/ Shop	Available size of product	Cost of the products
1.	Rugs of Acrylic fiber material		**Shop** : Avaran, B N Chambers, 4, RC Dutt Rd, opposite Welcome Hotel, Alkapuri, Vadodara	5’ × 7’	₹ 15000 to ₹ 28000 per piece (Cost vary according to patterns)

(Market survey was conducted during January to February 2021)

`

Table 3: Market survey of fabric materials of curtains, wall panel and upholstery available in the local market

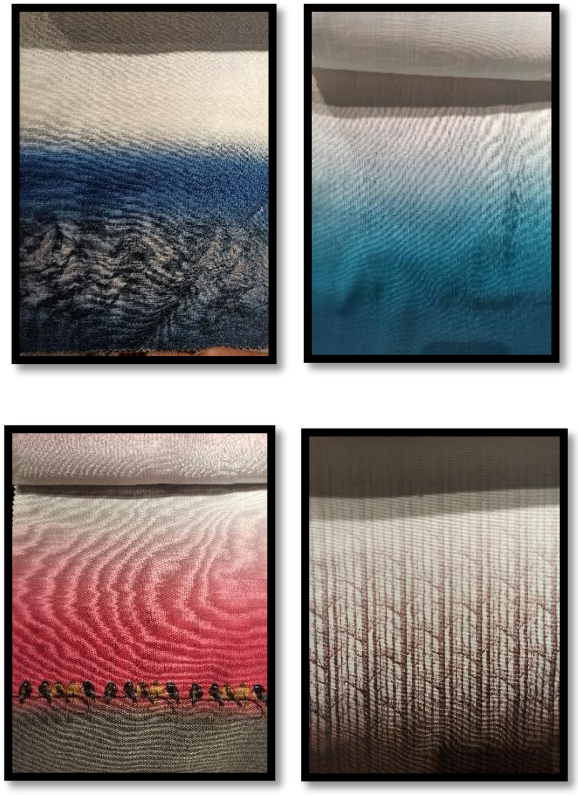
Sr. No.	Name of Products	Picture of products	Brand/ Shop	Cost of the products
1.	Curtain of cotton polyester mix material		**Shop** : CC pardawala, Curtain Craft Basement, Sandalwood Residency, BPC Rd, Near Urmi Char Rasta, Vadodara	₹ 830 to ₹ 1445 Per sq.mt. (Cost vary according to prints)

Table 3 Contd…….

`

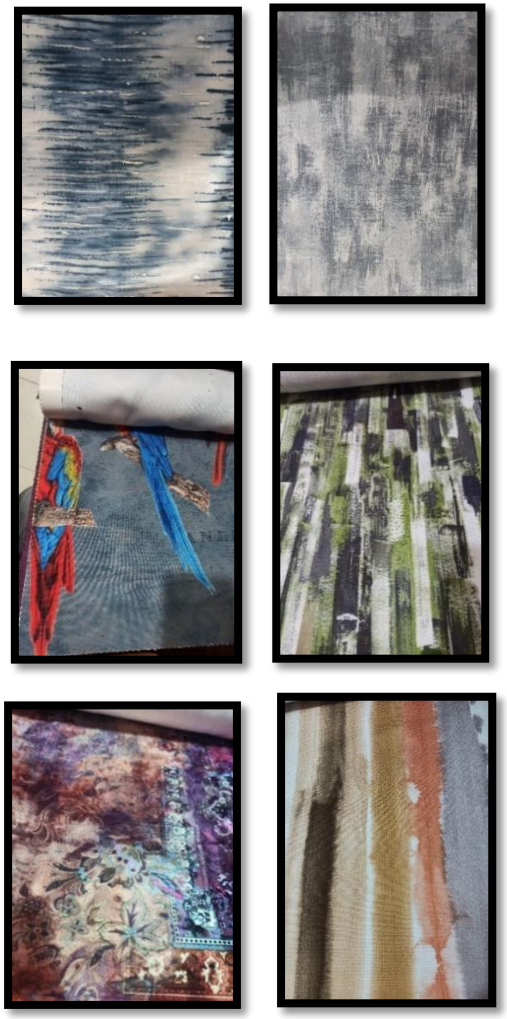
Sr. No.	Name of Products	Picture of products	Brand/ Shop	Cost of the products
				

Table 3 Contd…….

`

Table 3 Contd…….

2.	Curtain of cotton polyester mix material	   	**Shop** : Avaran, B N Chambers, 4, RC Dutt Rd, opposite Welcome Hotel, Alkapuri, Vadodara **Brand** : Prestigious textile	₹ 935 to ₹ 2000 Per sq.mt. (Cost vary according to prints)

Table 3 Contd…….

`

Table 3 Contd…….

3.	Curtain of cotton material	   	**Shop** : Avaran, B N Chambers, 4, RC Dutt Rd, opposite Welcome Hotel, Alkapuri, Vadodara **Brand** : Prestigious textile	₹ 1100 to ₹ 2000 per sq.mt. (Cost vary according to prints)

Table 3 Contd…….

`

Table 3 Contd…….

4.	Curtain of cotton material		**Shop** : Avaran, B N Chambers, 4, RC Dutt Rd, opposite Welcome Hotel, Alkapuri, Vadodara **Brand** : Prestigious textile	₹ 2200 Per sq.mt.
5.	Curtain of cotton material		**Shop** : Avaran, B N Chambers, 4, RC Dutt Rd, opposite Welcome Hotel, Alkapuri, Vadodara **Brand** : Prestigious textile	₹ 950 to ₹ 2050 Per sq.mt. (Cost vary according to prints)
6.	Curtain of cotton polyester mix material		**Shop** : Avaran, B N Chambers, 4, RC Dutt Rd, opposite Welcome Hotel, Alkapuri, Vadodara **Brand** : Prestigious textile	₹ 2100 to ₹ 3150 per sq.mt. (Cost vary according to prints)

Table 3 Contd…….

`

Table 3 Contd…….

7.	Wall panel or upholstery fabric of Velvet material	  	**Shop** : Avaran, B N Chambers, 4, RC Dutt Rd, opposite Welcome Hotel, Alkapuri, Vadodara **Brand** : Prestigious textile	₹ 1070 per sq.mt.

Table 3 Contd…….

`

Table 3 Contd…….

8.	Wall panel or seating fabric of cotton polyester mix material		**Shop** : Avaran, B N Chambers, 4, RC Dutt Rd, opposite Welcome Hotel, Alkapuri, Vadodara **Brand** : Prestigious textile	₹ 1775 per sq.mt.

(Market survey was conducted during January to February 2021)

`

Table 4: Market survey of glasses for window available in the local market

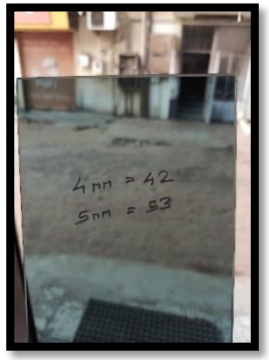
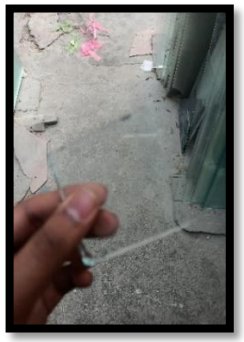
Sr. No.	Name of Products	Picture of products	Brand/ Shop	Available size of product	Cost of the products
1.	Window tinted glasses of Brown, Aqua Blue, Sapphire Blue and Blue color	   	**Shop** : Umiya Glass Center, 01,Badabazar Complex, Nizampura Main Road, Nizampura, Vadodara	3’ × 7’ & 4’ × 8’	Brown Reflective Tinted Glass: 4mm- ₹ 47 sq.ft. 5mm- ₹ 60 sq.ft. Aqua Blue Tinted Glass: 3.5mm- ₹ 42 sq.ft. Sapphire Blue Tinted Glass: 4mm.- ₹ 52 sq.ft. 5mm.- ₹ 65 sq.ft. Blue color Tinted Glass: 4mm.- ₹ 42 sq.ft. 5mm.- ₹ 53 sq.ft.

Table 4 Contd…….

`

Table 4 Contd…….

2.	Window tinted glasses of Dark blue, Brown and Blue color	  	**Shop** : Umiya Glass Center, 01, Badabazar Complex, Nizampura Main Road, Nizampura, Vadodara	3’ × 7’ & 4’ × 8’	Dark Blue Tinted Glass: 5mm. - ₹ 70 sq.ft. Brown Color Tinted Glass: 5mm. - ₹ 54 sq.ft. Blue Color Tinted Glass: 5mm.- ₹ 70 sq.ft.
3.	Window transparent glass		**Shop** : Umiya Glass Center, 01, Badabazar Complex, Nizampura Main Road, Nizampura, Vadodara	3’ × 7’ & 4’ × 8’	5mm. - ₹ 50 sq.ft.

(Market survey was conducted during January to February 2021)

`

Table 5: Market survey of carpet tiles available in the local market

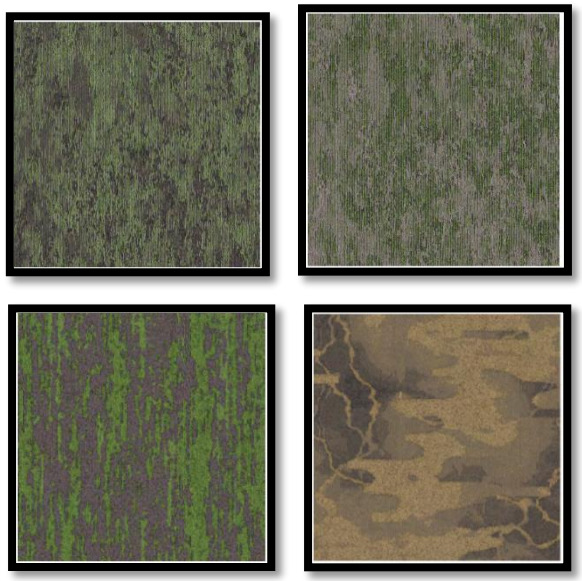
Sr. No.	Name of Products	Picture of products	Brand/ Shop	Available size of product	Cost of the products
1.	Carpet tile with Natural pattern		**Shop** : Digital Sound box, Sb7, Silver coin Complex, Shankheshwer Parshwanath Marg,Haripura, Vadodara **Brand** : Welspun flooring	Size: : 50 cm ×50 cm Thickness-6-7mm.	₹ 250 to ₹ 700 per sq.ft. (Price vary according to patterns)

Table 5 Contd…….

`

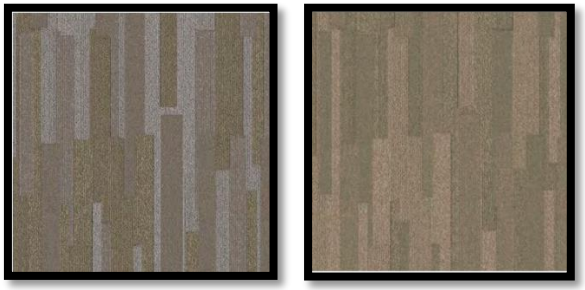
Table 5 Contd…….

2.	Carpet tile with Relaypattern		**Shop** : Digital Sound box, Sb7, Silver coin Complex, Shankheshwer Parshwanath Marg,Haripura, Vadodara **Brand** : Welspun flooring	Size: 50 cm ×50 cm Thickness-6-7mm.	₹ 250 to ₹ 700 per sq.ft. (Price vary according to patterns)

Table 5 Contd…….

`

Table 5 Contd…….

3.	Carpet tile with Urbane pattern		**Shop** : Digital Sound box, Sb7, Silver coin Complex, Shankheshwer Parshwanath Marg,Haripura, Vadodara **Brand** : Welspun flooring	Size: 50 cm ×50 cm Thickness- 6-7mm.	₹ 250 to ₹ 700 per sq.ft. (Price vary according to patterns)

(Market survey was conducted during January to February 2021)

Table 6: Market survey of laminate flooring available in the local market

Sr. No.	Name of Products	Picture of products	Brand/ Shop	Available size of product	Cost of the products
1.	Scraped oak grey brown laminate (laminate – impressive, im1850)		**Shop** : Decoply, Jetalpur Rd, Chikuwadi, Haripura, Vadodara **Brand** : Quick step flooring	Size- 1380mm × 190mm. Thickness- 8mm.	₹ 305 per sq.ft.

Table 6 Contd…….

`

Table 6 Contd…….

2.	White varnished oak laminate (laminate – eligna, EL915)		**Shop** : Decoply, Jetalpur Rd, Chikuwadi, Haripura, Vadodara **Brand** : Quick step flooring	Size-1380mm × 156mm. Thickness-8mm.	₹ 255 per sq.ft.
3.	Bleached white oak laminate (laminate - classic , clm1291)		**Shop** : Decoply, Jetalpur Rd, Chikuwadi, Haripura, Vadodara **Brand** : Quick step flooring	Size-1200mm × 190mm. Thickness-8mm.	₹ 230 per sq.ft.

Table 6 Contd…….

`

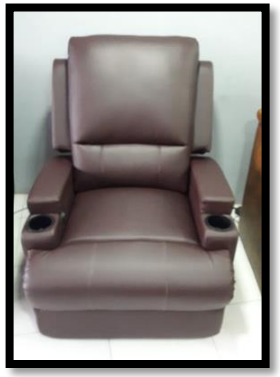
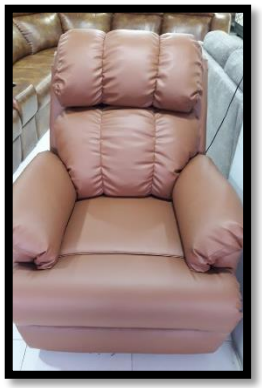
Table 6 Contd…….

4.	Golden Oak laminate (laminate - classic , cl2259)		**Shop** : Decoply, Jetalpur Rd, Chikuwadi, Haripura, Vadodara **Brand** : Quick step flooring	Size-1200mm × 190mm. Thickness-8mm.	₹ 230 per sq.ft.
5.	Virginia oak brown laminate (laminate - creo , cr3183)		**Shop** : Decoply, Jetalpur Rd, Chikuwadi, Haripura, Vadodara **Brand** : Quick step flooring	Size-1200mm × 190mm. Thickness-7mm.	₹ 205 per sq.ft.

(Market survey was conducted during January to February 2021)

`

Table 7: Market survey of Recliner sofa available in the local market

Sr. No.	Name of Products	Picture of products	Brand/ Shop	Cost of the products
1.	Recliner sofa (manual)	 	**Shop:** Furniture system, Fatehsagar. Opp. Convent School, Fatehgunj**,** Vadodara **Brand** : Recliners India	₹ 24400 - ₹ 30400
2.	Recliner sofa (battery operated)	 	**Shop:** Furniture system, Fatehsagar. Opp. Convent School, Fatehgunj**,** Vadodara **Brand** : Recliners India	₹ 36900 - ₹ 47400

(Market survey was conducted during January to February 2021)

`

Table 8: Market survey of plywood, MDF board and pinewood available in the local market

Sr. No.	Name of Products	Picture of products	Brand/ Shop	Available size of product	Cost of the products
1.	Plywood (19 mm)		**Shop** : Varun Traders, Satyam Building, opposite SBI Cantonment Branch, Jayesh Colony, Fatehgunj**,** Vadodara **Brand** : Gold oak	4’ × 8’ & 3’ × 7’	₹ 57 sq.ft.
2.	Plywood (12 mm)		**Shop** : Varun Traders, Satyam Building, opposite SBI Cantonment Branch, Jayesh Colony, Fatehgunj**,** Vadodara **Brand** : Super silver	4’ × 8’ & 3’ × 7’	₹ 40 sq.ft.

Table 8 Contd…….

`

Table 8 Contd…….

3.	MDF board (19 mm)		**Shop** : Varun Traders, Satyam Building, opposite SBI Cantonment Branch, Jayesh Colony, Fatehgunj**,** Vadodara	4’ × 8’ & 3’ × 7’	₹ 65 sq.ft.
4.	MDF board (12 mm)		**Shop** : Varun Traders, Satyam Building, opposite SBI Cantonment Branch, Jayesh Colony, Fatehgunj**,** Vadodara	4’ × 8’ & 3’ × 7’	₹ 48 sq. ft.

Table 8 Contd…….

`

Table 8 Contd…….

5.	Pine wood	 	**Shop** : Shree Laxmi Timber Mart, Nr. Vijay saw mill, Dabhoi Road, Pratapnager Near Haribhakti Estate, Vadodara	6” × 60” & 7” × 72”	₹ 40 Rupees per sq.ft.

(Market survey was conducted during January to February 2021)

`

Table 9: Market survey of laminate available in the local market

Sr. No.	Name of Products	Picture of products	Brand/ Shop	Available size of product	Cost of the products
1.	Laminate with Wooden pattern		**Shop** : Sangarsh Laminates, 4-5, Jemson Industrial Estate, Dharamsingh Desai Marg, opp. N.J. Metal, Shree Nagar, Chhani Jakatnaka, Vadodara **Brand** : RAN Wood	4’ × 8’ & 3’ × 7’	₹ 47 to ₹ 53 per sq. ft. (Price vary according to patterns)

Table 9 Contd…….

`

Sr. No.	Name of Products	Picture of products	Brand/ Shop	Available size of product	Cost of the products
					

`

Sr. No.	Name of Products	Picture of products	Brand/ Shop	Available size of product	Cost of the products
		  			

`

Sr. No.	Name of Products	Picture of products	Brand/ Shop	Available size of product	Cost of the products
2.	Laminate with Marble pattern		**Shop** : Sangarsh Laminates, 4-5, Jemson Industrial Estate, Dharamsingh Desai Marg, opp. N.J. Metal, Shree Nagar, Chhani Jakatnaka **Brand** : RAN Wood	4’ × 8’ & 3’ × 7’	₹ 60 to ₹ 73 Per sq.ft. (Price vary according to patterns)

`

Sr. No.	Name of Products	Picture of products	Brand/ Shop	Available size of product	Cost of the products
					

(Market survey was conducted during January to February 2021)

`

Table 10: Market survey of sponge foam sheet available in the local market

Sr. No.	Name of Products	Picture of products	Brand/ Shop	Available size of product	Cost of the products
1.	Sponge foam sheet		**Shop** : Atmiya Home Decor, A/13, Natwar Nagar, Near Jagdish Farsan Factory Outlet, New VIP Road, Vadodara	3' × 6'	₹ 1800 per sheet

(Market survey was conducted during January to February 2021)

`

Table 11: Market survey of wall paints available in the local market

Sr. No.	Name of Products	Picture of products	Brand/ Shop	Quantity	Cost of the products
1.	Wall paint	  	**Shop** : Veer Traders, Shop No.1,Anjani Krupa Apartment, Bh, Indu Chacha Ln, TP 13, Chhani Jakatnaka **Brand** : Asian paints	4 Liter	₹ 700 per 4 Liter

`

Sr. No.	Name of Products	Picture of products	Brand/ Shop	Quantity	Cost of the products
		 			

(Market survey was conducted during January to February 2021)

`

Table 12: Market survey of indoor plants available in the local nurseries (Surendra Nursery, Baroda Nursery and Roses Nursery, in Vadodara.)

Sr. No.	Name of Plants	Picture of Plants	Cost of the Plants
1.	Anubias barteri var. nana		₹ 150 per plant
2.	Philodendron		₹ 150 per plant

Table 12 Contd…….

`

Table 12 Contd…….

3.	Peperomia obtusifolia		₹ 150 per plant
6.	Asparagus densiflorus		₹ 250 per plant

Table 12 Contd…….

`

Table 12 Contd…….

7.	Echinopsis chamaecereus		₹ 250 per plant
8.	Crassula ovata		₹ 250 per plant

Table 12 Contd…….

`

Table 12 Contd…….

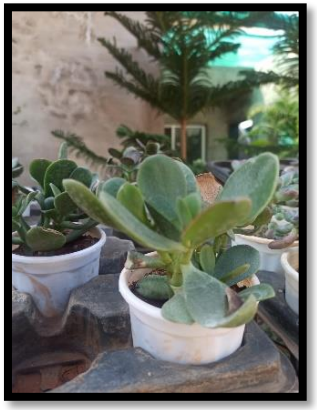
9.	Kalanchoe Pumila		₹ 200 per plant
10.	Crassula arborescens		₹ 200 per plant

Table 12 Contd…….

`

Table 12 Contd…….

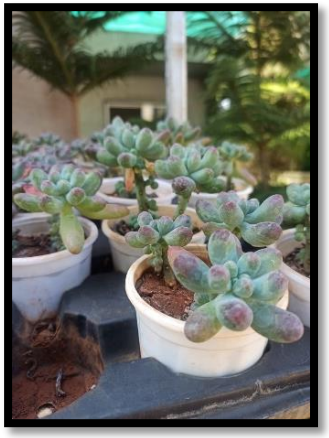
11.	Sedum rubrotinctum aurora		₹ 250 per plant
12.	Echeveria setosa var. deminuta x laui		₹ 300 per plant

Table 12 Contd…….

`

Table 12 Contd…….

13.	Graptopetalum paraguayense		₹ 250 per plant

(Market survey was conducted during January to February 2021)

`

4.1.8. Plywood, MDF board and pine wood

A market survey of plywood, MDF board and pine wood was conducted for designing storage and valance. Plywood was available in two thickness i.e. 12mm and 19mm and two sizes viz. 3’ × 7’ and 4’ × 8’. The plywood was available in two brands, Gold oak and Super silver with price ranging between ₹ 40 to ₹ 57 per sq. ft. MDF board was available in two thickness i.e. 12mm and 19mm and two sizes viz. 3’ × 7’ and 4’ × 8’. The MDF board was available with local manufacturer with price ranging between ₹ 48 to ₹ 65 per sq.ft. (Table-8). The pine wood was available in two sizes viz. 5” × 60” and 7” × 72”. The pine wood was available with local manufacturer ranging at ₹ 40 per sq.ft.

4.1.9. Laminates

A market survey of laminates was conducted for designing storage and valance. The laminate with wooden pattern was available in RAN wood brand. The available sizes of this laminate was 4’ × 8’ and 3’ × 7’ per sq.ft. with price ranging between ₹ 47 to ₹ 53 per sq.ft. The laminate with marble pattern was available in RAN wood brand. The available sizes of this laminate was 4’ × 8’ and 3’ × 7’ per sq.ft. with ranging between ₹ 60 to ₹ 73 per sq. ft. (Table-9).

4.1.10. Sponge foam sheet

A market survey of Sponge foam sheet was conducted which is used for providing backing to fabrics applied on wall panels. These sponge foam sheet were available with local manufacturer in 3’ × 6’ size with thickness of 2”. The price of these sponge foam sheets was ₹ 1800 per sheet. (Table-10).

4.1.11. Wall paints

Wall paints were available with different brands in the market. There were many color options available with Asian paints brands. The cost of 4 liter of Asian paint brand was ₹ 700 (Table-11).

4.1.12. Indoor plants

A market survey of indoor plants available in local nurseries was conducted. The indoor plants such as anubias barteri var. nana, philodendron, Peperomia

`

obtusifolia, asparagus densiflorus, Echinopsis chamaecereus, crassula ovate, Kalanchoe pumila, Crassula arborescens, Sedum rubrotinctum aurora, Echeveria setosa var. deminuta x laui and Graptopetalum paraguayense were available in the local nurseries with price ranging between ₹ 150 to ₹ 300 per plant (Table-12).

4.2 Background information of the client

The information regarding the background characteristic of the Client was gathered through an interview schedule. It was found that the age of respondent was 48 year. The client was residing in Manjalpur area of Vadodara city. The client had graduation degree in architecture and was architect by profession. The monthly income of the respondent was approximately ₹ 1, 50,000. There were six family members in the family. The client was staying with his parents, two children and wife. The theatre room was used for viewing cinema as well as for get together parties occasionally. Theatre room was used once in a week for three to four hours approximately.

4.3 Need and preference of the client for theatre room

This section comprised of detailed information about need and preference of client regarding theatre room which was congregated with the help of the interview schedule by the researcher. Various options for floor, wall, ceiling, window, seating, side table, storage and acoustic treatment were listed. The responses for the given options were “Most preferred”, “Least preferred” and “Not preferred”. The client require to extend a theatre room in adjoining terrace. The Client needed two modifications in the room, one was that he wanted to have a balcony instead of window on wall DA. Second modification was extended the room from terrace on the wall CD. The need and preference for interior space of theatre room as preferred by clients are discussed as below:

`

- **Floor:** For the flooring of the theatre room, various preference like wooden flooring, wooden texture vinyl floor, carpet and acoustic floor carpet tiles, were given for the selection purpose. Amongst the given options, acoustic carpet tile and wooden flooring were most preferred by the client**.**

- **Wall:** For the wall of theatre room, various preference like Acoustic panel, wall paints, wooden cladding, veneer, laminate, wallpaper, patterned texture, cork wall covering and fabric wall covering were given for the selection purpose. Amongst the given options, acoustic wall panel made of fabric were most preferred by the client for two walls and wall paint and wooden cladding for other two walls.

- **Ceiling:** For the ceiling of theatre room, various preference like Plaster of Paris (P.O.P.), gypsum board, acoustic panel made of fabric, laminate, wood, veneer and fabric ceiling were given for the selection purpose. Amongst the given options, acoustic panel made of fabric and wood were most preferred option of the client.

- **Window:** For the window of theatre room, various preference like curtains, valances, swags, drapes and blinds were given for the selection purpose. Amongst the given options, Curtains was the most preferred option of the client.

- **Seating:** For the seating purpose in theatre room, various preference like sofa, couch, recliner chair, upholstered designer chair, arm chair and lounge chair were given for the selection purpose. Amongst the given options, upholstered designer chair and recliner chair were most preferred option of the client.

- **Side table:** For the side table in theatre room, various material preference like natural wood, ply-wood and metal were given for the selection purpose. Amongst the given options, natural wood was most preferred material for side table. Various options for the shape preference like rectangular, square and

`

circular was given for selection purpose. Amongst the given options, rectangular shape was most preferred option of the client.

- **Storage:** For the storage of music system devises in theatre room, preference like movable and fixed storage were given for selection purpose. Amongst the options given, fixed storage was most preferred option for storing music system devises.

- **Acoustic treatment:** For the acoustic treatment of theatre room, various preferences of material like jute panel, acoustic foam panel, perforated board, acoustic wooden panel, printed polyester acoustic panel, fabric wrapped panel and wood wool panel were given for the selection purpose. Amongst the options given, fabric wrapped panel was most preferred option by the client.

4.4 Assessment of existing interiors of theatre room of selected residence

Here is the detailed discussion about the interior space for home theatre room of selected residence. In order to assess the existing interiors of selected home theatre room, various significant interior components like the dimension of the home theatre room, floor, walls, ceiling, lighting, furniture, acoustic treatment and Audio visual equipment's were assessed through observation schedule described as below:

i. **Dimension of theatre room:** The length of the theatre room was 14'-10", width was 12'-9" and height was 11'-0".

ii. **Floor:** The vinyl flooring was observed on the floor of the theatre room having rough texture and matte finish (Plate 1).

`

Plate-1 Existing floor of theatre room

iii. Walls: The “AB” wall of the theatre room was made up of bricks and cement plastered over it. This wall was finished with 4” wide polished cork wooden strips. The wall “AB” has a bay window which is usually covered with screen (Plate-3). It was observed that the old speakers and amplifiers were stored in this bay window. Jute fabric curtains were hung on the Bay window. Kota stone was used for sill of the window. The Air conditioner was placed above the lintel level (Plate 2).

Plate-2 Existing “AB” wall of theatre room with rolled up screen

`

Plate-3 Existing “AB” wall of theatre room with rolled down screen

The wall “BC” was finished with jute panel from floor to lintel level. Above the lintel level the wall was finished with white colored paint (Plate-4). The wall “BC” had a built-in display and storage units designed at the height of 1’-9” from the finish floor level. The display and storage unit was 7’-9” wide with height of 6’ -0”. Several books and CDs were stored in the storage unit. These storage units had openable shutters covered with the jute panel. A display unit was designed in the center of built-in storage. In this display unit, photo frames were placed. A decorative display of waste materials such as sand, aggregate, bricks, pieces of Kota stone and wood was placed in the middle of display unit (Plate-5). There was Main entry door of home theatre room on this wall which is 3’-4” wide and 7’-9” height and made of pine wood.

`

Plate-4 Existing “BC” wall of theatre room

Plate-5 Existing built-in display and storage units of theatre room

The wall “CD” was finished with white colored paint. There was a folding door with width of 6’-6” and height of 7’-9” opening into a small terrace (Plate-6). The folding door had four glass shutters with wood frame and metal rods. Curtains of jute material was used as soft treatment for this folding door.

`

Plate-6 Existing “CD” wall of theatre room

The wall “DA” had jute panel from floor to lintel level. Above lintel level, white colored paint was applied on this wall. There was an operable window on this wall having width of 6’-0” and height of 6’-0”. This window had a view of garden developed at ground floor. The Window was made up of glass with wooden frame and metal rods. Curtain made up of jute materials was used as soft treatment of the window (Plate-7). A lighting fixtures was placed above lintel level in the center of the wall “DA”.

`

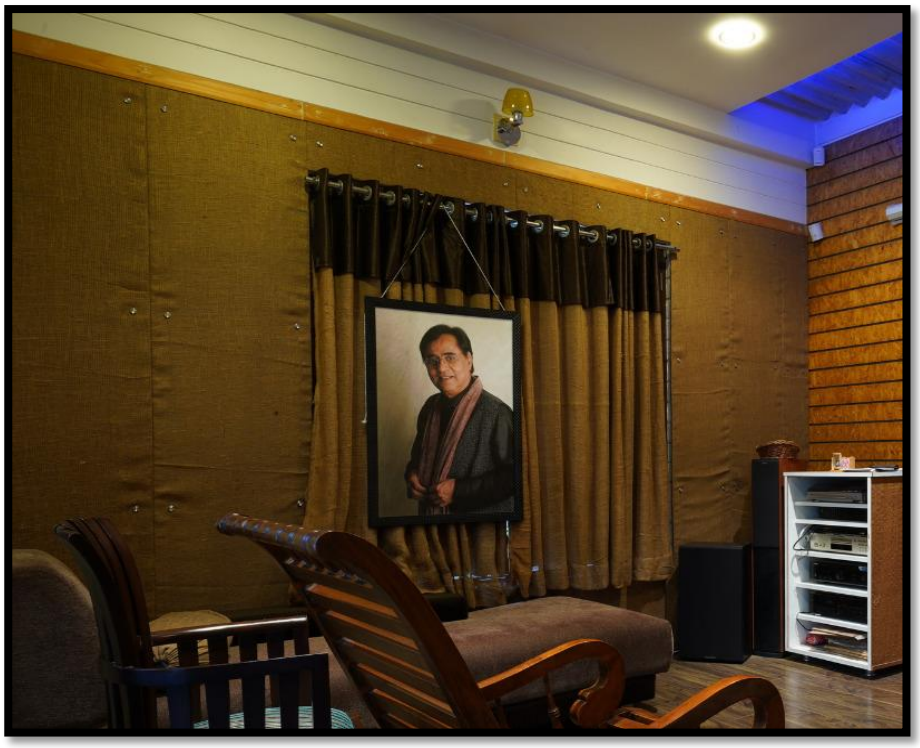


Plate-7 Existing “DA” wall of theatre room

iv. **Ceiling:** There was false ceiling in theatre room gypsum board. There was a beam of length 9’5” and height of 1’0” at one side of the ceiling. There was blue colored indirect light (Strip light) placed at other side of the ceiling. There were six surface (ceiling) lights and one ceiling fan on the ceiling of the home theatre room. The projector was hanged from beam. The color of ceiling was white. (Plate-8).

Plate-8 Existing ceiling of theatre room

`

v. **Lighting:** The theatre room had provision of sufficient natural day lighting coming from south, east and north direction. The provision of artificial lighting was made through lighting fixtures placed on the “DA” wall and surface and indirect lights on ceiling. There was one decorative floor lamp placed at north east corner of the room (Plate-9).

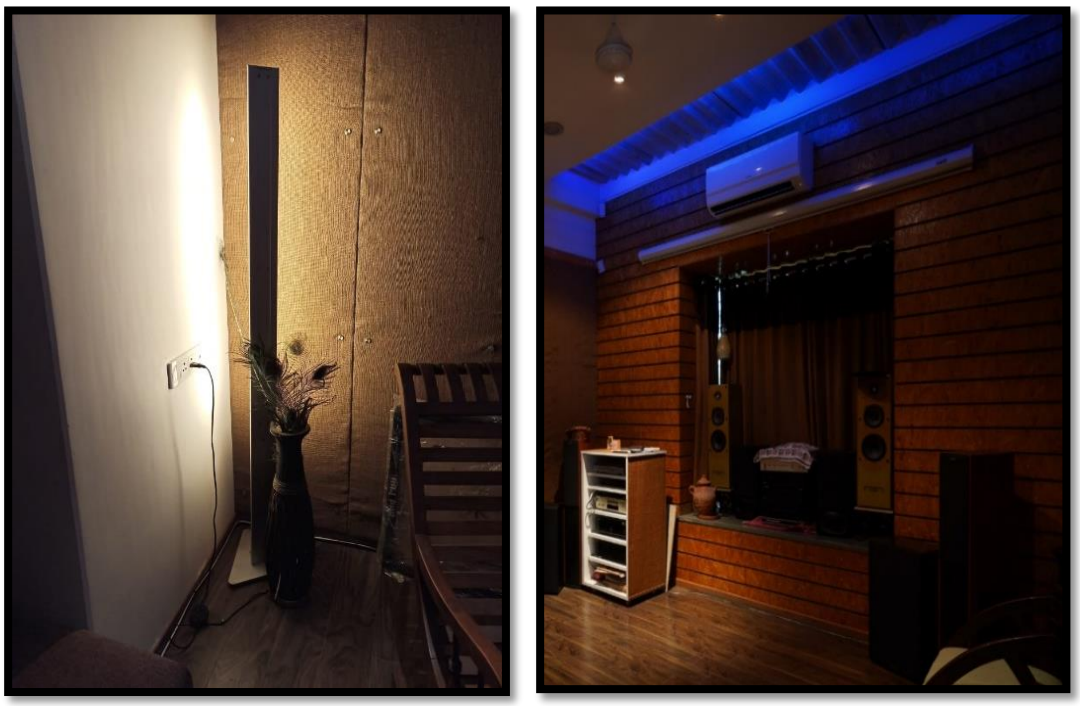


Plate-9 Existing provision of artificial lighting in theatre room

vi. **Furniture:** There were two types of furniture in the theatre room. The furniture required for seating purpose included a couch, a rocking chair and two types of wooden chairs. One chair was in broken condition (Plate-10). One low height movable storage was there having width of 1’-9”, height of 2’-9” and depth of 1’-6”. The music system was stored in this storage unit. The storage unit was made of plywood and laminate. There were six horizontal partition in the storage unit (Plate-11).

`

Plate-10 Existing seating furniture in theatre room

Plate-11 Existing storage furniture of theatre room

`

vii. **Acoustic treatment:** There was acoustic treatment applied on three walls of the theatre room. The two walls viz. “BC” and “DA” had jute panel used for acoustic treatment of the room. The third wall “AB” had polished cork wood panels on it (Plate-12). There was no acoustic treatment was observed on the fourth wall “CD”, floor and ceiling of the theatre room.

Plate-12 Existing acoustic treatment on the walls of theatre room

viii. **Audio visual equipment’s:** The audio visual system was stored in the movable storage unit. The audio visual equipment’s consisted of two speakers, two woofers, DVD player and AV receivers. There was one rolling screen placed on “AB” wall and one ceiling mounted projector in the theatre room.

Plate-13 Existing audio visual equipment’s in theatre room

`

4.5 Redesigning interior space of theatre room considering Biophilic Designs

According to the need and preference of the clients and observations gathered from the observation schedule and review of literature, working drawings of theatre room were prepared. Three different design options were proposed and given to the client for the selection purpose. For each design option, furniture layout, flooring layout, four wall elevations, ceiling design, working drawing, electrical layout and furniture drawings were proposed for theatre room. The 3D views of the selected design of the theatre room was proposed. The overall area of existing theatre room was 183 sq.ft. As per the requirement of client, the theatre room was extended in the adjoining terrace. The budget given by the client for the theatre room was ₹ 4, 00,000. Since the room was use for multiple purpose for example get-togethers, birthday parties, and other such events, the extra seating furniture was kept outside the room. Therefore, whenever extra seating is required in a room it is used from the extra furniture kept outside the room.

Proposed design option-1

Furniture layout

Two leaf shaped chair were designed and placed near wall “BC”. The rocking chair was placed near wall “DA” which was already there in the room and client wanted to retain this chair. One indoor plant (Philodendron plant) was placed at the corner of the room. The floor of extended area was leveled up to 0’-7” using plywood. Here two recliner sofas were placed. Side table having width of 1’-0”, length 1’-9” and height 1’-9” was placed between the two recliner sofas. This side table was made of plywood and laminate. Two succulent plant (Echinopsis chamaecereus and crassula ovate plant) were placed on the side table. The dimension of proposed storage on wall “AB” was 12’-9” width, 1’-9” depth and 1’-9” high. Two speakers were placed at corners of wall “AB”. Two succulent plants (Kalanchoe pumila and crassula arborescens) were placed on the surface of the storage. The storage and display unit on wall “BC” was also redesigned having width of 7’-9” and height 6’-0”.The proposed storage was

`

divided in three parts separated by ply wood. The fabric wrapped acoustic panel were applied on the shutters of proposed storage. The leaf shaped chair designed reflects the biomorphic form and pattern of biophilic design. The use of indoor and succulents plants represent the direct visual connection to nature.

Proposed flooring

According to client's preference carpet tiles of size 50cm X 50cm was selected as flooring option for the theatre room. The carpet tiles selected were based on the aqua theme. Therefore three different patterned carpet tiles reflecting aqua theme were designed for flooring creating an attractive and seamless water wave pattern on floor. The carpet tiles are easy to maintain and stain and fad resistant. This floor carpet tile have good sound absorption quality, and appropriate for in theatre room. According to 14 pattern of biophilic design, biomorphic form and pattern were used with natural color and natural pattern in flooring.

`

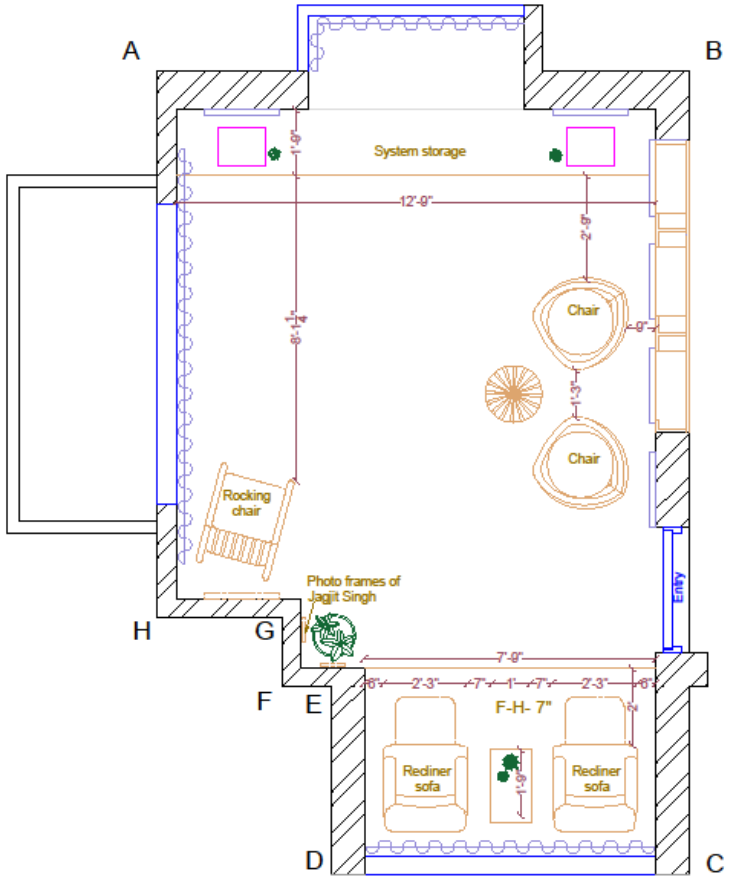
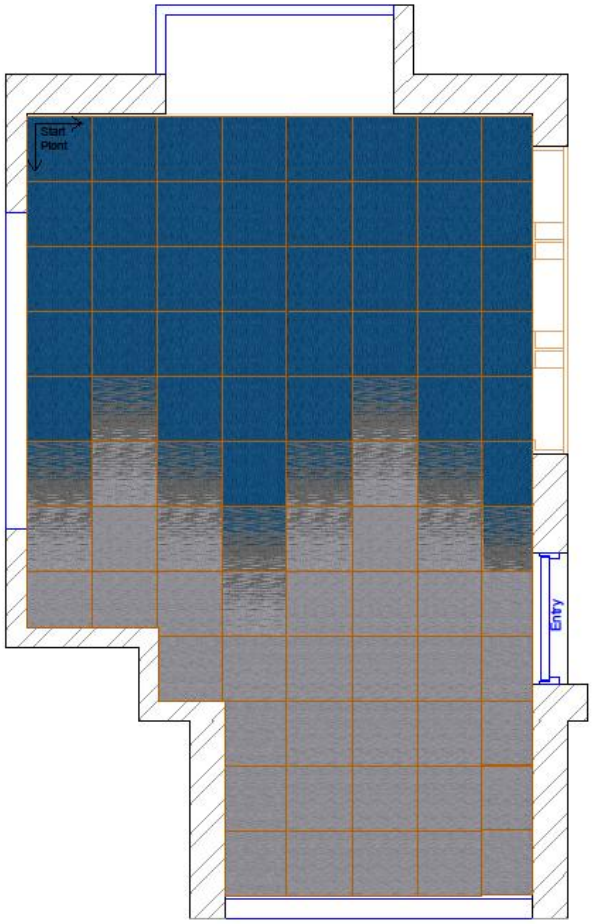


Fig. 1: PROPOSED FURNITURE LAYOUT (Option -1)

`



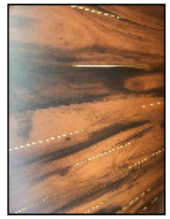
50cm x 50cm
Carpet Tile

50cm x 50cm
Carpet Tile

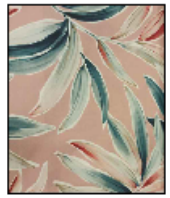
50cm x 50cm
Carpet Tile

S
E
W
N

Fig. 2: PROPOSED FLOORING LAYOUT (Option-1)



LAMINATE FOR WOODEN PELMET AND STORAGE



FABRIC USED ON ACOUSTIC PANEL

FABRIC USED ON CURTAINS

WALL PAINT (REVEL BLUE)

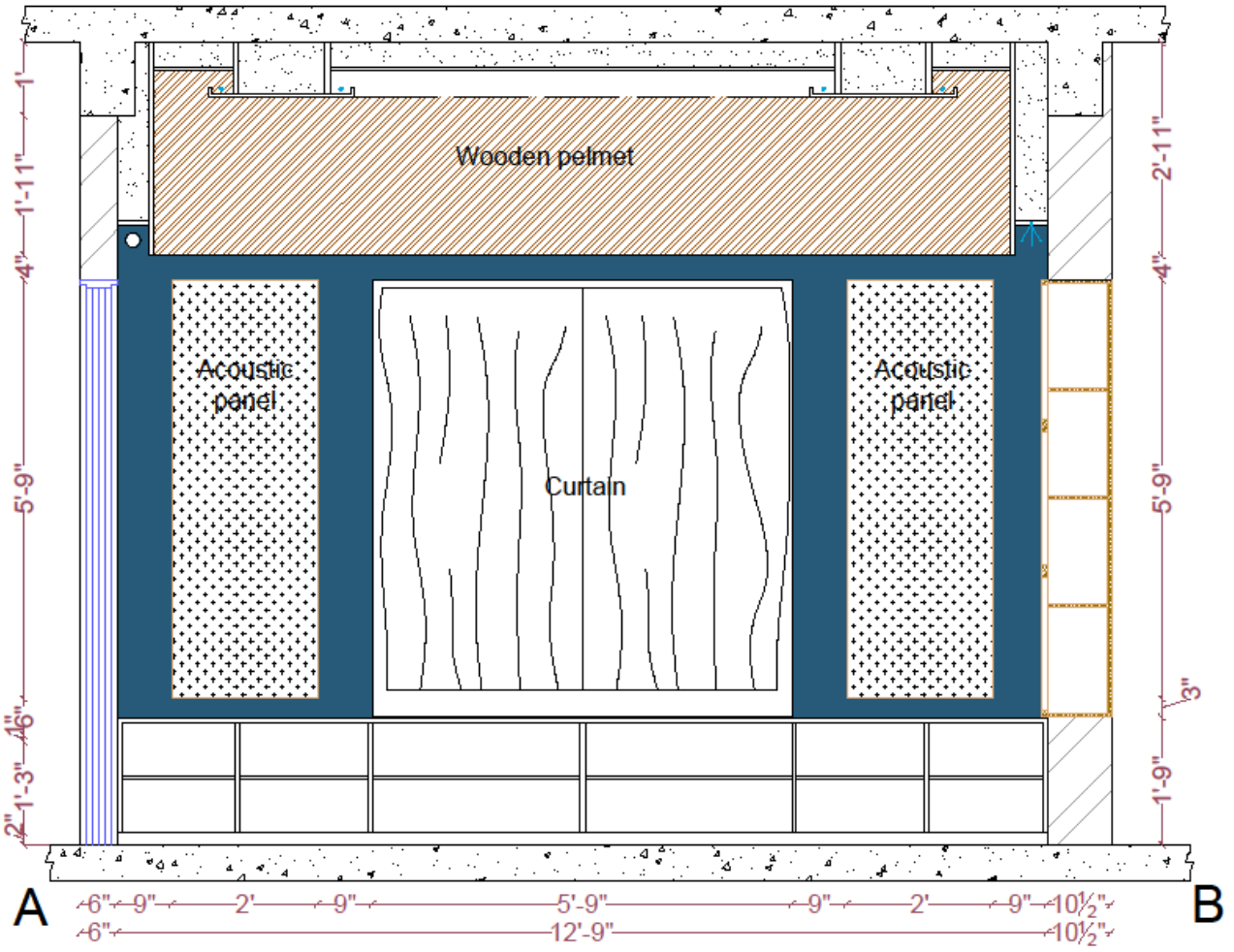
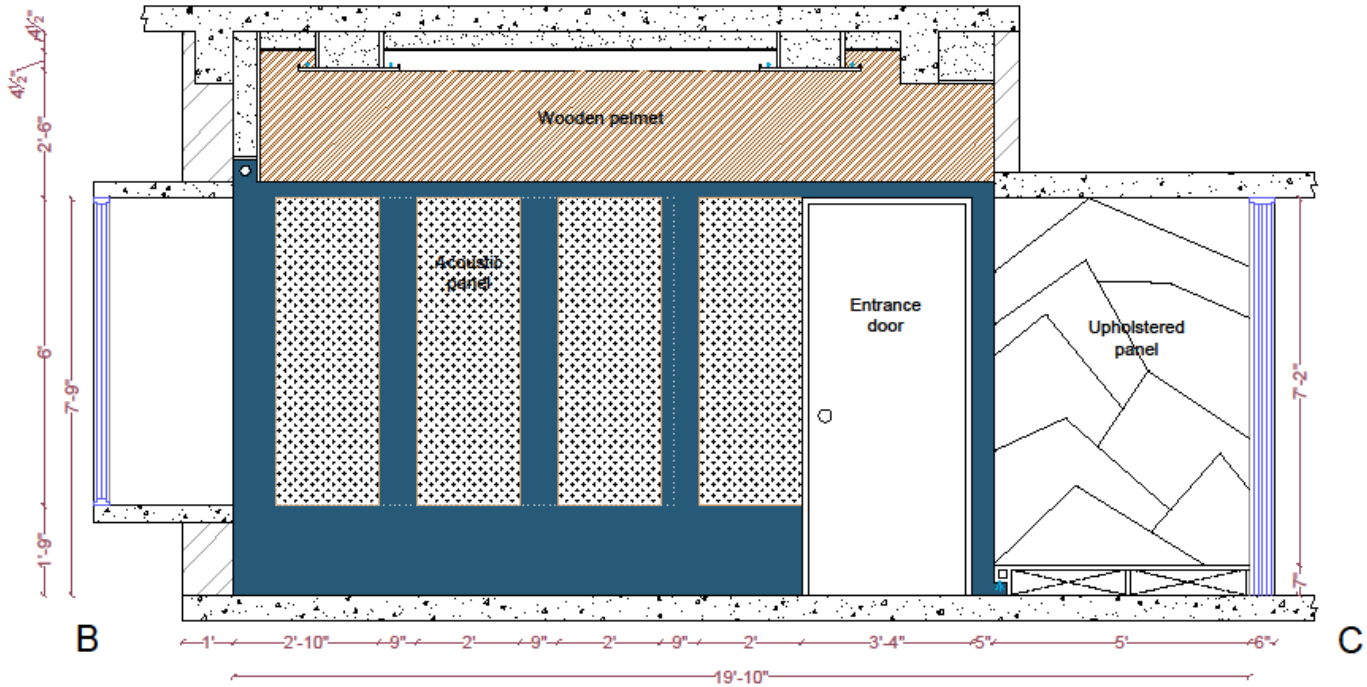


Fig. 3: PROPOSED WALL ELEVATION AB (option -1)



LAMINATE FOR WOODEN PELMET AND STORAGE

FABRIC USED ON ACOUSTIC PANEL

FABRIC USED ON UPHOLSTERED PANEL

WALL PAINT (REVEL BLUE)

Fig. 4: PROPOSED WALL ELEVATION BC (option -1)

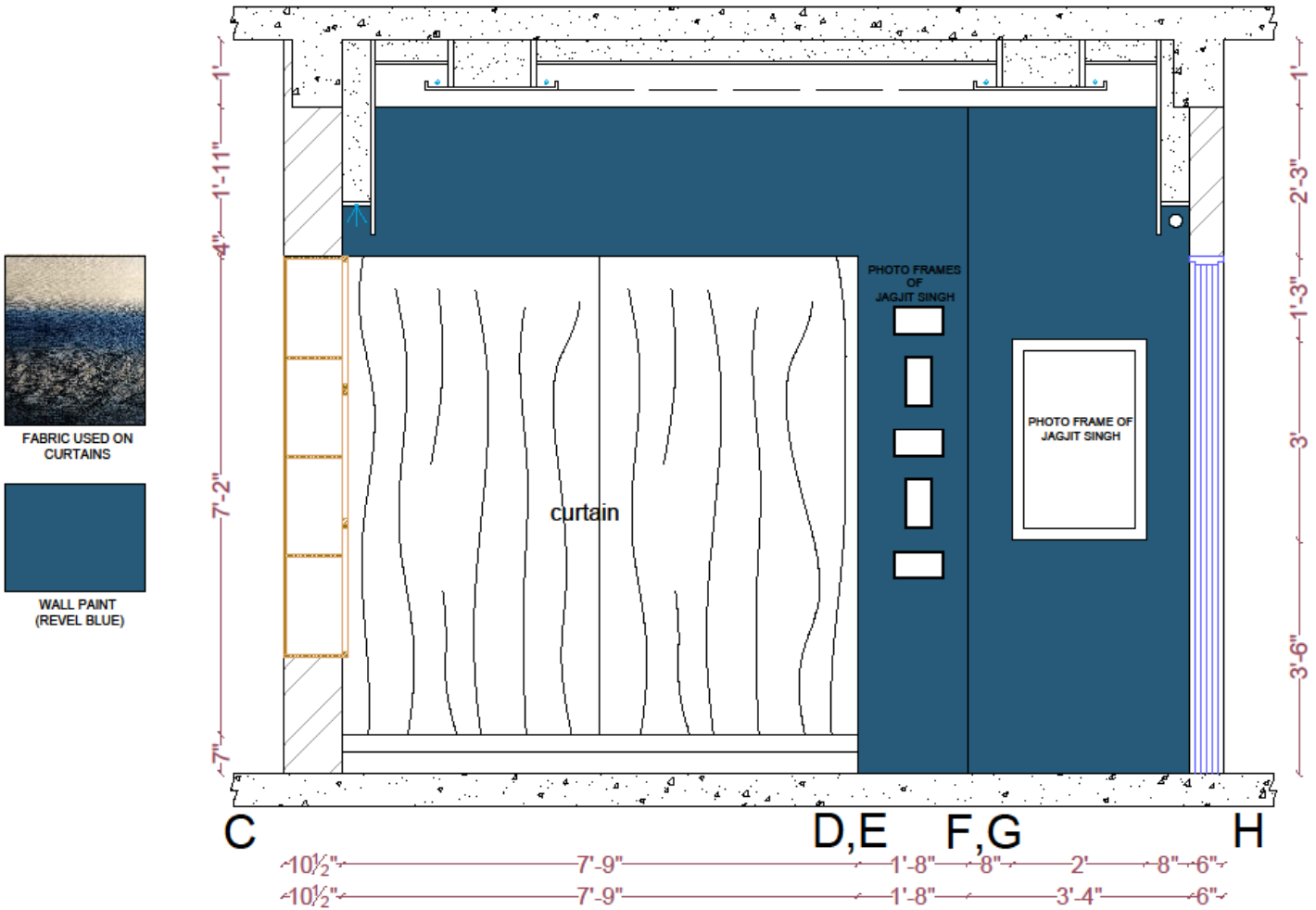


Fig. 5: PROPOSED WALL ELEVATIONS CD, EF, GH (option -1)

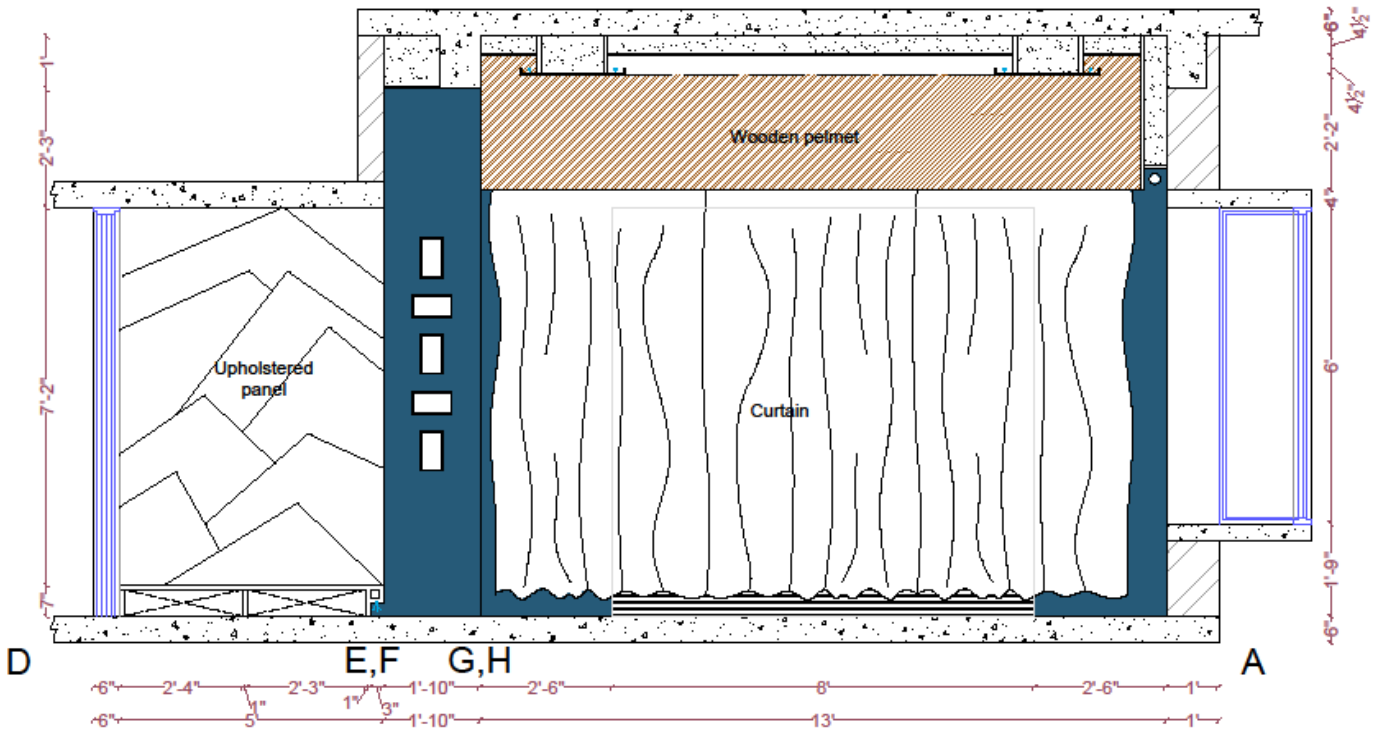
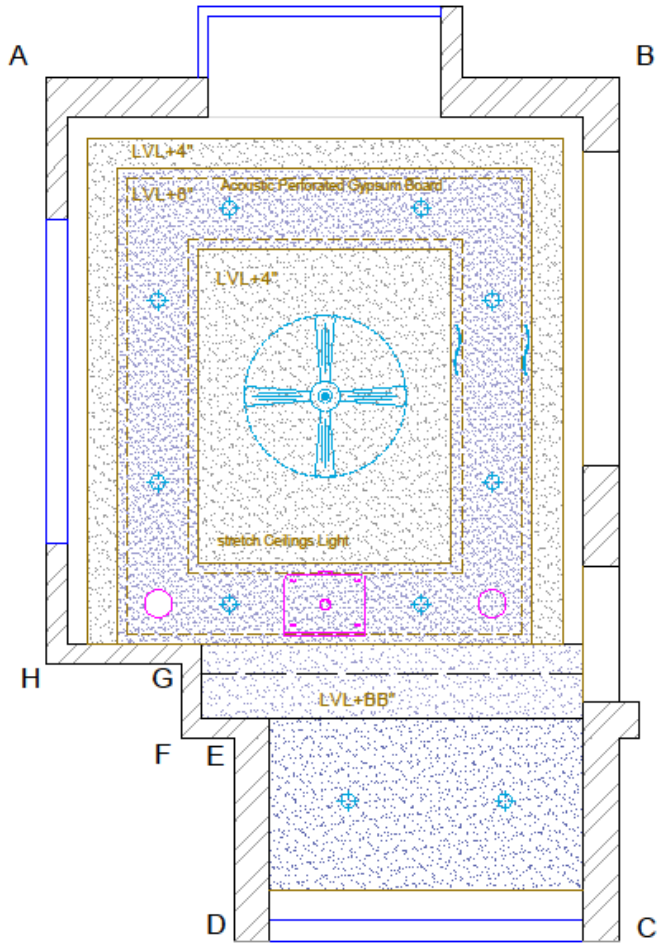


Fig. 6: PROPOSED WALL ELEVATIONS DE, FG, HA (option -1)

`



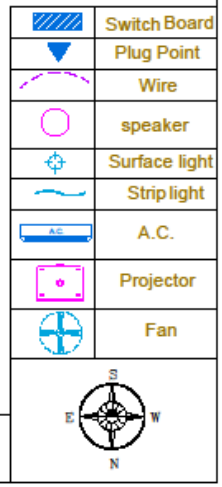


Fig. 7: PROPOSED FALSE CEILING DESIGN (Option -1)

`

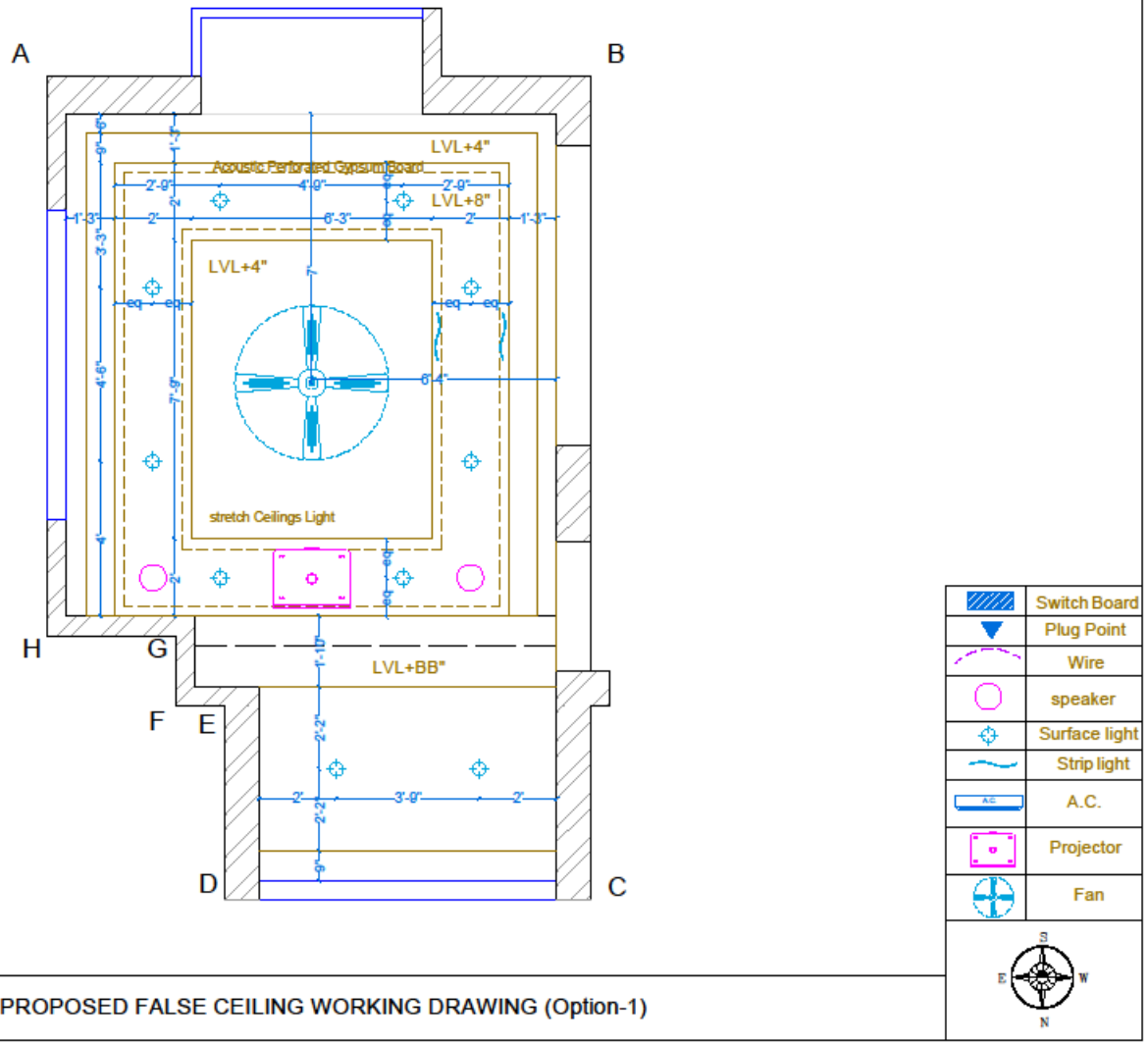
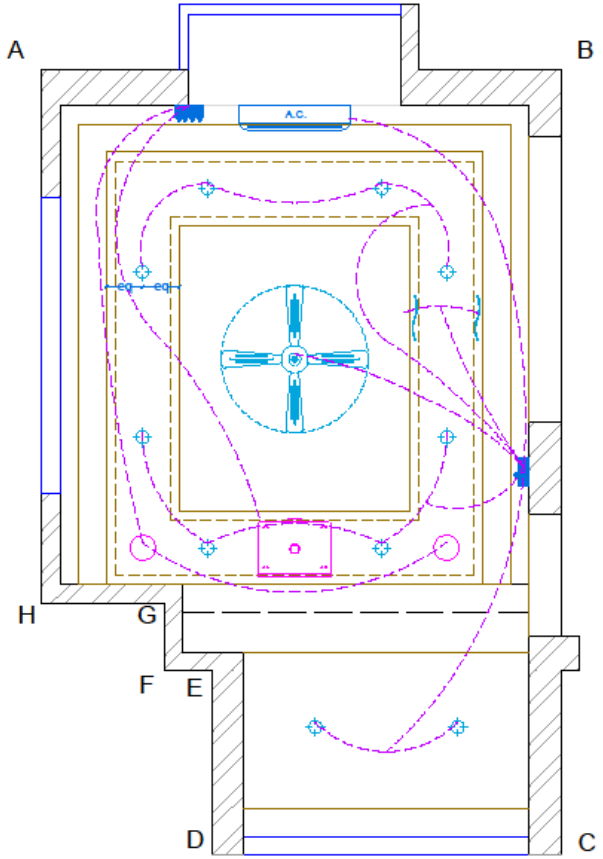


Fig. 8: PROPOSED FALSE CEILING WORKING DRAWING (Option-1)

`



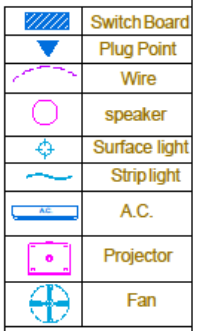


Fig. 9: PROPOSED ELECTRICAL LAYOUT (Option -1)

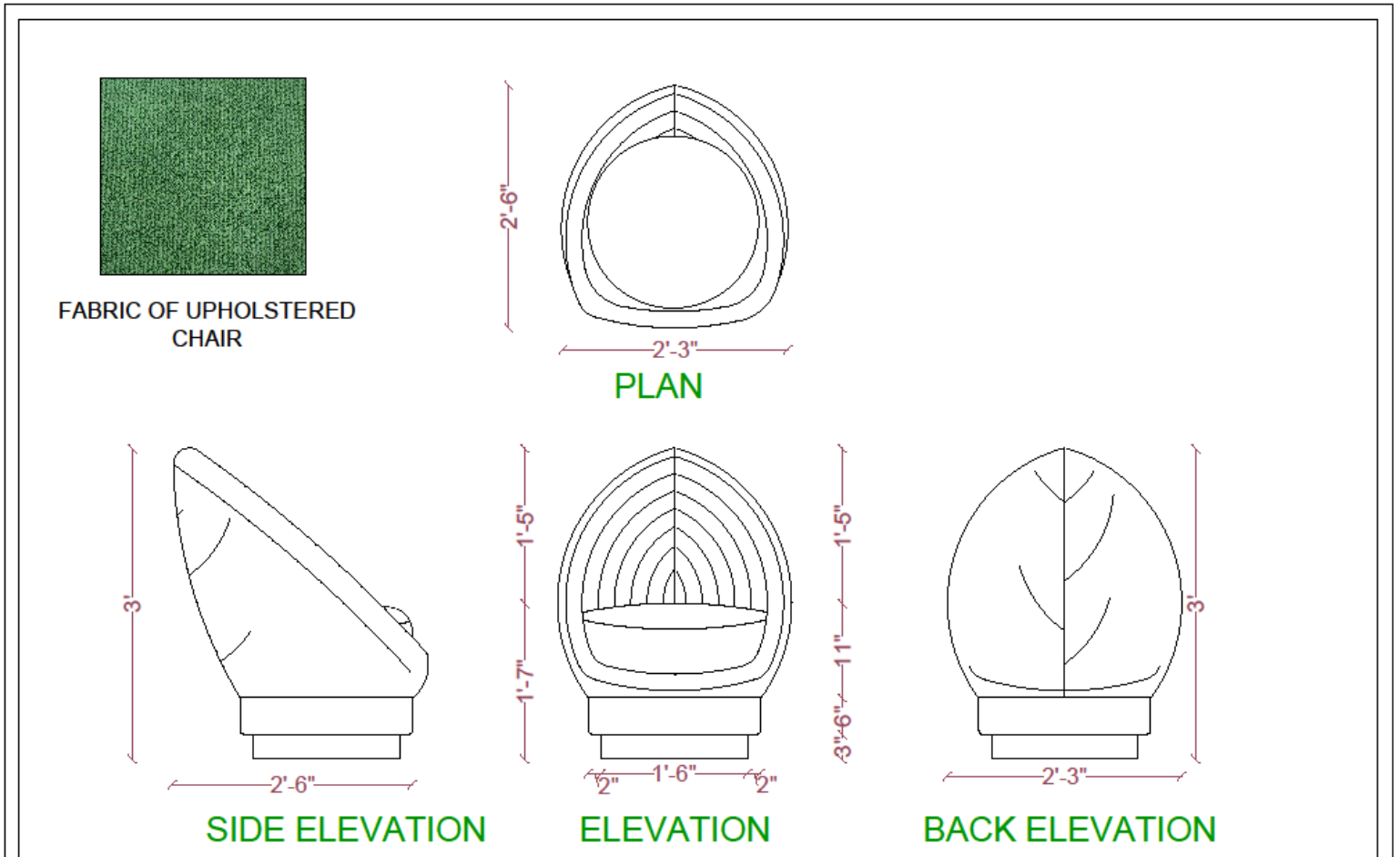
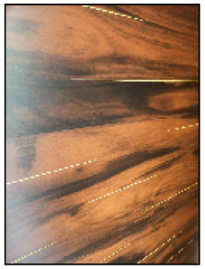
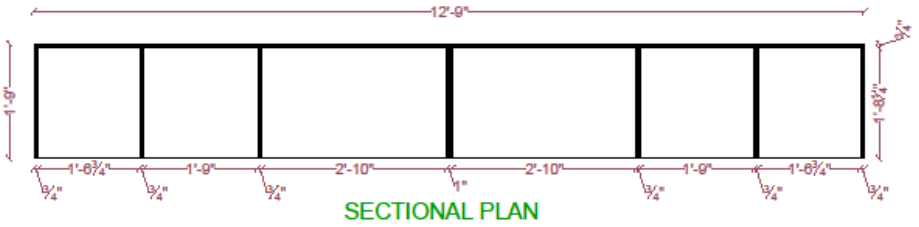


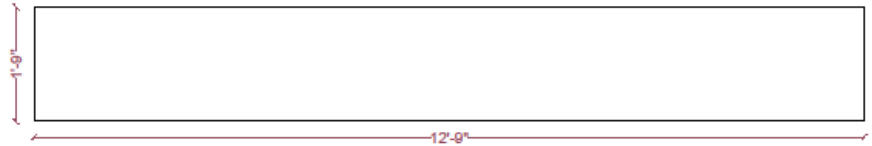
Fig. 10: PROPOSED LEAF SHAPED CHAIR DESIGN



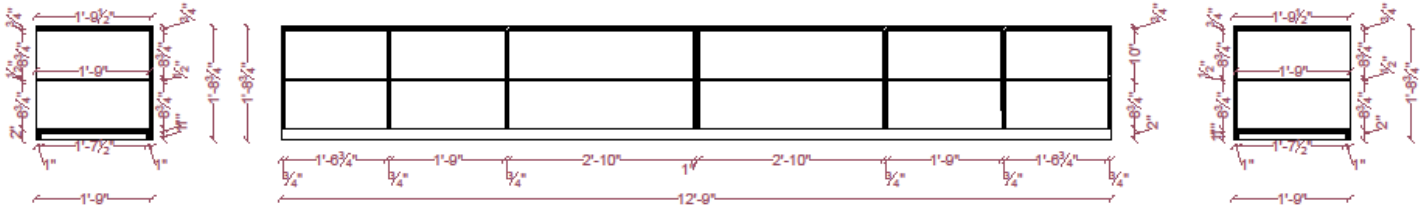
LAMINATE FOR STORAGE



SECTIONAL PLAN



PLAN



SIDE SECTION ELEVATION SIDE SECTION

Fig. 4: PROPOSED STORAGE DESIGN (option -1)

`

Proposed wall design

Wall AB: The length of the wall “AB” was 12’-9”. This wall have one bay window seating and a rolling screen. The screen as rolled down whenever required. Curtains having pattern of mountain were planned for this bay window. The Speakers were placed on the corners of this wall for better music experience. Two fabric wrapped acoustic panels having leaf pattern of size 2’-0” × 5’-9” were placed either sides of wall. A storage unit of height 1’-9”, depth 1’-9” and width 12’-9” was planned below the bay window. Plywood was used as base material for this storage unit and was finished with wooden figure laminate. A pelmet of width 12’-0” and height 2’-6” was placed above the lintel level. There was section behind this pelmet for screen when it was rolled up. Plywood was used as base material for this pelmet and was finished with wooden figure laminate. Strip light was placed behind the pelmet which gave effect of ambient light on both acoustic panel. Revel blue wall paint was planned for the remaining exposed wall. Wooden pattern laminate used in pelmet and storage unit, leaf pattern in acoustic panels and mountain pattern in curtain revealed biomorphic form and pattern of biophilic design. The presence of window on this wall helped in maintaining thermal and air flow in the room, which represents the thermal and air flow variability of Biophilic design pattern. The ambient light design reflected the nature in space aspect of biophilic design. Revel blue wall paint is related to water element of nature.

Wall BC: Earlier there was a terrace on this wall which was taken in to the room. Therefore the wall “BC” was extended 5’-0” as per the client’s requirement. The length of the wall was 19’-10” after its extension. There was a main entrance door on this wall. The dimension of door was 3’-4” wide and 7’-9” high. The door was made up of Pine wood. A storage was planned on this wall. The dimension of the storage was 7’-9” wide and the 6’-0” high. This storage was 1’-9” up from the finish floor level. Fabric wrapped acoustic panel of leaf pattern was planned for the shutters of the storage. Four acoustic panels of size width 2’-0” and height 6’-0” were planned on this wall where storage was designed behind three panels. A pelmet of width 12’-0” and height 2’-6” was placed above the lintel level. Plywood was used as base material for this pelmet and was finished with wooden figure laminate. Strip light was placed behind the

`

pelmet which gave effect of ambient light on acoustic panels. Revel blue wall paint was planned for the remaining exposed wall. The extended wall was covered with upholstered panel having abstract mountain pattern. Wooden pattern laminate used in pelmet, leaf pattern in acoustic panels and mountain pattern in upholstered panel revealed biomorphic form and pattern of biophilic design. The ambient light design reflected the nature in space aspect of biophilic design. Revel blue wall paint is related to water element of nature.

Wall CH: This wall had three protrusion namely CD, EF, GH. The length of wall "CD" was 7'-9", "EF" was 1'-8" and "GH" was 3'-4". The wall "CD" had curtains with mountain patterned on it covering the door. Two recliner sofa and side table was placed near this wall. Since the floor level was raised to 0'-7", in this extended area, strip light was planned to differentiate between the floor levels. The photo frames were placed on wall "EF". The indoor plant was placed at the corner of this wall. A photo frame of width 2'-0" and height 3'-0" was placed on wall "GH". Revel blue wall paint was planned for this wall. Mountain pattern in curtains revealed biomorphic form and pattern of biophilic design. The strip light design reflected the nature in space aspect of biophilic design. Revel blue wall paint is related to water element of nature. The indoor plant near this wall reflected direct connection to nature. The presence of terrace door on this wall helped in maintaining thermal and air flow in the room, which represents the thermal and air flow variability of Biophilic design pattern.

Wall DA: This wall had three protrusion namely DE, FG, HA. The length of wall, "DE" was 5'-0, "FG" was 1'-10" and "HA" was 13'-0". The wall "DE" with dimension of 5'-0" wide and 7'-0" high was covered with upholstered panel having mountain pattern. The photo frames were placed on wall "FG". The indoor plant was placed at the corner of this wall. A balcony was planned in place of window on this wall. The dimension of balcony's door was 8'-0" wide and 7'-9" high. Curtain with mountain pattern were planned for the balcony door. A pelmet of width 12'-6" and height 2'-6" was placed above the lintel level. Plywood was used as base material for this pelmet and was finished with wooden pattern laminate. Strip light was placed behind the pelmet which gave effect of ambient light on curtains. Revel blue wall paint was planned for this wall. Wooden pattern pelmet, upholstered panel and mountain pattern in

`

curtains revealed biomorphic form and pattern of biophilic design. The strip light design reflected the nature in space aspect of biophilic design. Revel blue wall paint is related to water element of nature. The presence of balcony on this wall helped in maintaining thermal and air flow in the room, which represents the thermal and air flow variability of Biophilic design pattern.

Proposed False Ceiling Design and Electrical Layout

Ceiling of theatre room was divided in two level 4” and 8”. Ceiling had a beam of 1’-0” towards wall “CD”. This beam was covered with the false ceiling. There was 6” offset from three walls for pelmet. At 4” level from the ceiling, 9” offset was planned. At 8” level from ceiling, 2’ wide rectangular shape was planned giving space for strip light. Existing projector was placed on this rectangular shaped. Perforated board were planned for the false ceiling which acted as good acoustic treatment. Ceiling fan was placed on center of the false ceiling.

According to theatre room size and ceiling design, ceiling surface light was placed on false ceiling in such a manner that light was distributed all over the theatre room. Total of 10 LED light of 15 watts each were placed in false ceiling for direct lighting. These fixtures were circular in shape. The tint of light from these lights was white.

The distribution of the switches was done keeping in mind the proximity of the fixture and the switchboard to minimize the length of wires. One switchboard was placed near entrance door so that operating them became easy. This switchboard included the connection of ceiling surface lights, ceiling indirect light, fan and A.C. other switchboard was placed near system storage. The other switchboard was placed near storage unit which included the connection of music system, speakers and ceiling mounted projector.

Proposed leaf shape chair design

The shape of chair was inspired by leaf. Ply wood was used as base material in this chair and sponge foam was used to add comfort and give proper shape. Green color cotton polyester mix fabric was used for upholstery. Stiches was used to create a shape of leaf vines on fabric.

`

Proposed music system storage

This storage unit of height 1’-9”, depth 1’-9” and width 12’-9” was designed to store music system. Plywood of 12mm and 19mm was used as base material and wooden pattern laminate was used as a finish. There were twelve compartment in this storage unit of three different sizes. The First size of the compartment was 2’-10” wide, second was 1’-9” wide and third was 1’-6” wide.

Proposed design option-2

Furniture layout

Two flower shaped chair were designed and placed near wall “HA”. The rocking chair was placed near wall “BC” which was already there in the room and client wanted to retain this chair. One indoor plant (Philodendron plant) was placed at the corner of the room. The floor of extended area was leveled up to 0’-7” using plywood. Here two recliner sofas were placed. Side table having width of 1’-0”, length 1’-9” and height 1’-9” was placed between the two recliner sofas. This side table was made of pine wood. Two succulent plant (Echinopsis chamaecereus and crassula ovate plant) were placed on the side table. The dimension of proposed storage on wall “AB” was 12’-9” width, 1’-9” depth and 1’-9” high. Two speakers were placed at corners of wall “AB”. Two succulent plants (Kalanchoe pumila and crassula arborescens) were placed on the surface of the storage. The storage and display unit on wall “BC” was also redesigned having width of 7’-9” and height 6’-0. The proposed storage was divided in three parts separated by ply wood. The fabric wrapped acoustic panels were applied on the shutters of proposed storage. A plain fabric green color was used in this acoustic panel where an abstract design was made with the help of stiches. The flower shaped chair designed reflects the biomorphic form and pattern of biophilic design. The use of indoor and succulents plants represent the direct visual connection to nature.

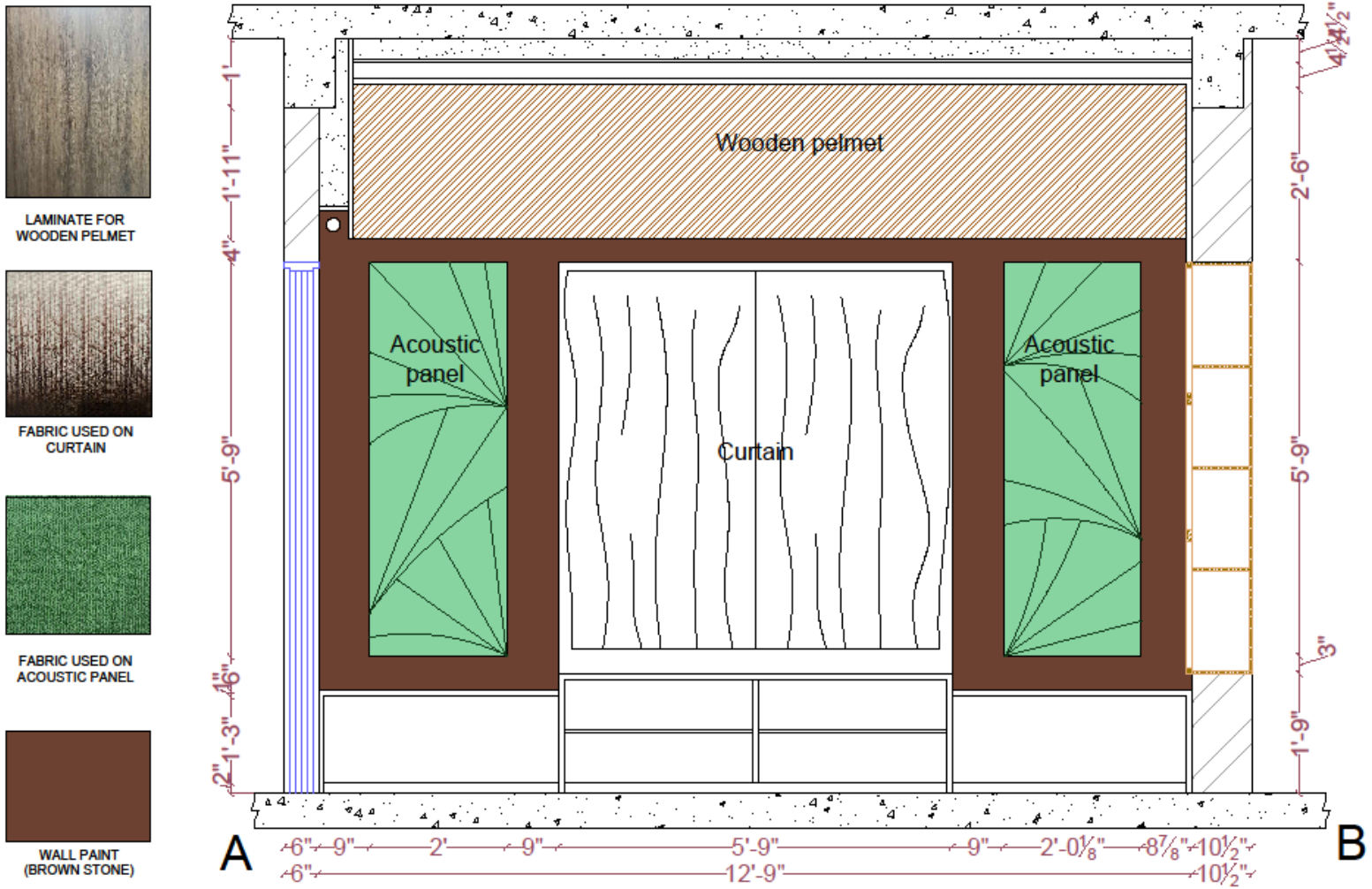


Fig. 14: PROPOSED WALL ELEVATION AB (option -2)

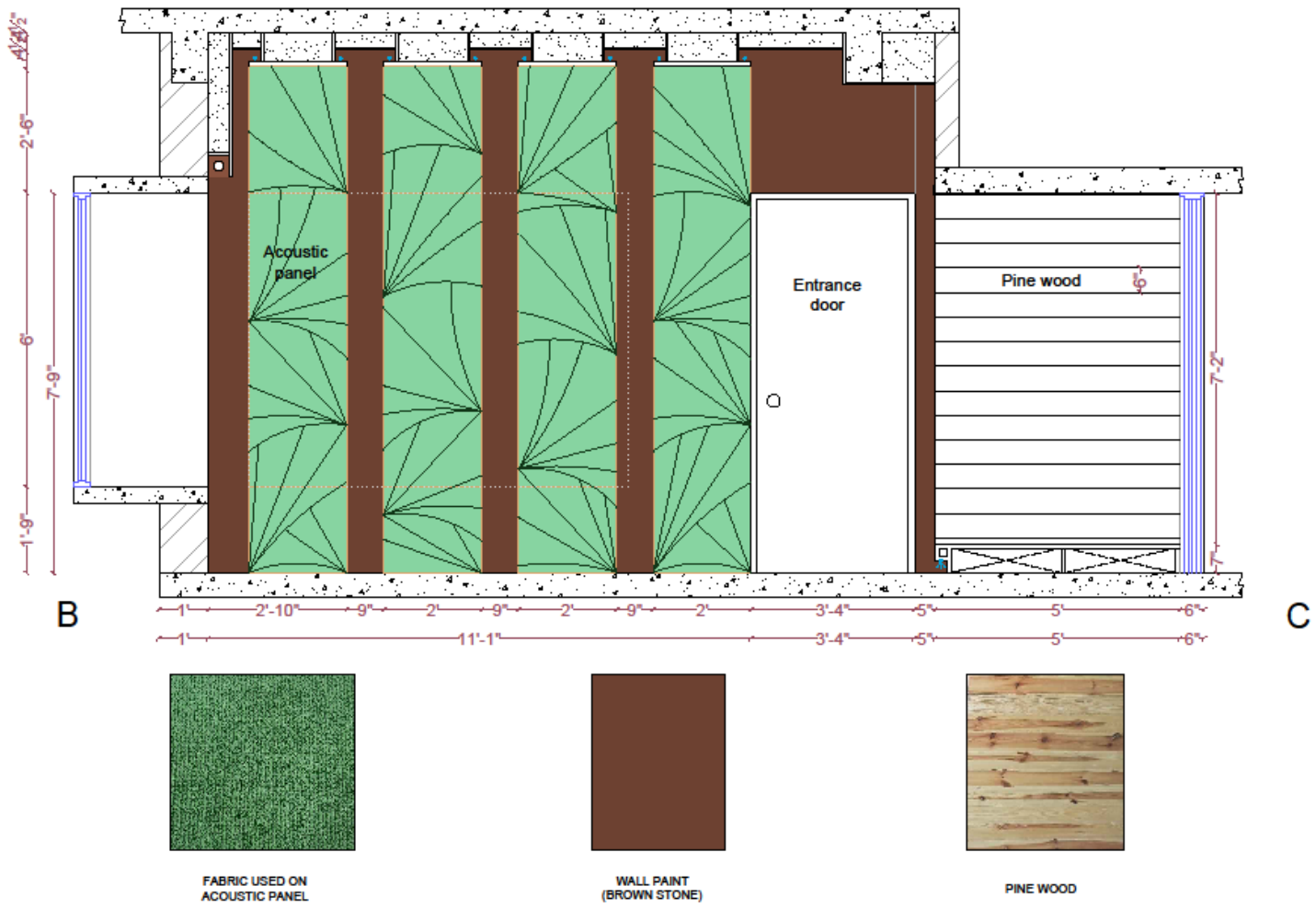


Fig. 15: PROPOSED WALL ELEVATION BC (option -2)

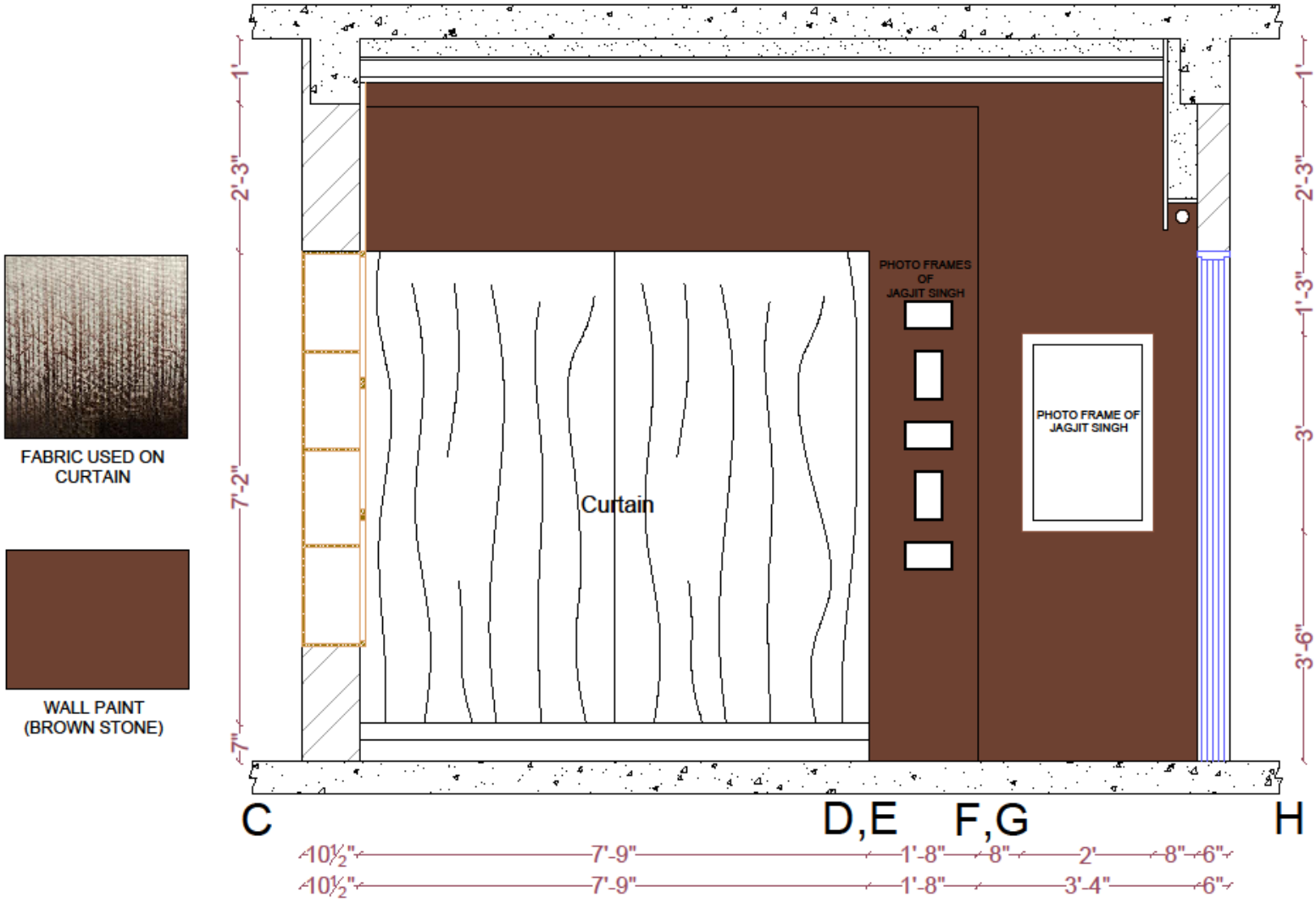


Fig. 16: PROPOSED WALL ELEVATIONS CD, EF, GH (option -2)

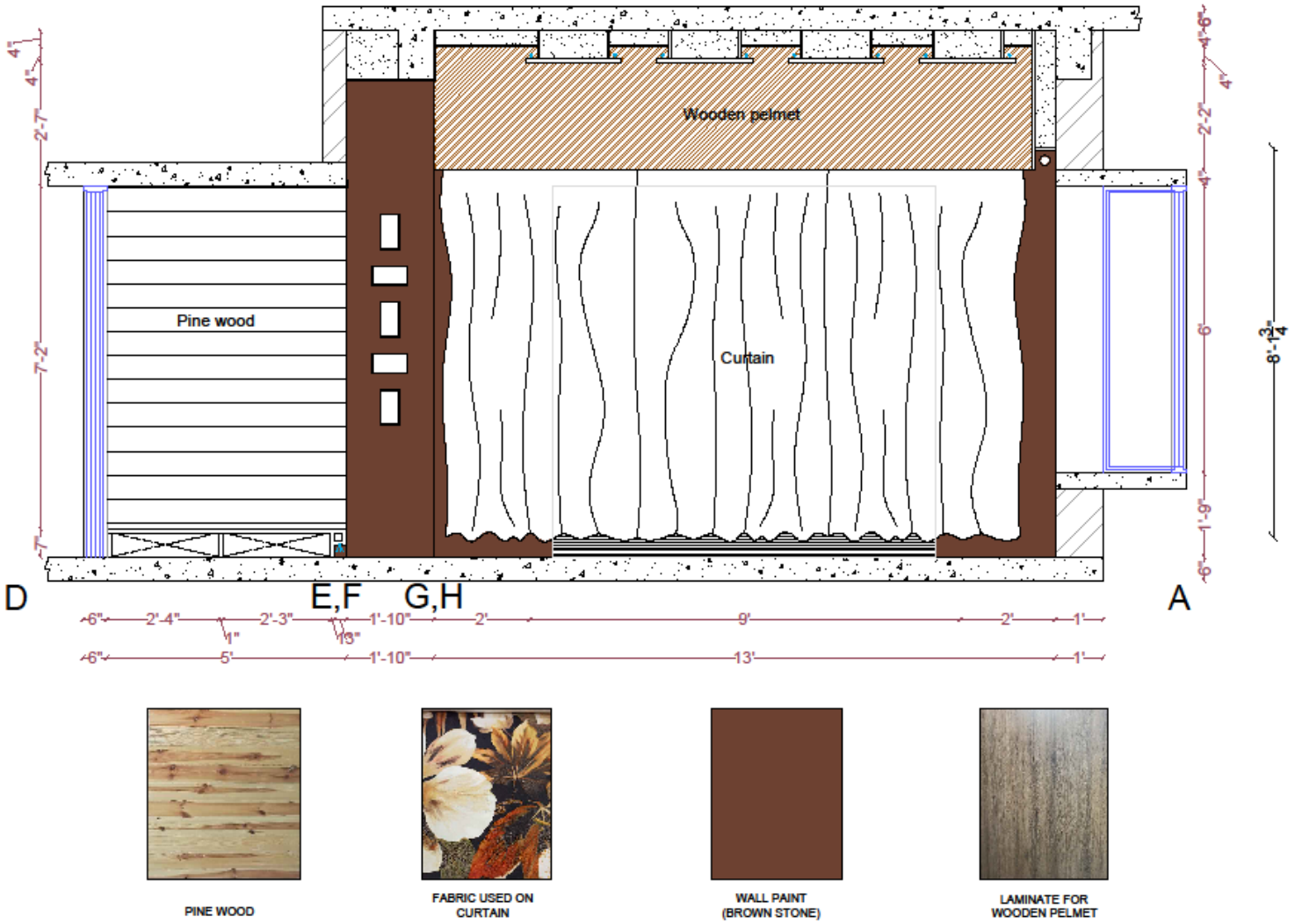


Fig. 17: PROPOSED WALL ELEVATIONS DE, FG, HA (option -2)

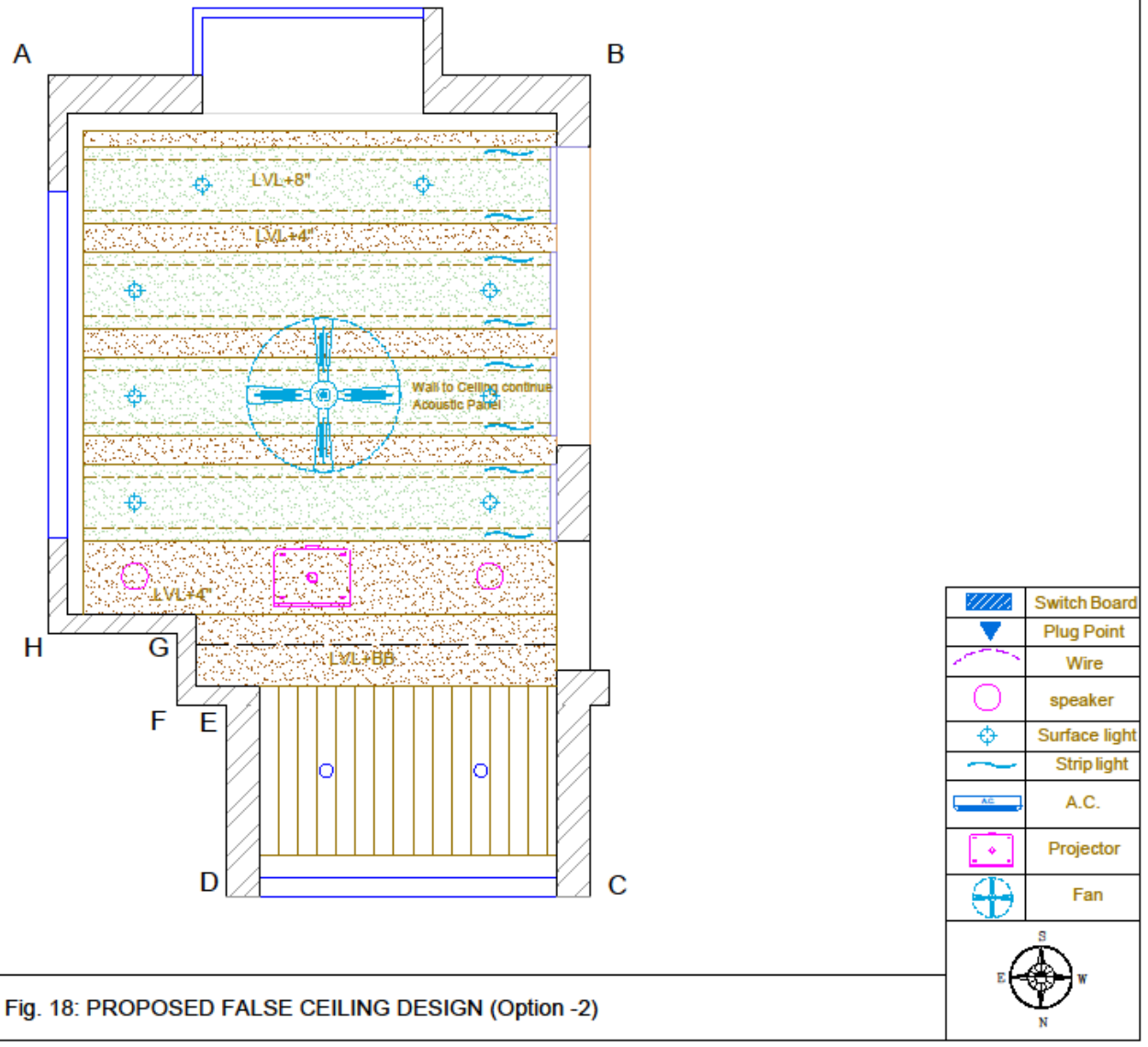


Fig. 18: PROPOSED FALSE CEILING DESIGN (Option -2)

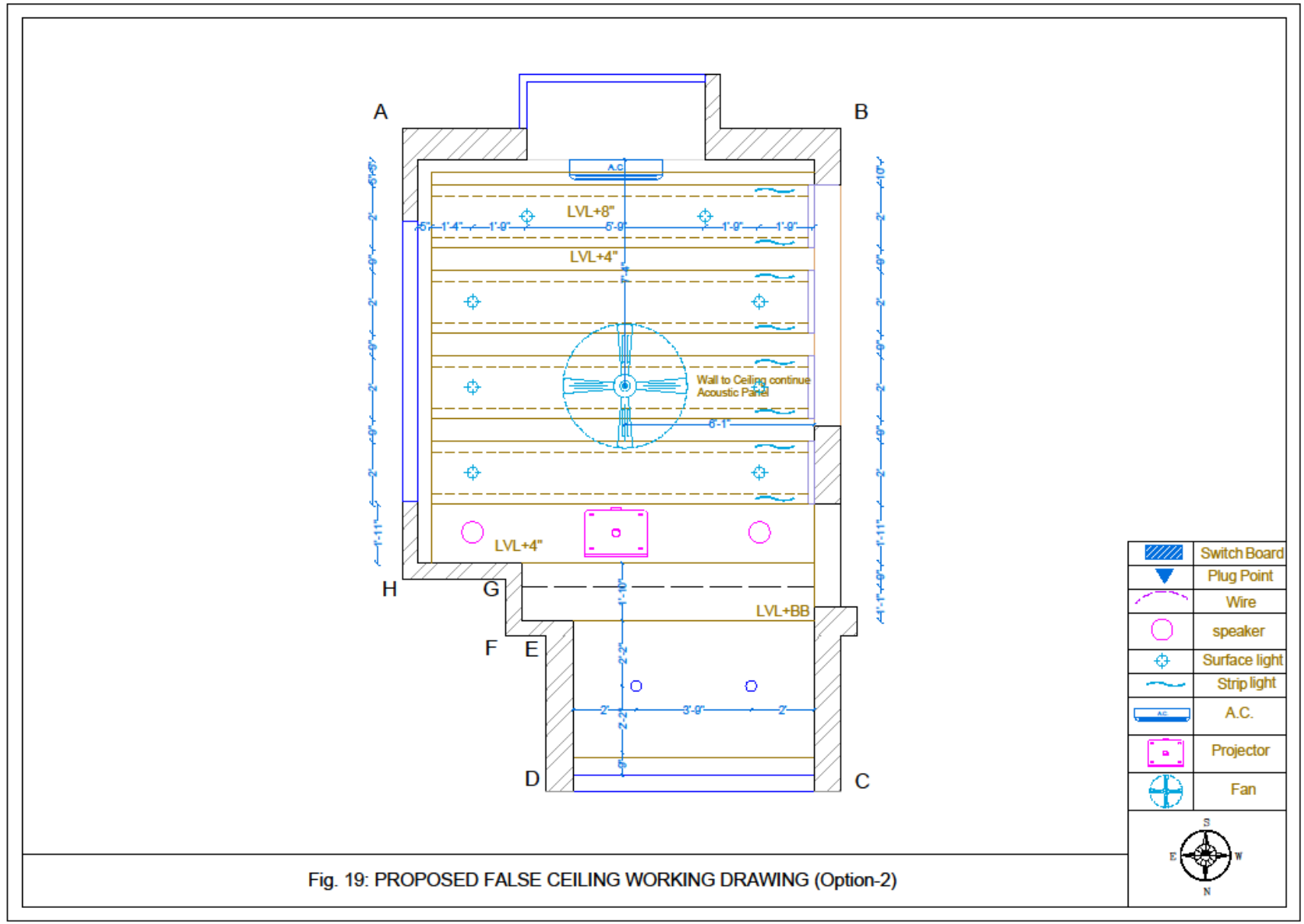


Fig. 19: PROPOSED FALSE CEILING WORKING DRAWING (Option-2)

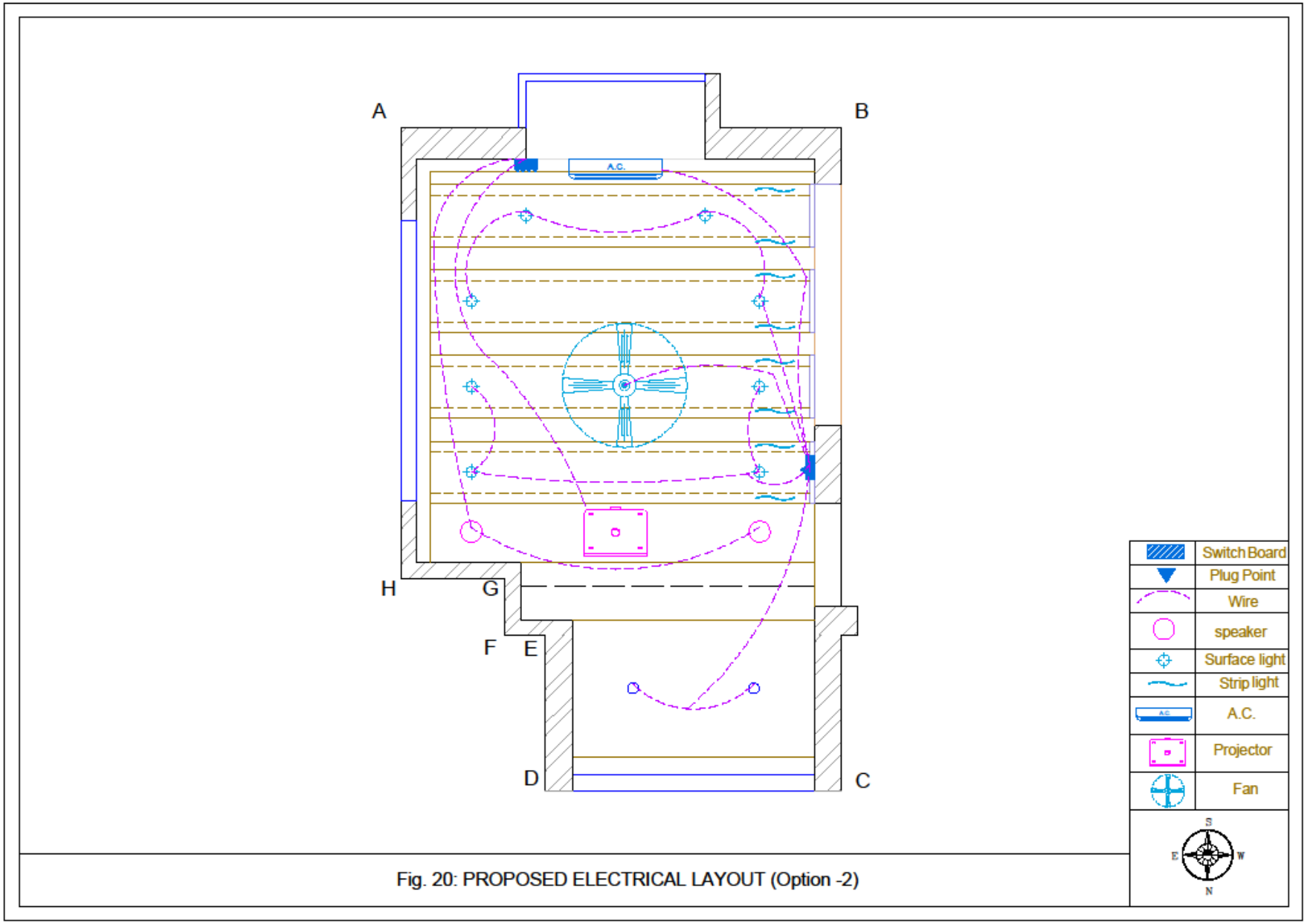
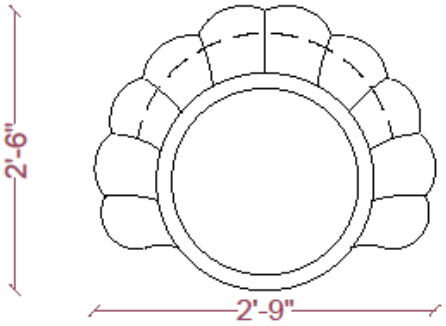
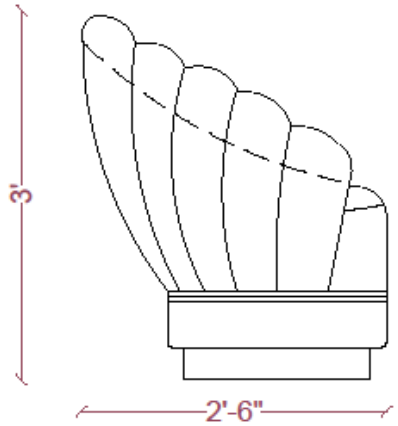


Fig. 20: PROPOSED ELECTRICAL LAYOUT (Option -2)

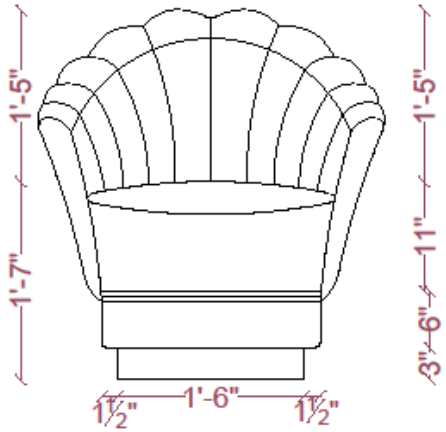
FABRIC OF UPHOLSTERED CHAIR



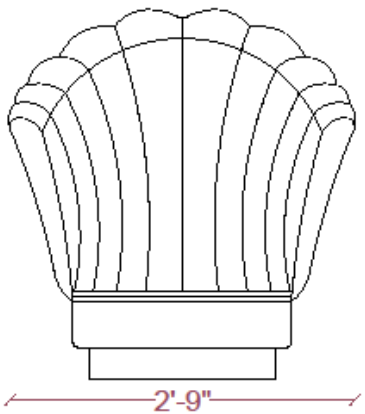
PLAN



SIDE ELEVATION



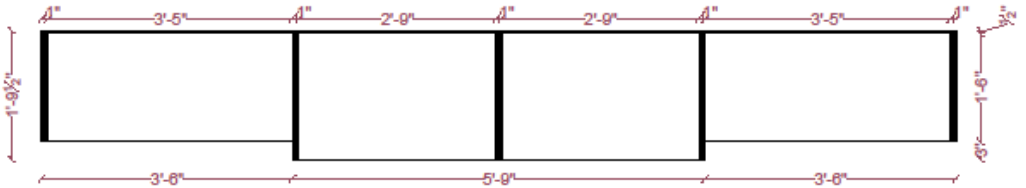
ELEVATION



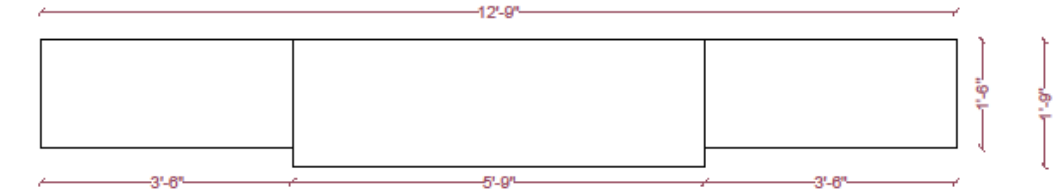
BACK ELEVATION

Fig. 21: PROPOSED FLOWER SHAPED CHAIR DESIGN

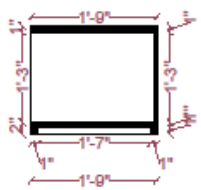
LAMINATE FOR STORAGE



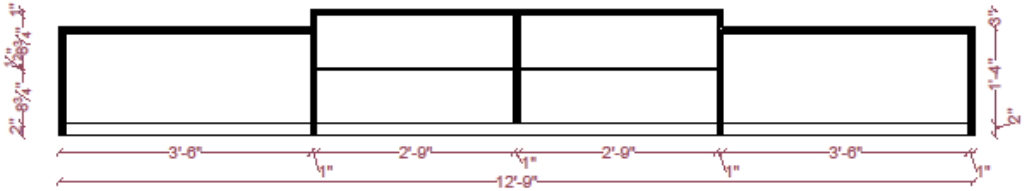
SECTIONAL PLAN



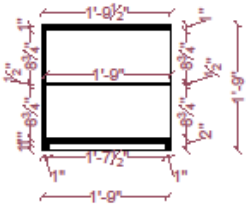
PLAN



SIDE SECTION



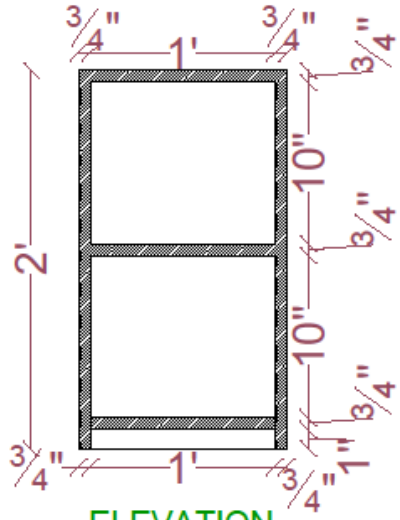
ELEVATION



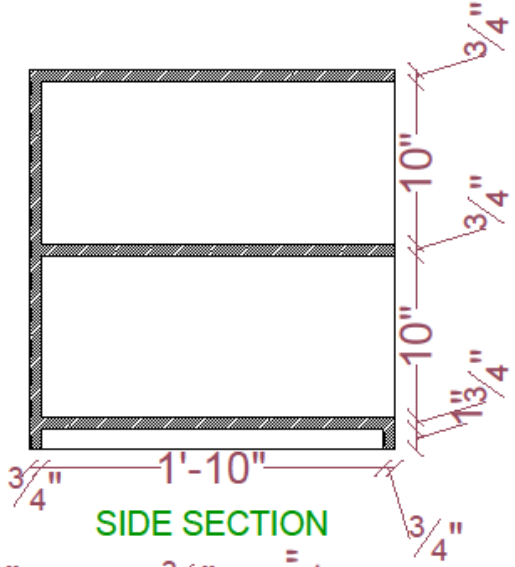
SIDE SECTION

Fig. 22: PROPOSED STORAGE DESIGN (option -2)

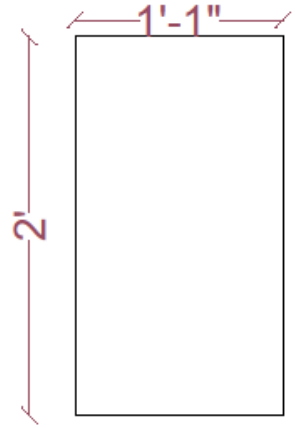
PINE WOOD



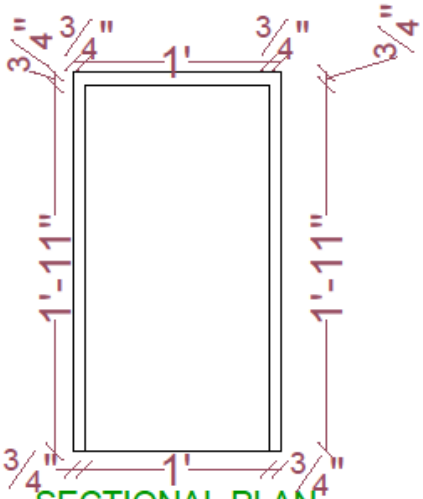
ELEVATION



SIDE SECTION



PLAN



SECTIONAL PLAN

Fig. 23: PROPOSED SIDE TABLE

`

Fig. 24: Top 3D View of Theatre Room

`

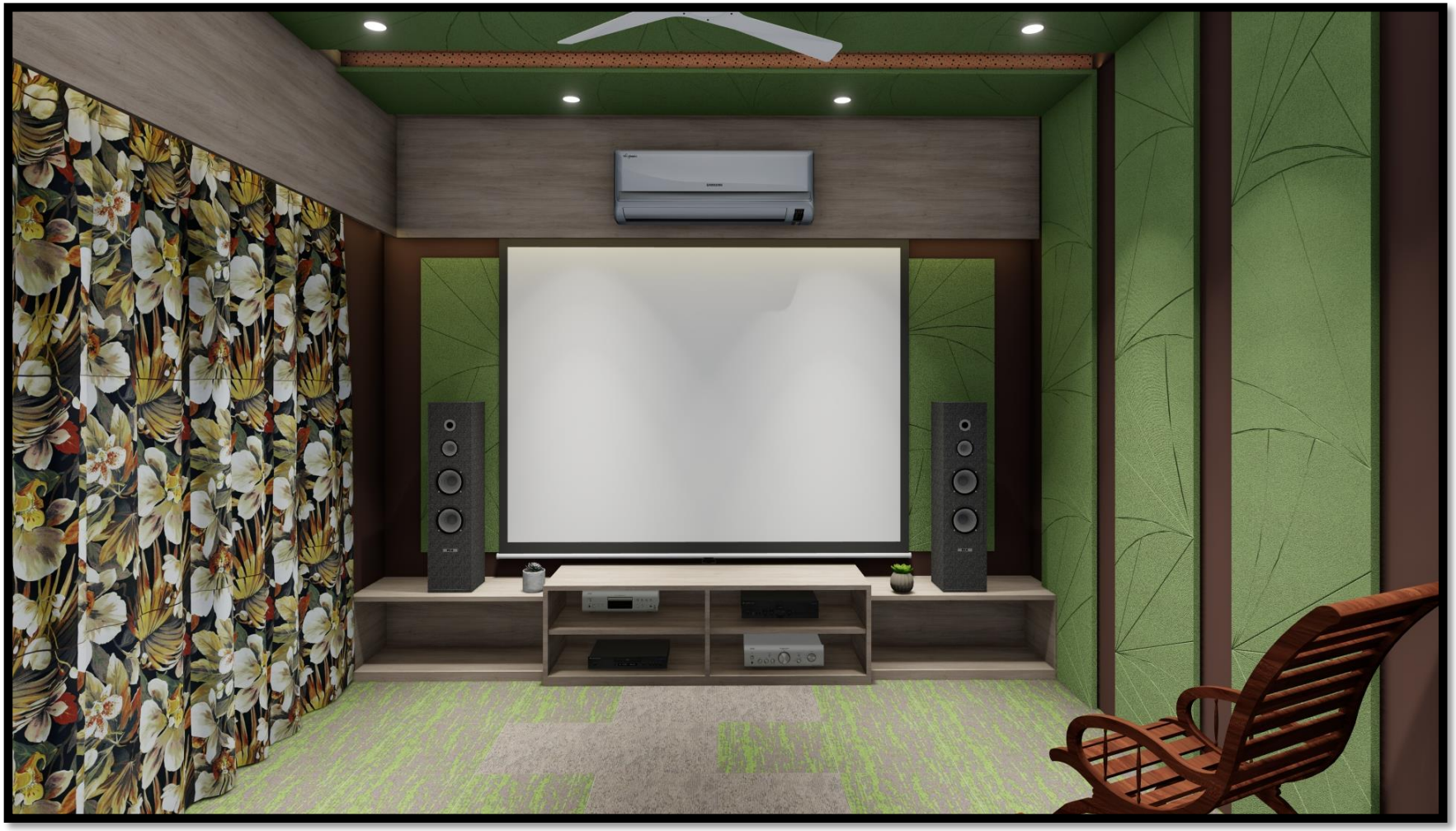


Fig. 25: 3D View of Proposed Wall “AB” of Theatre Room

`

Fig. 26: 3D View of Proposed Wall “BC” of Theatre Room

`

Fig. 27: 3D View of Proposed Wall “BC”,”EF” and “GH” of Theatre Room

`

Fig. 28: 3D View of Proposed Wall “FG” and “HA” of Theatre Room

`

Fig. 29: 3D View of Theatre Room from Corner “A”

`

Fig. 30: 3D View of Theatre Room from Corner “B”

`

Fig. 31: 3D View of Theatre Room from Corner “F”

`

Fig. 32: 3D View of Proposed Flower Shaped Chairs

`

Fig. 33: 3D View of Proposed Recliner Sofas

`

Fig. 34: 3D View of Proposed Storage Design

`

Proposed flooring

According to client's preference carpet tiles of size 50cm X 50cm was selected as flooring option for the theatre room. The carpet tiles selected were based on the grass theme. Therefore two different patterned carpet tiles reflecting grass theme were designed for flooring creating an attractive and seamless walk way pattern on floor. The carpet tiles are easy to maintain and stain and fad resistant. This floor carpet tile have good sound absorption quality, and appropriate for theatre room. The Biomorphic form and pattern were used with natural color and natural pattern in flooring which represent the patterns of biophilic design.

Proposed wall design

Wall AB: The length of the wall "AB" was 12'-9". This wall have one bay window seating and a rolling screen. The screen as rolled down whenever required. Curtains having pattern of trees were planned for this bay window. The Speakers were placed on the corners of this wall for better music experience. Two plain green colored fabric wrapped acoustic panels having abstract design made of stiches of size 2'-0" × 1'-9" were placed either sides of wall. A storage unit of height 1'-9", depth 1'-9" and width 12'-9" was planned below the bay window. Plywood was used as base material for this storage unit and was finished with wooden pattern laminate. A pelmet of width 12'-0" and height 2'-6" was placed above the lintel level. There was section behind this pelmet for screen when it was rolled up. Plywood was used as base material for this pelmet and was finished with wooden pattern laminate. Strip light was placed behind the pelmet which gave effect of ambient light on both acoustic panel. Brown stone wall paint was planned for the remaining exposed wall. Wooden pattern laminate used in pelmet and storage unit, leaf pattern in acoustic panels and tree pattern in curtain revealed biomorphic form and pattern of biophilic design. The presence of window on this wall helped in maintaining thermal and air flow in the room, which represents the thermal and air flow variability of Biophilic design pattern. The ambient light design reflected the nature in space aspect of biophilic design. Brown stone wall paint is related to earth element of nature.

`

Wall BC: Earlier there was a terrace on this wall which was taken in to the room. Therefore the wall “BC” was extended 5’-0” as per the client’s requirement. The length of the wall was 19’-10” after its extension. There was a main entrance door on this wall. The dimension of door was 3’-4” wide and 7’-9” high. The door was made up of Pine wood. A storage was planned on this wall. The dimension of the storage was 7’-9” wide and the 6’-0” high. This storage was 1’-9” up from the finish floor level. A plain green colored Fabric wrapped acoustic panel with having abstract design made of using stiches was planned for the shutters of the storage. Four acoustic panels of width 2’-0” and height 10’-3” were planned on this wall where storage was designed behind three panels. Brown stone wall paint was planned for the remaining exposed wall. The extended wall with dimension of 5’-0” wide and 7’-0” high was covered with pine wood panel. This pine wood wall covering gave a natural looks to theatre room. The green color fabric used in acoustic panels revealed biomorphic form and pattern of biophilic design. The pine wood panel reflected the material connection with nature aspect of biophilic design. Brown stone wall paint is related to earth element of nature. Repetitive use of symmetrical acoustic wall panels reflected complexity and order pattern of biophilic design.

Wall CH: This wall had three protrusion namely CD, EF, GH. The length of wall “CD” was 7’-9”, “EF” was 1’-8” and “GH” was 3’-4”.The wall “CD” had curtains with trees patterned on it covering the door. Two recliner sofa and side table was placed near this wall. Since the floor level was raised to 0’-7”, in this extended area, strip light was planned to differentiate between the floor levels. The photo frames were placed on wall “EF”. The indoor plant was placed at the corner of this wall. A photo frame of width 2’-0” and height 3’-0” was placed on wall “GH”. Brown stone wall paint was planned for this wall. Trees pattern in curtains revealed biomorphic form and pattern of biophilic design. The strip light design reflected the nature in space aspect of biophilic design. Brown stone wall paint is related to earth element of nature. The indoor plant near this wall reflected direct connection to nature. The presence of terrace door on this wall helped in maintaining thermal and air flow in

`

the room, which represents the thermal and air flow variability of Biophilic design pattern.

Wall DA: This wall had three protrusion namely DE, FG, HA. The length of wall, “DE” was 5’-0, “FG” was 1’-10” and “HA” was 13’-0”. The wall “DE” with dimension of 5’-0” wide and 7’-0” high was covered with pine wood panel. This pine wood wall covering gave a natural looks to theatre room. The photo frames were placed on wall “FG”. A balcony was planned in place of window on this wall “HA”. The dimension of balcony’s door was 8’-0” wide and 7’-9” high. Curtain with flower pattern were planned for the balcony door. A pelmet of width 12’-6” and height 2’-6” was placed above the lintel level. Plywood was used as base material for this pelmet and was finished with wooden pattern laminate. Strip light was placed behind the pelmet which gave effect of ambient light on curtains. The pine wood panel reflected the material connection with nature aspect of biophilic design. Brown stone wall paint was planned for this wall. Wooden pattern pelmet and flower pattern in curtains revealed biomorphic form and pattern of biophilic design. The strip light design reflected the nature in space aspect of biophilic design. Brown stone wall paint is related to earth element of nature. The presence of Balcony on this wall helped in maintaining thermal and air flow in the room, which represents the thermal and air flow variability of Biophilic design pattern.

Proposed False Ceiling Design and Electrical Layout

Ceiling of theatre room was divided in two level 4” and 8”. Ceiling had a beam of 1’-0” towards wall “CD”. This beam was covered with the false ceiling. There was 6” offset from wall “AB” and wall “HA” for pelmet. Green fabric wrapped acoustic panels having abstract pattern using stiches continued in the false ceiling from the wall “BC”. At 8” level from ceiling, strip light was placed on it. Existing projector was placed on false ceiling. Perforated board were planned between the acoustic panels for the false ceiling which acted as good acoustic treatment. Ceiling fan was placed on center of the false ceiling.

`

According to theatre room size and ceiling design, ceiling surface light was placed on false ceiling in such a manner that light was distributed all over the theatre room. Total of 10 LED light of 15 watts each were placed in false ceiling for direct lighting. These fixtures were circular in shape. The tint of light from these lights was white.

The distribution of the switches was done keeping in mind the proximity of the fixture and the switchboard to minimize the length of wires. One switchboard was placed near entrance door so that operating them became easy. This switchboard included the connection of ceiling surface lights, ceiling indirect light, fan and A.C. other switchboard was placed near system storage. The other switchboard was placed near storage unit which included the connection of music system, speakers and ceiling mounted projector.

Proposed flower shape chair design

The shape of chair was inspired by flower. Ply wood was used as base material in this chair and sponge foam was used to add comfort and give proper shape. Peach colored cotton polyester mix fabric was used for upholstery. Stiches was used to create a shape of petals of flower on the fabric.

Proposed music system storage

This storage unit of height 1’-9”, depth 1’-9” and width 12’-9” was designed to store music system. Plywood of 12mm and 19mm was used as base material and wooden pattern laminate was used as a finish. There were two height level in storage compartment. Middle part was 1-9” high and other extreme sides of the storage unit was 1’-6” high. There were six compartment in this storage unit of two different sizes. The First size of the compartment was 2’-9” wide, second was 3’-6” wide.

`

Proposed design option-3

Furniture layout

Three seater recliner sofa of width 6’-9”, length 4’-3” and seating height 1’-6” was placed near wall “HA”. The rocking chair was placed near wall “BC” which was already there in the room and client wanted to retain this chair. One indoor plant (Philodendron plant) was placed at the corner of the room. The floor of extended area was leveled up to 0’-7” using plywood. Here two recliner sofas were placed. Side table having width of 1’-0”, length 1’-9” and height 1’-9” was placed between the two recliner sofas. This side table was made of plywood and laminate. Two succulent plant (Echinopsis chamaecereus and crassula ovate plant) were placed on the side table. Three separate storage units were planned on wall “AB” for music system storage. Middle storage unit was 5’-9” wide, 1’-9” deep and 1’-9” high and other two storage units placed on extreme sides of middle storage were 2’-2” wide, 1’-9” deep and 1’-9” high. Two speakers were placed at corners of wall “AB”. Two succulent plants (Kalanchoe pumila and crassula arborescens) were placed on the surface of the storage. The storage and display unit on wall “BC” was also redesigned having width of 7’-9” and height 6’-0. The proposed storage was divided in five parts separated by ply wood. The upholstered panel were applied on the shutters of proposed storage. The use of indoor and succulents plants represent the direct visual connection to nature.

Proposed flooring

According to client’s preference wooden laminate floor of size 1380mm × 156mm was selected as flooring option for the theatre room. This laminate floor have white varnished oak wooden texture on it. This wooden pattern reflected biomorphic form and pattern of biophilic design.

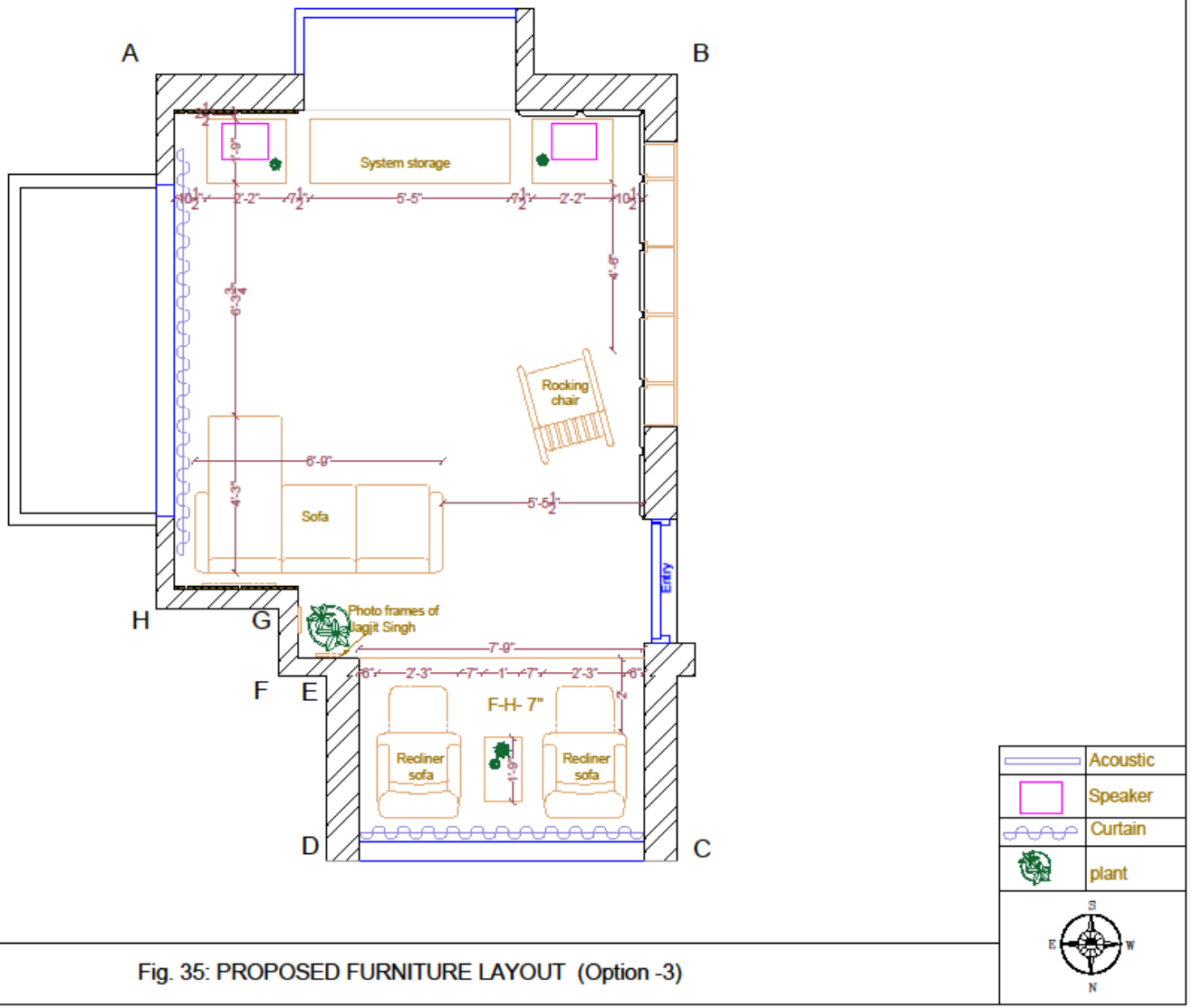


Fig. 35: PROPOSED FURNITURE LAYOUT (Option -3)

1380mm x156mm
Vinyl Tile

S
E
W
N

Fig. 36: PROPOSED FLOORING LAYOUT (Option-3)

ACOUSTIC PANEL

FABRIC USED ON CURTAIN

FABRIC USED ON UPHOLSTERED PANEL

WALL PAINT (STONE PATCH COLOR)

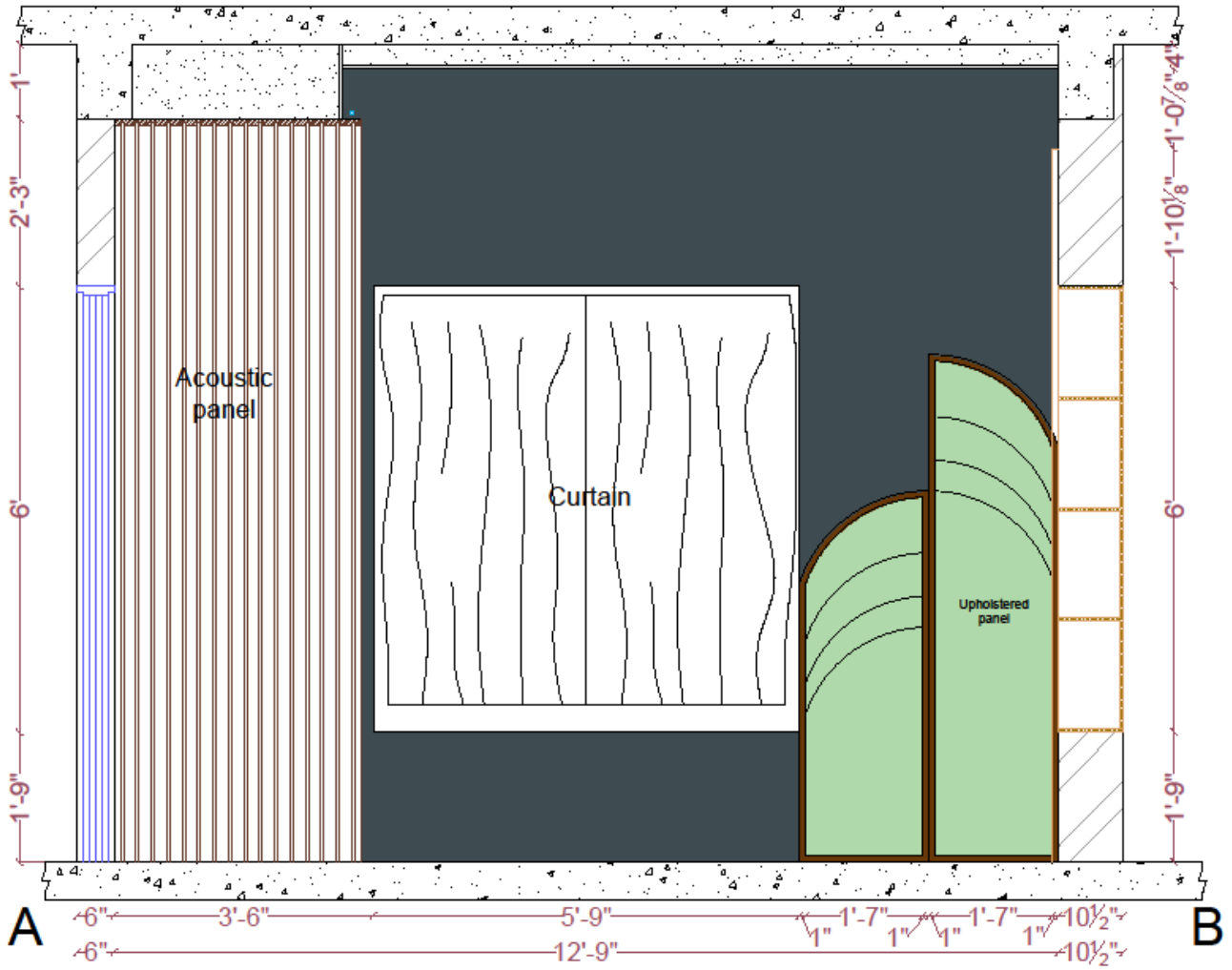


Fig. 37: PROPOSED WALL ELEVATION AB (option -3)

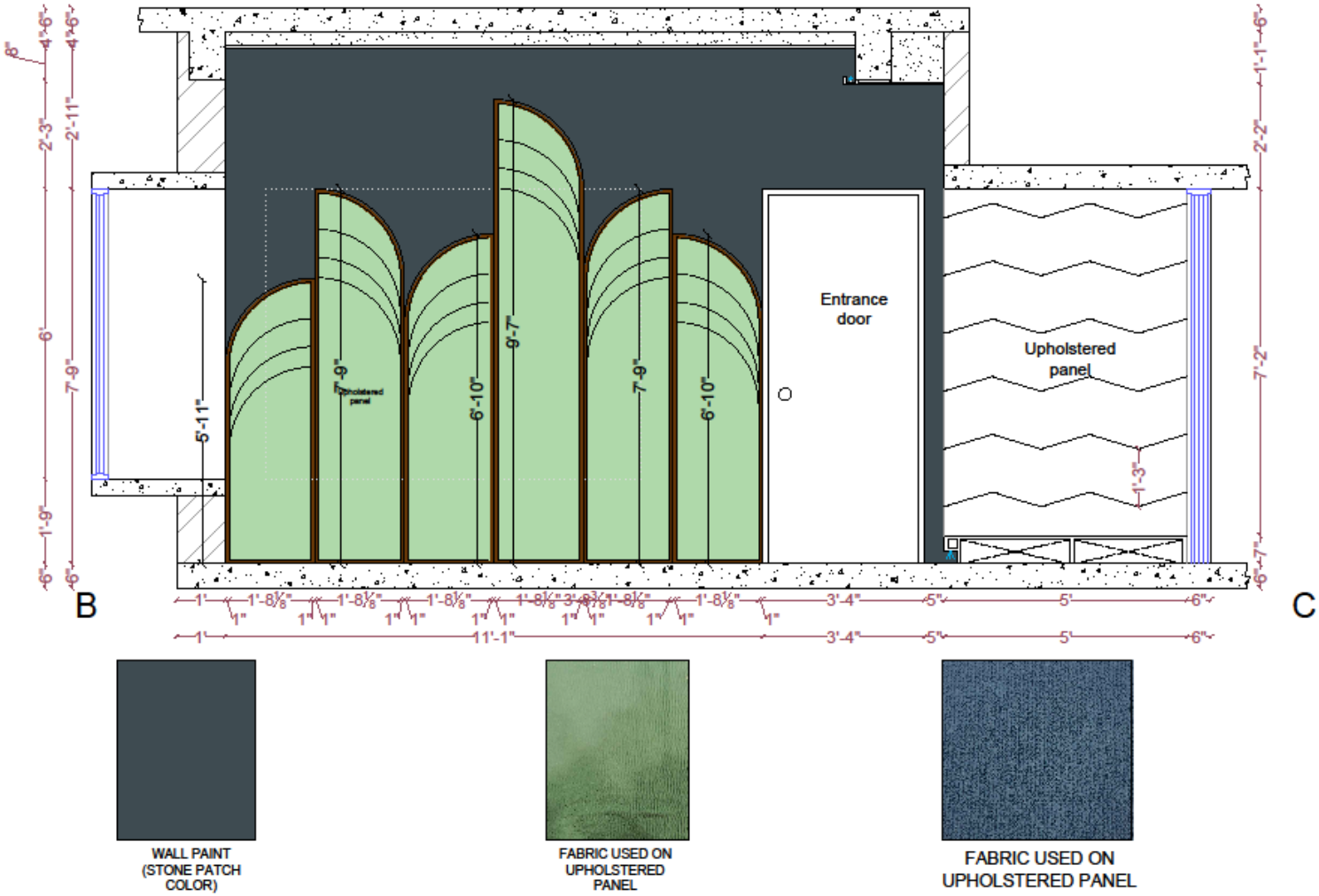
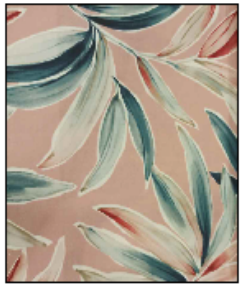


Fig. 38: PROPOSED WALL ELEVATION BC (option -3)

ACOUSTIC
WOODEN
PANEL



FABRIC USED ON
ROLLER BLIND

WALL PAINT
(STONE PATCH
COLOR)

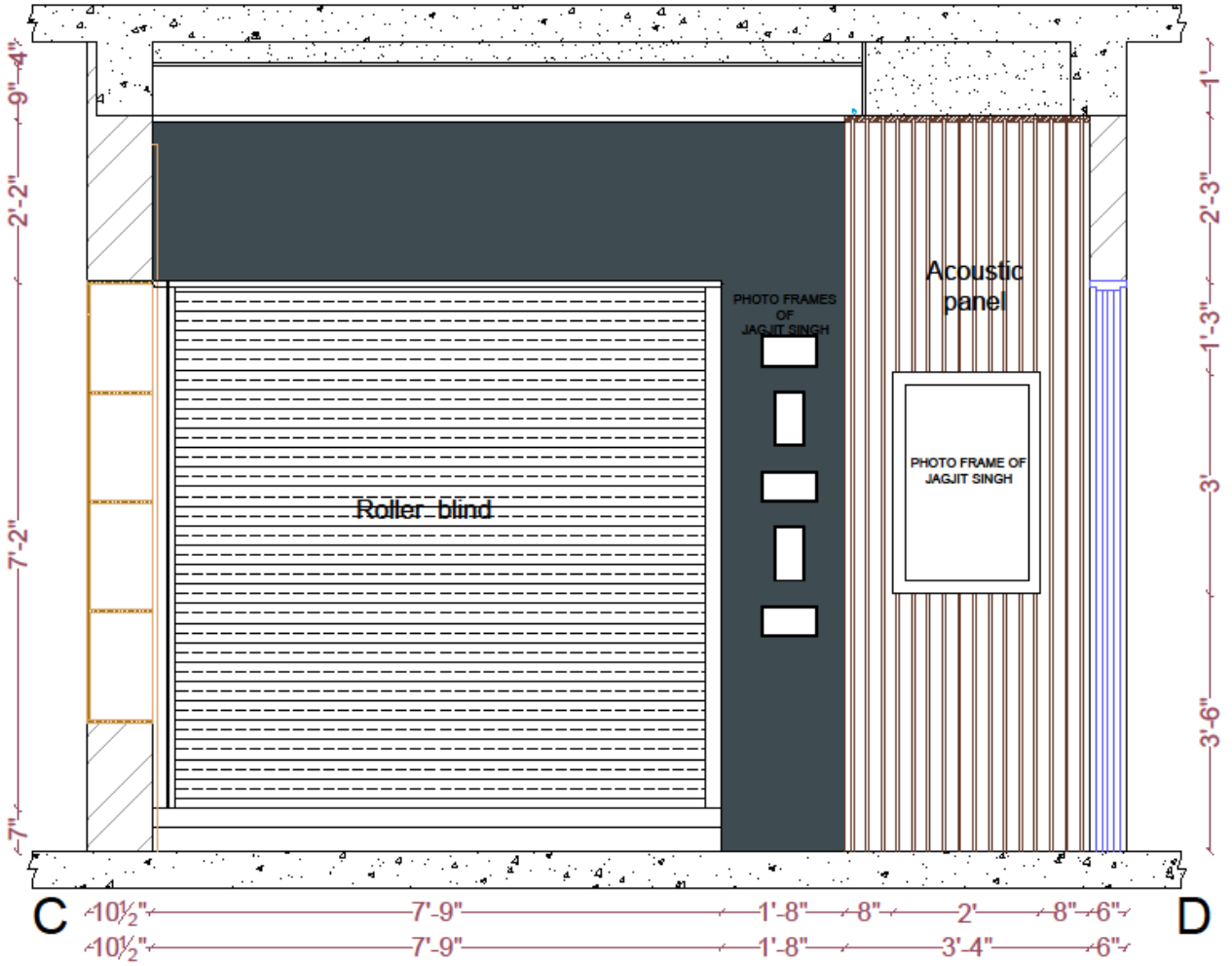
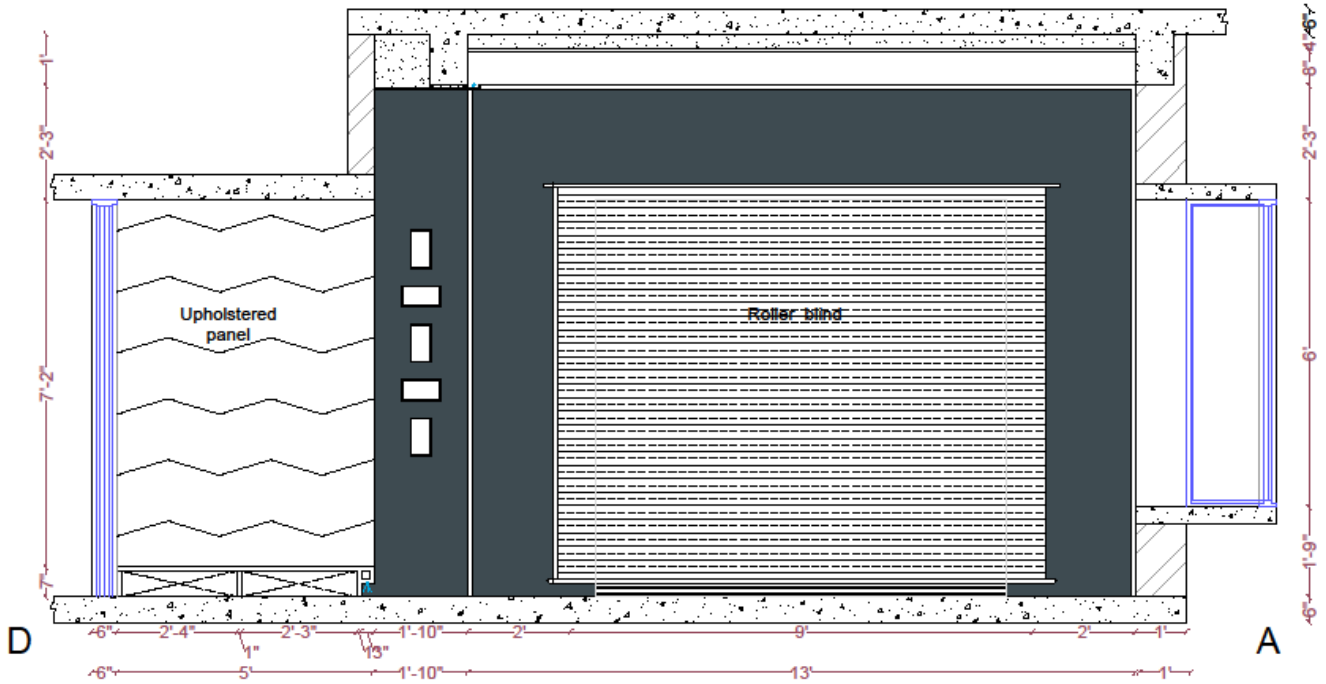


Fig. 39: PROPOSED WALL ELEVATIONS CD, EF, GH (option -3)

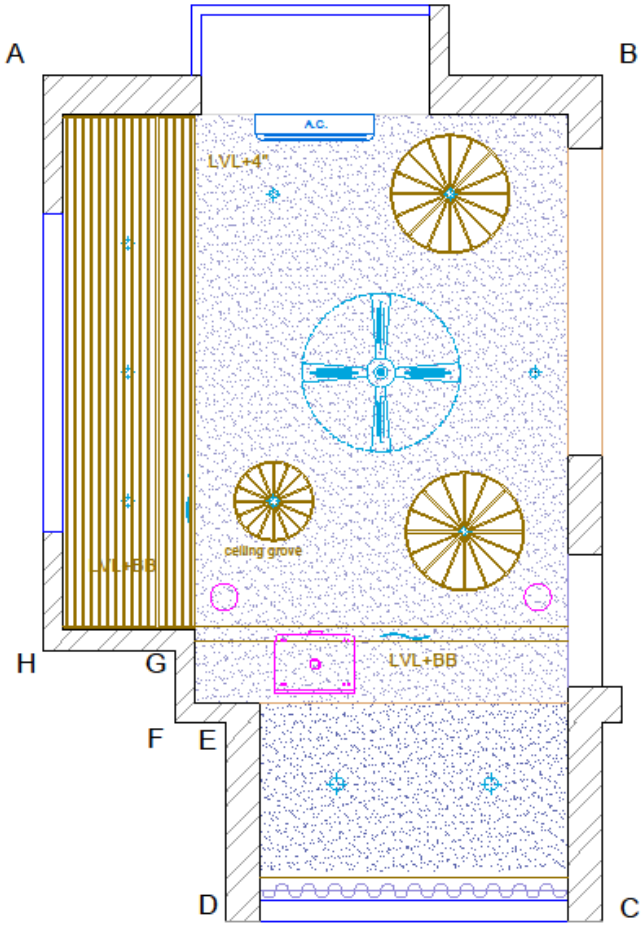


FABRIC USED ON UPHOLSTERED PANEL

FABRIC USED ON ROLLER BLIND

WALL PAINT (STONE PATCH COLOR)

Fig. 40: PROPOSED WALL ELEVATIONS DE, FG, HA (option -3)



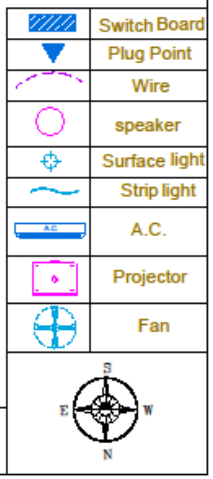


Fig. 41: PROPOSED FALSE CEILING DESIGN (Option -3)

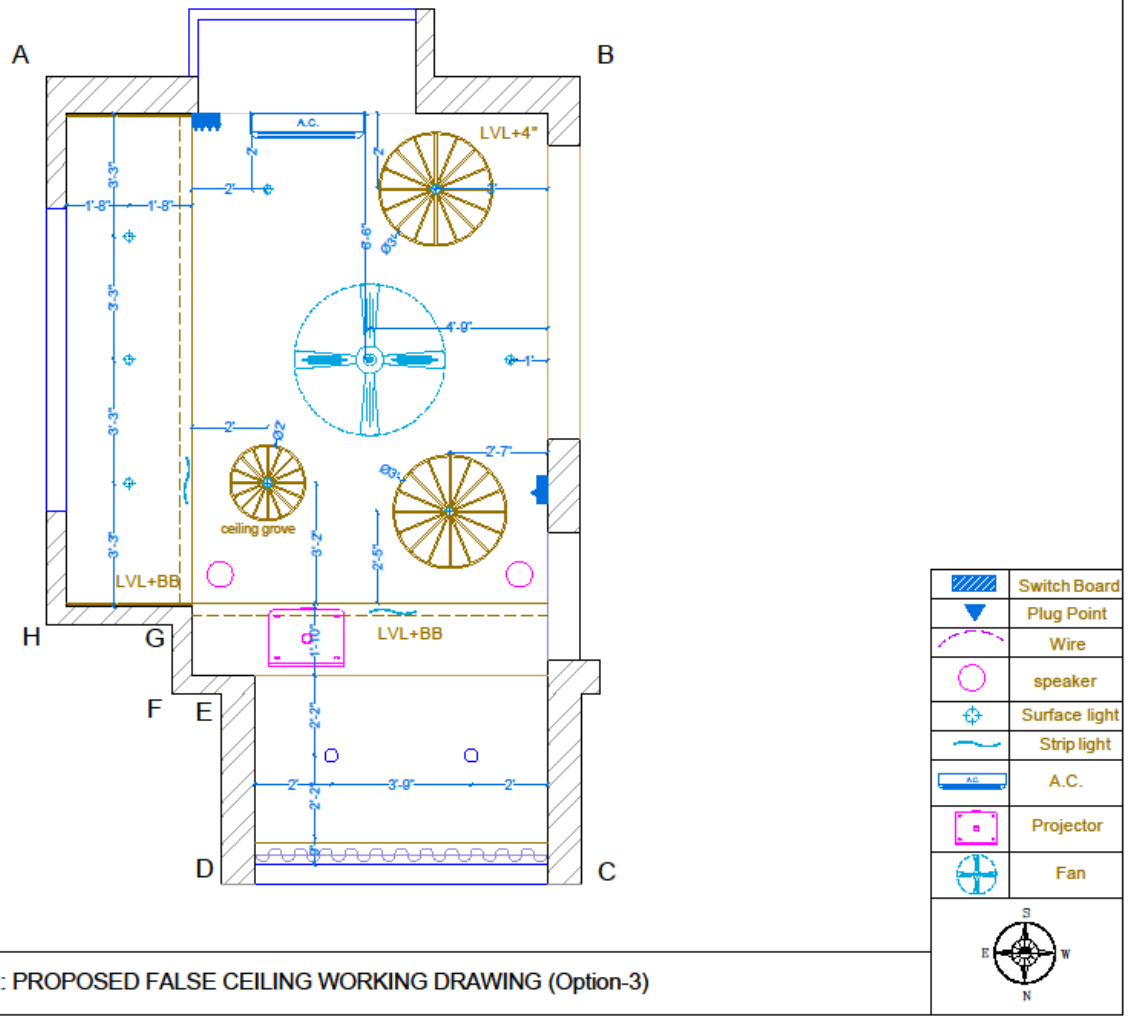


Fig. 42: PROPOSED FALSE CEILING WORKING DRAWING (Option-3)

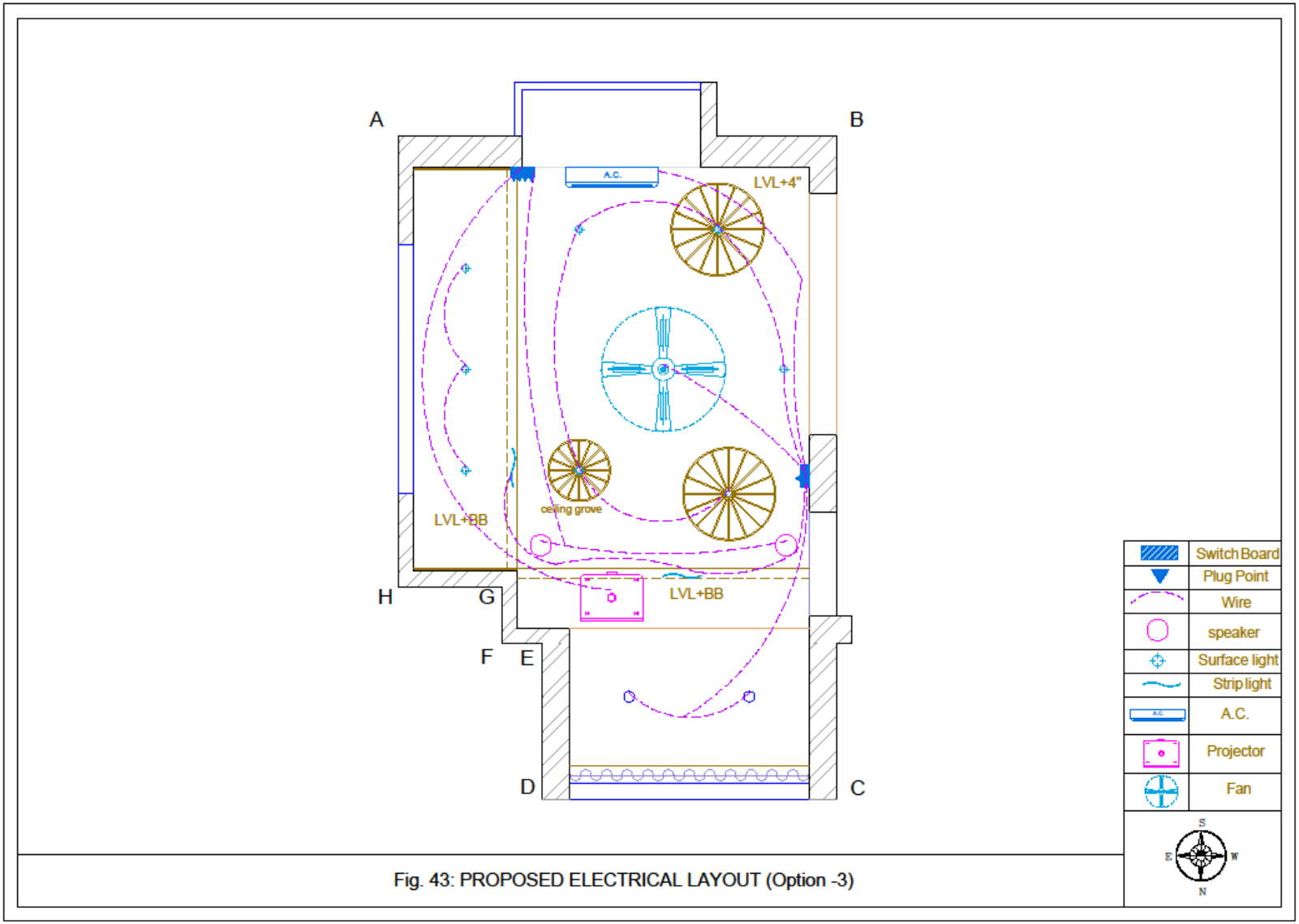


Fig. 43: PROPOSED ELECTRICAL LAYOUT (Option -3)

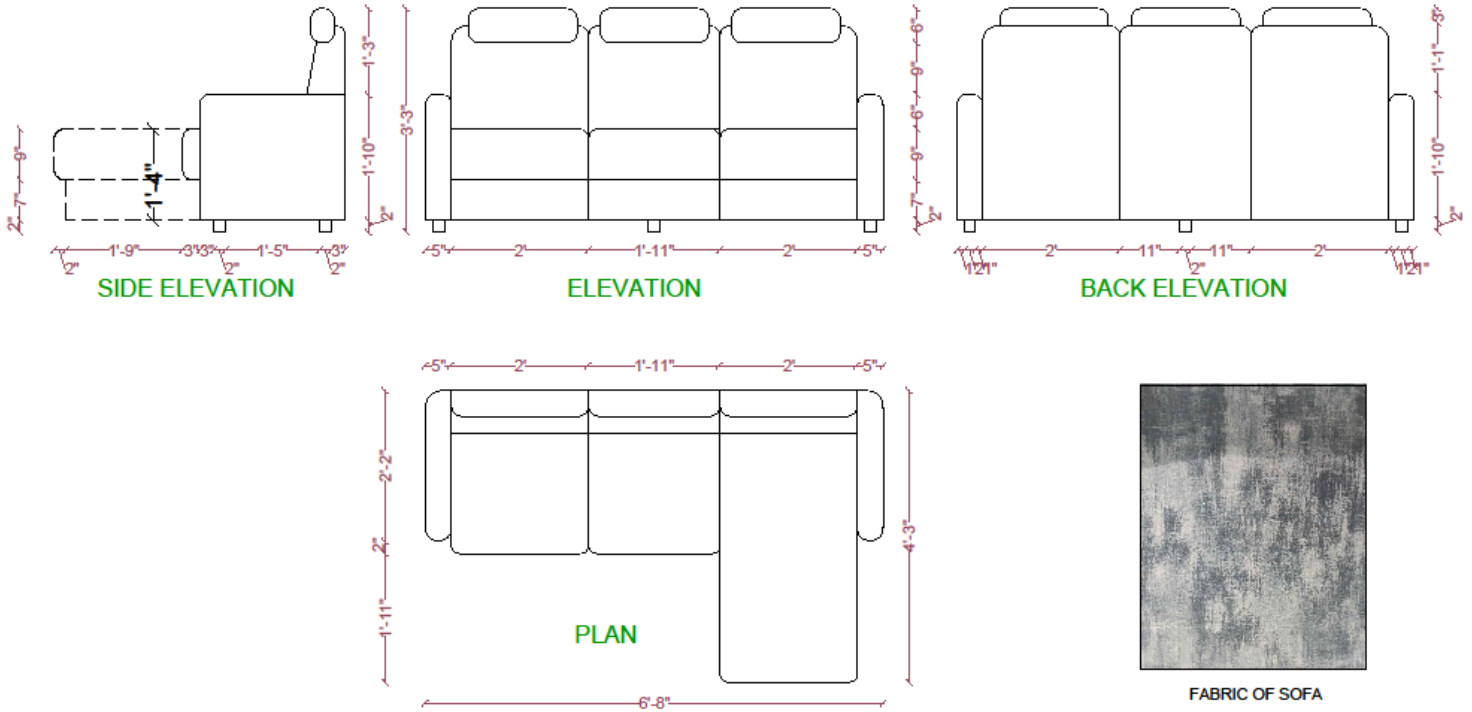
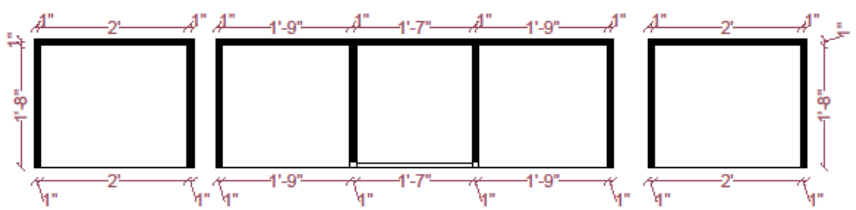


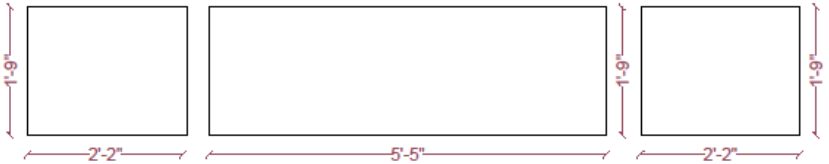
Fig. 44: PROPOSED SOFA DESIGN

`

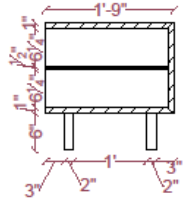
LAMINATE FOR STORAGE



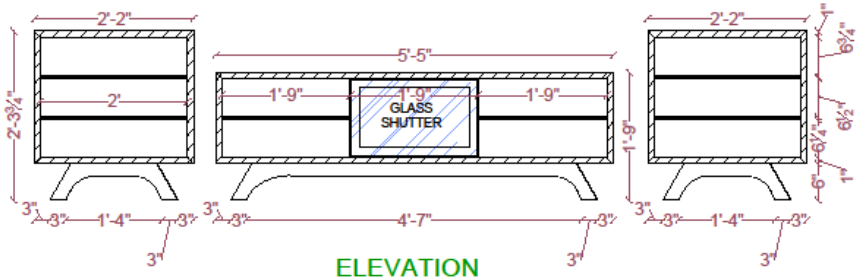
SECTIONAL PLAN



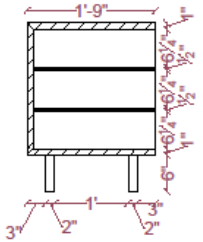
PLAN



SIDE SECTION



ELEVATION



SIDE SECTION

Fig. 45: PROPOSED STORAGE DESIGN (option -3)

`

Proposed wall design

Wall AB: The length of the wall “AB” was 12’-9”. This side wall have one bay window seating and a rolling screen. The screen as rolled down whenever required. Curtains having pattern of leaf were planned for this bay window. The Speakers were placed on the corners of this wall for better music experience. On left side of this wall wooden acoustic panel was designed which continued from wall to ceiling. On right side of wall, two upholstered wall panels were designed. First upholstered wall panel was of width 1’-9” and height 5’-0”. Second upholstered wall panel was of width 1’-9” and height 6’-10”. Green colored fabric was used on upholstered panel. These panels have wooden border of 1” and have 1’-10” radius curve on top side. This upholstered Panels have three stiches design on offsets of top curve. Three movable storage unit was planned. Center storage unit of height 1’-9”, depth 1’-9” and width 12’-9” was planned below the bay window. Two similar storage unit of height 2’-4”, depth 1’-9” and width 2’-2” was planned on extreme side of the middle of storage unit. Plywood was used as base material for this storage unit and was finished with wooden pattern laminate. Stone path wall paint was planned for the remaining exposed wall. Wooden pattern laminate used storage unit, stiches design on upholstered panel and leaf pattern in curtain revealed biomorphic form and pattern of biophilic design. The presence of window on this wall helped in maintaining thermal and air flow in the room, which represents the thermal and air flow variability of Biophilic design pattern. Stone path wall paint is related to stone element of nature.

Wall BC: Earlier there was a terrace on this wall which was taken in to the room. Therefore the wall “BC” was extended 5’-0” as per the client’s requirement. The length of the wall was 19’-10” after its extension. There was a main entrance door on this wall. The dimension of door was 3’-4” wide and 7’-9” high. The door was made up of Pine wood. A storage was planned on this wall. The dimension of the storage was 7’-9” wide and the 6’-0” high. This storage was 1’-9” up from the finish floor level. Upholstered panel used as a shutter of the storage. Six upholstered panels of size 1’-10” wide were planned on this wall where storage was planned behind five panels. These panels were of different height viz. 6’-0”, 7’-9”, 6’-10” and 9’-7”. These panels have wooden

`

border of 1” and have 1’-10” radius curve on top side. Panel have three curved lines made via stiches were designed on offsets of top curve there by making and effect of abstract coconut tree. This pattern was continue on wall “AB”. Stone path wall paint was planned for the remaining exposed wall. The extended wall was covered with upholstered panel having abstract wave pattern. Tree pattern and abstract wave pattern in upholstered panels revealed biomorphic form and pattern of biophilic design. Pine wood door reflected material connection to nature pattern of biophilic design. Stone path wall paint is related to stone element of nature. Upholstered panel design were continue from this wall to wall “AB”, it reflected complexity and order of biophilic design.

Wall CH: This wall had three protrusion namely CD, EF, GH. The length of wall “CD” was 7’-9”, “EF” was 1’-8” and “GH” was 3’-4”.The wall “CD” had curtains with leaf patterned on it covering the door. Two recliner sofa and side table was placed near this wall. Since the floor level was raised to 0’-7”, in this extended area, strip light was planned to differentiate between the floor levels. The wall “DE” with dimension of 5’-0” wide and 7’-0” high was covered with upholstered panel having abstract wave pattern. The photo frames were placed on wall “EF”. The indoor plant was placed at the corner of this wall. Wooden acoustic panel was continued from ceiling to wall “GH”. A photo frame of width 2’-0” and height 3’-0” was placed on this acoustic panel. Three seater sofa was placed near this wall. Stone path wall paint was planned for this wall. Wooden acoustic panel and Leaf pattern in curtains in upholstered panel revealed biomorphic form and pattern of biophilic design. The strip light design reflected the nature in space aspect of biophilic design. Stone path wall paint is related to element of nature. The indoor plant near this wall reflected direct connection to nature. The presence of terrace door on this wall helped in maintaining thermal and air flow in the room, which represents the thermal and air flow variability of Biophilic design pattern.

Wall DA: This wall had three protrusion namely DE, FG, HA. The length of wall “DE” was 5’-0”, “FG” was 1’-10” and “HA” was 13’-0”. The wall “DE” with dimension of 5’-0” wide and 7’-0” high was covered with upholstered panel having abstract wave pattern. The photo frames were placed on wall “FG”.A balcony was planned in place of window on this wall “HA”. The dimension of

`

balcony's door was 8'-0" wide and 7'-9" high. Roller blind with leaf pattern were planned for the balcony door. Stone path wall paint was planned for this wall. Leaf pattern in roller blind and abstract wave pattern revealed biomorphic form and pattern of biophilic design. Stone path wall paint is related to element of nature. The presence of balcony on this wall helped in maintaining thermal and air flow in the room, which represents the thermal and air flow variability of Biophilic design pattern.

Proposed False Ceiling Design and Electrical Layout

Ceiling of theatre room was divided in two level 4" and 1'-0". Ceiling had a beam of 1'-0" towards wall "CD". This beam was covered with the false ceiling. There were three circular shape design created with the help of groves on ceiling surface. Surface ceiling light was placed at center of circular design. Wooden acoustic panel designed on ceiling continued from both walls "AB" and "GH". One strip light was placed on wooden part. Existing projector was placed on false ceiling. Ceiling fan was placed on center of the false ceiling.

According to theatre room size and ceiling design, ceiling surface light was placed on false ceiling in such a manner that light was distributed all over the theatre room. Total of 10 LED light of 15 watts each were placed in false ceiling for direct lighting. These fixtures were circular in shape. The tint of light from these lights was white.

The distribution of the switches was done keeping in mind the proximity of the fixture and the switchboard to minimize the length of wires. One switchboard was placed near entrance door so that operating them became easy. This switchboard included the connection of ceiling surface lights, ceiling indirect light, fan and A.C. other switchboard was placed near system storage. The other switchboard was placed near storage unit which included the connection of music system, speakers and ceiling mounted projector.

`

Proposed sofa design

The proposed three seater sofa was of height of 3’-3”, depth 4’-3” and width 6’-8” and seating height of 1’-6” was placed near placed near wall “GH”. Ply wood was used as base material in this sofa and sponge foam was used to add comfort. The fabric of the sofa was velvet and the color was Gray.

Proposed music system storage

The proposed storage unit had three separate units. Middle storage was of height 1’-9”, depth of 1’-9” and width of 5’-9”. The other two storage placed on extreme side of middle storage unit was of height 2’-4”, depth of 1’-9” and width of 5’-9” to store music system. Plywood of 12mm and 19mm was used as base material and wooden pattern laminate was used as a finish. Middle storage unit have four section of 1’-9” width. The center storage was covered with glass shutter. The other storage units have three sections of 2’-0” width.

4.6 Estimating cost of theatre room

For successful planning of interior design project, cost estimation plays a vital role. Therefore, cost estimation was prepared considering the actual price and labour cost of the selected design of the theatre room. The cost estimation of redesigning the theatre room was done according to the prevailing rates in market as in January to February 2021. The details of the cost estimation of materials used in redesigning theatre room and labour charges are given in the following tables (Table-13)

`

Table No.13: Total cost estimation of interior component for theatre room

Sr. No.	Surface/ Indoor plants/ Furniture/ Window Treatment	Product/ Material	Total Area/ product quantity	Size	Color	Brand/ Shop	Material / product Cost	Labour Cost	Total cost
1.	Floor	Acoustic Carpet Tile	183 sq.ft.	50cm ×50cm	Green	Welspun flooring	₹ 250 per sq. ft.	₹ 25 per sq. ft.	₹ 50,325
		Pine wood	46 sq.ft.	6” × 60”	natural	Local manufacturer	₹ 40 per sq. ft.	₹ 35 per sq. ft.	₹ 3450
2.	Ceiling	Fabric wrapped acoustic panel	96 sq.ft.	24 pieces (2’ × 2’)	Green color	Local manufacturer	₹ 150 per sq. ft.	₹ 25 per sq. ft.	₹ 16,800
		Perforated gypsum board	116 sq.ft.	30 (2’ × 2’)	white	Local manufacturer	₹ 35 per sq.ft.	₹ 10 per sq.ft.	₹ 5220

Table 13 Contd……

`

Sr. No.	Surface/ Indoor plants/ Furniture/ Window Treatment	Product/ Material	Total Area/ product quantity	Size	Color	Brand/ Shop	Material / product Cost	Labour Cost	Total cost
		Pine wood	46 sq.ft.	6” × 60”	natural	Local manufacturer	₹ 40 per sq.ft.	₹ 35 per sq.ft.	₹ 3450
3.	Walls	Fabric wrapped acoustic panel	108 sq.ft.	27 pieces (2’ × 2’)	Green color	Local manufacturer	₹ 150 per sq.ft.	₹ 25 per sq.ft.	₹ 18,900
		Ply wood (12mm)	123 sq.ft.	5 pieces (3’ × 7’)	-	Super silver	₹ 40 per sq.ft.	₹ 30 per sq.ft.	₹ 18,947
		Ply wood (19mm)	34 sq.ft	2pieces (3’ × 7’)	-	Super silver	₹ 57 per sq.ft.		
		laminate	157 sq.ft.	5 (3’ × 7’)	Wooden figure	RAN Wood	₹ 47 per sq.ft.		
		Pine wood	80 sq.ft.	6” × 60”	natural	Local manufacturer	₹ 40 per sq.ft.	₹ 35 per sq.ft.	₹ 6000

`

Sr. No.	Surface/ Indoor plants/ Furniture/ Window Treatment	Product/ Material	Total Area/ product quantity	Size	Color	Brand/ Shop	Material / product Cost	Labour Cost	Total cost
		Wall emulsion color	372 sq.ft.	4litter	Brown Stone color	Asian paints	₹ 700	₹ 10 per sq.ft.	₹ 4420
4.	Window Treatment	Curtains	9 meter	1.4 running meter	Flower print	Prestigious textile	₹ 1450 per sq.mt.	₹ 15 per sq.ft.	₹ 13,185
		Curtains	10meter	1.4 running meter	Trees print	Prestigious textile	₹ 1125 per sq.mt.	₹ 15 per sq.ft.	₹ 11,400
5.	Furniture	Flower shape chair	2	-	gray	Local manufacturer	₹ 10,000 Per piece	-	₹ 18,900
		Recliner sofa	2	-	brown	Hindustan brand	₹ 36,900 Per piece	-	₹ 73,800

`

Sr. No.	Surface/ Indoor plants/ Furniture/ Window Treatment	Product/ Material	Total Area/ product quantity	Size	Color	Brand/ Shop	Material / product Cost	Labour Cost	Total cost
6.	Indoor plants	Philodendron plant	1	-	-	Surendra Nursery	₹ 150	-	₹ 150
		Echinopsis chamaecereus plant	1	-	-	Surendra Nursery	₹ 250	-	₹ 250
		Crassula ovate plant	1	-	-	Baroda Nursery	₹ 250	-	₹ 250
		Sedum rubrotinctum aurora plant	1	-	-	Baroda Nursery	₹ 250	-	₹ 250
		Echeveria setosa var. deminuta x laui plant	1	-	-	Roses Nursery	₹ 300	-	₹ 300

(The cost estimation is based on the prevailing rates in market as on August, 2019.)

`

Table 14: Total cost estimation of material and masonry work for extending balcony and room

Sr. No.	Total area	Material Cost + Labour cost	Total cost in
1.	90 sq.ft.	1300₹ Rupees per sq. ft.	₹ 1,17,000

Table 15: Total cost estimation of theatre room

Sr. No.	Title	Cost
1.	Interior components	₹ 2,39,999
2.	Balcony and room extended area	₹ 1,17,000
	Total project cost	₹ 3,56,999

Conclusion

As per the objective of the research, market survey of materials used in redesigning theatre room of selected residence was conducted. The market survey of acoustic material, rugs, fabrics, glass, floor tile, laminate flooring, recliner sofa, plywood, laminate, sponge foam sheet, wall paint, indoor plant plants was conducted from the various markets of Vadodara city the month of January to February 2021. The age of respondent was 48 years. The client was residing in Manjalpur area of Vadodara city. The client had graduation degree in architecture and was architect by profession. The monthly income of the respondent was approximately ₹ 1, 50,000. There were six family members in the family. The client was staying with his parents, two children and wife. The theatre room was used for viewing cinema as well as for get together parties occasionally. Theatre room was used once in a week for three to four hours approximately. Assessment of existing interiors was done through observation. According to client's need and preference, three design options were proposed with furniture layout, floor plan, and four wall elevations, ceiling design, ceiling working drawing, electrical layout, furniture detail

`

drawing and 3D views of design option two. The proposed design option two was selected by the client. The aspect of biophilic designs viz visual connection with nature, thermal and air flow variability, dynamic and diffused light, biomorphic forms and patterns, material connection and complexity and order with nature were considered in all the proposed designs options. The cost estimation of selected design was given based on the market survey conducted. The total cost of the project was ₹ 3, 56,999.

SUMMARY

CONCLUSION AND

RECOMMENDATIOS

`

CHAPTER V

SUMMARY CONCLUSION AND RECOMMENDATIONS

Majority of modern building practices have separated people from the natural world, in turn cutting off access to the positive benefits contact with nature can provide. The human need for nature is not a new idea, but one that has been ignored and pushed aside in modern times. Causes of this separation from nature are a result of modern day industry and growth. Constant development that has occurred over the last 100 years, specifically the results of the Industrial Revolution, has significantly damaged and degraded the natural environment, and has served to disconnect humans from the natural world. As a result, many of the current environments we have built around us are often devoid of natural features, green spaces, natural light, and ventilation. Lack of daylight, fresh air, and exposure to natural processes has begun to take its toll on physical health and well-being. Negative aspects of building design have been observed such as poor lighting, inadequate ventilation and climate control as well as chemical “off-gassing” which have resulted in the “sick-building syndrome”. Sick building syndrome usually occurs when the ventilation system is inadequate and materials and finishes such as paint, plastics, and wall coverings emit harmful fumes. Buildings with these problems have been known to cause “building related illness,” physical ailments that include respiratory and skin disorders and chronic fatigue.

In response to such isolation from nature and its purported benefits on health and well-being, biophilia and biophilic design “promise” the fostering of a positive relationship to nature. “Biophilic design” is the deliberate attempt to translate an understanding of the inherent human affinity into the design of built environment,” and the strategy of biophilic design is to “incorporate natural features and systems into the built environment”. Biophilic design is based on the biophilia hypothesis, as a significant theory of human connectedness with nature. Biophilia has been defined as the inherent human inclination to affiliate with nature. Biophilic design incorporates natural materials, natural light, vegetation, nature views and other experiences of the natural world into the modern built. “Biophilic design seeks to

`

create good habitat for people as a biological organism in the modern built environment that advances people's health, fitness and wellbeing".

Ryan et al. (2014) presented 14 patterns of biophilic design reflecting the nature-health relationships most prominent in the built environment under three categories intended to help define biophilic buildings viz. Nature in the Space, Natural Analogues and Nature of the Space. The patterns have a wide range of applications in both interior and exterior environments, and are intended to be flexible and adaptive, allowing for project-specific implementation. From a designer's perspective, biophilic design patterns have the potential to reposition the environmental quality conversation to give individuals' needs equal consideration alongside the conventional parameters for building performance. Consequently, these 14 patterns of biophilic design illuminate the relationship between human biology, nature and the built environment. Using these patterns, designers are able to implement and verify biophilic design in buildings, urban spaces, and landscapes. In addition, they have a strong psychological effect in the workplace, increasing well-being and productivity. The benefits of biophilic design are that it can reduce stress, improve cognitive function and creativity, improve wellbeing and expedite healing. Biophilic design can have a positive impact by reducing stress, improving emotional well-being, alleviating pain and fostering improvements in other outcomes in a highly stressful healthcare environment.

Staying home and entertaining family is becoming more and more desirable and having a theatre room is just the way to do that. Theatre rooms, are home entertainment audio-visual systems that seek to reproduce a movie theatre experience and mood using consumer electronics-grade video and audio equipment that is set up in a room of a private home. With theatre room, people can bring the cinema to their home, streaming their favorite movies, audio, and everything else with a full cinema experience without having to step out of home or deal with any crowd. Hence, the present study was undertaken to design a theatre room considering Biophilic designs seeing the clients need and preferences and assessment of the existing theatre room.

`

The consideration of the biophilic approach mandates the realization of the biophilic design elements that affects different scales of the built environment, from the macro level in creating green networks within urban design schemes to the micro details of providing natural light to interior spaces for human comfort. The experience of nature at a variety of scales is important to ensure a continued sense of connection with nature in an urban environment. The incorporation of the Biophilia attributes into design tools or element to consciously reduce stress, blood pressure levels and heart rates, whilst increasing productivity, creativity and self-reported rates of well-being. With the advent of theatre rooms, the families have been enjoying the blockbuster favourite movies at home which have become increasingly affordable and gratifying. Theatre room is an audio and video equipment configuration at home that emulates the movie theatre experience. A good theatre room setup might provide a more impressive experience than many small multiplex cinema screens. There are several benefits of having a theatre room like comfort, being with family only, avoiding crowd, watching movies at own time, repeat watch, a cinematic experience etc. Hence, investing in theatre room can result in a much more enjoyable movie watching experience. Incorporating Biophilic designs in a theatre room can enhance the movie viewing of families.

The extensive review of literature commenced by the researchers indicated that the researched piloted outside India and within India concentrated on relationship between nature views and day lighting on employees productivity, health benefits and performance of employees in Biophilic designed offices, health and wellbeing benefits of Biophilic designs, Biophilic designs and noise perception, potentials of Immersible Virtual Environment for Biophilic design, Biophilic approach to architecture, awareness assessment of Biophilic design, connecting with nature through Biophilic designs, Biophilic designs and energy use optimization, and application of Biophilic designs in various buildings. Few technical researchers were also found related to theatre room which focused on developing sensory information framework for 4D theatre room system, a system capable of assisting users in setting up a theatre room, designing and implementing Pneumatic Motion base for 4D theatre room and intelligent media center for home, Biophilic design

`

and architecture, nature inspired designs, impact of Biophilic designs on psychological health, and identifying the aspects of Biophilic designs corresponding to learning environment. Hence, there was dearth of researchers conducted in India related to home theatre room or it's designing. The researchers related to designing of home theatre room considering Biophilic designs were hard to find in India as well as outside India. Therefore, the researcher was interested in undertaking present research.

Statement of problem

The present study aims to redesign interiors space of Theatre room of selected Residence considering the Biophilic Designs.

Objectives of the study

5. To conduct market survey of materials used in redesigning theatre room of selected residence.
6. To ascertain the need and preference of the client for theatre room.
7. To assess the existing interiors of the theatre room of selected residence.
8. To redesign the interior space of theatre room considering the Biophilic Designs and provide detailed working drawings with cost estimation.

Delimitation

The present study was limited to redesigning interior spaces of theatre room of the selected Residence from Vadodara City.

Methodology

For the present study, the design project method was adopted. The observation sheet was used as an instrument for assessing the existing interior space of a theatre room. The assessment of space was done regarding interior components of space like physical structure, flooring, walls, ceiling, doors and windows, furniture and storage space, lighting and ventilation, and acoustic treatment. The interview schedule was prepared by the researcher to ascertain the need and preference of the client for designing a theatre room.

`

The interview schedule contained questions to draw personal, family and situational information of the respondent as well as information related to use of theatre room, activities performed in theatre room, and duration of time spent in theatre room (in a day). It also comprised questions to elicit information regarding need and preference of client for theatre room. The interior components for theatre room considered were type of flooring, wall treatment, ceiling, window treatment, door, furniture, storage, acoustic material, accessories, artificial lighting and color scheme. The observation schedule included the assessment of various components of interior spaces of existing theatre room. The components of interior spaces assessed were windows, doors, floor, walls, ceiling, lighting, fans and air conditioner, projector & screen, speakers, furniture, acoustic treatment, provision for cross ventilation and accessories.

The content validity was established for the data collection tools viz: observation sheet and interview schedule by giving to a panel of 9 judges comprising the experts from the Interior Design, Higher Payment Programme, Department of Family and Community Resource Management, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda, Vadodara and practicing Architects, Interior Designers and Civil Engineers. The valuable suggestions given by the experts were incorporated and the tools were modified and finalized for the data collection. For data collection, the observation sheet was administered by the investigator independently for obtaining details of existing interiors spaces of home theatre. Whereas, for getting acquainted with the requirements of the clients regarding the interior design of theatre room, an interview schedule was used by the investigator personally. The investigator personally interviewed the respondent. The observations were recorded in the observation sheet by the researcher. For creating the various visual projections AutoCAD 2019, goggle sketch up and lumion10 software was used for the present study. The cost estimation of the selected design was prepared considering the material cost and labour cost according to the rates prevailing in the market as in February, 2021.

`

Major Findings

The major findings related to Market survey, Need and preference of client, observation of existing home theatre room, Design Development and Cost Estimation are presented here

- **Market survey of materials used in redesigning theatre room of selected residence:** Market survey of materials used in redesigning theatre room of selected residence was conducted in different markets of Vadodara city namely Alkapuri, Akota, Nizampura, Fatehganj, Karelibag Dabhoi road and Chhani during January to February 2021. The materials surveyed were acoustic material, rugs, fabrics, glass, floor tile, laminate flooring, recliner sofa, plywood, laminate, sponge foam sheet, wall paint, indoor plant plants. The printed Polyester acoustic panel was available with different natural patterns with local manufacturer. The cost of printed polyester acoustic panel of 4' × 8' size ranged between ₹ 450 to ₹ 550 per sq.ft. Polyester acoustic panel were available in tranquil brand of 4' × 8' size with 9mm to 12 mm thickness at ranged between ₹ 110 to ₹ 160 per sq.ft. Fabric wrapped acoustic panel were available with local manufacturer. The cost of fabric wrapped acoustic panel of 2' × 2' size ranged at ₹ 150 per sq.ft. Wooden acoustic panel were available with different cut out pattern in the local market. The cost of wooden acoustic panel of 2' × 2' size ranged between ₹ 450 per sq. ft. Perforated Wooden acoustic panels were available in eco wood brand of 4' × 8' size at ₹ 198 per sq.ft. Glass wool material was available in local market having good sound absorbent quality and thermal insulation. The cost of glass wool material of 18 running meter size with 50mm thickness ranged between ₹ 300 per sq.mt. Perforated gypsum boards were available with design in local market. The cost of perforated gypsum board of 2' × 2' and 6' × 4' size ranged ₹ 35 per sq. ft.

  Rugs were available with different natural patterns and colors of acrylic fiber material with local manufacturer. The cost of acrylic rugs of 5' × 7' size ranged between ₹ 15,000 to ₹ 28,000 per piece. Fabrics materials for curtain, wall panel and upholstery were available in different natural prints and colors in the local market and prestigious textile brand. The materials of the fabrics cotton polyester

`

mix, cotton and velvet. The cost of the fabrics ranged between ₹ 830 to ₹ 3150 per sq.mt. Tinted and transparent Glasses for window were available in different colors in the local market. The color of the glasses were brown, aqua blue, sapphire blue, blue and dark blue. The available size of glasses was 3' × 7' and 4' × 8' with thickness between 3.5mm to 5 mm. the price of this glasses ranged between ₹ 42 to ₹ 70 per sq.ft. Carpet tiles were available with different patterns viz. natural, relay and urbane with Welspun flooring manufacture. These carpet tiles have good sound absorbing quality. These carpet tiles were available in 50cm × 50cm size and thickness of 6mm to 7mm. The cost of these carpet tiles ranged between ₹ 250 to ₹ 700 per sq.ft.

Laminate flooring were available with wooden pattern with the Quick step brand. Scraped oak gray brown laminate was available in 1380mm × 190mm size and thickness of 8mm costing ₹ 305 per sq.ft. White varnished oak laminate was available in 1380mm × 156mm size and thickness of 8mm costing ₹ 255 per sq.ft. Bleached White oak laminate was available in 1200mm × 190mm size and thickness of 8mm costing ₹ 230 per sq.ft. Golden oak laminate was available in 1200mm × 190mm size and thickness of 8mm costing ₹ 230 per sq.ft. Virginia oak brown laminate was available in 1200mm × 190mm size and thickness of 7mm costing ₹ 205 per sq.ft. Recliner sofas of manual and battery operated type were available in Hindustan brand. The Manual recliner sofas ranged between ₹ 24,400 to ₹ 30,400 and battery operated recliner sofas ranged between ₹ 36,900 to ₹ 47,400. A market survey of plywood, laminate, MDF board and pine wood was conducted for designing storage and valance. Plywood was available in two thickness i.e. 12mm and 19mm and two sizes viz. 3' × 7' and 4' × 8'. The plywood was available in two brands, Gold oak and Super silver with price ranging between ₹ 40 to ₹ 57 per sq.ft. MDF board was available in two thickness i.e. 12 mm and 19mm and two sizes viz. 3' × 7' and 4' × 8'. The MDF board was available with local manufacturer with price ranging between ₹ 48 to ₹ 65 per sq.ft. The pine wood was available in two sizes viz. 5" × 60" and 7" × 72". The pine wood was available with local manufacturer ranging at ₹ 40 per sq.ft. The laminate with wooden pattern was available in RAN wood brand. The available sizes of this laminate was 4' × 8' and 3' × 7' per sq.ft. price ranging between ₹ 47 to ₹ 53 per

`

sq.ft. The laminate with marble pattern was available in RAN wood brand. The available sizes of this laminate was 4’ × 8’ and 3’ × 7’ per sq.ft. with ranging between ₹ 60 to ₹ 73 per sq.ft. Sponge foam sheet used for providing backing to fabrics applied on wall panels were available with local manufacturer in 3’ × 6’ size with thickness of 2”. The price of these sponge foam sheets was ₹ 1800 per sheet.

Wall paints were available with different brands in the market. There were many color options available with Asian paints brands. The cost of 4 liter of Asian paint brand was ₹ 700. Indoor plants were available in local nurseries of Vadodara city. The indoor plants such as anubias barteri var. nana, philodendron, Peperomia obtusifolia, asparagus densiflorus, Echinopsis chamaecereus, crassula ovate, Kalanchoe pumila, Crassula arborescens, Sedum rubrotinctum aurora, Echeveria setosa var. deminuta x laui and Graptopetalum paraguayense were available in the local nurseries with price ranging between ₹ 150 to ₹ 300 per plant.

- **Background information of the client**

  The information regarding the background characteristic of the Client was gathered through an interview schedule. It was found that the age of respondent was 48 year. The client was residing in Manjalpur area of Vadodara city. The client had graduation degree in architecture and was architect by profession. The monthly income of the respondent was approximately ₹ 1, 50,000. There were six family members in the family. The client was staying with his parents, two children and wife. The theatre room was used for viewing cinema as well as for get together parties occasionally. Theatre room was used once in a week for three to four hours approximately.

- **Need and preference of the client for home theatre room:** It comprised of detailed information about the requirements regarding theatre room Interiors of the client which were congregated with the help of the interview schedule by the researcher. Various preferences were given to the clients for floor, wall, ceiling, window, seating, side table, storage and acoustic treatment. For floor, acoustic carpet tile and wooden flooring were most preferred by the client**.** For the wall, acoustic wall panel made of fabric were most preferred by the client for two walls and wall paint and wooden cladding for other two walls. For the ceiling, fabric

`

wrapped acoustic panel was most preferred option of the client. For the windows, curtains were the most preferred option of the client. For the seating purpose, upholstered designer chair and recliner chair were most preferred option of the client. For the side table, rectangular shape was most preferred option of the client. For the storage of music system devises, fixed storage was most preferred option for storing music system devises. For the acoustic treatment, fabric wrapped panel was most preferred option by the client. The client require to extend a theatre room in adjoining terrace. The Client also require to plan a balcony at the place of window on wall DA.

- **Assessment of existing interiors of home theatre room of selected residence:** In order to assess the existing interiors of selected home theatre room, various significant interior components like the dimension of the home theatre room, floor, walls, ceiling, lighting, furniture, acoustic treatment and Audio visual equipment's were assessed through observation schedule. The dimension of the theatre room was having the length of 14'-10", width of 12'-9" and height of 11'-0". The flooring of the theatre room was vinyl floor with having rough texture and matte finish. The wall "AB" of the theatre room was constructed with bricks and cement plastered finished with 4" wide polished cork wooden strips. The wall "BC" was finished with jute panel from floor to lintel level. Above the lintel level the wall was finished with white colored paint. A wall storage unit and display unit on this wall. Main entry door of theatre room on this wall "BC". The wall "CD" was finished with white colored paint. A folding door opening into a small terrace was on this wall. Curtains of jute material was used as soft treatment for this folding door. The wall "DA" had jute panel from floor to lintel level. Above lintel level, white colored paint was applied on this wall. There was an openable window on this wall. This window had a view of garden developed at ground floor. Curtain made up of jute materials was used as soft treatment of the window. There was false ceiling in theatre room made up of gypsum board. A beam of length 9'5" and height of 1'0" at one side of the ceiling. Blue colored indirect light (Strip light) was placed at other side of the ceiling. There were six surface (ceiling) lights and one ceiling fan on the ceiling of the home theatre room. The projector was hanged from beam. The color of ceiling

`

was white. The theatre room had provision of sufficient natural day lighting coming from south, east and north direction. The provision of artificial lighting was made through lighting fixtures placed on the “DA” wall and surface and indirect lights on ceiling. There was one decorative floor lamp placed at north east corner of the room. Two types of furniture were observed in the theatre room for seating purpose viz. a couch, a rocking chair and two types of wooden chairs. One chair was in broken condition. One low height movable storage was there. The music system was stored in this storage unit. There was acoustic treatment applied on three walls of the theatre room. The two walls viz. “BC” and “DA” had jute panel used for acoustic treatment of the room. The third wall “AB” had polished cork wood panels on it. No acoustic treatment was observed on the fourth wall “CD”, floor and ceiling of the theatre room. The audio visual system was stored in the movable storage unit. The audio visual equipment’s consisted of two speakers, two woofers, DVD player and AV receiver. There was one rolling screen placed on “AB” wall and one ceiling mounted projector in the theatre room.

- **Redesigning interior space of theatre room considering Biophilic Designs:** According to the need and preference of the clients and observations gathered from the observation schedule and review of literature, working drawings of theatre room were prepared with the help of AutoCAD 2019, goggle sketch up and lumion10 software. Three different alternatives were firstly given for the selection purpose to the clients. For all the three design options, the elements of nature patterns of flower, leaf, mountain, water, grass, earth, soil and wooden texture were used in flooring, fabric wrapped acoustic panels, furniture which represented the indirect connection to natural elements. The presence of indoor plants signified the direct connection to nature. Out of three design options proposed, option 2 was selected by the client which is as follows:

Selected Design option

For this design option, one music system storage, two flower shaped chairs, one existing rocking chair and two recliner sofa with side pine wood table were placed as furniture in theatre room. Carpet of size 50cm × 50cm was given in the theatre

`

room. The carpet tiles selected were based on the grass theme. Therefore two different patterned carpet tiles reflecting grass theme were designed for flooring creating an attractive and seamless walk way pattern on floor. For the wall “AB” of the theatre room, two plain green colored fabric wrapped acoustic panels having abstract design made of stiches of size 2’-0” × 5’-9” were placed either sides of wall. A pelmet of width 12’-0” and height 2’-6” was placed above the lintel level. Wall “BC” and “DE” was extended 5’-0” as per the client’s requirement and covered with pine wood panel. A storage was planned on this wall “BC”. The dimension of the storage was 7’-9” wide and the 6’-0” high. Fabric wrapped acoustic panel of leaf pattern stitches was planned for the shutters of the storage. Four acoustic panels of size 2’-0” wide and 10’-3” high were planned on this wall were storage was planned behind three panels. Wall “CD” had curtains with tree patterned on it covering the terrace door. The photo frames were placed on wall “EF”, “FG” and “. A balcony was planned in place of window on this wall “HA”. Curtain with mountain pattern were planned for the balcony door. A pelmet of width 12’-6” and height 2’-6” was placed above the lintel level. Brown stone wall paint was planned for the remaining exposed wall of theatre room. Ceiling of theatre room was divided in two level 4” and 8”. Ceiling had a beam of 1’-0” towards wall “CD”. This beam was covered with the false ceiling. Acoustic panel was continue from wall to ceiling. Existing projector was placed on ceiling. Perforated board were planned for the false ceiling which acted as good acoustic treatment. Ceiling fan was placed on center of the false ceiling. Total of 10 LED light of 15 watts each were placed in false ceiling for direct lighting. The distribution of the switches was done keeping in mind the proximity of the fixture and the switchboard to minimize the length of wires.

Cost estimation: This part constituted information regarding the computed cost estimation of selected design option of theatre room. For the flooring, acoustic carpet tile and pine wood were used. Fabric wrapped acoustic panel, perforated gypsum board and pine wood were used on ceiling. For the walls of theatre room, Fabric wrapped acoustic panel, plywood, laminate, pine wood and wall emulsion color were used. Flower shaped chair and recliner sofas were selected for seating purpose. Five indoor plants were located in indoor space like corner of room and

`

up to storage and center table. Room extension work was done by contractor which include labor work and material. The charges of contractor was ₹ 1300 per sq.ft. The overall cost estimation was ₹ 3, 56,999 according to the rates prevailing in the market as on February, 2021.

Conclusion

Living between concrete structures and with a diminished connection to nature, the increasing pressure on urban space & the ubiquitous technological presence, there is less opportunity to recuperate mental and physical energy. Biophilic design aims to remedy this modern disconnect with nature and fulfil the longing that humans have to be immersed in the natural environment. Having a home theatre system brings an extra smooth and enjoyable feel similar to what people will enjoy in a large movie theatre. For the present project, the design was developed for the theatre room. Mixing of spaces such as a change in flooring, walls and ceiling, providing storage space, seating furniture, acoustic treatments and color can boost the sense of comfort for the client. The furniture layout was designed in such a manner that allows comfortable floor and furniture of the theatre room. The interior of the theatre room was designed incorporating direct and indirect presence of natural elements in such a manner that would help to client spends time at home. Biophilic design's patterns were applied in theatre room by using patterns, materials, plants, lightings and designs. Biophilic design in interior design reduces stress, blood pressure levels and heart rates, whilst increasing productivity, creativity and self-reported rates of well-being. Considering biophilic design patterns, the investigator tried to achieve all these features while designing the theatre room.

Implication of the Study

The findings of the study brought out number of implications for the field of Family and Community Resource Management, Architects and Interior Designers, Government and the Consumers.

`

For the Field of Family and Community Resource Management

Interior design is a vital part of the curriculum of the Family and Community Resource Management field, under which Residential and Commercial Space Designing and Environment related courses are offered to students at each level of study. Therefore, the preferences acquired by the clients and the design developed keeping in mind the interior components of the available space. Present study will be helpful for the students of Interior Design specialization in planning various spaces like theatre rooms. Also, it would build a strong affinity in the students towards creating innovative biophilic design which are not only have economic, environment and health benefits but are also aesthetically attractive too. The students will also acquire knowledge related to implementation of Biophilic designs in interior and exterior spaces.

For Architects and Interior Designers

Having a home theatre system brings an extra smooth and enjoyable feel similar to what people will enjoy in a large movie theatre. The quality of interiors of theatre room considering biophilic design can enhance the experience and health of the users. The role of architects and interior designers is very vital in the overall accomplishment of any design project. The design developed under this study will provide vital design ideas to the designer for theatre rooms incorporating biophilic designs which are aesthetically attractive, satisfying, and most viable option for human nature connectedness. Further, the present investigation can be used as a reference material for designing similar kind of design project for other spaces considering Biophilic designs.

For Government

Government should make efforts in formulation strategies and policies which mandate architects and interior designers to adopt patterns of Biophilic designs in their projects. Government must give subsidy and incentives as a motivator to the architects and interior designers for designing spaces integrating Biophilic designs. The government can also

`

play a significant role in creating awareness among the purchasers about the need, importance and benefits of Biophilic designs.

For Consumers

The aware consumer regarding environmental conditions and impact of indoor environment of a building on health and well-being can play a vital role in designing spaces with natural elements. The responsive consumers can accelerate the demand for Biophilic designs consequently motivating the architects and interior designers.

Recommendation for Future Studies

1. A similar investigation in other cities of Gujarat or different states in India can be conducted.
2. A design projects can be undertaken on implementing Biophilic designs in residential and commercial spaces.
3. A study can be undertaken to find out the opinion and awareness among interior designers, architects and consumers regarding Biophilic designs.
4. A longitudinal research can be conducted to find out the impact of Biophilic designs on health and wellbeing of the residents.
5. A research can be carried out to find out the perception and experience of the residents or employees with the patterns of Biophilic designs.

Bibliography

`

BIBLIOGRAPHY

- Abbas, Z. and Jawaid, M. F. (2017). Biophilia and Built Environment: An Implication for Healthcare Facilities. International Journal on Emerging Technologies. 8(1): 628-634.
- Alcock, I., White, M.P., Wheeler, B.W., Fleming, L.E. and Depledge M.H. (2014). Longitudinal Effects on Mental Health of Moving to Greener and Less Green Urban Areas. *Environmental Science & Technology, 48* (2):1247-1255.
- Algamdi, M. (2020). Connecting Elders to Nature. A Study on Using Biophilic Design to Foster Successful Aging at Home in Saudi Arabia. Master's Thesis Submitted to Department of Fine Arts, The Faculty of The Graduate School at The University of North Carolina, Greensboro.
- Asdrubali, F., Schiavoni, S. and Horoshenkov, K. V., (2012). A Review of Sustainable Materials for Acoustic Applications. *Journal of Building Acoustic*. 19 (4): 283–312.
- Asim, F. and Shree V. (2019). The impact of Biophilic Built Environment on Psychological Restoration within student hostels. *Visions for Sustainability*, (12):18-3. DOI: http://dx.doi.org/10.13135/2384-8677/3534
- Barton, J., and Pretty, J. (2010). What Is the Best Dose of Nature and Green Exercise for Improving Mental Health, *Environmental Science & Technology*. (44): 3947–3955.
- Beatley, T. (2010). *Biophilic Cities*, Island Press, Washington DC.
- Beatley, T. (2013). *Launching the Global Biophilic Cities Network. University of Virginia School of Architecture Charlottesville, USA.* Retrieved from:http://www.thenatureofcities.com/2013/12/04/launching-the-global-biophilic-cities-network/. Accessed on 21st july, 2020.
- Beavers, I., Triggs, J. and Dou, L. (2011). HDMI Transceivers Simplify the Design of Home Theater Systems. *Analog Dialogue*: 45-02.
- Beery, T., Jonsson, I. K. and Elmberg, J. (2015). From environmental connectedness to sustainable futures: Topophilia and human affiliation with nature. *Sustainability. Switzerland, 7(7):* 8837–8854. Retrieved from http://doi.org/10.3390/su7078837. Accessed on 21st July, 2020.

`

- Bercher, P., Richter, F. H¨ornle, T., Geier, T., H¨oller, D. Behnke, G., Nothdurft, F., Honold, F., Minker, W., Weber, M. and Biundo, S. (2015). A Planning-Based Assistance System for Setting up a Home Theater. *Twenty-Ninth AAAI Conference on Artificial Intelligence*, Austin, Texas USA. Published by Association for the Advancement of Artificial Press, Palo Alto, California.
- Bliss, Bill. (2015). *The Business Cost and Impact of Employee Turnover*. Bliss & Associates Inc.
- Blomberg, L. (2015). *Dear EarthTalk: What is biophilic design in architecture and where can I see it implemented?* Newark: Winston Black. dottrans. English ed. Westport: Earth Action Network.
- Browning, B. (2012). The economics of Bioplhilia, Terrapin Bright Green LLC New York NY, Washington.
- Browning, B. and Cooper, C. (2015). Human Spaces: The Global Impact of Biophilic Design in the Workplace. Retrieved from http://humanspaces.com/resources/reports/. Accessed on 27 August, 2020.
- Browning Bill, Chris Garvin, Bob Fox, Rick Cook, Leslie Labruto, Namita Kallianpurkar, Catie Ryan, Siobhan Watson and Travis Knop. (2012)*The Economics of Biophilia*. Rep. Terrapin Bright Green LLC.
- Browning, W., Hon, A.I.A., Catherine Ryan and Clancy J. (2014). 14 Patterns of Biophilic Design: Improving Health and Well-Being in the Built Environment, Terrapin Bright Green, LLC.
- Browning, W.D., Ryan, C., Kallianpurkar, N., Laburto, L., Watson, S., Knop, T. (2012). The Economics of Biophilia, Why Designing with Nature in Mind Makes Financial Sense. New York: Terrapin Bright Green.
- Chen Y. (2017).The Impact of Biophilic Design on Health and Wellbeing of Residents through Raising Environmental Awareness and Nature Connectedness. Master's Thesis Submitted to The Department of Landscape Architecture, The University of Georgia, Athens, Georgia.
- Clark, E. and Chatto, CH.F. (2014). Biophilic Design Strategies to generate wellness and productivity, National professional conference.
- Cooper c. (2015). The Global Impact of Biophilic Design in the Workplace". Human Spaces: Interface Flooring. Georgia.

`

- Dannenberg, A.L., Frumkin, H. and Jackson, R.J. (2011). Making Healthy Places: Designing and Building for Health, Well-Being, and Sustainability. Washington, DC, Island Press.
- Dennis Burger D. (2021). Home Theatre 101: Learning the Basics of Home Theatre Systems. Retrieved from https://hometheaterreview.com/home-theater Accessed on 1st March, 2021.
- Dias, B. D. (2015). Beyond sustainability–biophilic and regenerative design in architecture. *European Scientific Journal*, *11*(9): 147-158.
- Douglas, E. and Gordon, H. (2010). Green schools as high performance learning facilities, National Institute of Building Sciences 1090 Vermont Avenue, NW, Suite 700, Washington, DC: 1-14.
- Downton, P., Jones, D.S., and Zeunert, J. (2016). *Creating Healthy Places*, Melbourne Metro, Docklands, Melbourne.
- Đurić, I., Ratković-Živanović, V., Labus, M., Groj, D. and Milanović, N. (2016). Designing an Intelligent Home Media Center. *Electronics and Energetics*. 29(3): 461 - 474 DOI: 10.2298/FUEE1603461D
- Elzeyadi, I. M. K. (2011). Daylighting-Bias and Biophilia: Quantifying the Impacts of daylighting on Occupational Health". In: Thought and Leadership in Green Buildings Research. Greenbuild 2011 Proceedings. Washington, DC: USGBC Press.
- Emamjomeh, A. (2019). Understanding the potential of Immersible Virtual Environment (IVEs) for Biophilic Design. Master's Thesis Submitted to the Department of Construction Management, Faculty of the Louisiana State University and Agricultural and Mechanical College, Louisiana State University, Louisiana.
- Engineer, A., Sternberg, E. M., and Najafi, B. (2018). Designing interiors to mitigate physical and cognitive deficits related to aging and to promote longevity in older adults: a review. *Gerontology*: 1–11.
- Friedmann, E., Son, H. and Tsai, C. (2010). The animal/human bond: Health and wellness. In A. Fine (Ed.), *Handbook On animal assisted therapy: Theoretical Foundations and guidelines*. Burlington, MA: Academic Press.

`

- Fromm, E. (1964). *The Heart of Man: Its Genius for Good and Evil*. New York: Harper & Row.: 13-143.
- Fromm, E. (1973). *The anatomy of human destructiveness*. Holt Paperbacks. New York.
- Fromm, E. (2010) *Babylon*. Lantern Books.
- Frumkin, H. (2016). *Environmental health: From global to local*. Wiley & Sons.
- Gary, T. and Birrell C. (2014). Are Biophilic-Designed Site Office Buildings Linked to Health Benefits and High Performance Occupants?. *Int. J. Environ. Res. Public Health.* (11): 12204-12222. Doi: 10.3390/ijerph111212204.
- Gautam A. (2017). Biophilic Design in Architecture. International *Journal of Engineering Research & Technology (IJERT).* 6 (3): 120-124.
- Gifford, R., and Mccunn, L. J. (2012). Appraisals of built environments and approaches to building design that promote wellbeing and healthy behaviour. In L. Steg, A. Van Den Berg, & J. de groot (Eds.), *Environmental Psychology: An Introduction*. Retrieved from http://web.uvic.ca/~esplab/sites/default/files/Gifford %26. Accessed on 15 June, 2020.
- Gillis, K. and Gatersleben, B. (2015). A review of psychological literature on the health and wellbeing benefits of biophilic design. *Buildings*, *5*(3): 948-963. doi:10.3390/buildings5030948
- Green, J. (2012). *Biophilic Building Design Held Back by Lack of Data.* Retrieved from: http://dirt.asla.org/2012/05/23/biophilic-building-design-held-back-by-lack-of-data/. Accessed on 19th August, 2020.
- Gunther, B., and Wober, M. (1989). The uses and impact of home video in Great Britain. In M. R. Levy (Ed.), *The VCR age: Home video and mass communication.* Newbury Park, CA: Sage: 50–69.
- Guo J. (2016). The effects of biophilic design in interior environments on noise perception: Designing a person-centered biophilic space for older adults. A thesis submitted to the Faculty of Fine Arts, Iowa State University, Ames, Iowa.
- Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., and Tommy, G., (2003). Tracking restoration in natural and urban field settings. (23): 109–123.
- Heerwagen, J. (2000). Green Buildings, Organizational Success and Occupant Productivity. Building Research and Information. 28(5): 353-367.

`

- Heerwagen, J. (2009). Restorative commons: creating health and well-being through urban landscapes, U.S. Depart of Agriculture, Northern Research Station: 38-57.
- Henke, L. L. and Donohue, T. R. (1989). Functional displacement of traditional TV viewing by VCR owners. *Journal of Advertising Research. 29*(2): 18–23.
- Herzog, T. and Bryce, A. (2007). Mystery and Preference in Within-Forest Settings. *Environment and Behaviour*. 39 (6): 779-796.
- Holman, T. (2000). Foreword. In R. Harley (Ed.), *Home theater for everyone: A practical guide to today's home entertainment systems.* Albuquerque, NM: Acapella.
- Humman Spaces. Retrieved from: http://www.terrapinbrightgreen.com. 23rd June 2020.
- Joye, Y. (2011). Biophilic design aesthetics in art and design education. *Journal of Aesthetic Education*, *45*(2):17-35.
- Kamath, R. and Udipi, S. (2010). Thesis and Scientific Writing: Process, From and Contect.
- Kandel, E. R., Schwartz, J. H., Jessell, T. M., Siegelbaum, S. A. H. and James, A. (2013). Principles of neural science: McGraw-Hill, Health Professions Division.
- Kaplan, R. (1993). The role of nature in the context of the workplace. Landscape and urban planning, 26(1-4): 193-201.
- Kaplan, R. and Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. New York: Cambridge University Press: 9-200.
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. J. Environ. Psychol. (15): 169–182.
- Kaplan, S. and Berman, M. (2010). Directed Attention as a Common Resource for Executive Functioning and Self-Regulation. *Association for Psychological Science*. 5 (1): 43-57.
- Kellert, S. R. (1993). The biological basis for human values of nature. In: Kellert and Wilson *The Biophilia Hypothesis*. Washington D.C.: Island Press: 42-72.
- Kellert, S. R. (1997). *Kinship to mastery: Biophilia in Human Evolution and Development.* Washington: Island Press.

`

- Kellert, S. R. (2005). Building for Life: Designing and Understanding the Human-Nature Connection. Island Press, Washington, DC, USA.
- Kellert, S. R. (2008) Dimensions, Elements, and Attributes of Biophilic Design. In Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life; Heerwagen, J., Mador, M., Eds.; Wiley: Hoboken, NJ, USA.
- Kellert, S. R. (2008). Biophilic Design (The Theory, Science, and Practice of Bringing Buildings to Life), NewJersy, John Wiley & sons.
- Kellert, S. R. (2012). *Birthright: People and Nature in the Modern World*. New Haven, London, Yale University Press.
- Kellert, S. R., Heerwagen, J. and Mador, M. (2008). *Biophilic Design: The Theory,Science, and Practice of Bringing Buildings to Life.* Hoboken, John Wiley & Sons. USA.
- Kellert, S. R. and Calabrese, E. (2015). The practice of biophilic design. *London: Terrapin Bright LLC*.
- Kellert, S. R and Heerwagen, J. (2008). Biophilic Design: The theory, Science and Practice of Bringing Buildings to Life. Hoboken, New Jersey: John Wiley and Sons.
- Kellert, S. R. and Wilson E. O. (1993). *The biophilia hypothesis*. Washington, D.C: Island Press: 484 .ISBN: 1-55963-148-1.
- Kerlinger, F.N. (1973). *Foundations of behavioral research.* (2nd Ed). New York: Holt, Reinhart and Winston.
- Kieran, S. (2005). Paraphrase of lecture, “Toward an Ethical Architecture”. Yale University School of Forestry and Environmental Studies, New Haven, CT.
- Kim, D., Cho S., Lee, S. and Kwon, S. (2015). Design and Implementation of Pneumatic Motion Base for 4D Home Theater. *International Journal of Advanced Smart Convergence.* 4(2): 131-137. doi.org/10.7236/IJASC.2015.4.2.131
- Kothari, C. (2012) Research Methodology (Revised ed.). New Delhi: New Age international publisher.
- Kothari, C. (2014) Research Methodology: Methods and Techniques (3rd ed.). New Delhi: New Age international publisher.
- Lerner A. and Stopka M. (2016). The Financial Benefits of Biophilic Design in the Workplace. MIST.

`

- Levy, M. (1987). VCR use and the concept of audience activity. *Communication Quarterly. (35):* 267–275.
- Levy, M. (Ed.). (1989). *The VCR age: Home video and mass communication.* Newbury Park, CA: Sage.
- Levy, M. and Gunther, B. (1988). *Home video and the changing nature of the TV audience.* London: IBA and John Libbey.
- Lewis M. (2018). "Should You Add a Media Room or Home Theater? – Costs, Pros & Cons". Retrieved from https://www.moneycrashers.com/add-media-room-home-theater-costs. Accessed on 21st July, 2020.
- Lin, C. A. (1992). The functions of the VCR in the home leisure environment. *Journal of Broadcasting & Electronic Media*, (36): 345–351.
- Lin, C. A. (2001). The VCR, home video culture and new video technologies. In J. Bryant & J. A. Bryant (Eds.), *TV and the American age* (2nd ed., pp. 91–107). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
- Lindlof, T. R. and Shatzer, M. J. (1990). VCR usage in the American family. In J. Bryant (Ed.), *Television and the American family.* Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.: 89–109.
- Living Building Challenge SM 3.0: A Visionary Path to a Regenerative Future. Retrieved from: https://living future.org/sites/default/files/reports/FINAL%20LBC%203_0_WebOptimized_low. pf. Accessed on 22rd June, 2020.
- Louv, R. (2008). *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*, Algonquin Books, New York.
- Matai, J. and Zimunya, W. (2020). Connecting Biophilic design to Neighbourhood Energy Use Optimisation in Rural Towns: The Case of Birchenough Bridge. *Journal of Urban Systems and Innovations for Resilience in Zimbabwe.* 2 (1):40 - 60
- Miller, E. (2018). Implementing Biophilic Attributes in Elementary Schools. Master's Thesis Submitted to Department of Fine Arts, The Faculty of The Graduate School at The University of North Carolina at Greensboro.
- Mishra, S. (2019). Biophilic Architecture-Importance and Advantages. *International Research Journal of Engineering and Technology (IRJET).* 6 (5): 1054- 1057.

`

- Modi, R. (2018). A Study of Biophilic Design for Restorative Learning Environment in Urban Schools. A thesis submitted to Undergraduate Programme in Interior design, faculty of Design, CEPT University, Ahmedabad, Gujarat, India.
- Mohanty A. (2019). Elderly Housing in Bhubaneswar. Bachelor's thesis submitted to Architecture Department of Planning and Architecture, National Institute of Technology Rourkela.
- Muir, J. (1877). Mormon Lilies. Liliaceous Wonder-A Mountain Covered with Flowers Gorgeous Lily Gardens-A Sublime Scene-The Queen of All. Special Correspondence of the Bulletin. Salt Lake.
- Mustafa F.A. and Yaseen F. R. (2019). Towards The Application Of Biophilic Parameters In Local Buildings: A Case Study Of Bilkent School, Erbil City- Iraq. *International Journal of Technology*. 10(2): 363-375
- Newman et al. (2015). Biophilic cities are sustainable, resilient cities. Journal, Retrieved from www.Mdpi.Com/2071-1050/5/8/3328/pdf. Accessed on 2nd, July, 2020.
- Newman, P. (2010). Can Biophilic urbanism deliver economic and social benefits cities? , Sustainable Built Environment National Research Centre. Australia.
- Noh, G., and Grant, A. E. (1997). Media functionality and the principle of relative constancy: An explanation of the VCR aberration. *Journal of Media Economics, 10*(3), 17–31.
- Nyrud, A.Q., Bringslimark, T. and Bysheim, K. (2014). Benefits from wood interior in a hospital room: A preference study. *Architechtural Science Review,* (57): 125–131.
- Ojamaa, H. (2016). *Enhancing the Human-Nature Connection Through Biophilic Design In the Built Environment. A Branch Library on the Banks of Lake Union.* Master of Architecture, University of Washington.
- Park, B. J., Tsunetsugu, Y., Kasetani, T., Kagawa, T., & Miyazaki, Y. (2010). The physiologicaleffects of *Shinrin-yoku* (taking in the forest atmosphere or forest bathin g): evidence from field experiments in 24 forests across Japan.*Environmental Health and Preventive Medicine*, *15*(1), 18–26. Retrieved from http://doi.org/10.1007/s12199-009-0086-9. Accessed on 25st July, 2020.

`

- Park, B.J., Tsunetsugu, Y., Kasetani, T., Morikawa, T., Kagawa, T., & Miyazaki, Y. (2009). Physiological effects of forest recreation in a young conifer forest in Hinokage Town, Japan. Silva Fennica. 43(2): 291-301.
- Park Y., Choi B., Lee H. and Sung K. (2012). A Framework of Sensory Information for 4-D Home Theater System. *An International Journal of Applied Mathematics & Information Sciences*. (6): 201-207
- Pollack, J.S. (2006). Biophilic Design For The First Optimum Performance Home, Ultimate Home Design: 36-41.
- Ramzy, N.S. (2015). Biophilic qualities of historical architecture: In quest of the timeless terminologies of "life" in architectural expression. *Sustain. Cities Soc.* (15): 42–56.
- Rauh, S. (2020). How to Build a Home Theatre. Retrieved from https://www.hgtv.com/design/rooms/other-rooms/how-to-build-a-home-theater. Accessed on 21st July, 2020
- Rhodesly, A. M. M. A. M. (2019). Biophilic Approach to Architecture: Case of the Alhambra, al-Andalus. Master's thesis Submitted to the Architectural Engineering Department, Faculty of Engineering, Alexandria University, Egypt.
- Riha, J. (2020). Home Theatre Design Basics. Retrieved from https://www.diynetwork.com/how-to/rooms-and-spaces/home-theater/home-theater-design-basics. Accessed on 21st July, 2020
- Roger, E. (2001). Movie Answer Man. Chicago, Sun-Times. <http://rogerebert.suntimes.com/apps/pbcs.dll/article?AID=/20010826/ANSWERMAN/108260306/1023>.forbes.com. Review of Home Theater Retrieved from: www.hometheaterforum.com. Accessed on 2nd February, 2021.
- Roös, P.B. (2016). *Regenerative-Adaptive Design for Coastal Settlements: A Pattern Language Approach to Future Resilience*. (unpublished PhD Thesis), School of Architecture & Built Environment, Geelong: Deakin University.
- Rubin, A. M., and Bantz, C. (1987). Utility of videocassette recorders. *American Behavioral Scientist*, 30: 471–485.
- Rubin, A. M. and Rubin, R. (1989). Social psychological antecedents of VCR use. In M. Levy (Ed.), *The VCR age: Home video and mass communication.* Newbury Park, CA: Sage: 92–112.

`

- Ryan, C.O., Browning, W.D., Clancy, J.O., Andrews, S.L. and Kallianpurkar, N.B. (2014). Biophilic Design Patterns, Emerging Nature-Based Parameters for Health and Well-Being in the Built Environment, International Journal of Architectural Research. 8(2): 62-76.
- Salingaros, N. (2012). Fractal Art and Architecture Reduce Physiological Stress. *Journal of Biourbanism*. 2 (2): 11-28.
- Sebring, B. (2020).31 HOME THEATER IDEAS THAT WILL MAKE YOU JEALOUS. Retrieved from https://sebringdesignbuild.com/31-home-theater-ideas/ Accessed on 21st July. 2020.
- Sharifi M. and Sabernejad J. (2016). Investigation of Biophilic architecture patterns and prioritizing them in design performance in order to realize sustainable development goals. European Online *Journal of Natural and Social Sciences*. Special Issue on Humanities and Social Sciences. 5 (3): 325-337.
- Silva, R. (2020). HOME THEATER & ENTERTAINMENT TV & DISPLAYS What Is Home Theatre and What Does It Do for Me?. Retrieved from https://www.lifewire.com/what-is-home-theater-1846801. Accessed on 21st July, 2020.
- Söderlund, J. and Newman, P. (2015). Biophilic architecture: a review of the rationale and outcomes, *AIMS Environmental Science*, 2(4): 950–969.
- Steg, L., Van den Berg, A. and De Groot, J. (2012). Environmental Psychology: History, Scope & Methods Environmental Psychology: An Introduction, First Edition. Chichester, Wiley-Blackwell. 1(11): 1-12.
- Stevenson, A. and Lindberg, C.A. (2013). *New Oxford American dictionary,* Oxford, Oxford University Press.
- Stigsdotter, U., Ekholm, O., Schipperijn, J., Toftager, M., Kamper-Jørgensen, F. and Randrup, T.B. (2010). Health promoting outdoor environments - Associations between green space, and health, health-related quality of life and stress based on Danish national representative survey. *Scandinavian Journal of Public Health*. (*38)*: 411-417.
- Stuart H. (1997). The Centrality of Culture: Notes on the Cultural Revolutions of Our Time. Media and Culture Regulation. Ed. Kenneth Thompson. London, Sage. : 207–38.

`

- Tahoun, Z. N. A. (2019). Awareness assessment of biophilic design principles application. *IOP Conf. Ser. Earth Environ. Sci.* 329 012044 doi:10.1088/1755-1315/329/1/012044.
- Thompson, D.A.W. (1917). *On Growth and Form*, Cambridge University Press.
- Terrapin Collaborates with Organizations to Challenge Assumptions and Develop Solutions that Lead to Improved Environmental and Financial Performance through Research, Planning, Guidelines, and Product Development. Retrieved from: http://www.terrapinbrightgreen.com/. Accessed on 23rd June, 2020.
- Ulrich, R. S. (1986). Human responses to vegetation and landscapes. Landscape and urban planning, (13): 29-44.
- Verma S.K. and Punekar R.M. (2017). Nature Inspired Design—A Review from an Industrial Design Perspective. In: Chakrabarti A., Chakrabarti D. (eds) Research into Design for Communities. (2): 869-878. *Smart Innovation, Systems and Technologies*, (66). Springer, Singapore. Retrieved from https://doi.org/10.1007/978-981-10-3521-0_74. Accessed on 22rd January, 2021.
- Vessel, E.A., Starr, G.G. and Rubin, N. (2012). The brain on art: intense aesthetic experience activates the default mode network. *Frontiers in human neuroscience*. (6)**:** 66.
- Wallender, L. (2021). 15 Tips for Building the Perfect Home Theatre Room. Retrieved from https://www.thespruce.com/building-the-perfect-home-theater-room-1821298. Accessed on 1st February, 2021.
- Well Building Standard Resources. Retrieved from: http://www.wellcertified.com/standard. Accessed on 22rd June. 2020.
- Wilson, E.O. (1979). Biophilia. New York Times Book Review.
- Wilson, E. O. (1984). *Biophilia: The human bond with other species*. Harvard University, Harvard Publishing. USA: 3-145.
- Wilson, E.O. (1986). Biophilia: the Human Bond with Other Species. Cambridge: Harvard University Press.
- Wilson, E.O. (1993). Biophilia and the conservation ethic. In *Biophilia: The Human Bond with Other Species*; Kellert, S., Wilson, E.O., Eds.; Harvard University Press: Cambridge, MA, USA.

`

- Wilson T. V. and Harris T. (2001). How Home Theatre Works. HowStuffWorks.com. Retrived from https://electronics.howstuffworks.com/home-theatre.htm. Accessed on 17 May, 2020.
- Wolf, Kathleen. (2014). Biofilia Economics. Retrived from http://www.charteredforesters.org/news/item/238- economics biophiliacollaborationtpbeii/. Accessed on 17June, 2020.
- Yassein G. and Ebrahiem S. (2018). Biophilic Design in the Built Environment to Improve Well-Being: A Systematic Review of Practices. *Journal of Urban Research*. 30: 128-146
- Young, J.A. (2008). *Biophilia: Getting Intimate with Nature.* Master of Architecture, University of Cincinnati.
- Zari M. P. (2019). Understanding and designing nature experiences in cities: a framework for biophilic urbanism, *Cities & Health*, DOI:10.1080/23748834.2019.1695511.

`

WEBLIOGRAPHY

1. Retrieved from https://en.wikipedia.org/wiki/Home_cinema 20july, 2020.
2. Retrieved from https://www.audioadvice.com/videos-reviews/home-theater-cost/ 21 July, 2020.
3. Retrieved from https://en.wikipedia.org/wiki/Home_cinema#:~:text=Home%20cinema%2C%20also%20called%20home,backyard%20of%20a%20private%20home. 21 July, 2020.
4. Retrieved from https://en.wikipedia.org/wiki/Home_cinema#:~:text=Home%20cinema%2C%20also%20called%20home,backyard%20of%20a%20private%20home. 20July, 2020.
5. Retrieved from https://www.moneycrashers.com/add-media-room-home-theater-costs/ 24 July, 2020.
6. Retrieved from https://interiordesign.lovetoknow.com/Home_Theater_Interior_Design 24 July, 2020.
7. Retrieved from https://simptechsolutions.com/designing-building-a-home-theater-6-tips-for-your-home-theaters-floor-ceiling-and-walls/27 July, 2020.

APPENDIX

`

Appendix – I

Estd. 1949
NAAC Accredited "A" Grade

DEPARTMENT OF FAMILY AND COMMUNITY RESOURCE MANAGEMENT
FACULTY OF FAMILY & COMMUNITY SCIENCES
THE MAHARAJ SAYAJIRAO UNIVERSITY OF BARODA
VADODARA

INFORMED CONSENT FORM

The Department of Family and Community Resource Management, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda, Vadodara, supports the practice of protection of human participants in research. The following will provide you with information about the research survey that will help you decide whether or not you wish to participate. If you agree to participate, please be aware that you are free to withdraw at any point throughout the duration of the research without any penalty. In this study, you will be asked about your background information, your need and preferences for home theatre room and assessing existing interior of the selected room. All information you provide will remain confidential and will not be associated with your name. If for any reason during this study you do not feel comfortable, you may leave the study. Your participation in this study will require approximately 15-20 minutes. If you have any further questions concerning this research, please feel free to contact Mr Rutvik Chapaneri through Phone +91 7990950789, email id: chapanerirutvik@gmail.com.

Please indicate with your signature on the space below that you understand what participation in the study involves and agree to participate. Your participation is strictly voluntary. All information will be kept confidential and your name will not be associated with any research findings.

_____

Name & Signature of Participant

Date:

Rutvik Chapaneri
M.Sc. (F.C.Sc.) Student
Department of FCRM
FFCSc, MSU

Dr. Shilpi Saraswat
Supervisor & Assistant Professor
Department of FCRM
FFCSc, MSU

`

Appendix -II

Observation Sheet to Assess the Existing Interior Spaces of Home Theatre Room

Name of the City: _____

Postal Address of the Site: _____

Name of Client: _____

Contact No. of the Client: _____

E-mail of Client: _____

SECTION I: Information regarding existing interior space of home theatre room

1. **Area of Home Theatre Room**_____
   Dimension of Home Theatre Room:
   Length- _____ Width- _____ Height- _____

2. **Windows**

- Color of Window _____

Location of Window	No. of Windows	Size of Window		
		Sill Level	Lintel Level	Width
East				
South				
West				
North				

`

- Material of Window:

☐ Wooden Frame (Glass) ☐ Iron Frame (Glass)
☐ Aluminum Frame (Glass) Any Other _____

- Finish on Window:

☐ Gloss ☐ Matte
☐ Semi-Gloss Any Other _____

- Condition of Window:

☐ Good ☐ Broken ☐ Rusted

3. Doors

- Color of Door _____

Location of Doors	No. of Doors	Size of Window		
		Sill Level	Lintel Level	Width
East				
South				
West				
North				

- Material of Door:

☐ Wooden ☐ Glass
☐ Aluminum Any Other _____

- Finish on Door:

☐ Gloss ☐ Matte
☐ Semi-Gloss Any Other _____

`

- Condition of Door:

  ☐ Good ☐ Broken ☐ Rusted

4. Provision of Cross Ventilation Facilities: ☐ Yes ☐ No

- Type of Ventilation Facilities:

  ☐ Window ☐ Ventilation Window
  ☐ Door Any Other _____

5. Floor

- Color of Floor _____

- Type of treatment on Floor:
  ☐ Soft ☐ Hard Any Other_____

- Type of Soft Flooring:

  ☐ Foam ☐ Rubber ☐ Carpet
  ☐ Cork laminate ☐ Soft Plastic Any Other _____

- Type of Hard Flooring:

  ☐ Wooden ☐ Concrete ☐ Ceramic
  ☐ Stone ☐ Marble ☐ Vitrified
  ☐ Mosaic ☐ vinyl Any Other _____

- Texture of Flooring:
  ☐ Smooth ☐ Medium ☐ Rough

- Finish on Floor:

  ☐ Gloss ☐ Matte
  ☐ Semi-Gloss Any Other _____

- Condition of Floor:
  ☐ Good ☐ Broken ☐ Scratched

6. Walls

- Color of Wall _____

`

- Material for Construction:

Wall Location	Brick	Wooden	Stone	Cement Brick	Any Other
East					
South					
West					
North					

- Type of Wall treatment:

Wall Location	Rustic	Plastered	Paint	Cladding	White Putty	Acoustic	Wall Paper	Any Other
East								
South								
West								
North								

- Hue:

Wall Location	Bright	Dull
East		
South		
West		
North		

- Texture:

Wall Location	Smooth	Medium	Rough
East			

`

South			
West			
North			

- Condition of the Wall:

Wall Location	Damp	Chipping Of Plaster	Chipping Of Paint	Good
East				
South				
West				
North				

- Finish on Wall:

☐ Gloss ☐ Matte
☐ Semi-Gloss Any Other _____

7. Ceiling

- Color of Ceiling_____
- Type of ceiling:

☐ Plain Ceiling ☐ False Ceiling Any other_____

- Material for Construction:

☐ P.O.P ☐ Wood ☐ A.C.P Sheet
☐ Gypsum board ☐ Metal Any other _____

- Finish on Ceiling:

☐ Gloss ☐ Matte
☐ Semi-Gloss Any Other _____

`

- Condition of the Ceiling:

☐ Good ☐ Damp/ Leaking
☐ Broken/Cracks Any other _____

8. Lighting

- Provision of Natural Lighting: ☐ Yes ☐ No
- Provision of Artificial Lighting: ☐ Yes ☐ No
- Total number of Lighting Fixtures in a room: _____

Location of Lights	Direct Light	Indirect Light	Accent Light	Task Light	Focus Light	General Light	Recessed Light
East Wall							
South Wall							
West Wall							
North Wall							
Floor							
Ceiling							

- Type of Lamp:

☐ Incandescent ☐Linear Fluorescent ☐ Compact Fluorescent

9. Fans & Air Conditioner (AC)

- Type of Fan

☐ Ceiling Mounted ☐ Wall Mounted
☐ Table Fan Any other _____

- Type of & Air Conditioner (AC)

`

☐ Split A.C. ☐ Window A.C.
☐ Cassette A.C. Any other _____

10. Projector & Screen

- Type of Projector

☐ Ceiling Mounted ☐ Table Stand

- Type of Screen:

☐ Fix Screen ☐ Foldable Screen Any other_____

- Dimension of Screen**:** Length-_____ Height- _____

11. Speakers

- Total Number of Speakers: _____
- Type of Speakers

☐ Ceiling Mounted ☐ Wall Mounted
☐ Movable Any other _____

12. Furniture

- Total Number of Chair: _____
- Total Number of Sofa: _____
- Total Number of Couch:_____
- Total Number of Center Table: _____
- Total Number of Side Table: _____
- Total Number of Storage: _____

- Type of Chair:

☐ Armchair ☐ Rocking chair ☐ Recliner chair
☐ Lounger chair ☐ Normal chair Any other _____

- Type of Sofa:

☐ Single Side ☐ U-Shape
☐ L-Shape Any other

`

_____

- Type of Storage:

☐ Movable Storage ☐ Wall Storage
☐ Fix Storage Any other _____

- Material used in furniture

Furniture	Natural wood	Ply-wood	metal	Thermo-plastic (moulded-Furniture)	Any Other
Chair					
Sofa					
Couch					
Center table					
Side table					
Storage					

- Treatment used in furniture

Furniture	Natural wood	veneer	Laminate	Upholstery	Any Other
Chair					
Sofa					
Couch					
Center table					
Side table					
Storage					

- Fabric used in upholstered furniture

`

Furniture	Leather	velvet	Wool	Cotton	Polyester	Any Other
Chair						
Sofa						
Couch						
Center table						
Side table						
Storage						

- Type of Finish used in furniture

Furniture	Gloss	Semi-Gloss	Matte	Any Other
Chair				
Sofa				
Couch				
Center table				
Side table				
Storage				

- Condition of furniture

Furniture	good	Broken	Any Other
Chair			
Sofa			
Couch			

`

Center table			
Side table			
Storage			

13. Acoustic Treatment

- Provision of Acoustic Treatment: ☐ Yes ☐ No
- Total Number of Acoustic Panel:_____

- Type of Acoustic Treatment:

  ☐ Sound Absorbers ☐ Sound Diffusers
  ☐ Noise Barrier ☐ Sound Reflector Any other_____

- Material Used in Sound Absorbers:

  ☐ Jute panel
  ☐ Wooden partial board
  ☐ Sustainable panel
  ☐ Acoustical foam panels
  ☐ White paintable acoustical wall panels
  ☐ Fabric wrapped panels
  ☐ Acoustical wall coverings
  ☐ Ceiling tiles
  ☐ Baffles and banners for ceiling
  ☐ Fiber glass blankets and roll
  ☐ Acoustic curtains (Thermal Blackout Curtains)
  ☐ Moving blankets
  ☐ Wood wool panel

  Any Other: _____

- Types of Sound Diffusers:

  ☐ Quadra pyramid diffusers
  ☐ Pyramid diffuser
  ☐ Quadratic diffuser
  ☐ Double duty diffuser

`

Any Other: _____

14. Accessories

- ☐ Painting
- ☐ Photo frames
- ☐ Mural
- ☐ Candles
- ☐ Decorative boxes
- ☐ Sculptures
- ☐ Flower vases
- ☐ Miniature plants
- ☐ Decorative pots

Any Other: _____

`

Appendix -III

Interview Schedule to know the need and preferences Client for Designing the Interiors of Home Theatre Room

SECTION I. BACKGROUND INFORMATION OF THE CLIENT

1. Name:_____
2. Age (in years): _____
3. Address: _____
4. Contact No:_____
5. Educational qualification :

   ☐ H.S.C
   ☐ S.S.C
   ☐ Graduate
   ☐ Post-Graduate

   Any Other: _____
6. Occupation: _____
7. Designation:_____
8. Years of Experience in Field:_____
9. Monthly Personal Income (in Rupees): _____
10. Number of Family Members: _____
11. Composition of Family: _____

    - Number of Males: _____
    - Number of Females: _____
    - Number of Children below 12 years: _____

`

- Number of Children between 13 to 18 years: _____
- Number of Family members in middle age: _____
- Number of Family members in old age: _____

12. Monthly Family income (in Rupees):_____

13. Use of home theatre room: _____

- Activities performed

  _____

  _____

  _____

  _____

- How many times the room used

  ☐ Daily
  ☐ Weekly
  ☐ Fortnightly
  ☐ Monthly

  Any Other: _____

- Time duration of its use _____

SECTION II. Biophilic Design

- Are you aware about Biophilic design in interiors: Yes ☐ No ☐
- If yes, how much you know about Biophilic design?

  _____

  _____

  _____

  _____

- Are you interested in Biophilic design: Yes ☐ No ☐

`

SECTION III. Needs and Preferences of Client for home theatre room

Please tell whether the following interior components you prefer in home theatre room(Y/N). If no, Please tell your preference.

Sr. No.	Interior Component	Most Preferred	Least Preferred	Not Preference
I.	**Floor**			
•	**Floor Option**			
	Wooden			
	Wooden texture vinyl floor			
	Carpet			
	Acoustic floor carpet tiles			
	Any Other, Please specify			
•	**Finish on Floor**			
	Gloss			
	Semi- Gloss			
	Matte			
•	**Texture of Floor**			
	Smooth			
	Medium			
	Rough			
II.	**Wall**			
•	**Wall Finish Option**			
	Acoustic panel			

`

Sr. No.	Interior Component	Most Preferred	Least Preferred	Not Preference
	Wall Paint			
	Wood Cladding			
	Veneer			
	Laminate			
	Wallpaper			
	Patterned Texture			
	Cork wood wall covering			
	Fabric wall covering			
	Any Other, Please specify			
•	**Finish on Wall**			
	Gloss			
	Semi- Gloss			
	Matte			
•	**Texture of Wall**			
	Smooth			
	Medium			
	Rough			
III.	**Ceiling**			
•	**Ceiling Option**			
	Plain ceiling			
	False ceiling			
	Any other, Please specify			
•	**Ceiling Material Option**			

`

Sr. No.	Interior Component	Most Preferred	Least Preferred	Not Preference
	Plaster of Paris (P.O.P.)			
	Gypsum board			
	Acoustic panel made of fabric			
	Laminate			
	Wood			
	Veneer			
	Fabric Ceiling			
	Any other, Please specify			
•	**Finish on Ceiling**			
	Gloss			
	Semi- Gloss			
	Matte			
•	**Texture of Ceiling**			
	Smooth			
	Medium			
	Rough			
IV.	**Window**			
•	**Soft Window Treatments**			
	Curtains			
	Valances			
	Swags			
	Drapes			
	Blinds			

`

Sr. No.	Interior Component	Most Preferred	Least Preferred	Not Preference
	Any other, Please specify			
V.	**Seating**			
•	**Seating Option**			
	Sofa			
	Couch			
	Recliner chair			
	Upholstered designer chair			
	Arm chair			
	Lounge chair			
	Any other, Please specify			
•	**Fabric used in upholstered** **Seating**			
	Leather			
	Velvet			
	Wool			
	Silk			
	Polyester			
	Polyester + cotton mix			
	Linen			
	Cotton			
	Any other, Please specify			
VI.	**Side table**			
•	**Material used in tables**			

`

Sr. No.	Interior Component	Most Preferred	Least Preferred	Not Preference
	Natural Wood			
	Ply-Wood			
	Metal			
	Any other, Please specify			
•	**Shape of Tables**			
	Rectangular			
	Square			
	Circular			
	Any other, Please specify			
•	**Finish on Tables**			
	Gloss			
	Semi- Gloss			
	Matte			
•	**Texture of table**			
	Smooth			
	Medium			
	Rough			
VII.	**Storage**			
•	**Type**			
	Movable Storage			
	Fixed Storage			
	Any other, Please specify			
•	**Material used in storage**			

`

Sr. No.	Interior Component	Most Preferred	Least Preferred	Not Preference
	Natural Wood			
	Ply-Wood			
	Metal			
	Any other, Please specify			
•	**Treatment use in storage**			
	Wood + Natural polish			
	Laminate			
	Veneer			
	Paint			
	Any other, Please specify			
•	**Finish on Storage**			
	Gloss			
	Semi- Gloss			
	Matte			
•	**Texture of Storage**			
	Smooth			
	Medium			
	Rough			
VIII.	**Acoustic Treatment**			
•	**Types of acoustic materials**			
	Jute panel			
	Acoustical foam panels			
	Perforated board			

`

Sr. No.	Interior Component	Most Preferred	Least Preferred	Not Preference
	Acoustic wooden panel			
	Printed polyester acoustic panel			
	Fabric wrapped panel			
	Wood wool panel			
	Any other, Please specify			

ABSTRACT

`

ABSTRACT

Since the Industrial Revolution, the built environment and urban areas have exploded at an unprecedented rate. People spend the majority of their time indoors surrounded by drywall, concrete, and steel. There is a desire for a reconnection with nature and natural systems. Hence, the biophilic design arises to remedy this modern disconnect with nature and fulfill the longing that humans have to be immersed in the natural environment. Biophilic design is an approach to interior design that seeks to connect interior of building occupants more closely to nature. Biophilic design have a many benefits like its helps to reduces stress, stimulates creativity and clear thinking, improves physical and psychological well-being and accelerates healing. Biophilic design divided in three patterns, first was nature in the space, second was natural analogs and third was nature of the space. Considering the relentless process of global urbanization, the benefits of Biophilic design become increasingly important in the design of urban spaces, architecture and interiors. Staying at home and entertaining family is becoming more and more desirable and having a theatre room is just the way to do that. Theatre room is place where family spends a quality time and viewing cinema and does other fun and relaxing activates. Incorporating Biophilic designs in theatre room can upsurge the pleasure of watching movies at home and enhance the viewing experience. With this view the present research was undertaken with objectives to conduct market survey of materials used in redesigning theatre room of selected residence. To ascertain the need and preference of the client for theatre room. To assess the existing interiors of the theatre room of selected residence. To redesign the interior space of theatre room considering the Biophilic Designs and provide detailed working drawings with cost estimation.

`

For the present investigation design project method was adopted. Two research tools viz. interview and observation schedule were selected for collecting information pertaining to background information and need and preference of the client and assessment of existing interior space of home theatre room respectively. The content validity of the tools was established and suggested modifications were integrated. Three design options were expounded centered on client's need and preference and assimilating patterns of Biophilic designs. AutoCAD 2019, goggle sketch up and lumion10 software was used for designing three design options for the client.

The market survey was of the materials used in redesigning theatre room of selected residence was conducted for acoustic material, rugs, fabrics, glass, floor tile, laminate flooring, recliner sofa, plywood, laminate, sponge foam sheet, wall paint, indoor plant plants. The existing interiors interior components of selected home theatre room viz. dimension of the home theatre room, floor, walls, ceiling, lighting, furniture, acoustic treatment and Audio visual equipment's were assessed through observation schedule. Based on the need and preference of the client and patterns of Biophilic designs, three design options were insinuated. For each design option, furniture layout, flooring layout, four wall elevations, ceiling design, working drawing, electrical layout and furniture drawings were proposed for theatre room. The 3D views of the selected design of the theatre room were readied. The proposed design embraced the patterns of Biophilic designs for indirect connection to nature viz. flower, leaf, mountain, water, grass, earth, soil and wooden patterns and texture in flooring, fabric wrapped acoustic panels, furniture which represented the. For direct connection to natural elements, indoor plants were planned in the design. Cost estimation of selected design by client was primed considering the actual price and labour cost. The cost for designing a theatre room considering Biophilic design was estimated to ₹ 3, 56,999. The designs developed will be helpful to the students of interior designing, architects and interior designers to undertake residential and commercial projects featuring Biophilic designs for ameliorating human nature connection and health and wellbeing of the residents.