

**DESIGNING OF GARDEN BENCH FOR PUBLIC  
GARDENS OF VADODARA CITY**

**APRIL 2023**

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**DESIGNING OF GARDEN BENCH FOR PUBLIC  
GARDENS OF VADODARA CITY**

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(Interior Design)

By

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### Ethical Compliance Certificate 2022-2023

This is to certify that **Ms. Haya Sheth's** study titled, **Designing of Garden Bench for Public Gardens of Vadodara City** has been approved by the Institutional Ethics Committee for Human Research (IECHR), Faculty of Family and Community Science, The Maharaja Sayajirao University of Baroda. The study has been allotted the ethical approval number **IECHR/FCSc/M.Sc./2022/10.**

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## CERTIFICATE

This is to certify that the thesis entitled “**DESIGNING OF GARDEN BENCH FOR PUBLIC GARDENS OF VADODARA CITY**” submitted for partial fulfilment of the requirement for the Degree of Masters in the Faculty of Family and Community Sciences (Family and Community Resource Management) to The Maharaja Sayajirao University of Baroda, carried out by Ms.Haya Sheth, is her original bonafide work.

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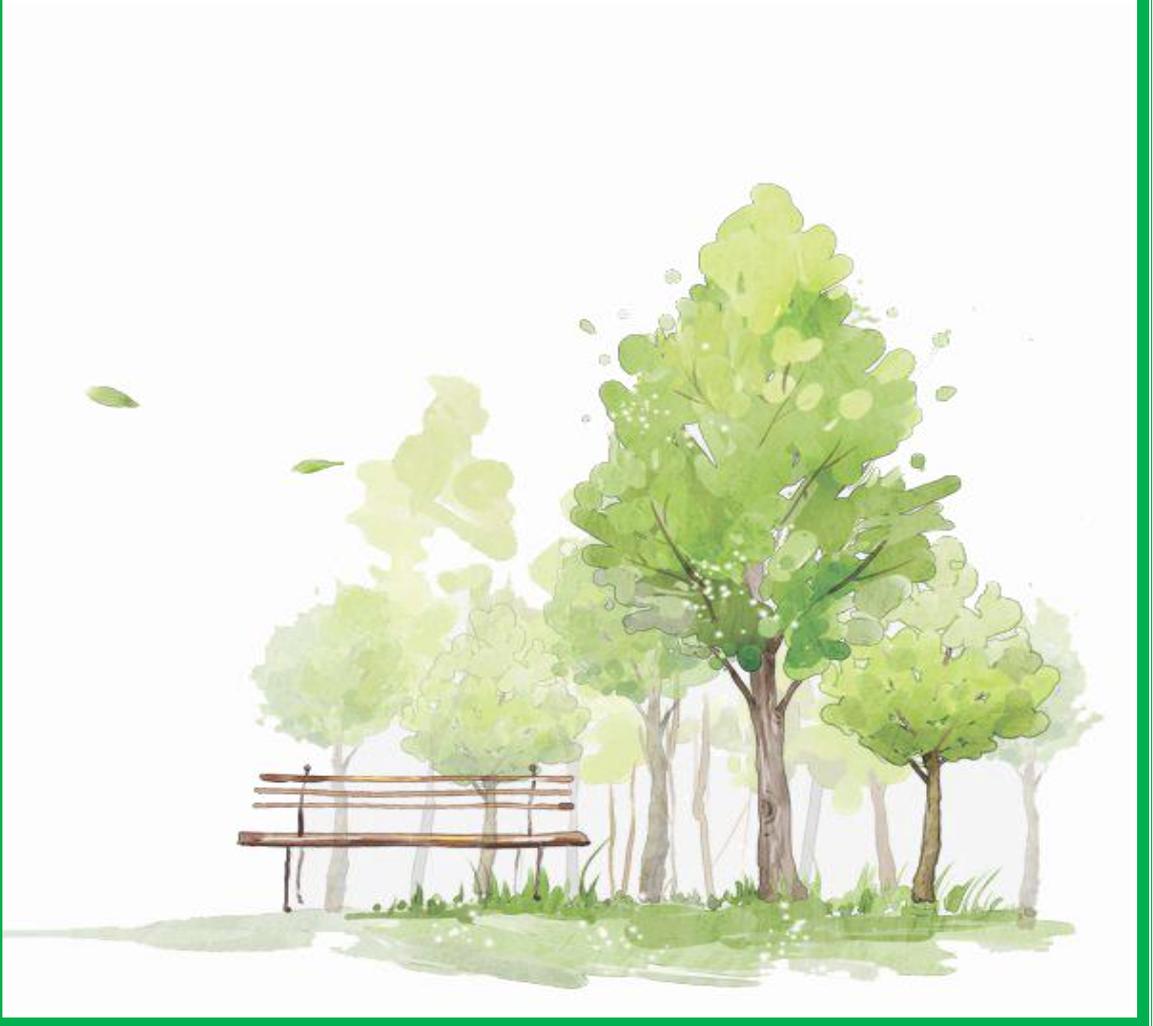
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# INTRODUCTION



# CHAPTER I

## INTRODUCTION

### 1.1 Public Gardens

A public garden is defined by the American Public Gardens Association (2018) as:

“An institution that maintains collections of plants for the purposes of public education and enjoyment, in addition to research, conservation, and higher learning. It must be open to the public and the garden’s resources and accommodations must be made available to all visitors. Public gardens are staffed by professionals trained in their given areas of expertise and maintain active plant records systems.” [1]

A public garden is a place where the public can come in their free time to relax, sit down, enjoy the view and communicate with friends and family. It is also a place where the people of a city come for the purpose of relaxation, recreation, social interaction, and physical exercise. Not everyone visits public gardens for exercise or walks. Some people come just to spend time with friends and family.

#### 1.1.1 Importance of Public Gardens

Public gardens have several benefits for both people and the environment. These gardens create a sense of belonging among people who are increasingly disconnected from each other [2]. With an increasing population, every residential area does not have its own private landscape for relaxing. People feel a lack of fresh air and an absence of open space. Hence, it is logical to have some common green open space like community gardens, public gardens, parks for children and many more. For those who do not have their own community garden, public gardens

are one of the most important aspects of their daily lives. Public gardening gives the citizens a chance to enjoy the fresh air and healthy outdoor exercise. They also provide a peaceful retreat from the noise and bustle of the neighborhood, easing stress for the public [2].

### **1.1.2 Components of Public Garden**

Singh and Dhaduk (2015) claim that garden components are the garden features that form the expressions of gardens, adding charm to the basic garden landscape and constituting its style while contributing strongly to its texture and structure. Every garden is composed of a number of different physical elements that are put together to create a garden with a design. Although every design makes use of the same components, certain designs are popular enough to acquire public importance. Public gardens are made up of two components that are hard and soft components. Soft components are those that are living, such as trees, flowerbeds, and hedges, while hard components are those that are man-made, fixed, and immovable, such as walkways, gazebos, benches, and water features.

## **1.2 Garden Benches**

Anyone who visits a public garden uses the bench directly or indirectly. People can spend more time outside by sitting on benches, which is good for their mental health and makes it easier for them to interact with others in their neighborhoods. Public benches are also good for physical health since it lets people with restricted mobility rest while they go around. Additionally, it offers spaces for individuals to socialize, and it also provides a place to sit for people who want to meet in large groups, or teenagers after school, and a space for people. Public benches are most commonly available in the 4–6-foot range.

### **1.2.1 Designing of Garden Benches**

Designing the best possible garden bench requires selecting the right bench material that provides both good looks and durability. Garden benches must be durable enough to withstand repeated use, weather conditions and other concerns. Garden benches can be made of wood,

metal, plastic, concrete or some combination of these materials. Each offers different pros and cons in relation to weight, wear, comfort, and aesthetics. The design of seating components should be compatible with all other site components as they are significant environmental components (Harris & Dines, 1988).

## **JUSTIFICATION**

Public gardens play various roles in the daily life of a human being. A public garden is a place where people feel connected to nature. Due to the compactness of residential spaces in urban areas, people feel a lack of fresh air and an absence of open space for relaxing. Spending time in the public garden can solve many of the problems related to mental and physical health. A public garden comprises various hard and soft components of the landscape such as trees, flowerbeds, hedges, water bodies, benches, gazebos, pathways and so on. Garden benches are an important component in public gardens, as visitors need to relax and sit down at some point in their visit to the garden. Also, some visitors come to the public gardens solely to sit and enjoy the surroundings. The universality of their daily use has earned benches a place among the most socially significant pieces of street furniture. So, it is essential to have a comfortable bench in the public garden. The comfort of the user must be taken into consideration. Since garden benches are now more expensive, they need to be properly designed using materials with higher durability and design of higher comfort level. A comfortable garden bench in a well-designed public garden will increase the number of visitors, thereby promoting the Sustainable Development Goals such as SDG 3, which is “Ensure healthy lives and promote well-being for all at all ages.” and SDG 11, which says “Make cities and human settlements inclusive, safe, resilient and sustainable.” [8]

During the review of literature, the researcher came across various studies conducted in India related to evaluation of landscape gardening, landscape practices, residential landscaping and gardening, designing of terraces, designing of an ideal outdoor garden, designing of a vertical garden, and community gardening. Studies conducted outside India were related to areas such as smart street furniture, lightweight concrete outdoor furniture, urban landscaping, wooden material in outdoor furniture, design and implementation

of smart benches, design considerations and design analysis. Review of the literature revealed a dearth of research on design of garden benches for public gardens in India.

The aim of the present research was to provide a new design for a garden bench that would combine aesthetics, functionality and expressive characteristics. The development of a new garden bench could provide extra value to the public gardens and the community, enhancing the experience for all. The present study would be helpful in improving the environment. The garden bench designs were created with the goal of bringing people closer to nature. The present study was helpful in widening the database and strengthening the curriculum for Interior Designing and Landscape Designing courses that were offered for the Interior Design specialization offered by the Department of Family and Community Resource Management, the Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda and various other institutes. The findings of the study would be helpful to Interior Designers and Architects in developing other furniture designs. The present research would also be beneficial to the sectors of Interior Design, Furniture Design and Landscape Design related industries and manufacturers, as well as to the general public that visits the public gardens. It will also be beneficial for the Parks and Garden Office, Vadodara Municipal Corporation (VMC), for the further development of public gardens in Vadodara city.

### **STATEMENT OF PROBLEM**

The present study aimed to develop design of garden bench for the public gardens of Vadodara city.

### **OBJECTIVES**

1. To identify the problems experienced by the respondents while using garden benches of selected public gardens of Vadodara city.
2. To observe various aspects of the garden bench installed by the Parks and Garden Office, Vadodara Municipal Corporation (VMC) of Vadodara city.
3. To propose garden bench designs for public gardens of Vadodara city.

## **DELIMITATIONS**

1. The study was limited to the selected public gardens of Vadodara city.
2. The study was limited to respondents above the age of 18 years.
3. The study was limited to the garden bench installed by the Parks and Garden Office, Vadodara Municipal Corporation (VMC) of Vadodara city.

# REVIEW OF LITERATURE



## **CHAPTER II**

### **REVIEW OF LITERATURE**

The major areas of related literature, surveys, scholarly papers, books, and other materials important to allied concerns, fields of research, or theories have been presented here, along with a description, summary, and critical evaluation of each work. In order to make the review comprehensible the present chapter was divided into the following sections:

#### **2.1 Theoretical orientation**

##### 2.1.1 Public Gardens

###### 2.1.1.1 Importance of Public Gardens

###### 2.1.1.2 Components of Public Gardens

##### 2.1.2 Garden Bench

###### 2.1.2.1 Types of Garden Benches

###### 2.1.2.2 Designing of Garden Benches

###### 2.1.2.3 Material for Garden Benches

###### 2.1.2.4 Market Survey for Garden Benches

#### **2.2 Empirical Researches**

##### 2.2.1 Researches conducted outside India

##### 2.2.2 Researches conducted within India

#### **Conclusion**

## **2.1 Theoretical Orientation**

### **2.1.1 Public Gardens**

Life is very busy, with work and responsibilities taking up so much time. However, constant work makes the human body tired and we seek peace. This is where the benefits of a public garden can help. Especially if one spends most of their time behind a desk or at a computer, turning to the garden can help to get rid of the day's stress. Getting outside and feeling physically attached to the ground is a pleasant change. Public gardens are often promoted as having economic advantages, providing health benefits and offering educational opportunities. Public gardens are also great for the environment [2].

A public garden is defined by the American Public Gardens Association (2018) as:

“An institution that maintains collections of plants for the purposes of public education and enjoyment, in addition to research, conservation, and higher learning. It must be open to the public and the garden's resources and accommodations must be made available to all visitors. Public gardens are staffed by professionals trained in their given areas of expertise and maintain active plant records systems.” [1]

Public gardens, with their orderly and diverse collections of plants and extensive educational programs, are ideally positioned to make major contributions not only to the amenity of our lives but also to the ways in which we envision the future. Throughout the United States, there is great interest in establishing new public gardens and building the capacity of existing ones to provide accessible, documented, and educational facilities that serve to attract visitors, but perhaps more importantly, serve

as guides to the kind of sustainable, rich, and beautiful world that we would like to build together for the future (Rakow and Lee, 2011).

Public garden is a mission-based institution that maintains collections of plants for the purposes of education, research, conservation, and/or public display. Public garden is more than a property that holds a gathering of plants, even when those plants are laid out in an aesthetically pleasing manner. A public garden is both a physical presence that includes plant collections, buildings, and infrastructure and an organization that manages those elements and uses them to further its mission (Rakow and Lee, 2011).

Public gardens are strongly influenced by their initial creators. Whether an individual, a group of individuals, an organization, or a government body, each entity that creates a public garden leaves its mark. Although most public gardens are started and owned by not-for-profit educational corporations, there are private public gardens and for-profit ones as well. The groups and organizations that start public gardens are incredibly diverse, so it is not surprising that the gardens they create are equally diverse (Rakow and Lee, 2011).

With the continuous increase in population in India, there is no place to relax. So, people are trying to self-relax in some other place organically and safely in the city. The public park and gardens are the targets for people to spend more time in quiet places and breathe fresh air (Akash, et al., 2021).

### **2.1.1.1 Importance of Public Gardens**

Public gardens play a significant role in helping cities and towns develop sustainable practices and the potential to multiply this contribution is evident. The application of the gardens' expertise in sustainable community development may also help to build valuable human and social capital in the form of leadership skills and networking capacities and create opportunities for entrepreneurship that improve the local economy as well (Snelling and Lindsey, 2017).

Doing something you enjoy whilst surrounded by people who care about you will in turn increase your happiness. Community gardens can play an important role here. Children can also benefit from gardening, as exposure to soil has been shown to reduce allergies and provide numerous health advantages [3].

Public parks serve an important societal function as recreational spaces for diverse communities of people, with well documented physical and mental health benefits. As such, parks may be crucial for how people have handled the effects of the COVID-19 pandemic, particularly the increasingly limited recreational opportunities, widespread financial uncertainty, and consequent heightened anxiety and public parks have always served a critical function as free recreational spaces, especially for low income and migrating communities. Parks and green spaces more generally are known to have positive impacts on mental health, with proven benefits. Also, parks can be quite expansive, allowing for safe enjoyment while maintaining social distance. As such, parks may serve an important and as of yet unquantified–function for people in coping with the COVID-19 pandemic (Volencic et. al., 2021).

Public gardens have several benefits for the people and the environment. These gardens create a sense of belonging among people who are increasingly disconnected from each other. Many city dwellers do not have a garden patio or even a sunny balcony for a container garden. And yet at the same time, many cities are filled with empty spaces and perfectly good land that is unused and filled up with ugly debris. Turning that land into public gardening space that would benefit the public would be a win-win for everyone. Public gardening gives city dwellers a chance to enjoy the fresh air and get healthy outdoor exercise. They also provide a peaceful retreat from the noise and bustle of the neighborhood, easing stress for the public [2].

### **2.1.1.2 Components of Public Gardens**

Every garden is made up of a variety of physical components combined together to form a garden with style. Some styles are common enough that they have their own names, but each style uses certain components. The designer will determine what to include and how to combine it based on the main goal or theme for the landscape. Softscape is any component of a garden that is or used to be alive. Ground covers, bushes and trees are major softscape components. Hardscape refers to items that are permanent and do not break down. It has many uses and comes in forms adapted to those uses. Edgings between plants and grass, walls and fences, walkways and driveways, patios and decking, structures like gazebos, garden benches or other seating, ponds, and pools [4].

### **2.1.2 Garden Bench**

A garden bench is something that encourages people to step outside. When a neighborhood has engaged residents, they support small local businesses. Social cohesion is enhanced, as is the physical and mental health of the population. Park benches are an important site furnishing to consider in a revitalization plan. In a park, a bench is usually placed somewhere with shade, a view, and some level of passing foot traffic. It may be a rest or a destination. At facilities or on the street, they might be placed near amenities, shopping areas, and complexes for people to rest, meet, or wait for transportation. The weight, back, and look may be different in the city than in a forest. Materials may need to be different in harsh environments [5].

A bench is usually placed somewhere with shade, a view, and some level of passing foot traffic. It may be a rest or a destination. At facilities or on the street they might be placed near amenities, shopping, and in plazas for people to rest, meet, or wait for transportation. The weight, back, and look may be different in the city than in a forest. Materials may need to be different in harsh environments. Garden benches may be made of

wood, metal, plastic, concrete or some combination of material. Each offers pros and cons for weight, wear, comfort, and aesthetic [5].

### **2.1.2.1 Types of Garden Benches**

#### **Types of garden benches according to its material**

The material used for the construction of a garden bench says a lot about its durability and strength. The types of garden benches based on the material used for their construction are listed below viz.

- Wooden benches are the best and most popular option for garden seating. They are the most natural and well-blended furniture for the garden. They go perfectly well in the gardens and blend flawlessly with the overall surroundings. They don't look out-of-place. The best quality wood benches are the ones that are made with lumber with center-cut heartwood having consistent grain. Parts of the bench should be screwed with stainless steel or zinc screws. These screws allow tightening easier in case the bench ever goes loose.
- If you think wooden garden benches would not go well with the look you are trying to achieve for your garden, metal garden benches may be an option for you. Before buying the metal garden bench, make sure that the type of metal is able to withstand the harsh weather conditions a garden bench is often exposed to Extruded Aluminum, Cast Aluminum, Retro Metal.
- Rattan garden benches are light-weight, weather-resistant, waterproof, and UV protective. This makes them perfect for outdoors. They are super easy and convenient to clean. Above all, rattan garden benches are comfortable and versatile. Rattan garden benches enhance the look of your garden and make it look stunning and attractive.
- Garden benches made of plastic are cheap, light-weight, durable, maintenance-free, and environmentally friendly. They are mostly unbreakable, waterproof, and available in attractive colors. Above all, they are safe to be used around kids. Plastic

garden benches are one of the most affordable and durable types of garden benches. However, plastic benches may not help you achieve a warm, attractive look for your garden, as they are too casual.

- Concrete garden benches are weather-resistant, durable, decorative, and extremely low-maintenance. Concrete garden benches are available in many designs and can be personalized as per your requirements. A custom-made concrete garden bench will add a touch of personality and meaning to your garden.

### **Types of garden benches according to its style**

- A classic wooden style bench is the straight garden bench. It is extremely appealing to look at and very practical in use. It looks great any garden or a park. These garden benches are available in numerous sizes.
- Curved benches bring about an intimate feel to the garden. There are two types of curved garden benches. In one type, the entire backrest and the armrest are curved while in the other type, just the backrest is curved with straight armrests.
- Backless garden benches can serve multiple purposes. Since they do not have a backrest, they can be placed anywhere in the garden. They can be approached from any side. And the fun part is, they can be used as a table when you are having a party in your garden.
- Reading under a tree can help you feel relaxed and peaceful. Sitting under the shade of a tree and enjoying the cool breeze can help you forget your worries and get lost in the moment. Tree garden benches can make the reading experience under a tree more comfortable and enjoyable. These types of garden benches are specially designed so that the seating is around the trunk of the tree. This way, the tree trunk is in the middle with seating all around it. You can sit comfortably on the bench and enjoy the shade of the tree even during a bright sunny day.

- Storage garden benches are great garden furniture to keep all the garden clutter hidden. Whether it is gardening tools or your child's toys, a storage bench can house it all in while serving the purpose of a bench. It looks like any normal bench. These benches are available in many designs which you can select from as per your liking.
- Memorial benches are a piece of furniture commemorating someone who has died. They can be made from wood, metal, stone, or any other synthetic materials. Memorial benches are usually made of thick wood or a material that is highly durable so that the bench lasts a long time.
- Benches with a back designed in a weaved-style or oval shape look beautiful. They are a stunning piece of furniture that adds a touch of class to any garden. These types of benches can bring the level of your garden up to an all-new level.

#### **2.1.2.2 Designing of Garden Benches**

Comfort is an important factor in designing a bench. But how comfortable a bench needs to be depended on how it will be used. Where people will stop briefly with packages, comfort is important, as in a park or main street where people may spend an entire afternoon. Concern for comfort must be combined with other considerations. Armrests and back support are normal features of benches; these provide assistance to the elderly. Back supports, contoured benches, and armrests provide comfort when sitting and support when getting up and down; these are important design elements, especially in areas where people sit for longer periods of time. Adding armrests in the center of a bench should be considered in cases where it is desirable to prevent people from sleeping on benches. Bench items designed for garden spaces must be constructed of safe materials and designed to prevent injury, without sharp edges or exposed fasteners. When installing bench elements onto existing concrete or asphalt, ensure the fixture and method of installation achieve a solid fix that minimizes the capacity for theft, removal, or damage to the iron benches. They are usually either attached to the ground with

anchor bolts (for example, using surface mounting, to attach a bench to a concrete slab) or embedded in the ground. Naturally, the technique used for mounting should be decided on in advance, so the bench can be made accordingly (Almandrawy, 2016).

The main design considerations are identified under the different items of bench: -

- The benches in gardens of urban spaces should be designed with the needs of the disabled, children, and the elderly in mind, and also to enable triangulation, i.e., they should be linked together to stimulate social encounters and encourage people to talk.
- Bench must be carefully studied and selected or designed to maintain the general character of the town, consider the impact of the bench upon the existing public garden and streetscape character in a broader urban context and then separately within a site-specific context.
- To create an eco-friendly bench which is healthy and comfortable, by having a balance between ecological integrity and economic viability.
- Benches design could affect the overall character of the garden, including variation of treatments and sensitivity and compatibility to architectural conditions.
- If a bench is properly integrated in the design of a public space, it creates an identity and develops a sense of place around it.
- Different types of designs are recommended for differing areas to reinforce the individual character of these areas.
- Bench selection and design should take into account weather effects such as sunlight, expansion and contraction, wind stress, moisture, and in some cases, salt spray and frost. The best designs usually incorporate strong, simple shapes, native materials, and natural finishes, generally in black, grays, and earth tones, accented with bright colors.
- New bench is contemporary and simple in design to reflect the design qualities, materials and architectural era that the bench is

being manufactured in, and to ensure that the bench is readily distinguishable from the bench in.

- Forms Surfaces benches are hard enough to face the challenges of weather and public use, yet refined enough to sit comfortably in gardens.
- The type of iron benches in the garden and its arrangement should take into account visibility and sightlines, lighting, and accessibility issues that may be faced by women, children, the elderly and the disabled. Areas which are unsafe or pose risks should be designed taking these factors into consideration (Almandrawy, 2016).

### **2.1.2.3 Material for Garden Benches**

Park benches may be made of wood, metal, plastic, concrete, or some combination of materials. Each offers pros and cons for weight, wear, comfort, and aesthetic.

#### **Wood benches**

**Aesthetics:** Wooden benches are a good choice for places with a natural aesthetic. Wood offers a classic feel, whether the design is rustic or refined. More rustic benches may be made of thicker planks and left to weather. Classic Park benches are often a combination of metal and wood, with finishes on both components providing protection and contrast.

**Wear:** The natural glow of wood makes it an attractive and classic choice, but it also brings with it the need for more maintenance than inert material types. Hardwoods like oak and ash are usually finished with a UV and weather-resistant sealant that protects while letting the natural beauty of the wood shine through. Yet wood and sealant are both vulnerable to carving, scraping, scratching, and wear. Though hardwoods are quite durable, they will not last the many decades that concrete might.

Comfort: The seat and slats of a wood bench are usually quite comfortable. Even hardwoods have a little give compared to materials like concrete.

Weight: Wood benches tend to have substantial weight, due to both wood and metal components. However, they can be moved if they are not bolted or embedded, and in high-traffic areas they are generally installed in such a permanent manner. This prevents theft and, importantly, accidental movement and tipping in unusual cases, weather, accidents, or people playing on the bench in unforeseen ways.

### **Metal benches**

Aesthetic: Metal may provide structure or design elements to benches made of wood, plastic, or concrete. Cast iron, either gray or ductile, is often featured in design details. Although raw cast iron develops a patina, porous materials like wood or concrete will soak up the iron oxides produced during patination. The resulting red stain is usually undesirable, and so a finish will be applied. Steel, aluminum, or stainless may also be used in a mixed-material bench. Other benches may be entirely made of metal. Steel strap benches are sleek and hardwearing, and are sealed to prevent corrosion. Stainless steel can be finished or left raw since the “stainless” part of stainless steel is its resistance to corrosion. Finished stainless is usually used in high salt environments. Unfinished, stainless soft silver gleam shines through. Aluminum benches can vary from the light silver of bleachers to more textured or painted designs. Most all-metal benches have either a sleek modern look or an industrial/commercial look like bleachers in stadiums.

Wear: Metal benches are generally very long lasting and low maintenance. Iron and steel benches that are powder coated will need an inspection and possible removal for re-finishing should the surface become too scratched. Iron Armor recovery can generally happen in the field. The material properties of metal mean that these stand up very well to the rigors of public use.

Comfort: The comfort of metal benches is variable, depending on the way the metal is made. Metal, like wood, can have given to it, depending on the thickness. Some grating-type benches with small holes may be less comfortable for a long rest than thicker slats benches. Metal transmits heat efficiently, and therefore can get uncomfortably hot or cold if untreated. Sealed metal, with a finish like Iron Armor, will help insulate the bench.

Weight: Steel benches, like wood benches, are heavy but are still often secured. Aluminum benches are lightweight and therefore easier to move and install than heavier metals like steel or cast iron. They are often used in places where they might be moved.

### **Plastic benches**

Aesthetic: Plastic benches have come a long way from early versions that bleached and crumbled in the sun. The most common plastic being used in benches these days is a wood-plastic composite. This innovation offers a more natural look in a plank made of recycled-plastic and wood. UV-protected and wear resistant, these wood alternatives are often used as planks in bench design.

Wear: The durability of plastic depends on the type and manufacture. Some plastic benches made of thin material may deform over time due to heat and use. Thicker plastics (often polycarbonate) lend themselves to a much longer life cycle. Wood-plastic composites in particular are prized for durability. High-quality versions require less upkeep and replacement than wood or inexpensive plastic. Even in composites, however, there can be many factors affecting life-time use. Hollow or sawdust cores may deform over time. Plastic, being soft, is almost as vulnerable as wood to wear over time.

Comfort: Plastic usually has some give and is a reasonable insulator. It will often feel as comfortable as wood, although it may get a little hotter in the sun.

Weight: Plastic benches may be used, like aluminum, in temporary situations where a bench may need to be moved often, due to their lighter heft. However, in the case of composite-wood, they're installed and bolted much like traditional wood benches.

### **Concrete benches**

Aesthetic: Concrete benches are often used in modernist or brutalist architectural settings. They can also be seen as the poured extensions of other site furnishings, as a lip around a water feature or a planting, in plazas and other central places. Concrete can also be used for weight and durability as part of a bench that then uses wood or wood composite as the slats and back. Concrete may be finished to change color or texture, but also can be left raw in the brut style.

Wear: Concrete has a definite advantage when it comes to resistance to wear. It is incredibly durable in all climates and with a variety of uses, and when rebar is reinforced, it will have a very long lifetime. The only time that concrete tends to wear out is when it's used by skateboards: repeated use may wear down the edge.

Comfort: Concrete's high hardness and ability to absorb and store heat may make it less comfortable than the other choices for a long stay or in the sun.

Weight: Where concrete is king is in weight: even without bolting, it is almost impossible to move <sup>[6]</sup>.

#### **2.1.2.4 Market survey for garden Benches**

A market survey was conducted by the researcher for materials that are used in garden benches and a market survey of ready-made garden benches available in different areas of Vadodara city, namely Alkapuri, Raopura, Waghodia, Akota, and Gotri, in November to December 2022.

**Table 1: Market survey of materials for garden benches available in Vadodara City**

Sr. No.	Material	Cost of material
1.	Concrete <sup>[7]</sup>	₹ 400 to ₹ 500 per sq. ft. (Cost vary according to Cement Brand)
2.	Micro - Terrazzo <sup>[7]</sup>	₹ 750 onwards per sq. ft. (Cost vary according to the selection of chips in terrazzo)
3.	Mild Steel <sup>[7]</sup>	₹ 60 onwards for per kg (Cost vary according to company)
4.	B class Galvanized pipe <sup>[7]</sup>	₹ 65 onwards for per kg (Cost vary according to the thickness of the pipe)
5.	304 Grade Stainless steel <sup>[7]</sup>	₹ 550 per kg
6.	202 Grade Stainless steel <sup>[7]</sup>	₹ 450 per kg
7.	Marble <sup>[7]</sup>	₹ 60 per sq. ft and ₹ 30 would be labor charge (Cost vary according to its quality and ₹ 30 would be labor charge)
8.	Granite <sup>[7]</sup>	₹ 80 onwards for per sq. ft (Cost vary according to its quality and ₹ 35 to ₹ 40 would be labor charge)
9.	Jodhpuri Stone <sup>[7]</sup>	₹ 100 per sq. ft. (₹ 35 would be labor charge)
10.	Waterproof Plywood <sup>[7]</sup>	₹ 75 per sq. ft. (Cost vary according to the thickness of the plywood and its Brand)
11.	Veneer <sup>[7]</sup>	₹ 50 to ₹ 110 per sq. ft. (Cost vary according to the thickness of the veneer and its Brand)

**Table 2: Market survey of ready-made Garden Benches available in Vadodara City**

Sr. No.	Picture of ready-made Garden Benches	About Garden Benches	Cost of ready-made Garden Benches
1.	 <p>Plate 1: Garden Bench type - 1 *Source - 1</p>	<p><b>Seating Capacity:</b> 3-Seater, <b>Material:</b> RCC <b>Bench Type:</b> With Backrest, Name plate And with different colour option</p>	Rs 3250 per piece
2.	 <p>Plate 2: Garden Bench type - 2 *Source - 1</p>	<p><b>Seating Capacity:</b> 3-Seater, <b>Material:</b> RCC <b>Bench Type:</b> With Backrest And with different colour option</p>	Rs 3500 per piece
3.	 <p>Plate 3: Garden Bench type – 3 *Source - 2</p>	<p><b>Seating Capacity:</b> 3-Seater, <b>Material:</b> RCC <b>Bench Type:</b> Without Backrest</p>	Rs 2000 per piece

		And with different colour option	
4.	 <p>Plate 4: Garden Bench type - 4 *Source - 1</p>	<b>Seating Capacity:</b> 3-Seater, <b>Material:</b> RCC <b>Bench Type:</b> With Big Backrest And with different colour option	Rs 3500 per piece
5.	 <p>Plate 5: Garden Bench type – 5 *Source - 1</p>	<b>Seating Capacity:</b> 3-Seater, <b>Material:</b> RCC <b>Bench Type:</b> With Backrest, Armrest And with different colour option	Rs 4500 per piece
6.	 <p>Plate 6: Garden Bench type – 6</p>	<b>Seating Capacity:</b> 3-Seater, <b>Material:</b> RCC <b>Bench Type:</b> With Backrest And with different colour option	Rs 3000 per piece

	*Source - 1		
7.	 <p>Plate 7: Garden Bench type – 7 *Source - 2</p>	<p><b>Seating Capacity:</b> 3-Seater, <b>Material:</b> GI <b>Bench Type:</b> With Backrest And with different colour option</p>	Rs 12000 per piece
8.	 <p>Plate 8: Garden Bench type – 8 *Source - 2</p>	<p><b>Seating Capacity:</b> 3-Seater, <b>Material:</b> Recycled Plastic waste <b>Bench Type:</b> With Backrest And with different colour option</p>	Rs 8500 per piece

\*Source – 1 (Manufacturer Jay ambe pipe factory) \*Source – 2 (Manufacturer concrete arts India)

## 2.2 Related Researches

### 2.2.1 Researches Conducted Outside India

A study on “Street furniture concept in Pasar Buah and Bukit Gundaling based on place identity” was conducted by **Ginting et al. (2018)**. This study aimed to design the concept of the Street furniture planning in Pasar Buah and Bukit Gundaling. The method used was a qualitative method, which was to design street furniture using five group elements of street furniture: decorative element, service furniture, trade furniture, signaling furniture, and advertisement furniture. The result of this study was the concept of the design of street furniture, the five elements of street furniture in the location of tourism objects must be reorganized for the development and arrangement of tourism objects in Karo District. The arrangement of elements of street Furniture on the location of attractions in Karo Regency was expected to support the increase of tourism and also the Economy in Karo District.

**Jaramillo et al. (2018)** conducted a study on “Street furniture in recycled and re-signified materials”. The study aimed to giving new life to these materials, generating technological, economic, environmental and sustainable solutions in the creation of sustainable street furniture, that allows propagating changes to the social dynamics of consumerism, which permeates the reality of Ocaña, generating new technologies in the manufacturing of street furniture, thus contributing to social and technologic innovation with the transfer of scientific-technical knowledge. The research was divided into four stages. The first stage consisted of a sector analysis to establish the percentage of waste coming mainly from the industrial sector, mostly cardboard tubes. In the second stage, a material characterization was carried out, to establish conditions of absorption, resistance and deformability. The furniture design was the third stage, proposing different models based on guidelines such as resistance, ergonomics, comfort and efficiency. And, in the fourth and last stage, laboratory tests were carried out on the different models, mainly evaluating resistance and wear to define the final furniture models.

A study was conducted by **Ghonaimy (2019)** on “Street Furniture Influence in Revitalizing the Bahraini Identity”. The study analyzed the street furniture condition and focused on the act of street furniture role in revitalizing Bahraini identity in such an area and the research draws the point of revitalizing the sense of belonging for the residences, which will positively influence the open spaces’ conditions and the visual quality. The results of the study revealed that the use of street furniture was one of the significant branches to transfer the feeling of belonging in their daily lives within heritage intimate spaces while practicing the daily activities. Landscape architecture elements contribute to the development of the country's cultural data. In addition to what the identity adds to the simplicity and significant meanings of the people who live in Bahrain.

**Rachmayanti et al. (2019)** conducted a study on “Analysis of Design Applications in Public Street Furniture in Bandung”. The objectives of the study were to analyze the appropriate application of street furniture and integrate in accordance with the capacity of the city as a world design city and to examine the existence of street furniture at Bandung strategic points in its context as City of Design by taking visual research methods. The result of the study revealed that Bandung has various theme parks, iconic streetscapes and communal spaces, but they do not have many variations on seating facility design. Some had their own thematic design following its location theme, but most of it was quite general with classic designed chairs. This tendency demonstrates that, while street furniture should be an outstanding design complementing its location theme, it does not appear as one unity, particularly in areas with a playful design but equipped with old school chair designs that do not really go well with the overall design.

A study conducted on “Sustainable Street Furniture” by **Allameh & Heidari (2020)**. The aim of the research was to focus on street furniture for adopting the concept of sustainability through the local cities. An experiment which was conducted at Art University of Isfahan (AUI) in order to explore the promises and challenges of designing for deep sustainability within different contexts of the city (Isfahan). The study

reveals that the sustainable street furniture can effectively act as a facilitator to sensate people on serious social and environmental problems, make them thinking on these issues, even influence on people behaviour by promoting sustainable behaviour. While the developed design interventions of the conducted experiment tried to have the least environmental effects, their focal point was to have a multi-layered design; meaning that they aimed to address the existing needs of a city life in an expressive manner.

**Panevski & Kanevce (2020)** conducted a study on “The Quality of Wooden Material in Outdoor Furniture”. The objective of the study was to analyse the quality of wooden material in outdoor furniture and exterior furniture and urban equipment or a garden set, were designed. By analysing this type of furniture and its needs from anthropometrical point of view, there comes the need for design of several different pieces of furniture, including: chair, armchair, stool, two-person bench, 3-person bench, rectangular table, square table, swing and matching flower pots. The results of the study revealed that the device that could provide practicability and convenience to humans’ daily lives. From design and aesthetic aspect, the challenge to maintain the stable structure and function with small material waste exists in both design areas. Thus, furniture and product design can be treated as a type of “mini architecture”. As Outdoor furniture or Green Architecture design, furniture and product design can also achieve sustainability with structure innovation, space flexibility and material saving.

**Zvonareva et al. (2020)** conducted a study on “A new approach to the design of street furniture in Krasnoyarsk”. The purpose of the study was to shape the image of the urban environment for outdoor furniture located in central of the city of Krasnoyarsk. The data was collected through internet survey in the social network. The result of the study concludes that the problem of a competent approach to the design of outdoor furniture objects was increasing its relevance. Town planning departments were interested in the selection of high-quality samples of outdoor furniture, designed as a result of an integrated approach, which takes into

account the colour texture solutions of materials, laws of rational composition and technology. They choose furniture that provides conditions for a healthy, comfortable, convenient life, both for an individual and for all residents of the city of Krasnoyarsk.

A study was conducted by **Alkaisi et al. (2021)** on “The Role of Healing Gardens in the Landscape Sustainability for Public Gardens.” The study aims to identify that healing gardens have a role in the landscape sustainability for public gardens. This study was based on descriptive analytical for public garden samples, which applied the design principles and elements of healing gardens (accessibility, Sense of control, Flexibility, etc.). Finding showed that healing gardens effectively contribute achieving landscape sustainability for public garden through the use of natural materials, the cultivation of local plants, consistent with the local climate, and enhancing social interaction and sensory interaction with the landscape.

The study was conducted on study on “The Influence of Urban Landscaping on Residents' Quality of Life” by **Chen & Lei (2021)**. The objective of the study was to finds that urban landscaping level will directly affect residents' quality of life and the relationship between ecological environment and quality of life by comparing the objective total index of urban quality of life with the data of green coverage rate in buildup areas. The quality of life in 35 cities was tracked in 2018. The result of the study concluded that the government should pay more attention to the needs of residents and attach importance to residents' feedback and opinions on social development and it plays a positive role in improving the urban ecological environment, constructing a harmonious society and improving the living quality of urban residents.

**Cimino et al. (2021)** conducted study on “Made in the shade: A qualitative study of factors impacting shade provision at outdoor public parks.” The research was aimed to gain in-depth understanding of the factors impacting shade provision at public parks. A total sample of 14 individuals were recruited and interviewed for this study. For this study snowball

sampling technique was used. The results suggested that Budget was an especially important factor for shade provision because shade items and their maintenance realities were often expensive. Ensuring enough budget was allocated towards shade may increase the opportunity for it to be included in parks.

A study conducted on “Pouring Concrete Benches for the Amphitheatre at SLO Botanical Garden” by **Gitchell (2021)**. The research was aimed to assess the logistics and construction processes for the construction of ten concrete benches for a new amphitheatre area at the San Luis Obispo Botanical Garden and these benches was provided stadium-style seating for around forty guests that the botanical garden staff can utilize for special events, tours and outdoor classes. It was found that the poured all ten benches in one day with no formwork fail, with only a small amount of concrete surplus.

**Kango et al. (2021)** conducted research on “Design and Implementation of smart Bench Integrated solar cell for public electricity saving”. The purpose of the study was to design bench furniture power by solar cells as a source of electrical energy for electronic features, namely LED light and USB ports embedded with bench objects and to focus on the fabrication of solar-powered park benches using solar charger control with the help of a maximum power point tracking system at an optimal cost designed for implementation in an outdoor environment. The results revealed that the primary needed to design and implement an intelligent bench, an integrated solar bench as a source of electrical energy for USB station chargers depends on the percentage of batteries supplied from the solar cell. The load of LED lights and USB station chargers depends on the percentage of batteries supplies from the solar cell.

**Liu (2021)** carried a case study on “Research on Environmental Protection Factors of Landscape Design in Garden Greening.” This study aims to improve the urban ecological environment and enhance the image of the city and the construction of landscaping projects must fully consider the project benefits and incorporate the low-carbon concept. The study

was conducted through field investigation. The finding of the study revealed that the concept of low-carbon environmental protection has been well reflected in the construction of gardens and landscapes. It can effectively reduce energy consumption, reduce urban heat island effect, realize water recycling, and protect the ecological environment. It plays a vital role in the construction of ecological cities.

**Morika and Ratum (2021)** conducted study the on “Review on outdoor furniture in time of pandemic Covid-19: A case of Ir. H. Juanda road, Bandung.” The contextual approach method was used as the basis for researching pedestrian activities in the pedestrian area along Ir.H. Juanda Road, Bandung, to find out design criteria for sitting facilities to adjust human behavior in times of pandemic. The result of the study explained that the elements in public space, has an important function in the form of non-verbal communication between humans. Furniture design with new criteria can be adapted to this post-pandemic condition to meet new human needs to stay healthy in times of coronavirus outbreaks.

**Rout & Galpern (2021)** had conducted the study on “Benches, fountains and trees: Using mixed-methods with questionnaire and smartphone data to design urban green spaces.” The objective of this study was to track how people use green spaces and understanding how design features impart their behaviors. The data was collected through Questionnaire with 362 students with random sampling technique. The study found that students responding to a questionnaire reported using locations near features in greenspaces differently than were recorded in a separate set of smartphone data. Also found that some features that were reported by students to help create a sense of wellbeing, were not regularly used. Therefore, researcher recommend that future researchers compare both tracking and questionnaire data when evaluating design features in green spaces.

The study on “Preliminary study on innovative design of bamboo furniture based on users’ big data” was conducted by **Sun and Shao (2021)**. The study aims to analyze the future development trend of bamboo furniture

and user portrait. The study was mainly coming from Baidu index and web page data crawled by Python web spider. The study found that the perspective of the development trend, the design of bamboo furniture will develop to an intelligent direction and the main style of bamboo furniture market was simple modern, European, pastoral style, the main structure type was woven structure; the users' attention mainly focuses on the attribute, height scale, folding adjustable and comfort of bamboo furniture.

A study was conducted by **Volenec et al., (2021)** on "Public parks and the pandemic: How Park usage has been affected by COVID-19 policies." The objective of the study was to examine whether park visitation increased when the COVID-19 pandemic began and whether park shutdown orders were effective at deterring park usage. analyzed the visitation patterns in 98 parks within this substantial park network. The finding revealed that public parks continue to serve a crucial role as recreational spaces and health resources during the COVID-19 pandemic, particularly in circumstances where recreational opportunities were limited.

The study was conducted on "Opportunities for Wonder in a Public Park" by **Butler (2022)**. The aimed- of this study was not to directly link childhood experiences to environmental action, but rather to discover whether such positive experiences were even possible in this setting. This study was based on a questionnaire completed by purposive sampling technique. A total of 13 surveys were received, 5 from Hostos Community College and 8 from Bronx Community College, including 1 survey taken in Spanish. The study found that the conveniences and constraints of modern life can lead to a growing disconnection with the natural world. Moreover, there was a growing recognition that children need unstructured time to play, to test themselves and to find their bearings in the world. Nature provides endless opportunities for this discovery, but for some city dwellers their accessible greenery takes the form of a landscaped public park.

A study was conducted by **Zhang et al., (2022)** on "Social Interaction in Public Spaces and Well-Being among Elderly Women: Towards Age-

Friendly Urban Environments.” The objective of the study was to identify the qualities of urban space which facilitate health improving social interaction for elderly woman. A case study was conducted in Beijing, field investigation, mapping and qualitative and quantitative analysis was undertaken. The survey was carried out in April 2021 and concerned 240 women of aged 55–75 years. The finding revealed that the social interactions of older women relate to both their physical and psychological situations. Moreover, Public spaces can positively impact the psychological well-being and social participation of elderly women. This research argues that general public space shaping guidelines and standards cannot fully incorporate the social interaction requirements of elderly women.

The study was conducted by **Zhdanova et al., (2022)** on “Principles of the Inclusion Green Spaces in the Public Area of a Residential Building.” The purpose of this study was to explore Principles of the Inclusion Green Spaces in the Public Area of a Residential Building. The results revealed that the design and construction of residential buildings with the inclusion of green spaces, taking into account the principles, was a promising direction. Moreover, modern reality has forced us to look at housing from a different point of view, as a place that should not only have a beneficial effect on the psychological state of a person, create conditions for social interaction, but also provide improved consumer qualities in the environmental and aesthetic aspects.

### **2.2.2 Researches conducted within India**

The study was conducted on “Japanese Garden: A Design Project for a Terrace of a Selected Residence and a Common Plot of a Residential Colony” by **Shah (2005)**. The objectives of the study were to gather information about the gardening space been utilized and to find out the opinion of home makers regarding landscaping gardening. The study was based on interviews conducted with 60 homemakers of Baroda city owning a garden were selected purposely. The finding revealed that a higher percentage of the respondent had developed Indian garden, the

grass was the common garden component present in the garden they were found using their garden mostly for relaxation purpose. The care and maintenance were also mostly taken care by the respondents and their family members.

**Chonkar (2013)** conducted study on “Designing terrace garden for commercial building in Vadodara city”. The objective of the study was to analyze the gathered background data and information regarding specific features of selected terrace gardens at commercial buildings, to gather and to analyze the extent of problems faced and extent of satisfaction experienced by the users (respondents) regarding selected terrace gardens and to propose a design for terrace garden of a commercial building with plan and cost estimation. The data was collected by questionnaire, interview schedule and observation sheet. The finding revealed that the employers of the terrace garden were satisfied with the existing designs of the terrace garden to moderate and high extent. Though the number of trees, shrubs and plants were not more in quantity in any of the cases, the presence of lawn was most liked by aspect of the terrace garden.

A study was conducted by **Pavasiya (2014)** on “Designing a Vertical Garden for a Residential area”. The objective of the study were to assess the awareness of the home owner’s architects and interior designer’s regarding the concept of vertical garden, to find out the extent of problems experienced by the home owners of the vertical garden, to propose a design of a residential vertical garden and to prepare an educational package (booklet) for enhancing the knowledge regarding the vertical garden. Purposive sampling technique was used to select respondents for the study. The major conclusion drawn for the study was that the homeowners and interior designers had high extent of awareness regarding vertical garden and the architects were having moderate extent of awareness regarding vertical garden. Regarding problems experienced it was found that majority of the homeowners experienced moderate extent of problems in using vertical garden and few of them experienced high extent of problem in using vertical garden.

A study conducted on “Design and Analysis of Convertible Bench” by **Ganapathi et al. (2017)**. The aim of this study was to identify the innovation designs, designed using 3D Design software and analyses the capabilities and boundaries of the particular furniture designed the hard wares, the application and future development, cost and price, and the important markets of transformable space saving furniture. The results revealed that Transformable space saving Product was an innovative product that has much opportunity for future development, and a huge potential market in metropolises. The designs of transformable table can be even more variable than those of the above 2 designs have been designed and analyzed to its potential from the finite element analysis the Stress and Strain acting on both the models in both the positions were acting minimally and tends to possess more life.

The study was conducted by **Patki (2017)** on “Relationship between Street Furniture in Pune and User’s Convenience”. The study aimed to identify and classify the different elements of street furniture according to its use and to study the elements with respect to scale, style, color, robustness, sitting. The data was collected through questionnaire with time sampling technique. The areas chosen were such that there was more public interaction and which were subjected to heavy pedestrian flow. The study found that the ordered and well-maintained streets were an expression of a confident and caring community. The finest townscapes often have the minimum amount of street furniture. That which was essential was sited carefully to reinforce an underlying sense of visual order. Pedestrianization schemes should reinforce those qualities which make an area special and not create sterile precincts cluttered with street furniture.

**Gokhale (2019)** conducted a study on “Revitalizing Urban Streets as an Identity of Interactive Public Place.” The aim of the research was to identifies the issues concerning the physical and visual attributes of urban street spaces and relation with human comfort and street’s identity as interactive public place. the analysis of existing sidewalk environment of M.G. Road field observation survey of one kilometer stretch was under

taken and the survey of both the sides of street were mapped and recorded in the form of detailed drawings and descriptive format. The results revealed that 'Street Evaluation Model' served as a pioneer tool for evaluating existing physical conditions of the street environment, qualitatively and quantitatively, based on which human comfort index and place identity index was derived and the indices of human comfort and place identity analysis will also contribute in planning, design and operation of street elements and conducting sensitivity analysis which can assess the effect of change in the physical attributes on identity scenario of the overall street environment, human comfort level and thereby on sense of place and tackling the impact of globalization, revitalization was considered as the most resilience approach. Place Identity Index and Human Comfort Index were the indices that can be applied in analysis of urban revitalization parameters.

The study was conducted by **Solanki (2019)** on "Street Furniture is Important for Attracting City and Public Spaces." The aims of this study were to propose the design strategy integrated of the street furniture given the correlation between the city image and the street furniture, and describes important role that the street furniture plays in city image construction. Comparative study was under taken at Chappan Dukan, Indore. The finding revealed that public spaces mirror the complexities of urban societies: as historic social bonds have weakened and cities have become collections of individuals public open spaces have also changed from being embedded in the social fabric of the city to being a part of more impersonal and fragmented urban environments.

A study conducted on "Precast Bamboo Reinforced Furniture Elements using Self Compacting Concrete" by **Anusha et al. (2020)**. The aims of the research were to check the viability of using an eco-friendly composite as street furniture, i.e., Park Bench. Additionally, owing to the increasing negative impact steel manufacturing has on the environment, the furniture was designed using a Bamboo-SCC composite. The study found that concrete furniture elements can be made using bamboo as a reinforcement and SCC ensures the stability of the reinforcement as there

was no vibration required to consolidate the concrete. The permeability of SCC was low, and GGBS as part replacement of cement provides more resistance against chemical attacks moreover, treated bamboo ensures longer life. Precast slabs ensure consistency in quality and reduce errors in design and indicates that it can take a load much greater than the design load without significant deflection. The load-carrying capacity of the bench was almost two and a half times of the design load. Based on the cost analysis, the precast concrete bench prepared using bamboo reinforcement was 18% low-cost than the bench made using steel reinforcement.

**Gopinath et al. (2021)** conducted a study on “Advanced Time-Based System for Public Garden.” The objective of the study was to help to overcome all the problems like wastage of electricity, water wastage in public garden. The findings of the study revealed that an advantage of this system was very simple, more competent and low cost. Using this system, the farmers can be able to utilize the available resources efficiently without wasting of resources. This system gives the accurate condition as per the requirement of authorities of garden. The user can also feed the input by GSM and on that basis; particular condition will turn on for defined time period. This system can be implemented for any field like home garden automation, In restaurant, public garden and college garden etc.

## **Conclusion**

On the basis of the extensive review of literature, it was evident that researches conducted outside India focused mostly on social interaction in public space, principle of the inclusion green spaces, impact of shade provision at outdoor public parks, innovative design of bamboo furniture, public parks and pandemic, outdoor furniture in time of pandemic, design and implementation of smart bench integrated solar cell.

However, the related researches carried out in India focused on urban streets furniture, relation between street furniture and user’s convenience, design and analysis of garden bench, time-based system for public garden, furniture elements using self-compacting concrete, street furniture and its importance

were reported. There was dearth of researches on design of Garden Benches for Public Gardens in India, in the recent times. The researches related to Problem faced while using garden bench and it's designing, considering its comfort were hard to find in India as well as outside India. Therefore, the researcher was interested in undertaking present research.

# METHODOLOGY



## **CHAPTER III**

### **METHODOLOGY**

The research design, sample size, sampling procedure, tool for data collection and operational definitions of the study are briefly explained in this chapter. The present study aimed to develop a design for a garden bench for the public gardens of Vadodara City. The present chapter was subdivided into the following sections:

3.1. Research Design

3.2. Operational Definitions

3.3. Locale of the study

3.4. Unity of Inquiry

3.5. Sampling Size and Sampling Procedure

3.6. Development and Description of the tool

3.7. Data Collection

3.8. Data Analysis

3.9. Design Development

### **3.1. Research Design**

A descriptive research design was implemented in the present research. The study gathered information about problems experienced by the respondents while using the garden bench and observed different aspects of the existing garden bench for the purpose of developing a new garden bench design.

### **3.2. Operational Definitions**

The operational definitions for the present study were as follows:

#### **3.2.1. Public Garden**

For the present study, a public garden was operationally defined as a garden which was managed by Parks and Garden Office of Vadodara Municipal Corporation (VMC), Vadodara city.

#### **3.2.2. Garden Bench**

For the present study, garden bench was operationally defined as a bench that was installed by the Parks and Garden Office of Vadodara Municipal Corporation (VMC), Vadodara city.

### **3.3. Locale of the study**

The locale for the present study was Vadodara, Gujarat, India. The following public gardens were selected:

- Harni Sculpture Park, Harni (East Zone Vadodara)
- Khodiyar Nagar Lake, Khodiyar (East Zone Vadodara)
- Gotri Lake Garden, Gotri (West Zone Vadodara)
- Bapod Lake, Bapod (East Zone Vadodara)
- Mahavir Udyan, Manjalpur (South Zone Vadodara)

### **3.4. Unity of Inquiry**

The unit of inquiry for the present study was 150 users of selected public gardens of Vadodara city.

### **3.5. Sampling Size and Sampling Procedure**

Purposive sampling technique was used for the present study. The sample size for the current investigation was 150 users of selected public gardens of Vadodara city. Interview of the respondents was taken while they visited the public gardens.

**3.5.1. Inclusion Criteria:** The following respondents were included in the study:

- Respondents who had given consent to participate in this study.
- Respondents who were using public gardens for the past 3 months.
- Respondents above the age of 18 years.

**3.5.2. Exclusion Criteria:** The following respondents were excluded from the study:

- Respondents who had not given consent to participate in this study.
- Respondents below the age of 18 years.
- Individuals who did not use the garden bench during visits to public gardens.

### **3.6. Selection, Development and Description of the tools**

The present study used two tools for data collection, an interview schedule and an observation sheet.

#### **3.6.1. Selection of the Tools**

Based on the objectives set for the current research, two tools were developed. An interview schedule was developed to identify the problems experienced by the respondents while using garden benches of selected public gardens of Vadodara city. An observation sheet was prepared to observe various aspects of the garden bench installed by the Parks and Garden Office, Vadodara Municipal Corporation (VMC) of Vadodara city.

### **3.6.2. Development of the tools**

Based on the information collected through a review of related literature, interaction and guidance of the experts and personal observation, tools were developed. Due consideration was given to include all points that would elicit the information needed to attain the objectives of the study.

### **3.6.3 Description of the tool**

The various sections of the tool developed for the study were described in detail as follows:

**3.6.3.1. Interview schedule for respondents:** The interview schedule comprised of two sections, which were as follows:

**Section I – Background information of the respondents:** The section collected personal and situational information about the respondent, which were age (in years), height, weight, frequency of visit to the public garden, duration of time spent in public garden, preferable time for them to visit the public garden.

**Section II - Problems experienced by the respondents while using garden benches of selected public gardens:** This section gathered information regarding problems experienced by the respondent while using public gardens. The factors that considered were comfort in using the garden bench, dimension of the garden bench, impact on human body and aesthetic appeal of the garden bench.

**3.6.3.2. Observation Sheet:** It included the observation of different aspects of the existing garden bench. The components of garden bench observed were its dimensions, comfort and aesthetics.

### **3.6.4. Establishment of Content Validity**

The tools prepared by the researcher for the present study were given to the panel of 17 judges from the Department of Family and Community Resource Management, Faculty of Family and Community Sciences. They were requested to check the clarity and relevance of the content. They were also asked to give suggestions to improve the tools. Judges'

opinions were taken into consideration and all grammatical changes were incorporated in the tools.

### **3.7. Data Collection**

Data was collected personally by interviewing the respondents to know the problem experienced by them who were using Garden Bench installed by the park and Garden Office, Vadodara Municipal Corporation (VMC) of Vadodara city. Consent was taken from the respondents and only the respondents who gave their consent in “Yes” was taken into consideration.

### **3.8. Data Analysis**

The data was analyzed by calculating frequency and percentage.

**Descriptive Statistics:** The data were presented in frequencies and percentages.

#### **3.8.1. Categorization of Data**

The following categories were made to enable the researcher to analyze the data.

##### **I. Age of the respondents (in years):**

- 18-37 Years
- 38-57 Years
- 58-77 Years

##### **II. Gender**

- Male
- Female

##### **III. Height of the respondents (in cm):**

- 135-154
- 155-174
- 175-194

##### **IV. Weight of the respondents (in kg):**

- 43-57
- 58-72
- 73-87

**V. Number of days in a week visited by the respondents in Public Garden**

- Daily
- One day
- Two days
- Three days
- Four days
- Five days
- Six days

**VI. Most preferred time of the day for respondents to visit Public Garden**

- Evening Time
- Morning Time
- Both Times of the Day

**VII. Hours spend by the respondents in Public Garden**

- Less than 2 hours
- More than 2 Hours

**VIII. Extent of problems experienced regarding the garden bench by the respondents**

This section dealt with the extend of problem experienced by the respondents while using the garden bench in public gardens.

**Table 3: Extent of problems experienced regarding the garden bench by the respondents**

<b>Sr. No.</b>	<b>Extent of problems experienced regarding the garden bench</b>	<b>Range Scores</b>
<b>1.</b>	<b>Comfort of the garden bench</b>	
	High Extent	29-36
	Moderate Extent	20-28
	Low Extent	12-19
<b>2.</b>	<b>Dimensions of the garden bench</b>	

	High Extent	15-18
	Moderate Extent	10-14
	Low Extent	6-9
<b>3.</b>	<b>Material of the garden bench</b>	
	High Extent	15-18
	Moderate Extent	10-14
	Low Extent	6-9

The scale consisted of 25 statements related to problem regarding garden bench. The scores of 3 to 1 were ascribed to each of the statements which depicted the extent of the problem. The problem regarding comfort of the garden bench, score ranged from 12 to 36, the problem regarding dimensions of the garden bench, score ranged from 6 to 18, The problem regarding material of the garden bench, score ranged from 6 to 18. Minimum and maximum possible scored divided into 3 categories on the basis of equal interval which were “high extent”, “moderate extent” and “low extend”.

### 3.9 Design Development

The problems experienced by public garden users were gathered through an interview schedule and the existing garden bench was studied through an observation schedule. The proposed designs included two-dimensional drawings made with the support of AutoCAD software version 2021, three-dimensional representation was done using Google Sketch Up version 2022 and render was done using Lumion 10.0 software. The new designs of a garden benches were represented through plan, elevation and 3D representation. The details of material and estimated cost (approximate) as per the prevailing market rates in November to December 2022 were also included.

## FINDINGS AND DISCUSSION



## CHAPTER – IV

### FINDINGS AND DISCUSSION

The aim of the present study was to identify the problems experienced by the respondents while using garden benches of selected public gardens of Vadodara city, to observe different aspects of the garden bench installed by the Parks and Gardens Office, Vadodara Municipal Corporation (VMC) of Vadodara city and to propose garden bench designs for public gardens of Vadodara city. This chapter dealt with presenting, interpreting and discussing the findings obtained through the analysis of the data collected through interview and observation. The results were presented in the following sub sections:

**Section I:** Background Information of the respondents

**Section II:** Problems experienced by the respondents while using garden bench

**Section III:** Observation of various aspects of the garden bench installed by Parks and Garden Office Vadodara Municipal Corporation (VMC)

**Section IV:** Proposed garden bench designs for public gardens

## Section I

### 4.1. Background Information of the respondents

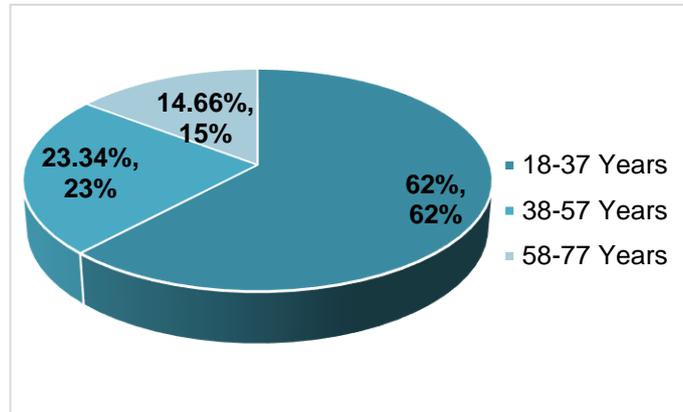
This section covers information with reference to the demographic data of the respondents. It includes personal information, the number of days in a week visited by the respondents, the most preferable time for respondents to visit and the hours spent in public gardens by the respondents.

**4.1.1. Personal Information of the Respondents:** This section contains data regarding age (in years), gender, weight (in Kg), height (in cm).

**Table 4: Distribution of the respondents according to their personal information**

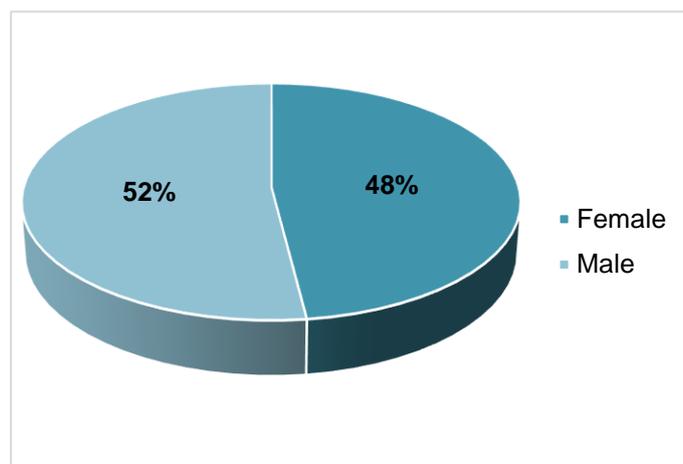
(n=150)			
Sr. No	Personal information of the respondent		
<b>1.</b>	<b>Age in Years</b>	<b>f</b>	<b>%</b>
	18-37	93	62.00
	38-57	35	23.34
	58-77	22	14.66
<b>Mean</b>			37.65
<b>SD</b>			16.77
<b>2.</b>	<b>Gender</b>	<b>f</b>	<b>%</b>
	Male	78	52.00
	Female	72	48.00
<b>3.</b>	<b>Height in cm</b>	<b>f</b>	<b>%</b>
	135-154	31	20.67
	155-174	97	64.67
	175-194	22	14.66
<b>Mean</b>			162.73
<b>SD</b>			10.83
<b>4.</b>	<b>Weight in Kg</b>	<b>f</b>	<b>%</b>
	43-57	40	26.67
	58-72	83	55.33

	73-87	27	18.00
		<b>Mean</b>	63.92
		<b>SD</b>	09.88



**Figure 1: Percentage distribution of the respondents according to their personal information**

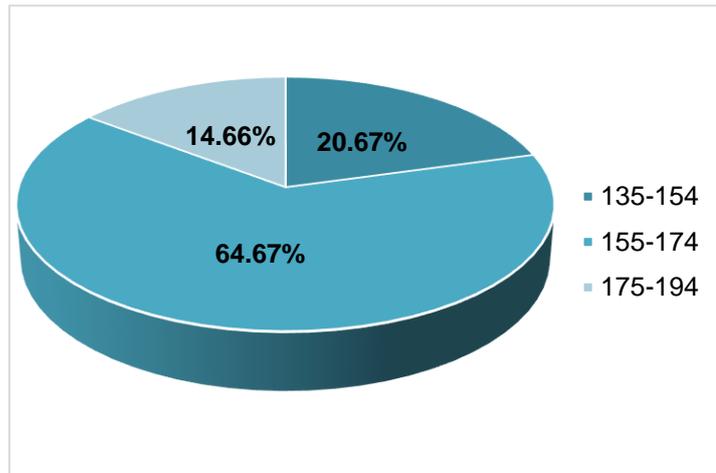
**Age of the respondents (in Years):** The data in **Table 4** and **Fig. 1** reveal that the mean age of the respondents was 37.65 years and SD was 16.77 years and less than two-third (62.00 per cent) of the respondents belong to age groups of 18-37 years. Less than one-fourth (23.34 per cent) of the respondents belonged to the age group of 38-57 years and more than one-tenth (14.66 per cent) of the respondents belonged to the age group of 58-77 years.



**Figure 2: Percentage distribution of the respondents according to their gender**

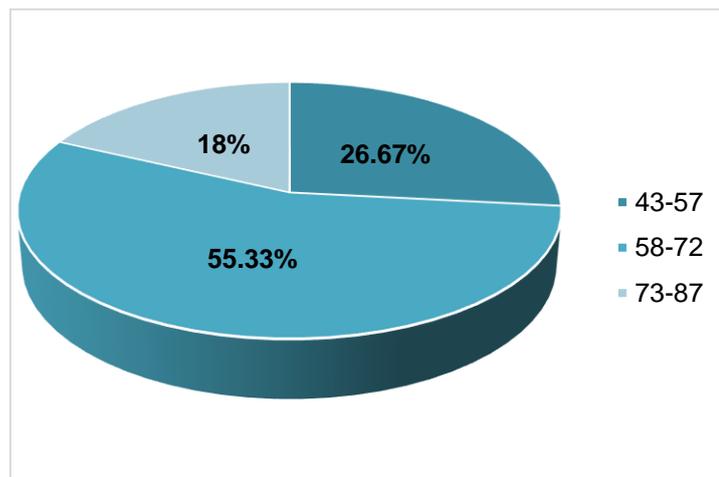
**Gender of the respondents:** The data in **Table 4** and **Fig. 2** reveal that more than one-half (52.00 per cent) of the respondents were female and

more than one-third (48.00 per cent) of the respondents were male.



**Figure 3: Percentage distribution of the respondents according to their height**

**Height of the respondents (in cm):** The data in **Table 4** and **Fig. 3** reveals that less than one-fourth (20.67 per cent) of the respondents belonged to the height category of 135-154 cm. Less than two-third (64.67 per cent) of the respondents belonged to the height category of 155-174 cm and more than one-tenth (14.66 per cent) of the respondents belonged to the height category of 175-194 cm. The mean height of the respondents was 162.73 cm.



**Figure 4: Percentage distribution of the respondents according to their weight**

**Weight of the respondents (in kg):** The data in **Table 4** and **Fig. 4** reveals

that more than one-fourth (26.67 per cent) of the respondents fell into the weight range of 43 - 57 kg. More than half (55.33 per cent) of the respondents fell into the weight range of 58-72 kg and more than one-tenth (18.00 per cent) of the respondents fell into the weight range of 73-87 kg. The mean weight of the respondents was 63.92 kg.

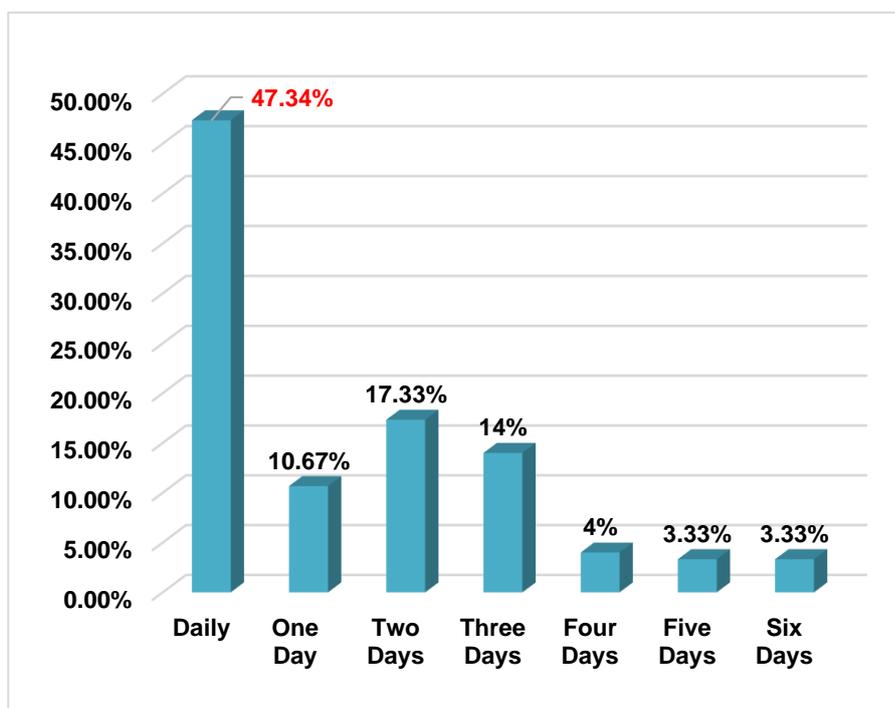
**Table 5: Distribution of the respondents according to their number of days in a week the respondents visited the public garden**

**(n=150)**

<b>Sr. No.</b>	<b>Number of days in a week the respondents visited the public garden</b>	<b>f</b>	<b>%</b>
1.	Daily	71	47.34
2.	One Day	16	10.67
3.	Two Days	26	17.33
4.	Three Days	21	14.00
5.	Four Days	6	04.00
6.	Five Days	5	03.33
7.	Six Days	5	03.33

**4.2. Number of days in a week the respondents visited the public garden:**

The data in **Table 5** and **Fig.5** reveals that less than one-half (47.34 per cent) of the respondents were visiting public garden daily, more than one-tenth (10.67 per cent) of the respondents were visiting the public garden for one day, more than one-tenth (17.33 per cent) of the respondents were visiting the public garden for two days, more than one-tenth (14.00 per cent) of the respondents were visiting the public garden for three days, less than one-tenth (04.00 per cent) of the respondents were visiting the public garden for four days and less than one-tenth (03.33 per cent) of the respondents were visiting the public garden for five as well as six days in a week.



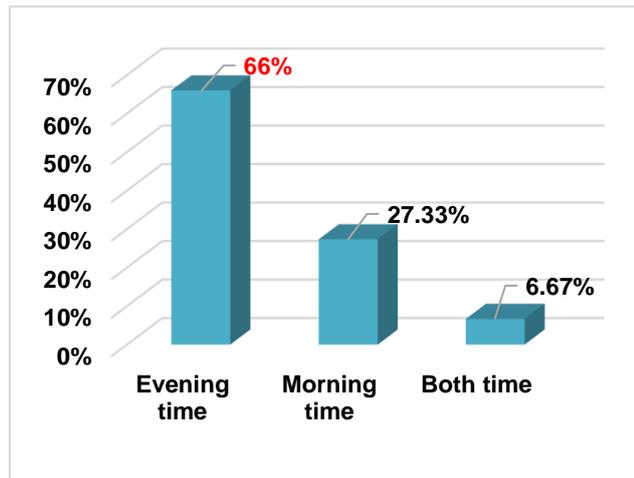
**Figure 5: Percentage distribution of the respondents according to their number of days in week the respondents visited the public garden**

**Table 6: Distribution of the respondents according to their preferred time to visit the public garden for the respondents**

**(n=150)**

Sr. No.	Preferred time to visit the public garden for the respondents	f	%
1.	Evening Time	99	66.00
2.	Morning Time	41	27.33
3.	Both Times of the Day	10	06.67

**4.3. Preferred time to visit the public garden for the respondents:** The data presented in **Table 6** and **Fig.6** reveals that two-third (66.00 per cent) of the respondents visited the public garden in the evening, more than one-fourth (27.33 per cent) of the respondents visited the public garden in the morning time and less than one-tenth (06.67 per cent) of the respondents visited the public garden at both times of the day.

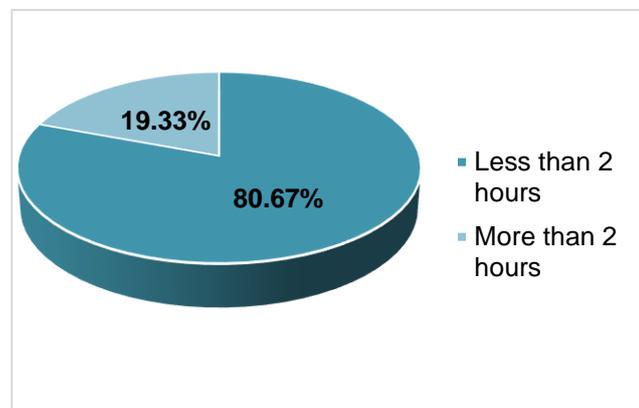


**Figure 6: Percentage distribution of the respondents according to their number of days in week the respondents visited the public garden**

**Table 7: Distribution of the respondents according to their amount of time spent in the public garden by the respondents (n=150)**

Sr. No.	Amount of time spent in the public garden by the respondents	f	%
1.	Less than 2 Hours	121	80.67
2.	More than 2 Hours	29	19.33

**4.4. Amount of time spent in the public garden by the respondents:** The data in **Table 7** and **Fig. 7** reveals that more than three-fourth (80.67 per cent) of the respondents were visiting public garden for less than 2 hours and less than one-fourth (19.33 per cent) of the respondents were visiting public garden for more than 2 hours.



**Figure 7: Percentage distribution of the respondents according to their time spend in the public garden by the respondents**

## Section II

### 4.5. Problems experienced by the respondents while using garden bench in the public garden

This section dealt with the problems experienced by the respondents while using the garden bench in public gardens. On the basis of various aspects of a garden bench, the respondents were asked the problems they experienced while visiting public gardens.

**Table 8: Distribution of the respondents according to their problems experienced while using garden bench in the public garden**

(n=150)								
Sr.No	Problems experienced regarding the garden bench	Experienced		Undecided		Not Experienced		Item intensity (Weighted Mean) (3-1)
		f	%	f	%	f	%	
<b>Comfort of the garden bench</b>								
1.	Over all comfort while sitting on the garden bench	46	30.67	3	2.00	101	<b>67.33</b>	1.63
2.	Discomfort regarding inclined backrest	67	44.67	4	2.66	79	<b>52.67</b>	1.92
3.	Discomfort regarding sitting without armrest	91	<b>60.67</b>	22	14.66	37	24.67	2.36
4.	Discomfort regarding sitting without leg rest	50	33.33	27	18.00	73	<b>48.67</b>	1.84
5.	Back pain experience while sitting on the garden bench	82	<b>54.67</b>	28	18.66	40	26.66	2.28
6.	Muscle tension experienced while sitting on the garden bench	41	27.33	23	15.34	86	<b>57.33</b>	1.7
7.	Neck pain experience while sitting on the garden bench	37	24.67	15	10.00	98	<b>65.33</b>	1.59
8.	Knees pain experience while sitting on the garden bench	49	32.67	23	15.33	78	<b>52.00</b>	1.80
9.	Feeling tired after sitting on a garden bench	47	31.33	40	26.67	63	<b>42.00</b>	1.89
10.	Discomfort while distinguish the garden	57	38.00	24	16.00	69	<b>46.00</b>	1.92

	bench colour							
11.	Edges of the garden bench feel rough	97	<b>64.67</b>	22	14.66	31	20.67	<b>2.44</b>
12.	Discomfort while spotting the garden bench	72	<b>48.00</b>	23	15.33	55	36.67	2.11
<b>Average Weighted Mean</b>								1.96
<b>Dimensions of the garden bench</b>								
13.	Problem regarding length of the garden bench	28	18.67	4	02.66	118	<b>78.67</b>	1.4
14.	Problem regarding depth of the garden bench	15	10.00	11	07.33	124	<b>82.67</b>	1.27
15.	Problem regarding height of the back rest	61	40.67	20	13.33	69	<b>46.00</b>	1.94
16.	Problem regarding inclined back rest	115	<b>76.67</b>	8	05.33	27	18.00	<b>2.58</b>
17.	Problem regarding Seat height of the garden bench	20	13.33	18	12.00	112	<b>74.67</b>	1.38
18.	Problems regarding overall size of the garden bench while sitting	16	10.67	11	07.33	123	<b>82.00</b>	1.28
<b>Average Weighted Mean</b>								1.64
<b>Material of the garden bench</b>								
19.	Problem regarding overall comfort of the material	42	28.00	22	14.67	86	<b>57.33</b>	1.70
20.	Problem regarding the hardness of the material	102	<b>68.00</b>	11	07.33	37	24.67	2.43
21.	Problem regarding the slipperiness of the material	30	20.00	19	12.67	101	<b>67.33</b>	1.52
22.	Problem regarding the roughness of the material	77	<b>51.33</b>	12	08.00	61	40.67	2.10
23.	Problem regarding heat radiation of the material	81	<b>54.00</b>	42	28.00	27	18.00	2.36
24.	Problem regarding dampness of the material	40	26.67	50	33.33	60	<b>40.00</b>	1.86
<b>Average Weighted Mean</b>								1.99

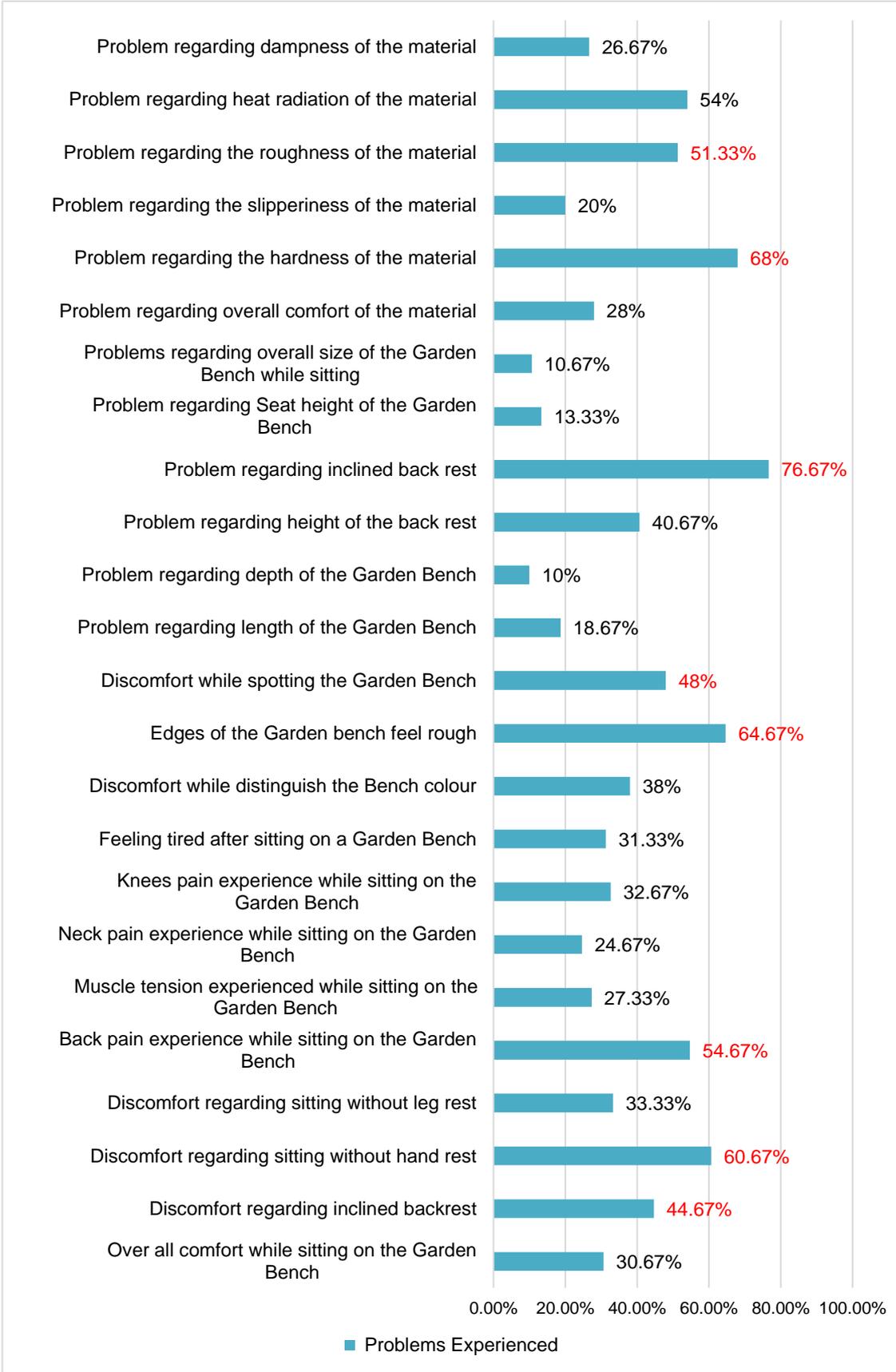
**Problems experienced regarding comfort of the garden bench:** The data in **Table 8** and **Fig 8**, reveals that more than two-third (67.33 per cent) of the respondents did not experience overall discomfort while sitting on the garden bench. The data also revealed that more than one-third (44.67 per cent) of the respondents reported feeling uncomfortable while more than one-half (52.67 per cent) of the respondents did not report feeling uncomfortable with an inclined backrest. Less than two-third (60.67 per cent) of the respondents

experienced discomfort in sitting without an armrest. Furthermore, less than one-half (48.67 per cent) of the respondents reported being comfortable without a leg rest and more than one-half (54.67 per cent) of the respondents reported back pain while sitting on the garden bench. Less than two-third (57.33 per cent) of the respondents did not experience muscle tension while sitting on the garden bench. It was found that less than two-third (65.33 per cent) of the respondents did not experience neck pain while sitting on the garden bench and more than one-half (52.00 per cent) of the respondents did not experience knee pain while sitting on the garden bench. Less than one-half (42.00 per cent) of the respondents did not experience a feeling of tiredness after sitting on a garden bench while more than one-third (46.00 per cent) of the respondents did not feel discomfort while distinguishing the bench colour. It was found that more than one-half (64.67 per cent) of the respondents reported that edges of the garden bench felt rough and more than one-third (48.00 per cent) of the respondents experienced discomfort in spotting the garden bench.

**Problems experienced regarding dimensions of the garden bench:** The data in **Table 8** and **Fig 8**, reveals that more than three-fourth (78.67 per cent) of the respondents did not experienced problem regarding length of the garden bench, majority (82.67 per cent) of the respondents did not experience problem regarding depth of the garden bench and less one-half (46.00 per cent) of the respondents did not experience problem regarding height of the garden bench. More than three-fourth (76.67 per cent) of the respondents experienced problems regarding inclination of the backrest and less than three-fourth (74.67 per cent) of the respondents did not experience problems regarding seat height of the garden bench. Majority (82.00 per cent) of the respondents did not experience problems regarding overall size of the garden bench.

**Problems experienced regarding Material of the garden bench:** The data in **Table 8** and **Fig 8**, reveals that more than one-half (57.33 per cent) of the respondents did not experience problems regarding overall comfort of the material. The data also revealed that more than two-third (68.00 per cent) of the respondents experienced problems regarding the hardness of the material and more than two-third (67.33 per cent) of the respondents did not experience

problems regarding the slipperiness of the material. It was revealed that more than one-half (51.33 per cent) of the respondents experienced problems regarding the roughness of the material and more than one-half (54.00 per cent) of the respondents experienced problems regarding heat radiation of the material. The data also revealed that more than one-third (40.00 per cent) of the respondents did not experience problems regarding the dampness of the material.



**Figure 8: Percentage distribution of the respondents according to their Problems experienced while using garden bench in the public garden**

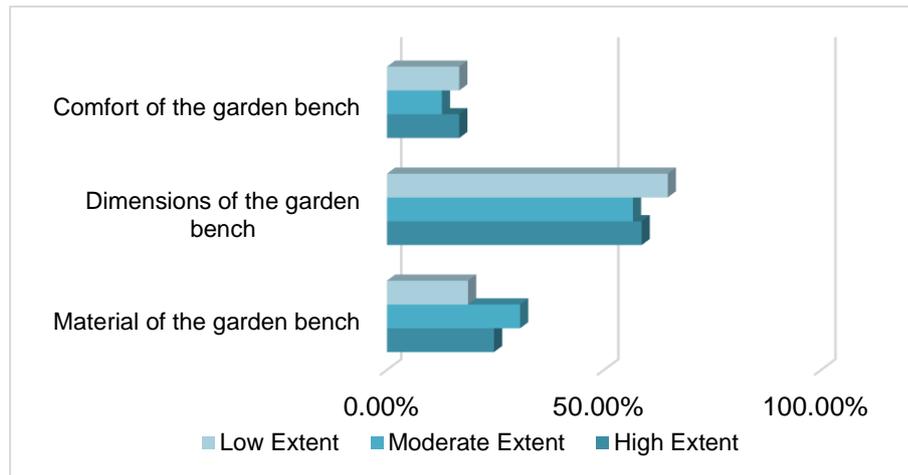
#### 4.5.1. Extent of problems experienced regarding the garden bench by the respondents

This section dealt with the extend of problem experienced by the respondents while using the garden bench in public gardens.

**Table 9: Extent of problems experienced regarding the garden bench by the respondents**

(n=150)			
Sr. No.	Extent of problems experienced regarding the garden bench	Respondents	
		f	%
<b>1.</b>	<b>Comfort of the garden bench</b>		
	High Extent (29-36)	25	16.66
	Moderate Extent (20-28)	88	<b>58.67</b>
	Low Extent (12-19)	37	24.67
<b>2.</b>	<b>Dimensions of the garden bench</b>		
	High Extent (15-18)	19	12.66
	Moderate Extent (10-14)	85	<b>56.67</b>
	Low Extent (6-9)	46	30.67
<b>3.</b>	<b>Material of the garden bench</b>		
	High Extent (15-18)	25	16.66
	Moderate Extent (10-14)	97	<b>64.67</b>
	Low Extent (6-9)	28	18.67

The data revealed that more than one-half (58.67 per cent) of the respondents experienced moderate extent of problems regarding the comfort of the garden bench. More than one-half (56.67 per cent) of the respondents experienced moderate extent of problems regarding the dimension of the garden bench and less than two-third (64.67 per cent) of the respondents experienced moderate extent of problems regarding the material of the garden bench.



**Figure 9: Extent of problems experienced regarding the garden bench by the respondents**

The data revealed that more than one-half (58.67 per cent) of the respondents experienced moderate extent of problems regarding the comfort of the garden bench. More than one-half (56.67 per cent) of the respondents experienced moderate extent of problems regarding the dimension of the garden bench and less than two-third (64.67 per cent) of the respondents experienced moderate extent of problems regarding the material of the garden bench.

Therefore, it was found that respondents having more than three-fourth (76.67 per cent) of problem regarding incline back rest, more than two-third (68.00 per cent) of the respondents experienced problem regarding the hardness of the material, less than two-third (64.67 per cent) of the respondents reported that edges of the garden bench felt rough, less than two-third (60.67 per cent) of the respondents experienced discomfort regarding sitting without a armrest, more than one-half (54.67 per cent) of the respondents reported back pain while sitting on the garden bench, more than one-half (54.00 per cent) of the respondents experienced problem regarding heat radiation of the material, more than one-half (51.33 per cent) of the respondents experienced problem regarding the roughness of the material and less than one-half (48.00 per cent) of the respondents experienced discomfort while spotting the garden bench.

### Section III

#### 4.6. Observation of various aspects of the garden bench installed by parks and Garden Office, Vadodara Municipal Corporation (VMC)

This section dealt with observations regarding various aspects of the existing garden bench in the public gardens of Vadodara City, installed by the Parks and Gardens Office, Vadodara Municipal Corporation (VMC). The various aspects of the garden bench that were observed were dimensions of the garden bench, material of the garden bench and aesthetics of the garden bench.

**Table 10: Observations of various aspects of the garden bench installed by parks and Garden Office, Vadodara Municipal Corporation (VMC)**

Sr. No.	Aspects of garden bench	Observations	
		Existing	Remarks
<b>Dimension of garden bench</b>			
1.	Total height of the bench	Height – 2'10"	The height of the bench was adequate.
2.	Width of total bench	Width – 2'1"	The width of the bench was adequate according to the design.
3.	Seat height of the bench	Height – 1'6"	The seat height of the bench was adequate.
4.	Length of the seat	Length – 4'6"	The length of the bench was adequate.
5.	Thickness of seat	Thickness – 2.5"	Thickness should be 1 ½" to 2" for long durability so it was found adequate.
6.	Thickness of Backrest	Thickness - 4"	To have a stable backrest, a 4" thickness was adequate.
7.	Depth of the bench	Depth – 1'4"	The depth of the bench was correct but a 1'6" depth would

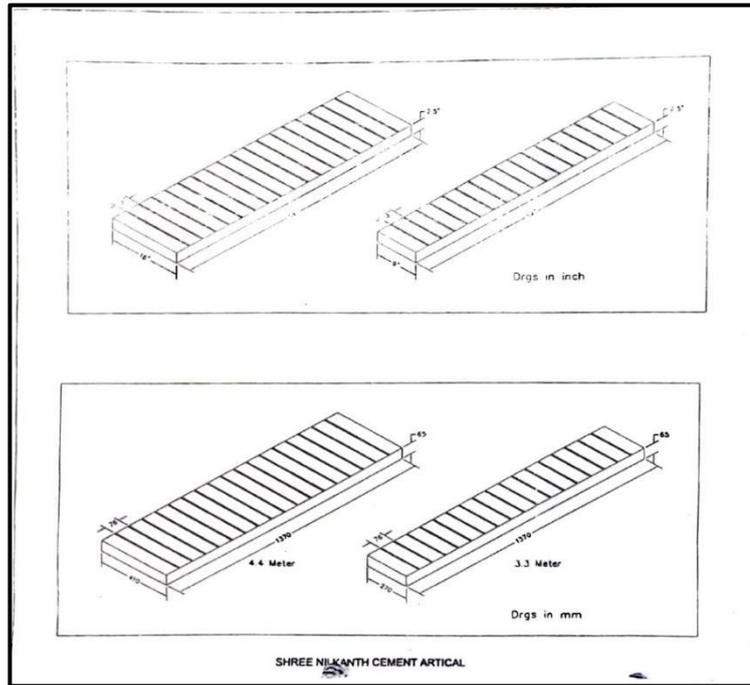
			be more comfortable.
8.	Height of the backrest	Height – 1'6"	The total height of the backrest was adequate but it had a 6" void space followed by a 9" of back support, which could be uncomfortable.
9.	Length of the backrest	Length - 4'6"	The length of the backrest was adequate as its standard size should be 3'6" to 5'.
10.	Angle between backrest and seat of the bench	Degrees – 5°	The angle between backrest and seat of the bench was found to be uncomfortable as ideal angle for a comfortable backrest is 10° to 15°.
11.	Distance between two legs of bench	Distance - 4'	For a three-seater garden bench, 4' between the two legs of the bench was adequate.
12.	Height of leg	Height – 1'4" (excluding seating)	Height of the legs was adequate
13.	Thickness of leg	4.5" thick	A thickness of 4.5" was adequate for a stable bench design.
<b>Material of the garden bench</b>			
14.	Material	RCC material	RCC was economic material and best fit for outdoor furniture.
15.	Construction	Fitted with nut and bolts	Some garden benches were found to be broken due to the loosening of nuts and bolts.
16.	Finish	Smooth (painted)	The paint quality was inadequate as it was fading and cracking in some benches.

17.	Strength and Durability	Material had strength and durability	The material of the garden bench had adequate strength and durability.
18.	Porosity	RCC material was porous	The material of the garden bench felt moist due to its porosity.
19.	Moisture retention	Yes, RCC had moisture retention	The material's porosity made it retain moisture, due to which the garden bench felt damp.
20.	Heat retention	RCC material retain heat	RCC is a material that retains heat which caused discomfort while sitting on the garden bench.
21.	Heat radiation	RCC material radiant heat	RCC is a material that radiates heat, which caused discomfort while sitting on the garden bench.
22.	Finished of Bench edges	Rough edges	The edges can be smoother and more curved to avoid being hurt.
23.	Comfort in cleaning	RCC material was easy to clean	The RCC material had a water resistance property that made it comfortable to clean.
24.	Ease of maintenance	RCC material was easy to maintained	The RCC material had a water resistance property that made it easy to maintain.
<b>Aesthetic of the garden bench</b>			
25.	Design Style	Modern and geometrical Design	The bench had a modern and geometric design but due to colour near to terracotta material it had the feel of traditional design in it.

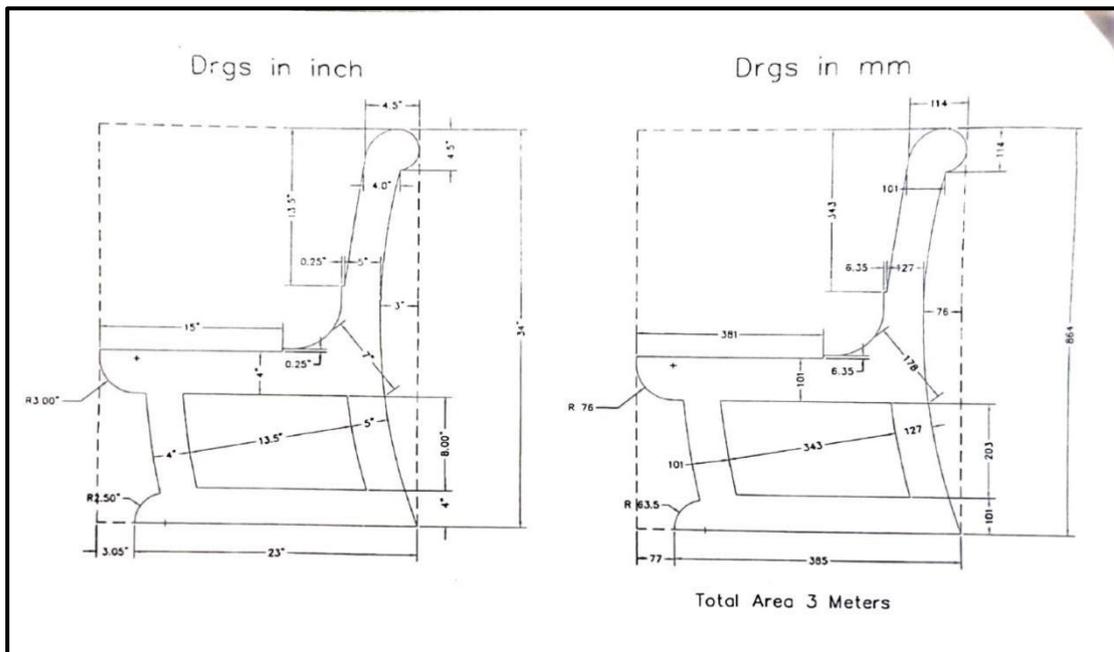
26.	Colour	Brown (near to terracotta colour)	Brown (near to terracotta colour) blends in with the environment and makes it difficult to spot the garden bench.
27.	Texture	Somewhat rough because of its design	The texture of the bench was slightly rough, which was visually not appealing.
28.	Pattern	Strip pattern	The repeating vertical bars pattern gave the bench a rough textural feeling which reduced its aesthetic appeal.
29.	Shape and form	Rectangular	The rectangular shape of the garden bench made it appear plain.
30.	Placement/ arrangement in space	garden bench was placed on the walkway	The placement of the garden bench made it blend with the colour and design of the walkway tiling.



**Plate 09: Existing garden bench Installed by Parks and Gardens Office, Vadodara Municipal Corporation (VMC)**



**Plate 10: Dimension of existing Seat of the garden bench provided by Parks and Gardens Office, Vadodara Municipal Corporation (VMC)**



**Plate 11: Dimension of existing legs of the garden bench provided by Parks and Gardens Office, Vadodara Municipal Corporation (VMC)**



**Plate 12: Garden bench colour blends in with the ground which was provided by Parks and Gardens Office, Vadodara Municipal Corporation (VMC)**



**Plate 13: Garden bench colour blends in with the environment which was provided by Parks and Gardens Office, Vadodara Municipal Corporation (VMC)**

The observation revealed that the incline back rest on the existing garden bench does not have the proper angle for comfortable sitting and it was also seen that the colour of the existing garden bench blended with the surrounding environment. Some aspects of garden bench design were found to be overlooked, namely the smoothening of edges and the provision of arm rests.

## Section IV

### 4.7. Proposed garden bench designs for public gardens

This section describes the design development of the garden bench and details related to various aspects of the designs proposed. The proposed designs of the garden bench were developed keeping in mind the problems experienced by the respondents while using the garden bench as well as observation by the researcher. The proposed designs were prepared using AutoCAD 2021, Google SketchUp 2020 and Lumion 10.0 software.

**Table 11: Proposed Garden Bench Design**

<b>Sr. No.</b>	<b>TITLE</b>
1.	Proposed Garden Bench Design - 1
2.	Proposed Garden Bench Design - 2
3.	Proposed Garden Bench Design - 3

The development of these designs was based on the observation and information gathered by the researcher. The designer found that the various aspects of the garden bench were overlooked, namely the smoothening of edges, provision of arm rests, not having the proper backrest inclination and the colour that blended with the surrounding environment.

The researcher conducted extensive market survey in the duration of the research (November to December 2022) to provide details of material and cost for the proposed garden bench designs. Thus, the cost of materials may vary due to passage of time and according to brand of the products and change in raw materials. The labour cost will vary according to the expertise of the labour.

#### 4.7.1. Proposed Garden Bench Design - 1

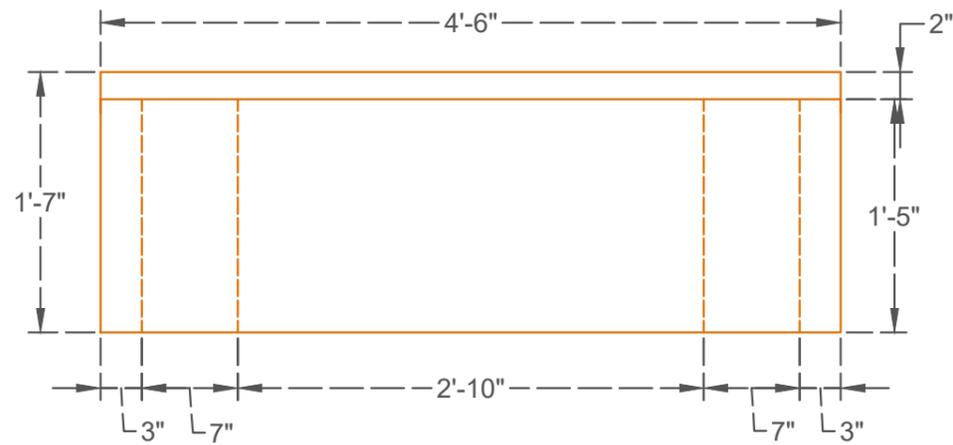
The first design proposed for the garden bench was a basic design, as shown in **Plate 14**. It resolved the problems related to back inclination, roughness of edges and colour.

The proposed garden bench measured a total height of 3', breadth of 1'7" and length of 4'6". The thickness of the back rest was 2", the height of the back rest was 1'6" the inclination of the back was 102°. The total depth of the seat was 1'5". The seat thickness was 3" for its steadiness and the height of the seat from the ground was 1'6". The thickness of the legs was 3", the total height of the leg from the ground was 1'3" and the leg was designed in such a way that it does not get stuck in the ground with its heavy load. The edge of the garden bench has been given a radius of 1½" for smooth curves.

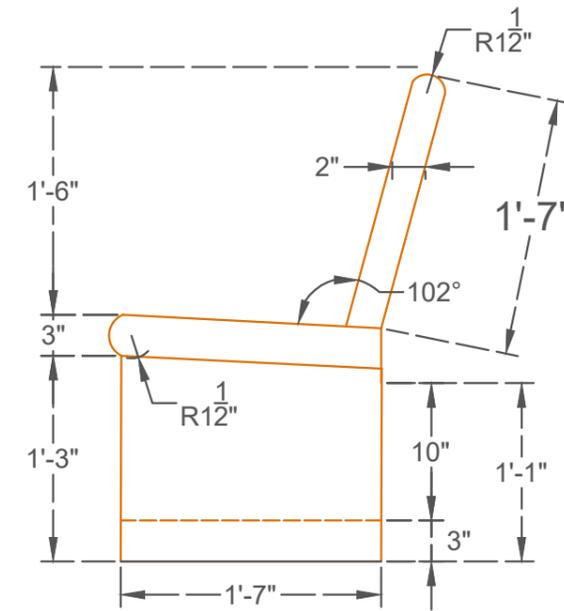
The researcher recommended RCC as a construction material, blue terrazzo for the top layer of the seat and heat – reflective paint as a finished material. The colour Teal Vinyl was selected for the heat – reflective paint. For a base structure, steel bars were suggested.

For aesthetic purposes, the researcher added a graphic of the skyline of famous places of Vadodara city, which was painted with black colour heat- reflective paint.

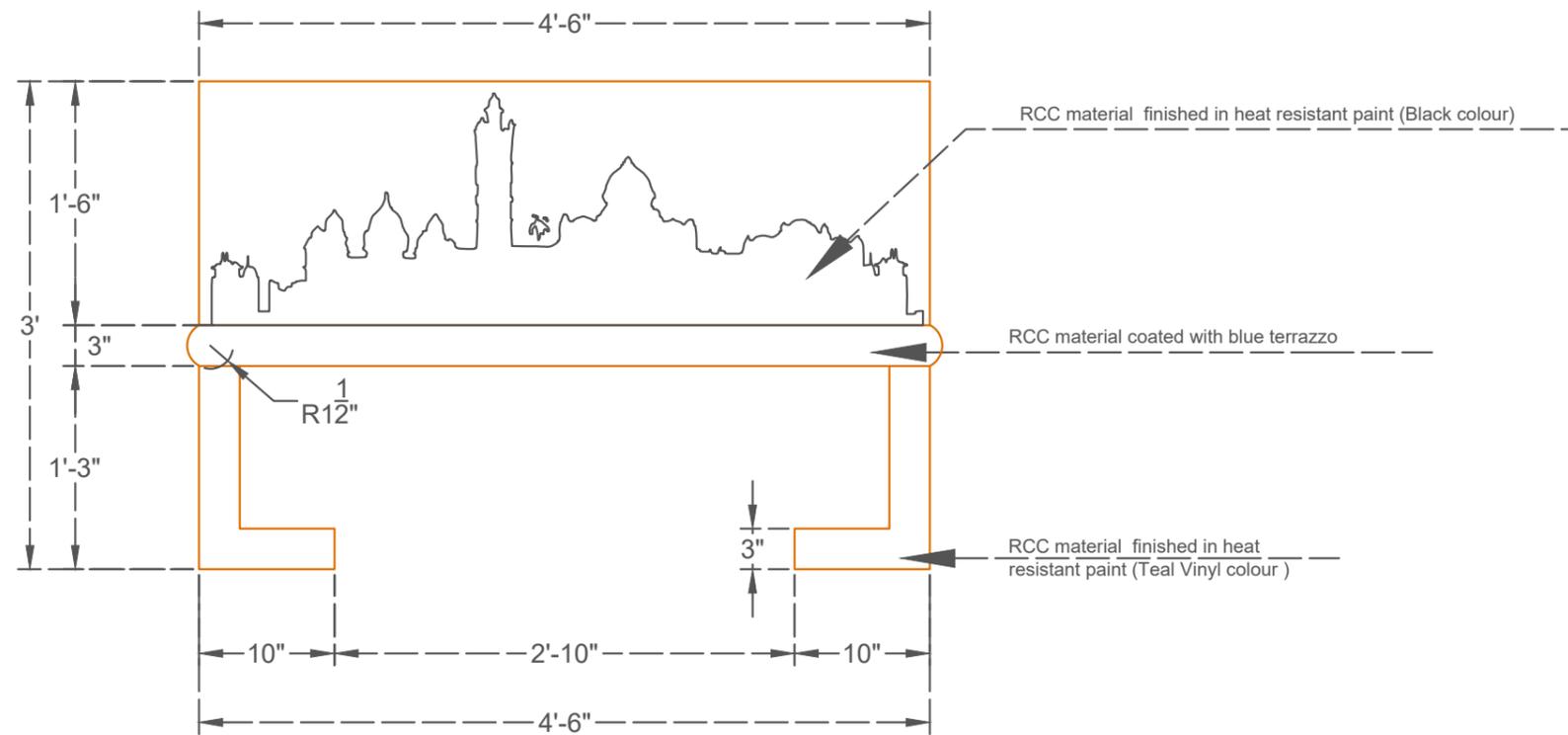
The estimated cost was found to be ranging from ₹ 5,000 to ₹5,500 for one Garden Bench. The effective cost for each garden bench would reduce with mass production.



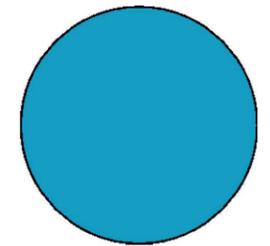
PLAN



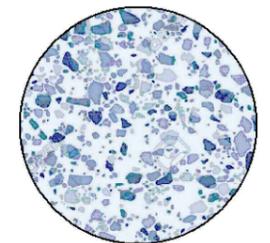
SIDE ELEVATION



ELEVATION



TEAL VINYL COLOUR

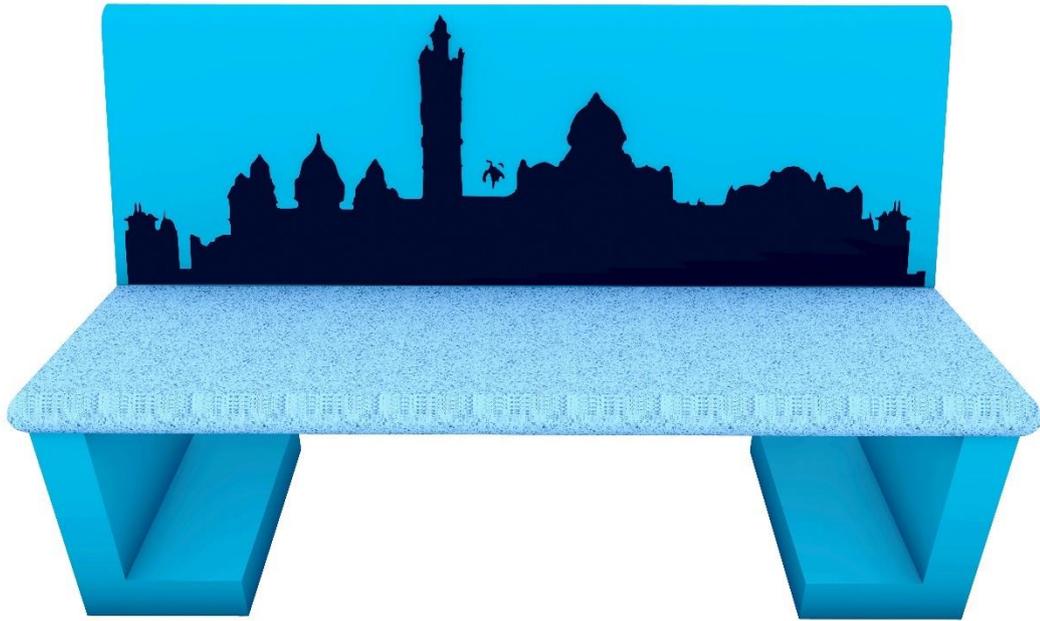


BLUE TERRAZZO



SKYLINE OF FAMOUS PLACES OF VADODARA CITY

\* All Dimensions specified are in Feet and Inches.



**Plate 15: Front view of Proposed Garden Bench Design - 1**



**Plate 16: Isometric view of Proposed Garden Bench Design - 1**



**Plate 17: Front view in the public garden of Proposed Garden Bench  
Design - 1**



**Plate 18: Isometric view in the public garden of Proposed Garden Bench  
Design - 1**

#### 4.7.2. Proposed Garden Bench Design - 2

The second design proposed for the garden bench was a comfortable design, as shown in **Plate 19**. It resolved the problems related to the back inclination, roughness of the edges, colour and arm rest.

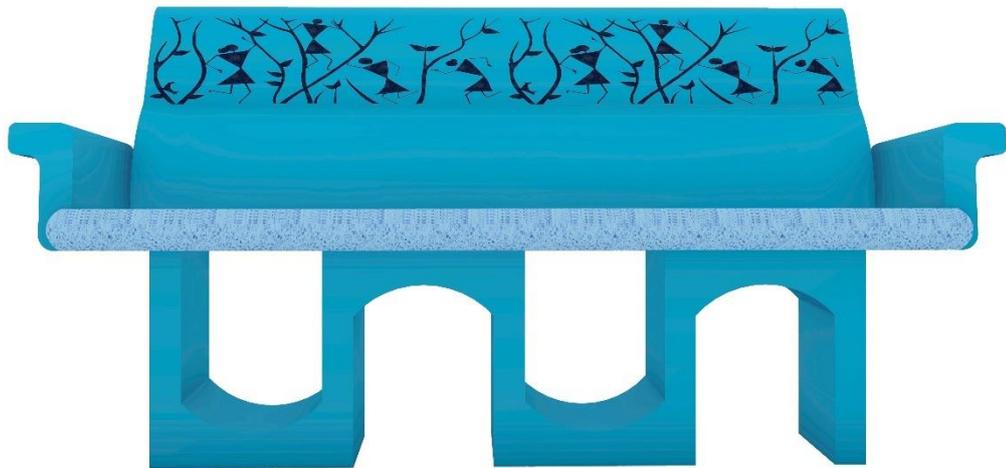
The proposed garden bench measured total height of 3', breadth of 1'7" and length of 5'2". The thickness of the back rest was 3", the height of the back rest was 1'6" and the inclination of the back was 102° with a slight curvature for a proper back rest. The thickness of the seat was 4" for its sturdiness and the height of the seat from the ground was 1'6". The total height of the leg from the ground was 1'2". The leg was designed in such a way that it does not get stuck in the ground with its heavy load and does not break away from the centre of the seat. The edge of the garden bench has been given a radius of 1½" for smooth curves. The thickness of hand rest was 2" and from top it measured 4".

The researcher recommended RCC as a construction material, blue terrazzo for the top layer of the seat and heat – reflective paint as a finished material. The colour Teal Vinyl was selected for the heat – reflective paint. For a base structure, steel bars were suggested.

For aesthetic purposes, the researcher added Warli Art, which mainly originated from Maharashtra and was practised by the Dang district in Gujarat, was painted with a black colour heat- reflective paint.

The estimated cost was found to be ranging from ₹6,000 to ₹6,500 for one Garden Bench. The effective cost for each garden bench would reduce with mass production.





**Plate 20: Front view of Proposed Garden Bench Design – 2**



**Plate 21: Isometric view of Proposed Garden Bench Design - 2**



**Plate 22: Frist view in the public garden of Proposed Garden Bench  
Design – 2**



**Plate 23: Isometric view in the public garden of Proposed Garden Bench  
Design - 2**

### 4.7.3. Proposed Garden Bench Design - 3

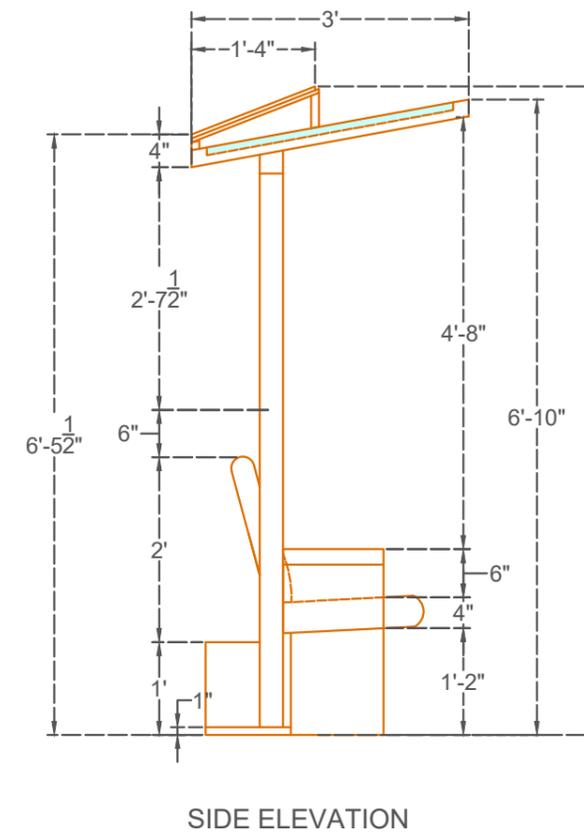
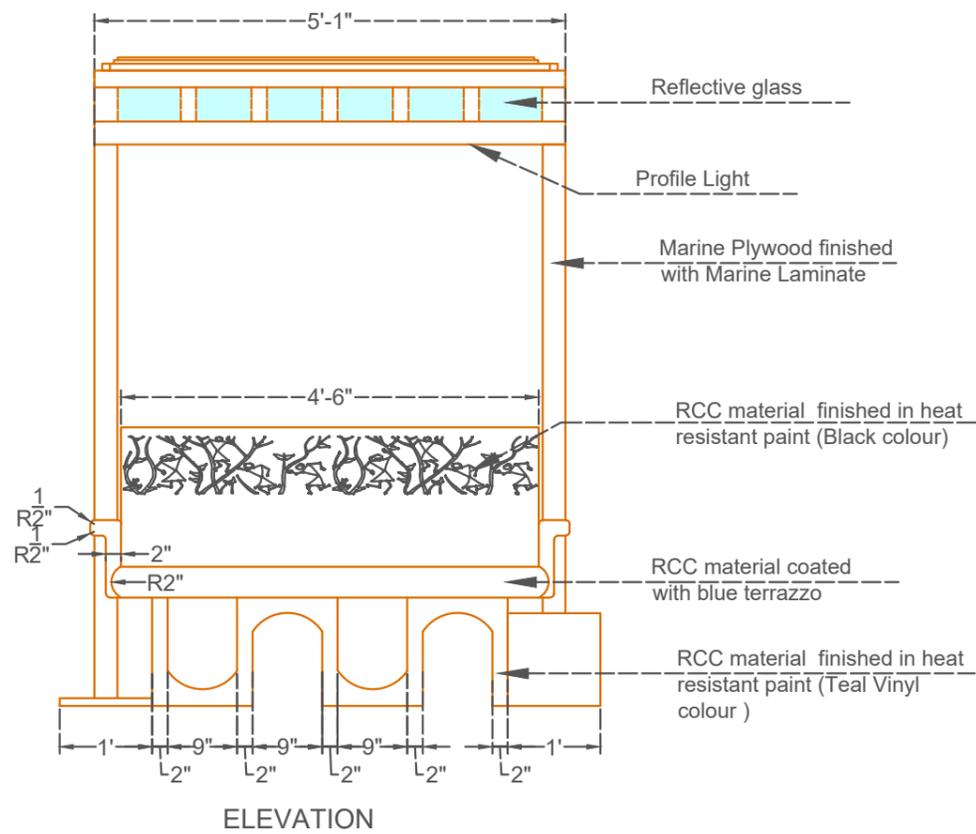
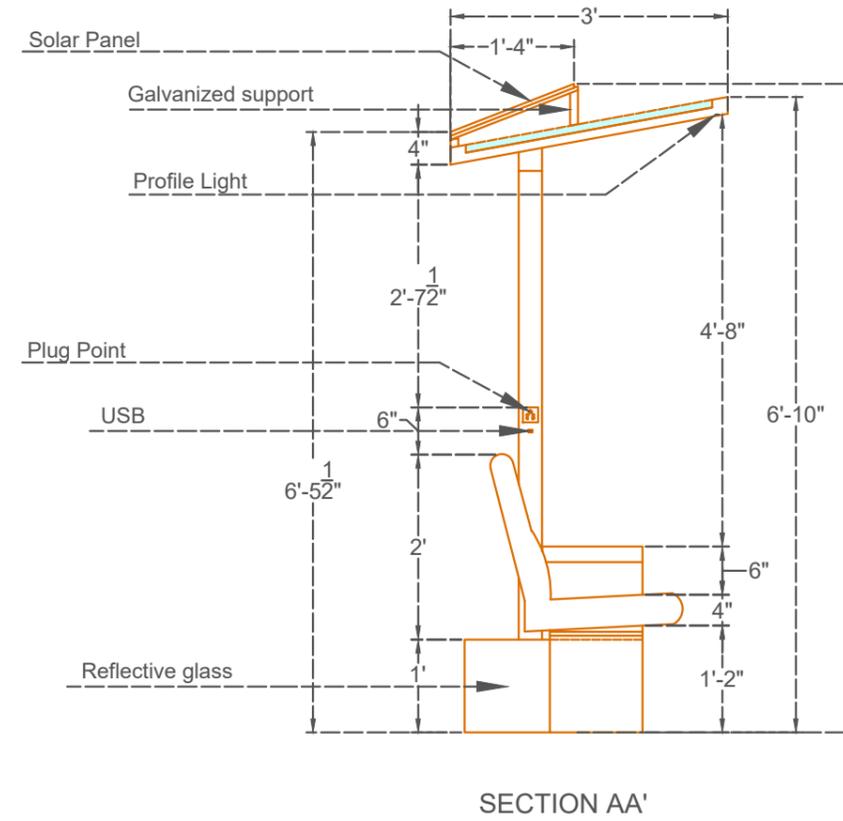
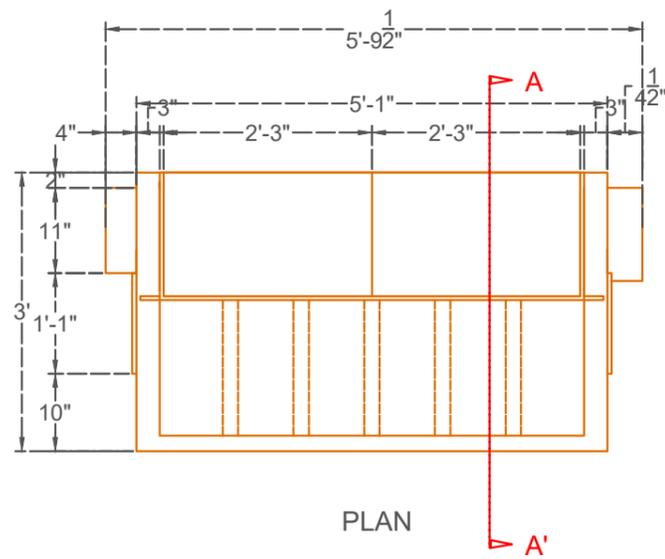
The third design proposed for the garden bench was an innovative design as shown in **Plates 24**. It resolved the problems related to the back inclination, roughness of the edges, colour, and arm rest. The design incorporated solar panels with a charging point.

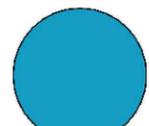
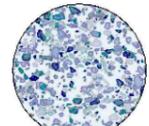
The proposed garden bench measured a total height of 7', breadth of 3' and length of 5'2". The thickness of the back rest was 3", the height of the back rest was 1'6" and the inclination of the back was 102° with a slight curvature for a proper back rest. The thickness for seat was 4" for its steadiness and the height of the seat from the ground was 1'6". The total height of the leg from the ground was 1'2". The leg was designed in such a way that it does not get stuck in the ground with its heavy load and does not break away from the centre of the seat. The edge of the garden bench has been given a radius of 1½" for smooth curves. The thickness of hand rest was 2" and from top it measured 4". The thickness of the pergola support was 3". Solar panels measured 4'6" length and breadth of 1'4". Solar panels fix at 70° angle on the top of pergola. A plug point has been placed on the pergola support, which was placed at a height of 3'6" from the ground level. With the plug point, researchers have placed a USB at a height of 3'3" from the ground level. On the right side of the garden bench, AC DC distribution box with a protected box has been placed, which has been measured at 1' length, 1' breadth and 1' height.

The researcher recommended RCC as a construction material, blue terrazzo for the top layer of the seat and heat – reflective paint as a finished material. The colour Teal Vinyl was selected for the heat – reflective paint. For a base structure, steel bars were suggested. The material suggested for the pergola was marine plywood with a marine laminate finish. The design also incorporated reflective glass for heat protection in the overhead part of the pergola. On the pergola, a galvanized structure was recommended to fix solar panels. The material for the protection box for the grid inverter was polycarbonate (Thermoplastic IP65).

For aesthetic purposes, the researcher added Warli Art, which mainly originated from Maharashtra and was practised by the Dang district in Gujarat, was painted with a black colour heat-reflective paint. Plug points and USB were given as smart features. 80 watts of solar panels were proposed in the design with 9-watt profile light of 2'6" length have been suggested under the pergola. A switch has been added to the AC DC distribution box so that the individual working in that public garden can turn on the profile light. Socket and USB connections were proposed in the design for basic uses such as charging a laptop, phone, or any item that required charging. In the design, IP65-rated 6 A plug points were recommended.

The estimated cost was found to be ranging from ₹18,000 to ₹20,000 for one garden bench. The effective cost for each garden bench would reduce with mass production.



-  MARINE LAMINATE
-  REFLECTIVE GLASS
-  TEAL VINYL COLOUR
-  BLUE TERRAZZO
-  WARLI ART

\* All Dimensions specified are in Feet and Inches.



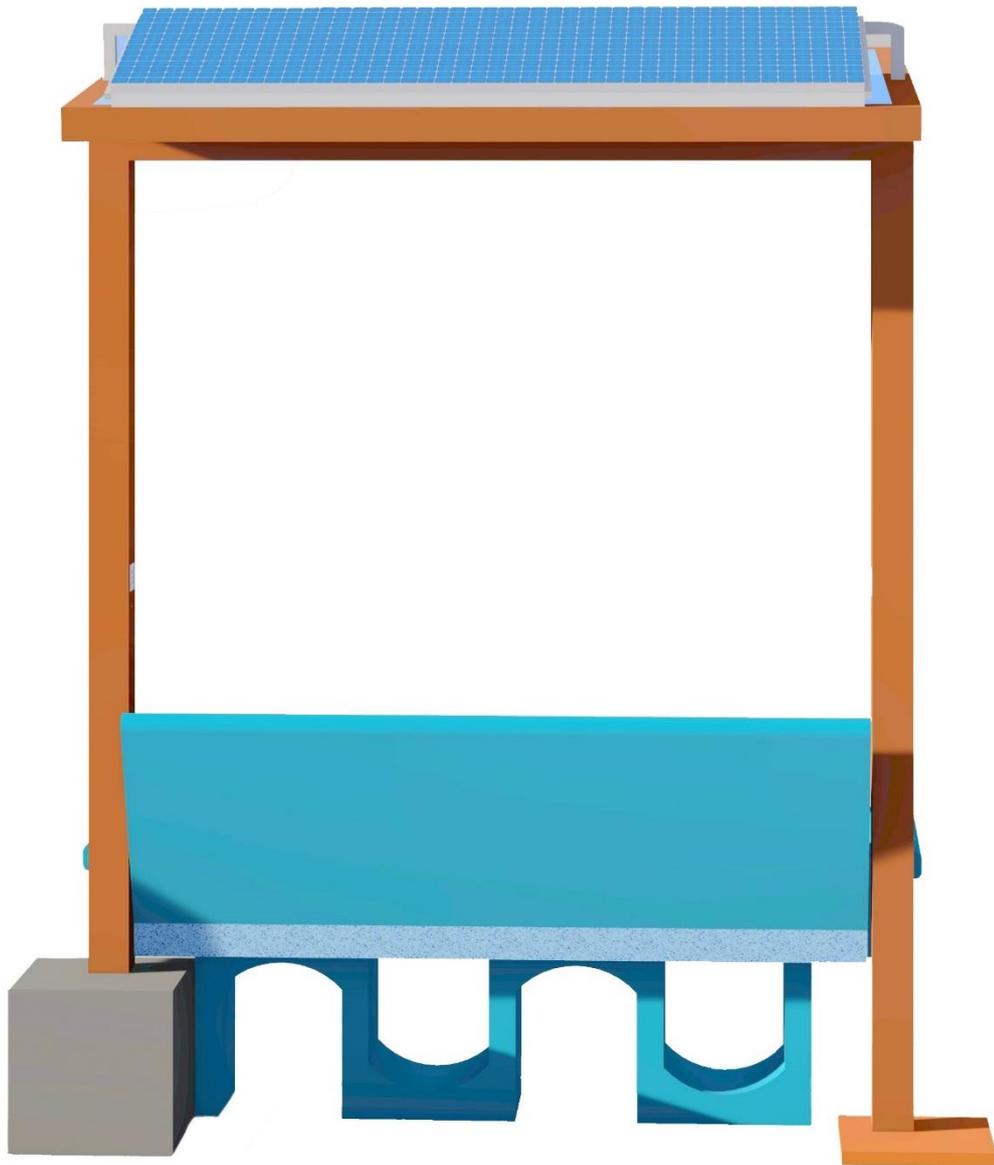
**Plate 25: Front view of Proposed Garden Bench Design – 3**



**Plate 26: Isometric view of Proposed Garden Bench Design – 3**



**Plate 27: Isometric view of Proposed Garden Bench Design – 3**



**Plate 28: Back view of Proposed Garden Bench Design – 3**



**Plate 29: Front view in the public garden of Proposed Garden Bench  
Design – 3**



**Plate 30: Isometric View in the public garden of Proposed Garden Bench  
Design - 3**

SUMMARY, CONCLUSION  
AND RECOMMENDATIONS



## CHAPTER – V

### SUMMARY, CONCLUSION AND RECOMMENDATIONS

Public gardens have multiple purposes in a person's everyday life. A public garden is a location where people may feel at one with nature. People in urban areas complain about a lack of fresh air and open space for relaxation as a result of the compactness of residential spaces. Spending time in the public garden can help with various mental and physical health issues. A public garden includes both hard and soft landscape elements such as trees, flowerbeds, hedges, water bodies, seats, gazebos, paths, and so on. Garden benches are an important feature in public gardens since visitors need to rest and sit down at some point during their visit. Additionally, some visitors only visit the public gardens to relax and take in the scenery. Benches rank among the most socially significant pieces of street furniture due to the universality of their daily use. So, it is essential to have a comfortable bench in the public garden. The comfort of the user must be taken into consideration. Since garden benches are now more expensive, they need to be properly designed using materials with higher durability and design of higher comfort level. A comfortable garden bench in a well-designed public garden will increase the number of visitors, thereby promoting the Sustainable Development Goals such as SDG 3, which is “Ensure healthy lives and promote well-being for all at all ages.” and SDG 11, which says “Make cities and human settlements inclusive, safe, resilient and sustainable.” [8]

During the review of literature, the researcher came across various studies conducted in India related to evaluation of landscape gardening, landscape practices, residential landscaping and gardening, designing of terraces, designing of an ideal outdoor garden, designing of a vertical garden, and community gardening. Studies conducted outside India were related to areas such as smart street furniture, lightweight concrete outdoor furniture, urban landscaping, wooden material in outdoor furniture, design and implementation of smart benches, design considerations and design analysis. Review of the literature revealed a dearth of research on design of garden benches for public gardens in India.

The aim of the present research was to provide a new design for a garden bench that would combine aesthetics, functionality and expressive characteristics. The development of a new garden bench could provide extra value to the public gardens and the community, enhancing the experience for all. The present study would be helpful in improving the environment. The garden bench designs were created with the goal of bringing people closer to nature. The present study was helpful in widening the database and strengthening the curriculum for Interior Designing and Landscape Designing courses that were offered for the Interior Design specialization offered by the Department of Family and Community Resource Management, the Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda and various other institutes. The findings of the study would be helpful to Interior Designers and Architects in developing other furniture designs. The present research would also be beneficial to the sectors of Interior Design, Furniture Design and Landscape Design related industries and manufacturers, as well as to the general public that visits the public gardens. It will also be beneficial for the Parks and Garden Office, Vadodara Municipal Corporation (VMC), for the further development of public gardens in Vadodara city.

### **Statement of problem**

The present study aimed to develop design of garden bench for the public gardens of Vadodara City.

### **Objectives**

1. To identify the problems experienced by the respondents while using garden benches of selected public gardens of Vadodara city.
2. To observe various aspects of the garden bench installed by the Parks and Garden Office, Vadodara Municipal Corporation (VMC) of Vadodara city.
3. To propose garden bench designs for public gardens of Vadodara city.

## **Delimitation**

1. The study was limited to the selected public gardens of Vadodara city.
2. The study was limited to respondents above the age of 18 years.
3. The study was limited to the garden bench installed by the Parks and Garden Office, Vadodara Municipal Corporation (VMC) of Vadodara city.

## **Methodology**

A descriptive research design was adopted for the present research. The locale for the present study was Vadodara city, Gujarat, India. The unit of inquiry was 150 users of selected public gardens of Vadodara city. Purposive sampling technique was used for the present study. The sample size for the current investigation was 150 users of selected public gardens of Vadodara city. Five public gardens of Vadodara city were selected, where garden benches were installed and maintained by the Parks and Garden Office of Vadodara Municipal Corporation (VMC) of Vadodara city. 30 respondents were interviewed from each of the five selected public gardens. Interviews of the respondents were taken while they visited the public gardens. Based on the objectives set for the current research, two tools were developed. An interview schedule was developed to identify the problems experienced by the respondents while using garden benches of selected public gardens of Vadodara city. The interview schedule consisted of two sections. Section I collected personal and situational information about the respondent, which were age (in years), height, weight, frequency of visit to the public garden, duration of time spent in the public garden, preferred time for visiting the public garden. Section II gathered information regarding problems experienced by the respondents while using the garden bench in the public gardens. The factors considered were comfort in using the garden bench, dimension of the garden bench, impact on human body and aesthetic appeal of the garden bench. Observation Sheet included the study of different aspects of the existing garden bench. The components of the garden bench observed were its dimensions, comfort and aesthetics. The data were analyzed and presented by applying descriptive statistics.

## Major Findings

The major findings of the study were as follows:

**Section I Background Information:** This section included data related to background information, the number of days in a week visited by respondents, the most preferable time for respondents to visit and the hours spent in public gardens by respondents. It was revealed that the mean age of the respondents was 37.65 years and less than two-third (62.00 per cent) of the respondents belong to age groups of 18-37 years. It was found that more than one-half (52.00 per cent) of the respondents were female and more than one-third (48.00 per cent) of the respondents were male. The height of the respondents ranged between 135 cm to 194 cm. Less than two-third (64.67 per cent) of the respondents belong to the height 155 cm -174 cm. The weight of the respondents ranged between 43 kg to 88 kg wherein more than one-half (55.33 per cent) of the respondents fell in the weight range of 58 - 72 kg. From the data gathered it was observed that less than one-half (47.34 per cent) of the respondents visited public gardens daily. It was also observed that more than one-fourth (27.33 per cent) of the respondents visited the public garden in the morning. The data revealed that more than three-fourth (80.67 per cent) of the respondents visited the public gardens for less than 02 hours.

**Section II Problems experienced by the respondents while using garden bench in the public garden:** This section dealt with the problems experienced by the respondents while using the garden bench installed by the Parks and Gardens Office, Vadodara Municipal Corporation (VMC) in public gardens. On the basis of various aspects, the respondents were asked problems experienced regarding the garden bench. The section was divided into three parts according to the comfort of the garden bench, dimension of the garden bench and material of the garden bench. It was found that more than three-fourth (76.67 per cent) of the respondents experienced problem regarding inclination of the backrest, more than two-third (68.00 per cent) of the respondents faced problem regarding the hardness of the material, less than two-third (64.67 per cent) of the respondents reported that edges of the garden bench felt rough, less than two-third (60.67 per cent) of the respondents

experienced discomfort regarding sitting without an armrest, more than one-half (54.67 per cent) of the respondents reported feeling back pain while sitting on the garden bench, more than one-half (54.00 per cent) of the respondents experienced problem regarding heat radiation of the material, while more than one-half (51.33 per cent) of the respondents experienced problem regarding the roughness of the material and more than one-third (48.00 per cent) of the respondents experienced discomfort while spotting the garden bench in the public garden.

**Section III Observation of various aspects of the garden bench installed by Parks and Garden Office, Vadodara Municipal Corporation (VMC):** This section detailed observations regarding the existing garden bench in the public gardens of Vadodara City, installed by the Parks and Gardens Office, Vadodara Municipal Corporation (VMC). The various aspects of the garden bench namely, dimensions, material and aesthetics of the garden bench were observed. The observation revealed that the incline backrest of the existing garden bench did not have the appropriate angle of inclination for comfortable sitting and it was also seen that the colour of the existing garden bench blended with the surrounding environment. Some aspects of garden bench design were found to be overlooked, namely the smoothening of edges and the provision of armrest.

**Section IV Proposed garden bench designs for public gardens:** The problems experienced by public garden users were gathered through an interview schedule, and the existing garden bench was studied through an observation schedule. The proposed designs included two-dimensional drawings made with the support of AutoCAD software version 2021, three-dimensional representations done using Google Sketch Up software version 2022 and render was done using Lumion 10.0 software. The new designs of a garden benches were represented through plan, elevation and 3D representation. The details of material and estimated cost (approximate) as per the prevailing market rates in November to December 2022 also included. The first design proposed for the garden bench was a basic design which resolved the problems related to the backrest inclination, roughness of edges of the bench and colour of the bench for better identification. The second design

proposed for the garden bench was a comfortable design. It resolved the problems related to the backrest inclination, roughness of edges of the bench, colour of the bench for better identification and included armrest. The third design proposed for the garden bench was an innovative design that resolved the problems related to the backrest inclination, roughness of edges of the bench, colour of the bench for better identification and included armrest. The innovation in the design incorporated solar panels with charging points for higher comfort and utility for the visitors of the public gardens.

## **Conclusion**

The study on “Designing of Garden Bench for Public Garden of Vadodara City” was conducted to find the problems experienced by the respondents while using garden bench in the public garden. The findings showed that the mean age of the respondents was 37.65 years. Less than one-half of the respondents visited the public garden daily. It was found that two-third of the respondents visited the public garden in the evening. It was found that more than three-fourth of the respondents were visiting public gardens for less than two hours. It was found that respondents having more than three-fourth of problem regarding inclination of the backrest, more than two-third of the respondents experienced problem regarding the hardness of the material, less than two-third of the respondents reported that edges of the garden bench felt rough, less than two-third of the respondents experienced discomfort regarding sitting without an armrest, more than one-half of the respondents reported back pain while sitting on the garden bench, more than one-half of the respondents experienced problem regarding heat radiation of the material while more than one-half of the respondents experienced problem regarding the roughness of the material and more than one-third of the respondents experienced discomfort while spotting the garden bench. Three garden bench designs were proposed. The first design proposed for the garden bench was a basic design. It resolved the problems related to back inclination, roughness of edges and colour for comfort in spotting the bench. The second design proposed for the garden bench was a comfortable design. It resolved the problems related to the back inclination, roughness of the edges, colour and included armrest for adding more comfort. The third design proposed for the garden bench was an innovative design. It

resolved the problems related to the back inclination, roughness of the edges, colour, and arm rest. The design incorporated solar panels with a charging point.

### **Implications of the study**

The findings of the present study had following implications:

#### **For the department of Family and Community Resource Management:**

The curriculum of the department of Family and Community Resource Management offers Interior Design specialization to the students at undergraduate and postgraduate level where courses such as landscape designing and furniture designing are included. The present study will be helpful for the student in planning better landscaped gardens in the future. Also, it would build a strong affinity in the students towards creating innovative furniture design.

#### **For Interior Designers, Landscape Designers and Furniture Designers:**

The design developed under this study will provide new design ideas to the designers. Further, the present investigation can be used as a reference of material and measurements for developing similar type of design for other furniture and spaces.

#### **For Government:**

The proposed design of the garden bench will be beneficial for the Parks and Garden Office, Vadodara Municipal Corporation (VMC) to upgrade the public gardens of Vadodara city with a more comfortable garden bench and in turn attract more visitors.

#### **For users of the public gardens:**

The design of the garden bench will be helpful for public garden users to sit comfortably and have some relaxing time while sitting on a garden bench. It would reduce their reported discomfort with regards to the existing garden bench.

### **Recommendations for future studies**

- The effectiveness of the proposed garden bench design can be studied.
- An identical study can be conducted on various other aspects of Public Gardens.
- The present study can be taken further by considering anthropometric data of the users.
- A further investigation can be made with consideration to sustainable designs and materials.
- A similar study can be conducted for benches in other public places.

# BIBLIOGRAPHY



## BIBLIOGRAPHY

- Harris, C., Dines, N., & Brown, K. (1988). Time-saver standards for landscape architecture (2nd ed.).
- singh, a., & dhaduk, b. (2015). A Color Handbook Landscape Gardening. New India Publishing agency.
- Gangneux, J., Joss, S., Humphry, J., Hanchard, M., Chesher, C., Maalsen, S., Merrington, P., & Wessels, B. (2022). Situated, yet silent: Data Relations in smart street furniture. Retrieved March 3, 2023, from <https://www.tandfonline.com/doi/pdf/10.1080/10630732.2022.2036311>
- Mulyono, G., Thamrin, D., & Antoni. (2017). Development of modular outdoor furniture product using lightweight concrete for public parks in Surabaya. IOP Conference Series: Materials Science and Engineering, 234, 012022. <https://doi.org/10.1088/1757-899x/234/1/012022>
- Lei, Z., & Chen, W. K. (2021). Study on the Influence of Urban Landscaping on Residents' Quality of Life. Natural Volatiles & Essential Oils, Volume 8(Issue 5), 7661–7667.
- Panevski, E. N., & Kanevce, I. (2020). THE QUALITY OF WOODEN MATERIAL IN OUTDOOR FURNITURE. International Journal - Wood, Design & Technology, Volume 9, 16–32.
- Kango, R., Hadiyanto, H., & Pongtuluran, E. H. (2021). Design and implementation of smart bench integrated solar cell for public space electricity saving. International Journal Papier Advance and Scientific Review, 2(2), 72–81. <https://doi.org/10.47667/ijpasr.v2i2.121>
- Taha, M. A. (2016). Design Considerations Iron Bench in the Gardens. International Journal of Engineering Research & Technology, Volume 5(Issue 11), 538–545.
- Rishbeth, C., & Rogaly, B. (2017). Sitting outside: Conviviality, self-care and the design of benches in urban public space. Transactions

of the Institute of British Geographers, 43(2), 284–298.  
<https://doi.org/10.1111/tran.12212>

- Zhang, Y., Chen, G., Jiang, X., Xue, C., & He, Y. (2022, January 10). Social Interaction in Public Spaces and Well-Being among Elderly Women: Towards Age-Friendly Urban Environments. (thesis). International journal of Environmental Research and Public Health.
- Butler, A. (2022). Opportunities for Wonder in a Public Park (thesis). City University of New York, New York.
- Zhdanova, I. V., Kayasova, D. S., & Kuznetsova, A. A. (2022). Principles of the Inclusion Green Spaces in the Public Area of a Residential Building (thesis). IOP Publishing, Samara.
- Rout, A., & Galpern, P. (2022). Benches, fountains and trees: Using mixed-methods with questionnaire and smartphone data to design urban green spaces (thesis). Elsevier GmbH, Alberta.
- Cimino, A., McWhirter, J. E., & Papadopoulos, A. (2021). Made in the shade: A qualitative study of factors impacting shade provision at outdoor public parks (thesis). Taylor & Francis Group, Guelph.
- Sun, Z., & Shao, J. (2021). Preliminary study on innovative design of bamboo furniture based on users' big data (thesis). IOP Publishing, Chengdu.
- Volenec, Z. M., Abraham, J. O., Becker, A. D., & Dobson, A. P. (2021). Public parks and the pandemic: How Park usage have been affected by Covid-19 policies (thesis). PLOS ONE, United States of America.
- Morika, D., & Ratum, A. (2021). Review on outdoor furniture in time of pandemic Covid-19: A case of Ir. H. Juanda road, Bandung (thesis). IOP Publishing, Bandung.
- Liu, C. (2021). Research on Environmental Protection Factors of Landscape Design in Garden Greening (thesis). IOP Publishing, Jiangsu.
- Lei, Z., & Chen, W. K. (2021). Study on the Influence of Urban Landscaping on Residents' Quality of Life (thesis). Natural Volatiles & Essential Oils.

- Omar, A., Ibrahim, S., & Khaleefa, H. (2021). The Role of Healing Gardens in The Landscape Sustainability for Public Gardens (thesis). IOP Publishing, Nahrain.
- Kango, R., & Pongtularan, E. H. (n.d.). (2012). Design and Implementation of smart Bench Integrated solar cell for public electricity saving. International Journal Papier Advance and Scientific Review, 2(2).
- Gitchell, M. (2021). Pouring Concrete Benches for the Amphitheater at Slo Botanical Garden (thesis).
- Zvonareva, P. P., Filipskay, I. V., & Yangulova, I. V. (2020). A new approach to the design of street furniture in Krasnoyarsk (thesis). IOP Publishing, Krasnoyarsk.
- Allameh, E., & Heidari, M. (2020). Sustainable Street Furniture (thesis). Retrieved from <https://doi.org/10.3311/PPar.12674>.
- Panevski, E. N., & Kanevce, I. (2020). The Quality of Wooden Material in Outdoor Furniture (thesis). International Journal - Wood, design & Technology.
- El-Ghonaimy, I. H. (2019). Street Furniture Influence in Revitalizing the Bahraini Identity. Journal of Contemporary Urban Affairs, 4, 11–20. <https://doi.org/https://doi.org/10.25034/ijcua.2020.v4n1-2>
- Rachmayanti, I., Hartanti, G., Setiawan, B., & Fernando, A. P. (2019). Analysis of Design Applications in Public Street Furniture in Bandung (thesis).
- Ginting, N., Rahman, N. V., Nasution, A. D., Loebis, M. N., & Sinaga, F. A. (2018). Street furniture concept in Pasar Buah and Bukit Gundaling Based on place identity (thesis). IOP Publishing, Sumatera Utara. Retrieved 2018, from doi:10.1088/1755-1315/126/1/012195.
- Jaramillo, H., Gallardo, R., & Martinez, C. (2018). Street furniture in recycled and resignified materials (thesis). IOP Publishing, Ocaña.
- Akash, B., Dhanush, A., Ganesh, K., Jayaraj, M., Srinath, M., & Saravana, S. (2021). Advanced Time-Based System for Public

Garden (thesis). International Journal of Research Publication and Reviews, Gandhi Nagar.

- Vengala, J., Namratha, K. B., & Anusha, S. (2020). Precast Bamboo Reinforced Furniture Elements using Self Compacting Concrete (thesis). IOP Publishing, Andhra Pradesh.
- Solanki, R. (2021, March). Street Furniture is Important for Attracting City and Public Spaces (thesis). International Journal of Science and Research.
- Bambawale, A. (2019). Revitalizing Urban Streets as An Identity of Interactive Public Place (thesis). Journal of Emerging Technologies and Innovative Research, Pune.
- Patki, P. (2017). Relationship between Street Furniture in Pune and User's Convenience (thesis). International Journal of Research in Civil Engineering, Architecture & Design, Pune.
- Ganapathi, R., Omprakash, B., & Mohan, S. B. A. L. A. (2017, November). Design and Analysis of Convertible Bench (thesis). International Journal of Creative Research Thoughts.
- Bambawale, D. A. (2019). Revitalizing Urban Streets as An Identity of Interactive Public Place. Journal of Emerging Technologies and Innovative Research, Volume 6(Issue 4).
- Solanki, R. (2021). Street Furniture is Important for Attracting City and Public Spaces. International Journal of Science and Research, Volume 10(Issue 3).
- Vengala, J., Namratha, K. B., & Anusha, S. (2020). Precast bamboo reinforced furniture elements using self-compacting concrete. IOP Conference Series: Materials Science and Engineering, 936(1), 012010. <https://doi.org/10.1088/1757-899x/936/1/012010>
- Akash, B., Dhanush, B., Ganesh, S., Gopinath, K., Jayaraj, M., Srinath, M., S, T. M. P., & Senthil, S. (2021). Advanced Time-Based System for Public Garden. International Journal of Research Publication and Reviews, Volume 2(Issue 4), 202–205.

- Akash, B., et al., (2021) Advanced Time-Based System for Public Garden. Department of Electronics and Communication Engineering Rajagopal, Polytechnic College, Gandhi Nagar, Gudiyattam, India.
- Rakow, D.A. and Lee, S.A. (2011) Public Garden Management. Hoboken, NJ: J. Wiley.
- Snelling, J. and Lindsey, jay (2017) The Role of Public Gardens in Sustainable Community Development. North Carolina, Arboretum: American Public Gardens Association.
- Volenec, zoe, Abraham, joel and Becker, A. (2021) Public parks and the pandemic: How Park usage has been affected by COVID-19 policies. thesis. Available at: <https://doi.org/10.1371/journal.pone.0251799>.
- Almandrawy, M. (2016). Design Considerations Iron Bench in the Gardens (thesis). <http://www.ijert.org>, Egypt.
- DeChiara, J., Panero, J., & Zelnik, M. (2000). Time-Saver Standards for Interior Design and Space Planning. McGraw-Hill.

# WEBLIOGRAPHY



## WEBLIOGRAPHY

1. What is a Public Garden? | American Public Gardens Association. Publicgardens.org. (2022). Retrieved 25 August 2022, from <https://www.publicgardens.org/about-public-gardens/what-public-garden>
2. Blackwood, R. (2022). Benefits of a Community Garden - Healthier Steps. Retrieved 25 August 2022, from <https://healthiersteps.com/benefits-of-a-community-garden/>
3. Love for Gardens. (2021, October 2). Home - love for gardens - the gardening blog. Love for Gardens. Retrieved December 1, 2022, from <https://loveforgardens.com/>
4. Sue, S. (2011, April 25). Softscape and Hardscape: Garden components. Den garden. Retrieved December 1, 2022, from <https://dengarden.com/gardening/Garden-Components-Used-to-Create-Style>
5. David. (2021, June 21). A guide to park benches (for thriving neighbourhoods). Reliance Foundry Co. Ltd. Retrieved December 1, 2022, from <https://www.reliance-foundry.com/blog/park-benches-guide>
6. Home stratosphere -. Home Stratosphere. (n.d.). Retrieved December 1, 2022, from <https://www.homestratosphere.com/>
7. Cost guide for Indian home owners. Contractor Bhai. (n.d.). Retrieved March 2, 2023, from <https://www.contractorbhai.com/cost/>
8. United Nations. (n.d.). The 17 goals | sustainable development. United Nations. Retrieved December 7, 2023, from <https://sdgs.un.org/goals>
9. Author, S.-. (2023, February 16). Bench dimensions (Indoor & Outdoor Size Guide). Designing Idea. Retrieved February 20, 2023, from <https://designingidea.com/bench-dimensions/>

# APPENDICES



## APPENDIX – I



Institutional Ethics  
Committee for Human  
Research  
(IECHR)

FACULTY OF FAMILY AND COMMUNITY SCIENCES  
THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

### Ethical Compliance Certificate 2022-2023

This is to certify that **Ms. Haya Sheth's** study titled, **Designing of Garden Bench for Public Gardens of Vadodara City** has been approved by the Institutional Ethics Committee for Human Research (IECHR), Faculty of Family and Community Science, The Maharaja Sayajirao University of Baroda. The study has been allotted the ethical approval number IECHR/FCSc/M.Sc./2022/10.

Prof Shagufa Kapadia  
Chairperson  
IECHR

Prof Mini Sheth  
Member Secretary  
IECHR

**APPENDIX – II**  
**INTERVIEW SCHEDULE**

**SECTION I: Background information of the respondents**

1) Name of the respondent: - \_\_\_\_\_

2) Address: - \_\_\_\_\_

3) Contact Number: - \_\_\_\_\_

4) E-mail ID: - \_\_\_\_\_

5) Age: - \_\_\_\_\_

6) Gender: -

A. Female

B. Male

7) Height (cm): - \_\_\_\_\_

8) Weight (kg): - \_\_\_\_\_

9) How many days in a week do you visit a Public Garden?

A. Daily

B. One day

C. Two days

D. Three days

E. Four days

F. Five days

G. Six days

10) How many hours do you spend in the Public Garden?

A. Less than 2 hours

B. More than 2 hours

11) Which time of the day is preferable for visit to the Public Garden?

A. Morning time

B. Evening time

C. Other times

**SECTION II: The Problems faced by the respondents of the Public  
Garden while using Garden Bench**

Sr. No	PROBLEMS	Yes	No	Not Sure
<b>Comfort of Garden Bench</b>				
1.	Are you comfortable sitting on Garden Bench?			
2.	Is the inclined back rest comfortable for you?			
3.	Are you comfortable sitting for a long time without a hand rest?			
4.	Are you comfortable sitting for a long time without a leg rest?			
5.	Do you experience pain in your back while using the Garden Bench?			
6.	Do you experience muscle tension in your leg while using Garden Bench?			
7.	Do you experience neck pain while using Garden Bench?			
8.	Do you have knees pain while sitting on Garden Bench?			
9.	Do you feel tired after sitting on Garden Bench for longer period of time?			
10.	Do you find it easy to distinguish the bench colour?			
11.	Do you think the bench's edges are rough?			
12.	Do you face difficulty in spotting a Bench?			
<b>Dimension of Garden Bench</b>				
13.	Do you feel that the length of the bench is enough for you to sit properly?			

14.	Do you feel that bench have enough depth for you to sit?			
15.	Do you feel back rest for the bench has proper height?			
16.	Do you feel bench has proper inclined back rest?			
17.	Do you feel the bench is too high for you to sit?			
18.	Do you feel the bench is too low for you to sit?			
19.	Do you face difficulty in sitting because of its size?			
<b>Material of Garden Bench</b>				
20.	Do you feel that the material of the bench makes it difficult to sit comfortably?			
21.	Do you feel that the material of the bench is hard?			
22.	Do you feel that the material of the bench is slippery?			
23.	Do you feel that the material of the bench is rough?			
24.	While sitting on a bench, do you feel that the bench is radiating heat?			
25.	While sitting on a bench, do you feel bench is damp sometime?			

Any other problem faced while using the Garden Bench: \_\_\_\_\_

\_\_\_\_\_

## APPENDIX – III

### OBSERVATION SHEET

Observation of various aspects of the garden bench installed by parks and Garden Office, Vadodara Municipal Corporation (VMC)

Sr. No.	Aspects of Garden Bench	Observation by Designer	
		Existing	Remarks
<b>Dimension of Garden Bench</b>			
1.	Total height of the bench		
2.	Width of total bench		
3.	Seat height of the bench		
4.	Length of the seat		
5.	Thickness of seat		
6.	Thickness of backrest		
7.	Depth of the bench		
8.	Height of the back rest		
9.	Length of the back rest		
10.	Angle between back rest and seat of the bench		
11.	Distance between two legs of bench		
12.	Height of leg		
13.	Thickness of leg		
<b>Material of Garden Bench</b>			
14.	Material		
15.	Construction		

16.	Finish		
17.	Strength and Durability		
18.	Porosity		
19.	Moisture retention		
20.	Heat radiation		
21.	Heat retention		
22.	Finishing of bench edges		
23.	Comfort in cleaning		
24.	Ease of maintenance		
<b>Aesthetics of Garden Bench</b>			
25.	Design Style		
26.	Colour		
27.	Texture		
28.	Pattern		
29.	Shape and form		
30.	Placement/ arrangement in space		

Other Observation: \_\_\_\_\_

\_\_\_\_\_

## APPENDIX – IV



Estd. 1949

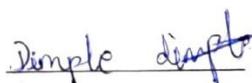
NAAC Accredited 'A' Grade

DEPARTMENT OF FAMILY & COMMUNITY RESOURCE MANAGEMENT  
FACULTY OF FAMILY & COMMUNITY SCIENCES  
THE MAHARAJA 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 to 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, problems experienced by you while using Garden Bench in Public Gardens of Vadodara city. 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 10-15 minutes. If you have any further questions concerning this research, please feel free to contact Ms. Haya Sheth, researcher, through Phone +919426836180, email id [shethhaya2001@gmail.com](mailto:shethhaya2001@gmail.com)

Please indicate with your signature on the space below that you understand what participation in this 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 Respondent  
Date:

  
**Ms. Haya Sheth**  
M.Sc. (F.C.Sc.)  
Department of FCRM,  
FFCSc, MSU

  
**Ms. Himani Shah**  
Research Guide &  
Assistant Professor  
Department of  
FCRM, FFCSc,  
MSU

# ABSTRACT



## ABSTRACT

Public gardens play a variety of roles in daily life. A public garden is a place where people feel connected to nature. Due to the compact nature of work and residential spaces in urban areas, people feel a lack of fresh air and an absence of open space for relaxing. The garden is a place where one can spend time doing activities to keep your body well maintained and mind fresh. A public garden comprises various hard and soft components of landscape such as, trees, flowerbeds, hedges, water bodies, benches, gazebos, pathways and so on. Garden benches are required in public gardens as visitors need to relax and sit down at some point in their visit to the garden. And so, benches are an important feature of parks and gardens. Benches are of various types. They can be made of varied materials such as wood, metal, concrete, and heavy plastic. A bench is something that is used by different types of people at varied times of the day. Thus, design and material selection of garden benches for public gardens is very important. Hence, the present study aimed to develop the design of garden bench for the public gardens of Vadodara City. A descriptive research design was adopted for this study. The locale for the present study was Vadodara city, Gujarat, India. Purposive sampling technique was used for the present study. The sample size for the current investigation was 150 users of selected public gardens of Vadodara city. Five public gardens of Vadodara city were selected, where garden benches were installed and maintained by the Parks and Garden Office of Vadodara Municipal Corporation (VMC) of Vadodara city. 30 respondents were interviewed from each of the five selected public gardens. Interviews of the respondents were taken while they visited the public gardens. Based on the objectives set for the current research, two tools were developed. The interview schedule consisted of two sections. Section I collected personal and situational information about the respondent, including frequency of visit to the public garden, duration of time spent in the public garden, preferred time for visiting the public garden. Section II gathered information regarding problems experienced by the respondent while using the garden bench in the public gardens. The observation sheet included the study of different aspects of the existing garden bench namely its dimensions, comfort

and aesthetics. The data were analyzed and presented by applying descriptive statistics.

The findings showed that the mean age of the respondents was 37.65 years. Less than one-half of the respondents visited the public garden daily. It was found that two-third of the respondents visited the public garden in the evening. It was found that more than three-fourth of the respondents were visiting public gardens for less than two hours. It was found that respondents having more than three-fourth of problem regarding inclination of the backrest, more than two-third of the respondents experienced problem regarding the hardness of the material, less than two-third of the respondents reported that edges of the garden bench felt rough, less than two-third of the respondents experienced discomfort regarding sitting without an armrest, more than one-half of the respondents reported back pain while sitting on the garden bench, more than one-half of the respondents experienced problem regarding heat radiation of the material while more than one-half of the respondents experienced problem regarding the roughness of the material and more than one-third of the respondents experienced discomfort while spotting the garden bench. Three garden bench designs were proposed. The first design proposed for the garden bench was a basic design. It resolved the problems related to back inclination, roughness of edges and colour for comfort in spotting the bench. The second design proposed for the garden bench was a comfortable design. It resolved the problems related to the back inclination, roughness of the edges, colour and included armrest for adding more comfort. The third design proposed for the garden bench was an innovative design. It resolved the problems related to the back inclination, roughness of the edges, colour, and arm rest. The design incorporated solar panels with a charging point.