

Assimilating Cycle Park as a Part of Urban Living

By Shikha Patel^{*}, Kiran Gangadharaiah[‡] &
Reshmi Manikoth Kollarath[°]

Cycling has a century-old history. Originated as the cheapest and most practical mode of transportation, the evolution and modernity of cycles have led to cycling becoming a popular adventure sport. While the first cycling race was held in 1868, this sport has evolved to various dimensions as a result of innovation and growing interest in sports. This study documents the evolution of cycling from being a mode of transport to recreation to adventure sport, as practised in recent times, as a part of urban living. With the help of a relevant literature review, this study proposes an architectural design of a cycle park in Bengaluru, with the aim to encourage its citizens to make it a part of their urban living. Bengaluru has observed a growing craze of cycling as a sport, over the past decade. Statistical data from cycle dealers and manufacturers reveals these growing trends. In support of the decision from the Forest Department of Bengaluru to allow cycling in Turrahalli forest, this paper proposes a cycle park adjacent to the Peripheral Ring Road amidst Turrahalli forest. The design aims to serve amateurs, professionals, and cyclists of all ages, giving them a safe and natural environment. With the implementation of such a proposal, the authors hope to encourage cyclists and city dwellers to take up cycling on regular basis, in response to the deteriorating global health.

Introduction

Cycling has come a long way since the starting of the 20th century. Beyond just the functional aspects of cycling as a means of transport and a form of recreation, cycling has also had an impact on urban planning. Early on cycles were advocated as a practical and cheaper alternative for a horse, and for this reason, they were introduced in postal and wire services, police and fire departments, and even in the army. The use of motor vehicles, being an expensive means, was mainly for recreation (for example, touring the countryside and enjoying nature) for the wealthier class. After the First World War and the late 1950s, cycling was ubiquitous on streets and public roads all over the world. Later, cycling was replaced by motor vehicles, and cycling headed towards an all-time low demand.¹ However, in the 1970s, the health, environmental and economic benefits of cycling were highlighted by activists, politicians, and later by policymakers, urban planners, and public

^{*}PhD Student, Department of Architecture and Urban Planning, Qatar University, Qatar.

[‡]Architect, Design Front Architects, India.

[°]Associate Professor, BMS College of Architecture, India.

1. J. Spinney, "Cycling the City: Non-Place and the Sensory Construction of Meaning in a Mobile Practice," in *Cycling and Society* (eds.) D. Horton, P. Rosen, and P. Cox, volume 1 (England, UK: Ashgate Publishing Limited, 2007).

health experts.² In terms of contributing to urban planning, cycle tourism enhanced rural modernization because it encouraged infrastructural improvements along popular routes and the spread of facilities such as cafes, restaurants, parks, information booths, and repair shops. The image of cycling and its engineering aspect was essentially linked to competitive racing, in support of the enthusiasm from spectacles. The challenges of speed, thrill, performance, time, and distance records made it more exciting for the audiences. The first long-distance race was staged in France, in the late 1860s, shortly after the launch of the velocipede. Cycle racing, on indoor and outdoor tracks, was the first commercialized and media-covered mass spectator sport.³ Figure 1 photographs a group of bicyclists in the U.S. army taken on 7th October 1896.



Figure 1. “Bicyclists” Group on Minerva Terrace, U.S. Army on October 7, 1896
 Source: A. Ruggiero, *Little-Known Heroes: All-Black 25th Infantry Bicycle Corps* (Gear Junkie Website, 2016).

This paper examines the phenomenon of cycling in India and the integration of cycling as a means of transport and recreation in urban planning. This paper delves into the evolution of cycling as a major sport and the necessity and relevance of developing sports infrastructure in a city. The paper examines the importance of

2. Civitas, *Enabling Cycling Cities: Ingredients for Success* (Mimosa: Civitas Mimosa, 2013); H. Oosterhuis, “Cycling, Modernity and National Culture,” *Social History* 41, no. 3 (2016): 233-248.

3. A. Ritchie, “The Origins of Bicycle Racing in England: Technology, Entertainment, Sponsorship and Advertising in the Early History of the Sport,” *Journal of Sport History* 26, no. 3 (1999): 489-520; N. Butler, *The Velocipede Invasion of 1869* (Charleston County Public Library, 2019).

these structures in the urban fabric and looks at how these structures can be integrated into the city through its design. For the purpose of this paper, cycling is viewed both – as a sport and a recreation activity of urban life.

Cycling and Urban Planning

With increasing environmental awareness in cities, people have started recognizing the benefits of active living, sport, and physical activity. There have been many studies that have established the social, environmental, and economic impacts of sports infrastructure on cities. Sports stadiums and related sports infrastructure can also become venues for other non-sport and recreational activities attracting the local community and providing spaces for people to come together. These structures also increase the imageability of the place with the potential to become iconic structures which in turn can provide different forms of capital to the city. Sports stadiums across the world are major landmarks providing visibility to the city at the global level and also major tourist destinations. Well-planned sports infrastructure can contribute to the economy along with increasing the fitness and overall wellbeing of the local community.⁴ Cities across the world are increasingly understanding the importance of developing a good sports infrastructure that would merge in the existing urban form, making the infrastructure a part of urban living. Even as cities across Europe have integrated local plans for active living within the broader planning process, many developing countries, such as India, are still working their way to make the urban planning process holistic.⁵

Urban planning should encourage physical activity in the community. This can be done through planning policies and urban design promoting walkability, pedestrianism and activities including cycling by providing biking and walking trails in the master plan. Out of the many forms of physical activity that urban planning of the city can offer to its people, this study emphasizes the importance of cycling as a sport and a recreational activity for urban life. This can offer multiple solutions to our cities, such as, generating thrust for more green spaces, social inclusion, better sports facilities, and building more equal societies and, eventually contribute to the goal of making our cities more sustainable and resilient.⁶ At the end of the 20th century, cities looked upon sport as a catalyst to generate an economy. Only industrialized cities invested in sports infrastructure, intending to create more job opportunities and attract tourism. This did not particularly include the local communities. However, since the last two decades, policymakers and

4. G. Dickinson, and Z. J. Jianhui, “Sports and Urban Development: An Introduction,” *International Journal of Sports Marketing and Sponsorship* (2020).

5. P. Edwards and A. D. Tsouros, *A Healthy City is an Active City: A Physical Activity Planning Guide* (Europe: World Health Organization, 2008).

6. Olympic Studies Centre, *World Cities Day 2020: The Power of Sport to Build Healthier, More Sustainable Urban Communities* (Tokyo: International Olympic Committee, 2020).

planners have become more sensitive towards locals and have created a new image and new opportunities to justify investments in sports infrastructures.⁷

Relevance of Cycling in Bangalore City

In the past, India has hosted many national and international tournaments and games, such as the Asian Games. Bangalore, one of the fastest metropolitan cities in India, hosted the Indian National games in 1997⁸ and National Youth Games in 2008.⁹ Bangalore has regularly been a host of International Premier League (IPL) cricket for the past decade. It is evident, that Bangalore's residents have shown a growing interest in sports. Sports clubs, health centres, gyms, arenas, and stadiums have made a significant contribution to the urban form and lifestyles of people.

One such popular, most sustainable interest among Bangalore's residents is cycling. Cycling serves as the cleanest mode of mobility. It is zero dependence on fossil fuels and zero-emission characteristics, which not only makes it affordable but also positively contributes to deteriorating climate. However, with the knowledge the authors have gained from their experience, cycling in Bengaluru is a sport rather than a mode of travel. After the IT boom in 2000, there has been an average increase in income levels of the working class in Bengaluru. With massive populations migrating from all over the globe, the traditional lifestyles have now become more dynamic. While automobile and public transportation remain the popular modes of travel, cycling is apparently the most popular recreation/leisure sport. There are more than 20 active cycling groups in Bangalore, out of which at least 5 have more than 3000 members.¹⁰ Especially, after the onset of COVID-19, more people have taken up cycling as a mode of primary physical activity. After the first lockdown of COVID-19, wholesalers of cycle shops reported a 30% hike in their sales, and owners of cycle repair shops reported 20 to 30% increases in their customers.¹¹ In response to this, the comprehensive mobility plan of Bruhat Bengaluru Mahanagar Palika (BBMP), announced the development of 600 kilometres of cycle tracks in the next 10 years around the city.¹² A report by Dutch social enterprise reports a 50% increase in the use of cycles in Bengaluru. Out of which, rides for recreation exceed the number of rides for commute and daily users.¹³ From the available data, it can be said that residents of Bengaluru prefer to cycle more for recreation than for work as illustrated in Figure 2.

7. C. Gratton, S. Shibli, and R. Coleman, "Sport and Economic Regeneration in Cities," *Urban Studies* 42, no. 5 (2005): 985-999.

8. J. Heitzman, "Sports and Conflict in Urban Planning: The Indian National Games in Bangalore," *Journal of Sport and Social Issues* 23, no. 1 (1999): 5-23.

9. Hindustan Times, *Bangalore to Host First Ever National Youth Games* (Bangalore, Karnataka, India: India News, 2008).

10. N. M., *Get Biking with These Cycling Clubs in Bangalore* (Bangalore, India, 2020).

11. A. S. Mounika, *Cycling the New Normal in Bengaluru, Sales Shoot up After Lockdown*. *Cycling* (Bangalore, India: The News Minute, 2020).

12. A. Dev, *Number of Pedallers rise in Bengaluru, but not Enough Space for Cycling* (Bengaluru, India: Hindustan Times, 2021).

13. Cycle To Work. *Bangalore Cycling Project* (Bengaluru, India, 2020).



Figure 2. Bike Ridership in Bangalore from January 2017 till February 2021

Source: Cycle To Work 2020.

Cycle manufacturers, newspapers, sports communities, local, national, and international organizations sponsor cycle races to promote the sport and diversify economies. Cycling has transformed from a mode of transportation to sports meeting the aspirations of the different populations. To serve such aspiration of Bengaluru citizens, this study proposes a cycle park in Bengaluru, where enthusiasts of all levels can come and practice and/or learn. The proposed cycle park design aims to provide a safe, approachable, affordable and equal atmosphere amidst nature to all cyclists. The proposed architectural project intends to bring out the pure structural effort without artifice thereby enhancing the selected site. Above all, it aims to create a dialogue between the existing urban form and the proposed curved geometry of the structure and display an example of architectural integrity. The proposed design follows global standards employed by reviewing examples around the world.

Context

Bengaluru, the capital city of Karnataka State, is not only the fastest-growing city in terms of population and area but also is one of the (fourth) largest metropolitan hubs in India. The physical growth of the city occurred in four phases: first, (in 1951 – 1961) growth of public sector undertaking creating jobs for

millions, second (1960 – 1970) growth of industries and state-run businesses, third (the 1980s) dramatic growth of the private sector and fourth (1990s) the offshoot growth from establishing IT industry. Only from 1991 – 2001, the area of Bengaluru expanded 92.1% and the population grew by 37.8%.¹⁴ With this huge number of people migrating to the city, the built environment is largely driven by market interests, not by communities, resulting in a diverse cultural system. The lifestyles of people vary due to the influence of distinctive cultures they bring in, individuals' financial capacities, and the localities they reside in. Figure 3 shows the location of Bengaluru with respect to the region and the nation.

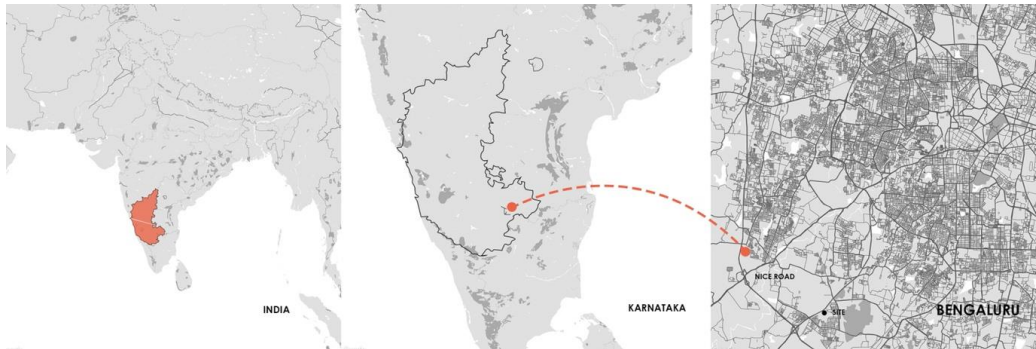


Figure 3. Location of Bengaluru

Source: Authors.

Lying in the Southern part of the Indian sub-continent, in the state of Karnataka (Figure 3), Bengaluru hails at 3,113 feet above sea level. The topography makes the climate pleasant throughout the year. Bengaluru enjoys 970 mm rainfall on an average annually.¹⁵ The strategy used for urban planning is orbital development, marked by ring roads (Figure 4). This type of development allows urban centres to decentralize accommodating growth with the addition of each ring road.

14. A. M. Varkey, *Ever-growing Bengaluru and Ineffective Planning* (Bengaluru, India: Deccan Herald, 2018); S. Puttalingaiah, S. Irfan, and A. D. Hanjagi, "Levels of Urbanization in Bengaluru Urban District of Karnataka, India," in *Social and Behavioural Sciences*, 70-80 (Bengaluru: International Conference on Humanities, 2020).

15. Bengaluru Online, *Geography of Bengaluru*. Bengaluru (India: BengaluruOnline.in, 2021).



Figure 4. *Orbital Development, Marked by Ring Roads*

Source: Authors.

According to the latest census (2011 – 2021) report, the population growth is consistent with an average of 3.5% annually.¹⁶ The native language of Bengaluru, Kannada, is now spoken by only 38% population, which is the result of mixed culture migration. The population density has also increased by 47% in the past decade (4,000 per square kilometre).¹⁷

With such dramatic increase in population number and diversity, Bengaluru has found a common sport - cycling, famed by cycling communities. The active cyclist groups in Bengaluru conduct cycling trips throughout the year. Nandi Hills ride, Manchanabele dam, Banyan tree ride, Pipeline ride, back to university ride, and Neelamangala ride are some of the popular cycling trails, visited by cyclists on a daily basis.¹⁸ The location of these cycling tracks is shown in Figure 5.

16. Census 2011, *Bangalore (Bengaluru) City Population 2011 - 2021*. Retrieved from: <https://www.census2011.co.in/census/city/448-bangalore.html>. [Accessed 6 May 2021.]

17. World Population Review, *Bangalore Population* (Bangalore: World Population Review, 2021).

18. Bangalore Cycling Routes (Bengaluru, India: Bumsonthesaddle.com, 2021).

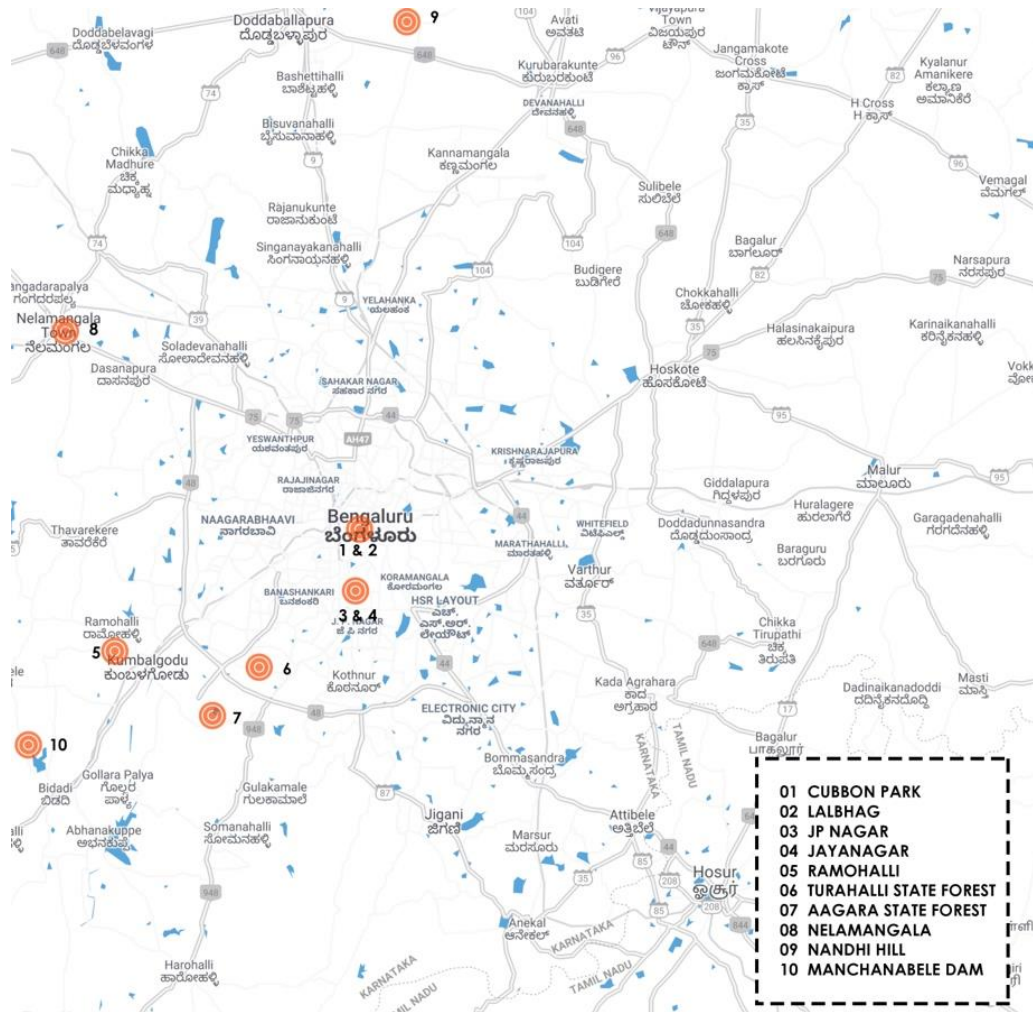


Figure 5. Map of Popular Cycling Trails

Source: Authors.

The evidence of active groups of cyclists from social media channels and pages is proof that if given better facilities, people will be more than willing to make use of it. During an informal interview, active cyclists reported that their growing interest in cycling is due to the following reasons:

- No formal training is required for beginners.
- All members of the family (or community) can participate and cycle together.
- The occurrence of long-term injuries and major accidents is relatively less
- The cost of cycling varies based on the level of expertise. Hence, the beginners find it affordable, to begin with.
- One doesn't need a dedicated playground or space to cycle.

In the past (the 1860s and 1870s), when cyclists were replaced by motor vehicle drivers on the road, many motivated cyclists and/ or activists made an effort

to revive cycling as a mode of transport. The “velocipede mania” in the 1860s, followed by “cycle boom” or “craze” in the 1890s, in many parts of the west is a piece of evidence that cycling as a mode of transportation has degraded and again revived over centuries.¹⁹

In 2014, the Directorate of Urban Land Transport (DULT) promoted the “cycle day” campaign once a month, to encourage cycling as a mode of mobility. Community partners and NGOs participated from different neighbourhoods of Bengaluru to carry this campaign.²⁰ In 2006 - 2007, the government of Karnataka invested Rs. 200 crores to give away free cycles to children aged above 13. In 2020, DULT submitted a 34 kilometres cycle lane project to BBMP (now under construction) on the outer ring road, which would give dedicated lanes for cyclists²¹ as part of its “Cycle District Project”. Also in 2020, DULT received suggestions of cycling routes, for development, from 109 active cyclists. DULT further developed these suggestions and with the help of Urban Local Bodies (ULB) of various municipalities in Bengaluru. As a result, the “Cycle District” project is now integrated with the “Bengaluru smart city mission”. Under this project, the government aims to develop dedicated cycle lanes around the city at various locations.²²

Design Statement

Acknowledging the importance and need of sports infrastructure in the city, the authors propose a design of a cycle park in Bengaluru. The proposed design examines standards and architectural details accepted and adopted globally. The inspiration of the structure of the cycle park is adopted from the Olympics Games, the velodrome geometry. The velodrome’s history dates back to the 19th century when Preston Park, Brighton in England constructed the first cycle track taking on velodrome structure.²³ Of course, the tracks did not display tuned 180 degrees and straight ways until 1896, when the Olympics spared the need to construct a consistent velodrome. Since then, velodromes have been modified in terms of the quality of tracks and sizes. Various sports companies have constructed velodromes for countries to host cycling races and/ or events. The proposed design structure and building materials used creates visual permeability for the user, making the cycle park a part of the existing urban form.

19. M. S. Toohey, *Amateurs, Cash Amateurs and Professionals: Social and Cultural History of Bicycle Racing in New Zealand*. (Lincoln University, 2010).

20. Government of Karnataka, *Cycle Day* (Bengaluru: Directorate of Urban Land Transport, 2014).

21. R. Malagi, *34-km Cycle Lane Coming up on the Outer Ring Road Soon*. *Commute* (Bengaluru, India: Citizens Matters, 2020).

22. J. K. R., *Cycling Districts to Come up Across Bengaluru* (Bengaluru: The Hindu, 2020).

23. M. Nystrom, *What is a Velodrome? Cycling Articles* (Active.com, 2020).

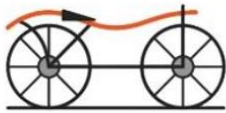
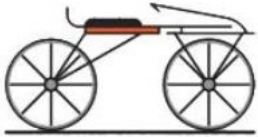
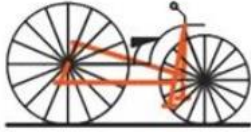
Literature Review

“Cycling occupies a somewhat unusual position among sports. It is an old sport, originating at the moment of the birth of the modern bicycle in the late 1860s; it is an extraordinarily well-documented sport; it is even a sport about which [much has] been written through the years – and yet...it is not a sport that has been well explored from a critical and academic point of view”. - Andrew Ritchie

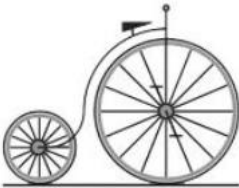

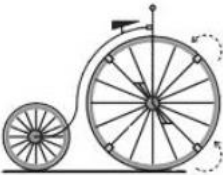
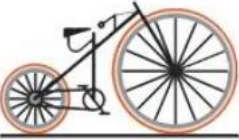

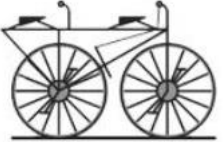


In the past, cycling tracks were constructed to serve the safety and convenience of cyclists. However, considering cycling as a sport, advanced tracks with scientific knowledge on the physics of cycling are a must to understand. Attempts to promote cycling as a daily sport are initiated by governments across the world. For example, the world’s longest continuous cycle track (20.4 miles) was achieved by the public works authority in Qatar in the Middle East.²⁴ This sport requires stamina, perseverance, self-reliance, core strength, balance, and bike handling skills and has inspired many people in India as well. As discussed earlier, the history of the cycle dates back to the late 18th century.







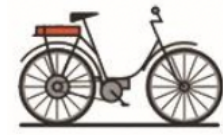
The following section looks at the evolution of the cycle and different types of cycling practised in the current times. Studying the evolution of cycle helps to understand the prerequisites of designing a cycle park. The evolution of cycle is transcribed in the process of designing the cycle park. Table 1 depicts a brief history of the evolution of the cycle.

Table 1. *Evolution of Cycle*

Year	Event	
1790	Celerifere – was invented by Comte Mede de Sivrac. The features include two equal-sized wheels and a seat, but no steering, brakes, or pedals. The rider glides on the celerifere after gaining speed using their feet.	
1817	Steerable Laufmaschine – also known as the running machine, velocipede, Draisine, and the swift-walker. Following the two-wheeler principle, the wooden steerable Laufmaschine has a steerable front wheel.	
1858	Pedals – The steerable laufmaschine has pedals added to it.	

24. M. Kaddoura, *The Longest Continuous Cycle Path in the World Laid in Qatar* (Doha, Qatar: Guinness World Records, 2020).

1863	Boneshaker – Blacksmith Ernest Michaux invents the first commercially successful velocipede in 1863, which is now called the boneshaker. The boneshaker was made of stiff materials and straight angles which made it a “boneshaker” to ride on over common cobblestone roads.	
1866	Penny Farthing – British engineer, James Starley invents the penny-farthing which is commonly known as the high wheeler. The penny-farthing looks pretty silly compared to modern bicycles, and it was pretty difficult to ride. This difficulty limited the popularity of the high wheeler.	
1876	Caliper Brakes – English inventors Browett and Harrison patent an early version of the calliper brake.	
1879	Bicyclette – After many attempts for lever-driven models, Henry J. Lawson patented the first rear-wheel, chain-driven safety bicycle.	
1885	Rover Safety Bicycle – The first model to look like what we now think of as a standard cycle. This model combines a low seat, strong metal for a chain, and two wheels that are similar in size.	
1889	The Pedal-Back Brake – These brakes were patented by Daniel-Stover and William Hance, which later become a standard feature on bicycles.	
1896	Coaster Brakes– These brakes allow the bike to move forward without requiring the pedals to move and the rider can brake by pedalling backwards. These brakes continue to be popular in some areas to this day.	
1898	Pedal-Powered Battery Regenerator – This is a peculiar design in which the pedals spin a generator, which in turn drives a small motor. Known for being the first electric velocipede.	

1938	Electric Hub Motor – Thomas M. McDonald files a patent for an electric hub motor. This may be the earliest of its kind for a front-wheel-mounted version. The patent filing details this bicycle aims to allow the bicycle to be operated by only power, with the option of pedals.	
1979	Mountain Bike – Californian Joe Breeze is credited for creating the mountain bike. The prototypes for these are developed by many early designers including Joe Breeze, Otis Guy, Gary Fisher, and Craig Mitchell. These are the first tough frames built for downhill racing.	
1984	Cogs – It becomes popular for cogs to be added to the rear gear cluster, increasing the number of speeds from 15 to 18, 21, and 24.	
2002	10-Cog Rear Cluster – Italian bicycle component manufacturer Campagnolo develops a 10-cog rear cluster, allowing for 30-speed bicycles.	
2009	Electronic Gears – International manufacturer Shimano develops electronic gears that allow for faster shifting.	
2012	ADAPTRAC – names after the inventor, a system allowing the rider to individually adjust tire pressure while riding. Through a system of carbon dioxide cartridges, allows riders to maintain optimum traction when riding in changing conditions.	
2014	Lithium Nickel Manganese Cobalt Oxide Batteries – Otherwise known as NMC batteries, this is a newer type of lithium battery that starts becoming popular with electric bicycles around 2013-2014. NMC delivers higher power in a smaller package than previous models.	

Source: Adapted from Evelo Electric Bicycles, *The History & Evolution of the Bicycle* (evelo.com, 2021).

Types of Cycling

Cycling as a sport is practised at various difficulty levels. These styles have helped popularize cycling as a sport, by making it physically and mentally

challenging for cyclists. The following are the some of the styles that have been translated into the proposed design of the cycle park.

- BMX (Figure 6) – BMX is one of the most popular off-road styles, usually seen and practised in the rural areas or countryside, where the cyclist would naturally get undulated terrain. It originated in the 1970s in California, where one could find youngsters riding and stunting off-road. Just like motorcycles. BMX cycles are sturdier in make and smaller in dimension. It is made to take abuse and stunts, which would challenge both, the rider and the ride. BMX cycles have frames made of steel (high-tensile) and aluminium, those meant for racing. BMX cycles offer various riding styles, from off-road to urban build-up spaces to ramps designed in BMX parks.²⁵
- Road biking (Figure 6) – This is the most commonly performed cycling as it doesn't need professional training. These cycles are used on a variety of roads such as BMX, racing, touring, and utility. It can be used in the velodrome as well as outdoors. The first-ever cycle race (1200 meters) was held on 31st May 1868 at the Parc de Saint-Cloud, Paris, where roading biking cycles were extensively used. As India is gradually turning its attention to adventure sports, road biking has become very popular over the past few decades.

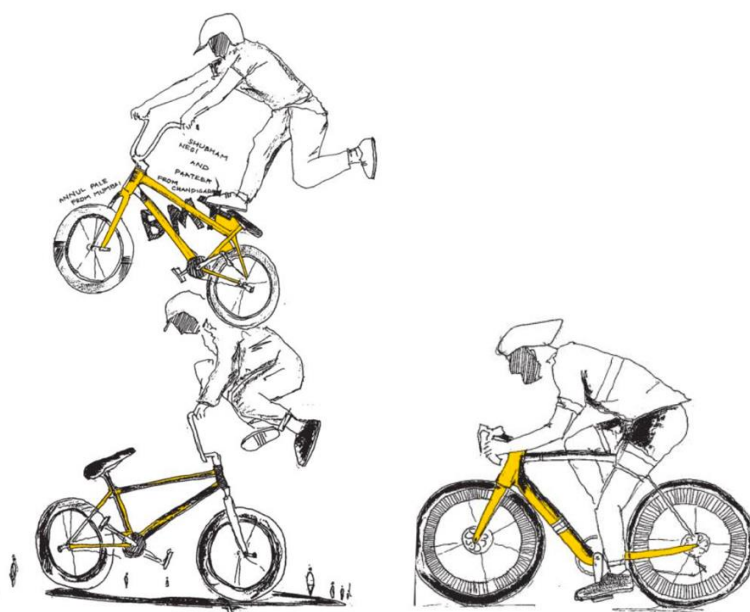


Figure 6. BMX Stunts and Road Biking

Source: Authors.

- Mountain biking (Figure 7) – This is an extreme style, where riders build their pumps and trails. Although there are no formal rules to this style,

25. P. Edwards, *Meet the First Stunt Bicyclist. He Did Tricks in the 1880s and Invented the wheelie* (Trivia Happy, 2016).

trained mountain bikers are aware of the unwritten rules, such as, be respectful of jumps and trails and being respectful of others. Weather and terrain play an important role in performing this style and conducting challenges. Dirt jumping, slopestyle, cross country, and downhill are some of the categories popularly performed while mountain biking.

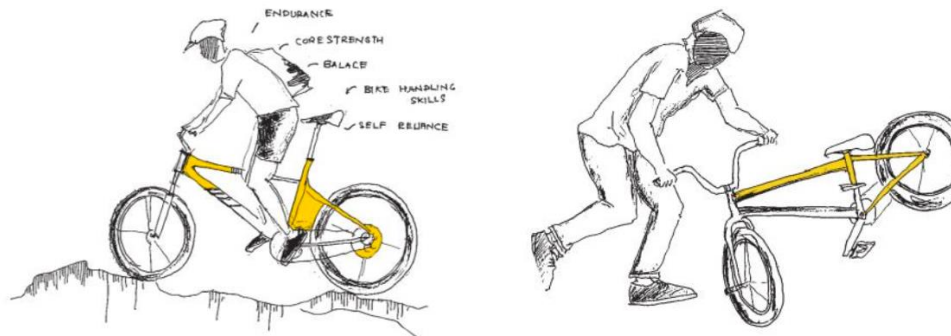


Figure 7. Mountain Biking Style

Source: Authors.

- Freestyle – The lightest weighing cycles are made to freestyle. They become popular shortly after BMX cycles and are used for flat trails, vertical skates, and aggressive street riding. Considered one of the safest styles, they come with multiple front and back gears.
- Dirt jumper – These bikes bridge the gap between BMX bikes and freestyles. Also known as jumpers, these cycles are designed to take flight for various ages of cyclists. They usually don't have front brakes and are a great choice for heavier riders.

The two examples below help the authors to understand the standards and architectural details of a velodrome. These examples are selected for desktop study as they have been tested by time and events over the decades. Both the examples have served national, international and local events. This paper suggests integrating such a facility into the city's urban form. Though these examples may not have particularly served the communities they are located in, but the design details and the concept of velodrome are important for this paper. The design developed of the proposed cycle park relies on the standards comprehended from the examples (see Table 2).

Example 1

Anna Meares Velodrome (10,000 m²) was built in 2016 to serve the Commonwealth games 2018 in Brisbane, Australia. The stadium can accommodate 1,500 spectators and can expand for 4,000 more with temporary seating. Several events throughout the year, such as Track National Championships, Queensland National Championships, and Cycling Queensland Club are hosted at Anna Meares. Cox

Rayner from COX Architects was the principal designer, jointly commissioned by Queensland State and the Australian government. With an elliptical footprint, Anna Meares Velodrome is one of the largest column-free arenas in the world. The steel roof makes the structure light weighted and provides a clear roof span of 118 meters. Figure 8 is an interior photograph of Anna Meares Velodrome showing the seating area, cycle tracks and steel truss on the roof. The stadium is water and energy-efficient and uses full LED broadcast lighting, making it one of its kind in the world.²⁶ Figure 9 presents the architectural plan and section of the stadium.



Figure 8. Anna Meares Velodrome

Source: C. F. Jones, *Photograph. Anna Meares Velodrome* (Brisbane, Australia: Cox Architects, 2018).

26. Arup, *The Architectural Vision is a Bowl that Grows from the Undulating Landscape. Anna Meares Velodrome* (Brisbane, Australia: ARUP, 2019); Austadiums, *Anna Meares Velodrome* (Brisbane, Australia: Austadiums.com, 2021); Cycling Queensland, *Anna Meares Velodrome* (Brisbane, Australia: cycling.org.au, 2021).

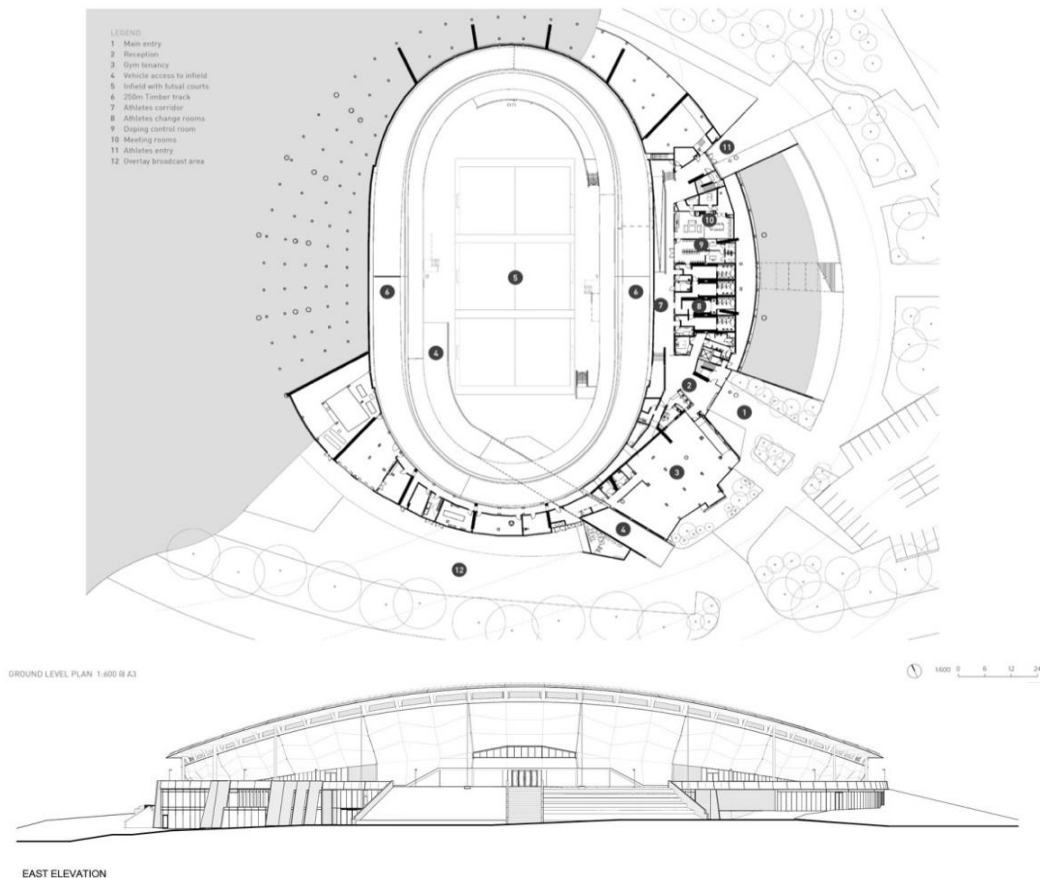


Figure 9. Top View Plan and East Elevation of Anna Meares Velodrome

Source: Archdaily, *Anna Meares Velodrome* / Cox Architecture (Brisbane, Australia: archdaily.com, 2021).

Example 2

Lee Valley Velopark in East London was inaugurated in February 2011. The velodrome has served as a permanent venue for Olympic 2012 and Paralympic games. Along with racing tracks, the velodrome has one mile of road tracks and 5 miles of mountain tracks. The design was publicly revealed by Hopkins Architects and Grant Associates in 2008, making it the first Olympic Park venue. The stadium can accommodate 6,000 spectators and provides for all levels of cyclists, amateurs, and champions. Figure 10 was photographed from the outdoor bicycle track of the velodrome followed by Figure 11 presenting its architectural plan and sectional elevation. The design focused on making it sustainable by adopting technologies like rainwater harvesting, harvesting natural light, and energy saving. The velodrome was a built-in way to make the London skyline beautiful, primarily using the traditional western cedar redwood as construction material. The idea was to avoid massive use of steel, in an attempt to not give a contemporary look.²⁷

27. Wordpress, *A Work of Perfect Engineering* (London: archvelopark.wordpress.com, 2016).



Figure 10. Anna Meares Velodrome

Source: Hopkins Architects, *London 2012 Velodrome* (London: archdaily.com, 2021).

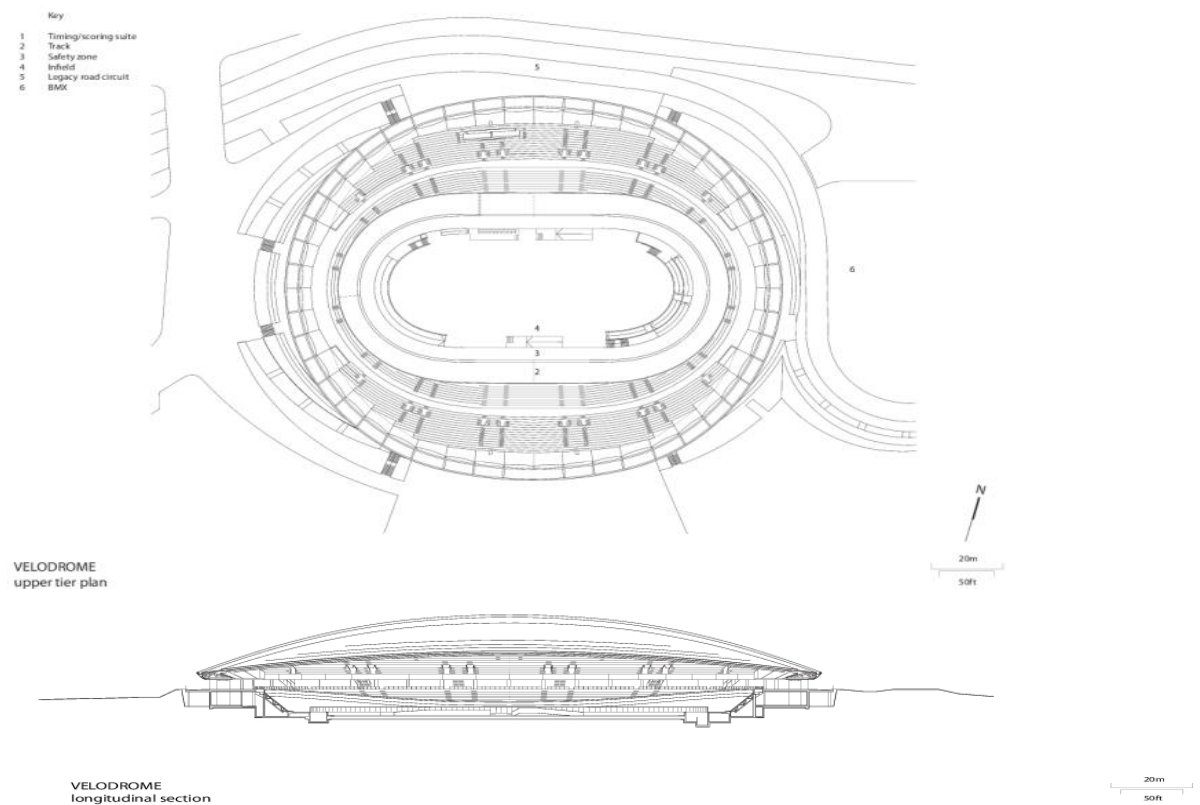


Figure 11. Upper-tier Plan and Sectional Elevation of Lee Valley Velopark

Source: Hopkins Architects, *London 2012 Velodrome* (London: archdaily.com, 2021).

The learnings from the case studies helped in the design decision for the cycle park at Bangalore. The comparison and how the learnings were adopted in the final design are presented in Table 2.

Table 2. Comparative Table of Case Study Learnings

Features	Anna Meares Velodrome, Australia	Lee Valley Velopark, London	Proposal
Total Area of Velodrome	10,000 m ²	21,700 m ²	11,450 m ²
Capacity	1500 (+4000)	6750	2000
Building Type	Indoor	Indoor	Indoor
Primary Material used	Concrete and Steel	Wood (western cedar redwood)	Concrete and Steel
Clear Roof Span	118 m	136 m	125 m
Sub-structure	Concrete	Concrete	Concrete
Super Structure	Steel	Steel	Concrete and Steel
The material used for tracks	Steel and wood	Steel and wood	Steel and Wood
The total length of the track	250 m	250 m	250 m
180 turning radius			
Innovation	Roof framing is configured to allow the complex hyperbolic paraboloid roof to be formed by simple straight components.	The roof is designed to reflect the geometry of cycling as well as being lightweight and efficient reflecting a bike. There is also a 360-degree concourse level with windows allowing people views of the Olympic Park.	The truss form which connects to the multiple steel support will gain better stability and the orientation has been designed on a contoured site.
Sustainability Target Achieved	Energy, water-efficient. Full LED lighting.	Energy, water-efficient. Use of maximum daylight.	Better daylight and ventilation and no land cut in the contours

Source: Authors.

Methodology

The motivation of proposing a design for the cycle park in Bengaluru was initiated by the author's interest in cycling as a sport. When researched further in Bengaluru's context, the vision was set to serve a rather larger community. In this regard, understanding the context became the first step of the overall design process. A thorough desktop study was carried out to understand the climate, geography, demography, and culture of Bengaluru. Information from municipal authorities confirmed the need for such a project and led the authors to select an appropriate site. As a second step, a literature review was conducted to identify scientific standards which would make the rider's experience safe. Examples from

over the globe guided in implementing these standards into the design. The findings of literature review confirm the need of such a park in Bengaluru, owing to its citizens growing interest in cycling as a sport. Also, the proposed design project is validated by realizing involvement of local authorities in developing such a facility. The third step, which was analyzing the physical and geographical conditions of the selected site, resulted in defining the limitations of structural design. With sustainable architecture as the core theme, a conceptual design was then developed disturbing as little as possible, the existing greens. The final design phase included details of architectural and structural design. The final design of this study is presented in the form of architectural plans, sections, and three-dimensional views. Figure 12 presents the above-mentioned design process.

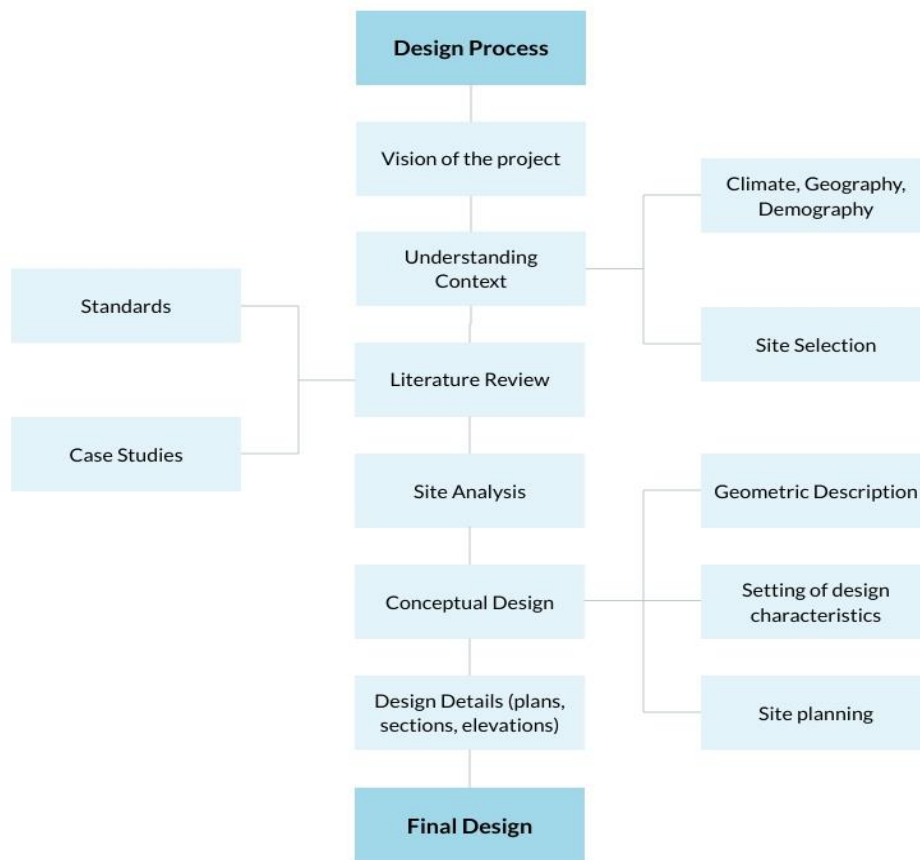


Figure 12. *Design Process*

Source: Authors.

Proposed Design

Site Selection

From Figure 5, it can be inferred that many existing popular trails in Bengaluru are located adjacent to the new ring road, Nice road, soon to become a peripheral

road. The proposed design aims to serve all ages and all professional levels of cyclists. Hence, it is reasonable to choose a naturally levelled landscape between nature to give the cyclists a real experience. On this basis, the site next to Nice road has been selected by the authors. Figure 13 shows the selected site location with the city as a reference. The selected site falls under the zone “park or open space” regulated by Bengaluru Land use development authority, further justifying the selected site by authors. Lying adjacent to the ring road, not only makes the site accessible but also makes the cyclists experience nature as it is surrounded by Turahalli forest’s deciduous trees. The Turahalli forest department currently allows enthusiasts and cyclists to practice and ride, which makes it rational to develop a cycle park there. The site is easily accessible by road and the nearest bus stop is 500 meters away. Figure 14 shows the selected site with reference to its surroundings.



Figure 13. Site Location on Bengaluru Map

Source: Authors.

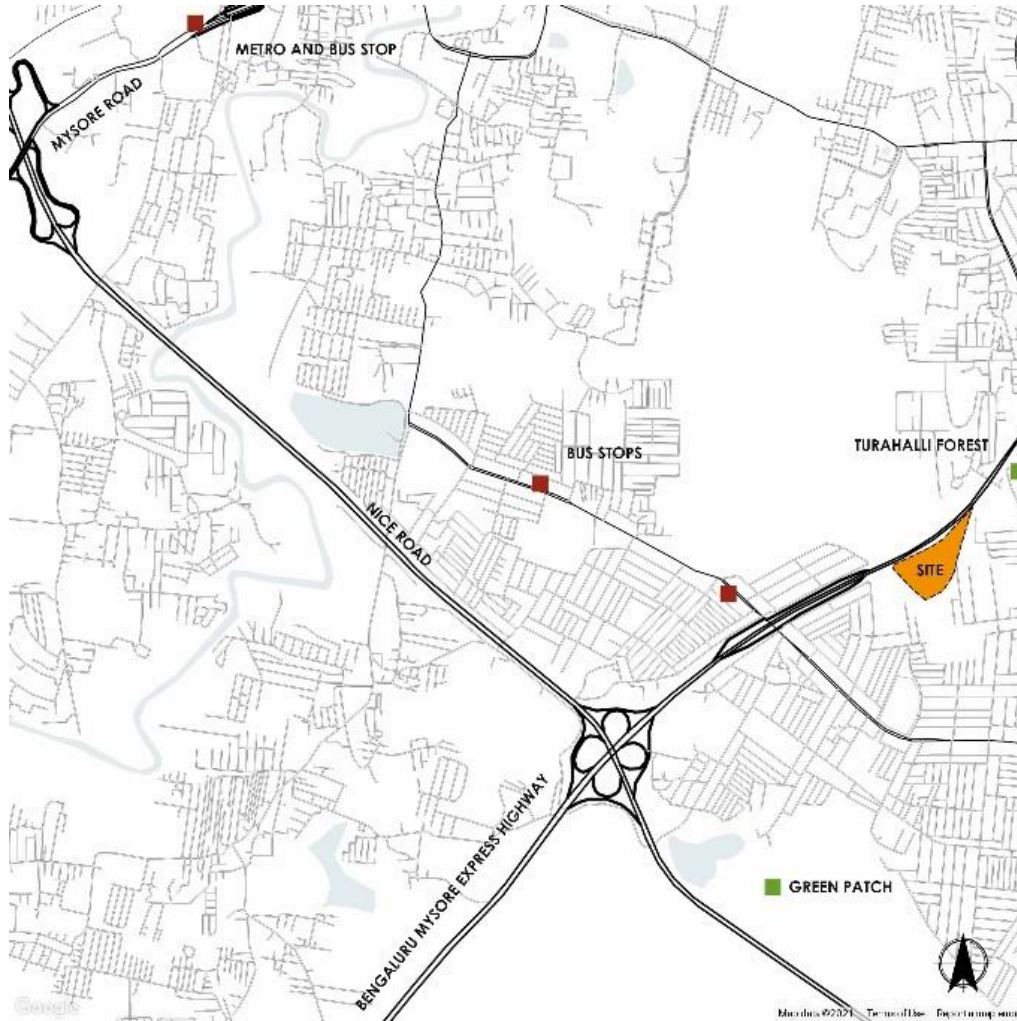


Figure 14. Site Location

Source: Authors.

Site Analysis and Setting

Post site selection, the next step is to lay the geometry based on the required functionality of the place. The function of the cycle park is specific and hence, the natural geography of the site is utilized to its best to lay the site layout. The proposed design is developed along the contours of the site, which assists to give natural tracks to BMX and mountain bikers. The maximum and minimum elevation of the contours on the site is 12-14 meters with a total site area of 19.07 acres (77,180 square meters). Figure 15 shows the contours of the selected site. The area surrounding the selected site is still under development and the only built forms found are small tea shops, grocery shops, auto garage–repair shops, and bus stops. As the area is allotted to Forest Department, which is responsible to conserve the forest as a natural resource, constructing permanent buildings and high rise is not a scope, even in the future. The proposed design utilizes all the existing trees, as a response to forest conservation.

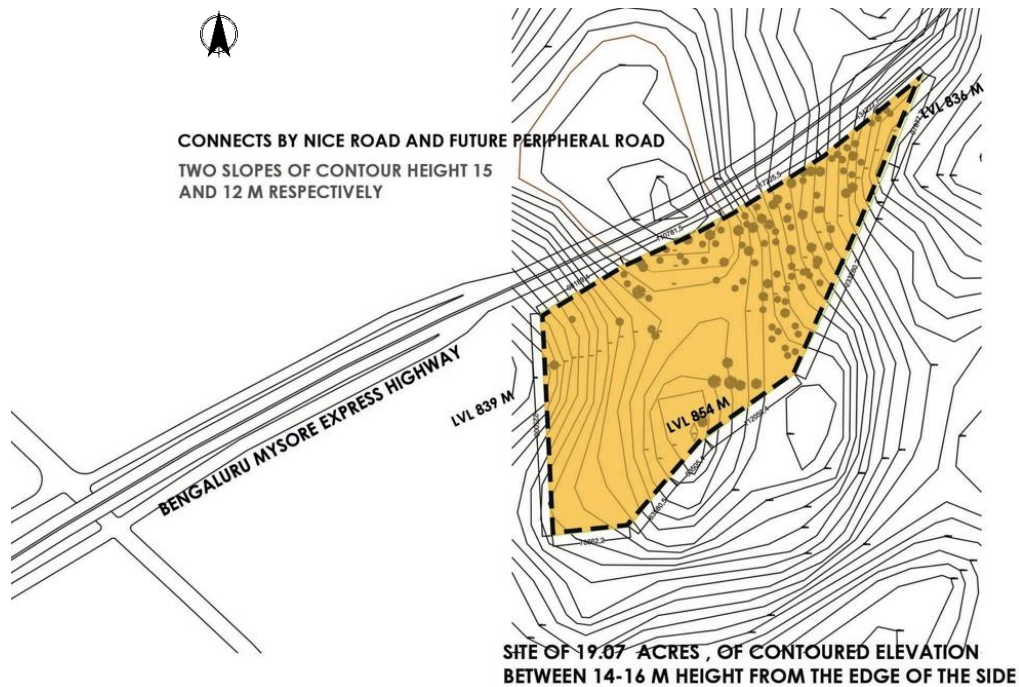


Figure 15. Proposed Site
Source: Authors.

The setting of the site and its building structure is inspired by the tension nodes of a cycle. During the ride, the cycle frame transfers the tension, that is the weight applied on the saddle, on the nodal points. The connection of those frames acts as a medium to circulate tension on all nodal points. However, based on the weight on the saddle and the pressure on the peddles, the tension at different nodal points differs from time to time. In the proposed design, these nodal points act as primary spaces, in terms of their function (refer to Figure 16).

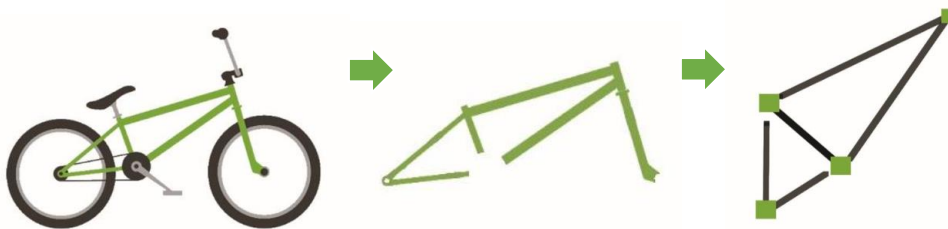


Figure 16. Concept Inspired by Tension Nodes in a Cycle
Source: Authors.

The main structure, that is the velodrome occupies the Northwest side of the site, which is adjacent to the peripheral road too. If the structure of the cycle frame is superimposed on the site, the location of the velodrome represents a major nodal point (tension point below the saddle). Laying the site from its northernmost edge, the indoor and outdoor mountain biking (MTB) park represents the topmost nodal point in the cycle frame (the handle of the cycle). The central part of the site comprises BMX park and kids pump park. Figure 17 presents the master plan of

the park followed by site sections in Figure 18. When implemented, this cycle park can serve as an athletic sports centre that can host national events. Housing is provided on the eastern edge as a response to such future events. On the opposite end of housing lies the velodrome with a capacity of 2,000 people, adjacent to an outdoor amphitheater and administration block. In the rear end of the site, the southern side lies the parking for visitors and cyclists. With a clear roof span of 125 meters in the velodrome, the structure is entirely constructed out of concrete and steel. The tracks are made out of wood and steel. The truss which connects to the multiple steel support is designed to gain better stability and orientation on a contoured site (see Figure 17). Figure 18 shows the elevational sections of the site.

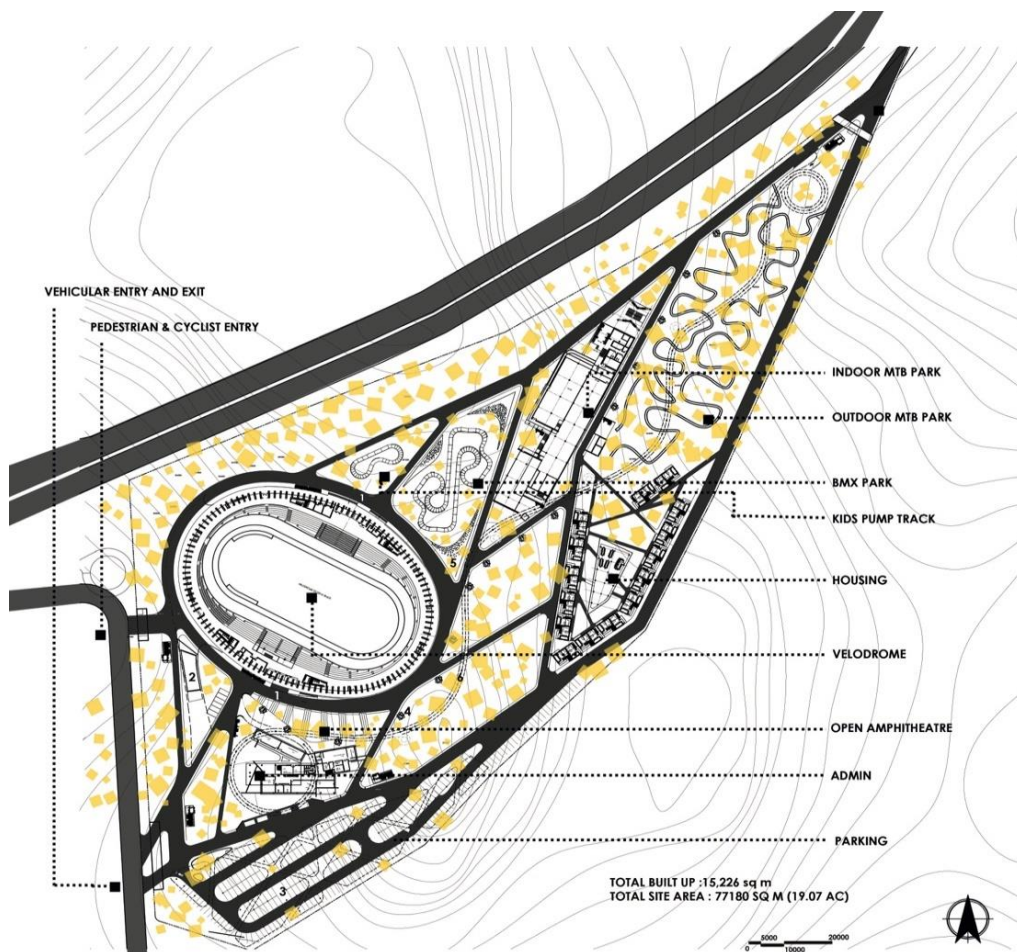


Figure 17. Site Plan Development

Source: Authors.

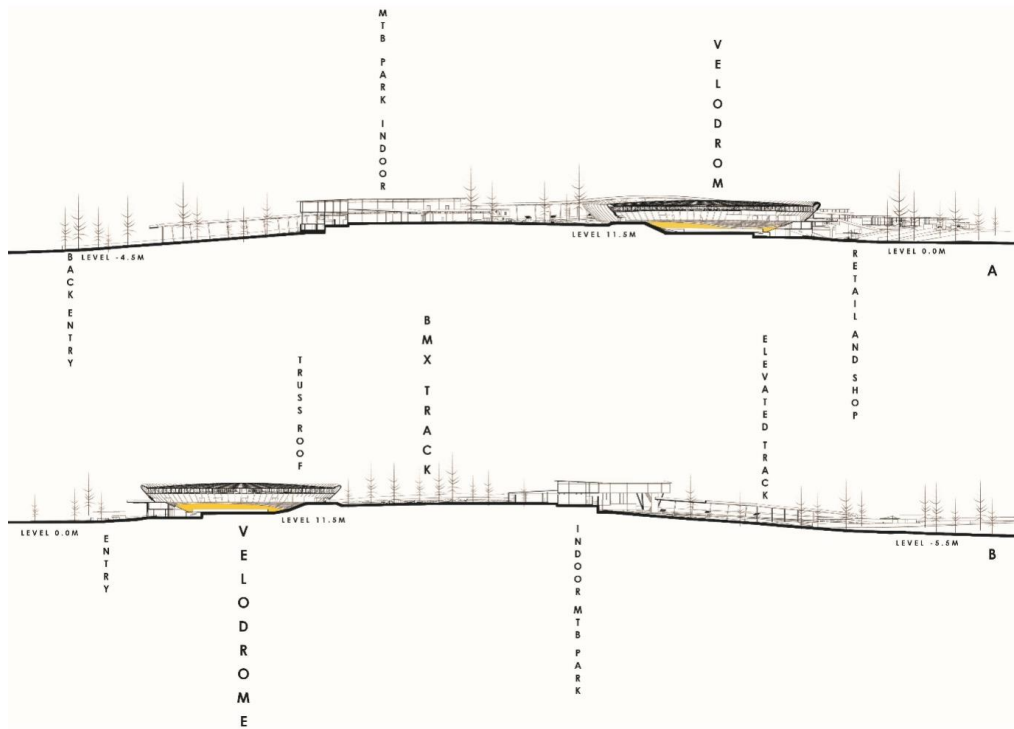


Figure 18. Site Sections

Source: Authors.

Design Details

The design of the velodrome is structured into steel and concrete frames supporting a column-free track. Above the ground level (2.5 meters), at 3.5 to 7.5 meters, accommodates the gym, cycle associations, and other services. The entry-level consists of entry/ exit points along with shops and public facilities. This, ground-level public facilities amalgamate the structure into the urban form of the place, not only visually but also by its function. The visual assistant will invite people to use the velodrome as a part of their routine. On the next level, the seating capacity accommodates 2,000 people from 8 meters and 11.5 meters. The wooden Velo track is supported by metal sections forming the outer shell and support for the velodrome. This is enveloped in glass with minimal openings, with the idea to use natural light to its fullest. This will create a feel of porousness in the structure, allowing people to experience nature without being outside. Even the tubular truss, which forms a light roofing structure is combined with metal tubes letting natural light in. The proposed design hopes to thus, coalesce with the existing urban environment that will encourage the users to make it a part of their urban life. Figure 19 shows details of the velodrome and its sectional details. Figure 20 presents an elevational section of the park, while Figures 21 and 22 present various views of the velodrome from the outdoor tracks.

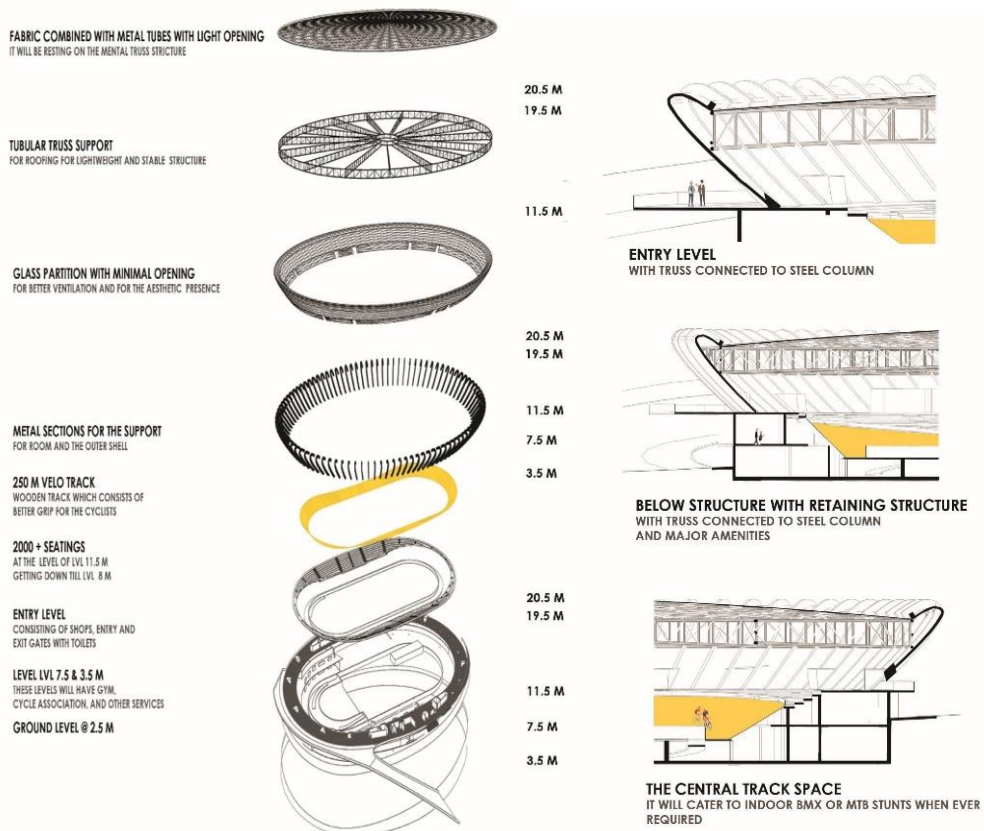


Figure 19. Design of Velodrome and Sectional Details

Source: Authors.

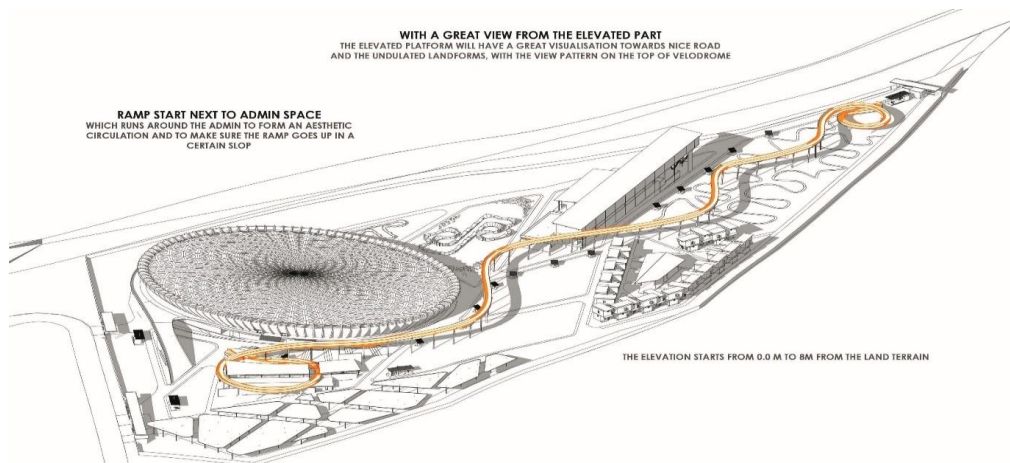


Figure 20. Elevational View

Source: Authors.

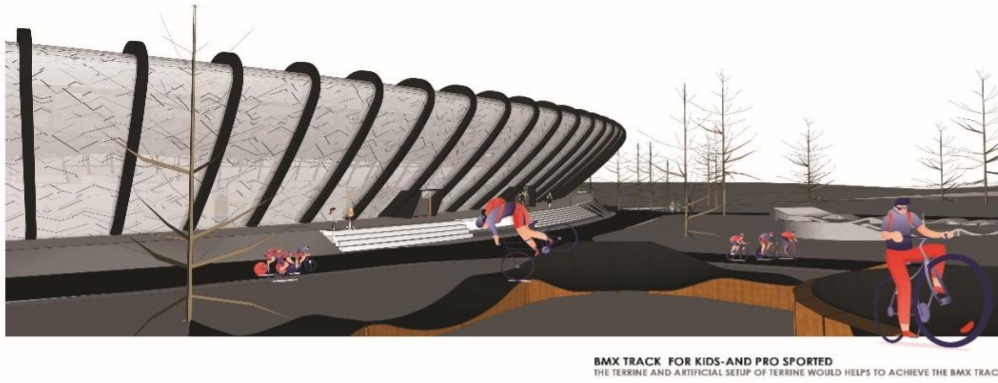


Figure 21. *Velodrome Top Section*

Source: Authors.



Figure 22. *View of Interlinked Spaces around the Park and View of Elevated Tracks*

Source: Authors.

Discussion

Planners and theorists have defined urban living as life and lifestyles in cities of 20th century.²⁸ What is expected out of this urban life is a subject of debate based on the geography, culture, and demography of the place. The literature review reveals the growing craze of the people of Bengaluru for the sport of cycling. Owing to the rise of COVID-19 and the subsequent lockdowns, this sport was seen as an escape from lockdown life and bouncing back to being fit. Additionally, the pleasant climate of Bengaluru allows for such a sport to be performed. For an unwalkable metro city like Bengaluru,²⁹ how can cycling become a part of urban living? With the aim to answer this question through architectural design, the paper presents a pilot cycle park design adjacent to the peripheral ring road. However, this would serve only a part of the population. More research is needed to develop such cycle parks around Bengaluru to really make it a part of citizens' urban living. As the key finding of this paper, focuses on the design of the cycle park, more research needs to be done on the social cohesion of such a facility. Will creating such an atmosphere invite more people to cycle? Does Bengaluru offer other sites between nature to practice the sport? What about the people living in the city centre who experience urban life to its maximum? How to bring the people to continue their pandemic lifestyle after the pandemic as this sport was initiated as an escape from lockdown? To answer these questions, and throw more light on the subject, more research is needed.

Conclusions

The study included a literature review exploring people's growing interest in cycling, especially during pandemic times (COVID-19). The influence of the mixed culture population and immigrants from all over the country and globe has given new light to the potential of cycling as a sport in Bengaluru, in the recent decade. Several cyclist groups have explored cycling trails in and around Bengaluru. However, many cyclists still do not get a chance to practice stunts due to no dedicated infrastructure. The amateurs also lose motivation due to the little infrastructure provided and for safety reasons. With this notion as a starting point, this study has documented international standards and case studies, to propose a cycle park for amateurs and professionals where they can practice cycling as a leisure activity as well as a sport. The idea is to give the infrastructure of an international cycling stadium within the city limits but also with natural textures, such as uneven terrain which is needed for mountain biking. The design provides BMX track cycling, road biking, mountain biking, freestyle and dirt jumper facilities. Concepts such as natural lighting, water and energy-efficient systems make the design relevant to the time. If implemented, this study aims to provide the

28. L. Bettencourt, and G. West, "A Unified Theory of Urban Living," *Nature* 467 (2010): 3, 21.

29. P. MV, *Bangalore Scores Low on Walkability Score* (Bengaluru, India: Bengaluru News, 2014).

place with appropriate infrastructure for all cyclists and for national and international cycling events to take place.

Bibliography

- Archdaily. *Anna Meares Velodrome/Cox Architecture*. Brisbane, Australia: archdaily.com, 2021.
- Arup. *The Architectural Vision is a Bowl that Grows from the Undulating Landscape. Anna Meares Velodrome*. Brisbane, Australia: ARUP, 2019.
- Austadiums. *Anna Meares Velodrome*. Brisbane, Australia: Austadiums.com, 2021.
- Bangalore Cycling Routes. Bengaluru, India: Bumsonthesaddle.com, 2021.
- Bengaluru Online. *Geography of Bangalore*. Bengaluru, India: BengaluruOnline.in, 2021.
- Bettencourt, L. and G. West. "A Unified Theory of Urban Living." *Nature* 467 (2010): 3.
- Butler, N. *The Velocipede Invasion of 1869*. Charleston County Public Library, 2019.
- Census 2011. *Bangalore (Bengaluru) City Population 2011 - 2021*. Retrieved from: <https://www.census2011.co.in/census/city/448-bangalore.html>. [Accessed 6 May 2021.]
- Civitas. *Enabling Cycling Cities: Ingredients for Success*. Mimosa: Civitas Mimosa, 2013.
- Cycle To Work. *Bangalore Cycling Project*. Bengaluru, India, 2020.
- Cycling Queensland. *Anna Meares Velodrome*. Brisbane, Australia: cycling.org.au, 2021.
- Dev, A. *Number of Pedallers rise in Bengaluru, but not Enough Space for Cycling*. Bengaluru, India: Hindustan Times, 2021.
- Dickinson, G., and Z. J. Jianhui. "Sports and Urban Development: An Introduction." *International Journal of Sports Marketing and Sponsorship* (2020).
- Edwards, P. *Meet the First Stunt Bicyclist. He Did Tricks in the 1880s and Invented the wheelie*. Trivia Happy, 2016.
- Edwards, P., and A. D. Tsouros. *A Healthy City is an Active City: A Physical Activity Planning Guide*. Europe: World Health Organization, 2008.
- Evelo Electric Bicycles. *The History & Evolution of the Bicycle*. evelo.com, 2021.
- Government of Karnataka. *Cycle Day*. Bengaluru: Directorate of Urban Land Transport, 2014.
- Gratton, C., S. Shibli, and R. Coleman. "Sport and Economic Regeneration in Cities." *Urban Studies* 42, no. 5 (2005): 985-999.
- Heitzman, J. "Sports and Conflict in Urban Planning: The Indian National Games in Bangalore." *Journal of Sport and Social Issues* 23, no. 1 (1999): 5-23.
- Hindustan Times. *Bangalore to Host First Ever National Youth Games*. Bangalore, Karnataka, India: India News, 2008.
- Hopkins Architects. *London 2012 Velodrome*. London: archdaily.com, 2021.
- Jones, C. F. *Photograph. Anna Meares Velodrome*. Brisbane, Australia: Cox Architects, 2018.
- Kaddoura, M. *The Longest Continuous Cycle Path in the World Laid in Qatar*. Doha, Qatar: Guinness World Records, 2020.
- M., N. *Get Biking with These Cycling Clubs in Bangalore*. Bangalore, India, 2020.
- Malagi, R. *34-km Cycle Lane Coming up on the Outer Ring Road Soon*. *Commute*. Bengaluru, India: Citizens Matters, 2020.
- Mounika, A. S. *Cycling the New Normal in Bengaluru, Sales Shoot up After Lockdown*. *Cycling*. Bangalore, India: The News Minute, 2020.
- MV, P. *Bangalore Scores Low on Walkability Score*. Bengaluru, India: Bengaluru News, 2014.

- Nystrom, M. *What is a Velodrome? Cycling Articles*. Active.com, 2020.
- Olympic Studies Centre. *World Cities Day 2020: The Power of Sport to Build Healthier, More Sustainable Urban Communities*. Tokyo: International Olympic Committee, 2020.
- Oosterhuis, H. "Cycling, Modernity and National Culture." *Social History* 41, no. 3 (2016): 233-248.
- Puttalingaiah, S., S. Irfan, and A. D. Hanjagi. "Levels of Urbanization in Bangalore Urban District of Karnataka, India." In *Social and Behavioural Sciences*, 70-80. Bengaluru: International Conference on Humanities, 2020.
- R., J. K.. *Cycling Districts to Come up Across Bengaluru. DULT Receives Ideas and Routes from Enthusiasts and the General Public*. Bengaluru, India: The Hindu, 2020.
- Ritchie, A. "The Origins of Bicycle Racing in England: Technology, Entertainment, Sponsorship and Advertising in the Early History of the Sport." *Journal of Sport History* 26, no. 3 (1999): 489-520.
- Ruggiero, A. *Little-Known Heroes: All-Black 25th Infantry Bicycle Corps*. Gear Junkie website, 2016.
- Spinney, J. "Cycling the City: Non-Place and the Sensory Construction of Meaning in a Mobile Practice." In *Cycling and Society*, edited by D. Horton, P. Rosen, and P. Cox, volume 1. England, UK: Ashgate Publishing Limited, 2007.
- Toohey, M. S. *Amateurs, Cash Amateurs and Professionals: Social and Cultural History of Bicycle Racing in New Zealand*. Lincoln University, 2010.
- Varkey, A. M. *Ever-growing Bengaluru and Ineffective Planning*. Bengaluru, India: Deccan Herald, 2018.
- Wordpress. *A Work of Perfect Engineering*. London: archvelopark.wordpress.com, 2016.
- World Population Review. *Bangalore Population*. Bangalore: World Population Review, 2021.

