

The Biggest Sports Halls in the World

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DOI: <https://doi.org/10.51584/IJRIAS.2026.11080010>

Received: 02 August 2026; Accepted: 07 August 2026; Published: 29 August 2026

ABSTRACT

More than ever in its history, the world as a whole is expressing awareness of its uniqueness in all matters, both those concerning the given reality (nature) and those created by man and his social community. In addition, issues concerning each human individual, his family, local social communities and close associations are as important as issues of larger social communities (states, regions) and the human population on a global scale. Namely, the global world is made up of components, so a serious attitude towards them is essential in order to build more complex systems from them. Powerful means of communication, both those concerning the physical movement of people and things (modern land, water and air communications) and those that transmit information (radio, television, Internet) have enabled mass (and relatively cheap) communication between people, and modern means of information transmission practically instantaneous (on-line) monitoring of events from any part of the world to any part of the world, including part of the Universe. The great and universal question of the relationship between personal and collective, local (regional) and universal-world, current and all-time (...). The topic covered in this paper is related to the architecture study program, but also to a large number of other studies (sports, art, cultural history, sociology, public health protection, organizational sciences, economics...). The content of the work entitled "THE BIGGEST SPORTS HALLS IN THE WORLD" includes us in the atmosphere of today's 'global world'. Large sports halls are major hubs of community and economy. They host global sporting events, major concerts, and political gatherings. They also boost local tourism, create jobs, and serve as emergency shelters during natural disasters. They employ hundreds of workers for events and day-to-day maintenance; fans and visitors spend money on local hotels, restaurants, and shops; bring people together for sports games and music concerts; host local school graduations, fairs, and cultural festivals; showcase the country's wealth and modern design; act as safe havens during floods or storms; often serve as mass vaccination or testing centers; and they smoothly conduct civic elections for large numbers of people.

Keywords: The Biggest Sports Halls, The World

INTRODUCTION

From the perspective of the Architectural Definition of Space (ADS) theory ^[1,2,3,4,5,6,7], the construction of large halls is a result of the relationship between the Social Environment-Man-Boundaries, while the influence of the Natural Environment on the design of large halls occurs in areas of strong winds (monsoons) and frequent earthquakes (as is the case, for example, with the Philippine Arena, Ciudad de Victoria, Bulacan, Philippines, built in 2014). The construction of large indoor sports halls has evolved from ancient covered training areas to the massive, multi-purpose arenas of today. Fueled by the steel and concrete of the Industrial Revolution, these indoor facilities emerged for gymnastics, boxing, and basketball before expanding into the multi-sport and entertainment centers we rely on today ^[2]. The history of large sports halls includes several key milestones: The early Greeks used covered spaces, such as the palaestra, primarily for training and martial arts exercises before the modern era largely turned to outdoor stadiums and amphitheaters. 19th-century industrialization: As cities grew, early modern arenas emerged as wooden structures designed for gymnastics. The advent of steel and iron allowed architects to span wider roofs, introducing areas for basketball and boxing. Concrete shells after World War II: The 1950s and 1960s saw the emergence of massive, cast-concrete domes. Facilities like the Houston Astrodome (opened in 1965, architects: Hermon Lloyd & W. B. Morgan and Wilson, Morris, Crain and Anderson, later known as Morris Architects) revolutionized indoor sports by

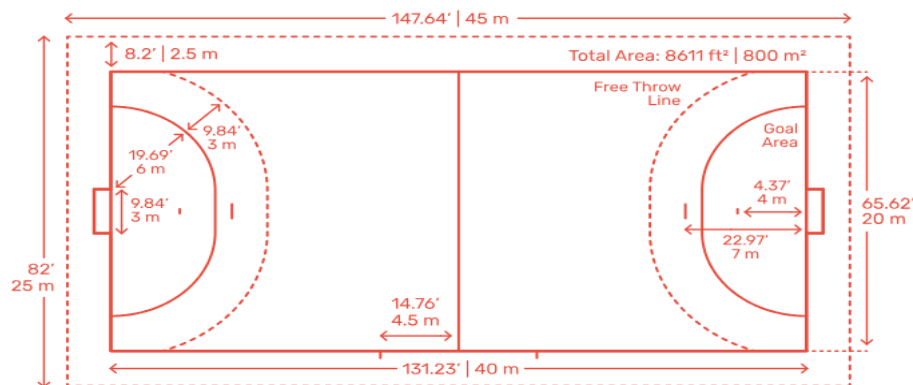
using air conditioning and enclosed spaces to keep fans comfortable year-round. Today's arenas rely on advanced cable-stayed roofs, retractable seating, and state-of-the-art acoustic engineering. Venues like the Stockholm Globe Arena (1989, architects: Svante Berg and Lars Vretblad) and the Wukesong Arena in Beijing (2008, architect Gu Yonghui) were built as year-round entertainment centers, designed to transform from basketball courts to concert stages within a few hours. The first modern indoor arena built to hold more than 10,000 spectators was the Chicago Stadium (architects: Hall, Lawrence & Ratcliffe, Inc.), which opened in 1929. With an initial capacity of approximately 18,000 to 20,000 people for boxing, hockey, and basketball, it was the largest indoor arena in the world at the time of its completion. While ancient outdoor amphitheaters such as the Roman Colosseum (70–80 AD) held tens of thousands of people, truly massive, fully enclosed indoor spaces were not possible until major engineering advances—particularly steel trusses and long-span arched roofs—were developed in the early 20th century. Other early architectural milestones in large indoor spaces include: Boardwalk Hall in Atlantic City, USA (opened 1929, architects: Lockwood Greene). This colossal space was built without internal roof supports and could hold up to 40,000 people. It was designed for large conventions and spectacles; The Royal Albert Hall in London, UK (built in 1871, architects Captain Francis Fowke and Major-General Henry Y. D. Scott), is an important historical predecessor, although it was designed more as a concert venue and could only accommodate around 8,000 spectators when it opened; the Wiener Stadthalle in Vienna, Austria (built between 1953 and 1958, architects Roland Rainer Dietrich/Untertrifaller) marked the rise of large, multi-purpose European indoor arenas; the Houston Astrodome in Houston, USA (opened in 1965, architects: Hermon Lloyd & W. B. MorganWilson, Morris, Crain & Anderson Praeger-Kavanagh-Waterbury) became a global marvel as the first domed sports stadium, allowing over 50,000 spectators to watch baseball and football under an air-conditioned roof; The Philippines Arena, Philippines (capacity 55,000, architects: Populous, constructors: Buro Happold), opened in 2014, has a massive 3.6-hectare roof and a column-free interior that provides unobstructed views; the Saitama Super Arena, Japan (capacity 37,000, architects: Dan Meis, Ellerbe Becket), is known for its incredible flexibility where massive structural blocks can be moved on air bearings to reshape an entire bowl of seating in just a few hours; the Paris La Défense Arena, capacity up to 40,000 (mainly 15,000–32,000), opened in 2017 (architect: Christian de Portzamparc, constructors: RFR Engineers). This domed stadium is the main home of the Racing 92 rugby team; the MVM Dome, Hungary, has a capacity of 20,028 spectators. The hall opened in 2021 (architect György Skardelli), is the largest purpose-built indoor sports hall in Europe, often hosting major championships in handball and martial arts. Similar to large sports halls, large stadiums began to be covered (enclosed) in the early 21st century. AT&T Stadium, USA (built 2009, architects: HKS, Inc., designers: Walter P Moore Engineers and Consultants Campbell & Associates Consulting Engineers, Inc.), has a capacity of 80,000 spectators (expandable to 100,000+), is located in Arlington, Texas. The stadium has a massive retractable roof and is the largest indoor stadium in the United States; Principality Stadium, Wales, has a capacity of 73,931, is located in Cardiff (built 1999, architects: Bligh Lobb Sports Architecture, designers: WS Atkins). The stadium has a fully retractable roof, making it the largest fully indoor stadium in Europe; The Singapore National Stadium, Singapore has a capacity of 55000. With the largest retractable dome in the world, it is designed to host mass outdoor events and fully air-conditioned sports matches. The stadium was built in 2014 (architects: Arup (sports venues), DP Architects (non-sport venues, QP), Aecom – landscape, constructors: Arup). World athletics championships are usually held on open fields. However, the World Athletics Championships also began to be held indoors since 1987. Before that, the event was inaugurated as the World Indoor Games in 1985^[8].

DESIGN OF SPORTS HALLS

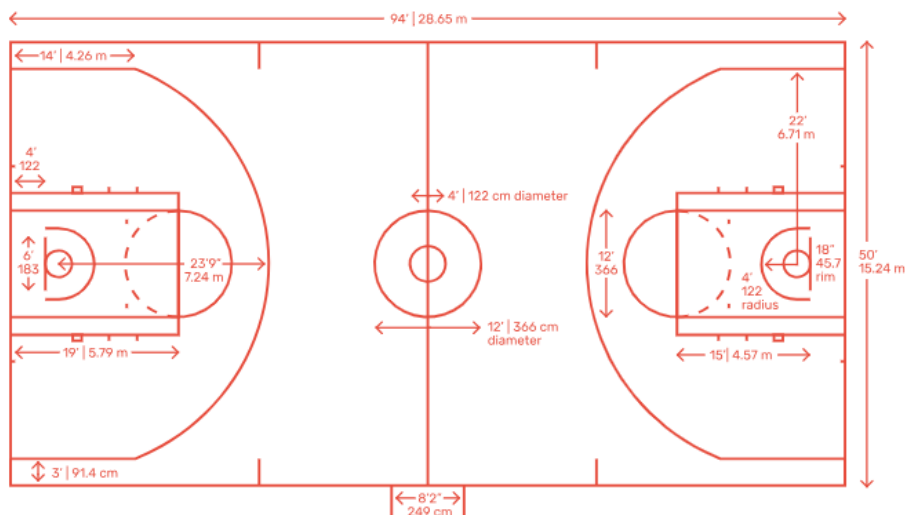
The design of international sports venues requires a multi-layered approach that combines specifications from governing bodies for individual sports (e.g. FIBA, FIVB), safety standards for flooring and regional guidelines for facilities (such as the Sport England Design Guidelines). Essential requirements include dimensions, spacing, flooring and environmental controls. The FIBA (The International Basketball Federation/Fédération Internationale de Basketball) regulations for sports venues impose a strict set of standards for dimensions, lighting and equipment to ensure safety, fair play and broadcast quality^[9,10]. The primary rules state that the playing surface must be 28 m × 15 m with a minimum ceiling clearance of 7 m (Figure 1). A running fence of at least 2 m (preferably 2–3 m) of unobstructed space must surround the entire perimeter of the court. Spectators must be at least 2 m from the boundary lines. Surfaces must be made of hardwood or glass

approved by FIBA, providing specific area resilience, shock absorption and slip resistance. The average horizontal illuminance for major tournament courts should be at least 1000 lux to 3000 lux, with a color rendering index (CRI) $\geq$ Ra 80 [3]. Level 1 competitions (international/elite) require FIBA-approved run protection units, scoreboards and supporting structures. Furthermore, any ceiling stops cannot be used if the ceiling height exceeds 10 m due to the risk of vibration. The scorer's table must be at least 6 m long and 80 m high, on a platform that is raised by at least 200 mm. For very detailed equipment testing protocols and mandatory basic specifications according to the level of competition (Level 1 or Level 2), please refer to the official FIBA Basketball Rules and Equipment or consult the FIBA Venue Guide for planning guidance. The FIVB (The International Volleyball Federation/Fédération Internationale de Volleyball) regulations [11] stipulate that official sports halls for international volleyball must have a rectangular court measuring 18 m $\times$ 9 m, surrounded by a free safety zone at least 5 m wide from the side lines and 6.5 m from the end lines (Figure 1). The minimum vertical free space for the game must be 12.5 m high. The International Volleyball Federation (FIVB) sets strict specifications for all international and world competition venues. The essential requirements detailed in the Official Volleyball Rules include: The playing surface must be flat, horizontal and uniform. The floor must be wooden or synthetic, light-colored and non-slip. Official competitions require a lighting level of at least 1000 lux, measured 1 m above the playing surface [3]. The temperature must not be lower than 10° C [3]. The free playing area above the court must reach at least 12.5 m without overhead obstructions such as scoreboards, lighting or roof structures. The net is set at 2.43 m for men and 2.24 m for women. The net posts must be placed 0.5 m to 1.0 m outside the side line and covered for the safety of the players. Venues must have facilities including changing rooms, an umpire's station, an electronic scoreboard and a dedicated room for the Video Challenge system and medical/doping control. For localised recreational or national league venues, the FIVB allows reduced parameters. Multi-sport halls are usually sized according to the number of badminton courts they can accommodate. A standard 4-court module is nominally 34.5 m $\times$ 20 m, while a 5-court module requires 40.6 m $\times$ 21.35 m. The minimum floor-to-ceiling clearance depends on the sport, but generally 7.5 m to 9 m is required for overhead equipment, lighting and nets for badminton and volleyball. Margins (safety edges for running) are essential. International-level games require larger safety zones and safety buffers between teams, officials and spectators than community-level halls. Floors for indoor sports must comply with the European standard EN 14904 for multi-purpose sports surfaces. Floors must absorb impacts to reduce injuries. They must allow for controlled rebound of the ball and prevent the floor from feeling too hard or too soft. For international basketball, surfaces must meet FIBA requirements (e.g. Level 1 requires specific glass or wooden floors with springs, while Level 2 allows for approved synthetic materials). International federations strictly regulate uniform, glare-free lighting. Multi-sport halls typically require 300 to 500 lux for club and regional levels, while international televised competitions require 750 to 1000+ lux [3]. Reverberation times should generally be controlled to between 1.5 and 2.0 seconds to ensure clear audibility for referees, coaches, and emergency announcements [3]. Facilities must be universally accessible, in accordance with local ADA or equivalent building codes. This includes ramp access, wheelchair-accessible locker rooms and showers, and designated seating areas for spectators. While multi-purpose halls are very flexible, certain sports have demanding, indisputable structural rules. For example, gymnastics halls require fixed heavy equipment that requires specific floor jacks or structural beam reinforcements, while martial arts require strict environmental controls and wall mats. The design of an auditorium within a sports hall requires balancing a versatile dual purpose. To avoid conflicts with the pitch layout, retractable seating is used in the stands [2]. Acoustic treatments should be incorporated to reduce reverberation. Impact-resistant materials should be used; safe exits that meet fire regulations should be provided. Telescopic or retractable seating systems are used. These allow the hall to function for everyday sports and quickly convert to an auditorium format for ceremonies or events. The back rows are raised to provide an unobstructed view of the main floor/stage area [2]. The eyes of the audience in the back should have a clear view over the heads of those seated two rows ahead. The seats should be durable, padded and upholstered, and foldable with armrests for ultimate comfort during long presentations or performances. Sports halls are notorious for being resonant. Therefore, acoustic wall panels (such as perforated wood or fabric-wrapped fiberglass) and acoustic ceiling baffles are installed to control reverberation time [3]. Motorized heavy-duty acoustic curtain baffles are used to separate spaces and block ambient noise from adjacent areas in a sports complex. All lower wall surfaces and seat backs should be impact-resistant to withstand stray basketballs or sports equipment. When the sports floor is used for auditorium-style folding chair arrangements, the chairs should be arranged in interlocking rows. Aisles should be wide enough to accommodate the maximum capacity of the audience, and emergency exits

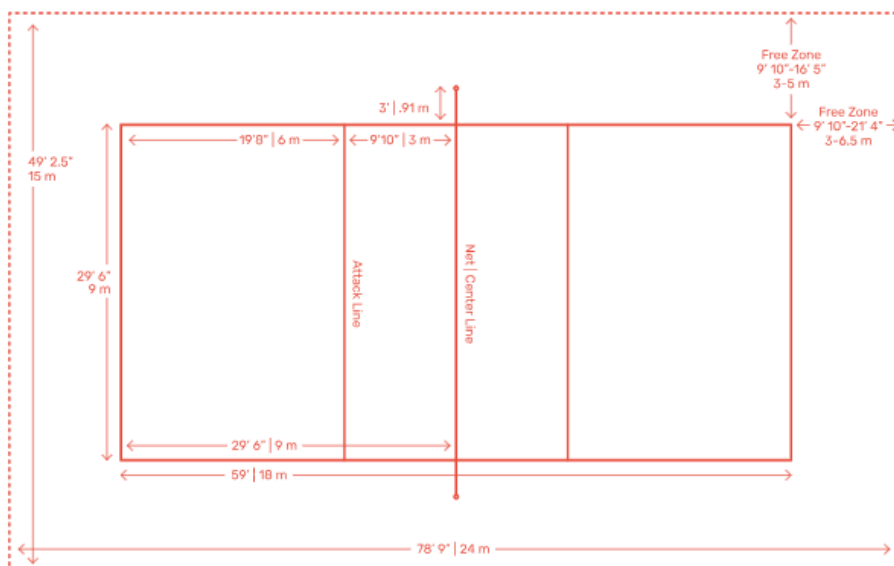
from the sports hall should not be blocked by retractable bleachers. Dual lighting should be provided, using bright, uniform, glare-free lighting for sports events and dimmable LEDs to create a focused, theatrical atmosphere for the auditorium. Motorized projection screens, ceiling-mounted projectors, and a centralized PA system that can accommodate both large gatherings and sports commentators are being installed [12,13,14,15,16,17,18,19,20,21].



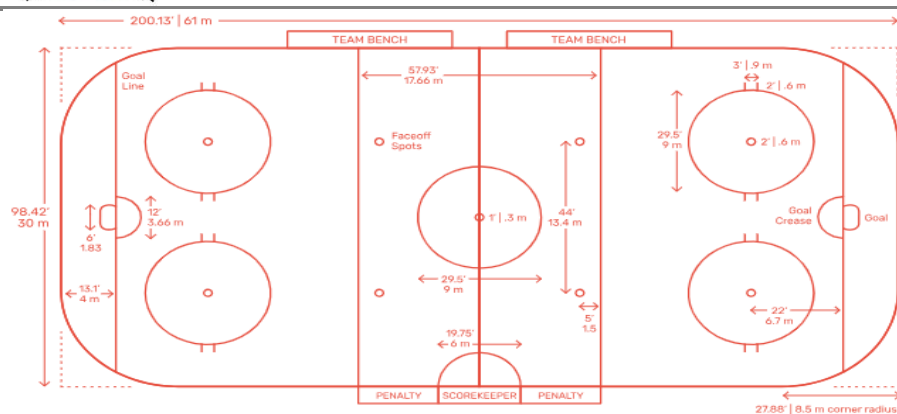
Handball Court



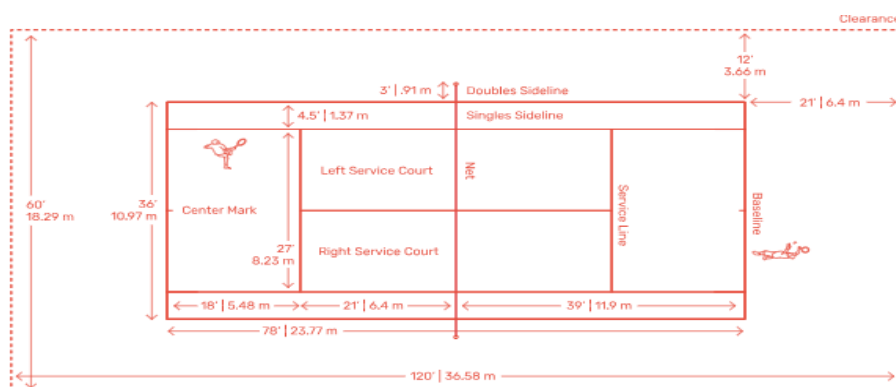
Basketball Court



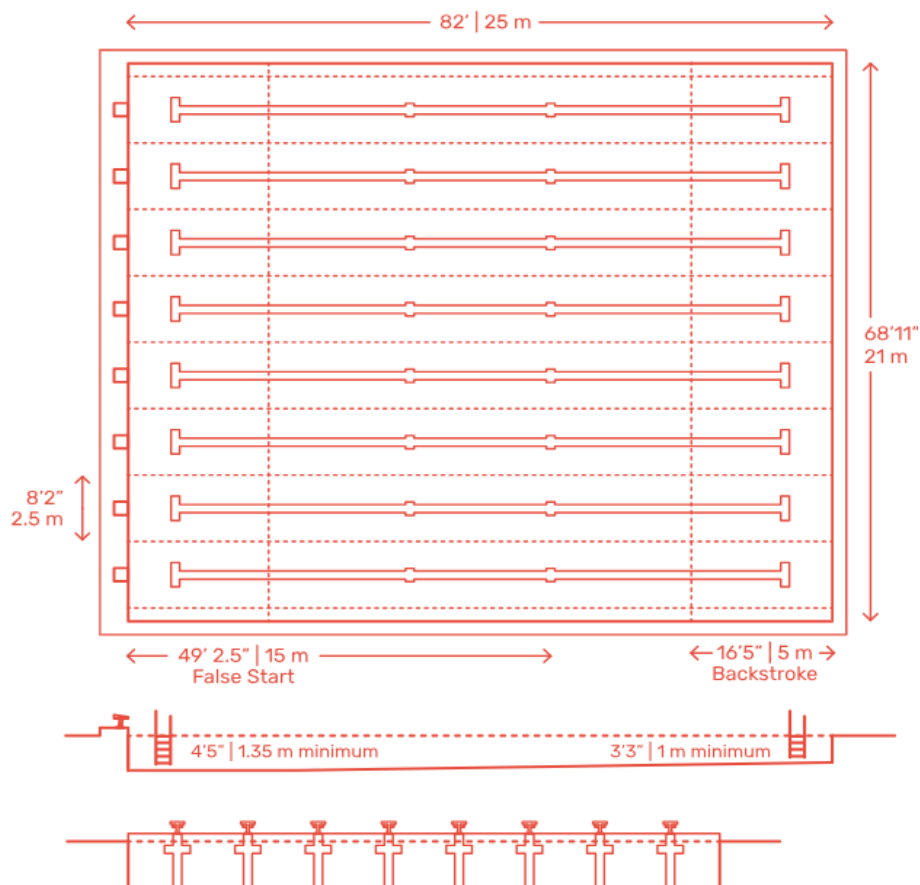
Volleyball Court



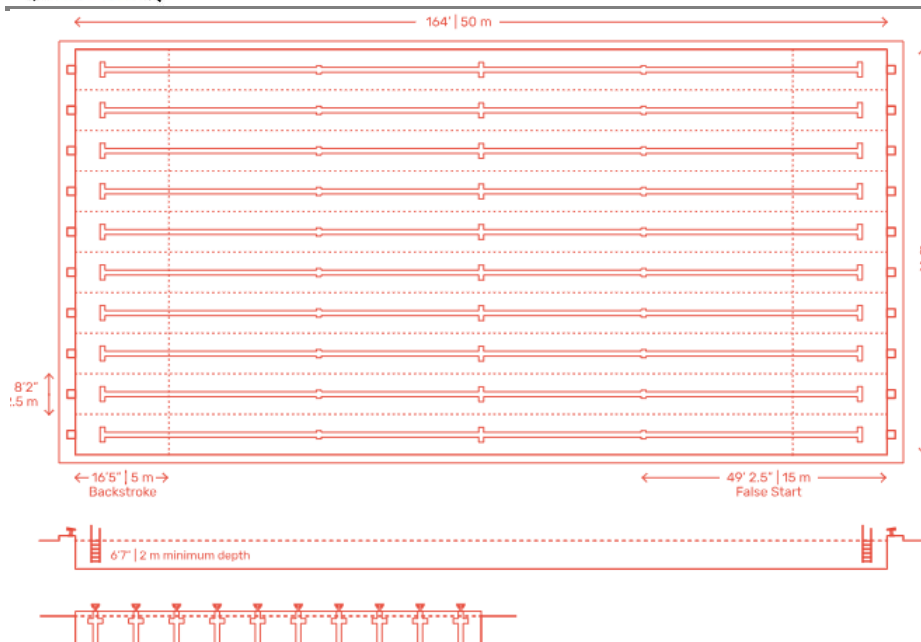
Ice Hockey Rink – International



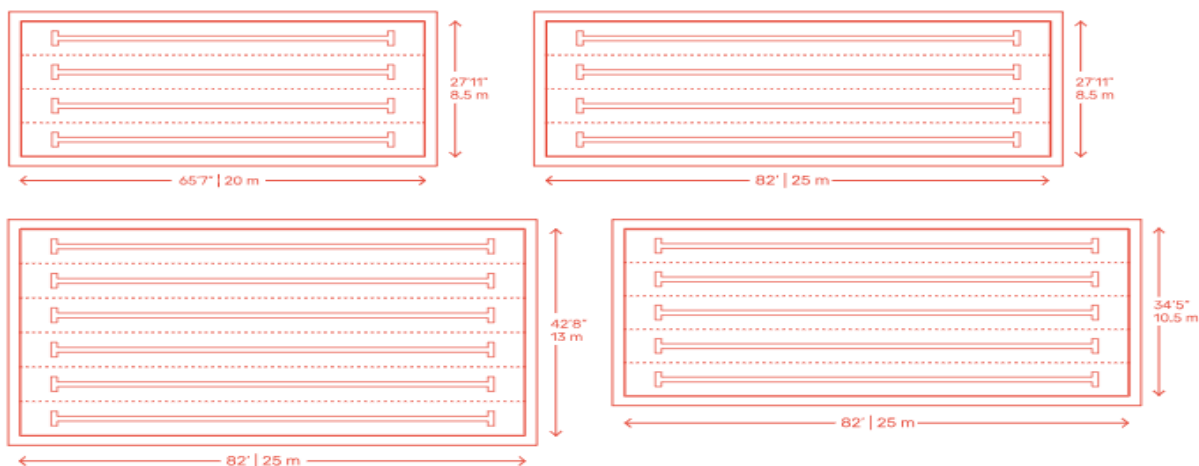
Tennis Court



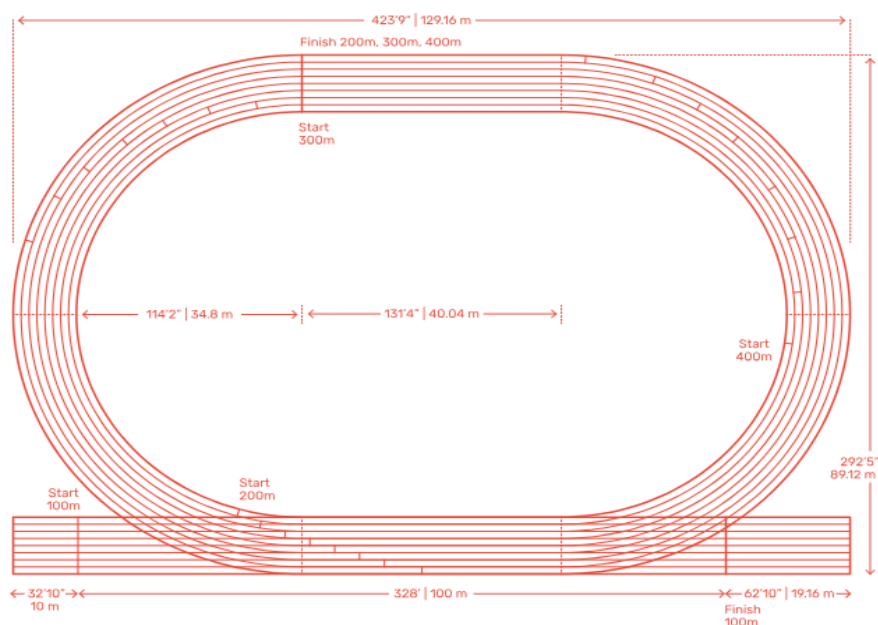
25m Eight Lane Swimming Pool



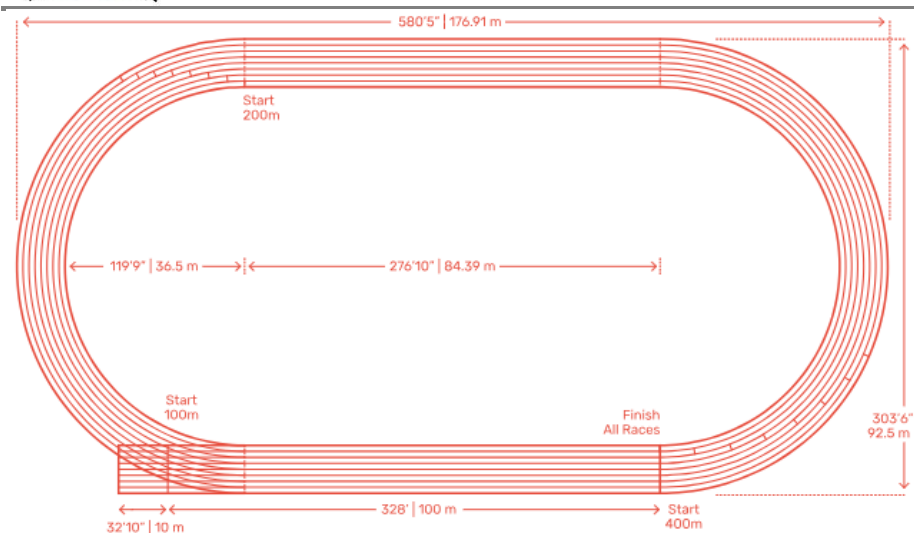
50m Ten Lane Olympic Swimming Pool



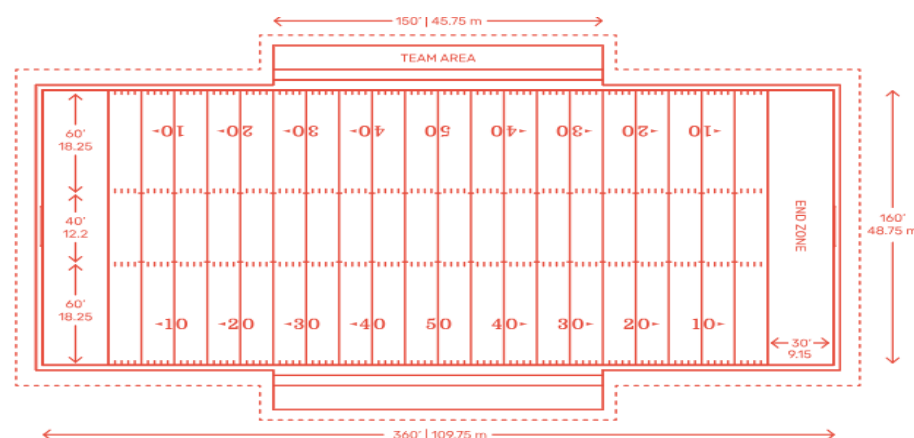
Community Swimming Pools



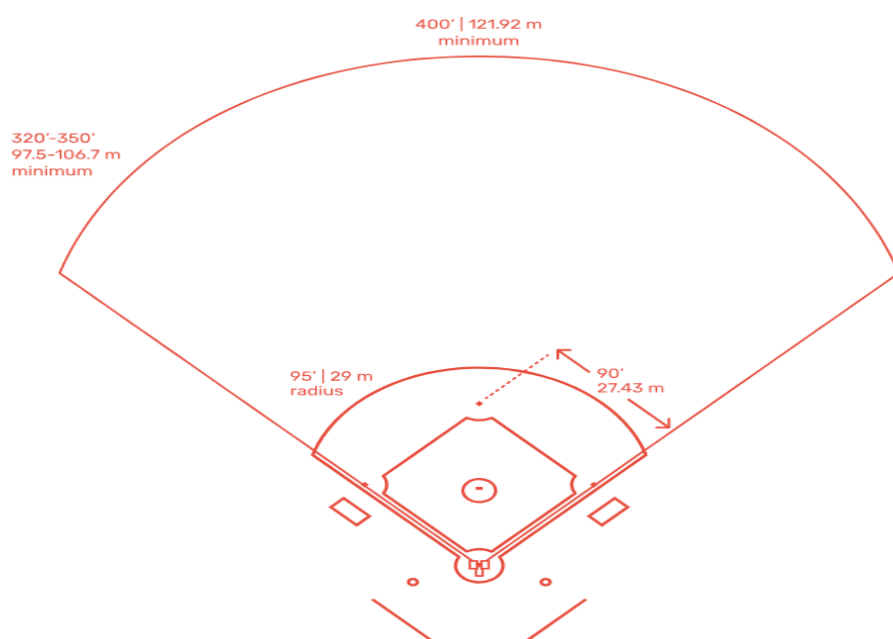
300m Running Track



400m Running Track



American Football Field



Professional Baseball Field (MLB)

Figure 1. Fields for certain sports

Source: <https://www.dimensions.com/collection/sports-fields-of-play>, Accessed: July 20, 2026

Converting an indoor basketball court into an Olympic-sized swimming pool (50 meters $\times$ 25 meters) is a massive civil engineering project ^[22]. It typically requires digging the foundation, reinforcing the structure to hold millions of liters of water, and installing heavy mechanical and HVAC systems (Figure 1). Converting a basketball arena into a supercross track or hockey rink has been done countless times before ^[23] (Figure 1). However, something you don't see every day is converting a basketball court into an above-ground Olympic-sized swimming pool to host Olympic trials. Let's just say that there's a lot involved in the process, even though it may seem fairly simple ^[24]. The temporary pools will be built in 13 days so that American athletes can compete for a spot in the Olympics. In anticipation of each Summer Olympics, the United States undergoes a dramatic transformation. For the fourth consecutive year, the 18,000-seat CHI Health Center, a basketball arena, will be transformed into an Olympic-caliber aquatic facility. The Omaha facility will become the site where the Americans will compete for a spot in the 2022 Olympic Games in Tokyo. Converting the indoor sports arena into an Olympic-sized swimming pool requires the construction of a massive, above-ground temporary pool above the arena floor. Using modular steel panels and specialized plumbing, the transformation takes several weeks, and the pool can hold approximately 3.0 million gallons of water and provide a massive spectator capacity. Aquatics design and consulting firm Counsilman-Hunsaker is working with USA Swimming and manufacturers Myrtha Pools USA and Neptune Benson to create the facility. Counsilman-Hunsaker, Myrtha and USA Swimming collaborated on the design, while Myrtha will fabricate and install the temporary main competition and training pools. The transformation is expected to take 13 days. A ten-lane competition pool will be built on the floor of the arena, with an edge drain and a depth of approximately 2.4 meters ^[25]. The transformation of the multi-purpose sports arena from a basketball court to an athletic field involves a massive reconfiguration. Since athletics competitions require significantly more space, teams remove the parquet and place synthetic polyurethane or rubber surfaces over the arena floor to create running tracks, ski jumps, and throwing circles ^[26] (Figure 1).

OVERVIEW OF THE MOST FAMOUS SPORTS HALLS IN THE WORLD

A large number of large sports halls/arenas have been built around the world, most notably in the United States. Some of them include: Philippine Arena: capacity 55,000 spectators, Bocaue, Philippines ^[27] (Figure 2); Mineirinho: capacity 25,000 spectators, Belo Horizonte, Brazil ^[28] (Figure 3); Co-op Live: capacity 23,500 spectators, Manchester, United Kingdom ^[29] (Figure 4); Manchester Arena: capacity 23,000 spectators, Manchester, United Kingdom ^[30] (Figure 5); Saitama Super Arena: capacity 22,500 spectators, Saitama, Japan ^[31] (Figure 6); SKA Arena: capacity 22,500 spectators, Saint Petersburg, Russia ^[32] (Figure 7); Arena Ciudad de México: capacity 22,300 spectators, Mexico City, Mexico ^[33] (Figure 8); Bell Centre: capacity 22,114 spectators, Montreal, Canada ^[34] (Figure 9); KFC Yum! Center: capacity 22,090 spectators, Louisville, Kentucky, United States ^[35] (Figure 10); Greensboro Coliseum: capacity 22,000 spectators, Greensboro, North Carolina, United States ^[36] (Figure 11); Dean Smith Center: capacity 21,750 spectators, Chapel Hill, North Carolina, United States ^[37] (Figure 12); Thompson–Boling Arena: 21,678, Knoxville, Tennessee, United States ^[38] (Figure 13); United Center: capacity 20,917 spectators, Chicago, United States ^[39] (Figure 14); Amerant Bank Arena: capacity 20,737 spectators, Sunrise, Florida, United States ^[40] (Figure 15); Tacoma Dome: capacity 20,722 spectators, Tacoma, Washington, United States ^[41] (Figure 16); Benchmark International Arena: capacity 20,500 spectators, Tampa, Florida, United States ^[42] (Figure 17); Canadian Tire Centre: capacity 20,500 spectators, Ottawa, Canada ^[43] (Figure 18); Rupp Arena: 20,500, Lexington, Kentucky, United States ^[44] (Figure 19); Xfinity Mobile Arena: 20,478, Philadelphia, United States ^[45] (Figure 20); Capital One Arena: 20,356, Washington, D.C., United States ^[46] (Figure 21); Little Caesars Arena: capacity 20,335 spectators, Detroit, United States ^[47] (Figure 22); Pyongyang Gymnasium: capacity 20,100 spectators, Pyongyang, North Korea ^[48] (Figure 23); Beach City International Stadium: capacity 20,053 spectators, Jakarta, Indonesia ^[49] (Figure 24).



Figure 2. Philippine Arena, Bocaue, Philippines, 2014 (Architects: Populous Holdings)

Source: <https://www.facebook.com/photo/?fbid=1410612590428460&set=pcb.1410613210428398>, Accessed: July 19, 2026

Source: <https://jayvee4.home.blog/2018/10/19/phillipine-arena/>, Accessed: July 19, 2026



Figure 3. Mineirinho (Estádio Jornalista Felipe Drummond), Belo Horizonte, Brazil, 2008 (Architects: GMP Architekten/Volkwin Marg, Hubert Nienhoff with Martin Glass)

Source: <https://www.shutterstock.com/search/mineirinho>, Accessed: July 19, 2026

Source: <https://transite.fafich.ufmg.br/torcedores-esl-one-belo-horizonte-2018/>, Accessed: July 19, 2026



Figure 4. Co-op Live, Manchester, United Kingdom, 2024 (Architects: Populous)

Source: <https://www.benharrisonphotography.co.uk/co-op-live-arena-manchester/>, Accessed: July 19, 2026

Source: https://en.tripadvisor.com.hk/Attraction_Review-g187069-d27151317-Reviews-Co_op_Live-Manchester_Greater_Manchester_England.html, Accessed: July 19, 2026



Figure 5. Manchester Arena, Manchester, United Kingdom, 1995 (Architect: Dan Meis)

Source: <https://www.webbaviation.co.uk/aerial/picture.php?/16103>, Accessed: July 19, 2026

Source: <https://tonylevin.com/road-diaries/peter-gabriel-io-tour/manchester-show#images-2>, Accessed: July 19, 2026



Figure 6. Saitama Super Arena, Saitama, Japan, 2000 (Architects: Dan Meis, Ellerbe Becket)

Source: https://www.nikken.co.jp/en/projects/sports/saitama_super_arena.html, Accessed: July 19, 2026

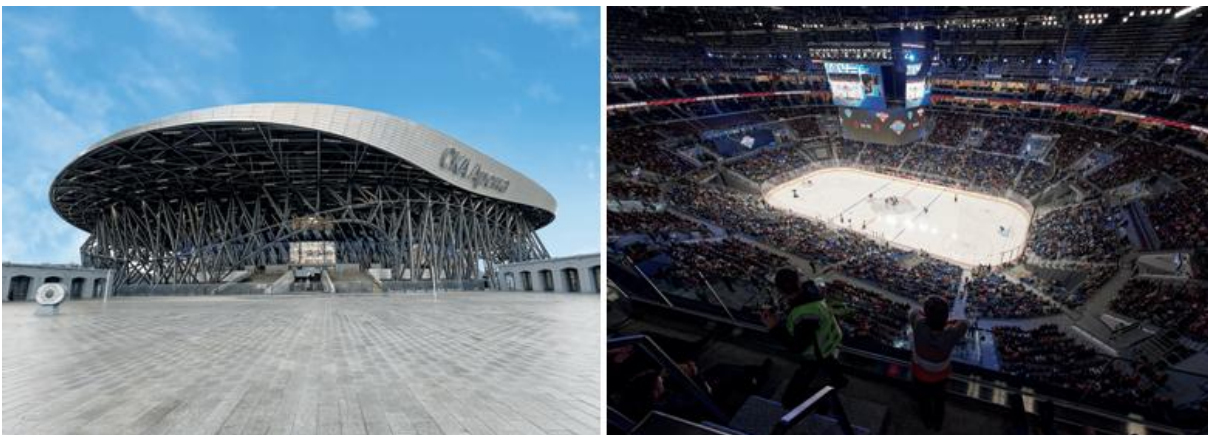


Figure 7. SKA Arena, Saint Petersburg, Russia, 2023 (Architects: Wolf Dieter Prix (Coop Himmelb(l)au) & Partner)

Source: <https://coop-himmelblau.at/projects/sca-arena-and-park-sports-and-concert-complex/>, Accessed: July 19, 2026



Figure 8. Arena Ciudad de México, Mexico City, Mexico, 2012 (Architects: KMD Architects Mexico)

Source: <https://stadibox.com/blog/guias-y-consejos/arena-cdmx-suites-stadibox>, Accessed: July 19, 2026

Source: <https://obras.expansion.mx/arquitectura/2020/02/25/arena-ciudad-de-mexico-cumple-como-fue-su-construccion>

Accessed: July 19, 2026



Figure 9. Bell Centre, Montreal, Canada, 1996 (Architects: LeMay & Associate, LLC., LeMoyné Lapointe Magne)

Source: <https://sportsmatik.com/sports-corner/sports-venue/bell-centre>, Accessed: July 19, 2026



Figure 10. KFC Yum! Center, Louisville, Kentucky, United States, 2010 (Architects: Populous (formerly HOK Sport), Louis and Henry Group, C.L. Anderson Architecture, Jill Lewis Smith Architects)

Source: <https://skylinescenes.com/products/kfc-yum-center-in-louisville>, Accessed: July 19, 2026

Source: https://www.wdrb.com/sports/crawford-running-down-the-covid-changes-youll-see-in-the-kfc-yum-center/article_cadeb4ca-2e66-11eb-9714-73ad5ea71c20.html, Accessed: July 19, 2026

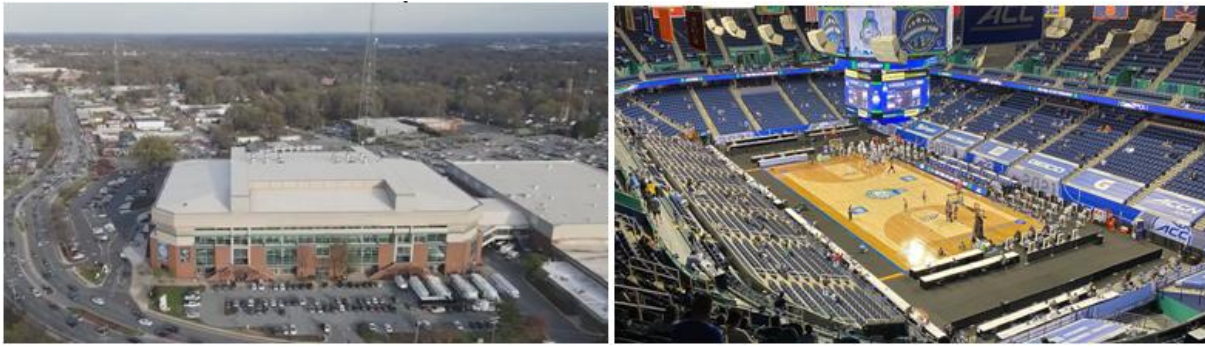


Figure 11. Greensboro Coliseum, Greensboro, North Carolina, United States, 1959-1993 (Architects: FABRAP)

Source: <https://myfox8.com/news/north-carolina/greensboro/greensboro-city-council-will-turn-over-coliseum-tanger-center-operations-to-ovg360/>, Accessed: July 19, 2026

Source: <https://www.newsobserver.com/sports/article249868083.html>, Accessed: July 19, 2026



Figure 12. Dean Smith Center, Chapel Hill, North Carolina, United States, 1986-2000 (Architects: Hakan/Corley & Associates, Finch-Heery; Structural engineer: Geiger Berger)

Source: <https://www.uncchildrens.org/uncmc/unc-childrens/locations/profile/?id=886>, Accessed: July 19, 2026

Source: <https://sportsmatik.com/sports-corner/sports-venue/dean-smith-center>, Accessed: July 19, 2026



Figure 13. Thompson-Boling Arena, Knoxville, Tennessee, United States, 1987-2007 (Architects: GSCD, Inc. Architects, Cideco Architecture & Planning Inc.; Structural engineer: Ross H. Bryan Engineers Inc.)

Source: <https://www.wvlt.tv/2023/08/23/thompson-boling-arena-get-new-name-food-city-partnership-report-says/>, Accessed: July 19, 2026

Source: <https://www.stadiumjourney.com/stadiums/thompson-boling-arena-s620>, Accessed: July 19, 2026



Figure 14. United Center, Chicago, United States, 1994 (Architects: Populous (then HOK Sport), W. E. Simpson Company, Inc., Marmon Mok)

Source: <https://stock.adobe.com/search?k=chicago+united+center>, Accessed: July 19, 2026

Source: https://www.reddit.com/r/stadiumporn/comments/1ilzcy2/united_center_chicago_il/, Accessed: July 19, 2026



Figure 15. Amerant Bank Arena, Sunrise, Florida, United States, 1998 (Architect: Ellerbe Becket; Structural engineer: Walter P. Moore & Associates)

Source: <https://mapy.com/en/turisticka?source=osm&id=1072343908&gallery=1&sourcep=foto&idp=6636101&x=-80.3254069&y=26.1583533&z=18>, Accessed: July 19, 2026

Source: <https://www.amerantbankarena.com/arena-info>, Accessed: July 19, 2026



Figure 16. Tacoma Dome, Tacoma, Washington, United States, 1983-2018 (Arhitekti: McGranahan Messenger Associates)

Source: <https://www.shutterstock.com/video/clip-1096237047-aerial-drone-view-flight-tacoma-dome-washington>, Accessed: July 19, 2026

Source: <https://www.mcgranahan.com/work/the-tacoma-dome/>, Accessed: July 19, 2026



Figure 17. Benchmark International Arena, Tampa, Florida, United States, 1996 (Architect: Ellerbe Becket; Structural engineer: Walter P Moore)

Source: <https://www.cltampa.com/news/tampas-amalie-arena-has-been-renamed-to-benchmark-international-arena-20590939/>

Accessed: July 19, 2026

Source: <https://suitehop.com/venues/benchmark-international-arena-suites>, Accessed: July 19, 2026



Figure 18. Canadian Tire Centre, Ottawa, Canada, 1996 (Architects: Rossetti Architects Murray & Murray Architects; Structural engineer: Carruthers & Wallace Ltd.)

Source: <https://www.robhuntley.ca/Kite-Aerial-Photography/Kite-Aerial-Photography-2013/Canadian-Tire-Centre-Ottawa>

Accessed: July 19, 2026

Source: <https://www.pcl.com/ca/en/our-work/canadian-tire-centre>, Accessed: July 19, 2026



Figure 19. Rupp Arena, Lexington, Kentucky, United States, 1976 (Architect: Ellerbe Becket)

Source: https://www.youtube.com/watch?v=DZk3_nrpE10, Accessed: July 19, 2026

Source: <https://uknow.uky.edu/campus-news/nothing-it-why-bbn-says-rupp-arena-heart-college-basketball>, Accessed: July 19, 2026

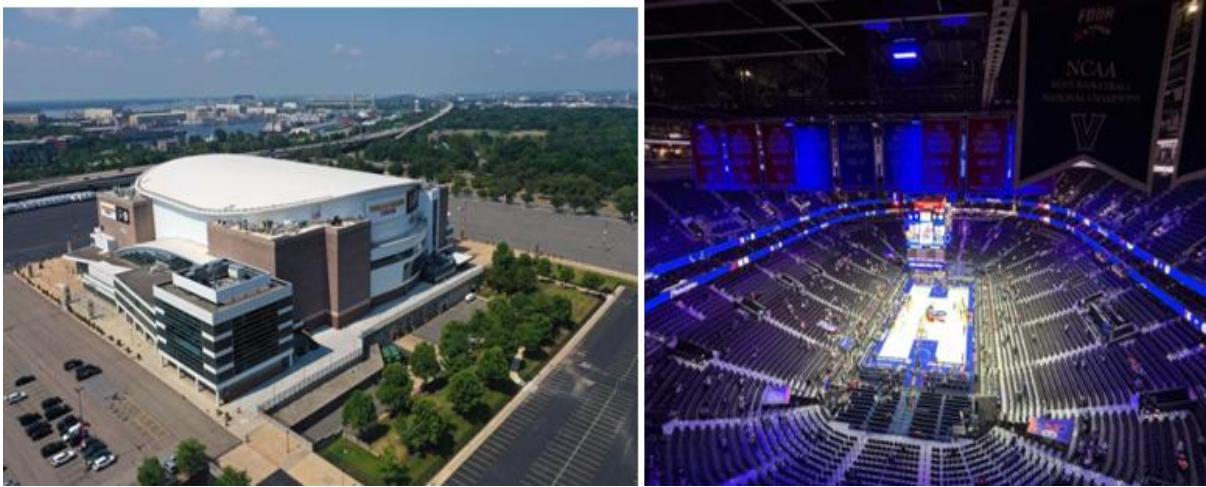


Figure 20. Xfinity Mobile Arena, Philadelphia, United States, 1996 (Architect: Ellerbe Becket; Structural engineer: Walter P MooreBernard Schwartz & Associates)

Source: <https://rnbphilly.com/5671047/wells-fargo-center-new-name-xfinity-mobile-arena/>, Accessed: July 19, 2026

Source: <https://aviewfrommyseat.com/photo/333054/Xfinity+Mobile+Arena/section-Liberty+Loft+3/row-1/seat-1/>, Accessed: July 19, 2026



Figure 21. Capital One Arena, Washington, D.C., United States, 1997 (Architects: Ellerbe Becket, Devroux & Purnell, KCF-SHG Architects; Structural engineers: Delon Hampton & Associates)

Source: <https://gallery.dcairphotos.com/Stock-Images/Capitol-One-Arena-Washington-DC>, Accessed: July 19, 2026

Source: <https://aviewfrommyseat.com/photo/446527/Capital+One+Arena/section-219/row-L/seat-12/>, Accessed: July 19, 2026



Figure 22. Little Caesars Arena, Detroit, United States, 2017 (Architects: HOK; Structural engineers: Magnusson Klemencic Associates)

Source: <https://www.dreamstime.com/little-caesars-arena-home-detroit-red-wings-national-hockey-league-american-heartland-downtown-mi-usa-may-aerial-view-image252480657>, Accessed: July 19, 2026

Source: <https://www.hok.com/news/2018-06/detroits-little-caesars-arena-named-sports-facility-of-the-year/>, Accessed: July 19, 2026



Figure 23. Pyongyang Gymnasium, Pyongyang, North Korea, 1973-2013 (Architect: Yun Ko-gwang)

Source: <https://www.theguardian.com/cities/gallery/2015/sep/11/pyongyang-north-korea-architectural-tour-through-the-ages-in-pictures>

Accessed: July 19, 2026

Source: <https://en.namu.wiki/w/%ED%8F%89%EC%96%91%EC%B2%B4%EC%9C%A1%EA%B4%80>, Accessed: July 19, 2026



Figure 24. Beach City International Stadium, Jakarta, Indonesia, 2012 (Architects: ENDATU Architects)

Source: <https://www.trip.com/travel-guide/attraction/north-jakarta/beach-city-international-stadium-50694526/>, Accessed: July 19, 2026

Source: <https://beachcityjakarta.com/>, Accessed: July 19, 2026

ANALYSIS OF SOME SELECTED EXAMPLES OF SPORTS HALLS IN THE WORLD

Populous Holdings, Inc. (doing business as Populous) ^[50] is a global company specializing in the design of sports stadiums and training centers, entertainment arenas, convention and exhibition centers, and aviation and esports facilities, as well as the planning and design of large-scale special events. It has offices in Kansas City, London, and Brisbane. Designing the world's largest indoor theater would be a challenge anywhere. In the Philippines, Populous had to consider the tropical and humid local climate, as well as an active earthquake zone. Located north of Manila, the world's most populous city, Populous envisioned the Philippine Arena as a true gathering place for the Ciudad de Victoria community and the wider city. Designed to accommodate 50,000 people inside, the arena also has a 'living space' around it, where an additional 50,000 people can gather for large-scale events. By building on this scale, Populous had to push the boundaries of arena design. Providing 50,000 people with a single focal point and creating a sense of intimacy in such a vast space is nearly impossible. The solution? A single-sided, saddle-shaped seating bowl that rises in the middle and slopes down the sides. This gives every seat a clear view, even as the arena's layout changes to accommodate the needs of a variety of events—from church services and award ceremonies to World Cup basketball games and Harry Styles concerts ^[51]. For smaller events, special acoustic and thermal curtain walls are used to separate the lowest tier of seating for a more intimate atmosphere (Figure 26). To handle the large number of people arriving at the same time, the arena's entrances immediately redirect people to clear pathways. The arena is well-ventilated and fully air-conditioned to keep the audience cool, and it is divided into multiple structures to enhance the building's earthquake resistance—an arena featured in the Discovery Channel documentary *Man Made Marvels: Quake Proof*. Recognized by the Guinness Book of World Records as the largest indoor mixed-use theater, the Philippine Arena has hosted events with huge crowds. On New Year's Eve 2014, one million people flocked to the arena and its grounds, making it Manila's equivalent of the Sydney Harbour Bridge ^[51].





Figure 25. Philippine Arena, Bocaue, Philippines, 2014 (Architects: Populous Holdings)

Source: <https://populous.com/preview/philippine-arena>, Accessed: July 19, 2026

Source: https://www.tripadvisor.com/LocationPhotoDirectLink-g3931974-d6984585-i108058449-Philippine_Arena-Bocaue_Bulacan_Province_Central_Luzon_Region_Luzon.html, Accessed: July 19, 2026

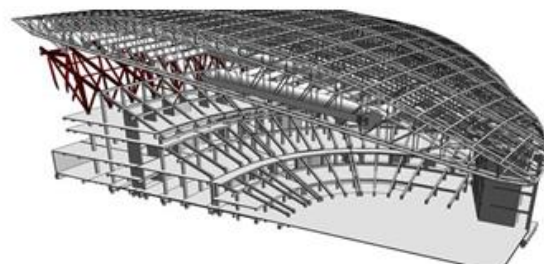
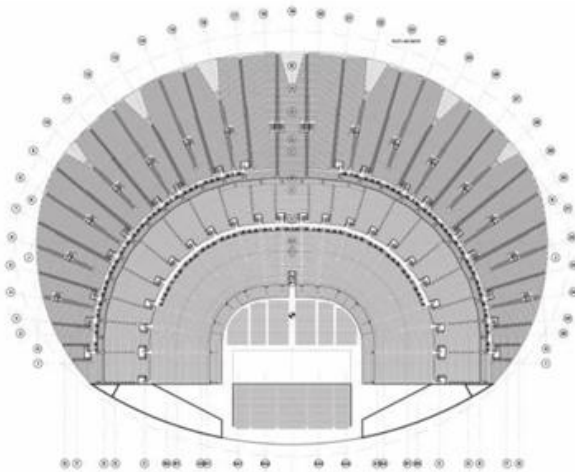


Figure 26. Philippine Arena, Bocaue, Philippines, 2014 (Architects: Populous Holdings)

Source: <https://www.facebook.com/manilaconcerts/photos/the-seat-layout-for-philippine-arena-in-bocaue-bulacan-philippine-arena-opens-on/10151615137453032/>, Accessed: July 19, 2026

Source: <https://www.pinterest.com/pin/manila-philippine-arena-50000-page-53--185210603397181249/>, Accessed: July 19, 2026

Gerkan, Marg & Partners (gmp) is an international architectural firm based in Hamburg, Germany. The firm was founded in 1965 by Meinhard von Gerkan and Volkwin Marg, and now employs over 300 people in 13 offices. That same year, the firm participated in an international competition with anonymous entries. Their design for Berlin Tegel Airport won first prize, bringing the firm international recognition. This achievement solidified the firm's reputation in the architectural world and paved the way for further success. The firm is currently led by the two founders together with their managing partners (Nikolaus Goetze, Hubert Nienhoff, Stephan Schütz and Wu Wei) ^[52]. The Mineirinho Arena (officially Estádio Jornalista Felipe Drummond), commonly referred to as Mineirinho, is Brazil's largest indoor multi-purpose arena, with a capacity of up to 19,781 spectators (as of 2024) for sporting, concert and cultural events. Located in the Pampulha neighborhood of Belo Horizonte, Minas Gerais, along Avenida Antônio Abrahão Caram, the arena was inaugurated on March 15, 1980, originally named Palácio dos Esportes. Designed to promote sports and entertainment in the country, it covers 56,000 m² and offers versatile facilities for a variety of gatherings. Over the decades, Mineirinho has become a cornerstone of Brazilian event organization, with record attendances, including 33,000 for the men's volleyball match between Brazil and Greece in 1994, and 30,954 for a concert by the band Titãs in 1993. During the 2014 FIFA World Cup, it served as the press center for Minas Gerais operations. The arena underwent a significant renovation in 2024 to modernize its infrastructure, improve safety and accessibility, while maintaining its role as a hub for outstanding cultural and sporting experiences ^[53]. Today, Mineirinho continues to host a wide range of events, from international sports competitions and musical performances to fairs and festivals, cementing its status as a vital cultural landmark in southeastern Brazil. Construction of the Mineirinho arena, officially known as Estádio Jornalista Felipe Drummond, began in 1973 under the administration of ADEMG (Administração de Estádios do Estado de Minas Gerais), a state-owned entity run by sports journalists who oversaw major sports infrastructure projects in Minas Gerais ^[54]. In October 1972, ADEMG signed a convention with the Federal University of Minas Gerais (UFMG) for the use of a 93,000 m² plot of land next to Mineirão Stadium for a project aimed at creating an indoor facility to complement the outdoor stadium within the Pampulha Sports Complex ^[54]. Initial planning stemmed from a 1971 request by Governor Rondon Pacheco, which led ADEMG engineers to develop a preliminary design for a multi-purpose sports hall. Construction progressed from 1973, but faced significant interruptions due to economic challenges, including a national crisis that affected the availability of materials. Work was halted in 1974 primarily due to the high concrete requirements for the roof structure, which required more concrete than the nearby Mineirão Stadium and was equivalent to the volume of a 13-story building, including the basement ^[54]. The project remained suspended from 1975 to 1976 due to financial difficulties, before resuming in 1977 with renewed state support. The workforce involved included teams coordinated by ADEMG, although specific details of the workforce from that period are limited in the records; the total effort took about eight years and involved intensive mobilization to complete the core elements of the arena. The arena was officially opened on March 15, 1980, with the inauguration ceremony presided over by Governor Francelino Pereira and attended by sports authorities and celebrities, including Formula 1 drivers Emerson and Wilson Fittipaldi, triple jump record holder João do Pula and tennis player Maria Esther Bueno ^[54]. The inaugural event included an unforgettable public gathering, culminating in an exhibition basketball game between the Brazilian national team and the Puerto Rican national team, marking the venue's debut as an indoor sporting event center. At the invitation of ADEMG, cartoonist Ziraldo presented the "Mineirinha" mascot during the ceremony, portraying her as a young, athletic figure symbolizing the heritage of Minas Gerais ^[54]. In preparation for the 2014 FIFA World Cup, the Ginásio Mineirinho underwent initial structural maintenance works worth approximately 5.6 million reais, aimed at restoring the concrete facade and roof to preserve its heritage status while improving its usability as a supporting venue for the tournament ^[55]. Additional external improvements, including earthworks, landscaping and paving, were planned to improve access and surroundings before the 2013 FIFA Confederations Cup, although they were subject to approvals and did not significantly alter the arena's internal capacity of around 25,000 spectators ^[55]. A more extensive renovation took place in 2015, with a total investment of 10 million reais - of which 9 million reais were federal funding from the Ministry of Sports and 1 million reais from the state contribution - to address urgent structural issues and modernise key systems. These works included waterproofing the roof, reinforcing the columns, and installing a rainwater collection system, with the aim of ensuring the arena's readiness for major sporting events such as the 2016 Rio Olympics training camp and improving its overall durability without expanding its capacity ^[56]. The most extensive upgrades began in 2022 following a 35-year concession to the private consortium DMDL/Progen, which committed a total of R\$150 million, including R\$41 million in an initial two-year revitalization phase. Key

improvements included the installation of 13,559 new seats for improved comfort, modernization of the sports lighting and electrical networks, renovation of the roof and covering, and upgrading of the fire protection systems, all of which contributed to increased security with reinforced doors, a fenced perimeter, and graffiti removal. These changes have adjusted the arena's capacity to 13,559 seats for sporting events - compared to the original design to meet modern safety standards - while allowing up to 20,000 visitors for cultural gatherings using the floor space. The arena reopened to the public in October 2024 after the completion of these works. Ongoing maintenance under the concession addresses challenges such as previous disuse and aging infrastructure, with planned incremental investments to maintain operations and adapt the venue to different events, although specific details about seismic retrofitting or sustainability measures remain undisclosed in public announcements ^[56] (Figure 27).



Figure 27. Mineirinho (Estádio Jornalista Felipe Drummond), Belo Horizonte, Brazil, 2008 (Architects: GMP Architekten/Volkwin Marg, Hubert Nienhoff with Martin Glass)

Source: <https://www.designi.com.br/c714ba6f5ff12c8d>, Accessed: July 19, 2026

Source: <https://noataque.com.br/volei/noticia/2024/10/11/mineirinho-passa-reforma-de-milhoes-volta-receber-jogos-volei/>

Accessed: July 19, 2026

Combining the latest in performance technology, sustainability and multi-functionality, Manchester's Co-op Live is set to open in May 2024 (Figure 28). As the UK's only major music venue, it is set to become the country's most influential music venue, while also making a significant contribution to the regeneration of East Manchester. For fans, innovative audiovisual technology and acoustics combine with Populous' unique 'smart bowl' seating design to provide the scale needed to attract the biggest international acts, while delivering an intimate and atmospheric experience that is usually only possible in a much smaller venue. Responsible not only for the architectural design of the 23,500-seat venue, but also for the interior design, orientation, landscaping and branding and commercial activation elements, Populous developed the design through extensive consultation with local residents, businesses and organisations. The result is a groundbreaking venue that is far more than its size^[57]. The angular shape of the building creates a strong visual identity that is instantly recognisable across Manchester. Externally, a large programmable 'digital halo' around the building's façade promotes upcoming events, with large-format LED screens strategically positioned on the façade to animate the venue. The LED screens are seamlessly integrated into the cladding, meaning the building presents a simple and uniform architectural identity^[57]. Inside the venue, sightlines from the rectangular, three-tiered seating bowl have been optimised for the music, resulting in a more compact configuration that ensures no seat is more than 95 metres from the stage. This brings fans up to 23 metres closer than any comparable venue in Europe. The arena also has the largest standing capacity in the UK, with space for 9,200 people, while the installation of retractable seats is also possible. To enhance the immersive experience for fans and artists, Populous avoided the use of pre-installed strip screens and corporate branding in the seating bowl to create a complete 'black box' effect. This means that the audience's attention is fully focused on the stage and the live performance - as it should be. A series of private viewing areas for different levels of catering provide incredible views of the stage from each side of the arena^[57] (Figure 28).



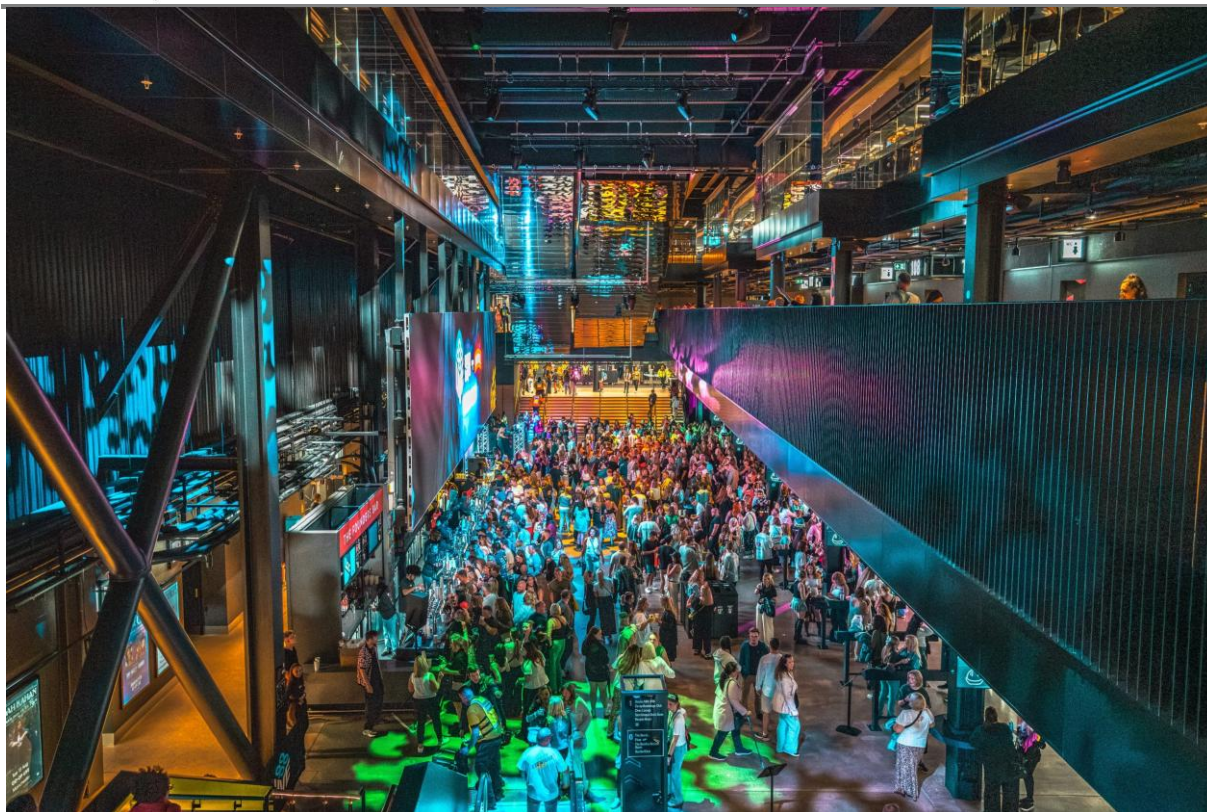




Figure 28. Co-op Live, Manchester, United Kingdom, 2024 (Architects: Populous)

Source: <https://www.benharrisonphotography.co.uk/co-op-live-arena-manchester/>, Accessed: July 19, 2026

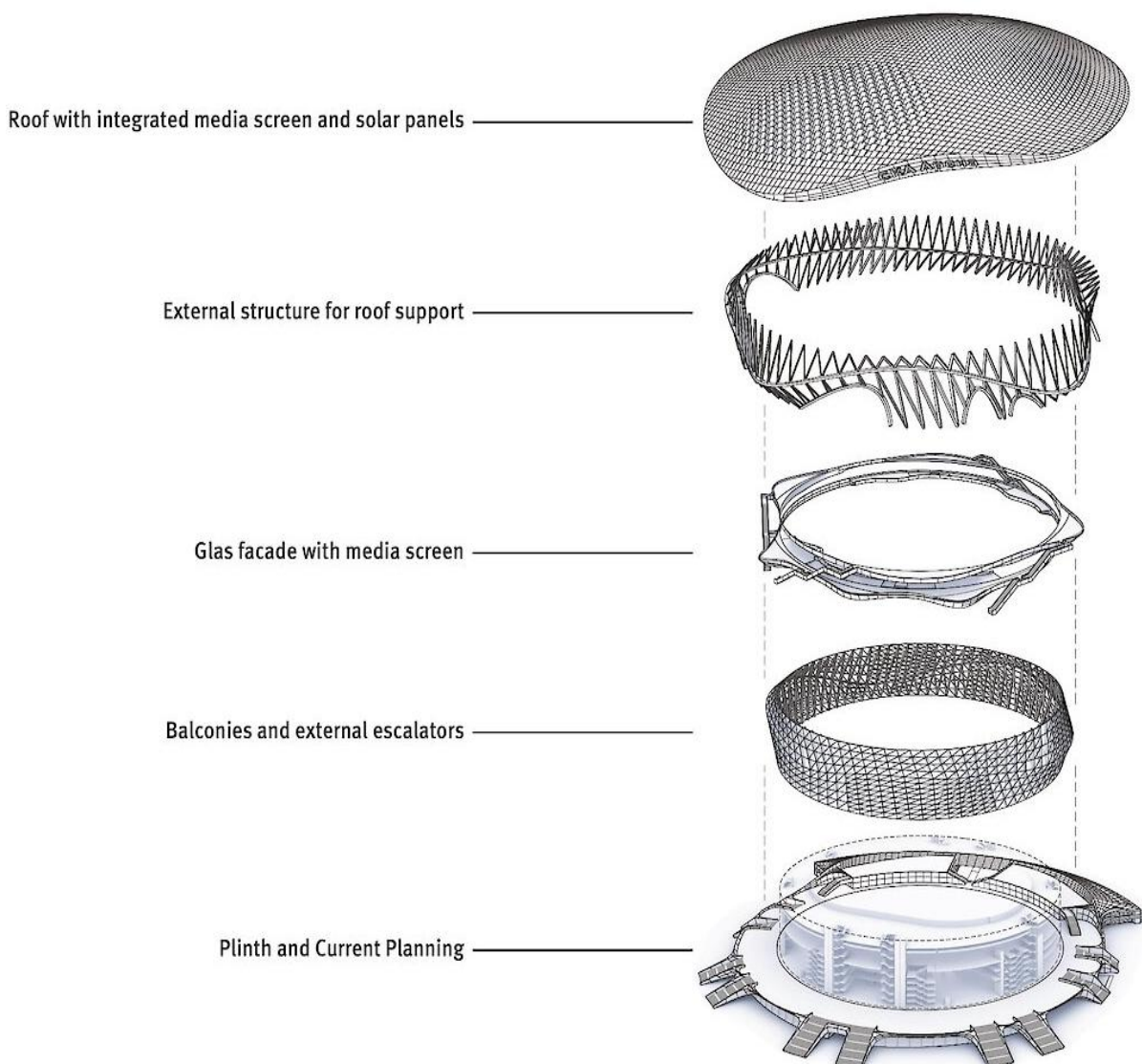
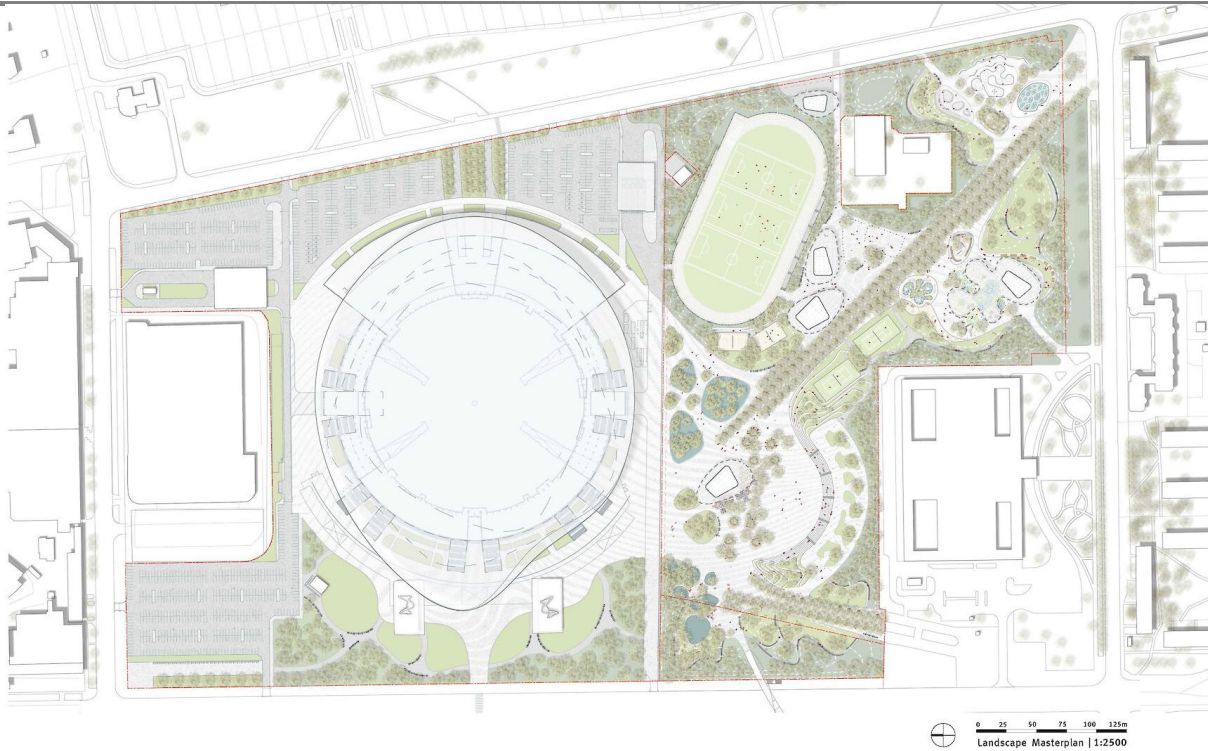
Source: <https://populous.com/showcases/coop-live-arena>, Accessed: July 19, 2026

Source: <https://www.cooplive.com/about-the-arena-69nb>, Accessed: July 19, 2026

Source: <https://www.eventtravel.com/co-op-live-manchester-2025>, Accessed: July 19, 2026

The architectural design of the SKA Arena, designed by the Viennese firm Coop Himmelb(l)au, draws heavily on the principles of Russian Constructivism, evoking the dynamic and revolutionary spirit of early 20th-century works such as Vladimir Tatlin's "Monument to the Third International" (Tatlin Tower). This inspiration is evident in the arena's angular, filigree frame and twisting structural forms, which reinterpret Constructivist ideals of movement, lightness, and industrial materiality in a contemporary context. The design philosophy emphasizes fluid integration with the existing stadium layout, transforming the site into a landmark symbolizing energy and progress while respecting Saint Petersburg's architectural heritage. Structurally, the arena stands at a height of 53.7 meters and encompasses almost 190,000 square meters of total area, with a prominent lightweight roof shaped like a flattened dome that generously towers over the seating area^[58]. This cantilevered configuration, supported by a robust steel structural ring, allows for unobstructed 360-degree views from all spectator positions, enhancing the immersive experience within the venue. The ring itself mimics the spiral geometry of Tatlin's Tower, providing both aesthetic dynamics and essential load-bearing support that adapts to the existing concrete elements of the stadium. The façade uses an innovative atmospheric envelope consisting of a translucent secondary cladding that wraps the structure, blending modern transparency with subtle hints of constructivist transparency and openness. Integrated LED lighting within the roof and cladding creates dynamic visual effects, illuminating the arena as a beacon visible from afar and enabling programmable displays that enhance its role as a cultural icon. This fusion of technology and form not only revitalizes the site, but also positions SKA Arena as a bridge between the historical avant-garde and cutting-edge architecture. Sustainability is woven into the design through energy-efficient systems, including solar panels placed on the sun-facing surfaces of the structural ring to generate renewable energy, contributing to the reduction of operational emissions. The cantilevered roof and open arcade elements facilitate natural ventilation, encouraging airflow and reducing reliance on mechanical cooling in milder conditions. These features align with modern environmental standards, ensuring the arena's longevity while respecting its constructivist roots in an efficient and functional form^[59] (Figure 29).





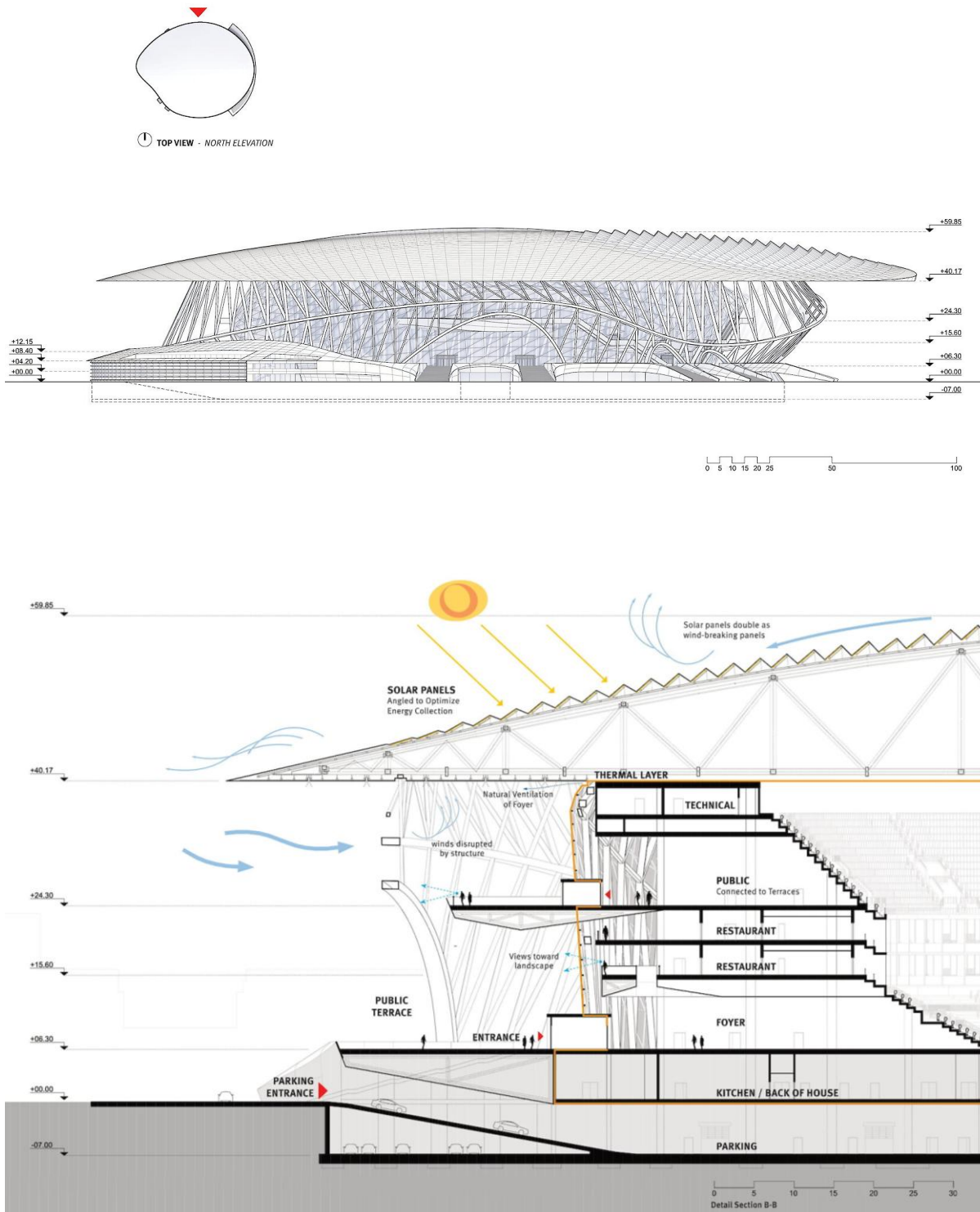


Figure 29. SKA Arena, Saint Petersburg, Russia, 2023 (Architects: Wolf Dieter Prix (Coop Himmelb(l)au) & Partner)

Source: <https://coop-himmelblau.at/projects/sca-arena-park/>, Accessed: July 19, 2026

The United Center is a huge indoor arena located on the west side of Chicago, Illinois. Opened in 1994, it is home to the NBA Chicago Bulls and NHL Chicago Blackhawks and is the largest arena in the United States by number of seats. It can accommodate up to 20,917 people for basketball, 19,717 for hockey and up to 23,500 people for concerts and other large entertainment events [60]. It covers 89186.9184 m². The utilitarian styled brick and concrete building contains 212 luxury apartments on multiple private levels. It was jointly built by the owners of the Bulls and Blackhawks to replace the legendary Chicago Stadium ("The Madhouse on Madison"), which is located directly across the street. The east side of the arena is famous for Michael Jordan's

iconic "Spirit" statue. In addition to regular season sports, over 200 events are held annually, including major concerts, conventions (such as the 1996 and 2024 Democratic National Conventions), tournaments... (Figure 30).



Figure 30. United Center, Chicago, United States, 1994 (Architects: Populous (then HOK Sport), W. E. Simpson Company, Inc., Marmon Mok)

Source: https://stock.adobe.com/search?k=chicago+united+center&asset_id=1573380262, Accessed: July 19, 2026

Source: https://www.reddit.com/r/stadiumporn/comments/1anpqw3/united_center_chicago/#lightbox,
Accessed: July 19, 2026

The Tacoma Dome is a multi-purpose arena characterized by a large wooden dome roof, 168 meters in diameter and 45 meters high. This design seats up to 23,000 spectators ^[61] and spans 39,800 m² from the floor to the upper seating levels. The structure uses the Varax system developed by Western Wood Structures, and consists of 288 triangular glued laminated timber units made of old-growth Douglas fir, each weighing approximately 2,360 kilograms and interconnected by steel hubs with a concrete tension ring. The construction used 490,000 meters of lumber purchased from Weyerhaeuser, including 28,512 2 x 20 cm boards, 1,274 glued laminated timber beams, and 1,568 glued laminated timber beams, forming the roof supported by 18,798 screws and 323,150 nails. The foundation includes extensive concrete, totaling 694,934.54925 m³ - enough for a 112,654.08 meter sidewalk. The roof itself weighs 654.99 metric tons and covers more than 24,281.1 m², reinforced with a 117,043 x 48,768 meter aluminum super-mesh for lighting and sound systems, secured with 14,527,073 cables and more than 4,023.36 meters of welding. At the time of its completion in 1983, the Tacoma Dome held the title of largest wooden domed structure in the world by volume, a record it held until shortly thereafter, and remains the largest dome in Washington after the Kingdome's demolition in 2000. The architectural design, led by McGranahan and Messenger Associates with geometric elements by Lyn Messenger, includes a wooden platform and cupola on top, while many of the curved beams bear inscriptions from construction crews and early visitors. The wooden construction provides R-30 insulation and favorable acoustics suitable for concerts and events ^[62] (Figure 31).



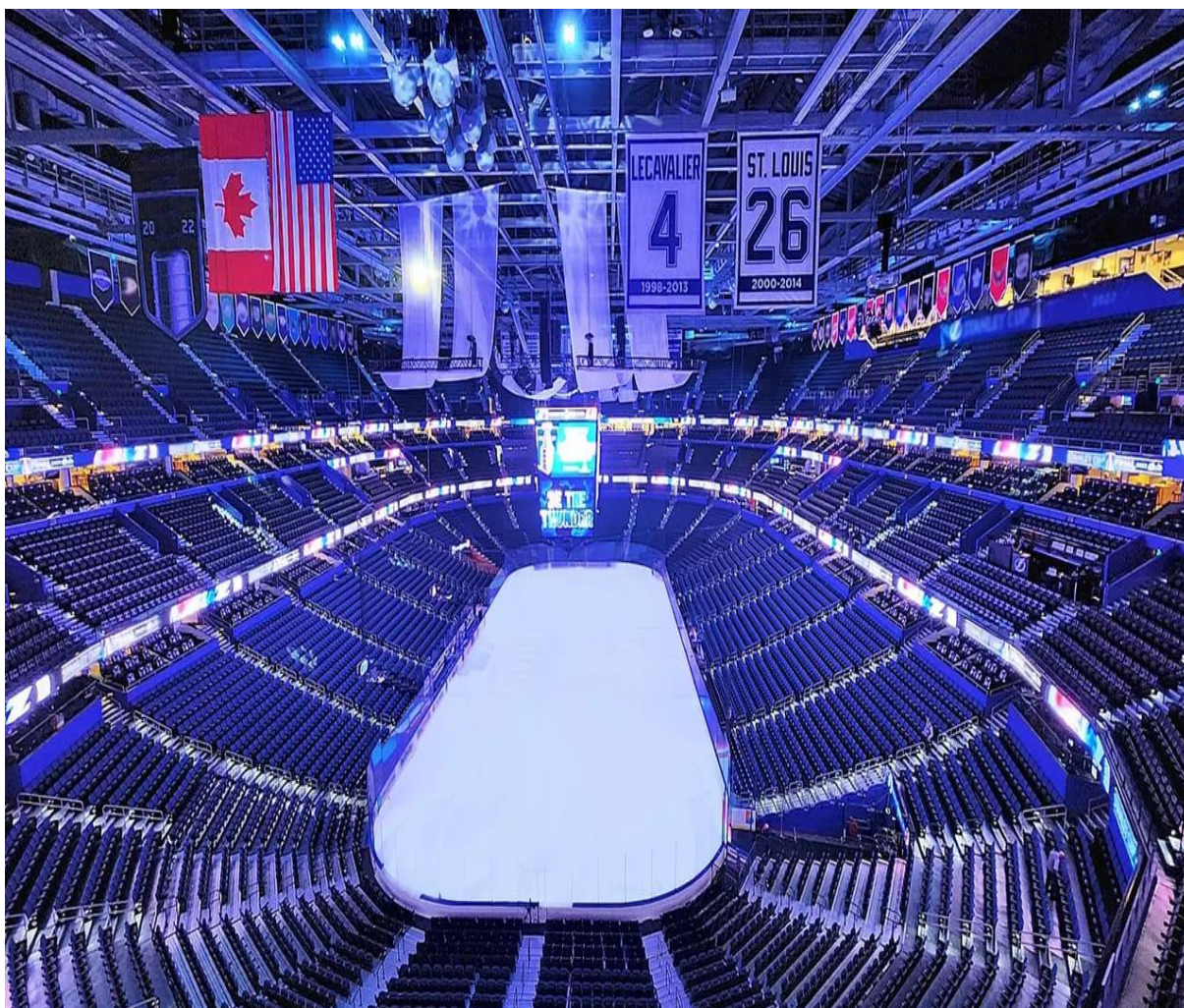


Figure 31. Tacoma Dome, Tacoma, Washington, United States, 1983-2018 (Architects: McGranahan Messenger Associates)

Source: <https://pixels.com/featured/tacoma-dome-1-clinton-ward.html?srsItd=AfmBOooLLOcWzY60mpUDRJuaAiEDFxEDw2tDkZsxodSbqJusObgGOZO1a>, Accessed: July 19, 2026

Source: <https://www.tacomadome.org/dome-info>, Accessed: July 19, 2026

Benchmark International Arena (formerly Amalie Arena) is a top sports and entertainment venue with an area of 670,000 m², located in the center of Tampa, Florida. Opened in 1996, it serves as home ice for the NHL's Tampa Bay Lightning and features luxury suites, unique lightning-throwing Tesla coils and the 11,000 m² Mich Ultra Sky Deck. Located at 401 Channelside Drive in Tampa's bustling Water Street neighborhood, this multi-purpose venue seats 19,092 for hockey games and up to 21,500 for concerts and large entertainment events. It regularly hosts over 150 events a year, including major tours, WWE events and family shows. The arena offers a variety of premium luxury venues and dining options, including the Chase Club and Ashley VIP Lounge. For transportation, visitors can use the convenient on-site parking or take the TECO Line tram to the designated Benchmark International Arena stop located right next to the venue ^[63,64] (Figure 32).



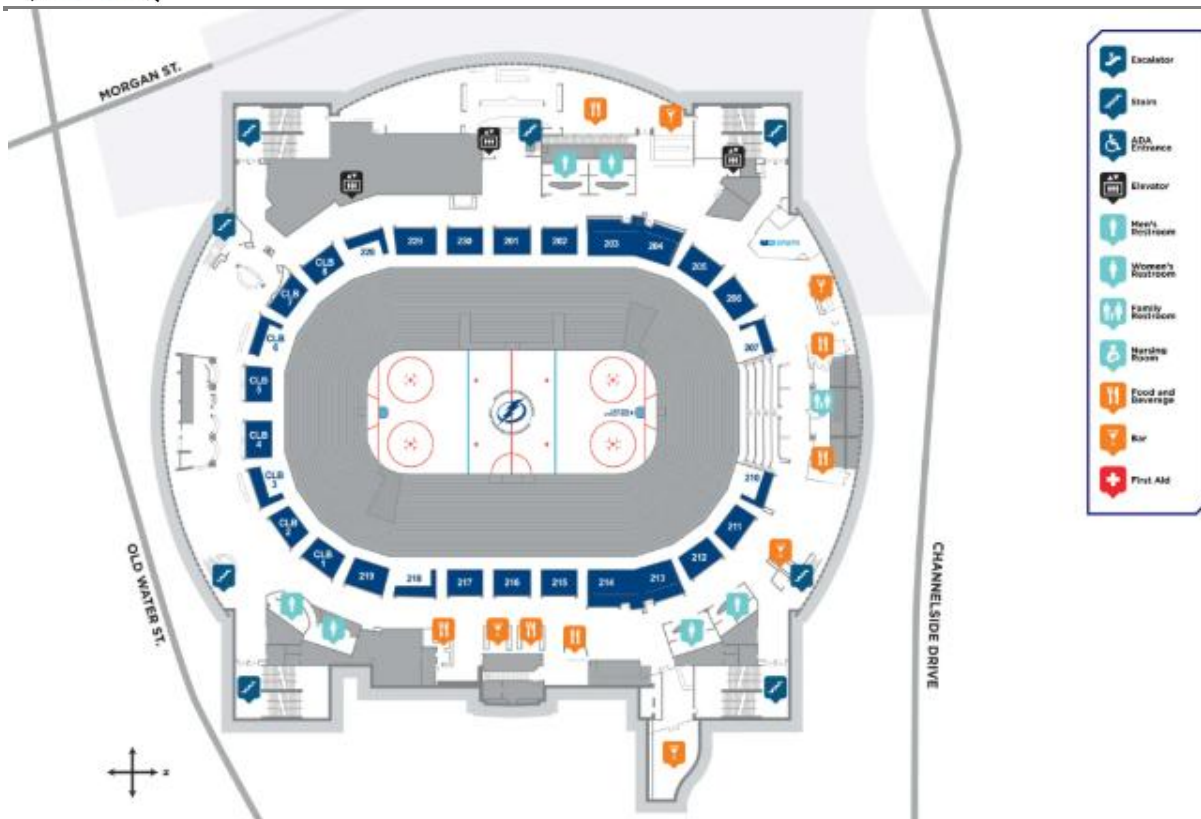


Figure 32. Benchmark International Arena, Tampa, Florida, United States, 1996 (Architect: Ellerbe Becket; Structural engineer: Walter P Moore)

Source: https://i0.wp.com/www.clrtampa.com/wp-content/uploads/2025/08/amalie_arena_4kclips_shutterstock_2555679933.webp.webp?ssl=1, Accessed: July 19, 2026

Source: <https://suitehop.com/venues/benchmark-international-arena-suites>, Accessed: July 19, 2026

Source: <https://www.benchmarkintlarena.com/arena-dining/>, Accessed: July 19, 2026

CONCLUSION

Sports halls are a vital part of modern infrastructure, serving not only sports activities but also a wide range of other events, from cultural gatherings to corporate conferences. Although architecture reflects the time in which it was created, its creators, more or less, look back on the past and look to the future, in order to give the architectural work a dimension of universality, continuity and understanding of the future. The Olympic Games, both those in ancient Greece and the modern ones, are the most representative expression of social organization, practice and evaluation of sports. Today, the Olympic Games are one of the largest state projects that engages the entire economy and society. Their organization brings overall progress to a country (which hosts them), and its inhabitants a special psychological feeling that they belong to the elite societies of the planet that 'write the history' of humanity. In addition to the Olympic Games, two other sports have a planetary popularity and significance, football and athletics. Although these sports are also represented at the Olympic Games, their popularity is so great that their world championships are organized. As structures that can accommodate the largest number of visitors (while ensuring more or less good audio-visual and other comfort parameters for visitors), stadiums have become venues for various manifestations, such as: classical music concerts, pop music concerts, various types of exhibitions, landings on the occasion of national holidays, political-demonstration gatherings... Large sports halls are increasingly approaching the function of stadiums, whereby these two architectural programs are approaching each other, both functionally and architecturally-shaped. In contrast to earlier attitudes and the understanding that sport should go the way of amateurism, today's understandings are completely different in that part of achieving top results. Enormous sacrifices and daily hard work are required of an athlete, which turns him into a professional (which is enabled by the current

law on sports in many countries). The Law on Sports, namely, regulates this matter in terms of the affirmation of sport and its top quality.

Large sports halls are (next to the stadium) the largest architectural physical structures in a city and as such have become 'signs' and 'benchmarks' in the image of the city. As facilities that host major sports competitions, including those on a global scale (Winter Olympic Games and Indoor World Championships in Athletics, for example), then concerts of world-famous music 'stars' (both in serious and pop music), large sports halls 'unite the world', and place the cities where they were built on the world map - visible and significant. As 'architecture is the framework of life', large sports halls have always offered new constructive systems and new forms, and have been a generator of new ideas in architecture in general.

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