ANNEXURE-3 (REVISED)

DESIGN BASIS REPORT

CONSTRUCTION OF INDIA PAVILION FOR THE WORLD EXPO 2025 TO BE HELD IN OSAKA, JAPAN ON DETAILED DESIGN, ENGINEERING, PROCUREMENT AND CONSTRUCTION BASIS TOGETHER WITH SERVICES FOR CIVIL, ARCHITECTURAL, ELECTRICAL, PLUMBING, HVAC OPERATIONS AND MAINTENANCE WORKS DURING THE EXPO AND SUBSEQUENT DISMANTLING OF THE INDIA PAVILION.

INDIA TRADE PROMOTION ORGANISATION

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Design Basis Report

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ITPO

DESIGN BASIS REPORT

CONSTRUCTION OF INDIA PAVILION – WORLD EXPO 2025 AT, OSAKA (JAPAN)

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Construction of India Pavilion - World Expo 2025 at Osaka (Japan)

DESIGN BASIS REPORT

1 General & Architecture

1.1 Introduction

World expos are organized every five years. In the year 2020, a world expo was held in Dubai, UAE and in 2015, it was held at Milan, Italy. A country showcases itself and its progress through such events. The Expo 2025 is scheduled to be held from 13th April 2025 to 13th October 2025 at Yumeshima, Osaka, Japan, in which area of 3513 Sqm. Has been allotted to ITPO for the construction of India Pavilion.

The theme of the Expo is “Designing Future Society for Our Lives” and the subthemes are “Saving Lives”, “Empowering Lives”, “Connecting Lives”. The Government of India intends to have a strong, noticeable presence at such events to showcase the rapid strides undertaken by it and its varied achievements, more so in the recent times, reflecting on its emergence as a major global player in designing the society of the future. It is proposed to create a world-class exhibition pavilion with grandeur and excellence, as an architectural icon complemented by modern facilities representing the spirit of this Expo. It is proposed to depict both traditional and modern India in the India Pavilion and relate these to the theme and the sub-theme while simultaneously demonstrating peaceful coexistence of nature and developments undertaken by mankind.

The theme and sub-themes in the India Pavilion may be reflected through various media including a seamless combination of audio-visual, computer generated information, touch screens, models and physical depiction. Live demonstration of art and culture would be undertaken as decided by ITPO in collaboration with ICCR, the Ministry of Culture and other stakeholders.

1.1.1 Guiding principles

The India Pavilion will be a temporary structure which will be dismantled after the completion of the Expo. The organizers of the Expo aim to achieve the following goals through theme content development:

I. To elevate the public awareness of the challenges in the ‘urban age’ and identify the potential solutions.
II. To facilitate the conservation of the heritage of our cities; to raise public awareness of healthy urban development.
III. To disseminate concepts, successful practices and innovations in sustainable urban development; to seek models for developing countries.
IV. To enhance communication and understanding within human society.

1.1.2 Zoning of the pavilion world

The site of the Expo is Yumeshima which an artificial island located on the waterfront in Osaka that offers visitors a view of the Seto Inland Sea. With an area of 1.55 sq. kms., the venue will have a pavilion area at its center, with water in its southern part and greenery in its western part.

Pavilions for official participants and other facilities will be spread across three zones according to their relationships with the subthemes:

a. Saving Lives

b. Empowering Lives

c. Connecting Lives

Expo Authorities have earmarked a plot admeasuring 3513 sq. m. (approximately 27 m. X 110 m.) for the India Pavilion in the 'Saving Lives' Zone. A Site Plan of the Expo 2025 is enclosed at Annexure-III.

1.1.3 Space utilization in the pavilion:

Thematic area as per the specified theme and sub-theme;

a. Space for display of exhibits (including a small exhibition area which will be changed periodically for various Indian states)
b. Area for commercial use (20% of the total constructed area) which will include shops and eateries
c. Office space, VIP lounge, Director Room for 16 seats and 4 seats
d. Storeroom, stage for programs, green room, reception
e. Holding area
f. Crowd movement corridor(s)
g. Public convenience
h. Landscaping, etc

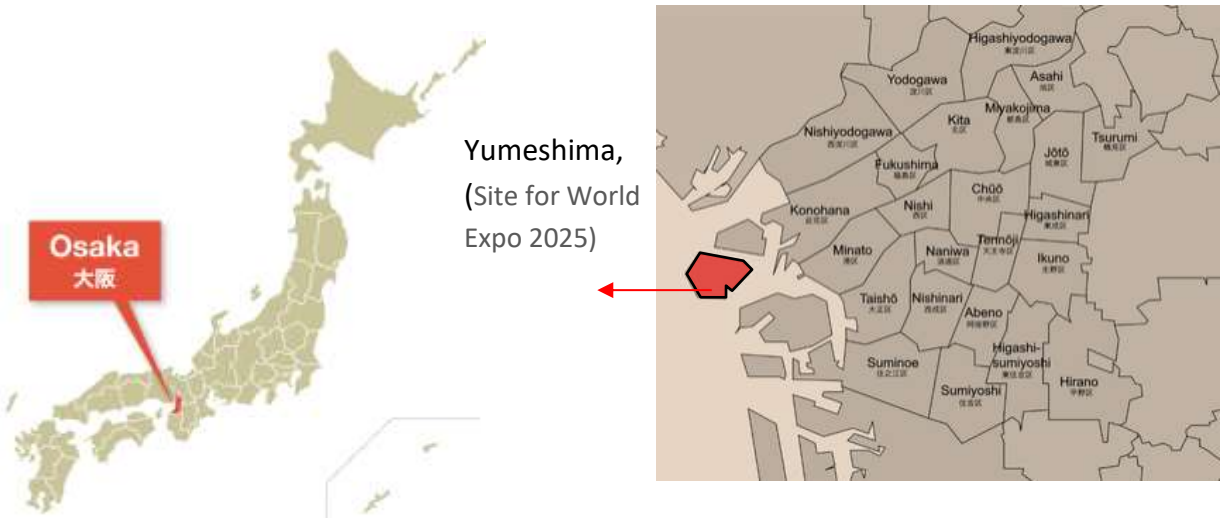


Image 1: Osaka, Location

1.2 Site analysis

1.2.1 Location and Description

Osaka is a designated city in the Kansai region of Honshu in Japan, and one of the three major cities of Japan (Tokyo-Osaka-Nagoya). With a population of 2.7 million in the 2020 census, it is also the largest component of the Keihanshin Metropolitan Area, which is the second-largest metropolitan area in Japan and the 10th-largest urban area in the world with more than 19 million inhabitants.

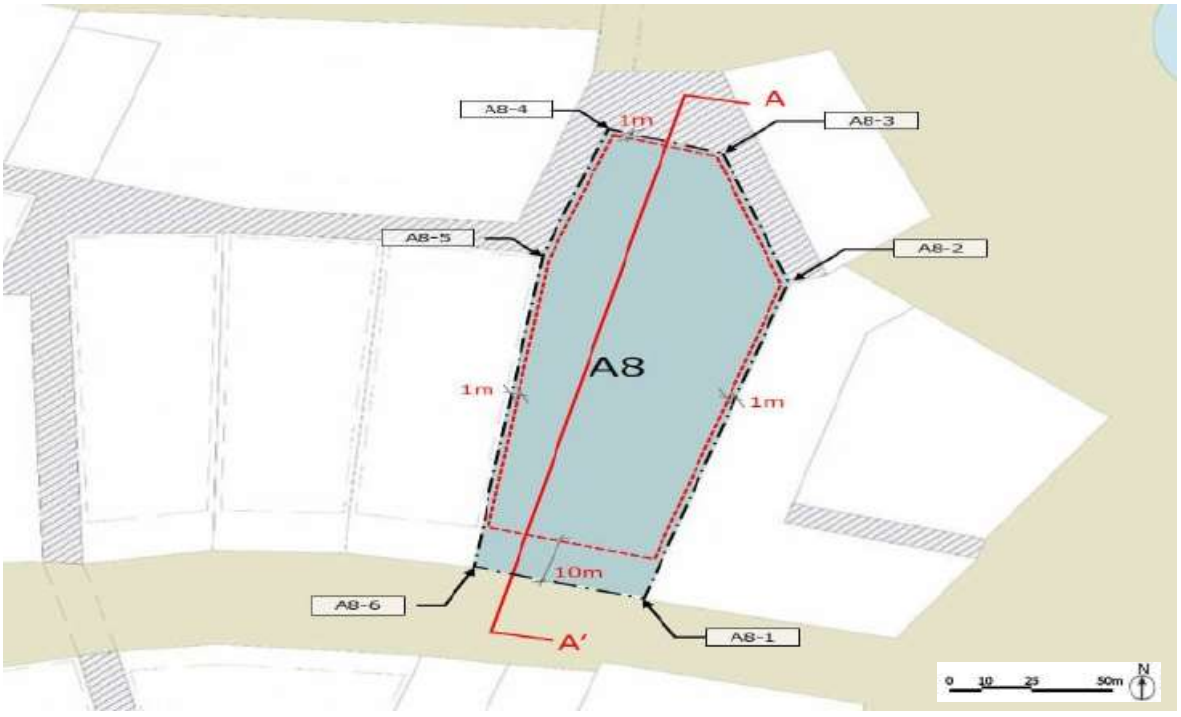
Osaka was traditionally considered Japan's economic hub. It is a major financial centre of Japan, and it is recognized as one of the most multicultural and cosmopolitan cities in Japan. The city is home to the Osaka Exchange as well as the headquarters of multinational electronics corporations such as Panasonic and Sharp. Osaka is an international centre of research and development and is represented by several major universities.

The city's west side is open to Osaka Bay and is otherwise completely surrounded by more than ten satellite cities, all of them in Osaka Prefecture, with one exception: the city of Amagasaki, belonging to Hyōgo Prefecture, in the northwest. The city occupies a larger area (about 13%) than any other city or village within Osaka Prefecture. When the city was established in 1889, it occupied roughly the area known today as the Chuo and Nishi wards, only 15.27 square kilometres (6 sq. mi) that would eventually grow into today's 222.30 square kilometres (86 sq. mi) via incremental expansions, the largest of which being a single 126.01 square kilometre (49 sq. mi) expansion in 1925. Osaka's highest point is 37.5 metres (123.0 ft) Tokyo Peil in Tsurumi-Ku, and the lowest point is in Nishiyodogawa-ku at −2.2 metres (−7.2 ft) Tokyo Peil. Osaka has a latitude of 34.67 (near the 35th parallel north), which makes it more southern than Rome (41.90), Madrid (40.41), San Francisco (37.77) and Seoul (37.53).

1.2.2 Proposed Site

The site of the Expo is Yumeshima. Yumeshima is an artificial island in Osaka Bay. It is part of Konohana-Ku, one of the 24 wards of Osaka, Japan. It is near the mouth of the Yodo River.

When all the landfill is completed, the total area will be 390 hectares (960 acres). It will be the site of Expo 2025, a World's Fair to be held in 2025. Osaka Expo Authority had allocated Type A (self-built – pavilion) plot – A8 to Indian Government for India Pavilion. A8 plot lies in saving lives zone (one of the themes of expo). The main access to the A8 plot is from the south side. And service entry to the plot is from the back side which is north facing. Israel pavilion is on west side of A8 plot, whereas signature zone is on east side of plot. The plot area is 3513.39 sq. m and height restrictions are of 12 m (17m for 50% less of building area)



1.2.3 Connectivity & Circulation

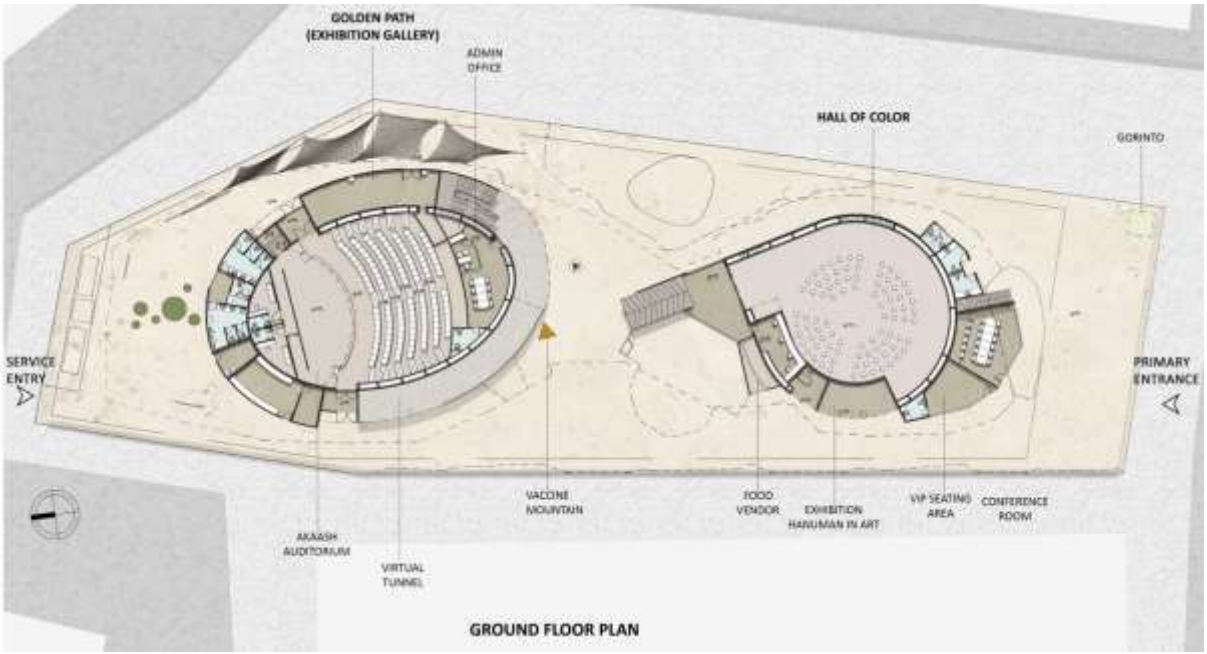
The site is well connected with Airport, railway station, road network and metro station. All the facilities lie within 25 km of radius of expo site.

1.2.4 Building Regulations

The site area admeasures 3,513.39 sq. m, with permissible building coverage of 70% (2459.37 sq. m) and maximum area for building is 2459 sq. m. The building regulations are followed as per Documents shared by Osaka Expo Authority.

Parameters	**Permissible**
Type of Pavilion	Type A (Self-Built) Pavilion
Plot Number	A8
Plot Area	3,513.39 sq. m
Building Coverage	70%
Maximum Area for Building	2,459 sq. m
Maximum Building Height	12 m (17m for 50% or less of the building area)
Set Back	10m front and 1m other sides

1.3 Site planning



The main entrance to the pavilion is from the south side, 10m wide pavilion entry in front, enough open space to cater out massive crowd, VIP seating area, conference room and toilets are in front area with separate entrance.

portal for VIPs. Visitors path follows from left side the 1st is an Exhibition space dedicated to hanuman art, and an information office for helping visitors, following the visitor path - an open-air theater (lotus theater) for artist performance and there is an entry to hall of color, a double height exhibition space – giving an visual experience of art through projection work,

and a ramp (slope 1:15) running along the wall of hall leading to auditorium block. The other functions at ground floor level involve administration space, auditorium block (158 seating) which involves- 2 - Green rooms, Stage and storage space. Adjacent auditorium block there is with takeaway kitchen, Golden Path, Virtual Tunnel, store and toilet facilities for visitors. Open Shopping area (lotus bazar) is on right side of auditorium Service entry is provided on the back side of the site, and electrical panel room.

performance balcony in hall of color which could be accessed only by artist through the spiral staircase and a service area which could accessed by technical team only.

1.3.1 Project components:

1.3.1.1 The pavilion complex involves:

1. ENTRANCE PLAZA
2. VIP SEATING AND CONFERENCE ROOM
3. INFORMATION OFFICE
4. EXHIBITION SPACE (HANUMAN IN ART)
5. HALL OF COLOR (EXHIBITION HALL)
6. ADMINISTRATION OFFICE
7. AUDITORIUM BLOCK
8. OPEN SHOPPING AREA (LOTUS BAZAR)
9. WORKSHOP AREA
10. OTHER FACILITIES

1.3.1.2 The area statement sheet for Pavilion Complex:

AREA STATEMENT - BUILT UP AREA		
S.NO.	**ROOM NAME**	**AREA (IN SQ.M)**
	GROUND FLOOR	
1	HALL OF COLOR (HANUMAN IN ART-EXHIBITION AREA, INFORMATION OFFICE, CONTROL ROOM AND FOOD VENDOR) (A1)	363
2	VIP AREA, TOILETS, CONFERENCE ROOM AND CIRCULATION AREA (A2)	103.4
3	HALL OF COLOR ENTRY AREA & FOOD VENDOR (A3)	71.2
4	KITCHEN AREA, STORE, AND TOILET (A4)	96.67
5	AUDITORIUM ENTRY, AUDITORIUM, STAGE, BACKSTAGE AND GREEN ROOM (A5)	433.67
6	ADMIN OFFICE, DIRECTOR ROOM, PANTRY, STORAGE (A6)	57.62
7	GOLDEN PATH – EXHIBITION AREA (A7)	51.9
8	VIRTUAL TUNNEL (A8)	70.2
	GROUND FLOOR BUILT UP AREA (A)	**1247.66**

	COVERED OUTDOOR AREA- SHOPPING AREA, OPEN GATHERING (D)	**797.4**
.		
	FIRST FLOOR	
9	AUDITORIUM PREFUNCTION AREA AND STAIRCASE (B1)	93.54
10	CONSOLE ROOM (B2)	18.8
	TOTAL FIRST FLOOR BUILT UP AREA (B)	**112.34**
	TOTAL GROUND FLOOR BUILT UP AREA (A)	**1247.66**
	TOTAL FIRST FLOOR BUILT UP AREA (B)	**112.34**
	(E) BUILT UP AREA (A+B)	**1360**
	TOTAL COVERED OUTDOOR AREA- SHOPPING AREA,OPEN GATHERING (D)	**648.34**
	TOTAL BUILT UP AREA (D + E)	**2157**

AREA STATEMENT - USABLE AREA (EXCLUDING AREA OF WALL)		
S.NO.	**ROOM NAME**	**AREA (IN SQ.M)**
1	AUDITORIUM VESTIBULE AREA	33.57
2	AUDITORIUM (158 SEATING)	251
3	STAGE AREA	61
4	BACK STAGE	21
5	GREEN ROOM 01	11.7
6	GREEN ROOM 02	11.7
7	TOILET 01 (GREEN ROOM 01)	2.5
8	TOILET 02 (GREEN ROOM 02)	2.5
9	HALL OF COLOR	185
10	CONFERENCE ROOM	45.6
11	VIP LOUNGE	22.5
12	EXHIBITION AREA 01 (HANUMAN IN ART)	24
13	INFORMATION OFFICE	8.5
14	CONTROL ROOM	18
15	ADMIN OFFICE	32
16	DIRECTOR ROOM	9
17	PANTRY	4
18	ADMIN TOILET	4.5
19	KITCHEN	26.2
20	KITCHEN STORE	13
21	EXHIBITION AREA 02 (GOLDEN PATH)	146
22	AUDITORIUM PREFUNCTION AREA (AT 1ST FLOOR)	57.5
23	AUDITORIUM CONSOLE ROOM	18.8
24	EXHIBITION AREA 03 (VIRTUAL TUNNEL RAMP)	70.2
25	STORE 01	4.8

26	STORE 02	14
27	TOILET 03 (PHYSICALLY CHALLANGED 01)	5
28	TOILET 04 (MALE TOILET 01)	6
29	TOILET 05 (FEMALE TOILET 01)	6
30	TOILET 06 (MALE TOILET 02)	15
31	TOILET 07(FEMALE TOILET 02)	15.6
32	TOILET 08 (PHYSICALLY CHALLANGED)	5.5
33	STAIRCASE AREA 01	23
34	STAIRCASE AREA 02	13
35	VESTIBULE AREA 01 (HALL OF COLOR ENTRY AREA INCLUDING RAMP)	71

1.4 Concept planning

1.4.1 Design Basis

1. **Pavilion Entry**

The pavilion entry is the area that welcomes visitors and sets the tone for their experience. It serves as a transition space between the outside environment and the inside of pavilion site.

There is a rock in front area as we enter. It is an architectural element covering VIP corridor area. It is organic in shape, with a small flat surface carved out in between for the dance performance. The structure is of timber framework suspended and attached with the above slab. The framework would be cladded with flexible waterproof material from outside and inside. This rock is lifted 5 feet from the ground, underneath this, there is a small statue of hanuman and in front face of rock there is going to be three triangular forms anchored on it.

2. **VIP Seating and Conference Room**

A VIP Lounge is located near the entrance plaza, with separate entrances for VIPs and the Conference room. A spacious Conference Room, with a removable partition which allows the room to split in two equal halves, and at the same time 2 different meetings can be conducted.

The Conference Room floor substrate is waterproof plywood. The curved walls are plywood and straight walls are plaster board with surface scoring for further application of interior materials with adhesives, external glazing with a glass door. The ceiling is plywood with surface scoring.

The VIP Lounge floor substrate is waterproof plywood. The curved walls are plywood and straight wall are plaster board with primer coating, external glazing with a glass door. The ceiling is plywood with primer coating.

3. **Information Office**

An information office and help desk for the public. It acts as central points where visitors can go to obtain information, ask for assistance, and get directions. The Information Office floor

substrate is waterproof plywood. The curved walls are plywood and straight wall are plaster board with primer coating. The false ceiling is plaster board with textured paint.

4. **Exhibition space (hanuman in art)**

An exhibition space is an area to display artworks, artifacts, or other items of interest to the public. The floor substrate is concrete and finish is handmade terracotta tiles (of Indian manufacture). The curved walls are plywood and straight wall are plaster board with chicken mesh applied on the surface firmly for further interior application. The false ceiling is plaster board with texture paint.

5. **Control Room**

The control room is located near the entrance of the color. The space provides a master control area for audio visual, projections, lighting and various services of the Pavilion.

The floor is plywood substrate with bamboo board (bamboo board to be of Indian manufacture). The curved walls are plywood and straight wall are plaster board both with primer coating, along with glass in aluminum frame. The false celling is plaster board with texture paint.

6. **Hall of Color (Exhibition Hall)**

The Exhibition Hall is designed to accommodate 120 people. It is a single storey triple height structure. It is a circular shaped hall And a performance balcony for artists performances at height of 6m.

The floor substrate is waterproof plywood. The walls are plywood with incombustible acoustic felt paneling. The false ceiling will be incombustible acoustic paneling in indigo color mounted on plaster board.

7. **Administration office space**

The administration and office space of a pavilion is an essential area that supports the day-to-day operations and management of the facility. This space is located behind the scenes and is not accessible to the public. The space encloses different facilities such as a workspace for 10 to 15 people, a director room, a pantry and a storage space.

The floor substrate is waterproof plywood finished with carpet tile. The curved walls are of plywood and straight wall are plaster board, with primer coating. The glass partition with glass door. The false celling is plaster board with texture paint.

8. **Auditorium Block**

The auditorium is a single storey double height structure. It shall be air conditioned and have capacity of 158 seating and has been designed for optimum values of acoustic parameters. The one fire exit is at ground level and three entries from first floor concourse area. The

auditorium block also involves 2 green rooms with toilets and a stage. The auditorium will serve the purpose for conferences / seminars as well as for cultural programs. Care has been taken while designing the interior acoustics to achieve desired values of reverberation time, ambient noise level and diffusion. The selection of materials on the ceiling, walls and at stage has been made to achieve these parameters and materials have been fixed at locations to achieve aesthetic values in addition to the technical requirements.

The floor substrate is waterproof plywood. The walls are plywood with incombustible acoustic felt paneling.

The stage flooring would be of sprung wood with bamboo boards. Stage trusses will be installed according to the stage design.

The back-stage flooring is waterproof plywood with carpet tile, wall is plaster board with primer base finish and the false celling is plaster board with texture paint.

Green room floor substrate is waterproof plywood. The curved walls are plywood and straight walls are plaster board with primer base finish. The false celling is plaster board with texture paint.

9. Open Shopping Area (Lotus Bazar)

It's an open plaza for shopping, with space provided to different vendors to sell the Indian goods. The walls are plywood with texture paint. The false ceiling will be as per design. The substrate of this area is concrete and it is paved with handmade terracotta tile (Of Indian Manufacturer).

10. Golden Path Exhibition

This exhibition is located east face of auditorium. This space involves a museum quality lighting system. The substrate of this area is concrete and it is paved with handmade terracotta tile (Of Indian Manufacturer). The walls are of plaster board with primer coating. The false ceiling is of plywood with primer coating.

11. Other Facilities

Auditorium Pre-Function Area

It is the pre-function area next to bridge connecting hall of color and auditorium.

The floor is of waterproof plywood finished with bamboo board (bamboo board of Indian manufacture). The walls are plywood with chicken mesh applied on the surface firmly for further interior applications.

Virtual Tunnel

This is a virtual experience tunnel. There would be one tunnels. The floor is of waterproof plywood finished with bamboo board (bamboo board of Indian manufacture). The walls are plywood with chicken mesh applied on the surface firmly for further interior applications.

Tree of Life

It is a tree-like structural column which will be supporting the roof above.

Net of Hope

It is a tensile net structure covering the shopping area (lotus bazar), supported from the main structure. It will be a kinetic tensile net structure system which would be manually operated. The idea of making it kinetic is to take it down for visitors to tie souvenirs or wishes.

Shopping plaza (Lotus Bazar)

This is an open space adjacent to the auditorium, with the shops planned. Provision shall be made for movable partitions to create segregation between the two shops.

Open Covered Area

The open covered area includes the shopping plaza (Lotus Bazar), the central space between the auditorium, hall of color, and other areas under the superstructure.

It is a fine dining experience designed to accommodate approx. 60 – 70 people at a time. Theme for restaurant is Indian culinary festival. The furniture for the same is the part of the scope. A kitchen and store, with respect to the size of restaurant is located adjacent to it, with kitchen having separate service entry. Kitchen equipment is not included.

The floor substrate is concrete. The walls are of plaster board with primer coating, external glazing with a glass door. The false ceiling is of plywood with primer coating.

Toilet and Utility Facilities:

Adequate toilet facilities for visitors are provided, with toilet facilities situated near the restaurant, auditorium, and open shopping area, where maximum footfall is expected. Additionally, two toilets are provided for individuals with physical challenged. The floor substrate is waterproof plywood with vinyl sheet finishing. The false ceiling is of calcium silicate with texture paint. The wall base is vaper resistant plaster board with Tadelakt lime plaster finish.

Staircase Area

There is one evacuation staircase. The staircases would be made of metal, with the tread, riser, and landing finished with exterior-grade wooden planks. Additionally, the staircases would be clad with odd-shaped natural fiber boards with waterproof coating.

Service Facilities:

Space for Services like Electrical Substations, HVAC Service Space, Control Room etc. has been planned.

1.4.2 External Development

1.4.2.1 Site Levels

The plot A8 is elevated 150 mm from surrounding roads. The topography of the site is Flat.

1.4.2.2 Circulation & Parking

The circulation has been planned to keep the pedestrian character of the complex.

1.4.3 Landscape

The landscape master plan has been developed in response to the environmental context, existing site features and requirements for efficient ongoing maintenance and sustainability. The objectives of landscape design seek to complement and enhance the architectural design theme.

The Landscape part is divided into two parts:

1. **Hardscape**: Paved plaza space around the pavilion, The substrate of site is concrete and it is paved with handmade terracotta tile (Of Indian Manufacturer) & red sandstone in some areas. The site flooring is going to be the combination of both different size terracotta tile and red sandstone.
2. **Softscape:** The planting on vertical garden.

1.4.3.1 Objective

The landscape design aims to create a high quality, attractive and contemporary precinct that will provide users with aesthetically pleasing and functional spaces.

1.4.3.2 Design Criteria

a. Provide safe environs.
b. Enable & encourage people to access parking facilities.
c. Build a sense of identity through distinct aesthetics.
d. Generally, incorporate key principles of good Landscape Design.
e. Create spaces with dominant landscape to enable ambient usage of spaces.

1.4.3.3 Landscape Irrigation Design

I. However, irrigation network shall also be connected to Water supply pipeline to cater to irrigation requirement.

II. The Type of Irrigation System shall be planned & adopted as detailed herein:

a. Land irrigation system through ring mains with the help of garden hydrant points comprising valves and chamber for surface irrigation of lawns.
b. Drip irrigation system for shrubs, trees and plants on the vertical gardens on the herbal fence distributing water through a network of valves, pipes, tubing, and emitters.
c. Drip irrigation systems can minimize water waste by delivering water directly to the roots of plants. This reduces evaporation and ensures that water is used only where it is needed.

III. Material for Irrigation System

a. All garden hydrant system mains and sub mains and branches shall be UPVC pipes class 10 kg/cm2 as per JIS Codes rating with matching fittings.
b. For drip irrigation system LLDP drip tubing of 10 kg/cm2 rating with all matching fittings and special e.g., coupling, tees, bends and reducer etc. with solenoid valve assemblies shall be provided.
c. All pumping systems shall be vertical inline stainless-steel pumps. All electrical works for the pumps including control cables shall be included.
d. Suitable filtration units, disc filters, pressure gauges, air release valves shall be provided as accessories for the irrigation system.
e. Materials of valves used in the irrigation system shall be as already specified in the water supply section of DBR.

1.4.3.4 Lighting

The plaza space around the Pavilion and Main entrance are lit by double and single arm solar pole lights.
Sculptures, wall features and architecture facade are lit up by use of Bollard Lights, LED Strip Light, Spike lights, watertight light for water features and down lighters.

Type of Light	Sample Image
Pole light (26'-0'' to 30'-0'')	
Path Lights and Bollards	
Strip LED Light	
Up and Down Lighters (Wall Mounted)	
Landscape recessed Light	
Linear Grazer Light	
Spike Light	

1.4.3.5 Planting Palate – Medicinal Plants

India, with its rich biodiversity, is home to a plethora of medicinal plants that have been used for centuries in traditional healing systems.

Decorative plants			
S.no	Scientific Names	Common Name	Plant Image
1.	**Hydrangea Macrophylla**	Bigleaf Hydrangea	
2.	**Hibiscus Rosa-Sinensis**	China Rose	
3.	**Papaver Orientale**	Oriental Poppy	
4.	**Camellia Japonica**	Japanese Camellia	
5.	**Hypericum Calycinum**	Rose Of Sharon	
6.	**Epipremnum Pinnatum**	Golden Pothos	

7.	**Ammocallis Rosea**	Madagascar Periwinkle	
8.	**Tagetes Erecta**	African Marigold	
9.	**Monstera Adansonii**	Swiss Cheese Plant	
10.	**Zinnia Elegans**	Common Zinnia	

Medicinal Plants			
1.	**Ophiopogon japonicus**	Mondo grass	

2.	**Lycoris radiata**	Dwarf red spider lily	
3.	**Aconitum**	Wolfs bane	
4.	**Amomum subulatum**	Black cardemom	
5.	**Gomphrena globosa**	Globe amaranth	
6.	**Aralia elata**	Japanese Angelica	

RET species from the selected list
(A: Ayurveda, F: Folk, S: Siddha, U: Unani, T: Swa Rig Pa, H: Homeopathy, M: Modern, C: Traditional Chinese Medicine)

Sl. No.	Botanical Name	Habit	Seeds	Stem cuttings
1	Abrus precatorius	Climber	Seeds	
2	Adenia hondala	Climber	Seeds	
3	Anodendoron paniculatum	Climber	Seeds	
4	Aristolochia indica	Climber	Seeds	
5	Asparagus racemosus	Climber	Seeds	
6	Celastrus paniculatus	Climber	Seeds	
7	Chonemorpha fragrans	Climber	Seeds	Stem cuttings
8	Cosicinium fenestratum	Climber	Seeds	
9	Decalepis hamiltonii	Climber	Seeds	
10	Gloriosa superba	Climber	Seeds	
11	Gymnema sylvestre	Climber	Seeds	Stem cuttings
12	Holostemma ada-kodien	Climber	Seeds	Stem cuttings
13	Ipomoea mauritiana	Climber	Seeds	Stem cuttings
14	Leptadenia reticulata	Climber	Seeds	Stem cuttings
15	Operculina turpethum	Climber	Seeds	Stem cuttings
16	Piper nigrum	Climber		Stem cuttings
17	Rhaphidophora persuta	Climber		Stem cuttings
18	Salacia reticulata	Climber	Seeds	
19	Tinospora sinensis	Climber	Seeds	Stem cuttings

20	Tylophora indica	Climber	Seeds	
21	Acorus calamus	Herb		Stem cuttings
22	Andrographis paniculata	Herb	Seeds	Stem cuttings
23	Coleus aromaticus	Herb		Stem cuttings
24	Ocimum gratissimum	Herb	Seeds	
25	Piper longum	Herb		Stem cuttings
26	Pseudarthria viscida	Herb	Seeds	
27	Uraria picta	Herb	Seeds	
28	Adhatoda beddomei	Shrub		Stem cuttings
29	Baliospermum montanum	Shrub		Stem cuttings
30	Clerodendrum serratum	Shrub	Seeds	Stem cuttings
31	Morinda citrifolia	Shrub	Seeds	
32	Plumbago zeylanica	Shrub	Seeds	Stem cuttings
33	Rauvolfia serpentina	Shrub	Seeds	Stem cuttings
34	Aegle marmelos	Tree	Seeds	
35	Aphanamixis polystachya	Tree	Seeds	
36	Artocarpus hirsutus	Tree	Seeds	
37	Boswellia serrata	Tree	Seeds	Stem cuttings
38	Butea monosperma	Tree	Seeds	
39	Canarium strictum	Tree	Seeds	
40	Cinnamomum tamala	Tree	Seeds	

41	Cycas circinalis	Tree	Seeds	
42	Elaeocarpus sphaericus	Tree	Seeds	
43	Garcinia gummi-gutta	Tree	Seeds	
44	Garcinia indica	Tree	Seeds	
45	Garcinia morella	Tree	Seeds	
46	Garcinia xanthochymus	Tree	Seeds	
47	Kingeodendron pinnatum	Tree	Seeds	
48	Limonia acidissima	Tree	Seeds	
49	Madhuca longifolia	Tree	Seeds	
50	Mesua ferrea	Tree	Seeds	
51	Michelia champaca	Tree	Seeds	
52	Myristica dactyloides	Tree	Seeds	
53	Myristica malabarica	Tree	Seeds	
54	Nothapodytes nimmoniana	Tree	Seeds	
55	Oroxylum indicum	Tree	Seeds	
56	Persea macrantha	Tree	Seeds	
57	Phyllanthus emblica	Tree	Seeds	
58	Pterocarpus marsupium	Tree	Seeds	
59	Pterocarpus santalinus	Tree	Seeds	
60	Santalum album	Tree	Seeds	

61	Saraca asoca	Tree	Seeds	
62	Shorea robusta	Tree	Seeds	
63	Sterculia urens	Tree	Seeds	
64	Syzygium travancoricum	Tree	Seeds	
65	Sygygium travancoricum	Tree	Seeds	
66	Terminalia arjuna	Tree	Seeds	
67	Terminalia chebula	Tree	Seeds	
68	Toona ciliata	Tree	Seeds	
69	Vateria indica	Tree	Seeds	
70	Dipterocarpus indicus	Tree	Seeds	

Note: These plants are suggested, however in case they are not available these shall be substituted with plants locally available in Japan.

1.4.3.6 Material for Landscape Area

Terracotta pavers with compact soil base for Plaza space around the pavilion.

1.4.3.7 Outdoor Furniture

At least 12 benches shall be provided in the outside area at different locations. They serve as vital amenities, providing opportunities for rest, social interaction, and enjoyment of the surroundings.

1.4.3.8 Planting quantity for herbal fence

Number of plants/ herbs in single Module (planting Tray) – 4 Plants/ species as per availability duly approved by PDMA

SR. NO.	LANDSCAPING AREAS	COUNT OF MODULES
1.	Modules on Façade	500
2.	Modules on Herbal Fence	400
3.	Plants on Herbal Habitat	250
4.	Other Landscape Areas	100

1.4.4 Segregation between the plot boundary

Segregation will be of wall (Height variation - min 450mm to max 1200mm), constructed along with the foundation.

1.4.5 Signages:

Signages of different sizes are proposed at different locations inside the pavilion complex. The design basis of the signage is readability at pedestrian movement. And it should be in accordance with standards shared by Osaka Expo Authority (the manual of type A pavilion design guidelines).

Outdoor Signage shall be made with 304 Grade SS letters, front face being Acrylic sheet with vinyl pasted as approved and with LEDs for lighting and back support shall be made with ACP of approved colour along with Necessary MS Framework required for Letters support.

The directional Totems for the pavilion will be made with a combination of SS and Acrylic sheet with approved reflective Vinyl and required MS framework supports.

Wayfinding signages are important for guiding owner, visitor and support staff to the correct location. Wayfinding and fire signages will be backlit

The internal signages for the entire pavilion will be made mainly with minimum 8mm white Acrylic as per approved shape & design in digital print with Matt lamination. Fire Signage as

per relevant statutory norms shall also be provided in pavilion. Emphasis will be given towards making the signages with modern look & feel with uniformity.

1.5 Aesthetics

a. The façade, although made of modern and traditional materials alike, follows the artistic scenography-oriented approach quite closely in the essence.

1.6 Architectural features of the project

The Architectural features of the project are as follows:

Exterior building facade:

a. Amongst the themes at Osaka expo 2025, we are presenting the “saving” theme in our design. The theme strikes a meaning of rescue when first heard. Synonymous to rescue is the tale of Hanuman and Lakshman’s Sanjivani.
b. Sanjivani is a word that embodies saving in the essence resonating rejuvenation and life. Hanuman risked his own life and performed unearthly feats just to rescue the god he worshipped and his beloved brother.
c. The exterior of our pavilion symbolizes this very context of Dronagiri and Sanjivani. The cladding of roof substrate is waterproof plywood with external grade fire rated and water proof Wooden Board (Of Indian Manufacturer) with water proofing compound/ membrane laid over the board with cementitious textured layer as the top coat and structurally supported by Glulam/solid timber trusses and sandwiched with water proofing membrane.

Ramp for circulation:

a. Universal Accessibility: The ramp ensures inclusivity, accommodating visitors with mobility challenges for seamless circulation throughout the pavilion.
b. Architectural Cohesion: Harmonizing with the pavilion's aesthetic, the ramp integrates seamlessly, contributing to its overall visual appeal and thematic coherence.
c. Symbolism and Interpretation: Beyond functionality, the ramp embodies themes of progression and inclusivity, enriching visitor experiences with deeper narrative resonance and symbolic significance.

1.7 Design philosophy.

A. The pavilion, inspired by Hanuman's Sanjivani narrative, epitomizes "saving" across dimensions:
    1. Environmental Stewardship: Sustainable materials like bamboo and recycled plastics reduce ecological impact, preserving resources “saving” the planet.
    2. Cultural Legacy: Architectural motifs from Hindu mythology honor cultural narratives, safeguarding traditions “saving” cultural oblivion.
    3. Inclusive Design: Universal accessibility ensures everyone feels welcomed, “saving” them from the feeling of exclusion.
    4. Community Empowerment: Open spaces foster cultural exchange, “saving” diverse voices from obscurity.
    5. Innovative Solutions: 3D printing drives efficiency, saving time and resources while advancing technology.

B. In sum, the pavilion embodies Hanuman's ethos of saving lives and cultures, integrating sustainability, inclusivity, and innovation into its narrative.
C. The Architectural design and scenography created by PDMA for the ITPO, in its entirety requires to be followed in spirit, form and content. Unless agreed otherwise, the Contractor must avail and consult with the PDMA during all stages of development and implementation of detailed design.

2 Civil Structures

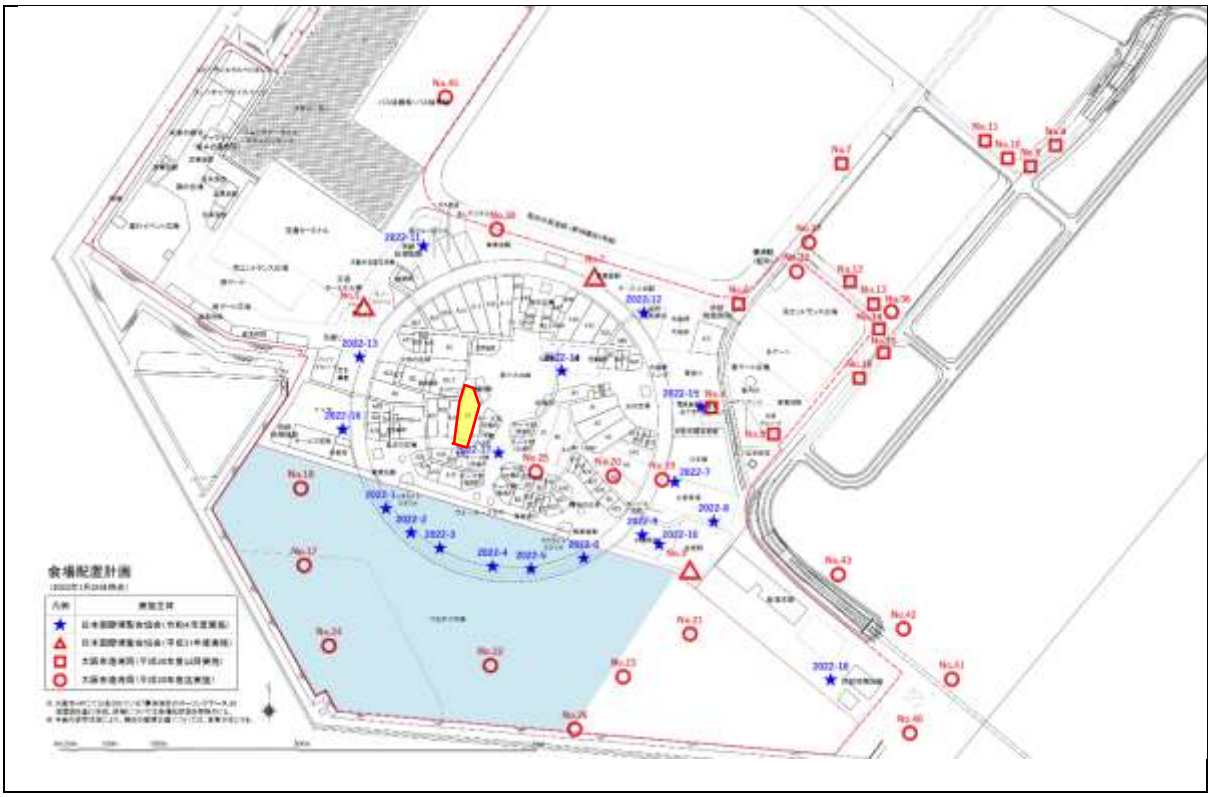
2.1 Scope of Design Basis Report

This report provides a concise overview of the structural design and philosophy behind the Japan Timber Pavilion Project, with a specific focus on the unique aspects of construction pertinent to timber super-structures. The project, inspired by the "SUGREEV SETU" concept seeks to blend the traditional craftsmanship of Japanese woodwork with modern seismic safety standards. The building has plan dimensions Approx. 90x30m. This synthesis aims to achieve a balance between aesthetic elegance and structural durability, particularly in addressing the challenges posed by Japan's seismic activity.

The design of the pavilion Sub-structure is in scope and is to be realized with meticulous attention to the seismic resilience of the timber structure and the overall structural system. Emphasizing the foundational elements supported by use of floating foundation, the project stands as a testament to sustainable and resilient architectural practices. Acknowledging the dynamic nature of such a comprehensive project, the report anticipates potential revisions in design and drawings, driven by the dual forces of unforeseen project requirements and the pursuit of enhanced design efficacy through continuous analysis and regulatory compliance.

2.2 Salient Features of Project

2.2.1 Site Location / Key Plan / Master Plan



2.2.2 Building Description

Table 1 - Building Description

Sl. No.	Building Name	Function of Building	Foundation Type
1	Pavillion	Exhibition and Auditorium Space	Floating Foundation

2.3 Sub-Structure

The foundation system will be designed to interact along with the superstructure taking care of seismic forces and local soil conditions. This will involve a floating foundation (Refer Section 3.1) system, selected based on the soil report findings and designed to accommodate the expected seismic forces, as per the soil analysis report and the seismic considerations detailed in the Japanese codes. For design of sub-structure and super-structure connection with baseplate or by other means will be based on super-structure load reactions provided.

The proposed site is at “A8” plot number of the Expo site area, and the nearest bore hole is No.25. Since this pavilion is temporary structure for approximately 1 year, liquefaction of soil is not considered in sub-structure design.

2.3.1 Floating Foundation:

Floating foundation is proposed by digging 2 to 3 meter in depth from NGL (Natural Ground Level). For floating foundation excavated soil weight should be higher or equal to total weight of the building to avoid over stressing the soil below foundation. At the base of excavation, thin raft (Apx. 300mm to 400mm Thick) to be cast with inverted beam with stub-column provided for supporting plinth level and super-structure above. Ground floor level flooring can be casted/placed over inverted beams as per architectural intent. Since the soil will not be refilled in excavated area, perimeter wall shall be constructed of RCC to retain the external soil. **Workflow of the same is presented in figure no.1.**

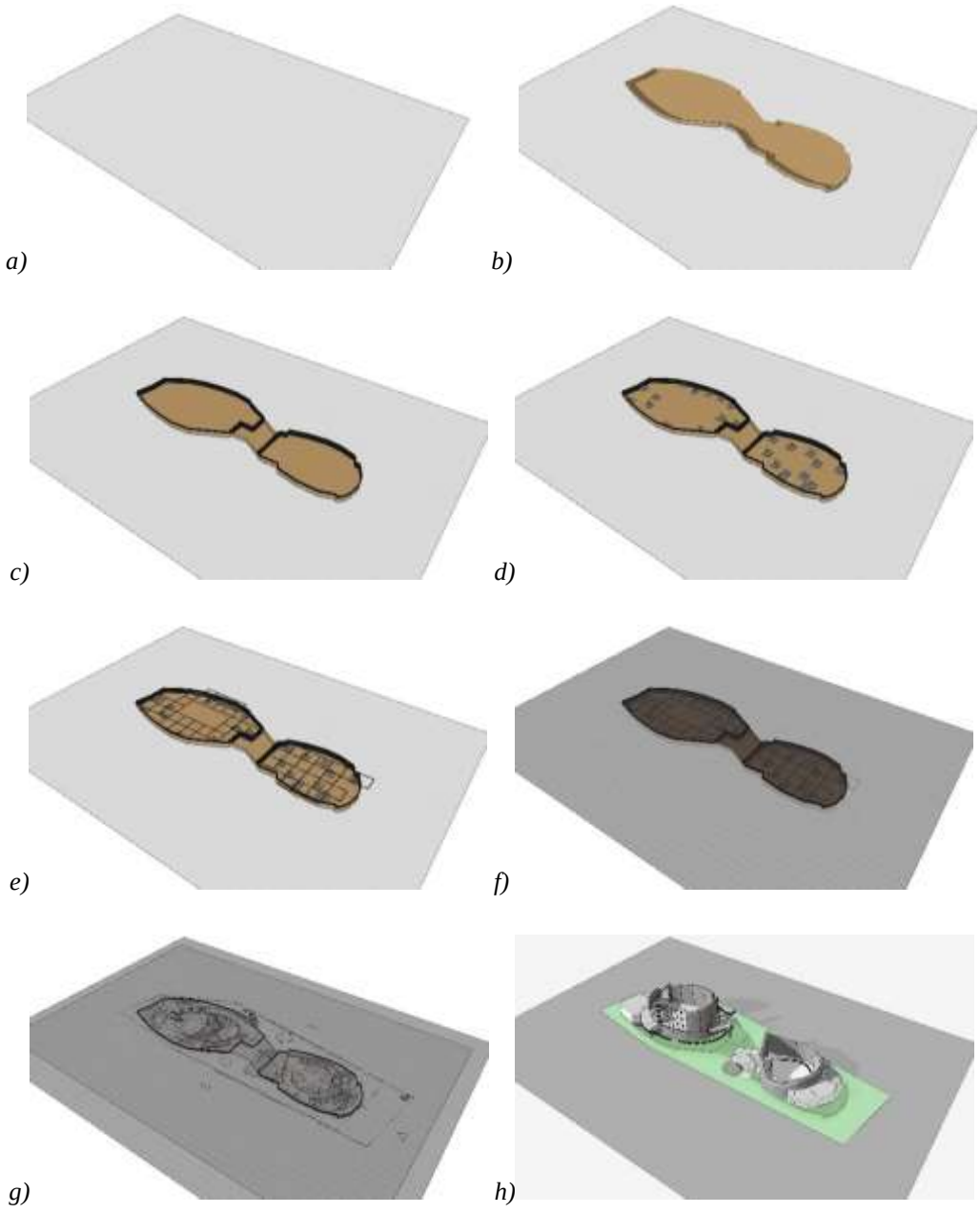


Figure 1: Floating Foundation Workflow. a) Ground Level, b) Excavation of Soil Weight ≥ Building Weight, c) Peripheral Retaining Wall & Thin raft with inverted beam at base, d) Column erected from inverted beam based on column layout, e) Tie Beam at Ground Level, f) Flooring, g) Ground Level, h) Super Structure

2.4 Important Japanese Standards Proposed to be followed

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1. Redundancy and Robustness in Building Structural Design, 2013
2. Introduction to Shock-Resistant Design of Buildings, 2015
3. Architectural Form and Mechanical Kansei, 2014
4. Recommendations for Loads on Buildings (2015), 2015
5. Guidebook of Recommendations for Loads on Buildings 1, 2016
6. Guidebook of Recommendations for Loads on Buildings 2 - Wind-induced response and load estimation/Practical guide of CFD for wind resistant design -, 2017
7. Recommendations for Design of Building Foundations, 2001
8. Recommended Procedures for Planning Soil Investigations for Design of Building Foundations, 2009
9. AIJ Recommendations for Design of Ground Improvement for Building Foundations, 2006
10. Evaluation of foundation soil for design and construction of building foundations, 2015
11. Recommendations for Designing of Small Buildings Foundations, 2008
12. Design Examples of Small Building Foundations, 2011
13. Standard for Structural Design of Timber Structures, 2006
14. Recommendation for Structural Calculation of Traditional Wood Buildings by Calculation of Response and Limit Strength, 2013
15. Design Manual for Engineered Timber Joints, 2009
16. Design Practice for Engineered Timber Joints, 2012
17. Fundamental Theory of Timber Engineering, 2010
18. Q&A for Designing Timber Shear wall Structures, 2011
19. Design Standard for Steel Structures -Based on Allowable Stress Concept-, 2005
20. Recommended Provisions for Seismic Damping Systems applied to Steel Structures, 2014
21. AIJ Recommendations for Plastic Design of Steel Structures, 2017
22. Stability Problems of Steel Structures 2013, 2013
23. AIJ Recommendations for Design of Connections in Steel Structures, 2012

24. AIJ Guidebook on Design and Fabrication of Column Base in Steel Structure, 2017
25. AIJ Guidebook on Design and Fabrication of Welded Connections, 2008
26. AIJ Guidebook on Design and Fabrication of High Strength Bolted Connections, 2016
27. Design Recommendations for Composite Constructions, 2010
28. Recommendations for the Design and Fabrication of Light Weight Steel Structures, 2002
29. AIJ Recommendations for the Design and Fabrication of Tubular Truss Structures in Steel, 2002
30. Recommendation for Limit State Design of Steel Structures, 2010
31. AIJ Recommendations for Fire Resistant Design of Steel Structures, 2017
32. Concept and Framework for the Structural Design of Steel Structurs 1999
33. "Recommendations for Sustainable
34. Steel Building Construction (Draft) -Member Reuse-", 2015
35. Standard for Structural Calculation of Reinforced Concrete Structures, 2010
36. AIJ Standard for Lateral Load-carrying Capacity Calculation of Reinforced Concrete Structures (Draft), 2016
37. AIJ Guidelines for Seismic Design of Reinforced Concrete Foundation Members (Draft), 2017
38. Data for Structural Calculation of Reinforced Concrete Building, 2002
39. Guidelines for Performance Evaluation of Earthquake Resistant Reinforced Concrete Buildings(Draft), 2004
40. Behaviors and Design Method on Vertical Joint of Wall Panel Precast Concrete Structures, 1989
41. State-of-the-Art Report on High-Strength Concrete, 2009
42. Guidelines for Design and Fabrication of Diagonally Reinforced Concrete Members, 2010
43. Standard for Structural Design and Construction of Prestressed Concrete Structures, 1998
44. Recommendations for Design and Construction for Partially Prestressed Concrete (Class 3 of Prestressed Concrete) Structures, 2003

45. Guidelines for Structural Design and Construction of Prestressed Concrete Buildings Based on Performance Evaluation Concept (Draft), 2015
46. AIJ Standard for Structural Calculation of Steel Reinforced Concrete Structures -Based on Allowable Stress Concept and Lateral Load Carrying Capacity-, 2014
47. Recommendation for Detailing and Placing of Reinforcement on Steel Reinforced Concrete Structures, 2005
48. Design Standard for Composite Structures, 2014, 95p, 2,400
49. Guidebook on Design of Concrete Filled Steel Tubular Structures, 2012, 177p
50. AIJ Recommendation for Design of Latticed Shell Roof Structures, 2016
51. Damping and Response Control of Shell and Spatial Structures, 2008, 358p
52. Buckling and Strength of Latticed Shells, 2010, 382p
53. Recommendations for Design of Cable Structures, 1994
54. Guidebook for Numerical Analysis of Spatial Structures, 2017
55. DOME STRUCTURES IN JAPAN -RECENT ADVANCES IN STRUCTURAL ENGINEERING, 2004
56. Extreme Ground Motions and Seismic Performance Evaluation of Buildings - How to Prepare for Mega Subduction and Inland Earthquakes -, 2013
57. Seismic Loading-toward Performance-Based Design, 2008
58. Earthquake Ground Motion and Strong Motion Prediction -Key items for learning the basics-, 2016
59. Generation Guide for Seismic Input Motions Based on the Recent Advancement of Ground Motion Studies, 2009
60. Recommendation for the Design of Base Isolated Buildings, 2013
61. An Introduction to Dynamic Soil-Structure Interaction, 1996
62. Active and Seiactive Control for buildings -State of the Art-, 2006
63. Intelligible Guide to Structural Control, 2014
64. AIJ Recommendations for the Design and Construction of Ground Anchorages, 2018
65. Ground Anchorages Questions & Answers for Building Engineers, 2010
66. Recommendation for Design of KIGEN-TSUKI Buildings, 2013
67. Manual for Re-using Structural Members, 2009

68. AIJ Recommendations for of Earth Retaining for Excavation, 2017
69. Guidebook on Excavation Works Considering Neighboring Structures, 2015
70. Recommendation for Design and Construction Practice of Temporary Pier, 2014
71. AIJ Standard for Design and Calculation of Reinforced Concrete Boxed-shaped Wall Structures, 2015
72. AIJ Standards for Structural Design of Masonry Structures, 2006
73. Guideline for Reinforcement of Concrete and Masonry Box-shaped Wall Structures, 2013
74. Guidelines and Commentary to Seismic Evaluation for Concrete Masonry Garden Walls, 2014
75. Guidelines for Maintenance and Management of Structures in Nuclear Facilities, 2015
76. Protecting high-rises against long period motions - Wisdom to share among designers and engineers, 2013,
77. Structural Design Recommendation for Chimneys, 2007

Note: The above list is suggestive and not exhaustive. Apart from these basic codes, any other related codes shall also be followed wherever required.

Notes:

1. As per soil report the soil is liquefiable. Since the structure is temporary soil is considered to be non-liquefiable soil.
2. Bore hole no.25 data & any sub-sequent data received to be considered for sub-structure design.
3. Super-structure is considered to be timber structure.

2.5 Super structure

Introduction

This report pertains to the roof structure design of the India Pavilion at Expo Osaka 2025.

The India Pavilion at Expo Osaka 2025 stands as a testament to the fusion of tradition and modernity, encapsulating the rich cultural heritage of India within a contemporary architectural marvel. Spanning an approximate footprint of 90 meters in length, 30 meters in width, and soaring to a height of 16 meters, this pavilion serves as a captivating showcase of Indian ingenuity and innovation.

Central to the pavilion's design is its faceted timber roof structure, which serves as both a striking visual centerpiece and a symbol of sustainability. Crafted from responsibly sourced timber, the soaring roof spans the length of the pavilion, creating a sense of grandeur and openness while providing shelter and shade for visitors.

Objectives

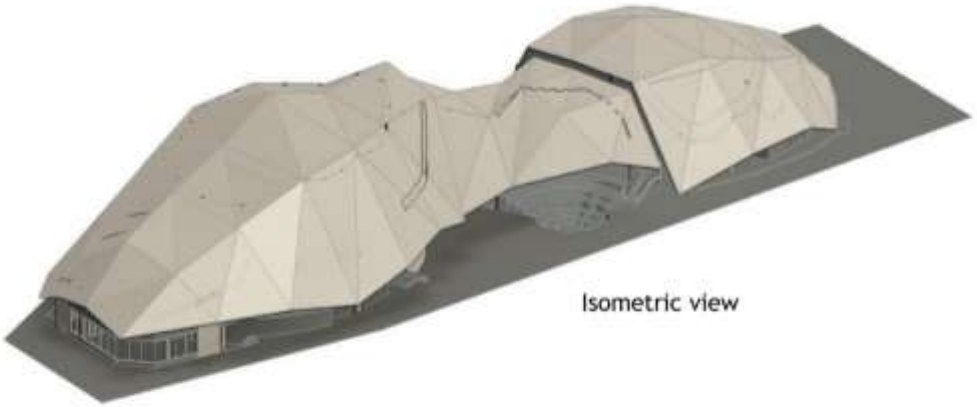
a. Develop an innovative design solution that optimizes the structural efficiency and performance of the timber roof structure while adhering to aesthetic and functional requirements.
b. Develop innovative structural load transfer mechanisms to accommodate the unique configuration of the pavilion's timber roof, where multiple timber beams converge at node points.
c. Develop a robust structural design that considers the unique wind, seismic and settlement challenges present in the Expo Osaka 2025 site location in Japan.

Reference Codes

[01]	AIJ Standard for Structural Design of Reinforced Concrete Structures (ST-001)
[02]	AIJ Standard for Structural Design of Timber Structures (ST-002)
[03]	AIJ Standard for Structural Design of Steel Structures (ST-003)
[04]	AIJ Standard for Structural Design of Foundations (ST-005)
[05]	AIJ Standard for Structural Design of Earthquake Resistant Buildings (ST-010)
[06]	AIJ Standard for Load Calculations on Building Structures (ST-011)
[07]	AIJ Standard for Architectural Design Loads on Building Structures (ST-012)
[08]	AIJ Standard for Wind Load on Buildings (ST-013)
[09]	AIJ Standard for Snow Load on Roofs (ST-014)
[10]	AIJ Standard for Structural Analysis of Buildings (ST-016)
[11]	AIJ Standard for Structural Dynamics of Buildings (ST-017)
[12]	AIJ Standard for Fire Resistance Design of Building Structures (ST-018)
[13]	AIJ Standard for Sustainable Building Design (ST-022)
[14]	Japanese Building Standard Law 2018 Revision
[15]	JAS 3001: Standard for Structural Timber
[16]	JAS 3002: Standard for Laminated Timber
[17]	JAS 3003: Standard for Timber Preservation
[18]	Recommendations for Structural Design 2010 (Tokyo Association of Architectural Firms)
[19]	Recommendations for Loads on Buildings 2015(AIJ)
[20]	Recommendation for Design of Connections in Steel Structures 2006 (AIJ)

[21]	Design Practice for Engineered Timber Joints 2012 (AIJ)
[22]	Design Manual for Engineered Timber Joints 2010 (AIJ)
[23]	Japan CLT Association - Manual of CLT construction design for practitioners 2018

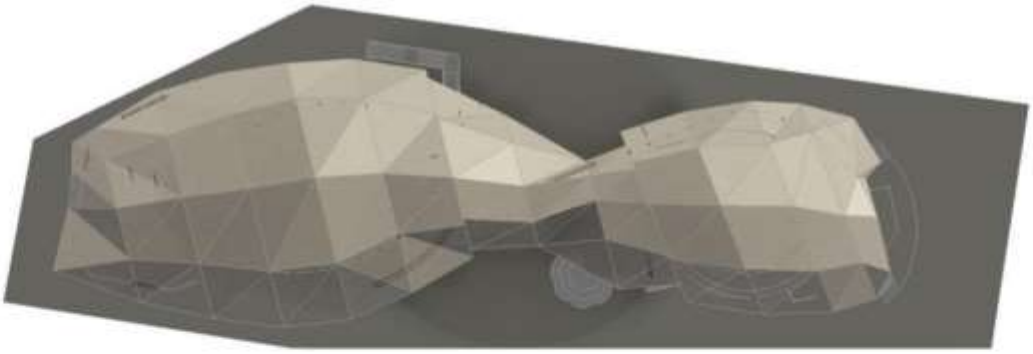
Architectural Views



Isometric view

Side 1

Side 2



PLAN

FRONT 1

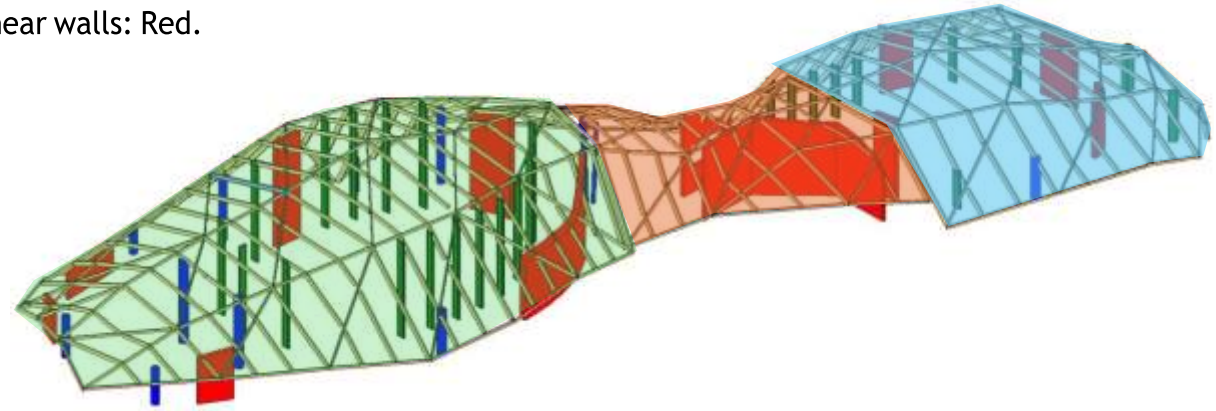
FRONT 2

Concept Structural Design

The following figure shows the pavilion roof structural framing together with its support structure comprising of columns and shear walls.

RCC columns: Blue

Timber columns: Green
Shear walls: Red.



The entire pavilion is split longitudinally into 3 zones as marked above. Each zone has its own structural system for gravity and lateral loads.

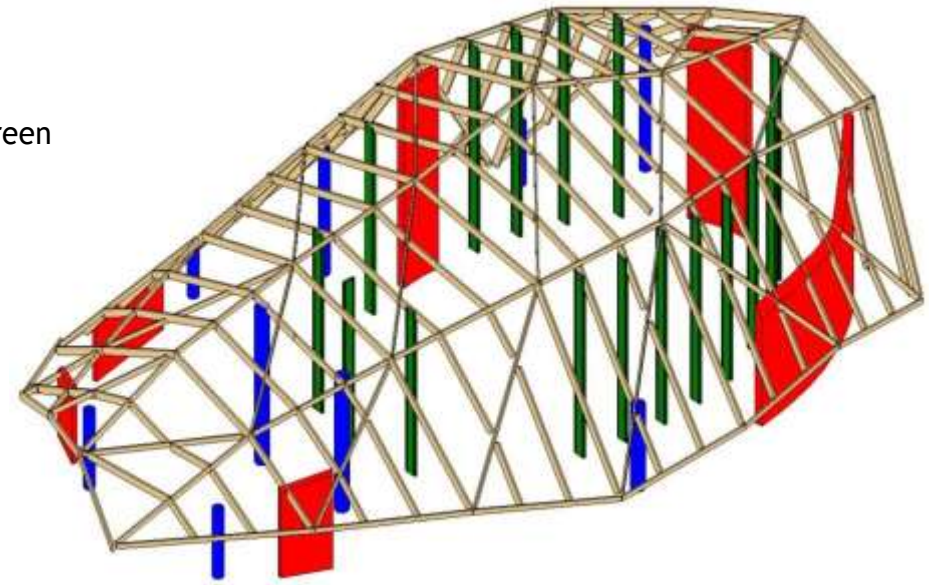
The structural system is planned such that some of the columns and all shear walls take up gravity loads from the roof structure. The lateral loads from the roof structure are taken up by all shear walls and some of the columns.

Note: For shear wall explore usage of Glulam, solid timber, and plywood in construction. If not feasible, consider steel or concrete.

Zone wise information is given in the following sketches-

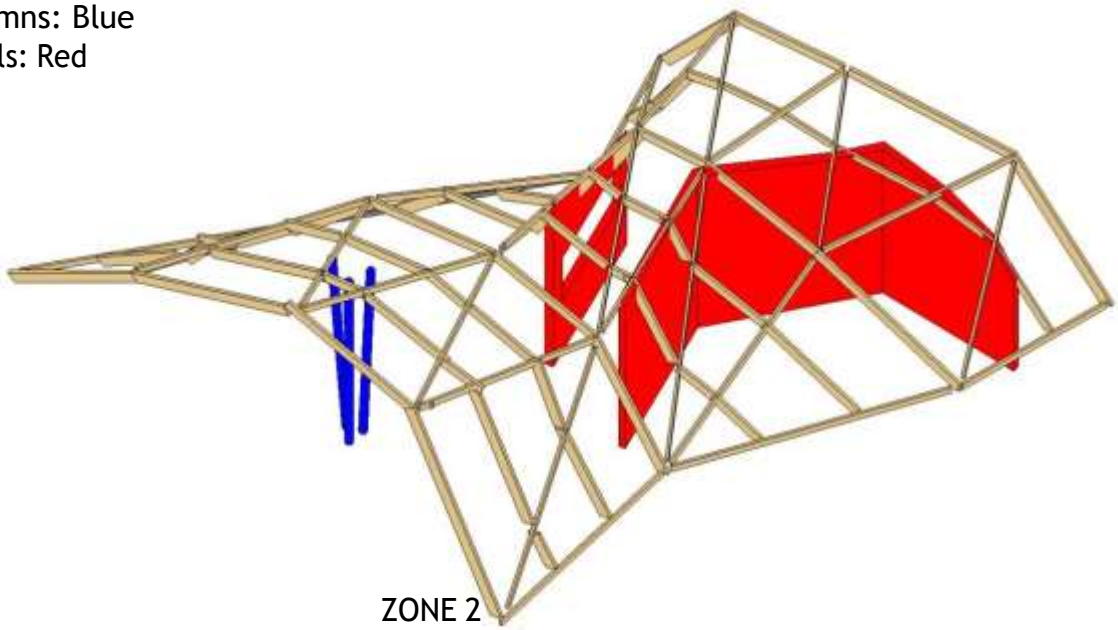
RCC columns: Blue

Timber columns: Green
Shear walls: Red.



ZONE 1

RCC columns: Blue
Shear walls: Red

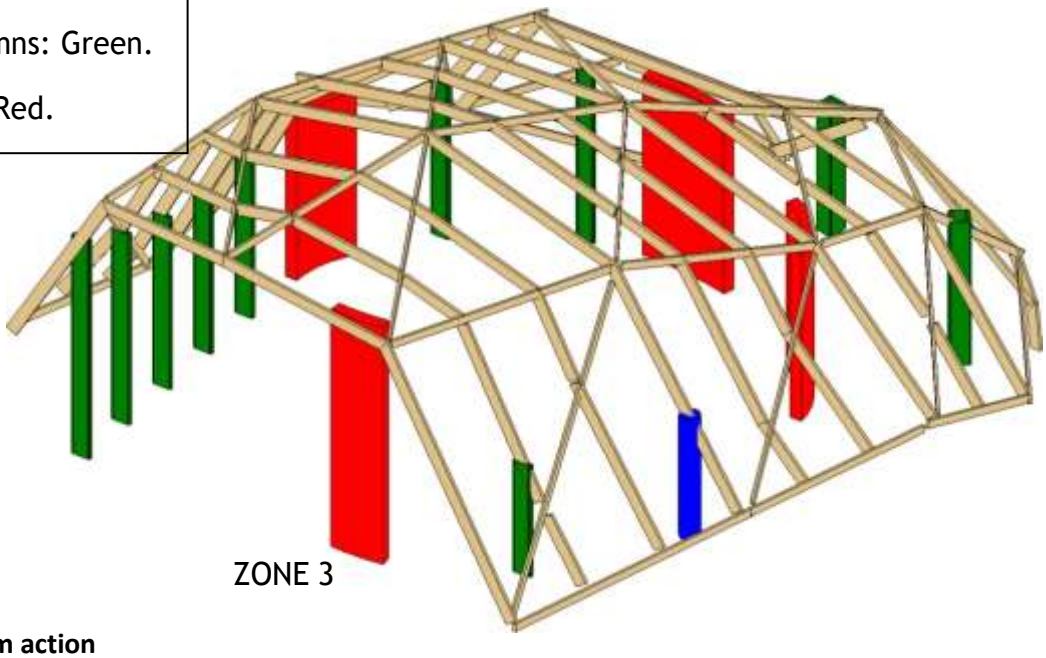


ZONE 2

RCC columns: Blue

Timber columns: Green.

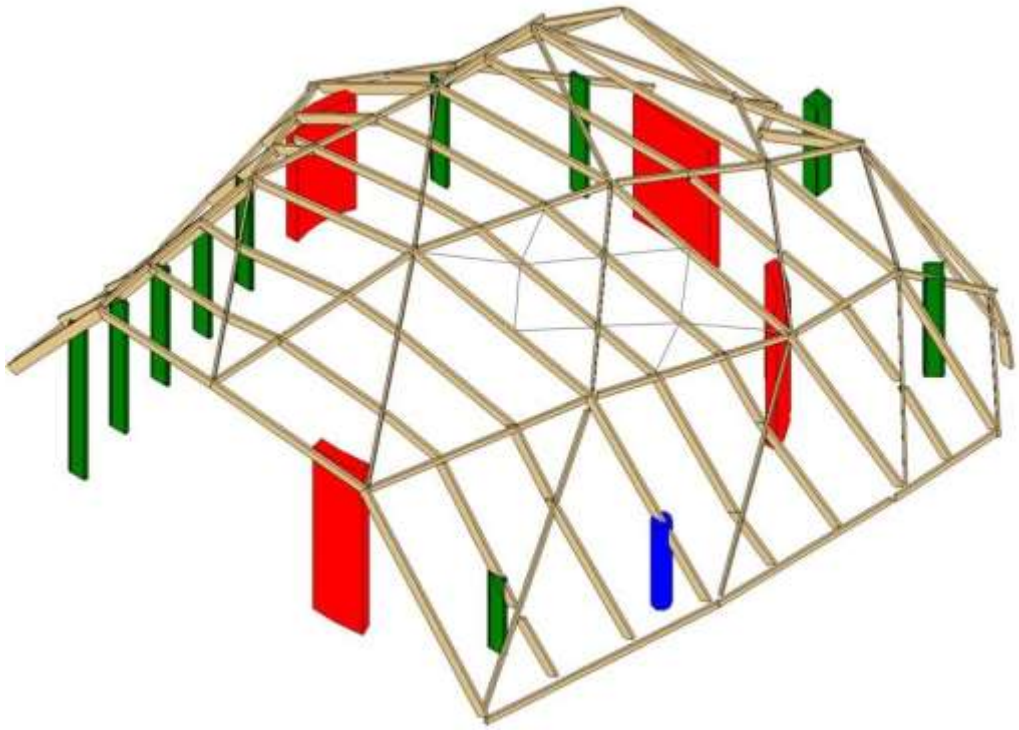
Shear walls: Red.



ZONE 3

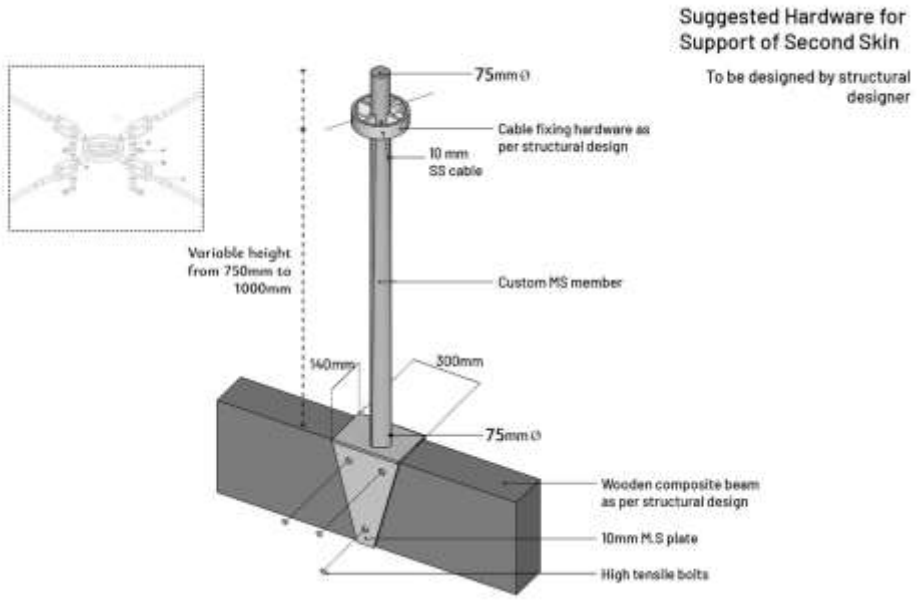
Bracing for diaphragm action

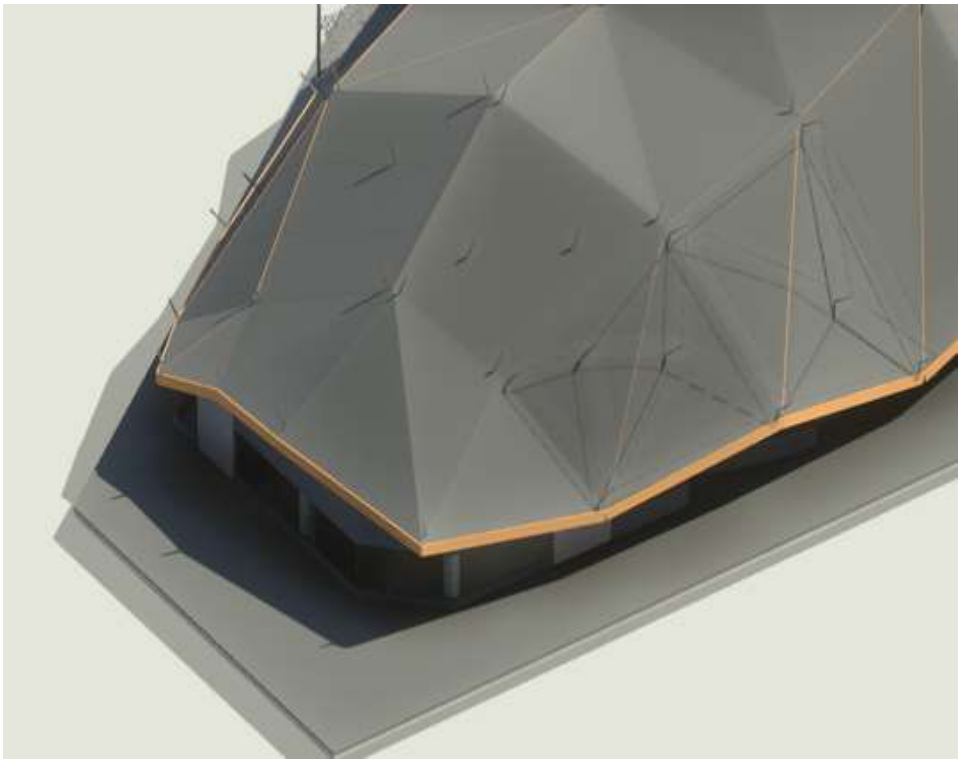
The timber roof structure functions as a diaphragm, transferring lateral loads to the shear walls and providing overall structural stability to the pavilion. Braced roof framing elements, such as thin rods, are integrated into the roof system to enhance diaphragm action and resist lateral motion.



Bracing elements shown only at one location here but will be used over the entire roof.

Custom fabricated MS hardware for supporting second skin has to be installed on top of the structural beam. Refer to indicative image below:





Loads

The following loads are to be considered in structural design based on [06] and [19].

1. Dead load (G)
2. Live load (Q)
3. Snow load (S)
4. Wind load (W)
5. Earthquake load (E)
6. Temperature load (T)
7. Earth or hydraulic pressure (H)
8. Other loads

Basic dead load	G	nominal dead load, or is determined according to actual conditions
Basic live load	Q	99 percentile non-exceedance live load under normal conditions, or is a corresponding value if it is difficult to statistically evaluate
Basic snow load	S	100-year-return-period snow load, based on ground snow depth
Basic wind load	W	100-year-return-period wind load, based on mean wind speed
Basic earthquake load	E	100-year-return-period earthquake load, based on the horizontal peak ground acceleration on the engineering bed rock
Basic temperature load	T	100-year-return-period wind load under normal conditions, or is a corresponding value if it is difficult to statistically evaluate
Basic earth pressure and hydraulic pressure	H	99 percentile non-exceedance values in normal conditions or a corresponding

Load combinations.

1. Load combinations for design and assessment of buildings or parts are to be selected based on the required performance level of the buildings or the parts.
2. The required performance level of buildings or parts must be determined by designers based on importance, sociality, economy, relevance to existing design codes, etc.
3. Loading states to be considered are, according to actual conditions, as follows,
   A. Normal states
   B. State of live loading
   C. State of snow load

D. State of strong wind
E. State of earthquake
F. State of temperature change

Load combination for Limit State Design (LSD) format:

1. When designing a building and/or a structural member, the following limit state shall be considered appropriately for each load combination.
    A. Safety limit state
    B. Serviceability limit state
2. A target performance level shall be defined using a target reliability index considering the predetermined reference period.

Load values.

Refer [19] and Section 08 of Enforcement Order of [14] for calculation basis of load values.

Materials

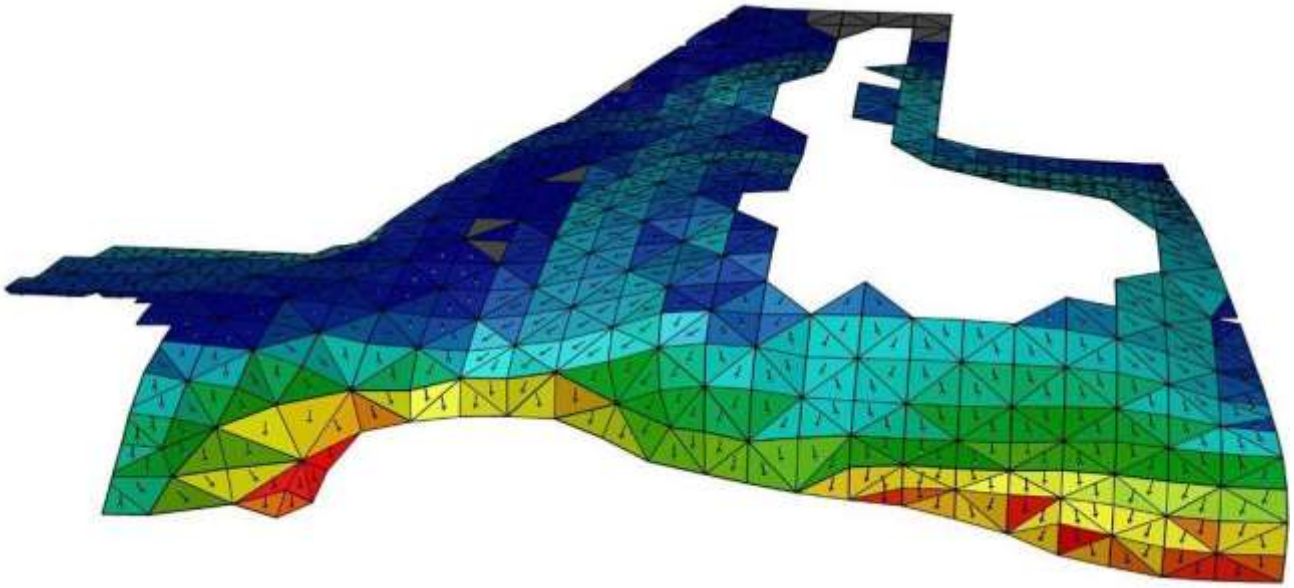
Material availability, procurement and its alignment with project program are key parameters for the project. The following options are under consideration:

1. Sugi pine pillars
2. Yellow cedar beams
3. Glulam is made from sugi pine, yellow cedar or other suitable species.
4. CLT is made from sugi pine, yellow cedar or other suitable species.
5. Engineered bamboo.

Reference Images for EOC Timber Projects

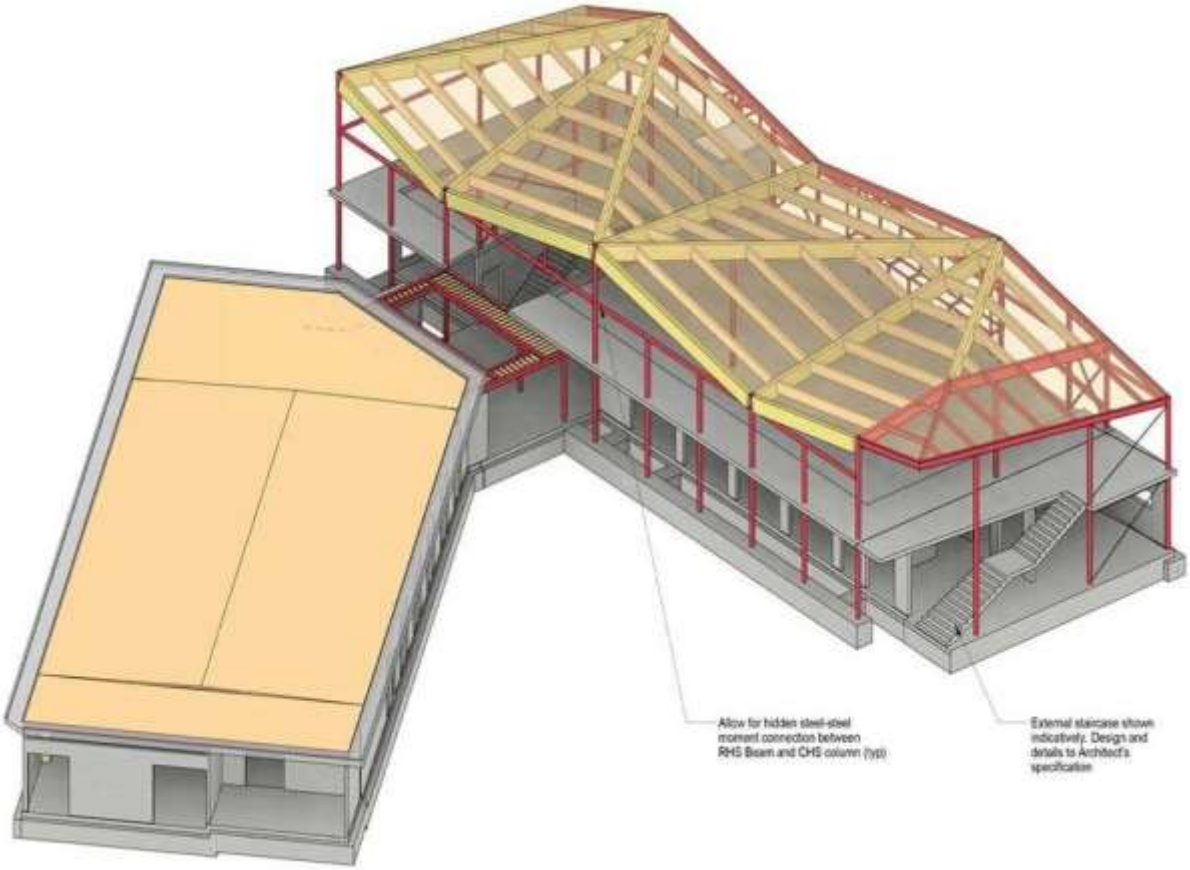
1. Trinum – Mediatheque for Digital Culture, Lomme, France

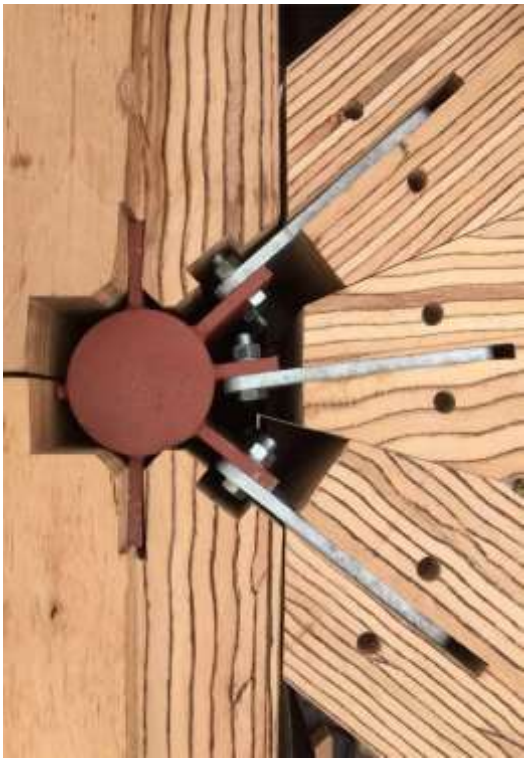
2. The following image shows the surface slopes to validate proper drainage of rain or snow water.



3. The Black & White Building, London, UK

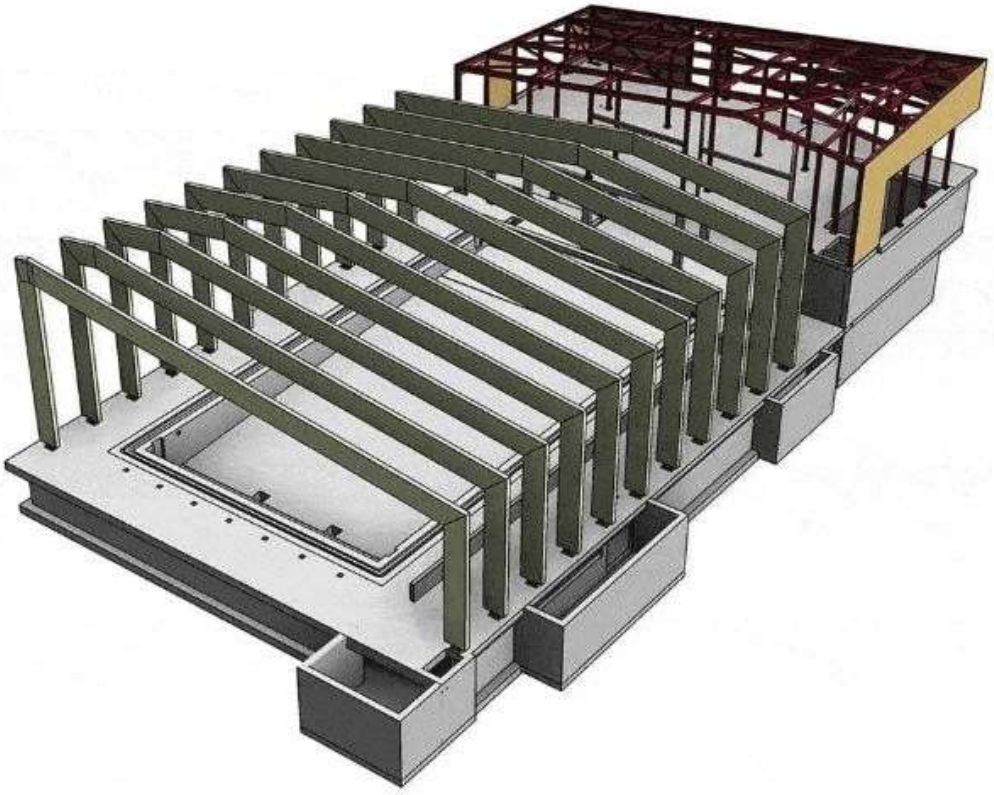
4. Promega, Southampton, UK





5. Tanbok School, Pentecost, Vanuatu

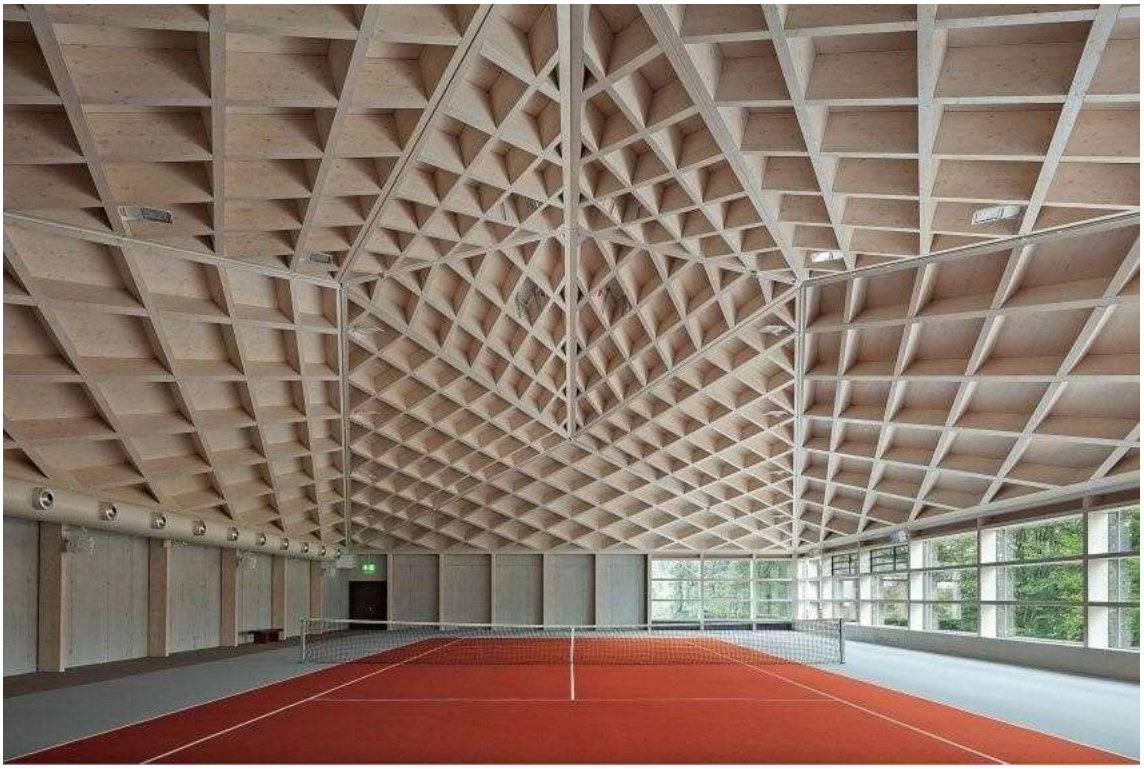
6. City of London Freemen's School Swimming Pool, Ashstead, UK

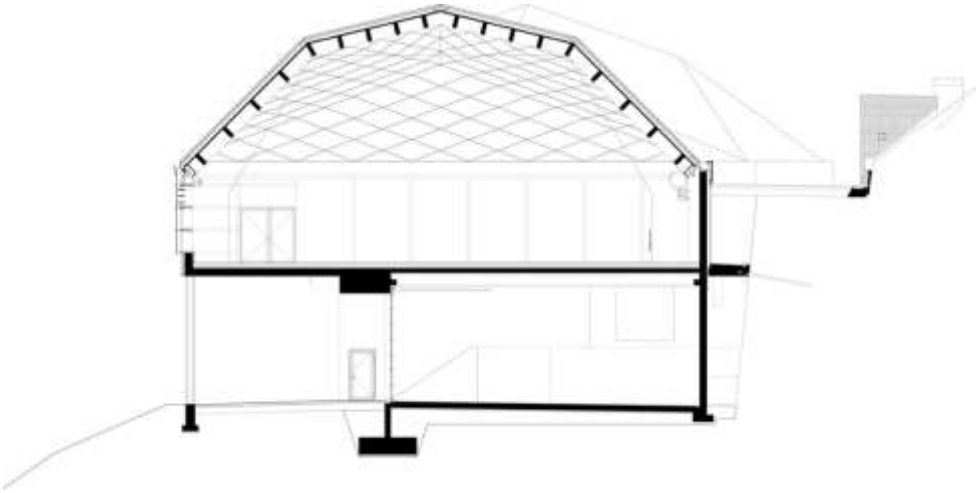


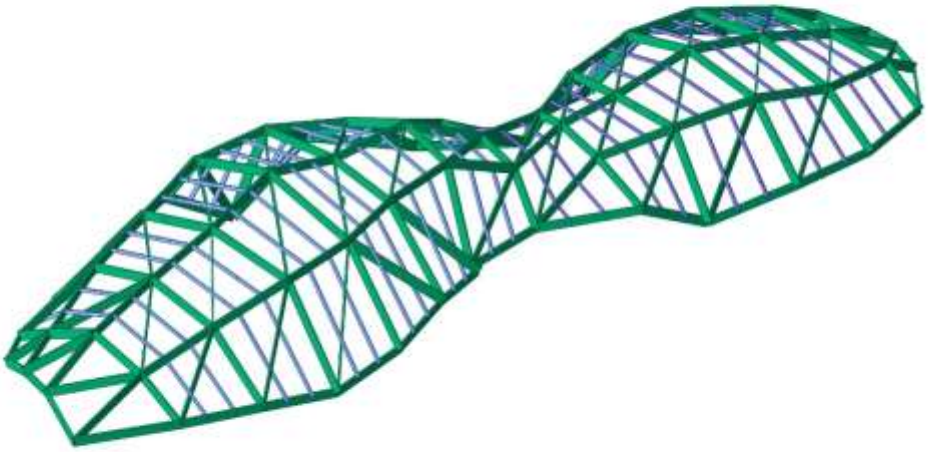
External Reference Images

1. CLT Dome

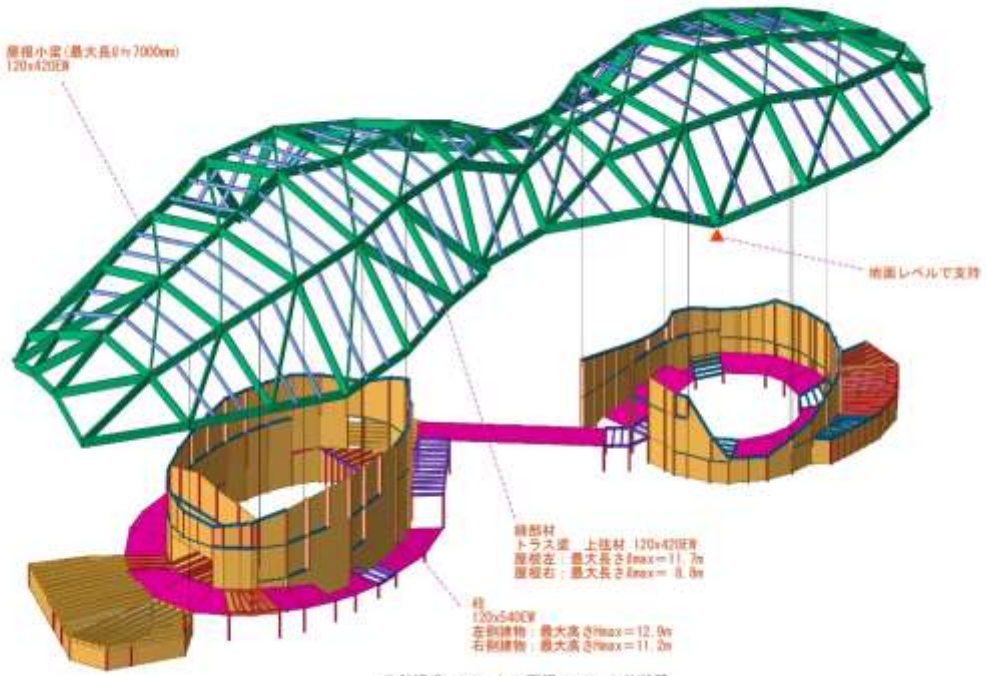
2. Diamond Domes Tennis Courts, Switzerland







屋根フレームモデル図



内部構造フレーム・屋根フレーム分離図

3 Plumbing (Water Supply and Sanitary Installation)

All water used in the buildings is generated by on site catchment with an available utility services connection that provides freshwater.

Plumbing water distribution systems shall deliver flushing and cold water to all sinks, showers, hand sinks and other plumbing fixtures unless otherwise stated. Two distinct piping systems will be provided so that the project will deliver:

a. Potable water only to fixtures that normally require it such as drinking fountains, hose bibs, wash sinks and wash basin. The domestic water shall be supplied directly to the user point throw the hydro pneumatic variable frequency drive pump.
b. Non-potable water to primer P-traps and to flush urinals and water closets. The flushing water shall be supplied directly to the user point throw the hydro pneumatic variable frequency drive pump.

Potable water systems shall be pipe CPVC and shall be labeled as a POTABLE water system. Non-potable water systems shall be pipe din CPVC above grade and cast iron below grade, including for waste and drainage, and shall be labeled as NON-POTABLE, SANITARY, STORM, VENT or other terminology to clearly indicate its intended use.

Hot water shall be supplied in only kitchen area throw the localized geyser system as per actual required capacity and the domestic water shall be supplied to the geyser by pressurized water supply line which are coming from the underground pump room.

All toilets and halls of color shall be vandal proof, stainless steel in the public areas or porcelain in the single user rest rooms. Manual operated, tamper resistant, flush valve and fixture operators with wall hung water closets are recommended to provide for best public health and safety.

Wastewater shall be piped to existing street sewer. We recommend thorough cleaning of the existing street sewer service should be provided prior to connection of this new facility to the system. New piping will be shown on the design drawings.

OVER HEAD TANK

a. Fire tank = 5 KL (For each block)

b. Domestic water tank = 0.5 KLD (For each block)

c. Flushing water tank = 0.5 KLD (For each block)

The requirement of the rainwater harvesting as per the attached calculation. It is based -on intensity of the rainfall. Capacities of rainwater harvesting tanks shall be required of 15 minutes storage capacity.

Project: Construction of India Pavilion Osaka, Japan Expo 2025				
Sub: Details Calculation of Rainwater Harvesting Pit.		**Total Plot Area**	**3513.39**	**Sqm.**
S. No.	**Description**	**Details**	**Unit**	**Remarks**
A	**Terraces areas - Volume of runoff**			
1	AREA @ 70% of total plot area	2459.37	SQM	
		0.2459	HECTARE	
2	RAINFALL (One Hour)	100	mm/Hr	
3	COEFFICIENT	0.9		
4	**DISCHARGE AS PER RAINFALL INTENSITY (Q)**	**221.34**	**CUM/Hr**	
B	**Paved, Road, Parking, Private terrace areas - Volume of runoff**			
1	AREA @ 20% of total plot area	702.68	SQM	
		0.0703	HECTARE	
2	RAINFALL (One Hour)	100	mm/Hr	
3	COEFFICIENT	0.8		
4	**DISCHARGE AS PER RAINFALL INTENSITY (Q)**	**56.21**	**CUM/Hr**	
C	**Landscaped & green areas - volume of runoff**			
1	AREA @ 10% of total plot area	351.34	SQM	

		0.0351	HECTARE	
2	RAINFALL (One Hour)	100	mm/Hr	
3	COEFFICIENT	0.15		
4	**DISCHARGE AS PER RAINFALL INTENSITY (Q)**	**5.27**	**CUM/Hr**	
D	**Total for all areas - volume of runoff & Calculation for RWH**			
1	Total Volume of runoff generated from the proposed campus (A+B+C)	**282.83**	**m^3**	
2	Size of the Rainwater Harvesting Pit Structure for 15-minute storage (size 5x4x4 m.)	**70.71**	**m^3**	
3	Volume of a single rectangular recharge pit	**71.60**	**m^3**	
	Number Of Bore in Each Pit	**1.00**	**Nos.**	
	Total Absorption of Each Pit	**0.99**	**Cum**	
4	**Hence No. of pits required**	**1**	**Nos**	
	Note:			
	Calculations based on Rational Formula			
	Q=10*C*I* A			

Note: Irrespective of the codes and compliances mentioned the contractor shall carry out all the work strictly in compliance with the codes and norms applicable in Osaka, Japan

Note: Electromechanical, plumbing, sanitary & fire shall be as per the architectural drawings & Spaces. Irrespective of what is shown elsewhere

4 Fire Fighting System

According to the International Fire Code the fire flow for the site is required to be as per NFPA-14 codes. This includes flow rates for hydrants on site as well as hose streams at the interior of the building.

There are fire hydrants connected to a 6 inch diameter pipe coming from underground, soft water supply line that is pressurized by diesel soft water supply pumps.

The design will provide for at least of fire hose capacity plus any left in the fire water supply. The fire supply will provide at least fresh and potable water capacity. The fire system will be fed via fire water supply tank which are providing separately for the entire fire water network for the entire project. The fire pump will be dedicated to the fire protection system only and will use a diesel engine as are liable power source. The fire pump, diesel driver, fuel tanks related and required accessories will be provided via a packaged system, selected to flow up to at a required pressure and will be dedicated to serve the fire protection system only. This system is proposed to be provided as a packaged fire pump enclosure, entirely designed and piped by the package systems - manufacturer including the pump(s), diesel engine, driver, double containment fuel tank, closed loop test header, fire department connection, controls, weatherproof enclosure.

All fire protection systems will include fire hydrant, fire hose cabinets, extinguishers, smoke detector, heat detector and fire alarm system. Other typical passive fire protection devices will be provided such as fire rated constructions, emergency exit signage and lights, as required by local fire codes.

Fire hose cabinets will be provided and will include a, automatic, wet Class “C” standpipe design, with provisions for both civilian and professional fire-fighting capabilities.

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Note: Electromechanical, plumbing, sanitary & fire shall be as per the architectural drawings & Spaces. Irrespective of what is shown elsewhere.

5 Electrical & LV Works

5.1 Electrical design criteria

Electrical systems will be designed to comply with the NEMA 70 National Electric Code/Japanese local code. Electrical service will be coordinated with the local utility company and this project will provide any materials or installations. Communications service will be coordinated with the local utility and will be provided as described and required by the utility.

A connection point for a generator has been requested to permit powering the distribution system should a utility outage occur. A manual transfer switch with blank lugs on the generator side is included in the distribution system to satisfy that requirement.

It is presently assumed that the underground primary will supply a pad-mounted transformer. Calculated loads indicate that a 250 KVA transformer will be needed, and the secondary will be in a 208/120 V, 3-phase, 4-wire configuration. The method of transitioning from the transformer to secondary service conductors will be as follows: Two services will serve the facility. A 600 amp service will feed all loads, while only the 800 amp service will be connected to the manual transfer switch, to which the portable generator will be connected when needed.

The point of service for communications services for this facility will be coordinated with the communications provider. It is assumed two 3 inch diameter schedule 40 PVC conduits will be installed underground from that point to the Main Communications termination location inside the building.

Main communications, Public Address, Platform Sound System and their associated features will be procured using design build specifications. Each specification specifically describes major equipment, arrangements, operations, materials and performance of completed systems. The Fire Alarm system will also be procured as design build.

Sound systems for the performance platform and the court area will be integrated with a PA system. The sound system for each area and function will be capable of independent operation. The PA will also include some local speakers for announcements in corridors, restrooms and other similar spaces that may be occupied during events.

Lighting will be direct with luminaires mounted to the trusses in the large court and bleacher sections. All lighting is to be LED unless special lighting requirements are defined during design. Theater type lighting will be hung from the existing lighting battens (rails). These lighting units consist of multi-color LED units with a portable control system.

A multi-gang floor outlet will be provided. The outlet will contain power, microphone outlets connected to the PA units.

5.2 Power

The proposed distribution system to supply all the elements needing electrical power in and around the facility is 208/120 V. – 3 phases, 4 wire configurations. 800 ampere secondary conductors will be run below grade to the main distribution panelboard which in turn will supply panelboards as required to supply all areas and loads. Molded case circuit breakers will protect the panels and each feeder and branch circuit. The separate service will have 200 ampere secondary conductors run underground to a main breaker in the electrical room for first, second floor & 100-amp secondary conductors run underground to a main breaker in the electrical room for ground floor. That main breaker will supply a panelboard located in the electrical substation equipment room.

Interior wiring will be accomplished with wires run in raceways. Where concealment of raceways is possible or where raceways are not subject to possible damage, metal-clad cable may be installed. Where wiring penetrates fire-rated building elements, galvanized rigid conduit in conjunction with appropriate fireproofing installations will be used. Flexible metallic conduit and liquid-tight flexible metallic conduit will be used when connecting to motors, other vibrating equipment, and where needed to complete conduit runs in difficult configurations. The locations and installation of raceways will be coordinated with architectural elements. Some raceways may require opening trenches in the existing floor, while others may require core drilling existing walls and ceilings. Routing and ways to minimize disruption will be assessed during the design phase.

Standard receptacles will be 20 amp, 125 V. commercial quality duplex type for general use. In many cases GFCI devices will be used for safety. Special configurations of receptacles will be provided where needed. Tamper resistant devices will be provided in all public spaces, exterior and other sensitive devices will be provided with locking covers needing a key to access. Weatherproof devices will be provided inside the building in areas considered likely to be subjected to water or other contaminants.

Adequate number of Power points in Kitchen area, restaurant area and Exhibition area shall be provided in consultation with the Consultant and equipment providing company.

Equipment selected by others (mechanical, plumbing, pantry, concessions etc) will be coordinated with electrical to ensure the proper circuits, connection devices and services are included for their complete and operable installations.

The transformer capacity provided is the minimum; however, the actual capacity of the transformer to be installed shall be determined by the actual connected load. This shall be deemed included in the scope of work.

5.3 Lighting

Due to the high costs of energy (electricity in particular), luminaires utilizing LED light sources will be selected Where LED sources are deemed inappropriate or cannot be found for a specific lighting application, high-efficiency fluorescent or other types of units will be selected. This type of facility lends itself well to use of LEDs and it is unlikely other source types will be needed in any space.

Luminaires in places where they may be subject to damage will be selected to withstand heavy to moderate abuse. Where located in areas possibly accessible to individuals in unsupervised situations very robust luminaires will be selected. Likewise, the installation of suspended luminaires over the sports courts and adjacent areas will be installed using hook hangers in order to mitigate possible extensive damage due to thrown balls or other items and to permit them to move without significant damage during seismic events.

Some interior luminaires will be selected to include a version of the fixture that supports an integrated emergency through UPS that provides illumination during a power outage that complies with modern Life Safety codes. The UPS will provide lighting for emergency purposes during outages of normal power for a minimum period of 90 minutes as required by Life Safety codes.

Lighting switches shall be standard toggle type switches type. Switches will also be able to be manually switched on and off. All spaces will have manual switches. The main overhead court lighting system has been divided into two equal levels of lighting. The entire complement of lighting units above the main court area is arranged so each lighting unit is on an alternate switch All control switches are located in the main entry vestibule (as requested), but each switch in that location is supplied by a separate circuit breaker in a panel located in the Ticket Office. The switches in the entry vestibule can only operate the overhead lighting if the breaker in the Ticket Office is in the “on” position.

Exit lights shall be LED emergency type with UPS back-up.

Light switches and receptacles shall be provided with heavy duty grade cover plates of nylon or stainless steel.

Exterior lighting will be LED pole mounted type. Exterior lighting will be provided to permit parking and walking activities to be safely integrated and increase security by illuminating

access points to the building. Photocell and time clock controls, with manual override, will be provided for use.

5.4 Communications

Various low voltage systems will be provided. WI-FI, CCTV System, data, fire detection and alarm, a sound system at the performance platform and a public address system are included in the facility.

Sound systems at the performance platform and for court events will be able to operate separately and independently, but they will be interconnected to insure announcements and programs requiring full building sound coverage will be possible. The PA system includes some programming to be played over the sound systems if selected.

WI-FI and data will be supplied from services delivered by the local communication company. The room housing the Main Communications termination equipment will have at least one wall with ¾" thick by 8 feet high Type AC fire-resistant plywood. Two conduits with nylon bushings will terminate in the space adjacent to that plywood. One conduit will carry the new communication service to the plywood for distributing from there to other equipment and locations. The other conduit with a pull wire is for future use and will be closed off with a cap. Coordination with communication suppliers is still underway. Required arrangements, installations and materials needed by the communications suppliers will be included in the project. Wireless distributed antennae are included in the main communications requirements.

The service will be terminated on an equipment rack and will supply telephone, data and other signals for the various outlets and equipment distributed throughout the building. Cat 6 cable will be run in raceway/conduit to each WI-FI, data and CCTV outlet and other service outlets. TV service is planned for the facility as instructed. The areas that will have communications and the final arrangement of communications is still under discussion.

Fire detection and alarm system will be provided. A Fire Alarm Control Panel will be provided in the main entry/Office. A battery unit will be provided to keep the FDAS operational during a power outage for up to 48 hours without power. Manual pull stations will be provided at all building exits and at other locations where necessary. Exterior horns will be provided to alert any occupants outside the building or passersby there is a fire alarm being reported at the facility. Horn/strobe units will be distributed throughout the facility to alert those in the building to evacuate. There is no reporting equipment in the Fire Alarm system to provide reporting of an alarm or trouble to a remote or offsite location in compliance with directions.

5.5 Earthing

Earthing of the system is required to avoid the shock during the use of the electrical equipment. A body earthing shall be provided to all the electrical equipment. A dedicated earthing shall be provided to ELV system, UPS system and other electrical equipment based on the local norms.

5.6 Fire Alarm System

Fire Alarm system is mandatory in all the buildings. The installation of the Fire Alarm system based on the NFPA 72 or local Japan Standard as applicable. A dedicated UPS system shall be provided for the system.

5.7 UPS

Emergency Systems: Buildings often have emergency electrical systems to provide power during power outages or emergencies. Emergency lighting, exit signs, backup generators, and uninterruptible power supply (UPS) systems are examples of components that ensure continued operation of critical systems like emergency lighting, fire alarms, PA, CCTV Server & Computer and communication systems.

5.8 Electrical load Calculation: -

Electrical Load Calculation			
S.NO.	**DESCRIPTION**	**AREA (IN SQ.M)**	Total load (KW)
	TOTAL BUILT UP AREA	**2206**	
1	**Lighting, Power and Equipment Load**		124
2	HVAC Equipment Load		25
3	External Lighting & Façade Lighting		15
4	Water pumps		10
5	Firefighting Jockey pumps		30
6	Sign Boards		15
	Total Connected Load (KW)		**219**
	Total Connected Load In KVA @ 0.95 Power Factor		231
	Total demand Load in KVA, after considering diversity Factor @ 0.8		184
	Dry Type Transformer, 1 No. 250 KVA at Loading Factor 0.8		
	UPS for Emergency Lighting Load, 1 No. 75 KVA		

Note: Irrespective of the codes and compliances mentioned the contractor shall carry out all the work strictly in compliance with the codes and norms applicable in Osaka, Japan

Note: Electromechanical, plumbing, sanitary & fire shall be as per the architectural drawings & Spaces. Irrespective of what is shown elsewhere

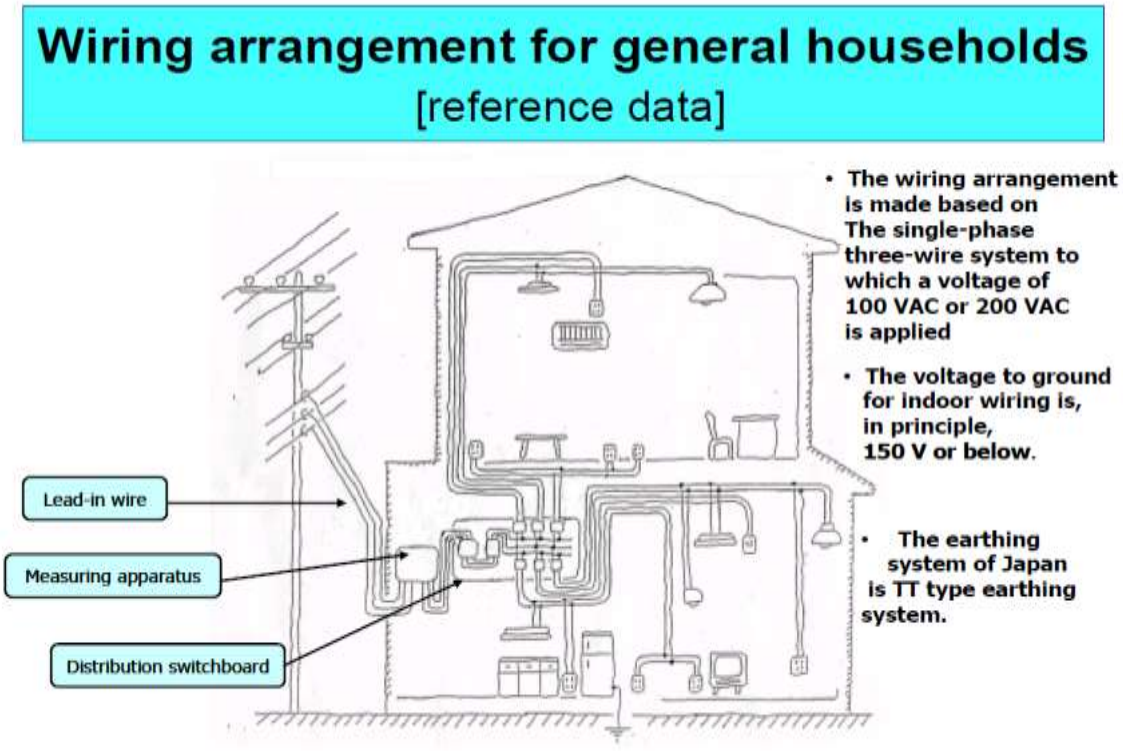
Technical Specification: -

Japan, the common voltage is 100 Volts
The plugs and plugs are typing A / B.
The frequency is 50/60 Hertz.

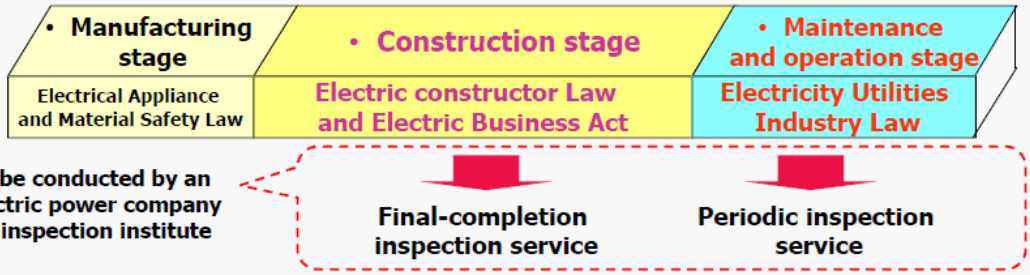
Japan is connected to a 100-volt current and uses two frequencies. Those are 50 Hz in Kansai and in the east of the country, and 60 Hz in Kanto and in the north. It originates from the fact that eastern Japan imported German power generators during the Meiji period while the west imported them from the USA. There have been voices that called for the unification of the frequency, but it has not yet been realized. So still, when they send electricity to each other, they change the frequency with transformer stations.

Power facilities for business use electrical power companies generating stations, transmission lines etc. Power facilities for general use They are those client facilities that receive low-voltage (600 V or lower) electric power, such as general transmission lines, etc.

Classification of power facilities in general households.

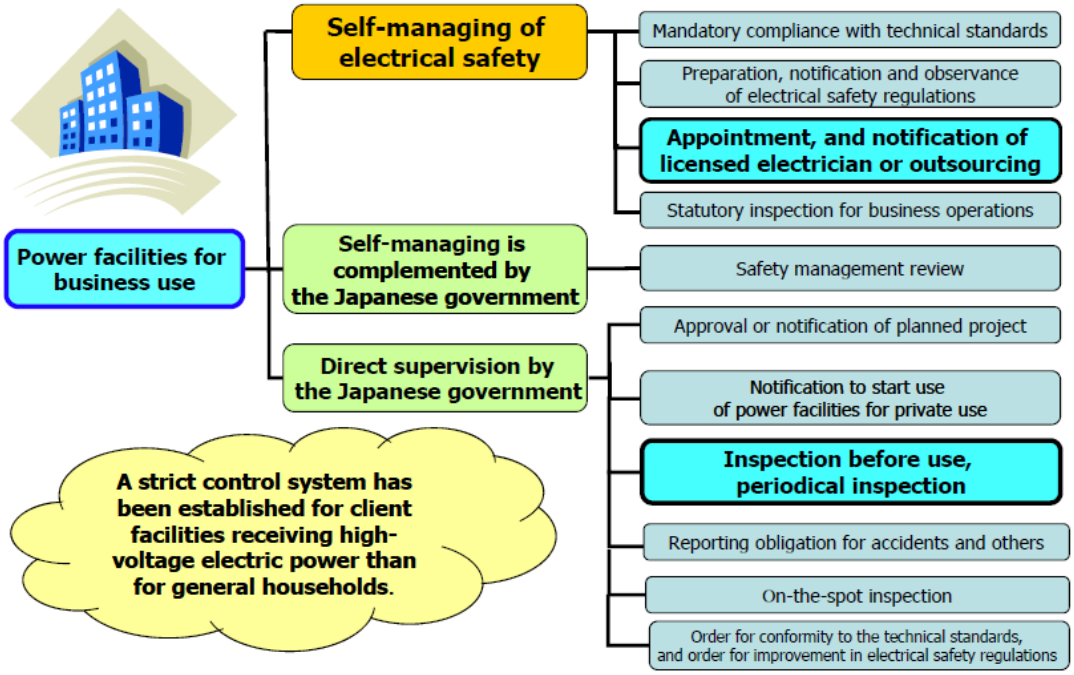


Measures to ensure electrical safety in general households, etc.



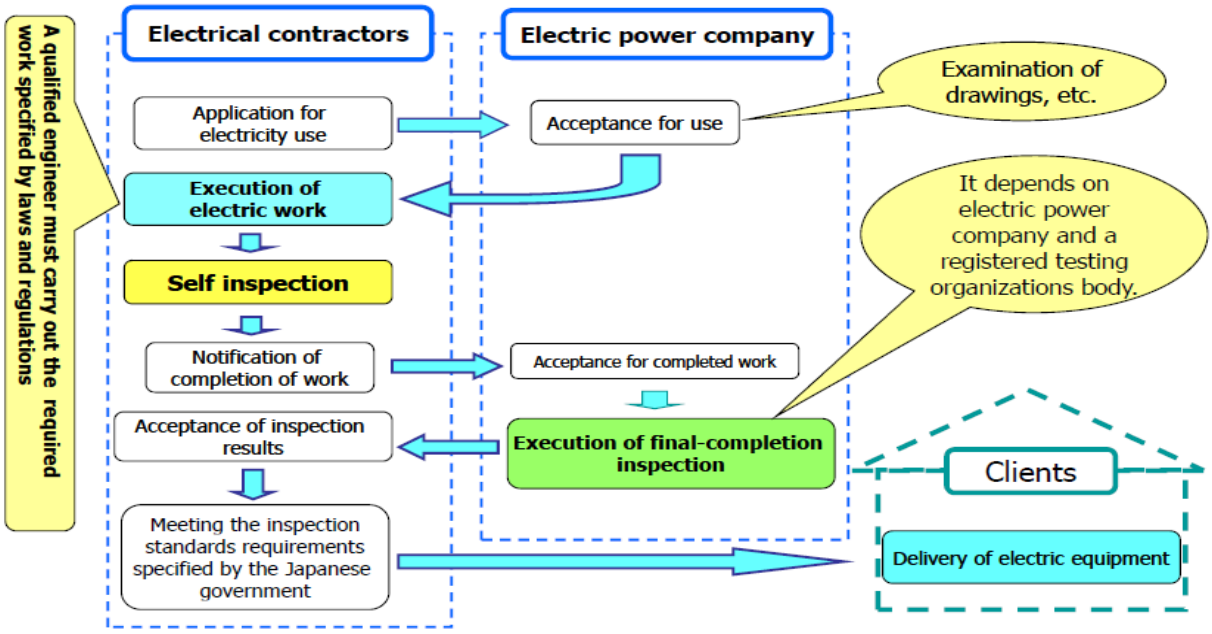
- Manufacturing stage (Manufacturing and selling of components and materials)
  - **Electrical Appliance and Material Safety Law**
    - ⇒ **This law regulates manufacturers and importers.**
- Construction stage
  - **Electric Constructor Law and other laws**
    - ⇒ **These laws regulate electric constructors and electric contractors.**
- Maintenance and operation stage
  - **Electricity Utilities Industry Law**
    - ⇒ **This act regulates general households and electric power companies.**

Electrical safety system for client facilities receiving high-voltage electric power



- Construction stage

Workflow of quality assurance during electric work



Progress of technological innovation and basic policy for future inspection service

- The Electrical Safety Inspection Association has been striving aggressively to provide attentive, conscientious and effective inspection services which can meet the needs of its customers.
- While at the same time, we at the Association think that IT (information-technology) revolution and development of equipment technology, such as solar photovoltaic technology, to deal with environmental problems will have a significant effect on the current inspection services and their methods as well.
- For this reason, we, as one of the members of the electrical safety inspection associations in Japan, also need to examine our basic policy for the inspection services and the association's work tasks into which a new technology will be brought, while closely monitoring the changing trends in development of such technology.

6 HVAC System

6.1 General

a. This report outlines the system design, basis of design, calculated load of HVAC system.

b. The preliminary report has been prepared based on the preliminary information furnished and the standard data available.

c. While the basic system design is not likely to change, the rating and specification of some equipment may change after firming up the detailed engineering.

6.2 Standard & Codes

The applicable standards/ codes are: -

a. American Society of Heating, Refrigeration and Air-Conditioning Engineer (ASHRAE).

b. ASHRAE Standard 62.1,2010 Ventilation.

c. JIS.

6.3 Basis of Design

Outside Conditions	Summer:	34.2 ^{O}C DB ; 24.7 ^{O}C WB
	Monsoon:	31.6 ^{O}C DB ; 26^{O}C WB
Inside Conditions	General:	22.2^{O}C +/- 1^{O}C DB or as per Equipment
	(Summer & winter):	RH not exceeding 55% in all areas.

Lighting Load : 1.0 W/Sq.Ft.

Equipment Load : 1.0 to 2.5 W/Sq.Ft.

Fresh Air - 1 Air changes per hour or as per ASHRAE 62.1

Occupancy : As per seating Plan

Note: Irrespective of the codes and compliances mentioned the contractor shall carry out all the work strictly in compliance with the codes and norms applicable in Osaka, Japan

6.4 Load Estimated Requirement

6.4.1 Based on the above parameters the calculated cooling load requirement is given below:

S. No.	Description	Floor	Area (Sq.ft)	Occupancy	Light Load (W/Sq.ft)	Equip. Load (W/Sq.ft)	Fresh Air (CFM)	Dehumidified CFM	Tonnage Summer	TONNAGE WINTER (HEATING)	SELECTED CFM	SELECTED T.R	UNIT TYPE
GROUND FLOOR													
BLOCK B													
1	ENCLOSED SHOP	GF	97	2	1.5	2.0	16	282	0.55	0.55	7.1	KW	FCU
2	ADMIN OFFICE	GF	338	3	1.0	2.0	68	521	1.18	0.93	2# 2.5	HP	HEAT PUMP
3	DIRECTOR ROOM	GF	98	4	1.0	2.0	20	347	0.71	0.50	2.5	HP	HEAT PUMP
4	AUDI SITTING	GF	3332	156	1.0	1.5	780	12563	26.22	20.31	75	KW	FM AHU
	TOTAL		7200	226	9	13	1524	24681	50	23			
BLOCK C													
1	CONTROL ROOM	GF	196	3	1.0	2.0	34	326	0.72	0.53	2.5	HP	HEAT PUMP
2	INFORMATION CENTER	GF	100	2	1.0	2.0	18	214	0.45	0.27	2.5	HP	HEAT PUMP
3	VIP SEATING AREA	GF	244	6	1.2	2.0	44	696	1.40	0.95	2.5	HP	HEAT PUMP
4	CONFERENCE ROOM	GF	489	20	1.0	1.5	100	2492	4.71	4.26	2# 2.5	HP	HEAT PUMP
5	HALL OF COLOR	GF	1842	88	1.0	2.0	440	7024	14.69	12.12	45	KW	FM AHU
	TOTAL		2871	119	5	10	635	10752	22	18			
	GRAND TOTAL		**10071**	**345**	**14**	**23**	**2160**	**35433**	**72**	**41**			

Net Cooling load = 67 Tons (237 kW)

Note: Irrespective of the codes and compliances mentioned the contractor shall carry out all the work strictly in compliance with the codes and norms applicable in Osaka, Japan

6.5 System Design

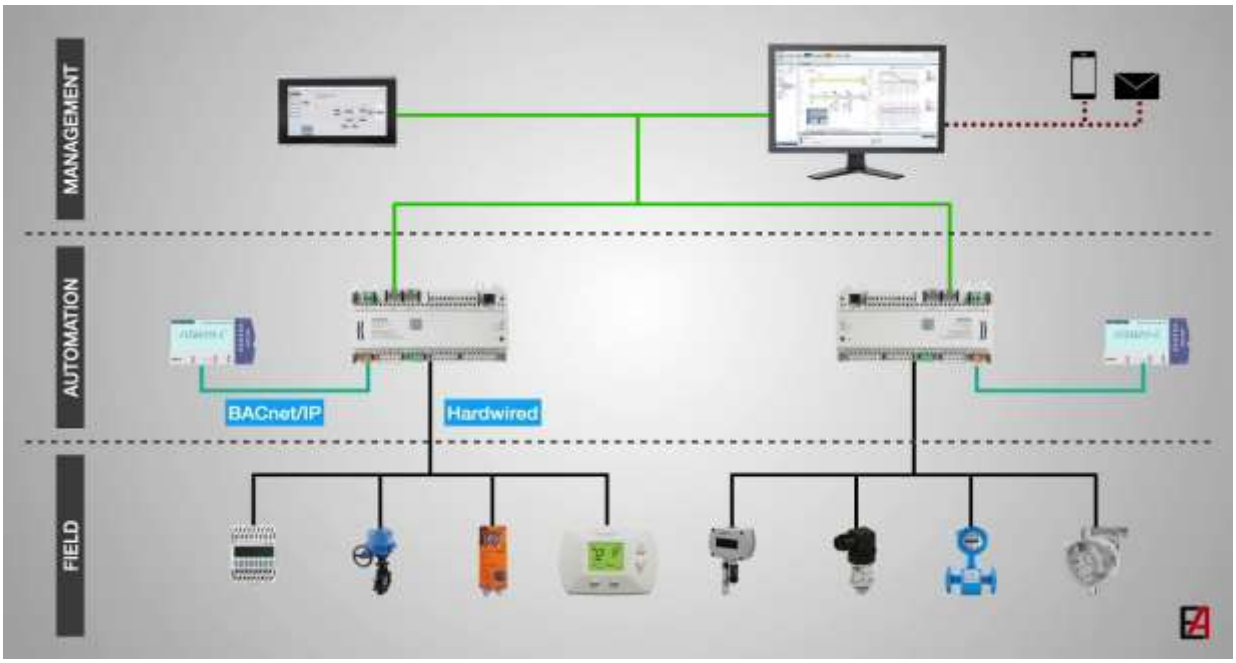
1. The chilled/Hot water from the available tapping point would be circulated through Underground/Overground piping to the several air handling units located on the mezzanine. Each area would have floor mounted AHUs or FCU/ Heat Pump depending upon the requirement.
2. The installation of individual AHUs/ FCUs would result in easy sub-division and subsequent saving in operating cost as the areas not in use could be switched off.
3. The air handling units would be provided with the following accessories:
4. Fresh air dampers with filter.
5. Thermometer and pressure gauges.
6. Butterfly valve at inlet and balancing valve at outlet.
7. Motorized fire dampers on the supply duct and return air opening.
8. All individual cabins/rooms shall have fan coil units/ Heat Pump.
9. The chilled water will be circulated through M.S. “C” class pipes with 30 mm Polyurethane foam (PUF) insulation, wrapped in glass wool cloth and coated with fireproof paint.
10. It is proposed to provide prefabricated ducting made of PIR (Polyisocyanurate foam panel or board) / PUF (polyurethane foam panel or board) for internal use. The thickness of board shall be 20 mm, density of foam shall be 45 kg/m³, thermal conductivity 0.022W/m.K. The Aluminum foil shall be 80µ thick and provided on both sides and the foil shall be embossed.
11. This duct is antifungal, light weight (just 15 % of G.I Ducts), available in many colors and different shape and sizes, and easy to install with a much lesser time as compared to conventional G.I ducts. This duct is widely used in all countries.
12. Since the ducts are made of insulating material itself, chances of sweating due to thermal barriers are minimal. It can be dismantled easily and fast.

6.6 Power Requirement (Connected Load)

Since we will be getting Chilled water/Hot water (From available tapping point) for our AC units major power requirement shall be for the air handing units and ventilation fans only. The total Power requirements for AHUs will be 30 kW (3 Phase). And for Heat Pump/ FCUs will be 5 kW (Single phase)

7 Control System (BMS)

a. It is proposed to use a Microprocessor based DDC control system to build an automation system (BAS), facility management system (FMS) and to optimize AHU operation and minimize running costs.
b. These features help to bring down energy consumption by 10 to 15%.
c. All the AHUs & FCUs/Heat Pump will be controlled by BMS (BACnet, Modbus, Lanworks)
d. The following services also are proposed to be included in BMS.
e. Security such as life safety, lighting control, CCTV, door break sensors etc. for entrance on each block.
f. A maintenance schedule is part of the program which provides timely information for routine preventive maintenance, thereby reducing the chances of breakdown and prolonging the life of all the equipment.
g. It will also control the LED displays to be used in both blocks, Audi &other places.



Picture: Schematic of Building Management System (BMS)

7.1 Power Requirement (Connected Load)

Since we will be getting Chilled water/Hot water (From available tapping point) for our AC units major power requirement shall be for the air handing units and ventilation fans only.

The total Power requirements for AHUs will be 30 kW (3 Phase). And for Heat Pump/ FCUs will be 5 kW (Single phase)

8 Acoustics

8.1 Acoustics for Auditorium, Hall of Color and Conference room.

Acoustic part covers the paneling of walls, ceiling, carpets, chairs, wooden stage, doors and baffles for large corridors.

Basis of Acoustical Design:

a. Exterior Noise Transmission to Interior.
b. Interior Sound Isolation.
c. Sound Absorption.
d. Diffusion.
e. Background Noise from Building systems.
f. Exterior to Interior Noise transmission.
g. Building System (HVAC, Electrical) Noise and Vibration Control.

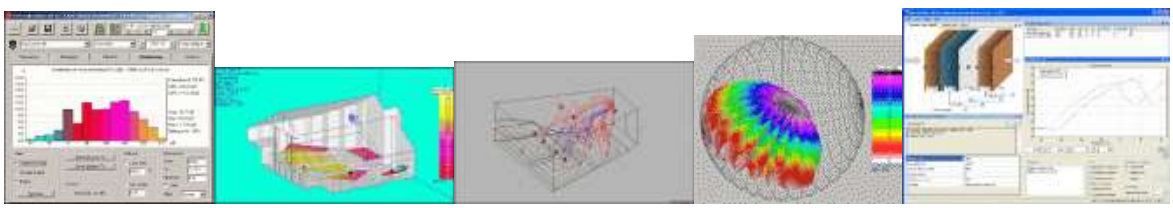
For Acoustical calculation of an Auditorium, Seminar/Conference Rooms, Lecture Theatre all the surfaces are required from "door, chair, carpet, ceiling, wall and loudspeakers." This includes 6 dimensions of the area or more surfaces.

In addition to the ideal reverberant tail used for Standard Mapping, **EASE** is capable of computing room reflections with different Ray Tracing methods. Both methods are combined in what we call Standard Mapping with Reflections.

a. Account for the arrival sequence of first-order reflections.
b. Check the possible tonal coloration and comb filtering.
c. Evaluate the effect on speech intelligibility.

3D Model of the space is made and imported in software for Acoustical & Electro-Acoustical (Speaker) mapping, which gives the results where energy distribution concentrating as per the desired Area.

For any **material specification** the graph between **100Hz – 8000Hz** is considered by the consultant through measurement report by NPL/Sound Flow (afmg), then the specifications of the material to be added to Ease Model for mapping.



Note -NRC value should not be considered, as it does not tell the correct value at room level, it's just a value of small piece of the product.

Acoustical Parameters

1) Direct SPL
2) Total SPL
3) STI intelligibility measures (according to IEC60268-16:2003)
4) D/R Ratio
5) RaSTI
6) Critical Distance
7) C Measures (C7, C50, C80, CSplit)
8) Level Measures (L7, L50, L80, LSplit)
9) Arrival Times
10) Loudspeaker Coverage Overlap
11) Loudspeaker Aiming
12) Articulation Loss (% AlCons)
13) RT60

The reports of the measurement above acoustical Parameters from 1-13 are required at.

a. Pre-Design
b. Design
c. Post Installation

Software used:

a. Acoustical Mapping
b. Material Design/Specification (Sound Flow).
c. Measurement & Testing (Systune/REW).

8.16 Electrical System in Acoustic Lining for Auditorium and Hall of Color.

Electrical work in Acoustic lining of Auditorium includes Recess/surface mounted down lights, TRIAC dimmable LED down lights (Compliance to IEC standards), Signage, 6A/16A Power points, wiring, cabling, earthing, cable tray/raceways of respective size etc. of latest technology with all accessories to complete the electrical system in all respect for proper functioning of system. The system of mounting these lights will be integrated with a false ceiling design.

9 Finishing Schedule – Annexure- 3a Revised

END OF DBR