FUNCTIONAL-UTILITY PROGRAM

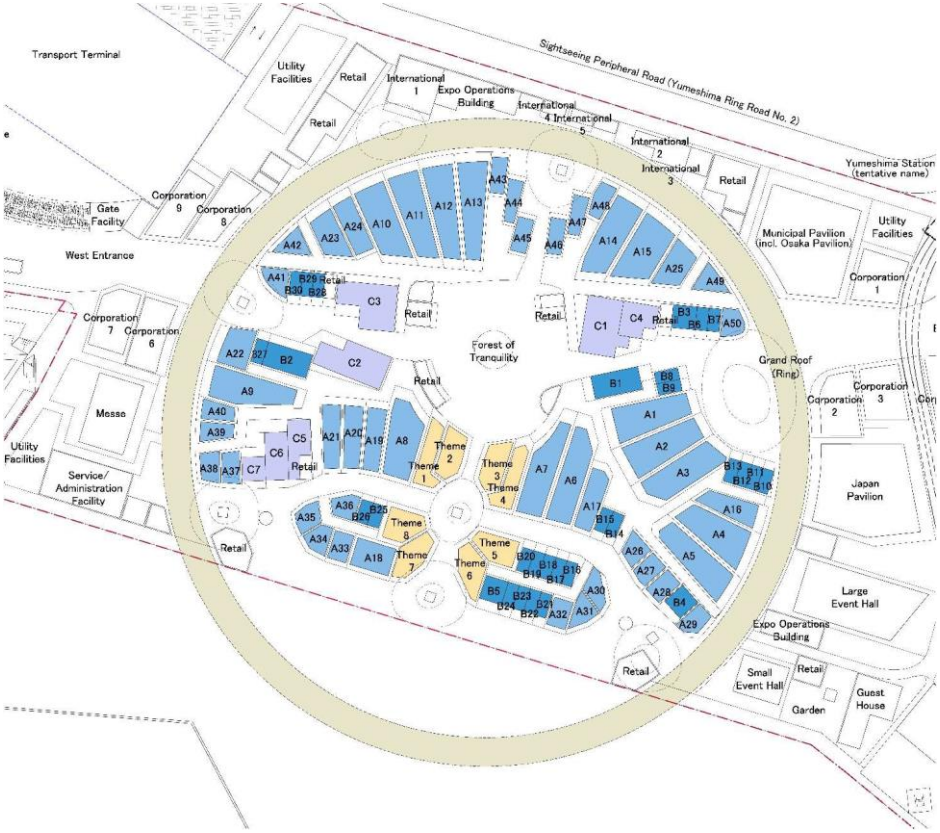
General requirements for the design and construction of the Polish Pavilion at the World Expo 2025 Osaka, Japan

MAIN ENTRANCE VIEW

I. General description of architectural concept

1. Location

This guideline document outlines matters related to pavilion planning necessary to ensure that participants will properly design the type A pavilions (self-built) for Expo 2025 Osaka, Kansai, Japan. A brief review of the Master Plan (zoning) developed by the Organizer was also included in order to enable each participant to design their pavilion based on the theme and subthemes of the Expo.
Polish Pavilion is located in the Saving Lives Zone of Expo site.
The Pavilion represents type A (small plot up to 900m^2).
The plot number is A36.



2. Functional-utility division

Configuration on two floors with a mezzanine

The design proposition is divided into a simple two-storey system with a high ceiling and a mezzanine that will serve as an administrative part.

The entrance hall invites us to enter the monumental staircase.

On the side, there is a waiting room used for organizing groups, with its own independent entrance (the queue can be divided into two independent queues). The exhibition part upstairs has an area of over 300 m^2, divided into 3 interconnected parts, flowing in a spiral direction.

At the end of this route there is a staircase guiding visitors down to the ground floor, where exhibitions of approximately 150 m^2 area are held, leading further to the auditorium and shop. Alternatively, from the entrance hall visitors can go directly to this part of exhibition.

The monumental staircase leads also to the restaurant that has been enlarged and now has an observation deck.

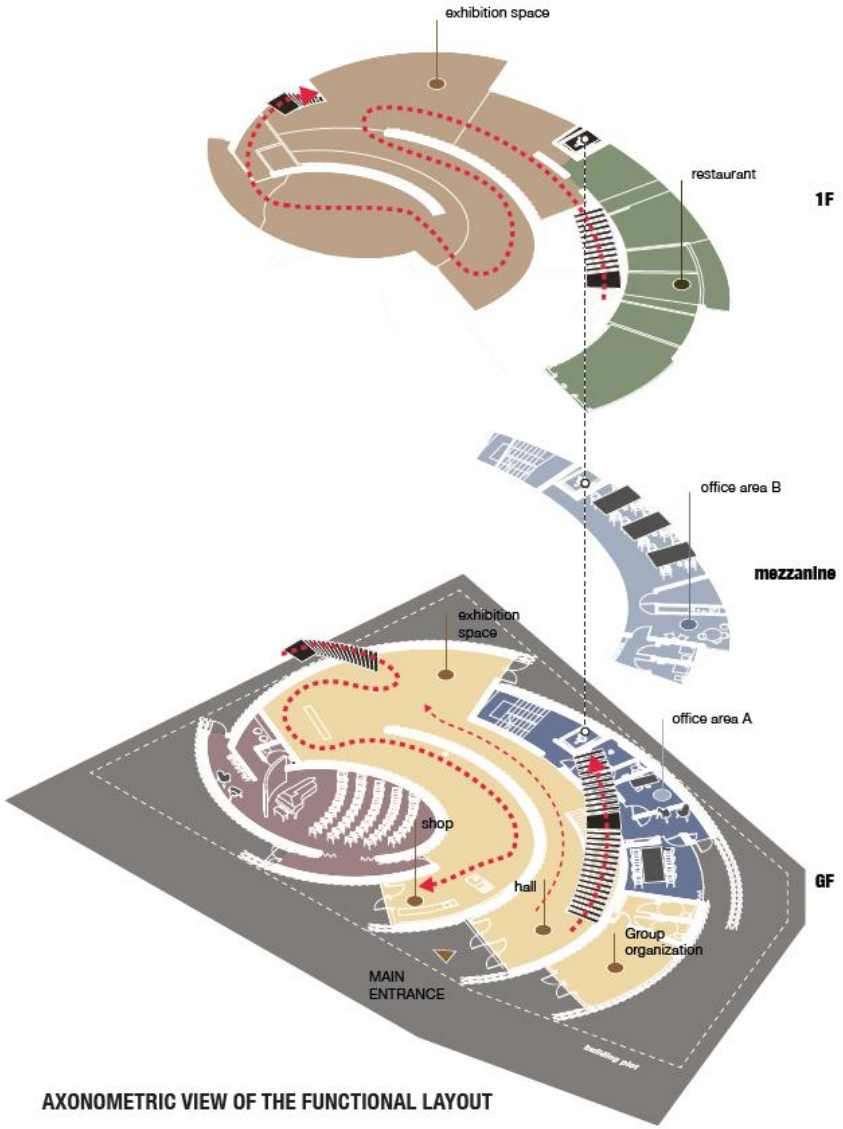
The administrative part is divided into a ground floor (for office area A) and a mezzanine (for office area B), with its own independent entrances through a pleasant garden, and even a discreet connection to the exhibition – this solution allows to show the exhibition outside the opening hours.

The design has a public elevator located in a strategic place, introducing convenient access to the restaurant, and placing the visitor near the beginning of each exhibition space.

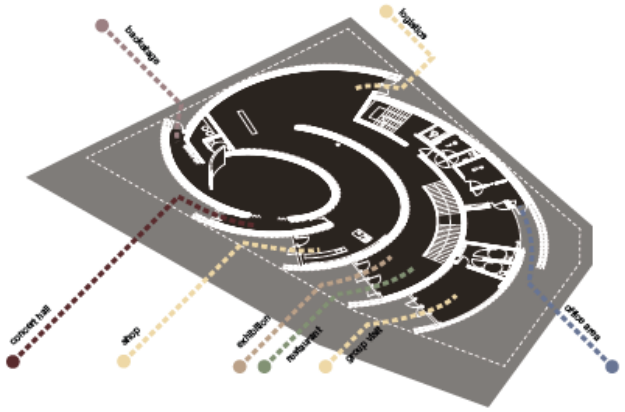
Concert hall

The audience was designed to focus on its basic aspect: the acoustics. Elegant and noble materials shall be used for the construction. The calm and light atmosphere makes it easy for visitors to concentrate on the main hero of the event - the music. Thanks to the focus on the shape of both the stage and the hall, we obtain excellent acoustics, which, combined with the materials used, will allow us to achieve a reverberation time of 0.23 s, according to our preliminary calculations (a value proper for recording studios).

The space of the hall, along with its strategic location on the ground floor, makes it possible for this area to be used together with exhibition space, allowing alternative configurations for other purposes, such as meetings, conferences and even fashion shows. All this with the use of backstage, well connected to the hall.



AXONOMETRIC VIEW OF THE FUNCTIONAL LAYOUT



Flow as part of the spiral

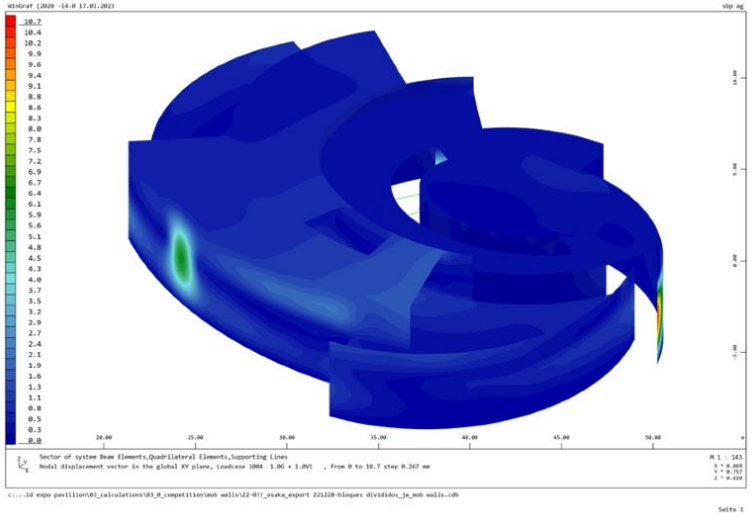
The centrifugal distribution of the layout responds excellently to the functional and flow requirements of the project. This arrangement allows for an intuitive understanding of the different accesses at first glance and an efficient management of queues typical of an event of these characteristics. Once we are inside, the shape itself naturally guides spectators through an intrinsically fluid space.


SOUTH BIRD'S-EYE VIEW

NORTH-WEST BIRD'S-EYE VIEW

3. Structure and main materials

The conditions of the plot, which is located on an artificial island, as well as exposure to wind and seismic activity are the main constraints faced by any building constructed on this site. Preliminary structural calculations show that this design performs well against wind loads and earthquakes, thanks to the intrinsic stability of the curved walls that confer stiffness in all directions.



The construction of the Pavilion consists mainly of wooden CLT boards based on wooden walls made of glued columns and beams, connected on both sides with OSB boards. OSB boards provide shear strength to wooden walls, allowing them to withstand in-plane lateral forces. The load-bearing walls perform in all directions, while the shear-bearing connections between the boards and the walls allow the walls to horizontally stabilize the structure against strong lateral forces created by winds and earthquakes, without steel bracing (as it is common among timber frame structures). CLT boards will transfer loads in one direction, only to load-bearing walls. Thanks to the building's multi-directional and organic form, the stiffness of the structure shows very little horizontal deflections under wind loads (as can be seen in the results illustrated in the figure on the right).

The basic building material used for the Pavilion is wood. Wood is an asset of this design and for this reason we try to make the most of it, so that it serves not only as a load-bearing skeleton of the Pavilion, but also its as its aesthetic shell. The structural system is based on a wooden skeleton and a CLT ceiling system supported on wooden beams. The use of natural materials (such as wood fiber insulation) as well as the use of recycled finishes is also planned, in accordance with the guidelines of the Organizer of Expo 2025. All these elements, unlike concrete structures made in situ (on site), will be easy to dismantle and sort during demolition. Wooden foundations were chosen to allow for quick and easy assembly and dismantling of the temporary structure of the Pavilion and to provide a sustainable construction. The Pavilion will be supported on wooden floating piles connected to a wooden beam made of glued timber, on which the skeleton of the walls will be placed. That means we have a 100% wooden construction. As for the elements of the facade, they are not a complex mix of custom-made modules (which is common in parametric designs), but instead their diversity is based on the repetition of two simple elements. This allows for more efficient serial production and very simple installation by stacking them like bricks or blocks. These wooden pieces are produced in a process that uses Japanese craft techniques. With a moderate volume and weight (about 8 kg, depending on the type of wood used), they can be stacked to facilitate transport and assembly.

The idea of this system is that by repeating a single element inspired by nature, we get a very rich and vivid image.

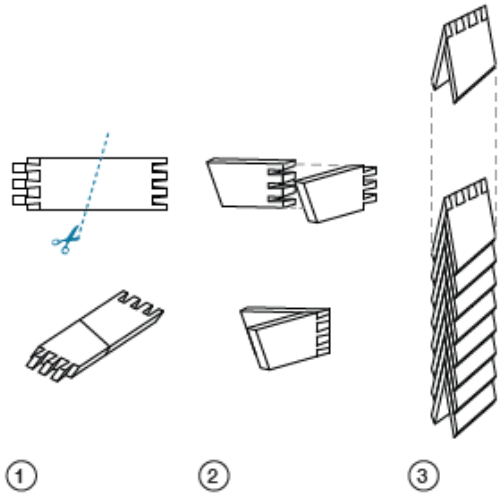
The use of wood is also a response to the requirement to use materials and techniques available in Japan. Other advantage of prefabricated wooden elements is their low-carbon impact and easy transport to the World Exposition site. After the EXPO, the wooden pieces can be reused as raw material for CLT boards production, garden beds, pallet supports and even as new floor panels or small wooden products. Post-consumer wood products do not differ in their quality or visuals from products made of primary raw material, and often are even preferred due to the fact that – unlike fresh wood from the forest – they are already dried.

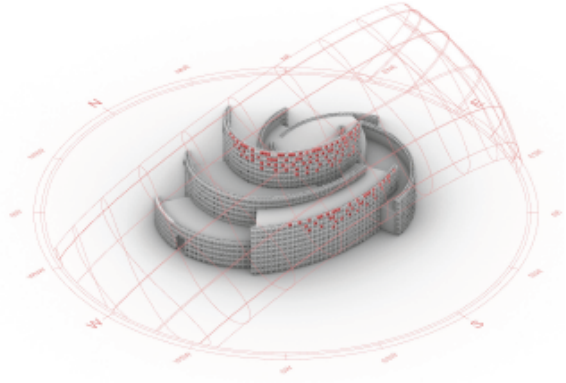
Alternatively, wood has a potential to be used as fuel – a solution that offers the opportunity to turn waste into a low CO_2 emission energy source, as the tree accumulates CO_2 throughout its life and only returns some part of it when burned. The starting point for achieving good energy efficiency of the design is the bioclimatic and passive nature of the Pavilion. It is a wooden, well insulated structure, with many areas protected from being overheated by the sun. Its large door openings are strategically placed in the

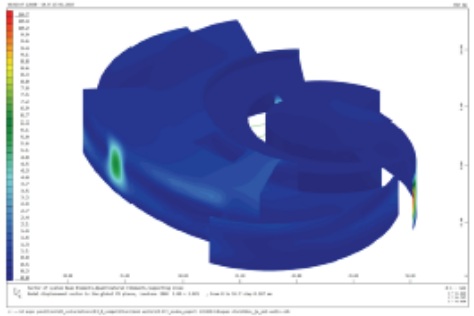
northern part, and sheltered by high walls that cast shadows over the waiting room with queuing area. The fact that it is an ephemeral architecture designed for the summer period, with very well established schedule, allows us to optimize the design specification in order to meet the thermal requirements of this period, to assure its perfect functioning. In this regard, natural ventilation during closing hours is proposed, which will make it possible to use night-time cooling to minimize daytime loads.

The design uses a district heating and cooling networks provided by the Expo Organizer (as per clause 3-4-4/G-27 of the M11i - Design Guidelines type A) which, thanks to more efficient production, will allow the use of more moderate solutions in the Pavilion itself. In this case, these solutions are limited to ventilation for air exchange and supply (mainly cooling) through more efficient systems, such as cooling plates. The concept is perfectly consistent with the assumptions described in the guidelines of the Osaka 2025 Organizer, a list of which can be found on the graphic explanation of the design. Project meets virtually all of them.

In addition to the originally described solutions, we took the suggestion about the use of perovskite solar cells into account. We did it in a way that is natural for the project, i.e. we distributed photovoltaic modules along the southern facades, which curved shape uses the energy from the sun throughout the day. This ecological gesture will be visible from the outside thanks to the flickering reflections of the cell surfaces, and inside the exhibition thanks to the elongated skylight.







Modular facade

The shape of the modules has been reviewed in order to optimize its manufacture and consumption of materials. At the same time, the superposition of diagonals of the modules generates a dynamic image that accompanies the movement of the arms of the spiral in the vertical axis. Now they speak of dynamism in all directions. Moreover, the construction of this pavilion in Osaka gives us the opportunity to take advantage of priceless Japanese woodcraft and pay respect to this culture.

Green energy

Perovskite panels have been integrated in a natural way to the project, that is, generating solar modules that are distributed along the facades most exposed to the south whose curved shape maximizes its solar exposure by following the trajectory of the sun throughout the day. An ecological gesture that can be distinguished from afar from the great ring and from the skylight of the interior of the exhibition hall.

Naturally stable form

The conditions of the plot, located on an artificial island, as well as the exposure to wind and seismic conditions are the main constraints faced by any structure built in this place.

The structural calculations conclude that the project has an excellent performance against the wind loads and against the seismic due to the intrinsic stability of the curved walls that confer stiffness in all directions.

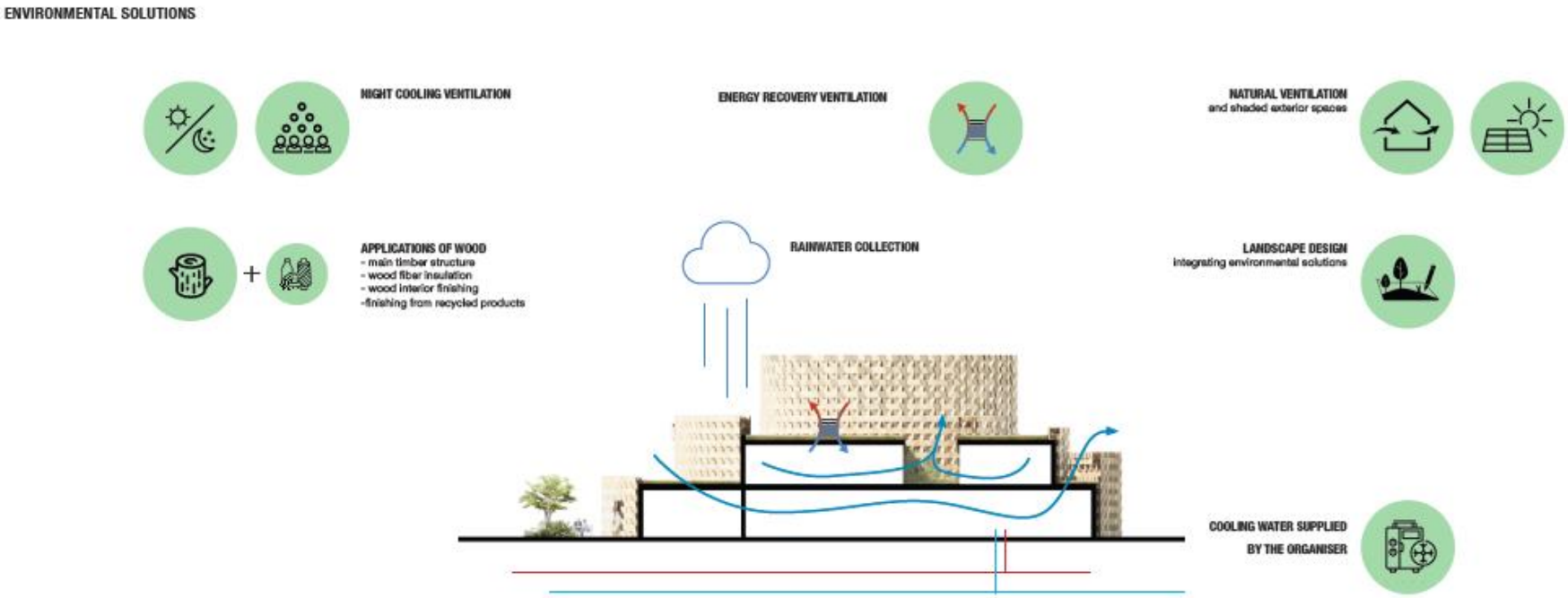
4. General information about functional-utility parameters of the Pavilion

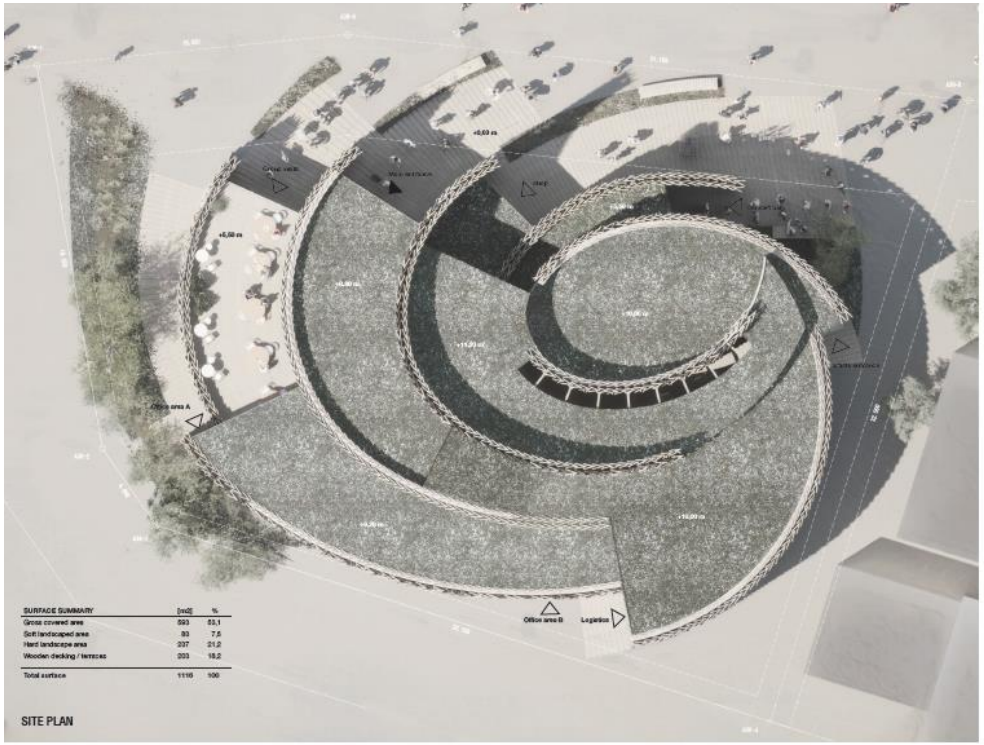
Pavilion's total area: 989,50m^2

Maximum height : + 13,60 m from the level of the ground

Site summary

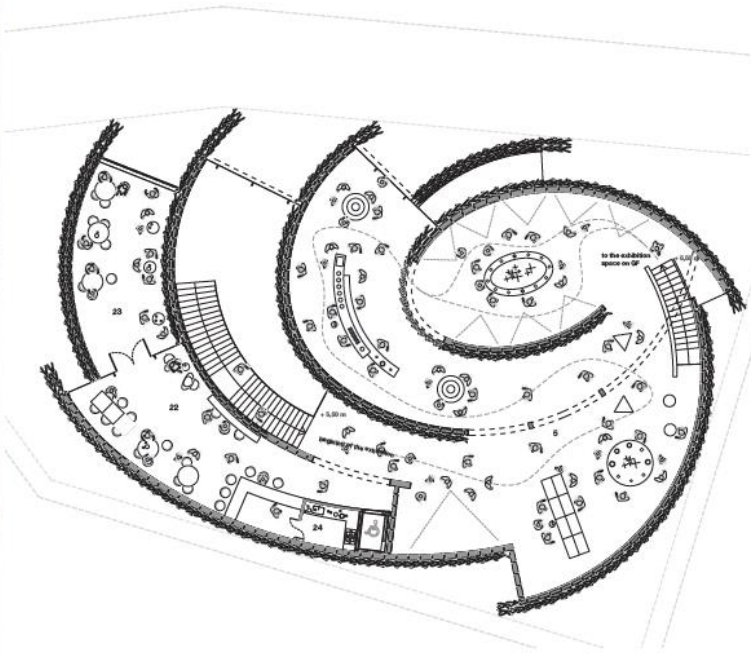
Area	Description	[m^2]	% share in the scope of study
Paved area	Finishing: same as finishing used for pedestrian ways surface on the Expo site	237	21,2
Natural soil – soft landscaped area		83	7,5
Driveways, pedestrian ways, external stairs etc.	Finishing: wooden floor	203	18,2
Structures – Polish Pavilion building		593	53,1
Total area		1116	100





SURFACE SUMMARY	[m2]	%
Gross covered area	593	53,1
Soft landscaped area	83	7,5
Hard landscape area	237	21,2
Wooden decking / terraces	203	18,2
Total surface	1116	100

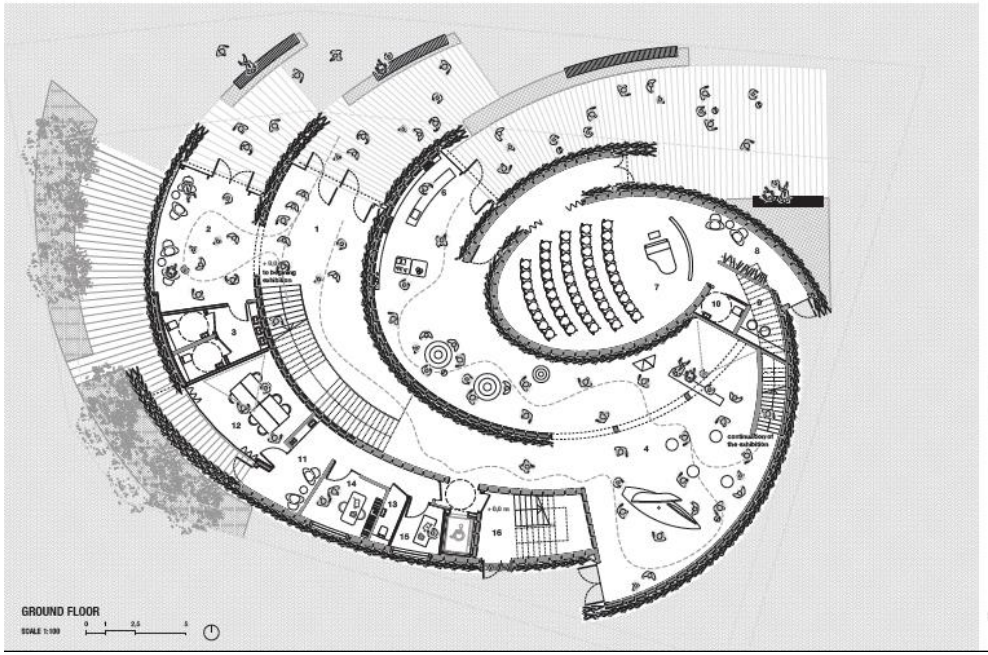
SITE PLAN



FIRST FLOOR

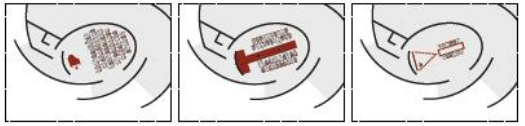
FLOOR SURFACE SUMMARY

		[m2]
Exhibition		**616,9**
1	Entrance hall	44,4
2	Group organization area	31,1
3	Restrooms	13,9
4	Exhibition (Ground floor)	177,5
5	Exhibition (1st floor)	309,4
6	Shop	38,7
Concert Hall		**96,3**
7	Concert Hall	71,2
8	Backstage	16,0
9	Wardrobe for artists	8,0
10	Restroom	3,2
Office area A		**75,2**
11	Entrance	11,2
12	Meeting room	20,4
13	Restroom	2,7
14	Exhibition curator's office	9,9
15	Vice curator's office	6,34
16	Circulation	25,83
Office area B		**66,3**
17	Office space	39,3
18	Storage	6,9
19	Kitchen + social facilities	20,0
20	Restrooms & showers	13,90
21	Circulation	9,2
Restaurant		**113,7**
22	Restaurant	68,7
23	Terrace	42,1
24	Back office	6,9
Total surface		969,6

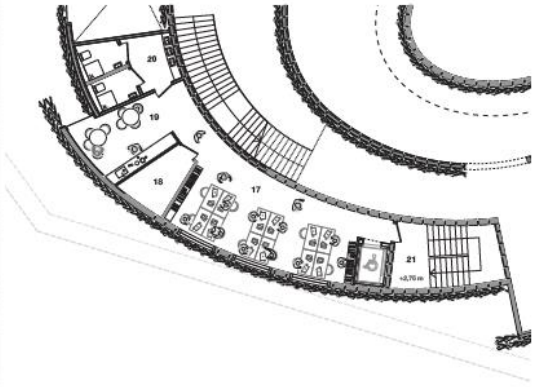


GROUND FLOOR

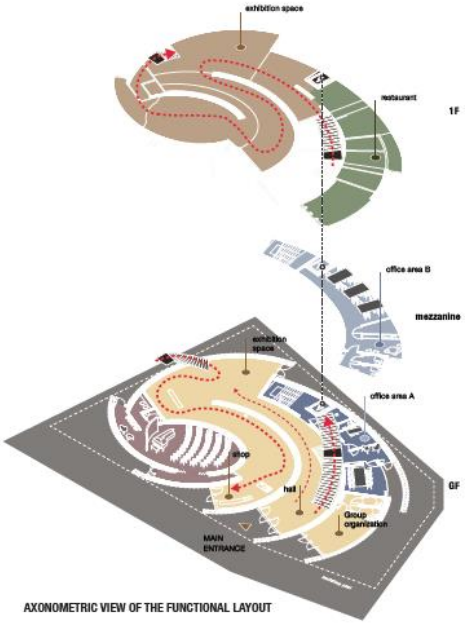
SCALE 1:100



CONCERT HALL FLEXIBILITY

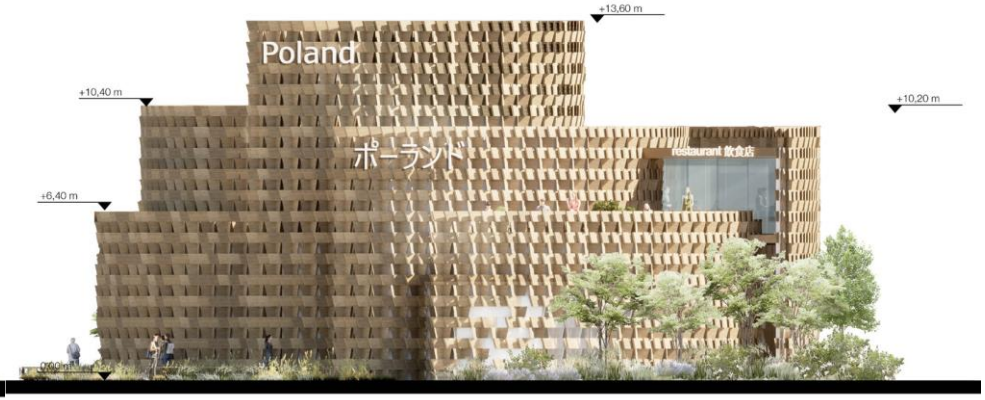


MEZZANINE LEVEL



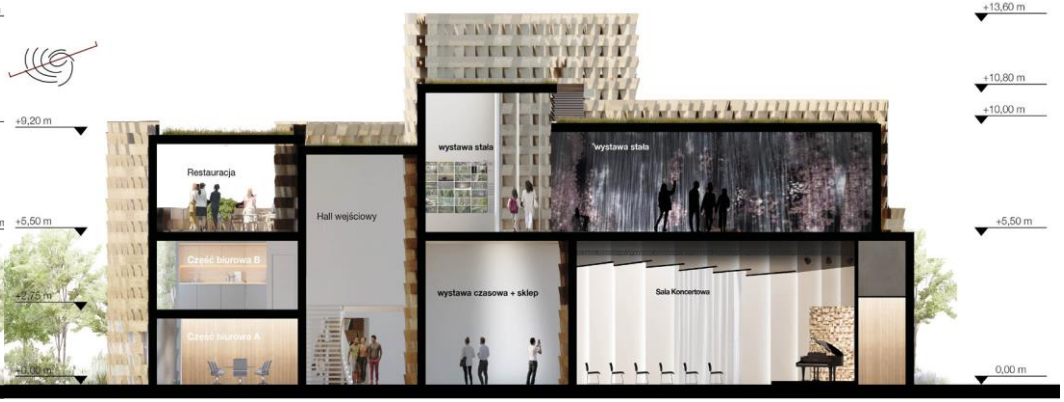
AXONOMETRIC VIEW OF THE FUNCTIONAL LAYOUT

NORTH-EAST ELEVATION

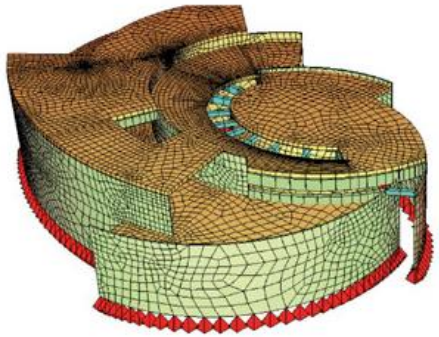


NORTH-WEST ELEVATION

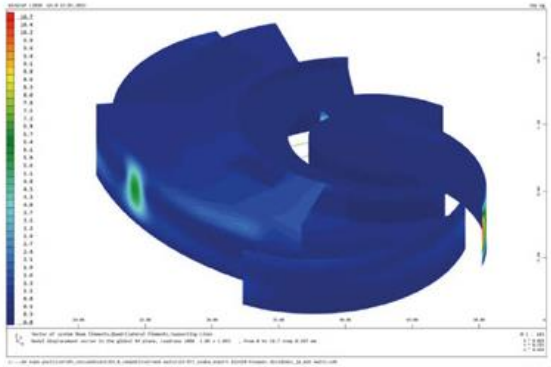
A-A SECTION SCALE 1/100 0 1 2,5 5



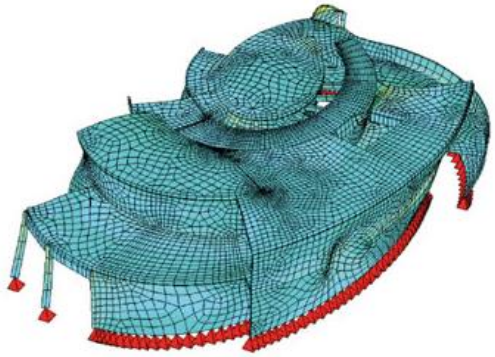
B-B SECTION



Structural system's view of the Finite Element Model in SOFISTI

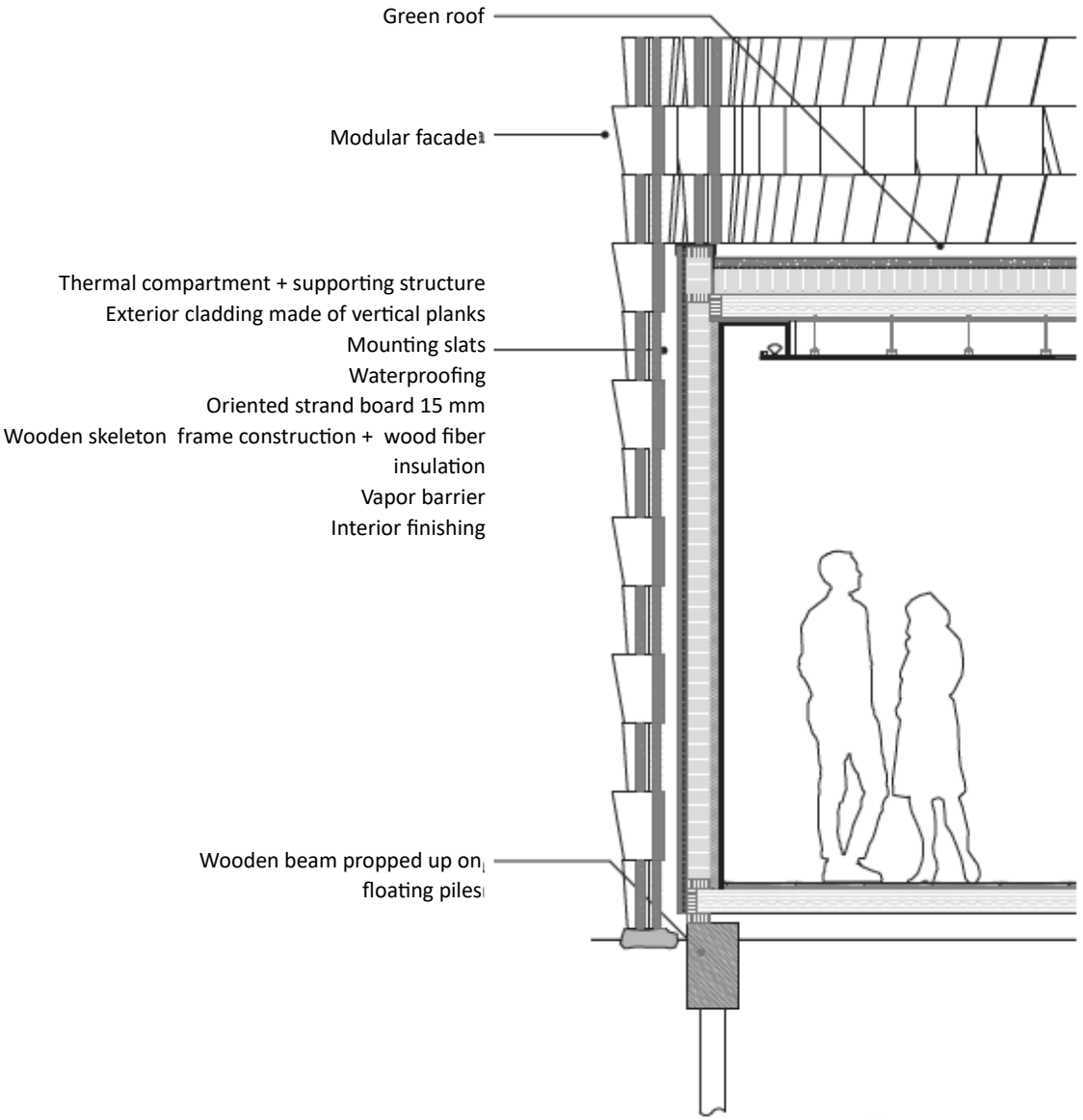


Horizontal deflection of the Pavilion under wind loading in its flexible direction in SOFISTIK



Pavilion's fundamental mode of vibration, in torsion in SOFISTIK

FACADE DETAILS **SCALE 1:30**



II. Requirements related to the pavilion design

Concept Design – General Design Plan

1. First Set of Documents to be Submitted

Referring to the plot sheet for the plot preliminarily allocated to a participant based on the Theme Statement and the application for the allocation of exhibition space it had submitted, participants must submit at least the following documents:

- An application for approval of the general design plan for the pavilion (statement of compliance declaring the participant complies with relevant laws and regulations of Japan, prefectural and municipal ordinances of Osaka and other regulations) and a checklist
- The layout of facilities (it must define the interior and exterior of the pavilion, landscape, access, etc.): Scale of 1/200
- The ground plan, elevation, and sectional plan of the pavilion: Scale of 1/100
- BIM data (For details, please refer to the “BIM Requirements for Type A (Self-Built) Pavilions”.)
- Standards and specifications of building materials etc.
- Technical proposal for the structure and facilities of the pavilion
- Plans for facility load capacity and utilities
- A universal design checklist
- A planned operation schedule for design, bidding, construction, demolition and other relevant works

Participants may proceed with the next phase only after the first set of documents are approved by the Organizer.
The Organizer may give participants technical instructions and/or recommended revision necessary for approval.

Final Design – Detail Design Plan

2. Second Set of Documents to be Submitted

Participants must submit at least the following documents to elaborate on the contents of the first set of documents that were submitted and approved.

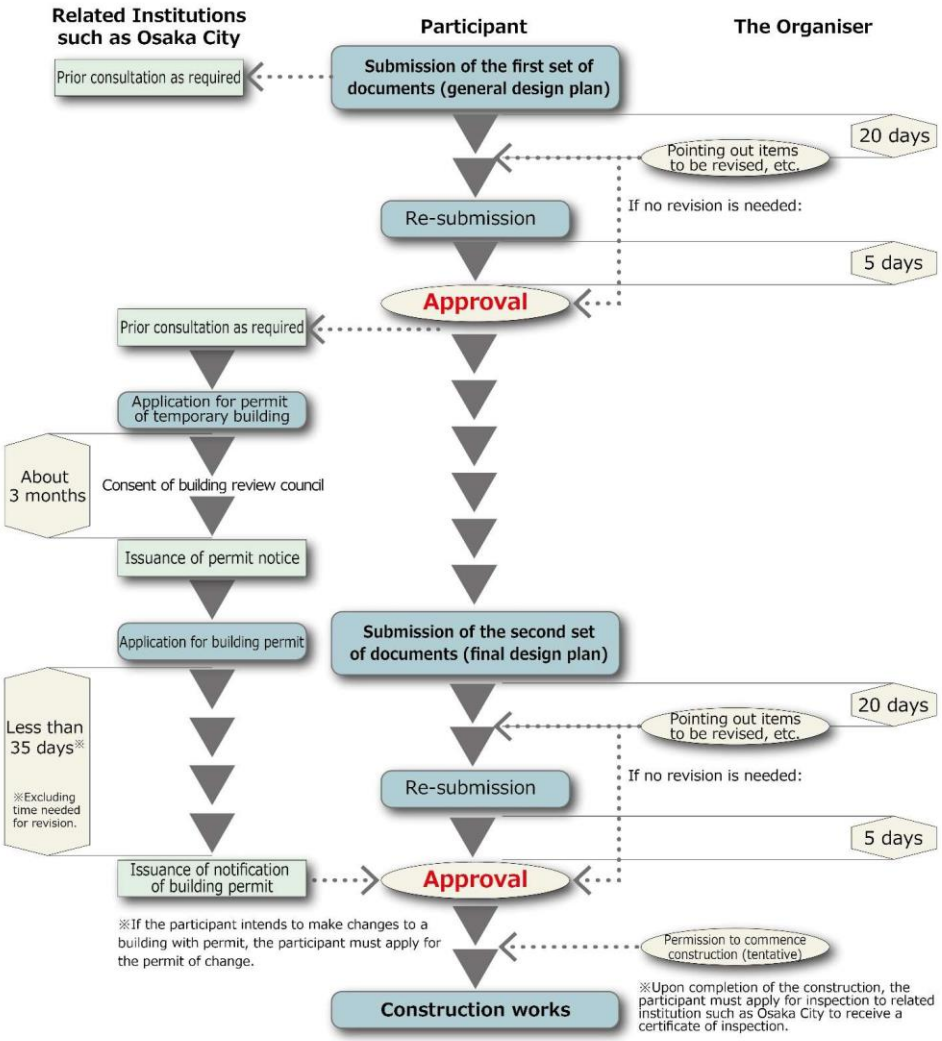
- An application for approval of the final design plan for the pavilion (statement of compliance declaring the participant complies with relevant laws and regulations of Japan, prefectural and municipal ordinances of Osaka and other regulations) and a checklist
- The layout of facilities (it must define the interior and exterior of the pavilion, landscape, access, etc.): Scale of 1/200
- The ground plan, elevation, and sectional plan of the pavilion: Scale of 1/100
- BIM data (For details, please refer to the “BIM Requirements for Type A (Self-Built) Pavilions”.)
- A plan for the standards, specifications and procurement of building materials etc.
- Technical proposal/design plan for the structure and facilities of the pavilion
- An energy use plan (utility use plan)
- An environmental plan (CASBEE® assessment software)
- A plan for the universal design
- A universal design checklist

- A construction/demolition plan
- The final schedule for design, bidding, construction, demolition and other relevant works

Participants may proceed with construction works only after the second set of documents are approved by the Organiser and they receive the Permit for Commencement of Construction (tentative name).

The Organizer may give participants technical instructions and/or recommended revision necessary for approval.

After the second set of documents are approved, participants will continue developing an operation plan for the pavilion and events in cooperation with the Organizer.



Compliance with Laws and Regulations and Other Standards

Participants must pursue the planning, designing, and construction of Type A (self-built) pavilions in compliance with relevant Japanese laws, prefectural or municipal ordinances of Osaka, and other laws and regulations, including the following (Please refer to the following websites in Japanese):

> Building Standards Act and Order for Enforcement of the Act

(Building Standards Act) https://elaws.e-gov.go.jp/document?lawid=325AC0000000201

(Order for Enforcement) https://elaws.e-gov.go.jp/document?lawid=325CO0000000338

> Architect Act and Order for Enforcement of the Act

(Architect Act) https://elaws.e-gov.go.jp/document?lawid=325AC1000000202

(Order for Enforcement) https://elaws.e-gov.go.jp/document?lawid=325CO0000000201

> City Planning Act and Order for Enforcement of the Act

(City Planning Act) https://elaws.e-gov.go.jp/document?lawid=343AC0000000100

(Order for Enforcement) https://elaws.e-gov.go.jp/document?lawid=344CO0000000158_20200907_502CO0000000268

> Fire Service Act and Order for Enforcement of the Act

(Fire Service Act) https://elaws.e-gov.go.jp/document?lawid=323AC1000000186

(Order of Enforcement) https://elaws.e-gov.go.jp/document?lawid=336CO0000000037

> Osaka Prefectural Ordinance on the Enforcement of the Building Standards Act

(Prefectural Ordinance) http://www.pref.osaka.lg.jp/houbun/reiki/reiki_honbun/k201RG00000834.html

> Osaka Municipal Ordinance on the Enforcement of the Building Standards Act and Regulation for Enforcement of the Act (Municipal Ordinance)
https://www.city.osaka.lg.jp/toshikeikaku/cmsfiles/contents/0000119/119044/jourei_190614.pdf
(Municipal Regulation)
https://www.city.osaka.lg.jp/toshikeikaku/cmsfiles/contents/0000119/119044/saisoku_201001.pdf
> Other regulations relating to the Building Standards Act (various types of regulations that must be satisfied when submitting an application for a building permit set out in Article 6 of the Building Standards Act)
—Building standards-related regulations set out in Article 9 of the Order for Enforcement of the Building Standards Act, Act on Promotion of Smooth Transportation, etc. of Elderly Persons, Disabled Persons, etc. (Accessibility Improvement Act)
> Other related laws and regulations
—Construction Material Recycling Act, Landscape Act, Act on the Measures by Large-Scale Retail Stores for Preservation of Living Environment, Entertainment Places Act, etc.
Other guidelines, including this guidelines document, and documents designated by the Organiser, as well as other standards relevant to specific plans, must also be complied with.
Construction Work and Demolition Work Guidelines for Self-Built Pavilions are planned to be developed.

A detailed description of the Expo Organizer's requirements regarding the design, construction and demolition of the pavilion is included in the documents that are an integral part of the concept, as listed below.

1. Plot Sheet A36
2. Universal design guidelines
3. Design Guidelines type A (EN) (June2022)
4. GL4-7-1 Construction Demolition guidelines type A EN
5. Design Guidelines Appendix (EN) (Jul 2021)
6. BIM requirements
7. Presentation Architectural & Construction Guidance for Type A Pavilions
8. Checklist for Universal Design Guidelines UD_Ver.1 (Dec.2022),
9. Design Guidelines Check List_Ver.1 (Dec.2022),