Jincheng Plaza Transport Hub – Chengdu, China

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AREP won the competition to design an urban mobility hub within the ecological zone of Chengdu, the ancient imperial city in eastern China, home to 10 million people.

The project aims to reconnect urban living with nature by creating an efficient transport network within a vibrant urban setting and well-integrated into the surrounding landscape. The interchange hub provides connections to four metro lines (1, 9, 11, and 18) and accommodates a multimedia resource centre and retail outlets.

1. The site

The site is located on the edge of the historic north-south thoroughfare and near the 5th Ring Road. Just 12 km away from Chengdu's city centre, the hub will sit within the green belt and in the vicinity of a river and a lake on its east side. On the west side, the 653-metre long and 283-wide site faces the sparkling decoration of the world's largest building, the New Century Global Center, a 1,700,000-square metre complex providing leisure, retail and hotel facilities…

2. The programme

The project conveys a different image of transport hubs and meets the intention of the City of Chengdu and of the metro operator to create an urban living space offering well-being and cultural opportunities, a place where people can make discoveries and meet.

The transport hub blends seamlessly with the surroundings and forms a coherent space that demonstrates the importance of mobility within modern cities. It lies beneath a garden and its large-volume spaces are able to accommodate four metro lines as well as commercial and cultural activities giving the facility its distinctive character. The details of the programme were refined in parallel with the spatial layout and the functions of the transport hub.

AREP put forward the idea of a cultural amenity that would tie in with the high quality of the site while giving it a distinctive identity. A large multimedia resource centre appeared as the best choice for this purpose. It will expand over 50,000 sqm (usable floor area) and will be complemented by 15,000 sqm of retail space. Pedestrian areas, car parks and technical premises will occupy the rest of the 200,000-square metre floor area.

3. The architectural project

The transport hub is discreet and restrained and integrates smoothly with the surroundings, «turning its back» on the giant New Century Global Center. It opens up onto the landscape and the lake to the east, thus capturing the morning light, a decision that played a key role in the selection of the project by the city of Chengdu and the metro operator.

The large underground infrastructure playfully combines vegetation, lightness and natural light. All the metro platforms are located 20 metres below ground level. The transfer areas, services, commercial, and cultural amenities are located 13 metres below ground level (reference datum). They connect to the city and the gardens through the slight gradient of a slope that offers extensive views of the surrounding landscape.

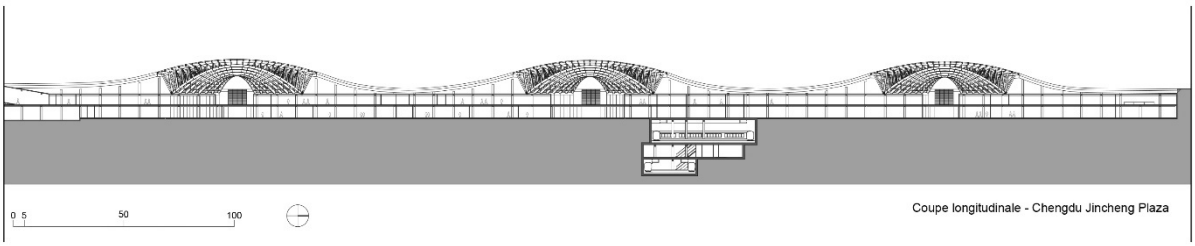
On the east bank, three undulating structures rising eight metres above the natural ground level marks the entries to the station, retail outlets and multimedia resource centre. They structure the entire space and open up the interior volumes allowing for daylight to pour into the area while enhancing functional legibility.

The choice of timber for the structure of the three entrances came naturally and underlines their special architectural form in an environmentally friendly and simple manner. The bracing and the crossed arches are made of glue-laminated pine timber, which ensures the stability and lightness of the smoothly undulating but large-span forms reaching 96 metres. This is China’s largest timber span structure.

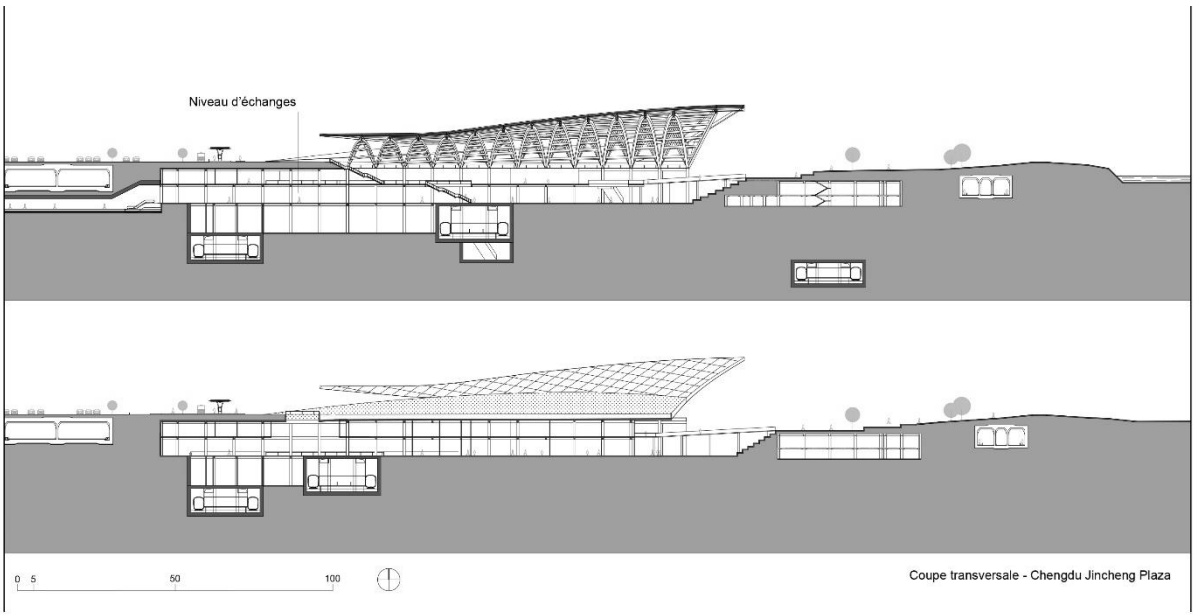
The timber comes from North America. The structure is covered with ETFE. Chengdu has a mild climate that allows the interior of the transport hub to be well ventilated naturally, without any heating or air-conditioning.

The roof structure is divided into soil covering area and ETFE daylighting area. The former area applies concrete framework structure (9x9m standard column net), and the latter structure separates from it and applies steel-plywood structure. Set wooden arch support at level -2m, which is connected with the concrete slabs on two sides to provide horizontal bracing.

Despite the constant flow of passengers, Jincheng Plaza is a place that promotes well-being, optimizes movement through pleasant circulation routes punctuated by leisure, cultural or shopping opportunities. It is also a place that connects with and respects the surrounding environment, the relaxing natural landscape formed by the green belt, the lake and the river.



Coupe longitudinale - Chengdu Jincheng Plaza

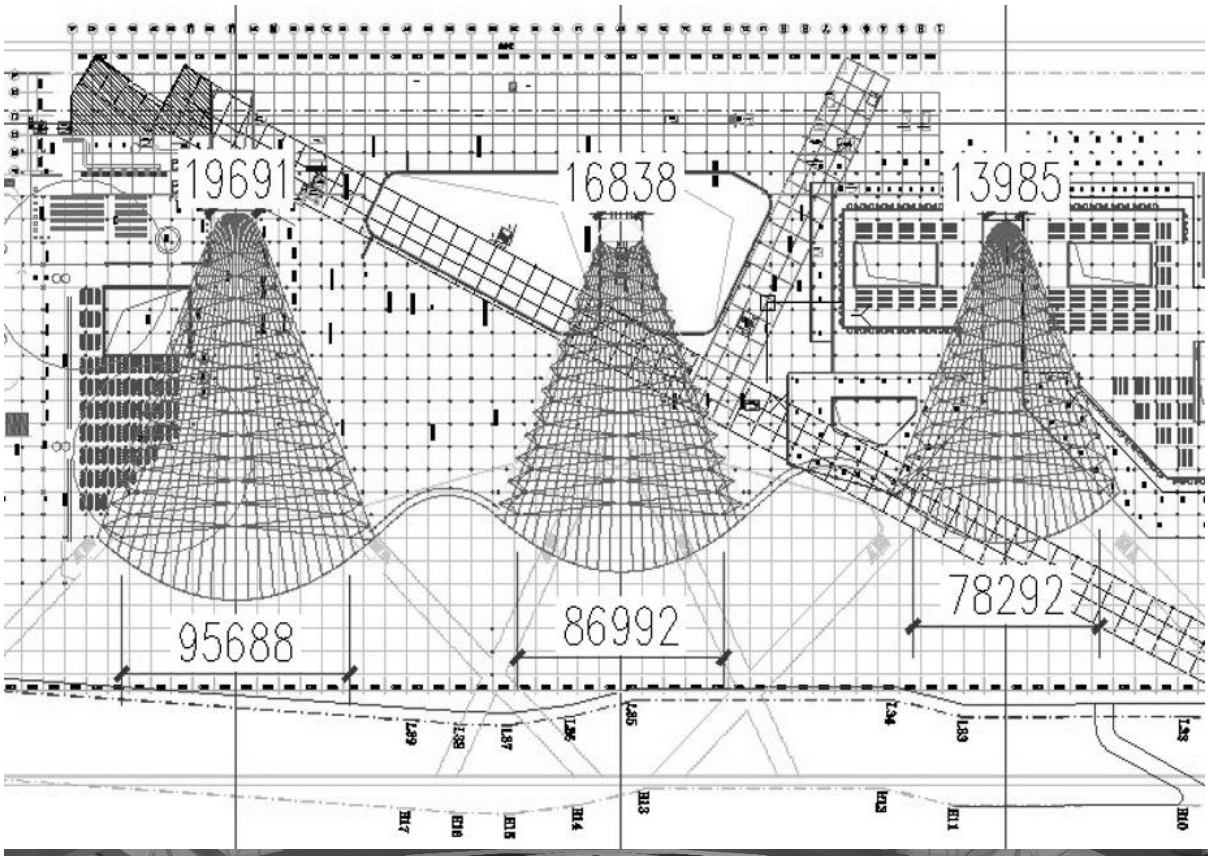


Coupe transversale - Chengdu Jincheng Plaza

4. The project profile

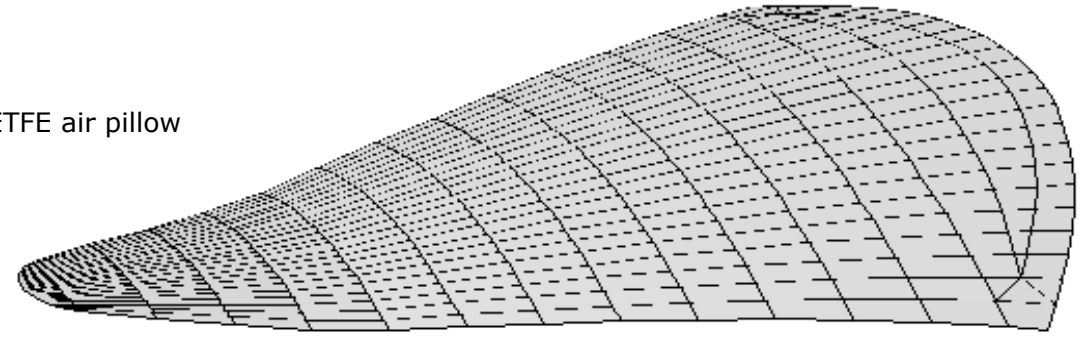
ETFE roof becomes larger from north to south, the main arch spans are 78.3~14.0m, 87.0~16.8m, 95.7~19.7m, and the roof height (from level -2.0m) are 17m, 20m and 23m.

Every two main arches are intercrossed and form spatial structure with roof transverse beam and diagonal bracing. The main arch spacing is 9m.

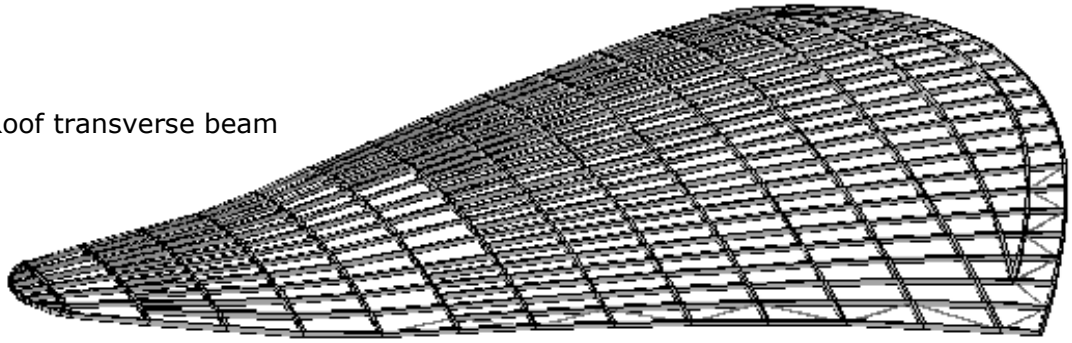


5. The project structure layout

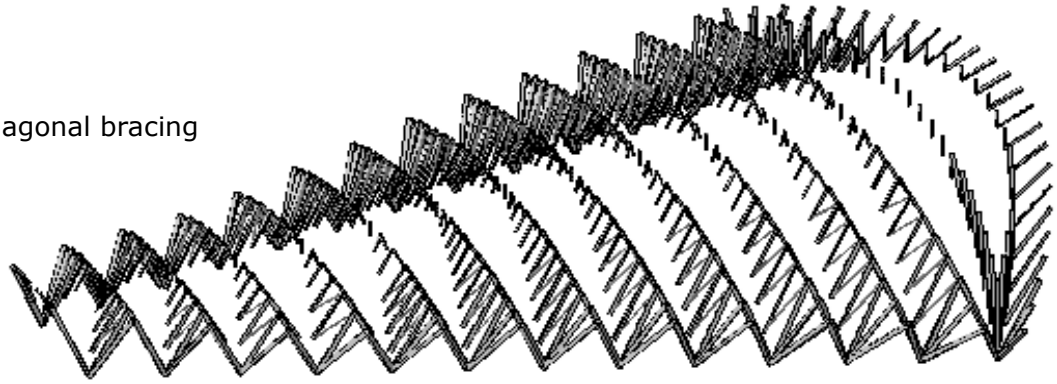
ETFE air pillow



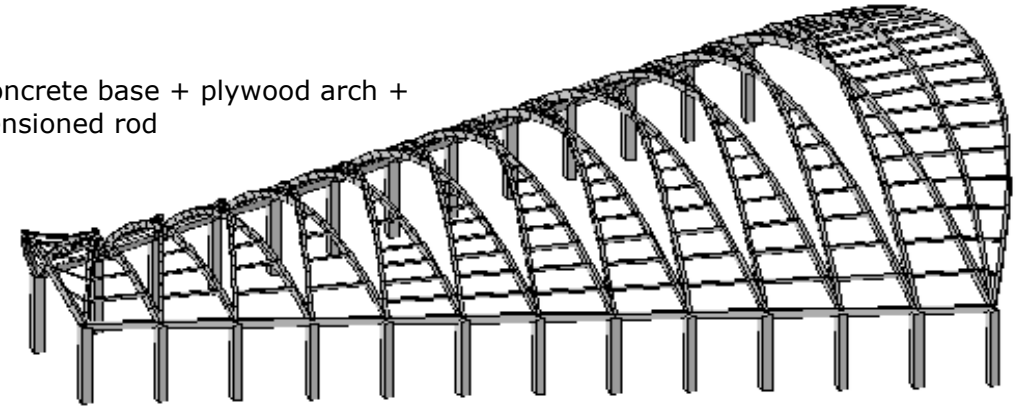
Roof transverse beam



Diagonal bracing



Concrete base + plywood arch +
Tensioned rod



6. The use of timber

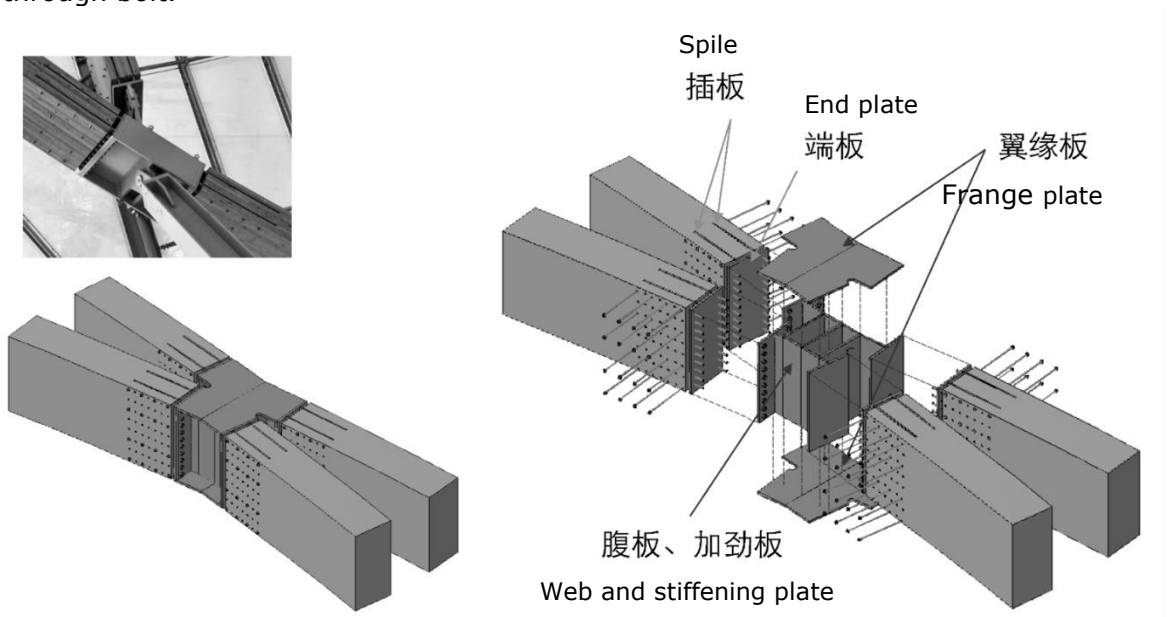
Today, China produces and uses small quantities of timber, but has recently started developing the production of timber in an environmentally friendly way. Its quality is not yet good enough, though, to be used in the construction industry. Both the client and the local authorities enthusiastically embraced the use of timber for the structure. Wood is a sustainable and natural material that is present throughout the traditional Chinese architecture and contributes to creating a welcoming and stress-free environment. The structure has been designed by MAP3 and will be implemented by a Chinese firm.

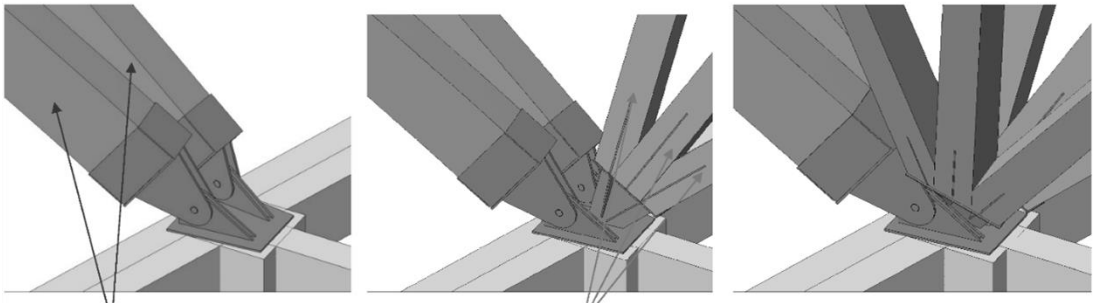
6.1. Large span wooden structure and ETFE air pillow

- The wooden structure, together with steel joint and members, can fully play performances of different materials and decrease load.
- The structure members and covering materials are exposed to show an integration design of the architectural and structural space and present unique sense of freshness, comfort and harmony.
- Reduce the use of large-area glass curtain wall, avoid light pollution, select lightweighted new roof material. ETFE will significantly reduce the self-weight of the roof cover.
- ETFE roof material is shading, energy efficient and saving decoration cost.
- ETFE is pollutant-proof and not easily showing the dirt. The lateral ventilation skillfully designed at the roof connection can reduce risk of water leakage.
- ETFE roof is modular in blocks which is easy for replacement during maintenance.

6.2. Steel joint design

Crossing joint of dual-arch: wood arch beam connects with spile and end plate through nail and bolt. Prefabricated in factory, it is then connected on site with central rigid joint through bolt.



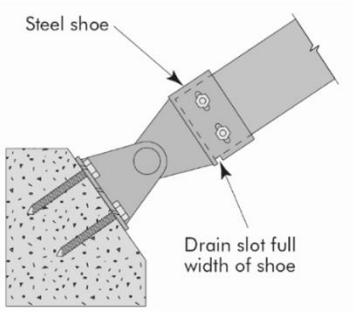


胶合木弧线主拱

Main arch of compressed wood arch

斜撑

Diagonal bracing



6.3. Timber structure advantage

Life span: modern timber structure can have a long-life span of 200 years if it is well maintained.

Energy saving: as experiment shows, the heating energy consumption of buildings with timber structure is at least 20% lower than those buildings with reinforced concrete.

Aseismic performance: the past cases and multiple vibration tests show that timber structure can resist magnitude 8 or even larger earthquake. The joints formed by timber and metal connecting members are elastic and deformable to some extent. Its self-deformability can effectively consume seismic force and ensure integral safety of the building framework.

Environmental: in the growing process, 1m3 wood absorbs around 1-ton CO2, and after trees are cut down they can be made into wood products, the carbon elements of CO2 will be permanently reserved, and sustainable forest management can ensure that forest can continuously provide wood material without destroying the environment.

Recycling: when the timber structure reaches its life end, wood can be recycled or used as energy.

6.4. Timber structure problem solution

Fireproofing: when compressed timber is combusted, the peripheral carbonization layer flame delay will intrude the interior and destroy structural stress, provide safety escaping time, and work out big enough wood transverse section to satisfy fireproof design. The timber structure in this project is exterior so it is easy to escape. Fireproofing of timber structure is basically relying on fireproof gypsum board and sprinkling system to reach the national fire code requirement.

Dampproof: through methods of baffling, drying and drainage, make rainwater deviates timber structure surface, and use anticorrosive wood to improve durability of key components if necessary. Use one-way breathing paper on walls to discharge moisture in walls, and since exterior moisture cannot enter, the whole structure will keep dry.

Termite: for modern timber structure, it mainly applies combination of physical and chemical methods to make anticorrosive treatment on timber close to foundation and install insect net is also necessary.

Cost: the cost of timber structure building largely depends on degree of interior and exterior decoration. As timber structure itself has vivid expressive force, it can greatly reduce the decoration cost.

Client:
Chengdu Communications Investment
Group Co. Ltd (CCIC)

Project management:
AREP Ville; Sichuan Provincial Architectural Design and Research Institute (SADI); China Railway Eryuan Engineering Group Co., Ltd (T2 yuan)

AREP team:
Luc Néouze, Zhang Jianhua, Li Jinzhou,
Zhou Hongyue, Yu Xiaolin, Xu Dalin
Structural engineering:
MaP3

Surface:
225,000 sqm

Delivery:
2020