



**NEW TERMINAL AREA** MADRID-BARAJAS

Project Information

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**Location :**

Madrid, Spain

**Architect :**

Estudio Lamela & Richard Rogers Partnership

**Completion :**

2005

**Client :**

AENA (Aeropuertos Españoles y Navegacion Aérea)

**Engineering Firm :**

Structure: Anthony Hunt Associates, TPS with OTEP; HCA SERVICES.

Installations: TPS; INITEC. Façade: OAP Façade Engineering.

**Contractor :**

Dragados and FCC.

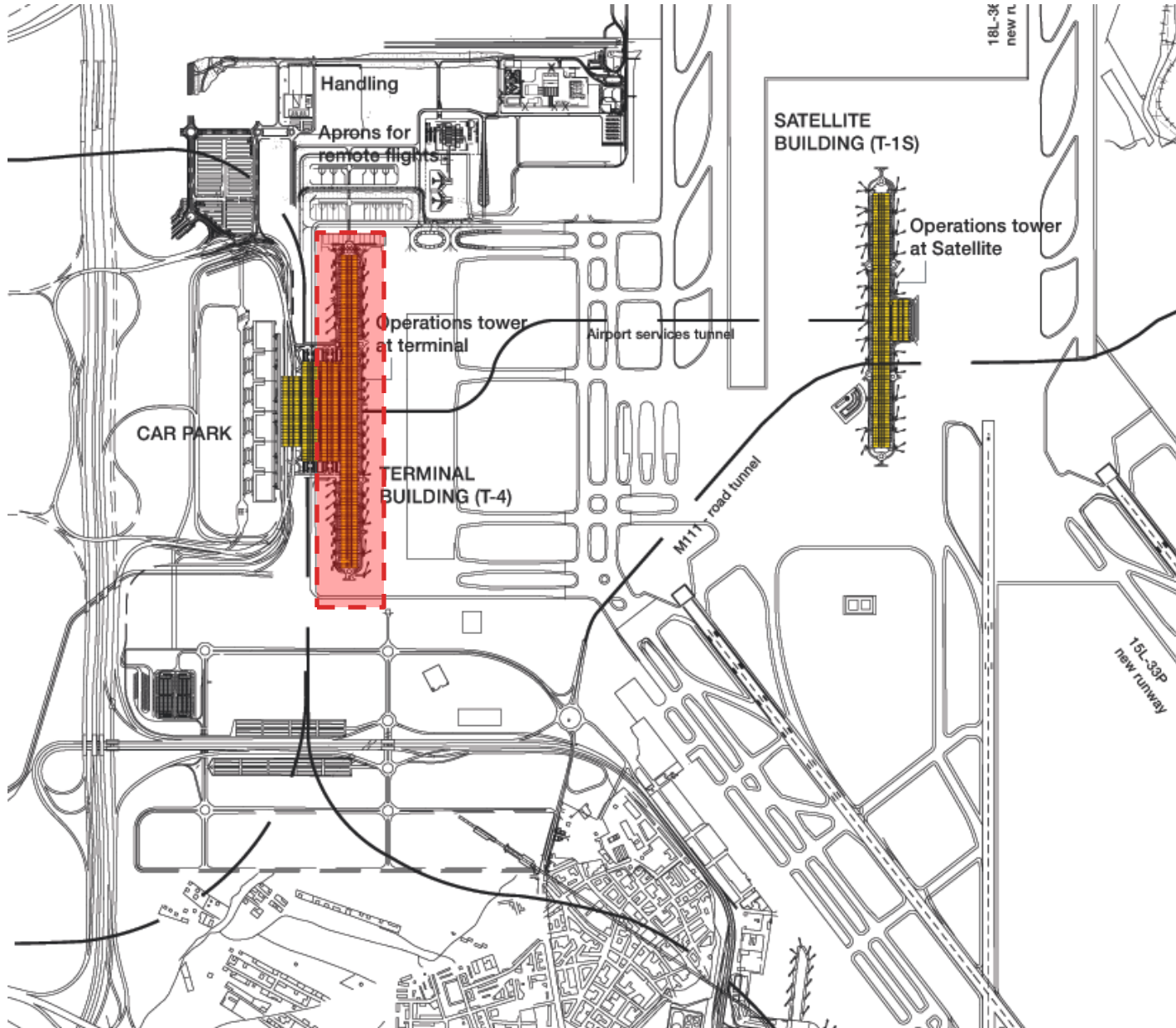
Project was a result of a competition in 1997

Scheme was simplistic, adaptable, robust and flexible

### **Architectural Goals**

- Simple geometrical techniques
- Open spaces, or “canyons”, separating each longitudinal module
- Reducing dependency on artificial lighting
- Architectural functionality
- Bright non-oppressive interior
- Light transparent exterior
- Flexible and modular construction using precast materials
- Optimum acoustic absorption





SITE PLAN

**BUILDING LAYOUT**

Airside Passengers

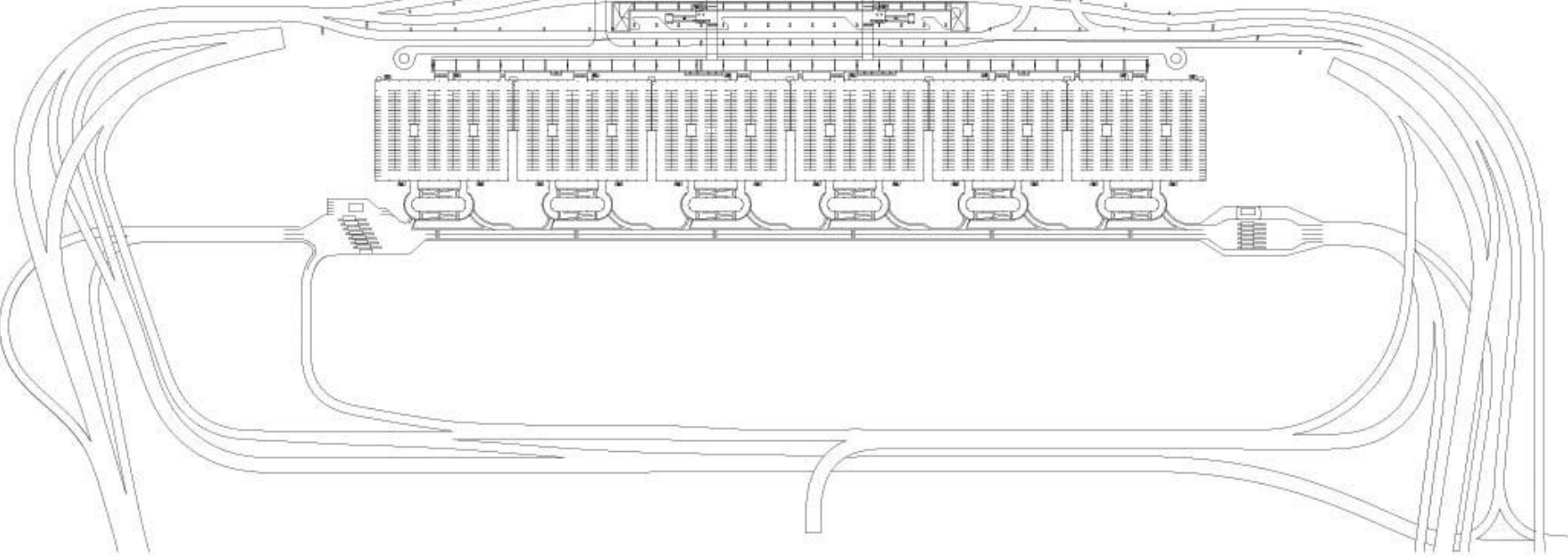
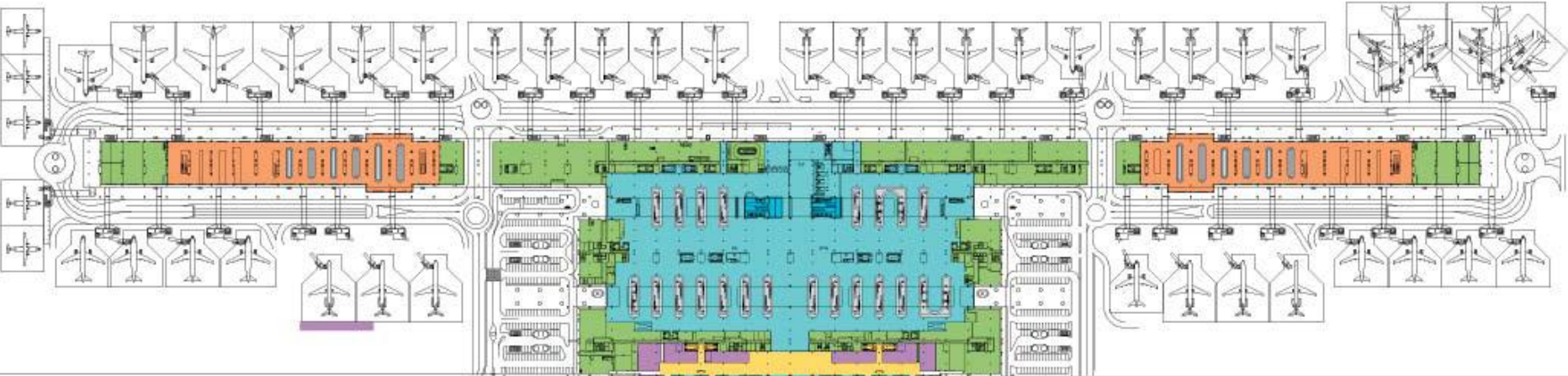
Landside Passengers

Circulation

Retail

Airport Service

Luggage



TERMINAL GROUND

**BUILDING LAYOUT**

Airside Passengers

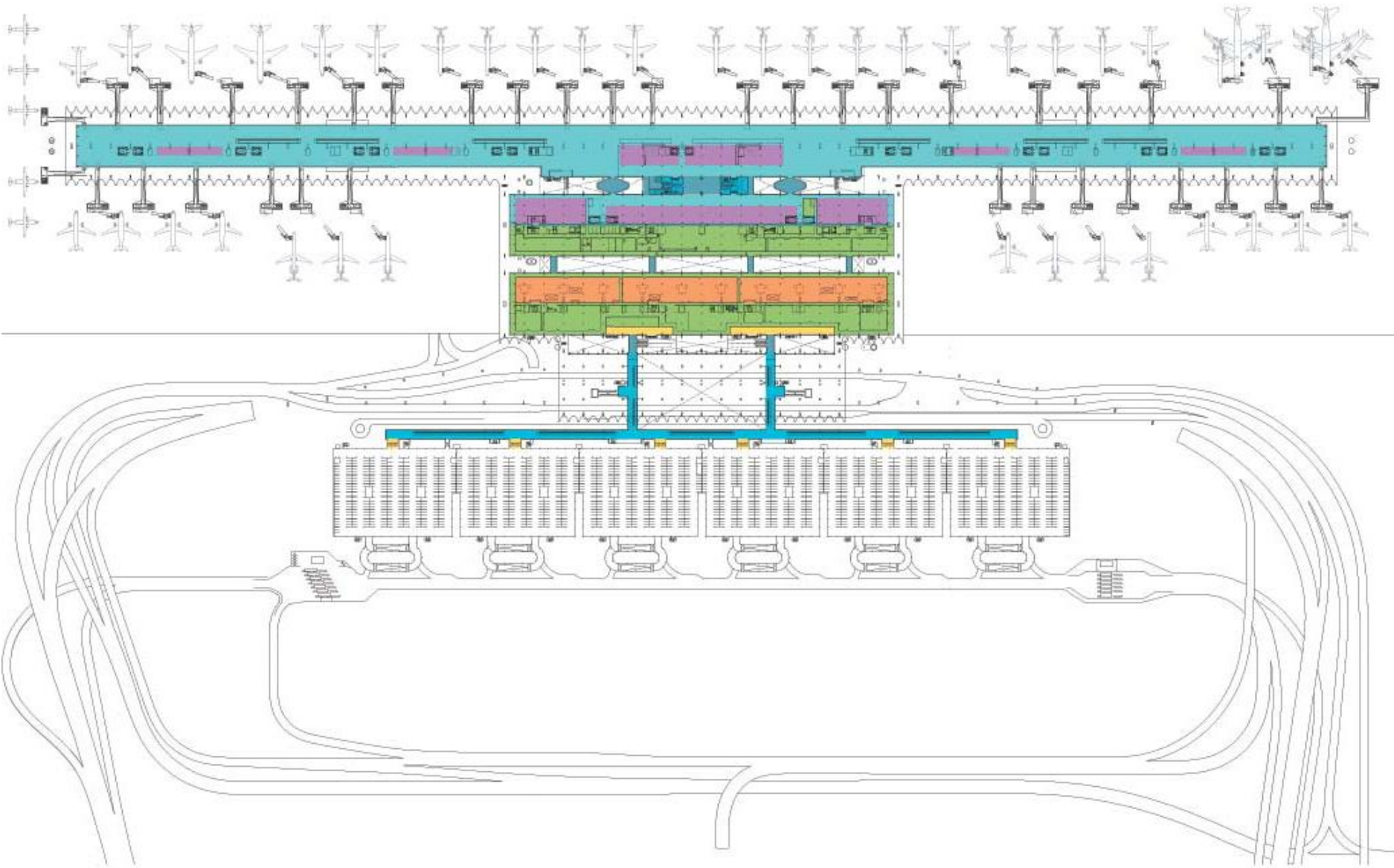
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Circulation

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TERMINAL LEVEL 1

**BUILDING LAYOUT**



Airside Passengers

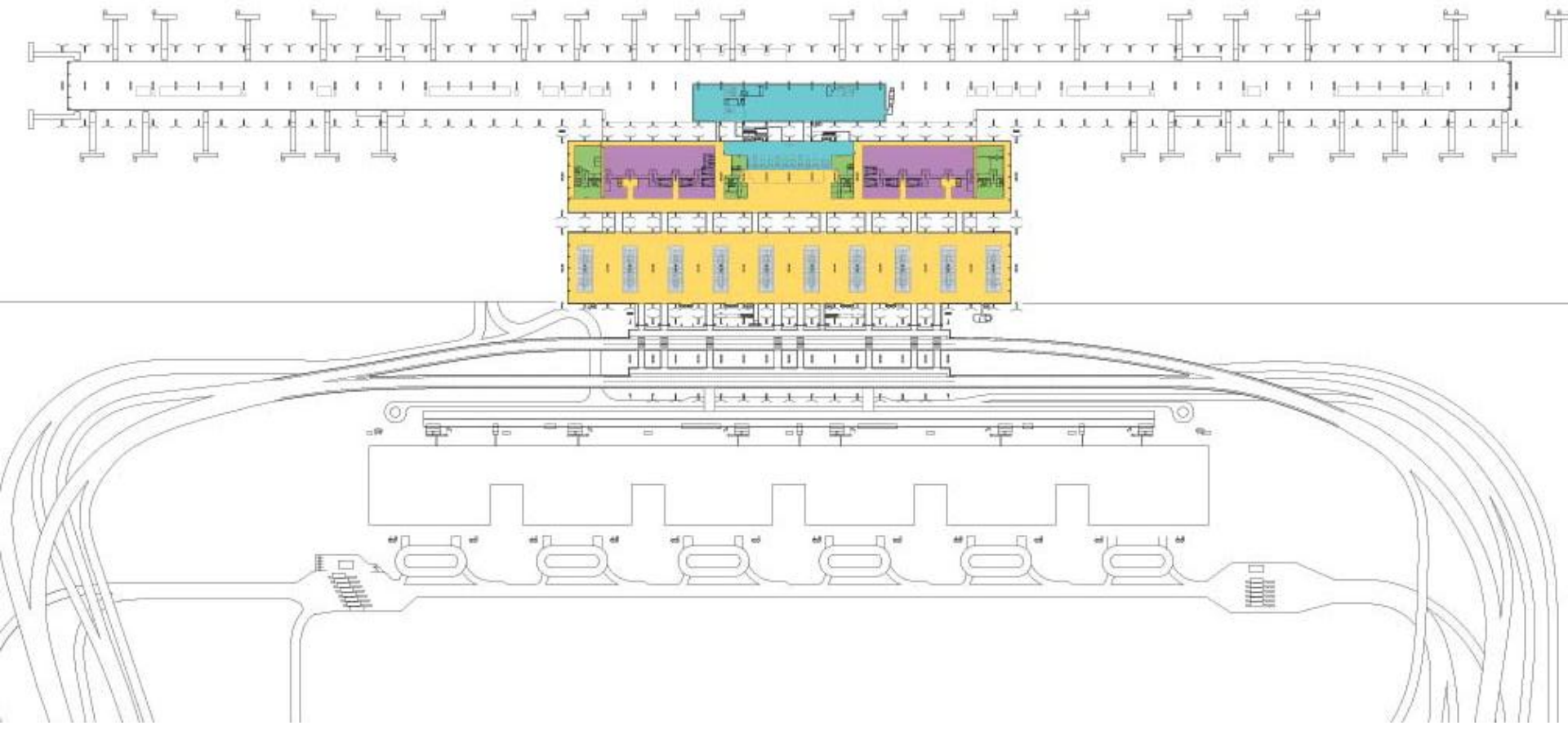
Landside Passengers

Circulation

Retail

Airport Service

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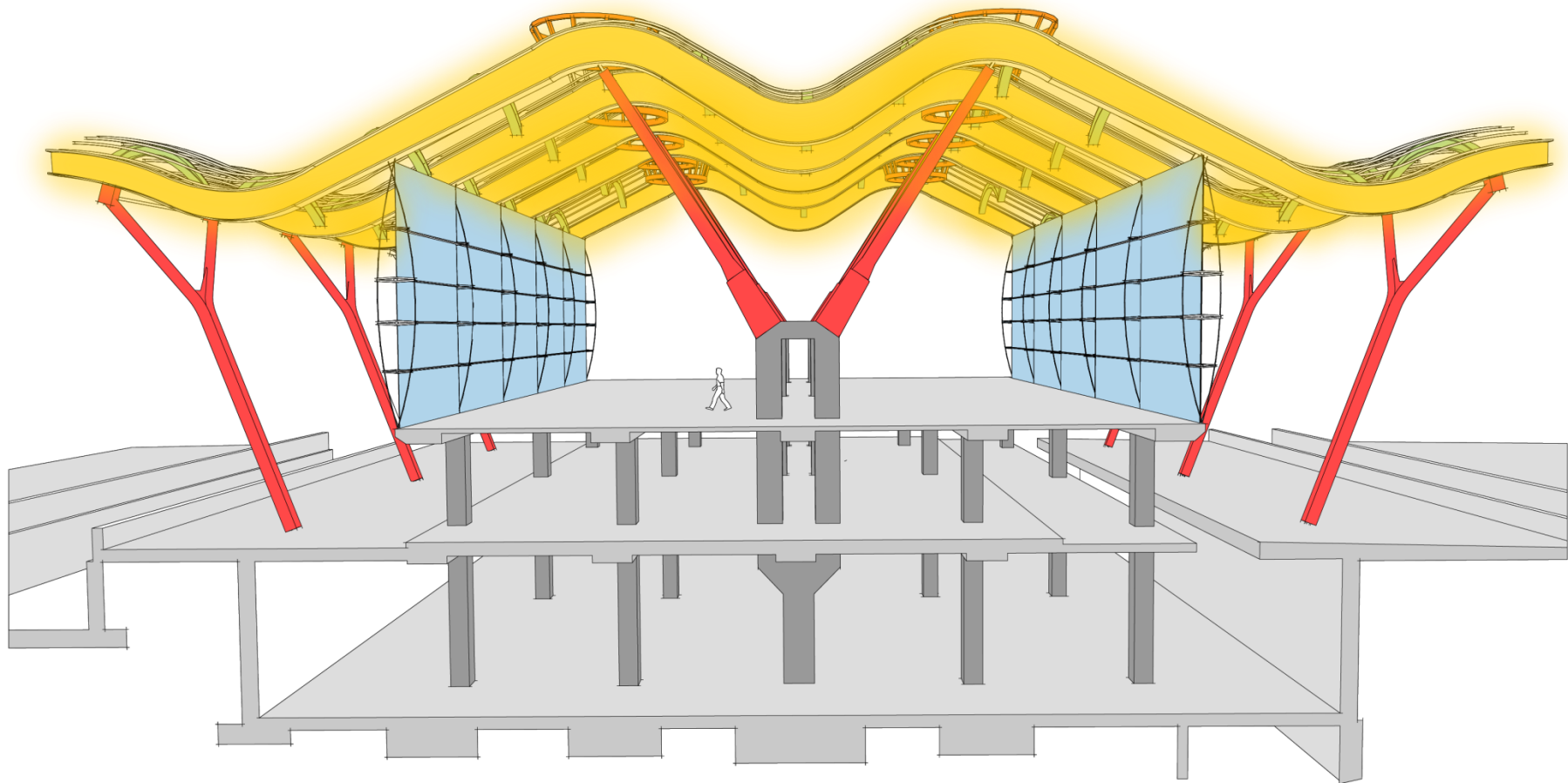


TERMINAL LEVEL 2

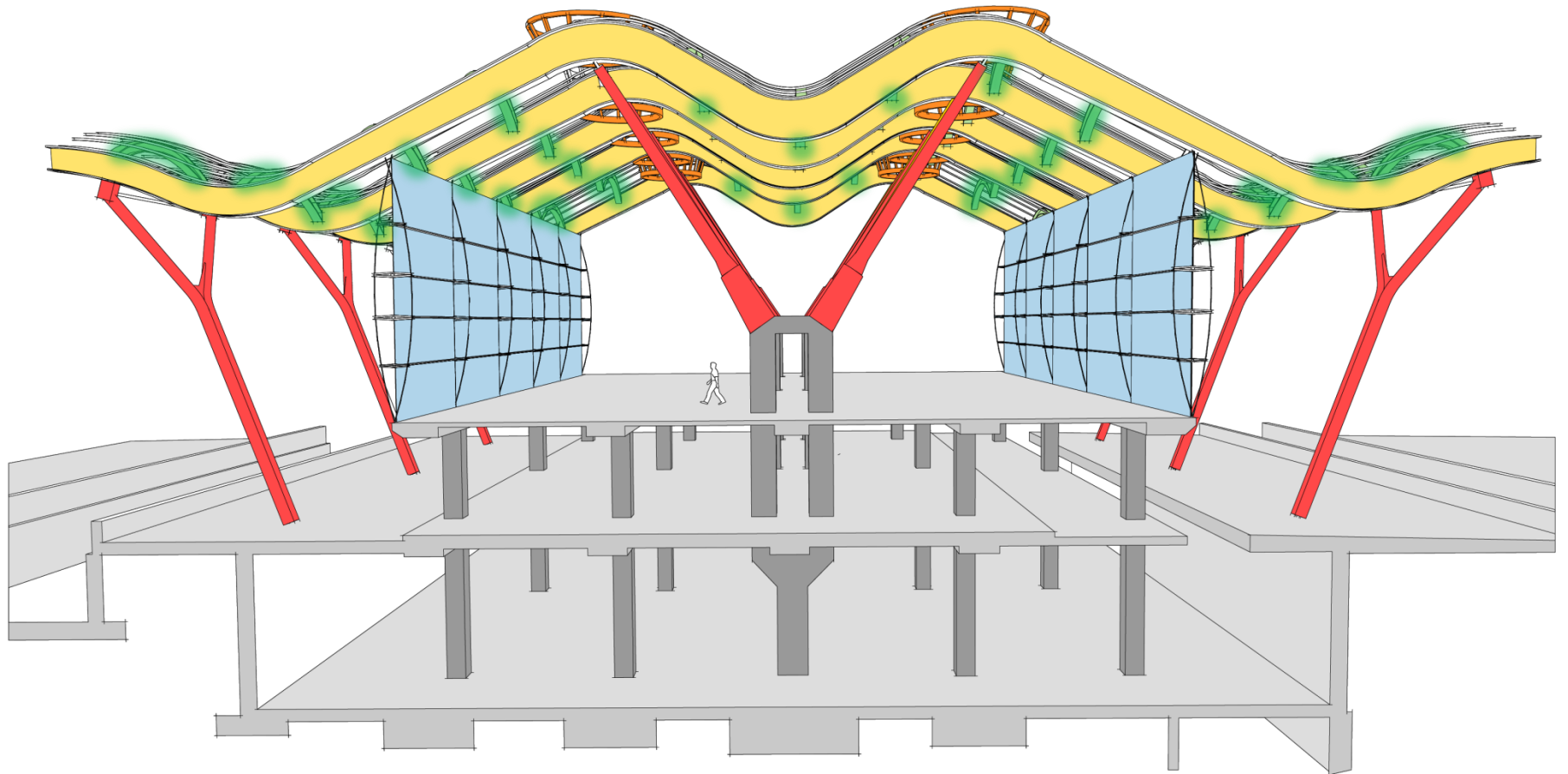
**BUILDING LAYOUT**

- Ground slopes gently down from west to east towards the Rio Jamara
- 10-20m of soil is clay sands below those very dense clay sands and hard salty sandy clays are prominent
- No general water table above basement level
- The site gave for good construction conditions since the water from heavy rains can drain through the shallow sandy layers into the river.

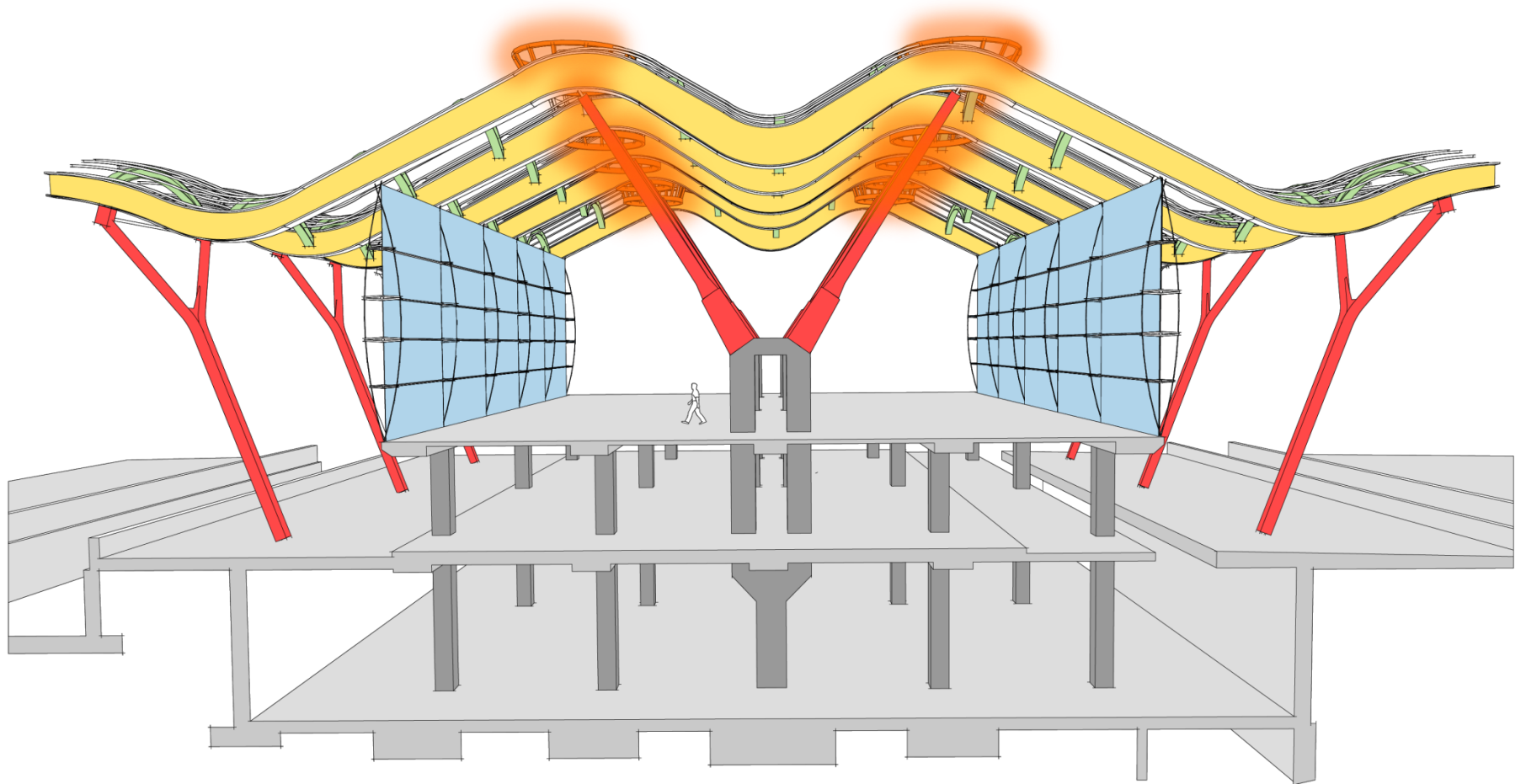
- Constant Profile
- Basement construction was generally carried out in open excavations, using *in situ* concrete walls which were propped at all floor levels
- A waterproof membrane was applied to the outer face of the walls and drainage installed before the placing of granular fill material.
- Walls were designed for earth pressure during compaction of backfill material.
- Where diaphragm walling was used ground anchors were used to provide lateral wall support as excavation took place within the basement.



TRANSVERSE BEAMS



TRANSVERSE BEAMS  
LONGITUDINAL BEAMS



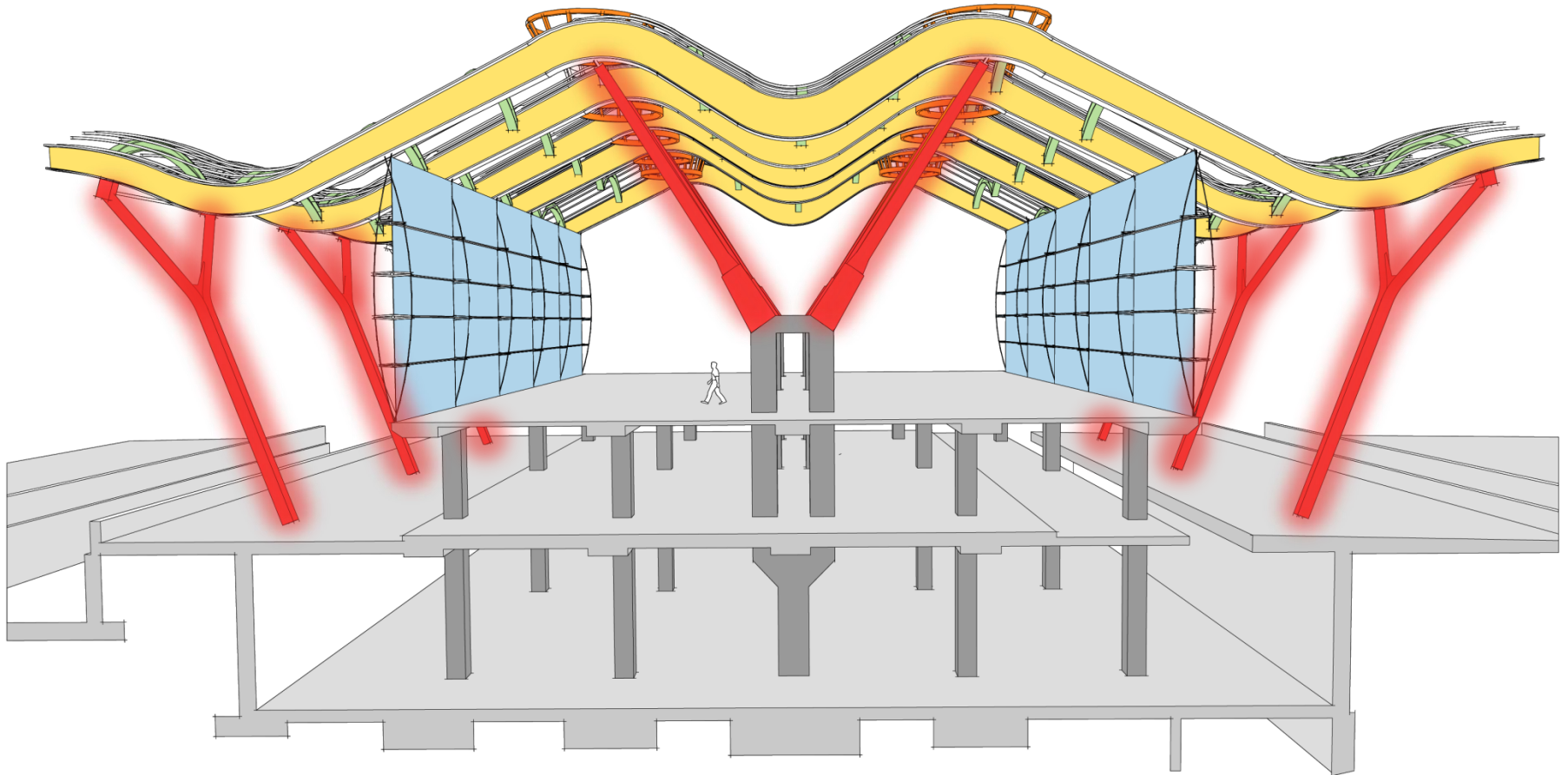
TRANSVERSE BEAMS

LONGITUDINAL BEAMS

SKYLIGHTS

**STRUCTURAL DESIGN**

Each module is 72m by 72m. Each module must be structurally independent in order to minimize load transfer across the joists.

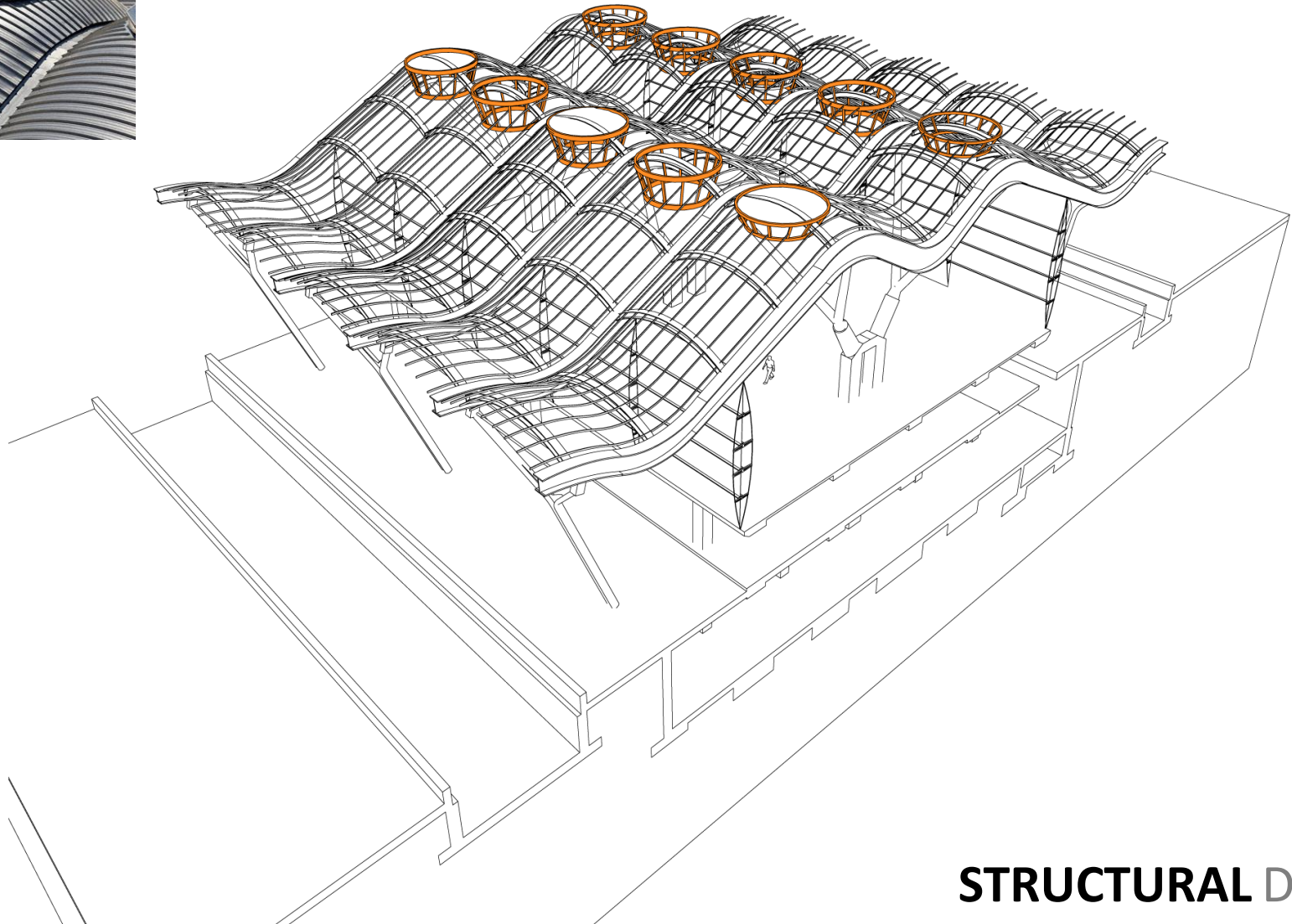


TRANSVERSE BEAMS  
LONGITUDINAL BEAMS  
SKYLIGHTS  
SPLIT COLUMNS

**STRUCTURAL DESIGN**

## Roof

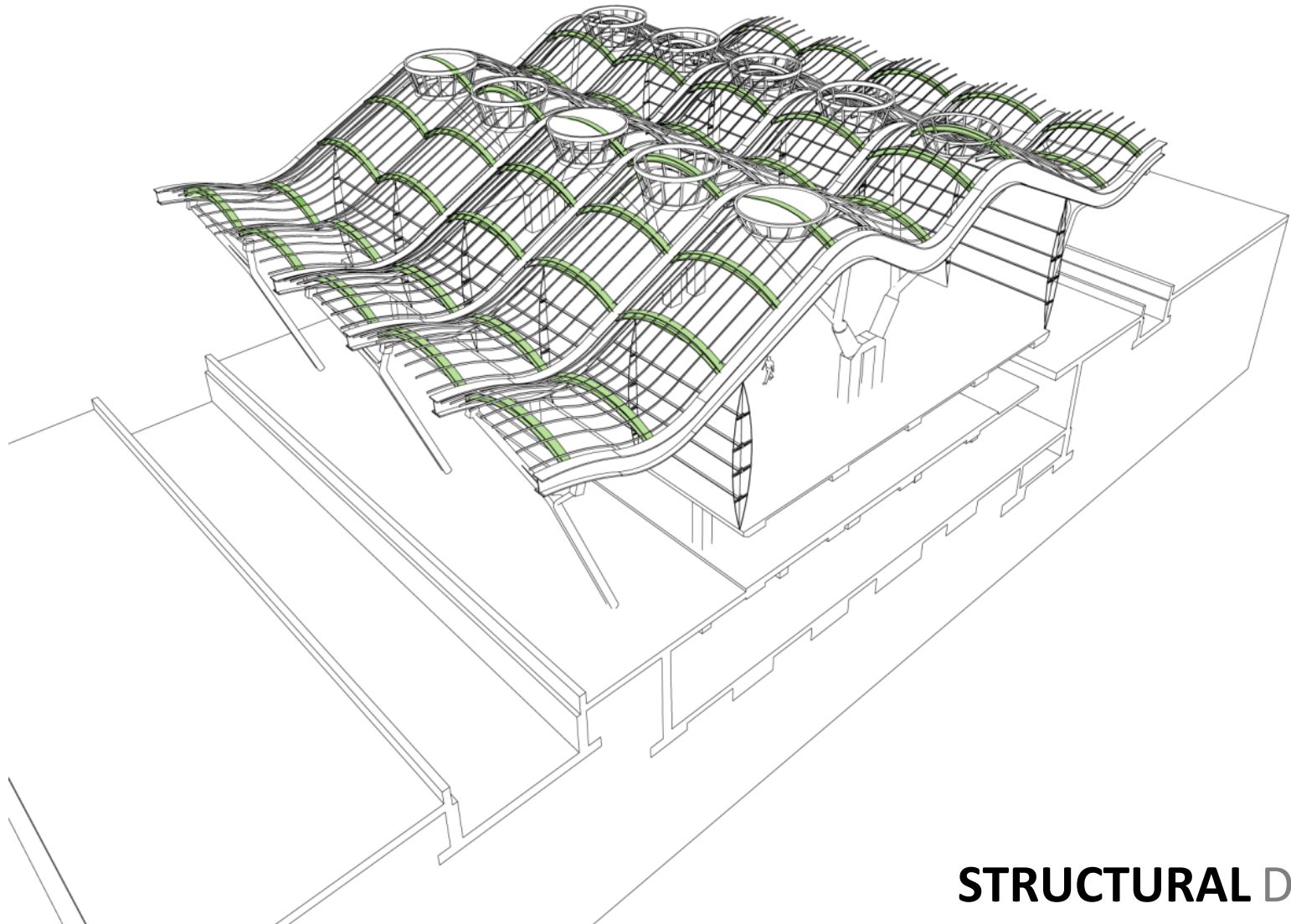
- Inside covered in bamboo
- Spanish limestone paving
- Supported internally on pairs of cantilevered columns





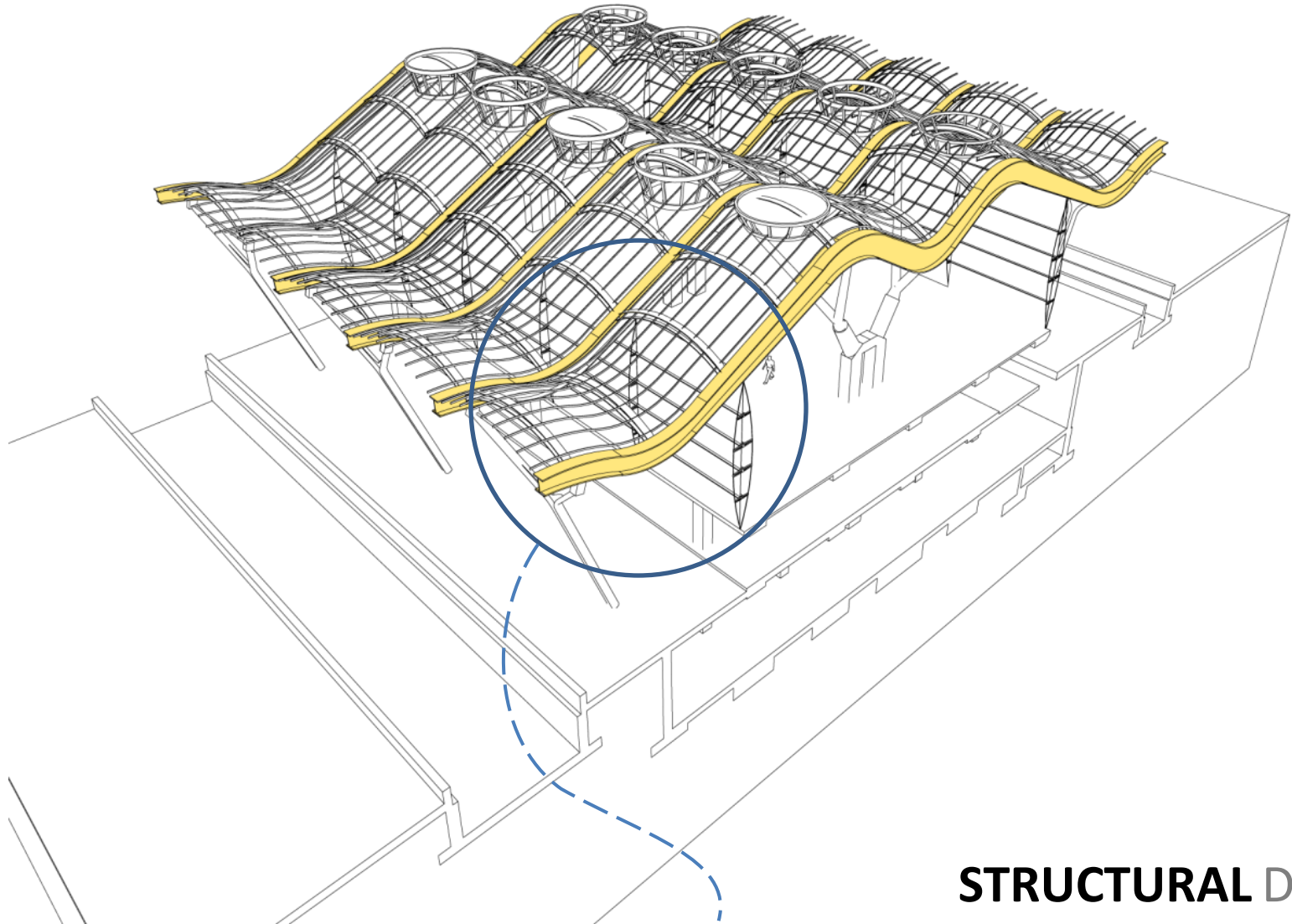
## Secondary Roof structure

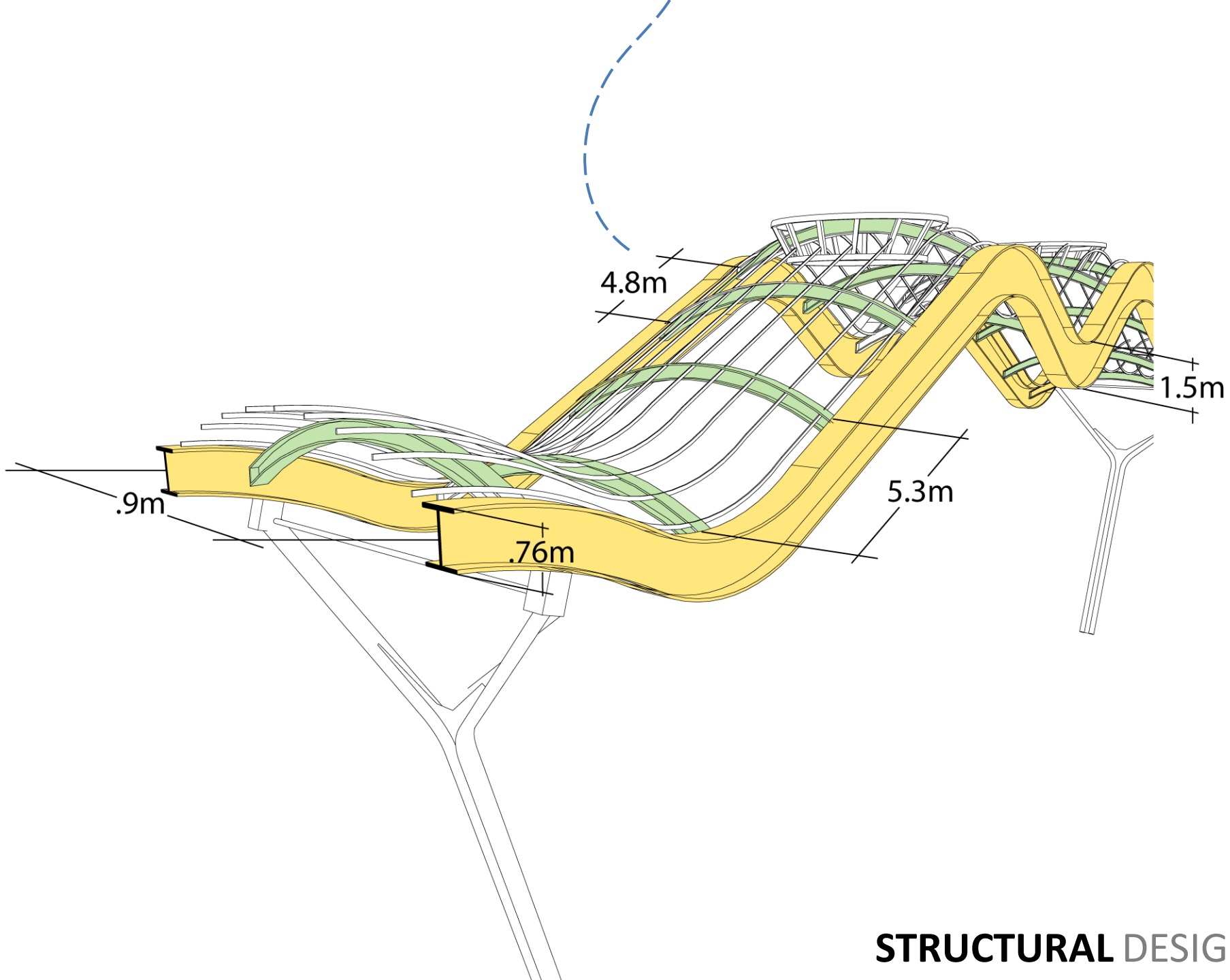
- Arches spaced 9m apart
- Support purlins that run in the same direction as girders



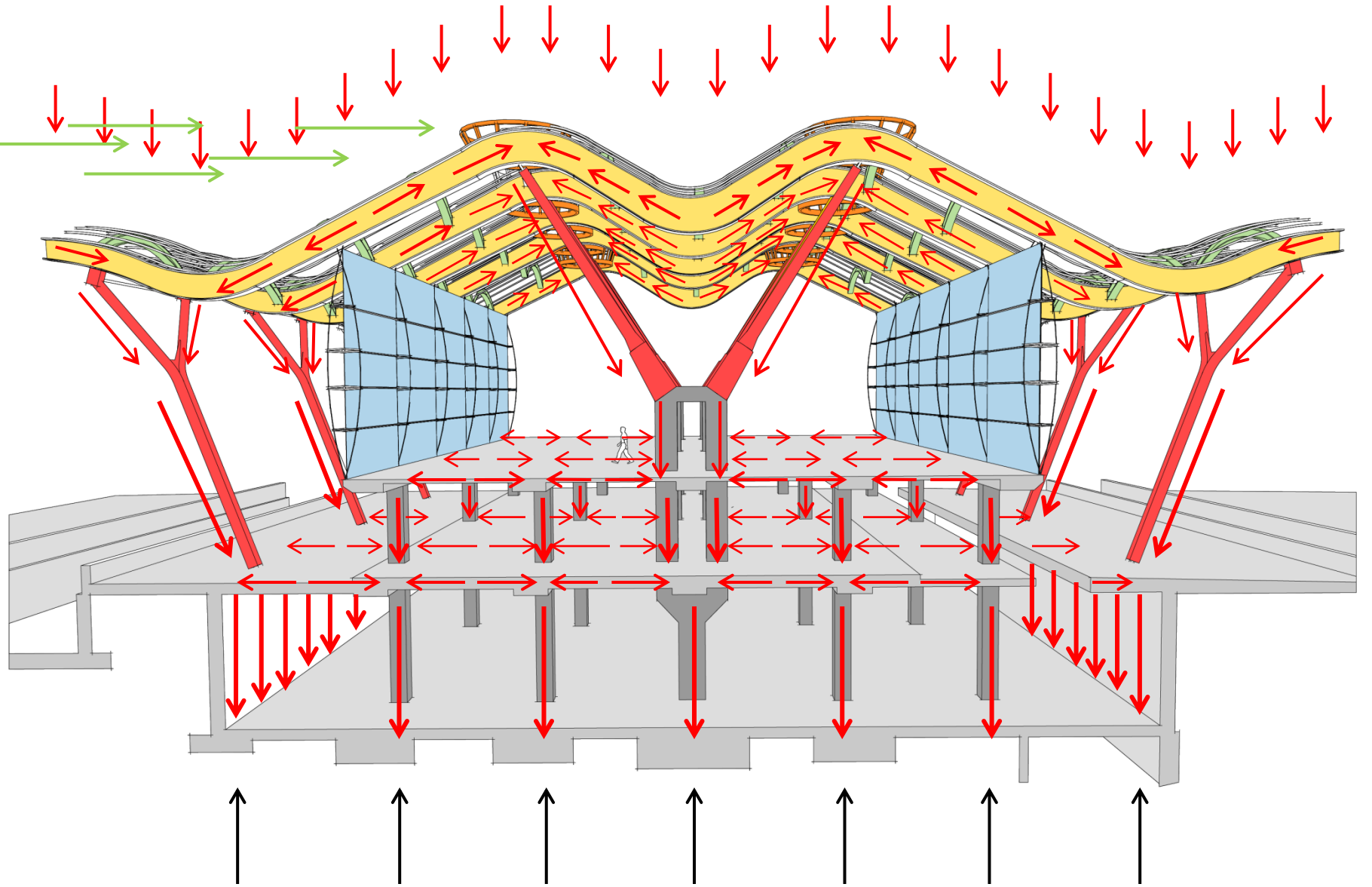
## Primary Roof structure

- Girders 72m long
- Ranges in depth from 1500mm at center to 750mm at tip
- Run parallel to each other (Approx. 9m on center)
- 3 sections bolted together; central “double-S bend and 2 tapered outer sections





**STRUCTURAL DESIGN**



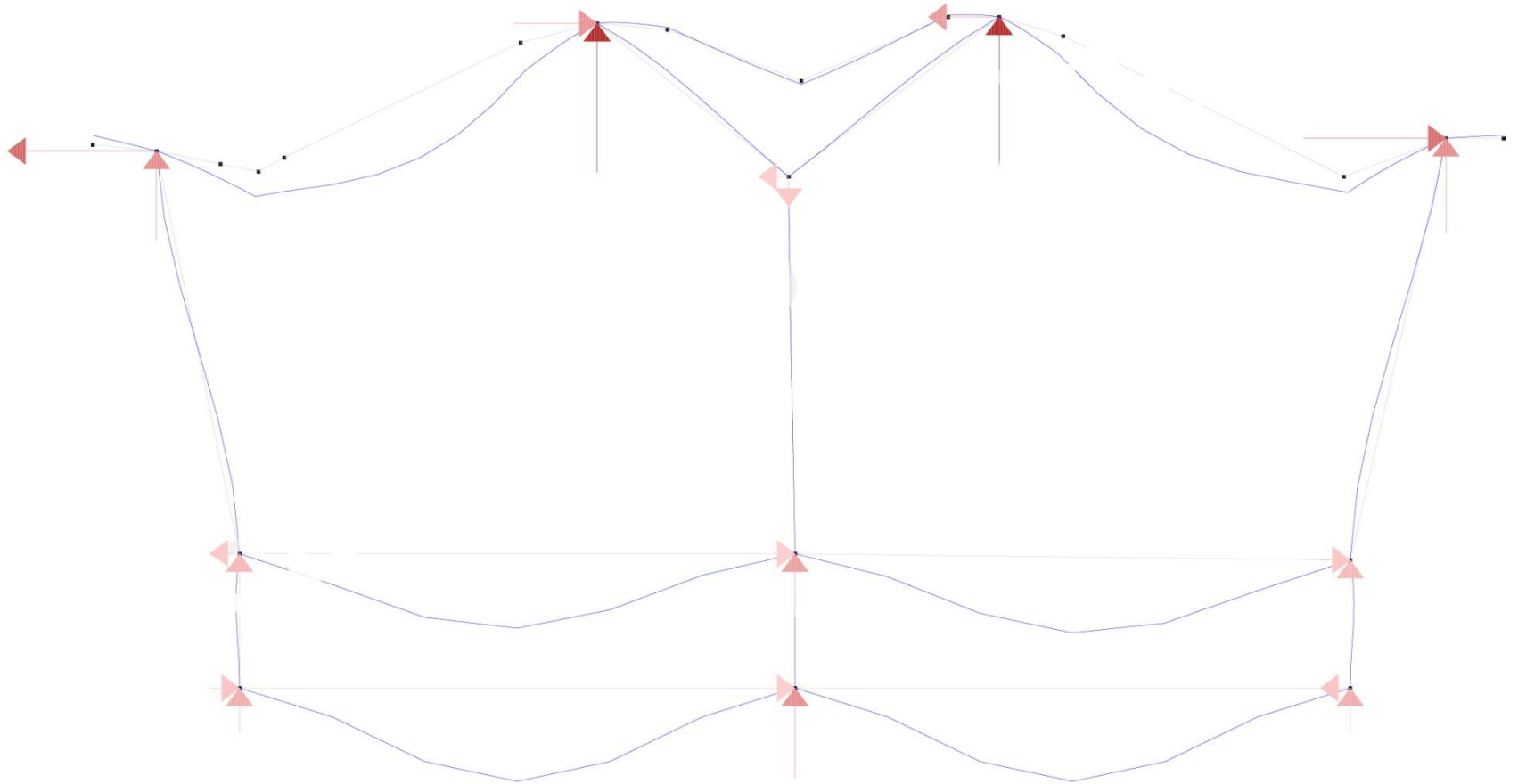
**LOADING** CONDITIONS

## Vertical structure

- Going across there are four columns: 2 central V-shaped and 2 Y-shaped columns at each end supporting the cantilevered roof.
- Central columns are tapered circular hollow steel sections, filled with sand cement grout to provide additional frame stiffness
- Steel casting is used to bolt the base of the tapered columns to a shaped concrete column.
- Outer edges of roof is supported on raking columns at 18m centres
- Stainless steel rods are pre-tensioned to ensure the lateral wind load on glazed elevation doesn't induce compression. Because the building has glazing on both sides, the transverse roof beams are tied down by vertical trusses.

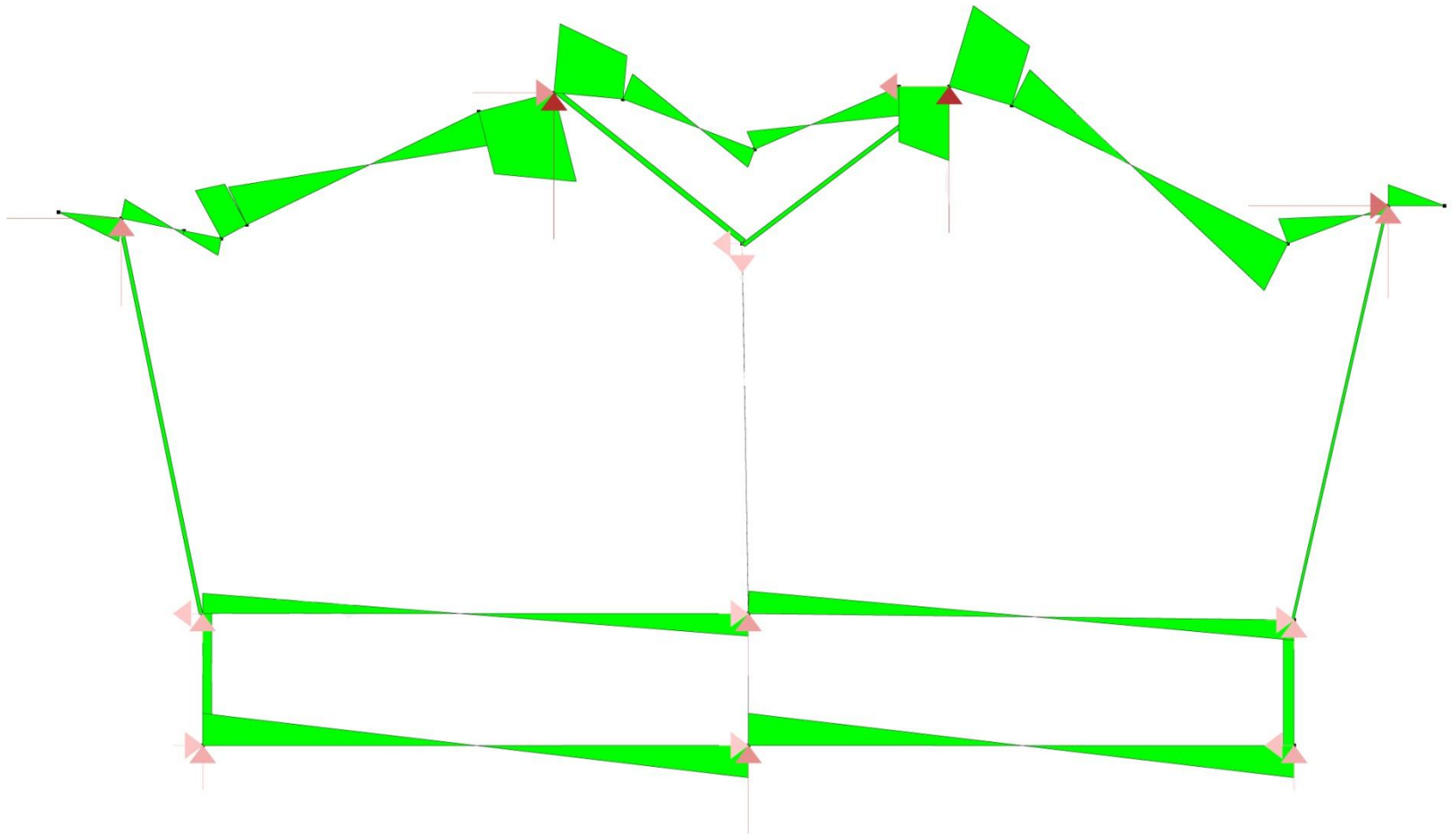


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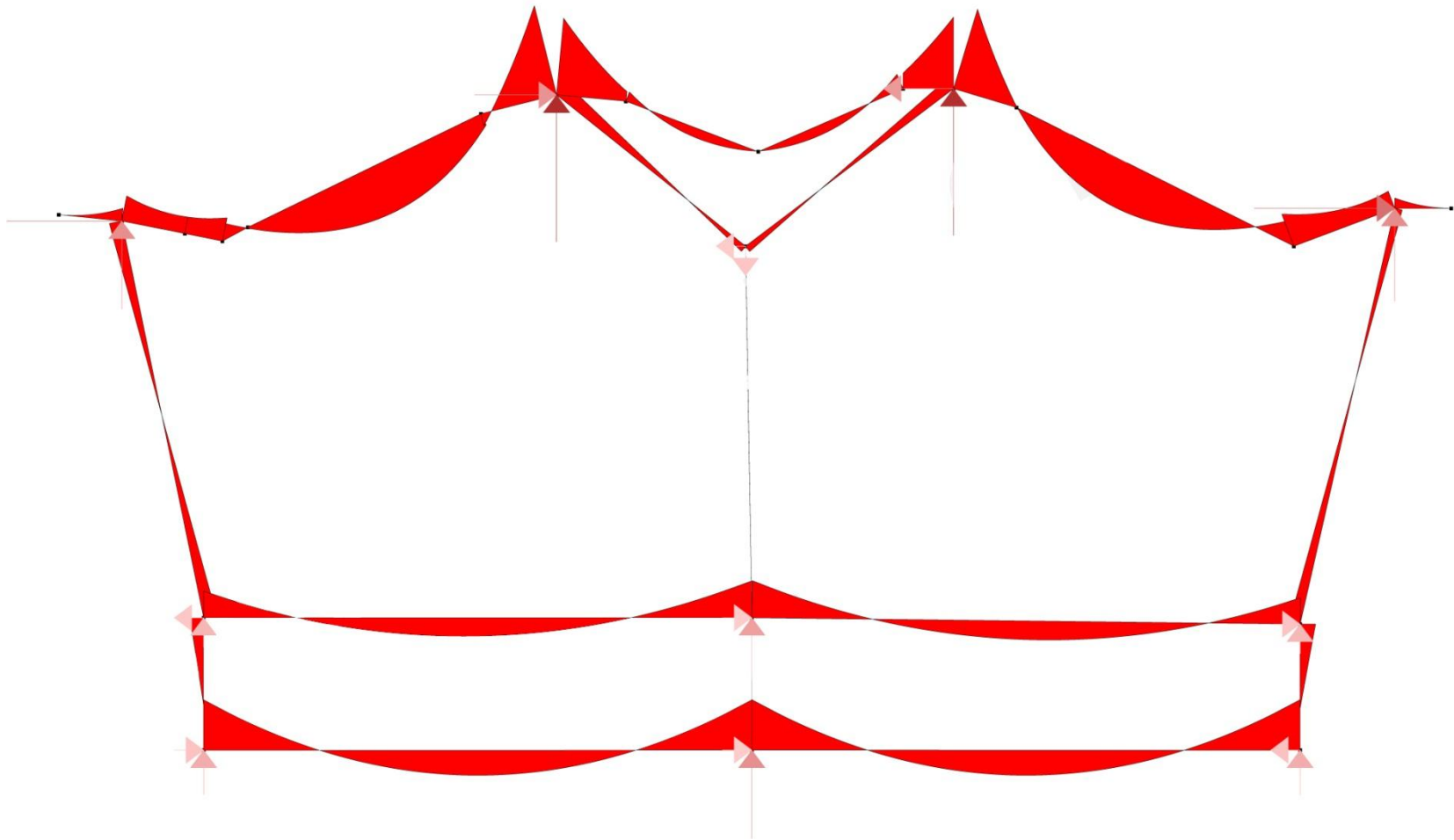
DEFLECTION

**LOADING** CONDITIONS



SHEAR (V)

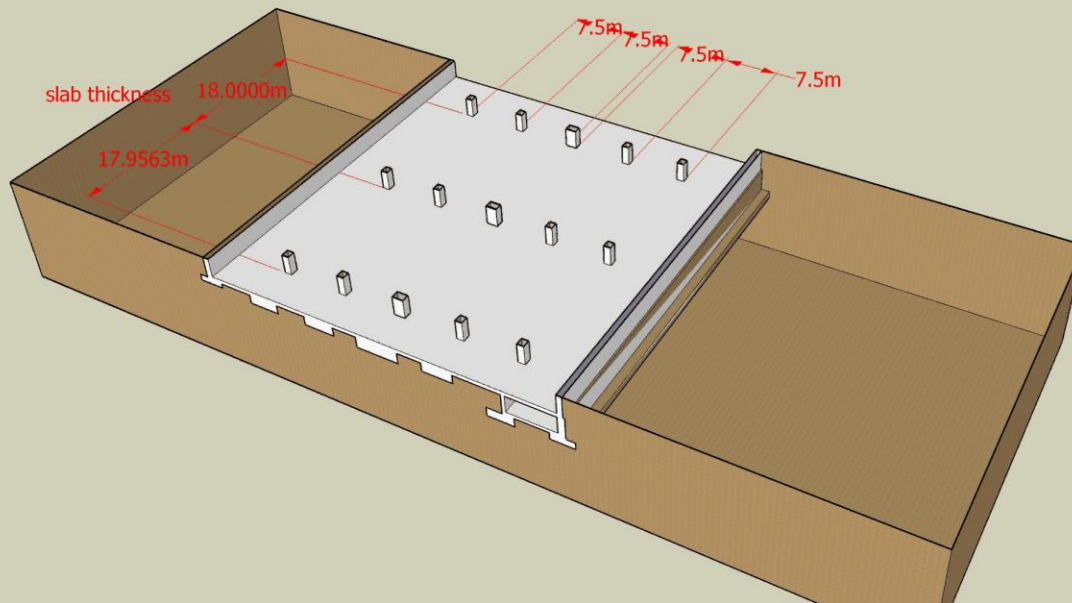
**LOADING** CONDITIONS



MOMENT (M)

LOADING CONDITIONS





**THANK YOU**

Ripsime Hovsepian  
Anahid Sargsyan  
Alfred Sierra  
Salud Sierra