НЕСУЩИЕ СИСТЕМЫ

Aluminum grid shell structures and systems for free- from envelopes

Introduction. Grid shell structures

Background

- Think-wall rigid space frame structures of curved shape;
- Vladimir Shukhov – end of XIX century – pioneered gridshells (1896 All-Russia industrial and art exhibition (RIAE));
- End of XX century – wide spread of sophisticated free- form grid shells;

the British Museum courtyard, covered with grid shell

Tower from RIAE bought by Nechaev-Maltsov and moved to Polibino, Russia)

Introduction. Grid shell structures

Skylights

- Large-span shells without supporting structures (self-supporting property of the strucutre);

VEER MALL, Ekaterinburg, Russia

Introduction. Grid shell structures

Facades

- Beg of 2000 – parametric design as a brand new architectural style;
- New tasks combining facade utilitarian function (building protection) and artistic function (building as “objets d’art”);

Supporting Systems LLC

Company profile:

2002 – setting up a company

- Specialization:
  - curtain wall façade installation;
  - manufacturing (certified Schüco partner);

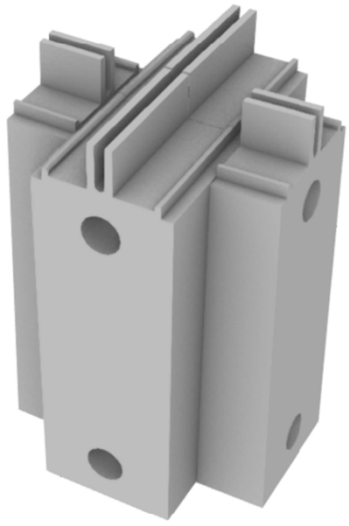
2007 – specialization change:

- engineering (parametric design);
- manufacturing (free form space-frame systems and structures (useful model patent №72708);

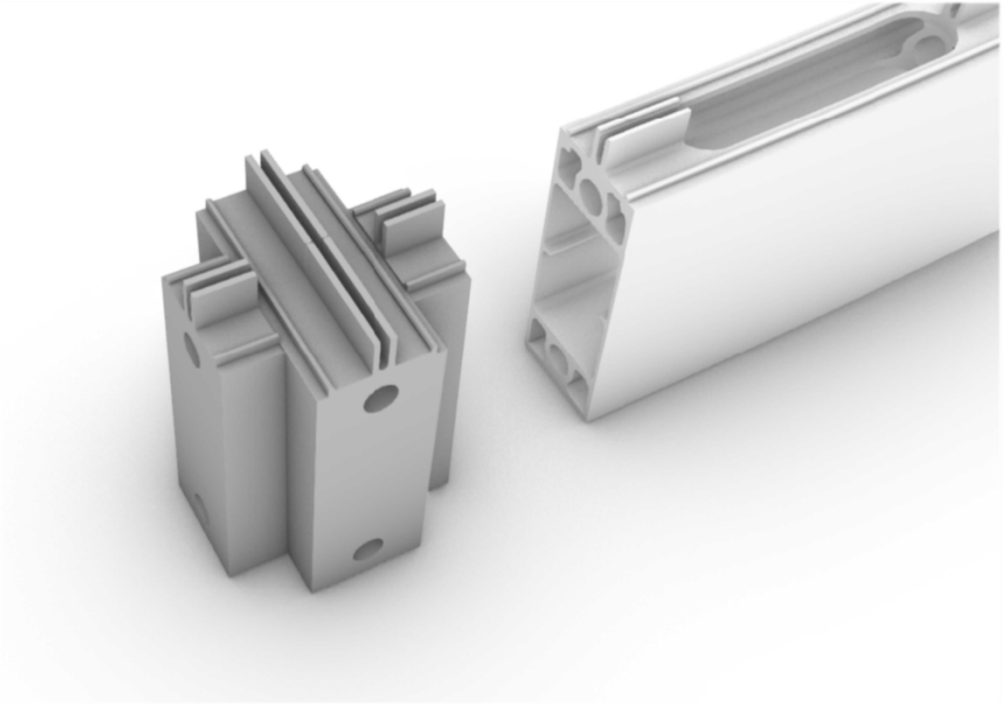
Technical Description

Single layer system

- Self- supporting grid shell structure «SpaceStructure»;
- All elements – 100% prefabricated;
- Material – high tensile aluminum alloy (AW-6082T6 and AW-2024T3);



Node

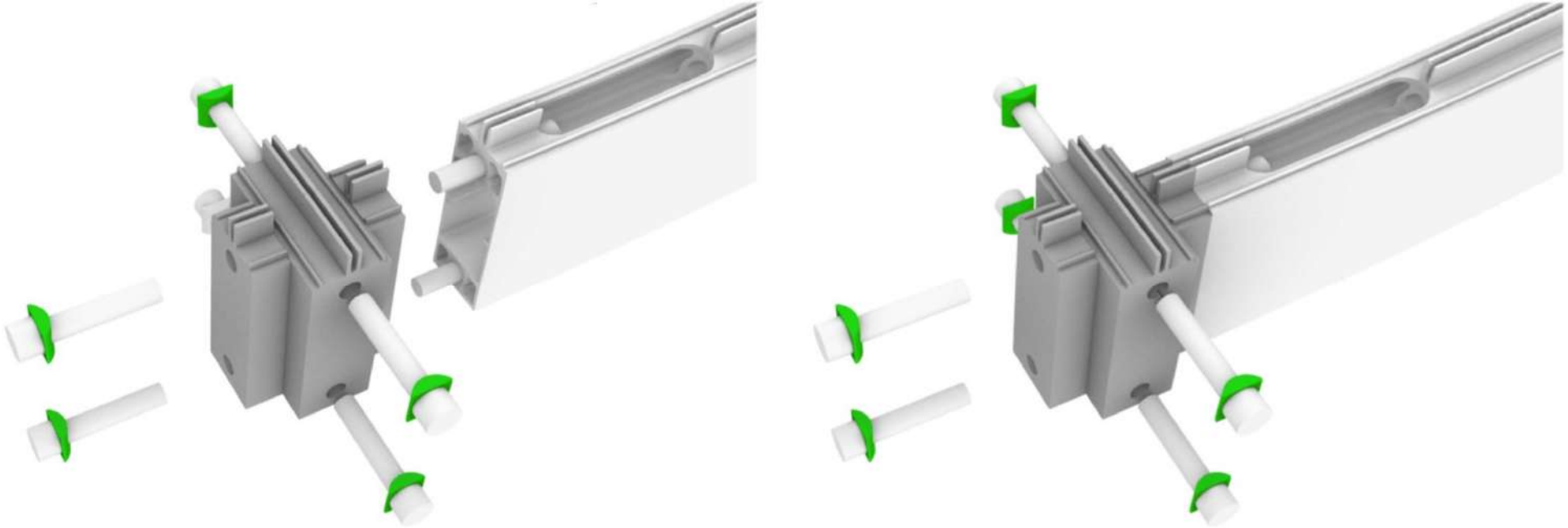


Tube (Profile)

Technical Description

Single layer system

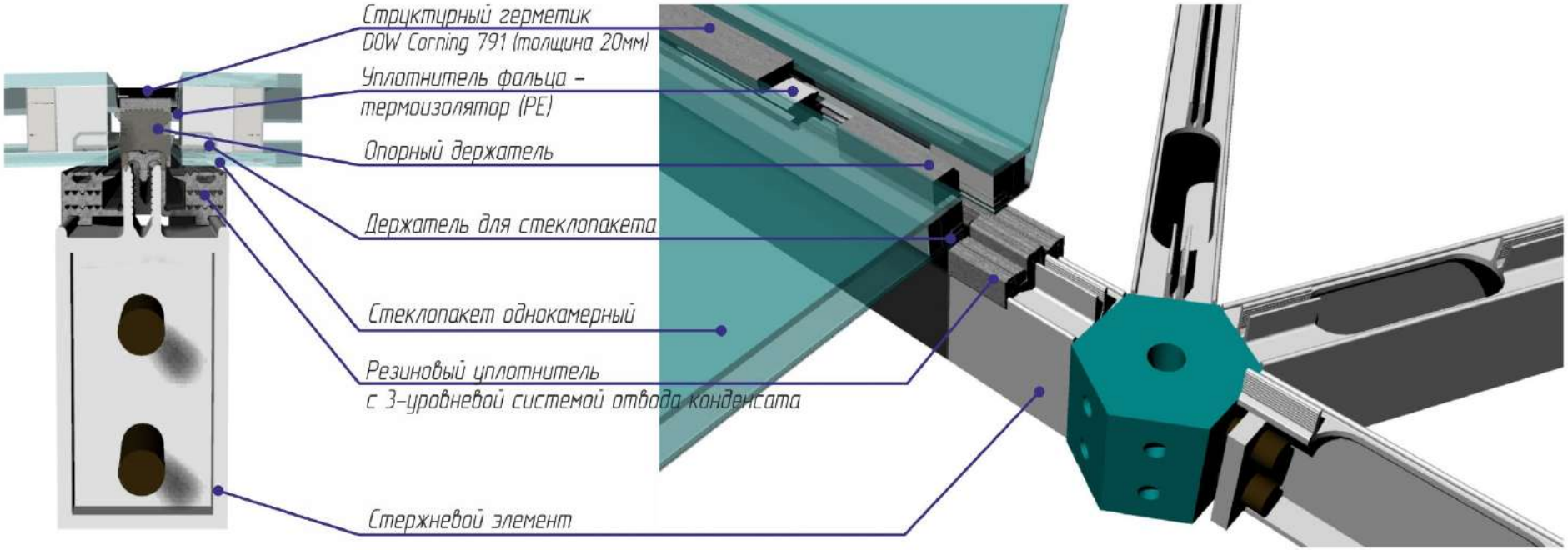
- Self- supporting grid shell structure «SpaceStructure»;
- All elements – 100% prefabricated;
- Material – high tensile aluminum alloy (AW-6082T6 and AW-2024T3);
- Connection – bolted, stainless steel bolts A2-70 DIN 912;
- Connection without welding – high manufacturing and erection speed;



Bolted connection

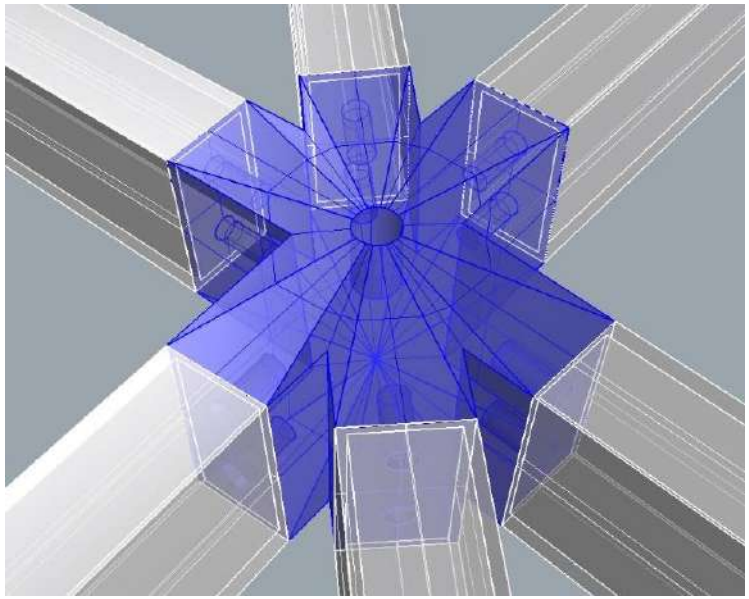
Technical Description
Gasket

- EPDM gasket (2- or 3-layer) installed directly on the aluminum structure;
- Integrated in aluminum profiles;
- Certified solution with gaskets supplied by Schüco and Raico;
- Structural glazing – concealed fixing of glass units;

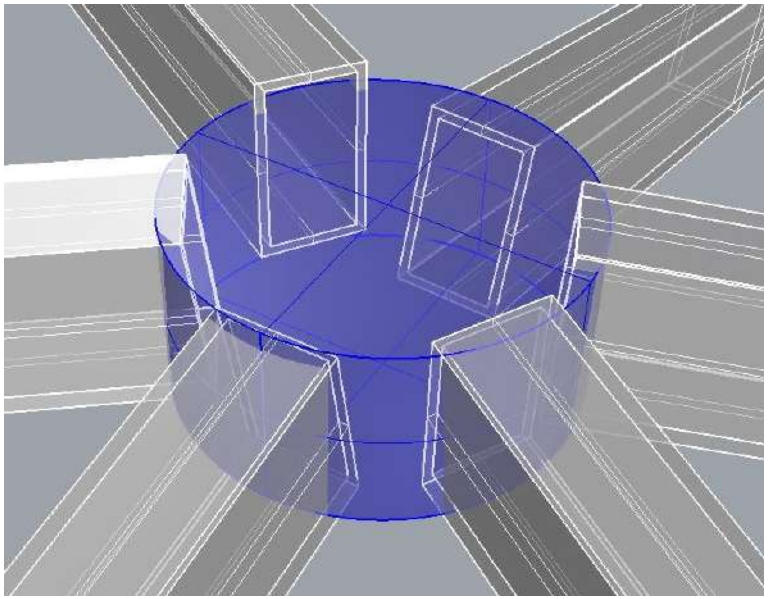


High tensile aluminum alloys solution advantages over steel

- High corrosion resistance;
- Low dead load (important in historical buildings reconstruction);
- Strong visual appearance;
  - Anodized or powder-coated surface;
  - Nodal element additionally processed – “Star”- node;
  - EPDM gasket comprehensive fixation;



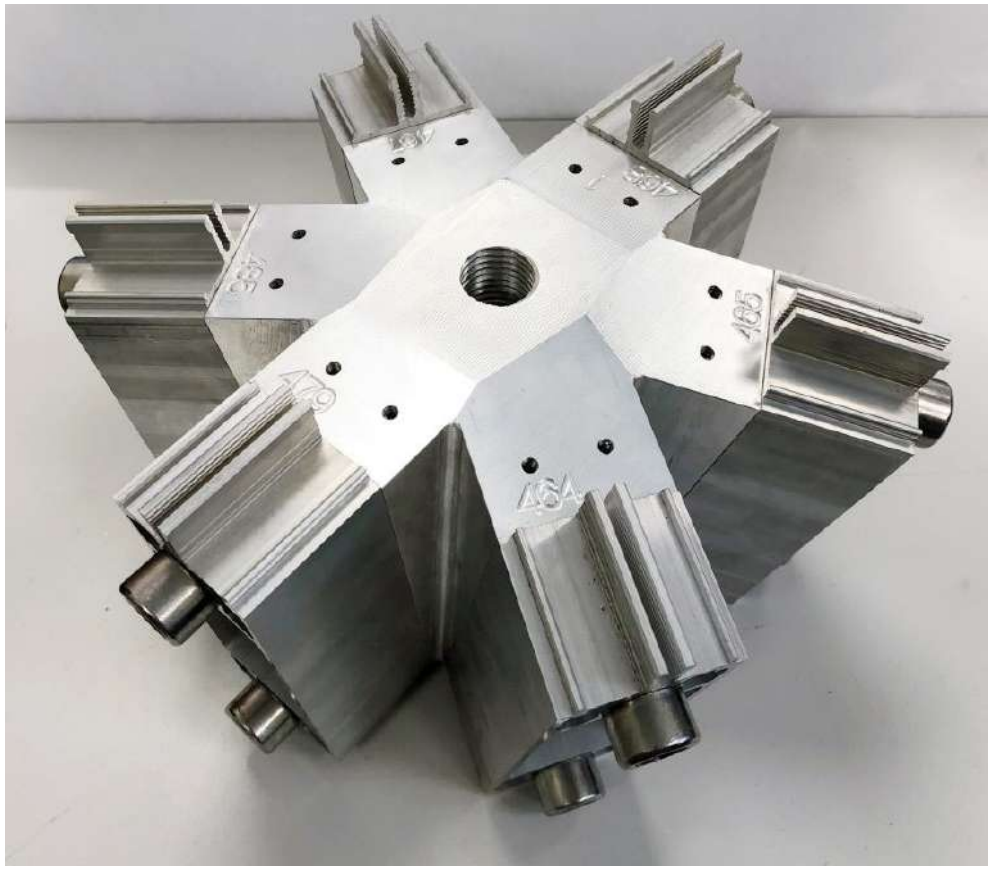
Star- node



Cylinder node

High tensile aluminum alloys solution advantages over steel

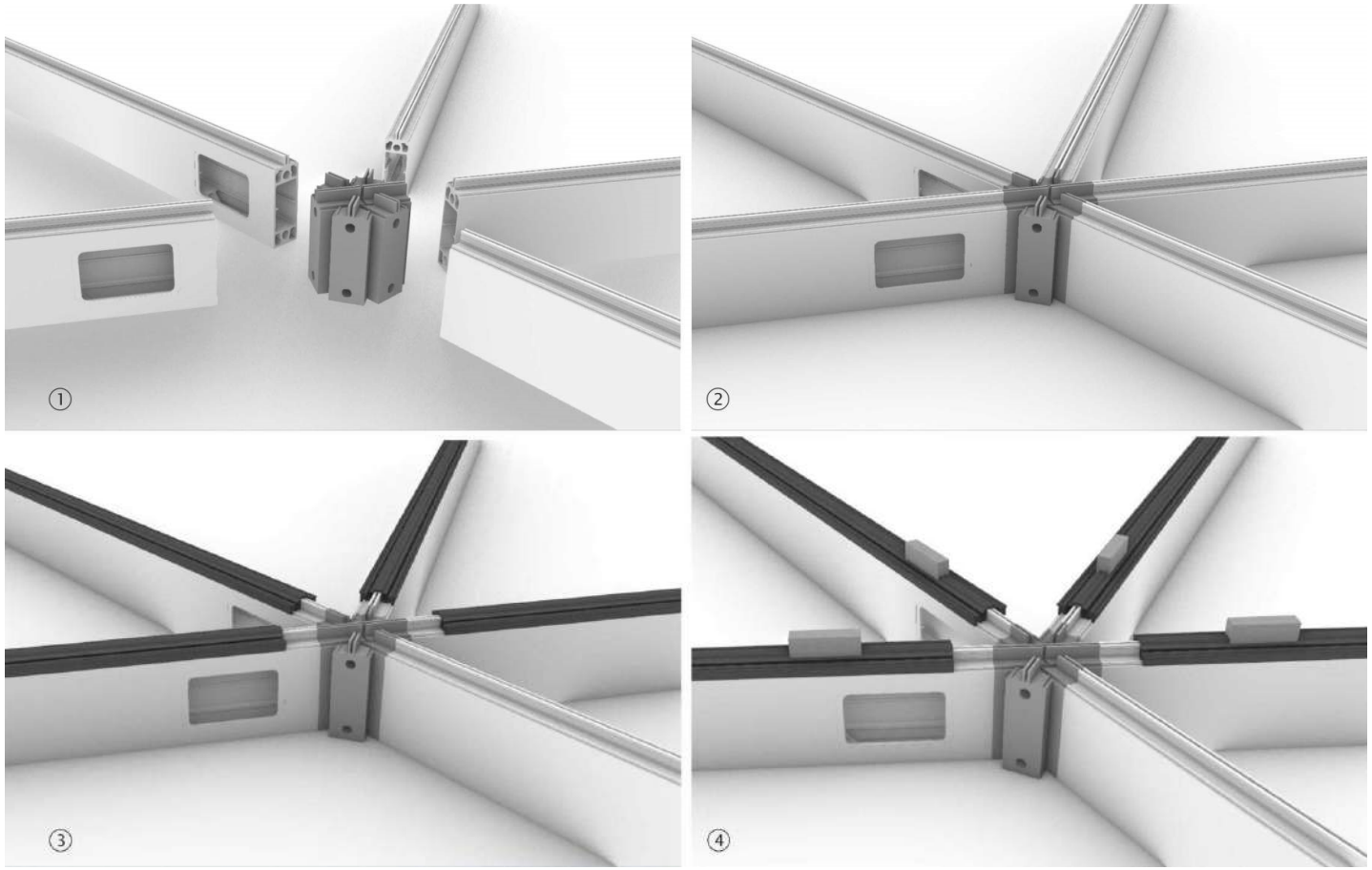
- Material – high tensile aluminum alloy (EN AW 6082T6);
- Top surface additional processing to avoid EPDM gasket dipping (comprehensive fixation);



Technical Description

Single layer system

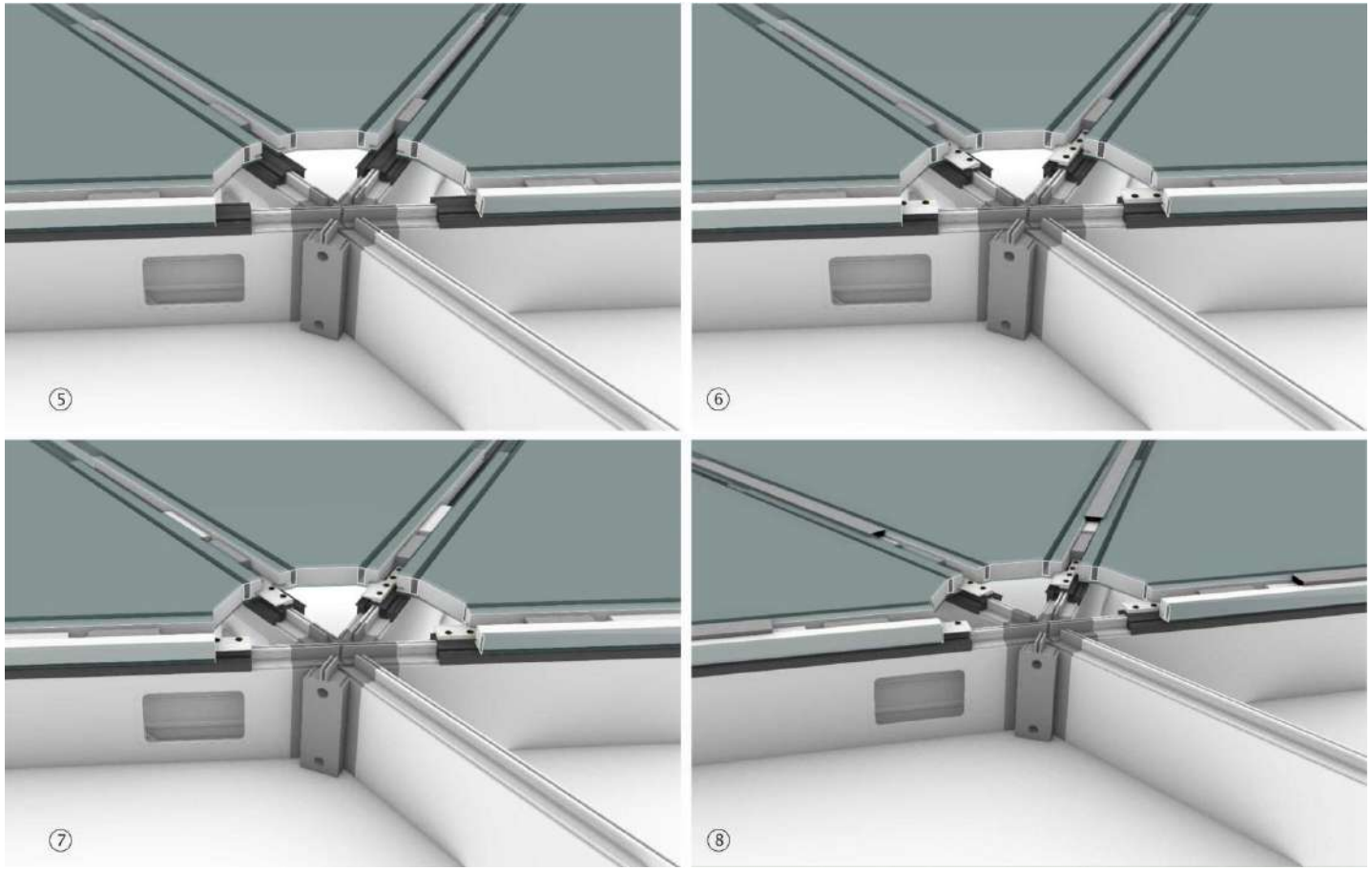
- Self- supporting grid shell structure «SpaceStructure»;
- Material – high tensile aluminum alloy (AW-6082T6 and AW-2024T3);
- EPDM gasket (2- or 3-layer) installed directly on the structure;



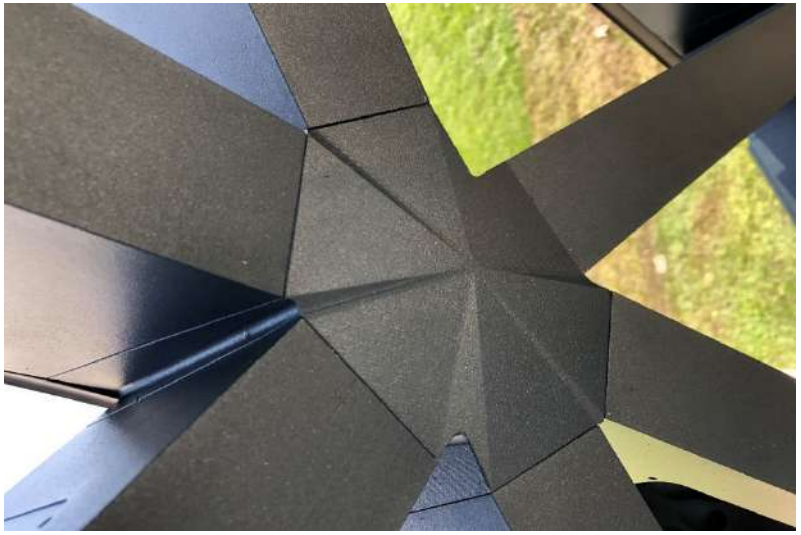
Technical Description

Single layer system

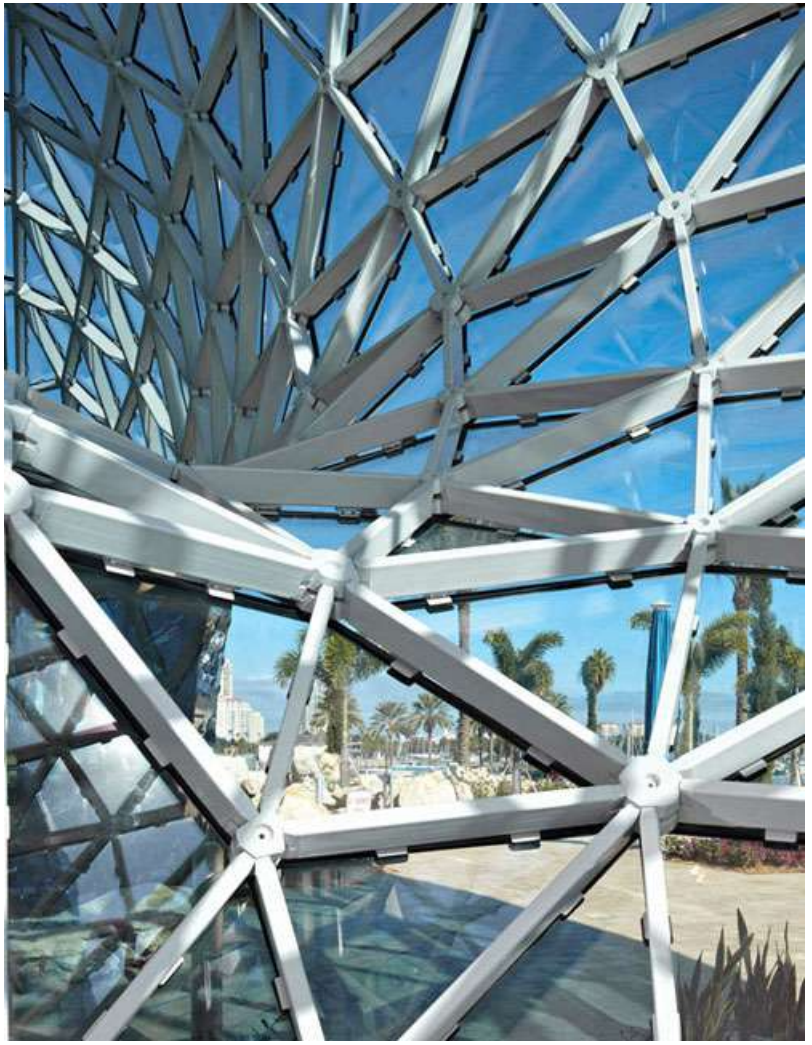
- Glass units installed directly on the structure;
- Fast and easy mounting;



Free form construction system
Visual appearance



Star- node (aluminum)

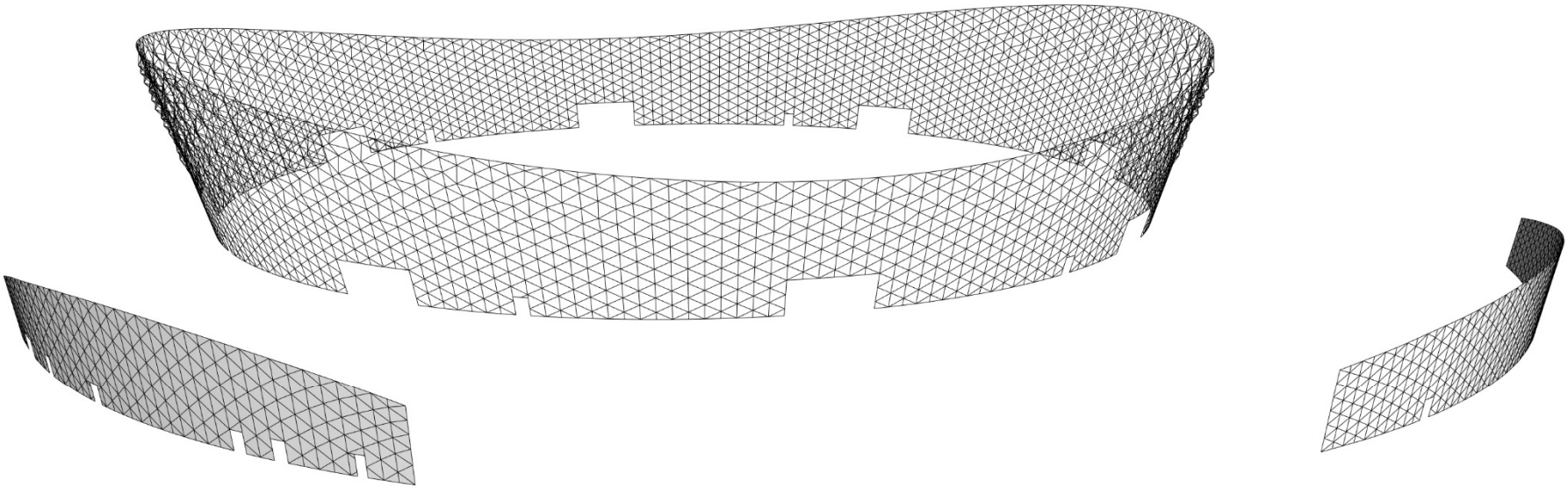


Cylinder node (steel)

Design

Parametric design

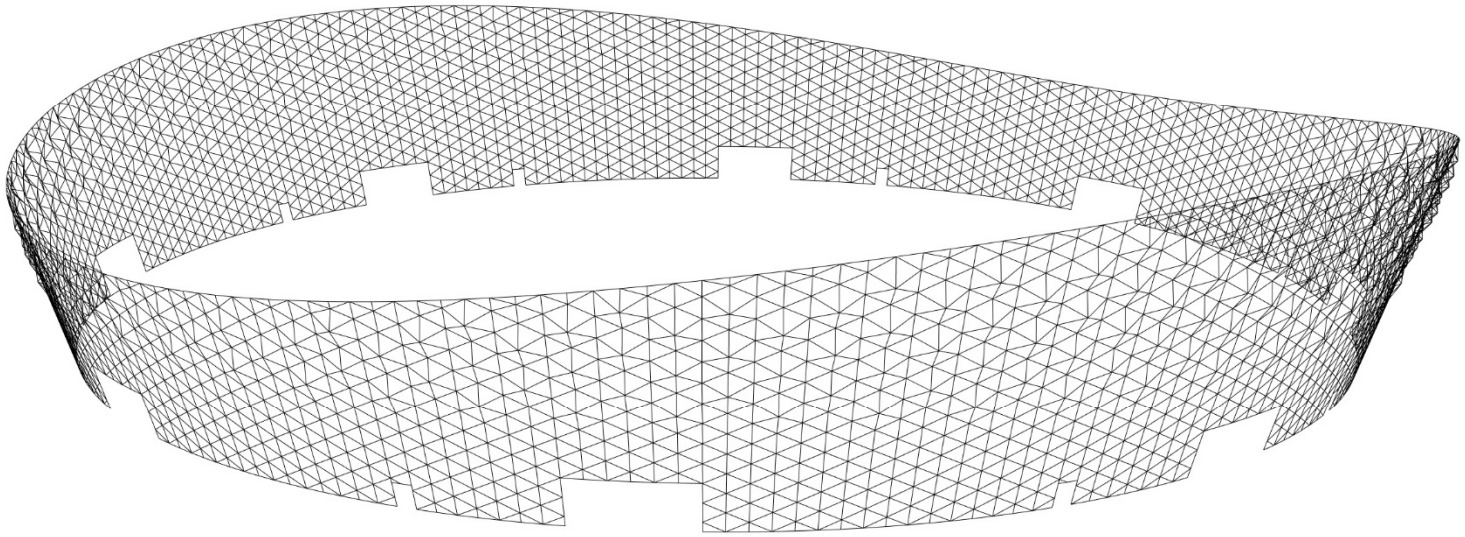
- Parametric models in Rhinoceros/ Grasshopper software generation;



Design

Parametric design

- Parametric models in Rhinoceros/ Grasshopper software generation;



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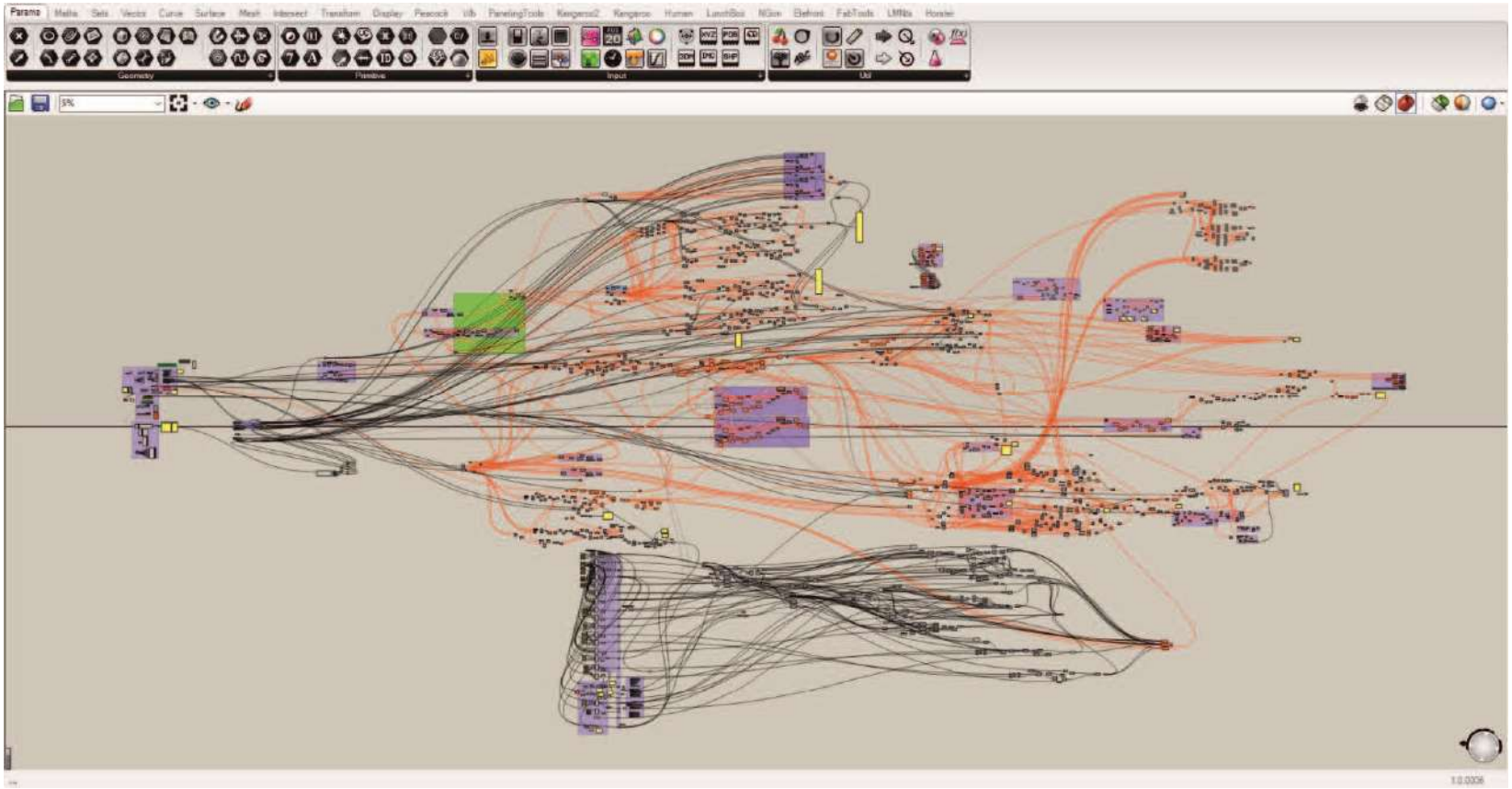
Design

Parametric design

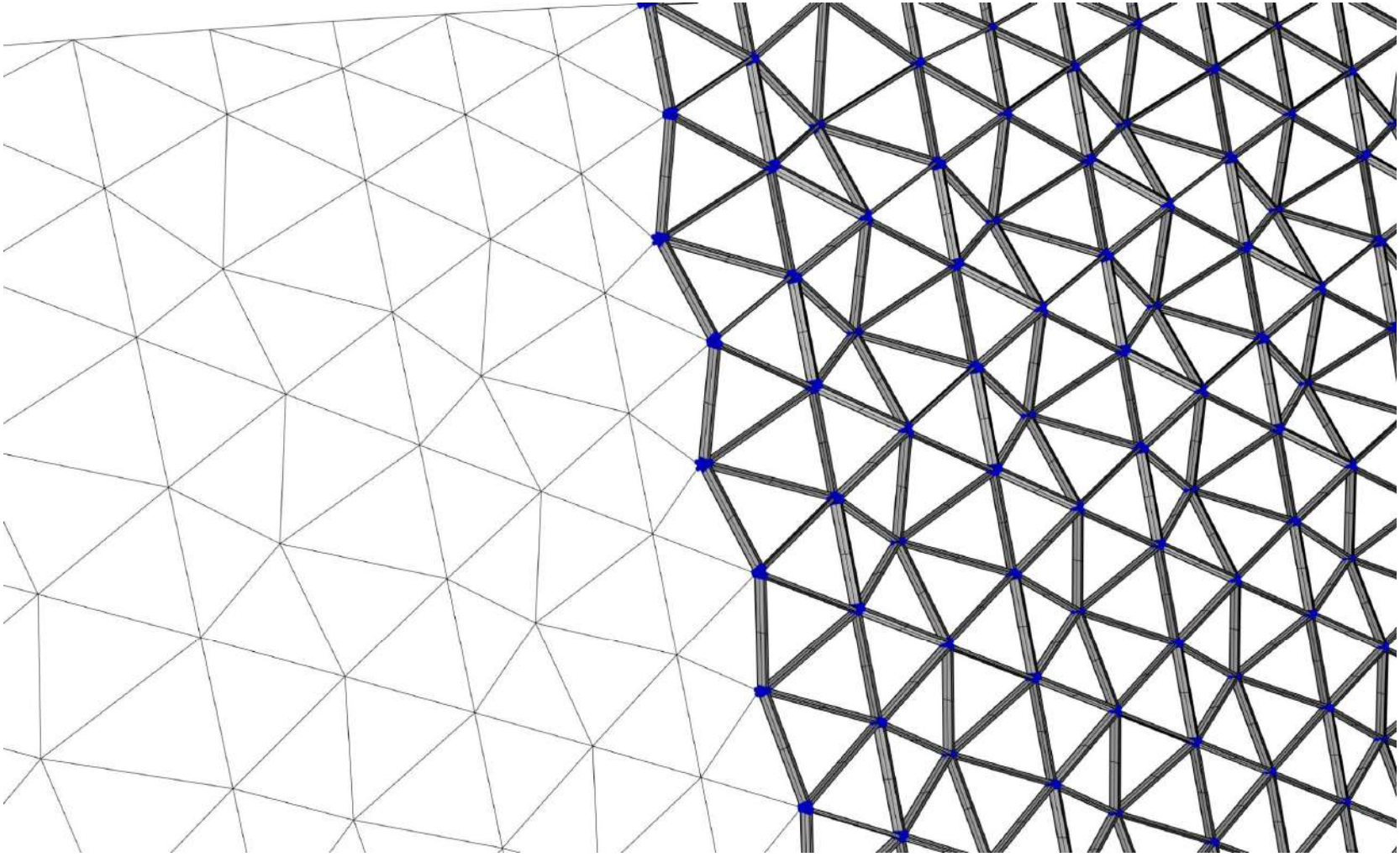
- Easy to introduce changes in the code;
- highly automated logic;



Design

Parametric design

- Detailed design model generation;



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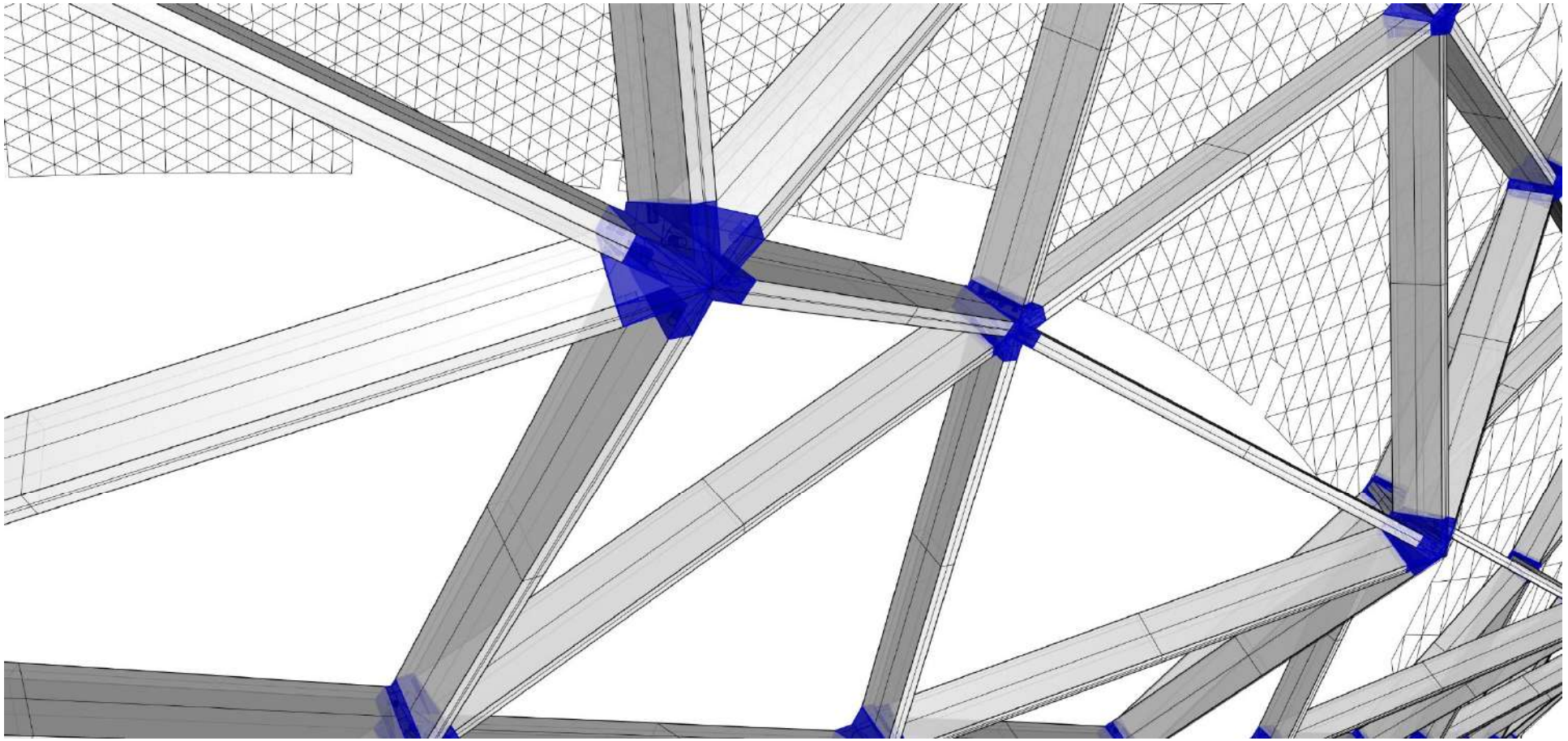

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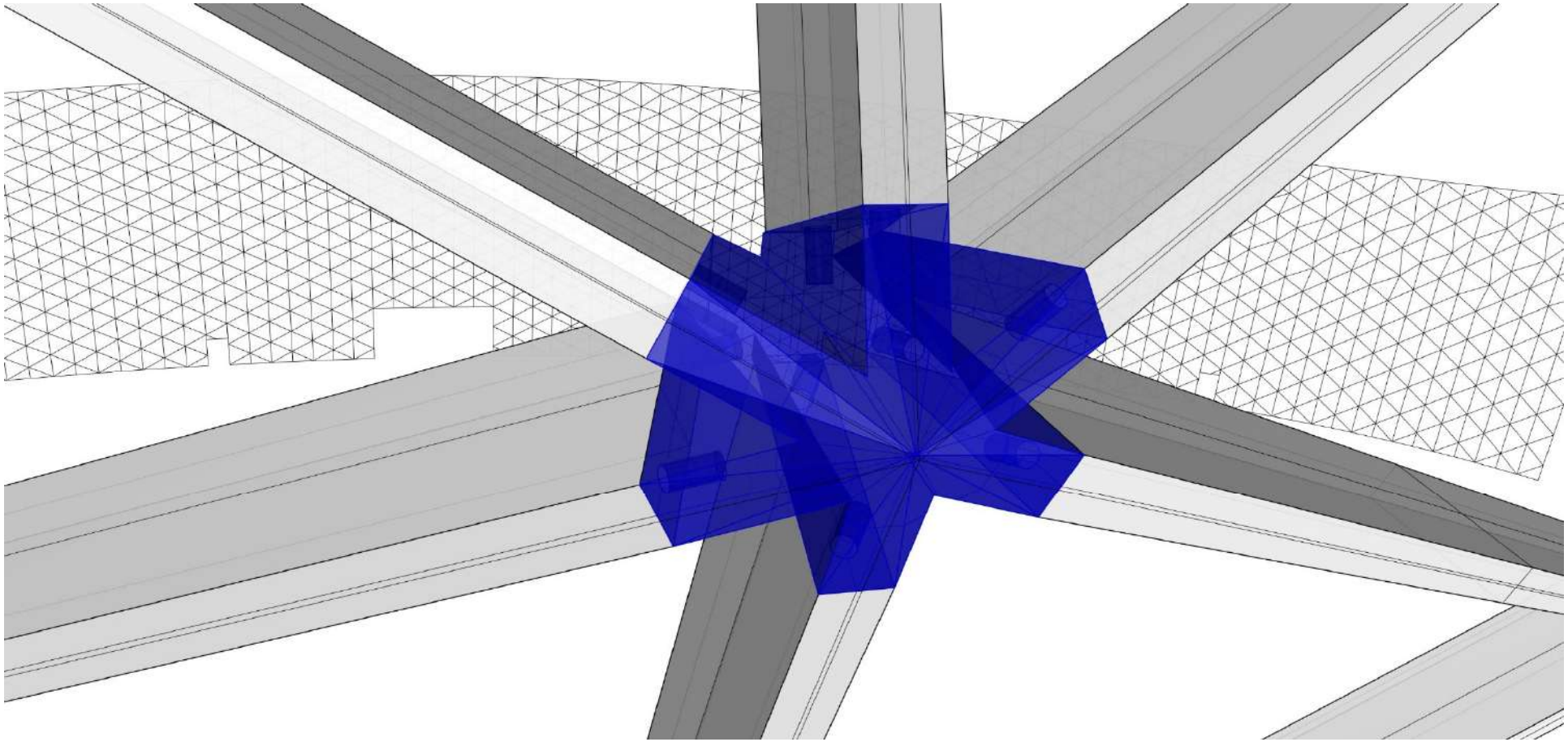

Design

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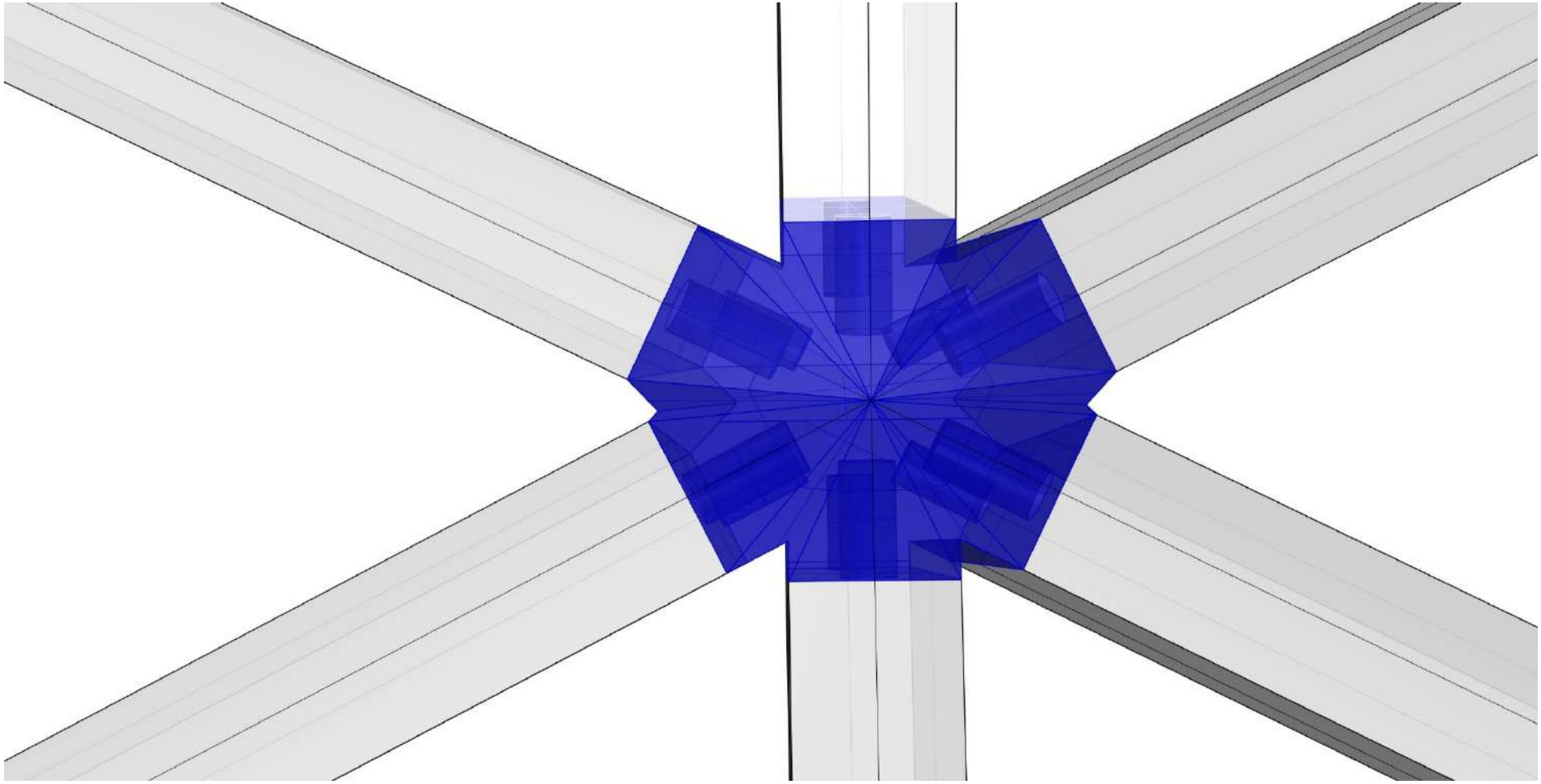
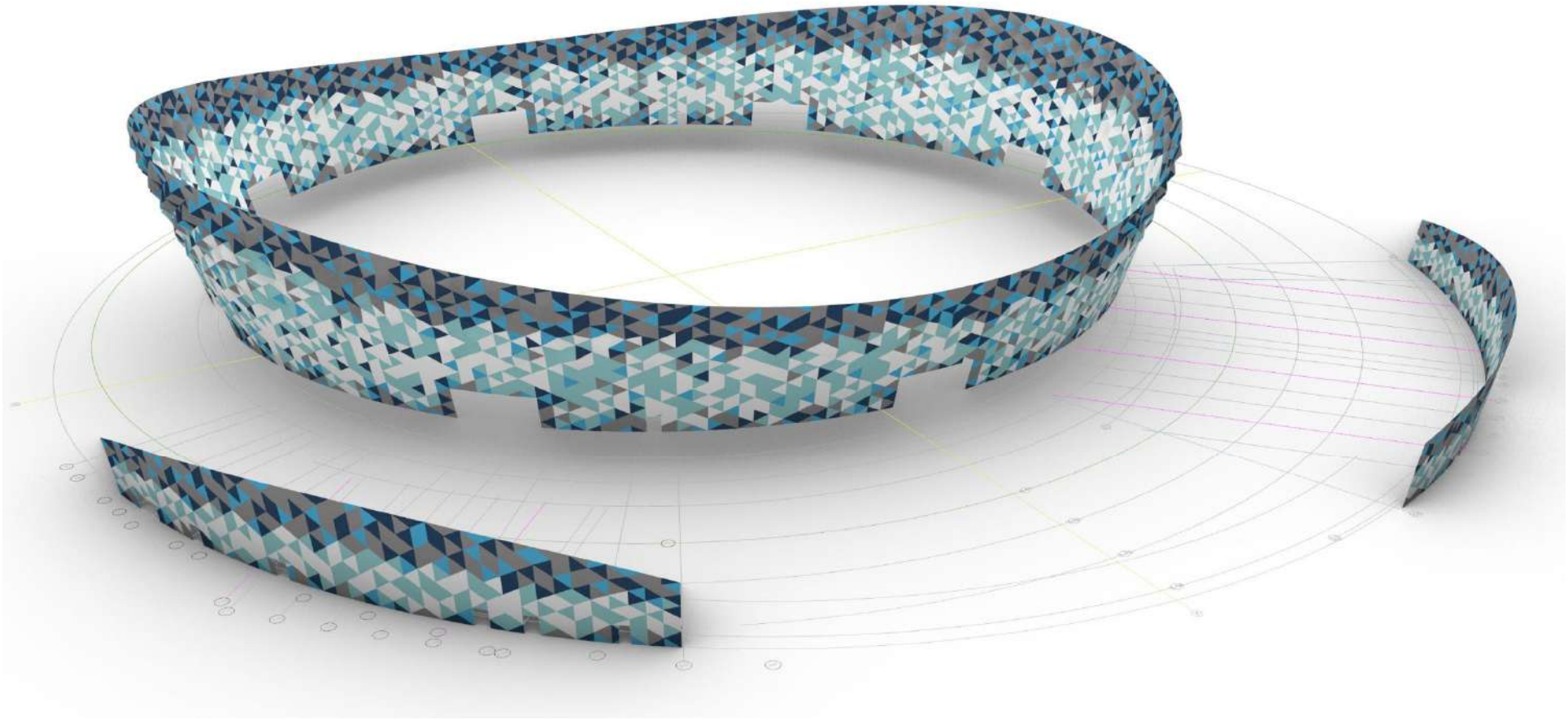


Design

Parametric design

- Glass units specification automatically generated from the detailed design model;



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Design

Parametric design

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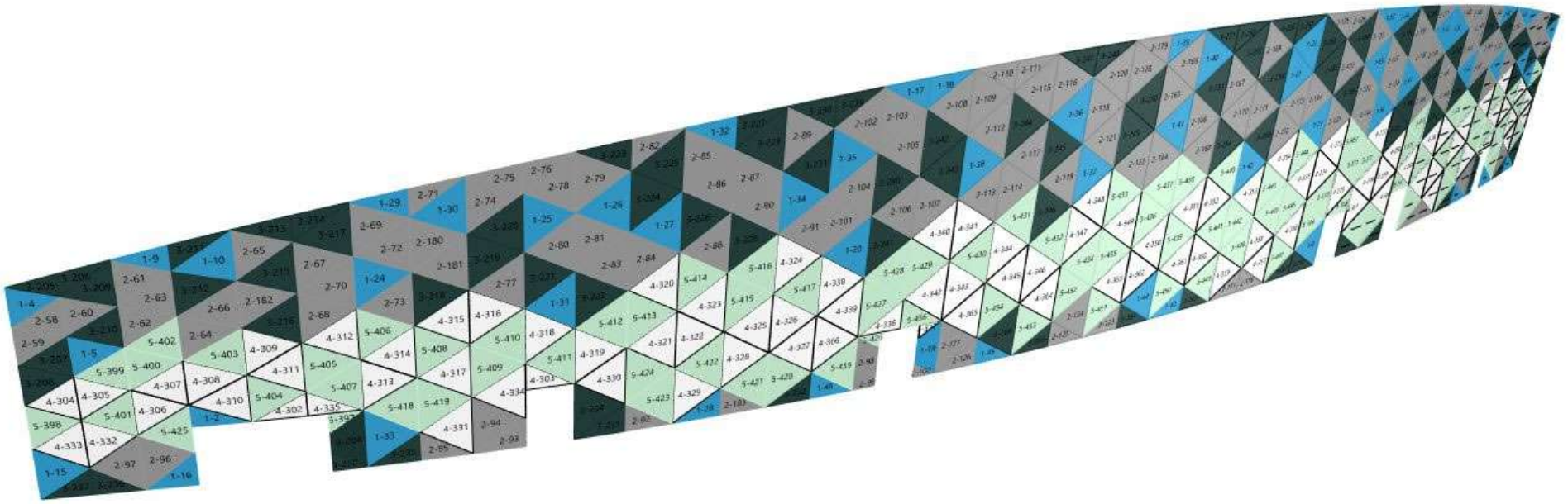

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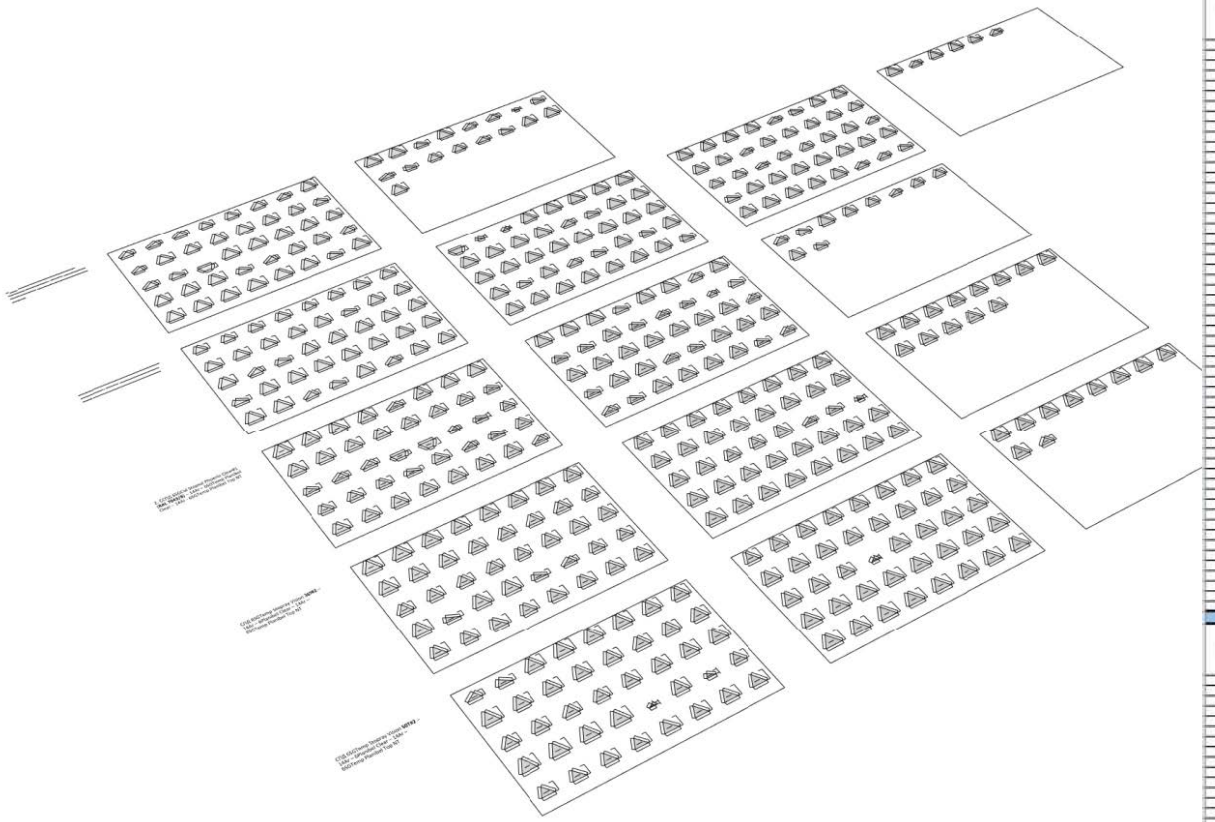
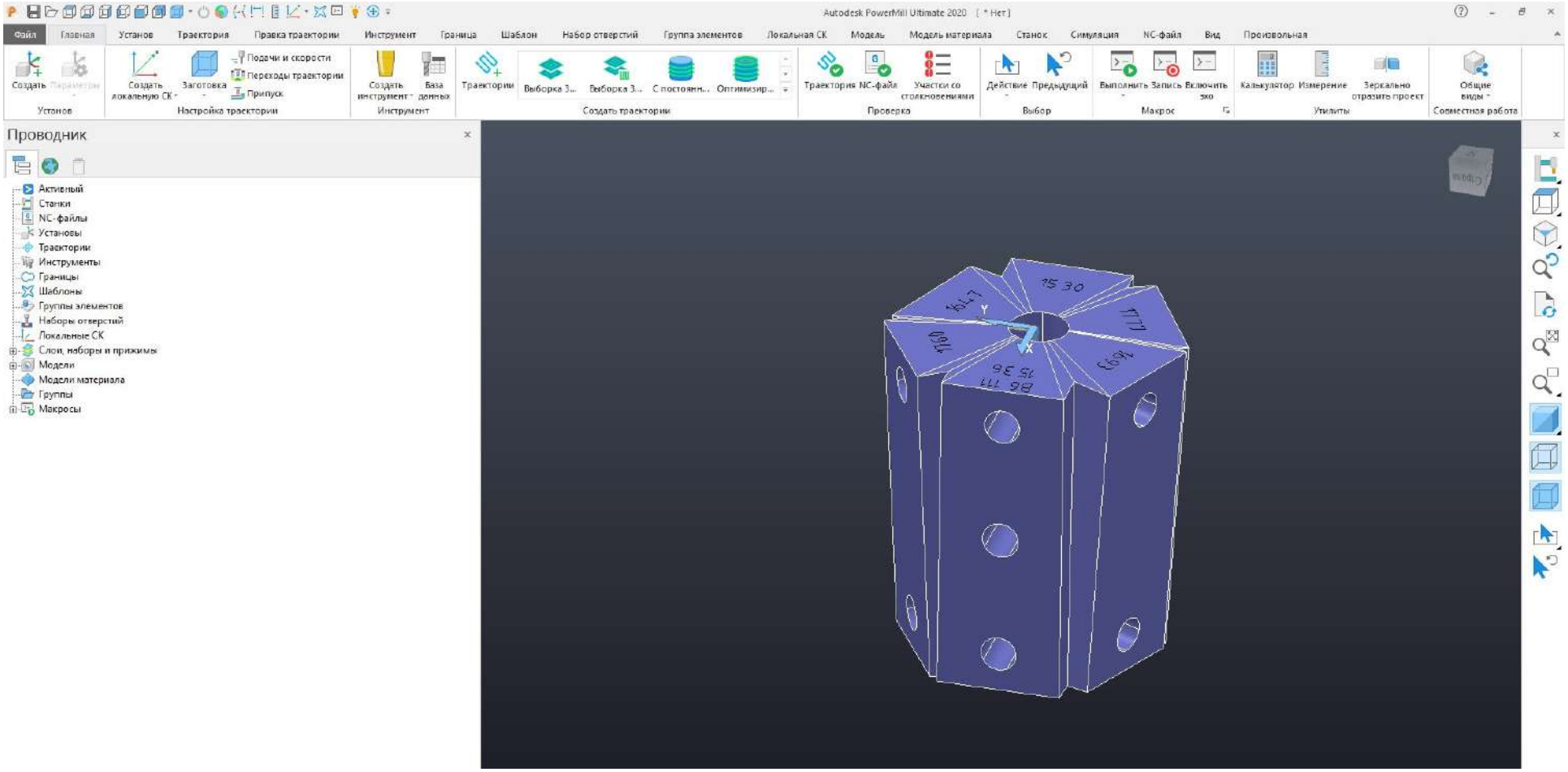


Design

Detailed design model transfer from Rhinoceros to PowerMILL

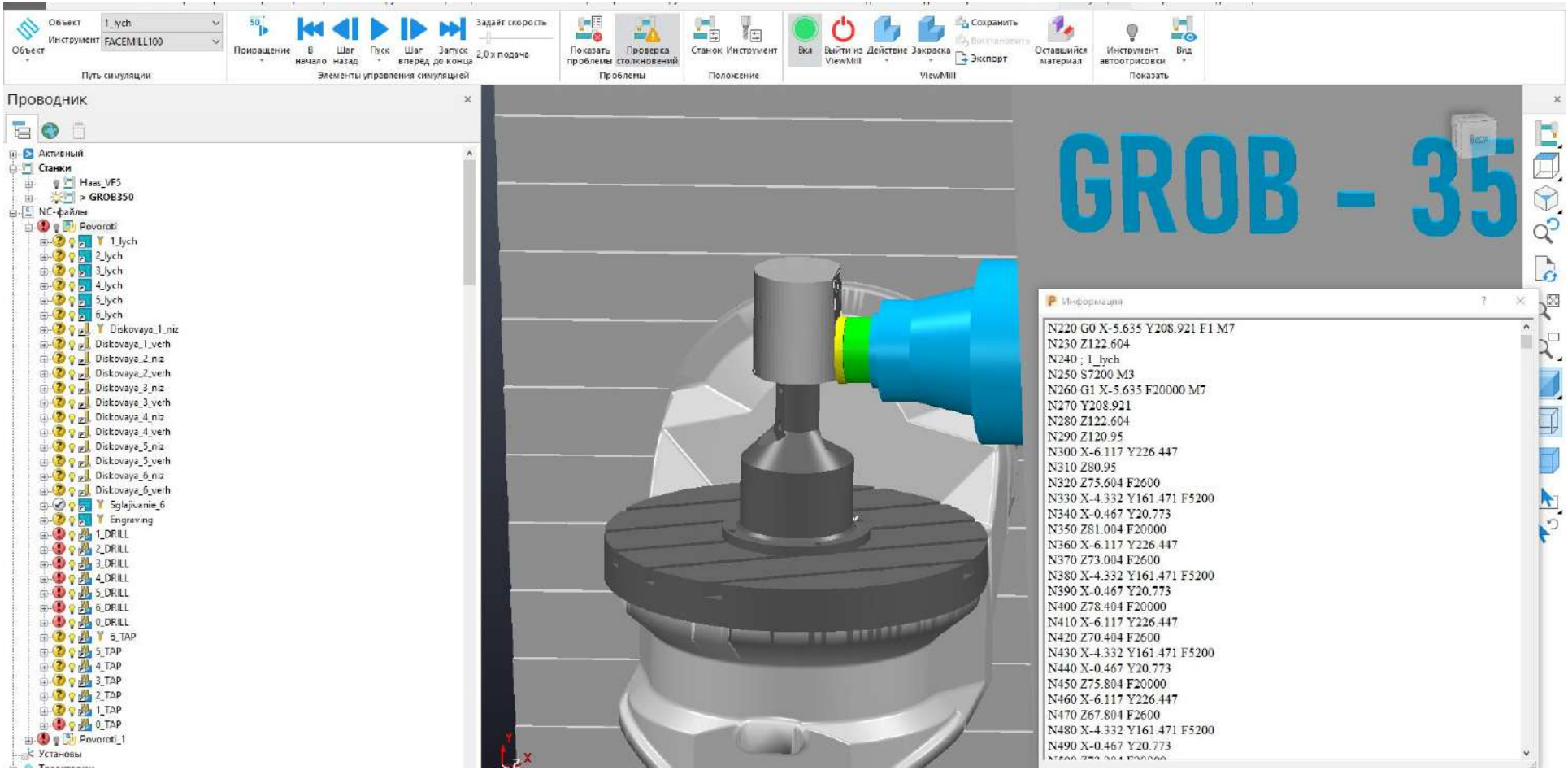
- CNC machinery automatic coding;
- Nodal element after transferring to PowerMILL*;*



Design

Detailed design model transfer from Rhinoceros to PowerMILL

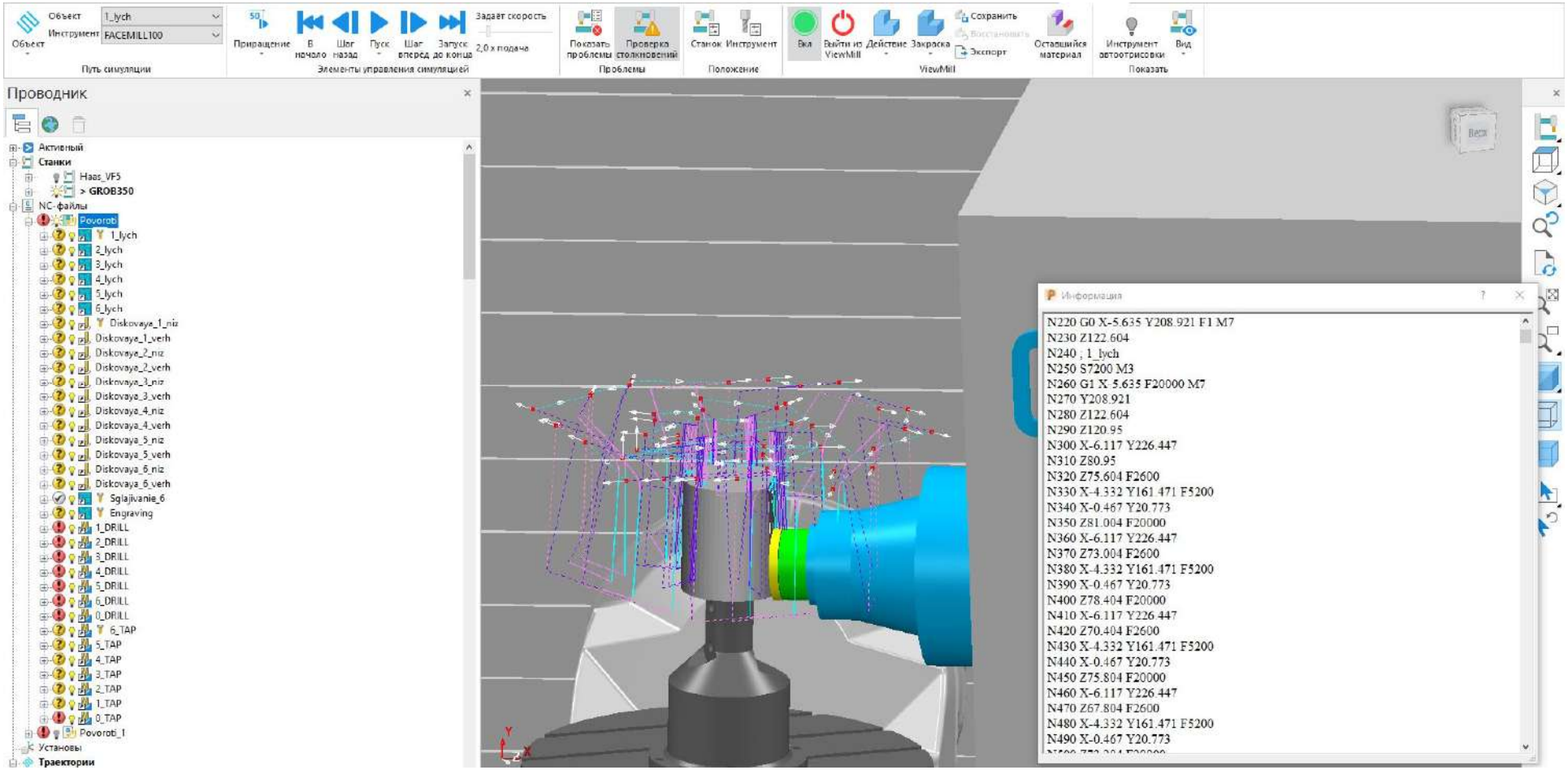
- CNC machinery automatic coding;
- NC cutter path;



Design

Detailed design model transfer from Rhinoceros to PowerMILL

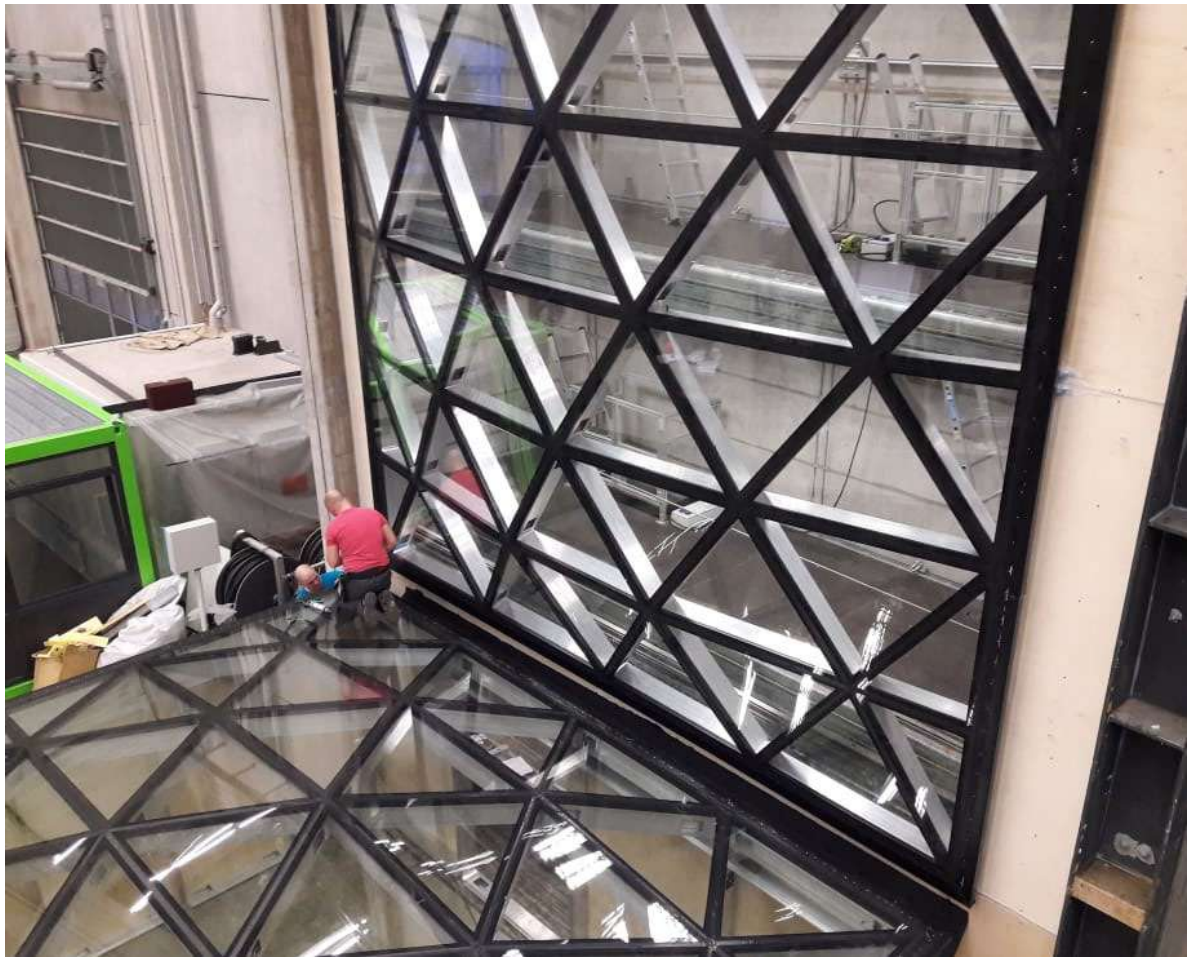
- CNC machinery automatic coding;
- NC cutter path + G code;



Certification

Certification testing (ift Rosenheim GmbH)

Air permeability – Class A4 (EN 12152) / ГОСТ 26602.2-99 ;
Water tightness – Class RE1200 (EN 12154) / ГОСТ 26602.2-99 ;
Resistance to wind load – +/- 4,5 kN/sqm (EN 13116); ***snow load*** – + 6,0 kN/sqm (EN 12179);



Evidence of Performance
Air permeability, Watertightness static, Resistance to wind load

Test Report
No. 19-004424-PR01
(PB-B01-02-en-01)

ift ROSENHEIM

Client	Supporting Systems Novosibirsk, Sovetskaya street, 10 Russia
Product	Roof in stick construction
Designation	Supporting system
Material	Aluminium profiles and solid aluminium
Overall dimensions (W x H)	5,880 mm x 3,850 mm (roof part)
Construction project [1]	G2S, Novosibirsk
Special features	The vertical facade part has not been evaluated.

Results

Air permeability
In accordance with EN 12152:2002-02
Class A4 *)

Watertightness - static
In accordance with EN 12154:1999-12
Class RE_{1200}

Resistance to wind load
In accordance with EN 13116:2001-07
Design load ± 3.0 kN/m² Safety load ± 4.5 kN/m²

Resistance to wind load (simulated snow load)
In accordance with EN 12179:2000-06
Snow load
+ 6.0 kN/m²

*) Classification applies for joint related air permeability.

ift Rosenheim
23.04.2020

Thomas Krichbaumer
Deputy Head of Testing Department
Building Component Testing

Thomas Stefan, Dipl.-Ing. (FH)
Operating Testing Officer
Building Component Testing

Basis
EN 13830:2003-09
Method statement by company SCHÜCO International KG, Bielefeld, dated 08 October, 2019
Test standard/s:
EN 12153:2000-06
EN 12155:2000-06
EN 12179:2000-06
Corresponds to the national standard/s (e.g. DIN EN)

Representation

Instructions for use
The results obtained can be used by the manufacturer for preparing the Declaration of Performance in accordance with the Construction Products Regulation 305/2011/EU. The provisions of the applicable product standard have to be observed.
[1] According to the manufacturer, the facade originates from the specified construction project and was selected by the client as representative building component.

Validity
The data and results refer solely to the tested and describes specimen. Classification remains valid as long as the product and the above basis remain unchanged. The results can be extrapolated under the manufacturer's own liability subject to observance of the relevant specifications set out by the applicable product standard. This test/evaluation does not allow any statement to be made on any further characteristics regarding performance and quality of the construction presented, in particular the effects of weathering and ageing were not taken into account.

Notes on publication
The ift-Guidance Sheet "Advertising using ift test documents" applies. The cover sheet cannot be used as an abstract.
The report contains a total of 41 pages.

ift Rosenheim GmbH · Theodor-Gietl-Str. 7-9 · D-83026 Rosenheim · Kontakt · Tel. +49 8031 261-0 · Fax +49 8031 261-290 · www.ift-rosenheim.de · Prüfung und Kalibrierung – EN ISO/IEC 17025 · Inspektion – EN ISO/IEC 17020 · Zertifizierung Produkte – EN ISO/IEC 17065 · Zertifizierung Management-Systeme – EN ISO/IEC 17021

Supporting systems llc

Manufacturing plant , Novosibirsk

Supporting systems llc

Manufacturing plant , Novosibirsk

- 5-axis CNC machinery Grob (Germany) and Haas (USA);
- Manufacturing capacity – 10 000 sqm/month;

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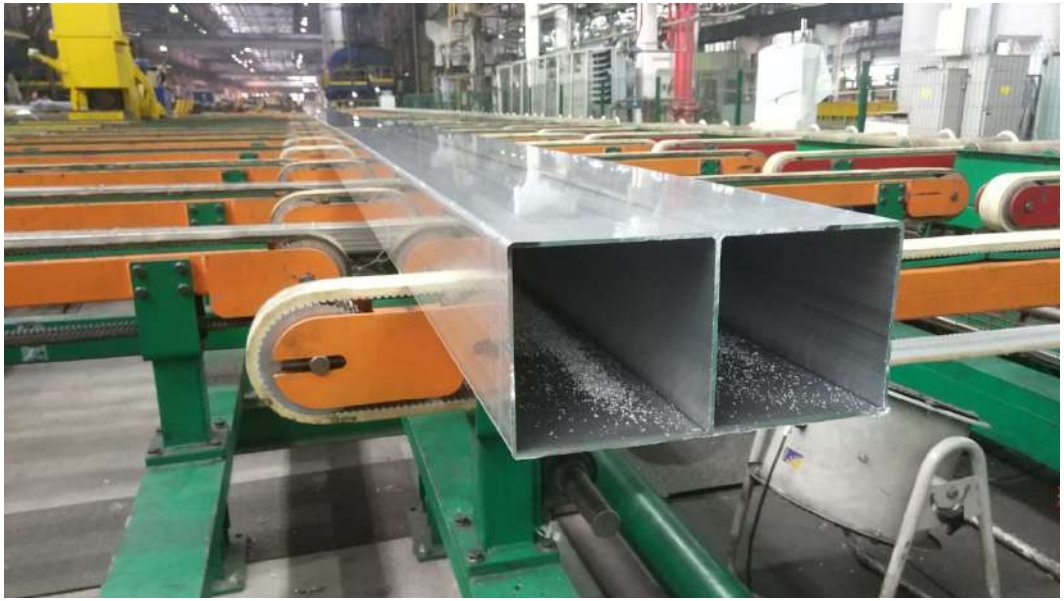
Grid shell structures

High tensile aluminum alloys extrusion

- Large-size profiles special extrusion;
- High tensile aluminum alloy AW-6082T6 and AW-6063T66 ;

- Modern high tensile aluminum alloys have characteristics equal to steel;

Alloy AW- 6082T6 – yield strength 250 MPa;
Alloy AW- 6063T66 – yield strength 200 MPa;
Steel S235J2G3 or S235J0 – yield strength 235 MPa and 255 MPa;



Grid shell structures

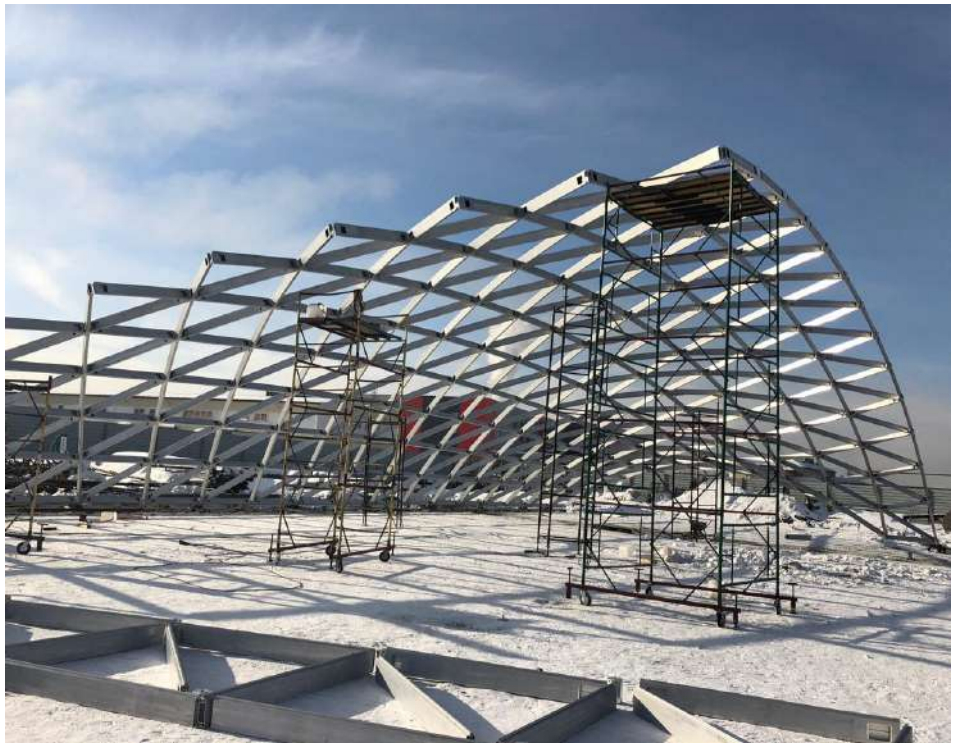
High tensile aluminum alloys extrusion

- Large-size profiles special extrusion;
- High tensile aluminum alloy AW-6082T6 and AW-6063T66;

Supporting systems llc

Product quality control

- All elements of the structure – fit-up assembly test and geometry check;



НЕСУЩИЕ СИСТЕМЫ

Single layer system erection

- On site enlarge assembly and installation;

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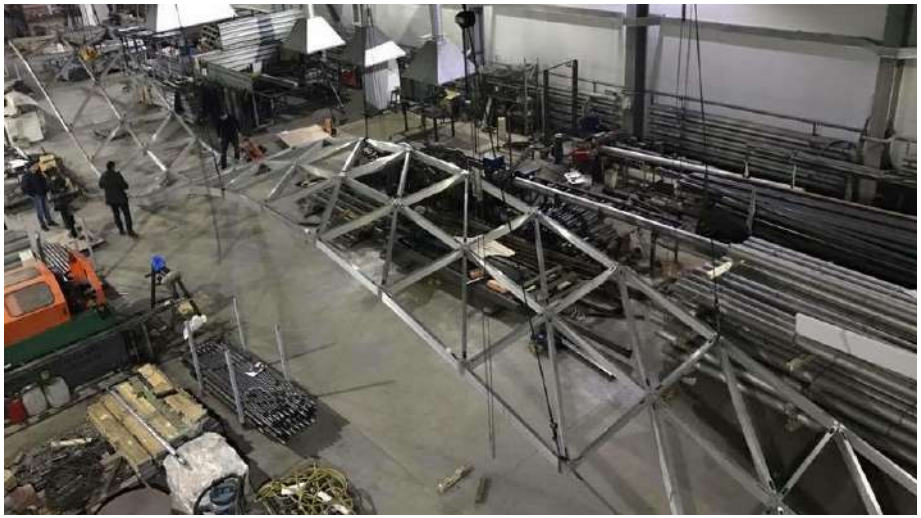
- On site enlarge assembly and installation;

НЕСУЩИЕ СИСТЕМЫ

Single layer system erection

- On site enlarge assembly in temporary rubb shelter ;



НЕСУЩИЕ СИСТЕМЫ

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НЕСУЩИЕ СИСТЕМЫ

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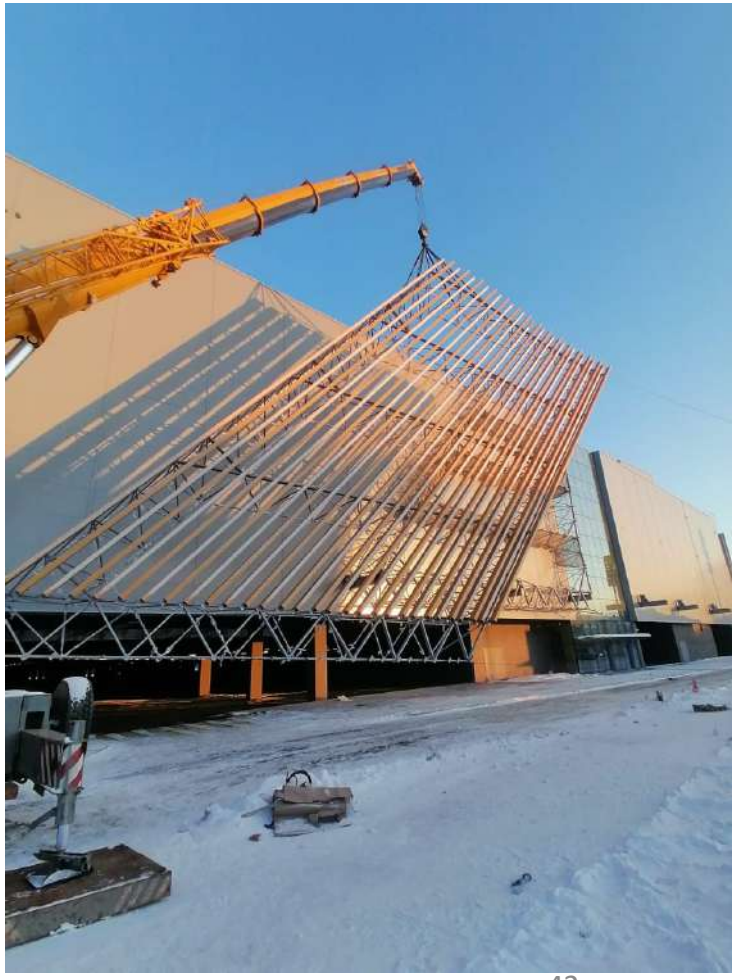
НЕСУЩИЕ СИСТЕМЫ

Single layer system erection

- On site enlarge assembly in temporary rubb shelter ;

Single layer system erection

- Installation of several pre-assembled parts simultaneously;



Single layer system erection

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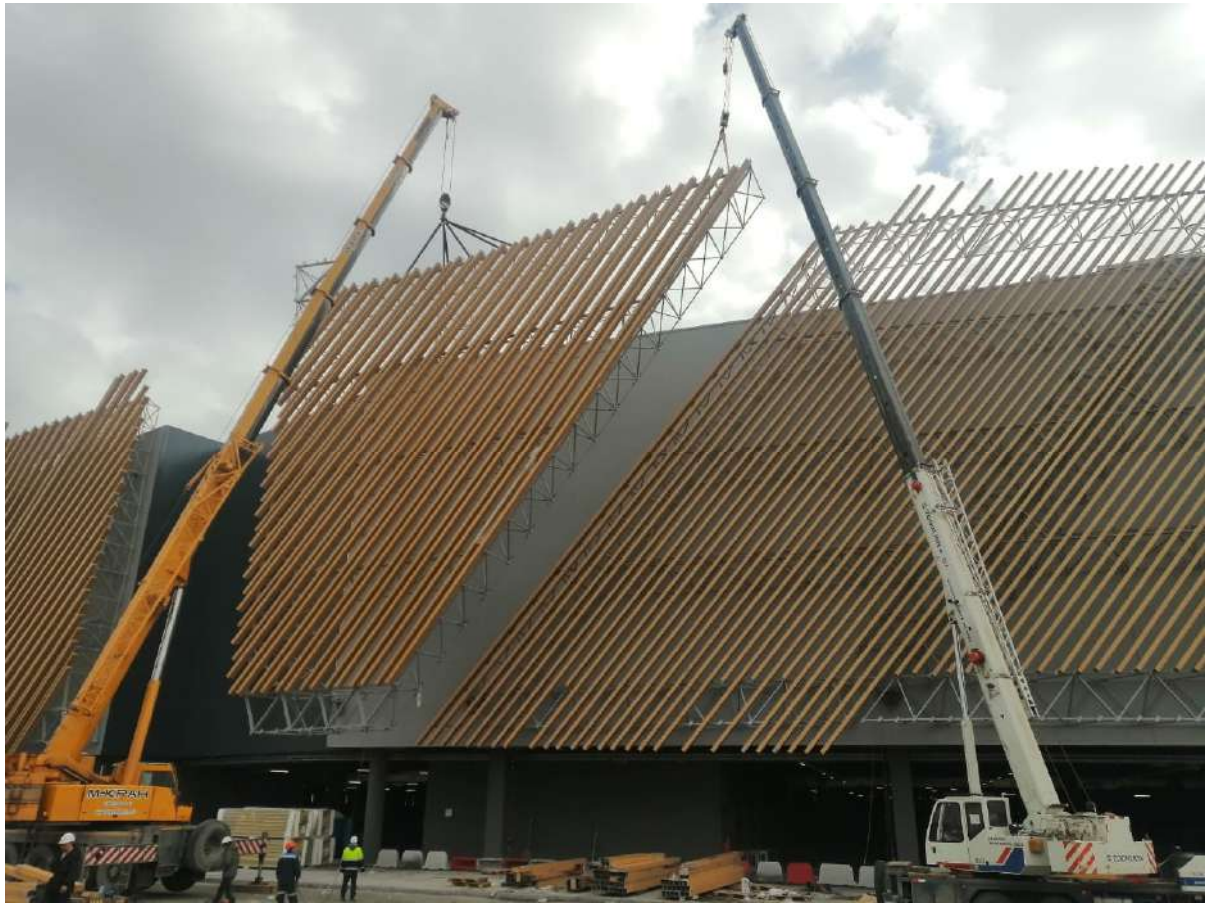

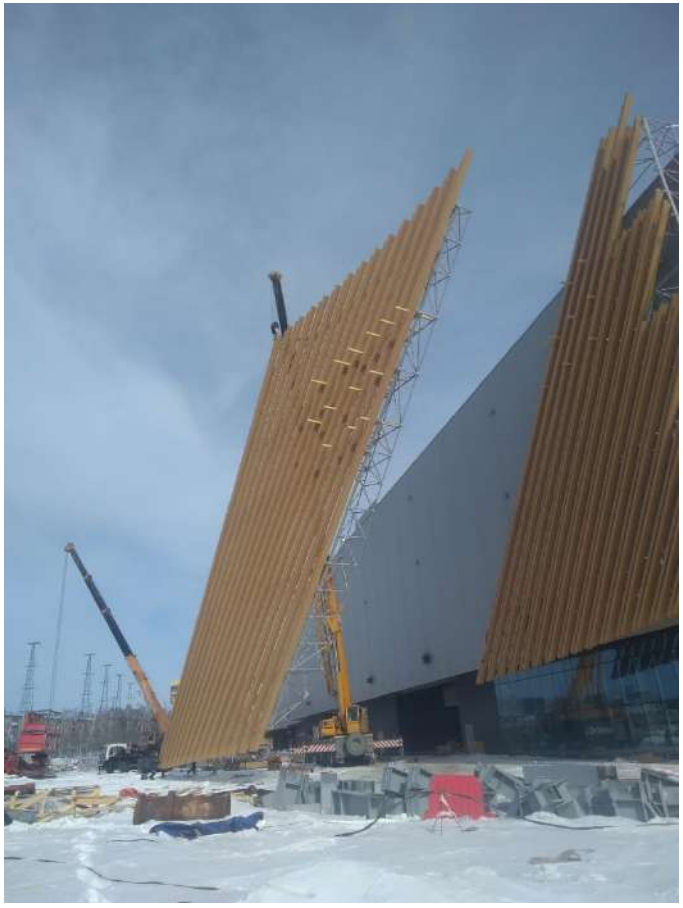

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Single layer system erection

- Installation of several pre-assembled parts simultaneously;

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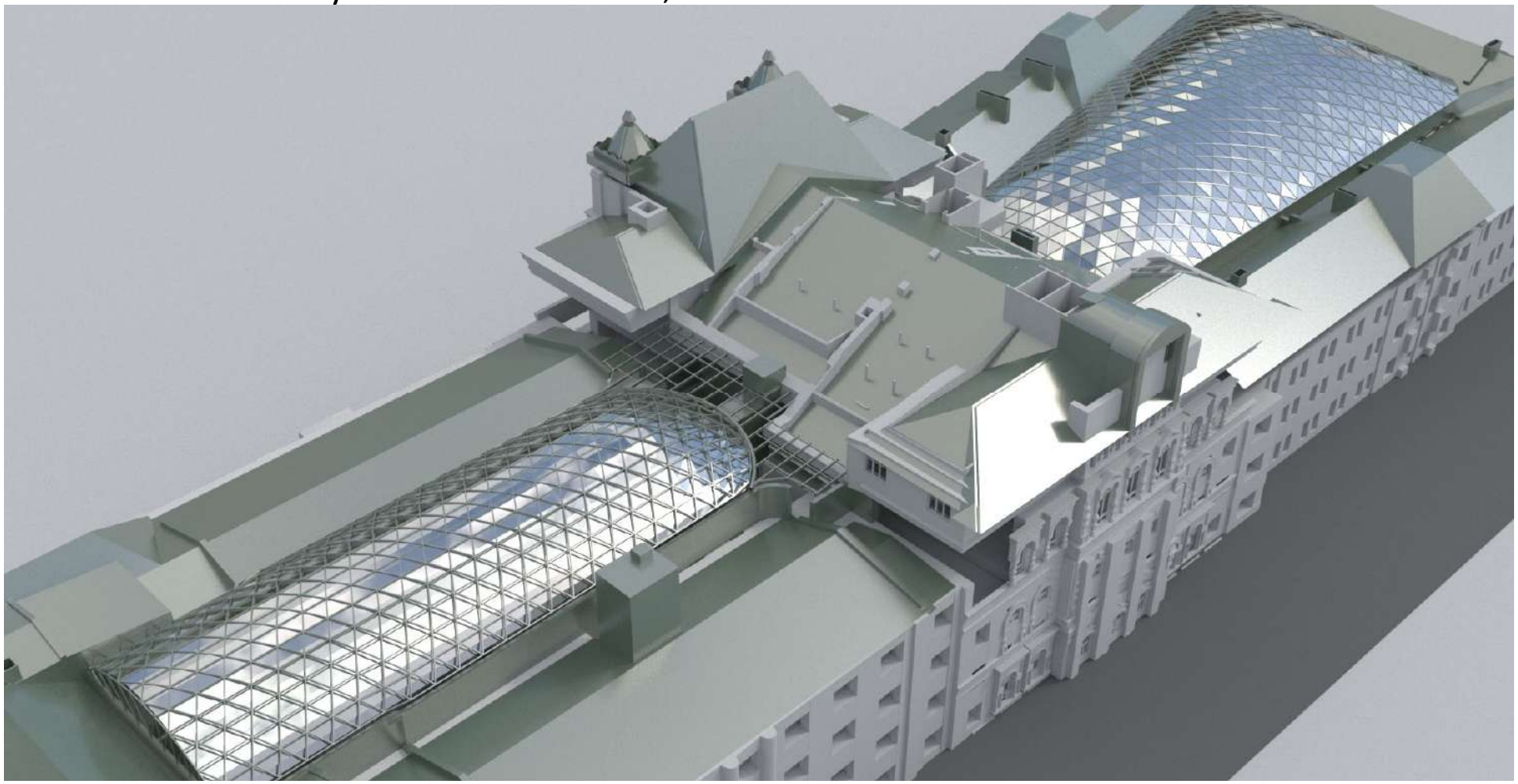
Single layer system erection

Example of Moscow Polytechnique museum

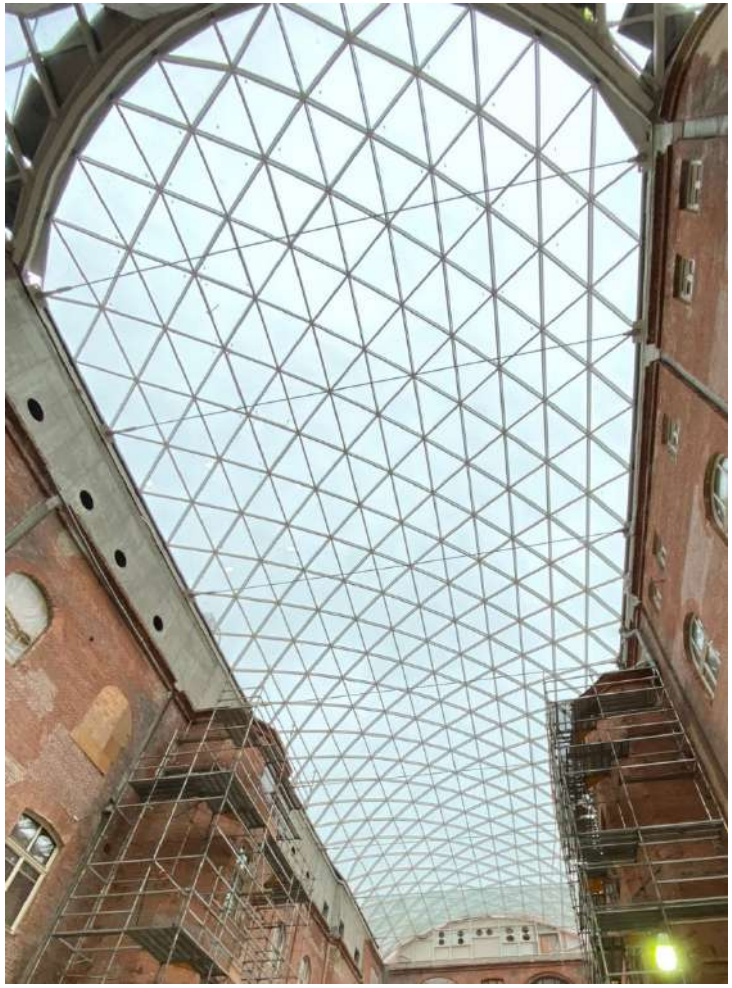
- Element-by-element installation;



Single layer system erection

Example of Moscow Polytechnique museum

Erected structure



Concept

НЕСУЩИЕ СИСТЕМЫ

Single layer system erection

Example of Moscow Polytechnique museum

- Step 1. Perimetral steel beam installation;

Single layer system erection

Example of Moscow Polytechnique museum

- Step 2. Platform erection and element-by-element skylight structure assembly;

Single layer system erection

Example of Moscow Polytechnique museum

- Step 3. Platform erection and element-by-element skylight structure assembly;

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Single layer system erection

Example of Moscow Polytechnique museum

- Gasket installation;

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Single layer system erection

Example of Moscow Polytechnique museum

- Glass units installation;

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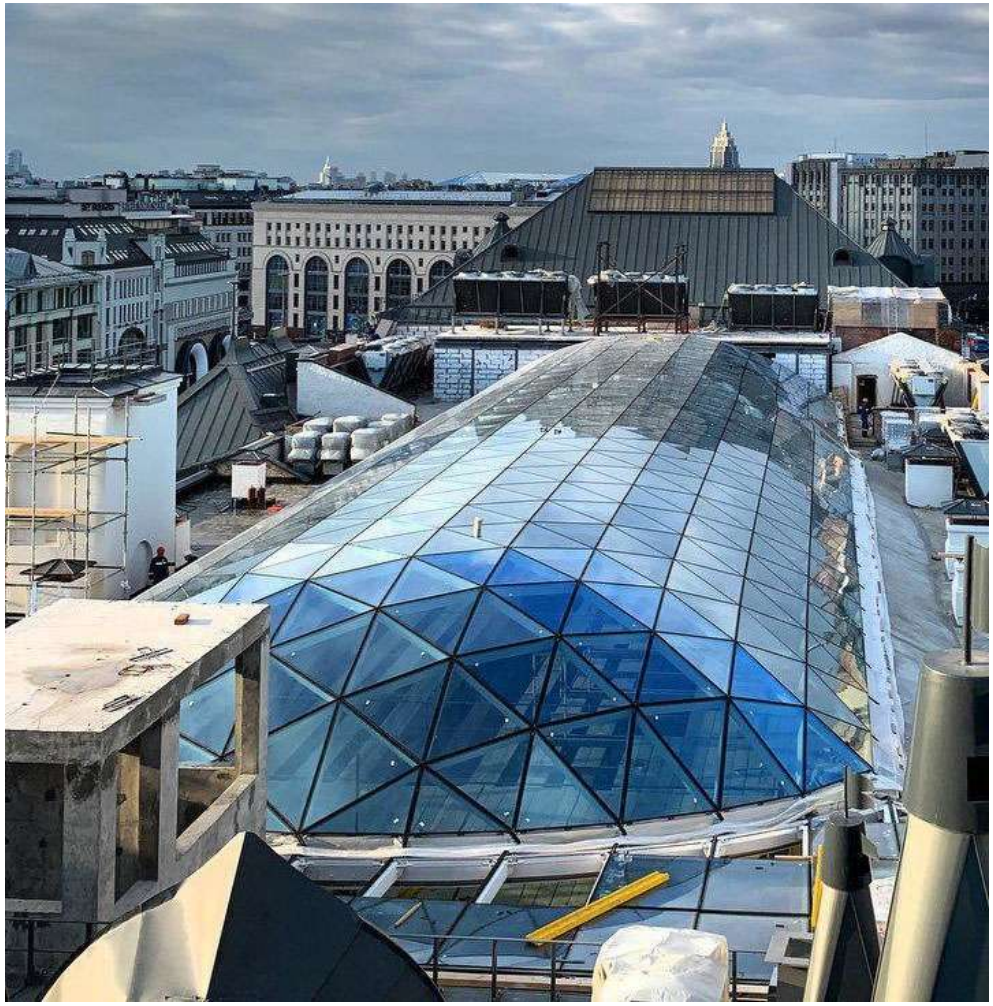
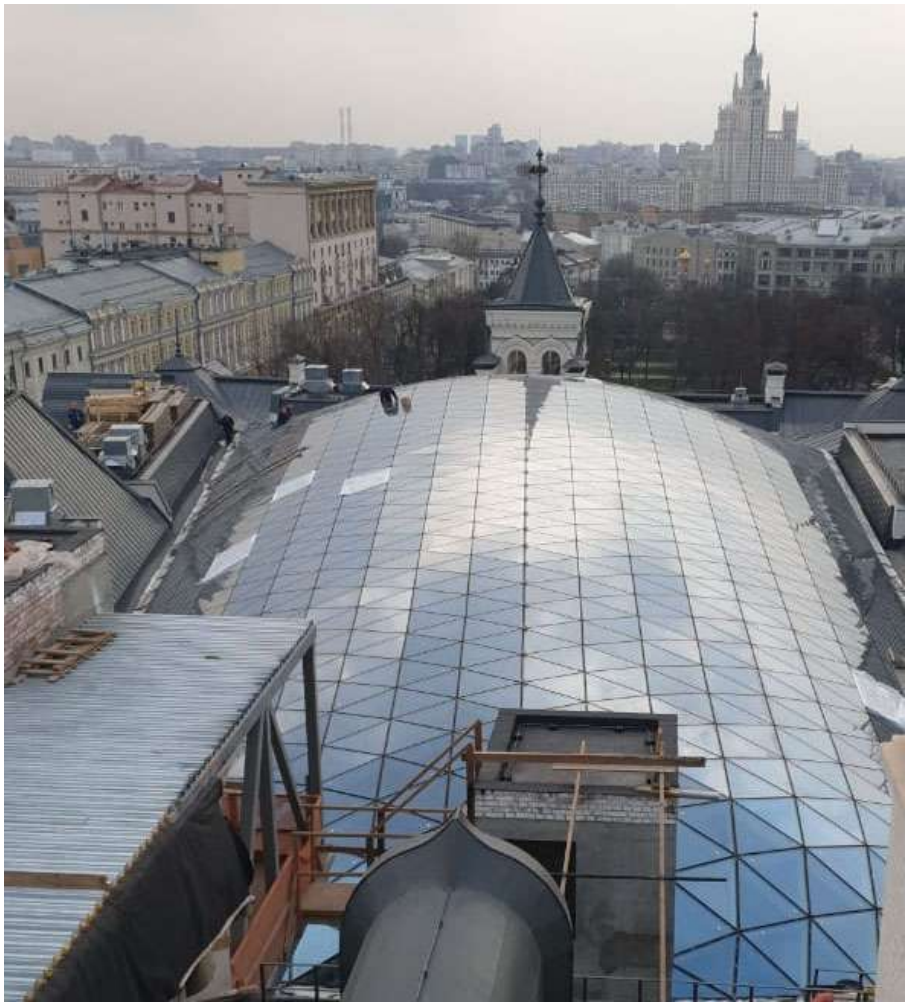
Single layer system erection

Example of Moscow Polytechnique museum





Reference list

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Veer mall, Yekaterinburg, Russia

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Veer mall, Yekaterinburg, Russia

Project activities :

-Design
(Schematic drawings
Workshop drawings
Detailed design model);
-Free form skylight manufacturing and on-site supervision;

Surface area:
16000 sqm (skylight)
3000 sqm (facade)
20000 sqm (lamellas)

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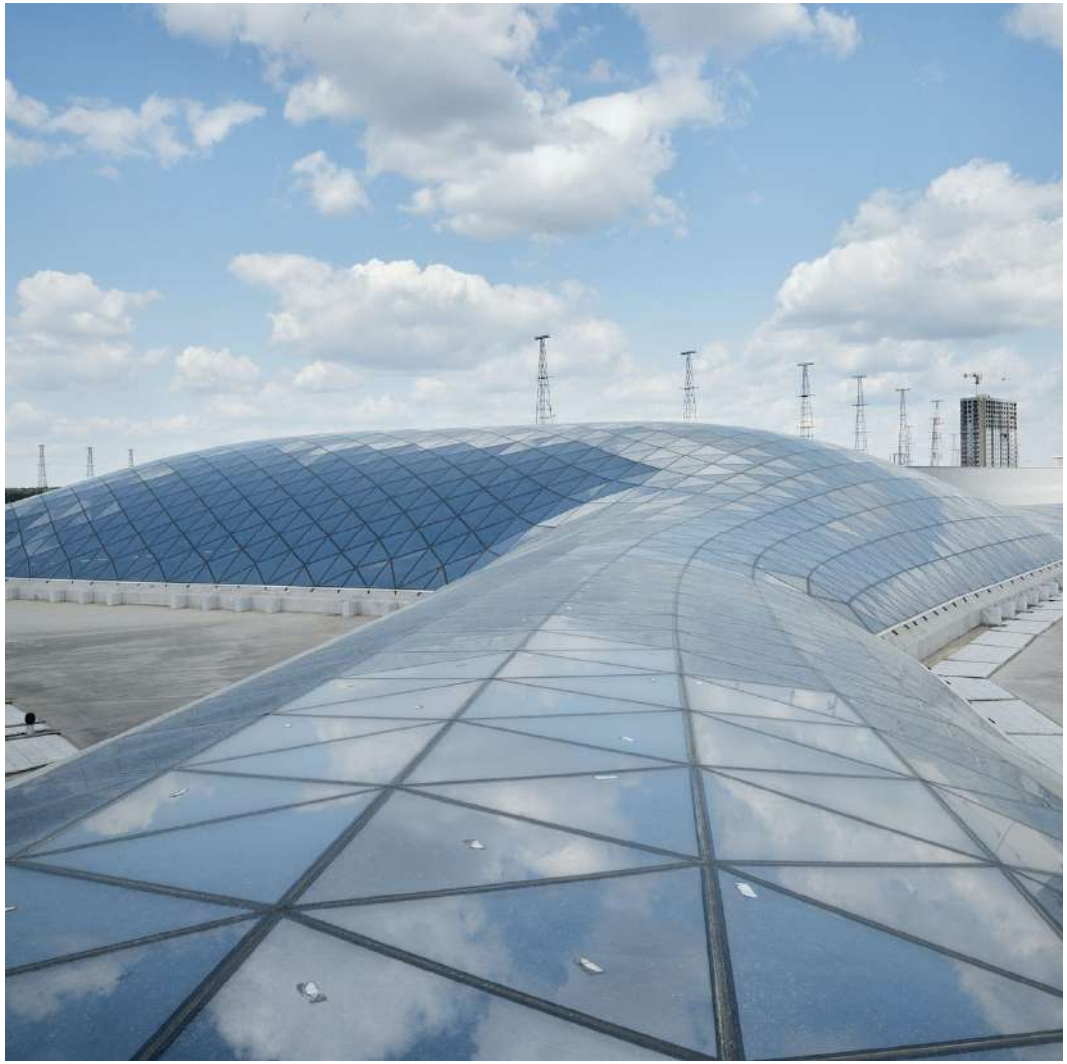

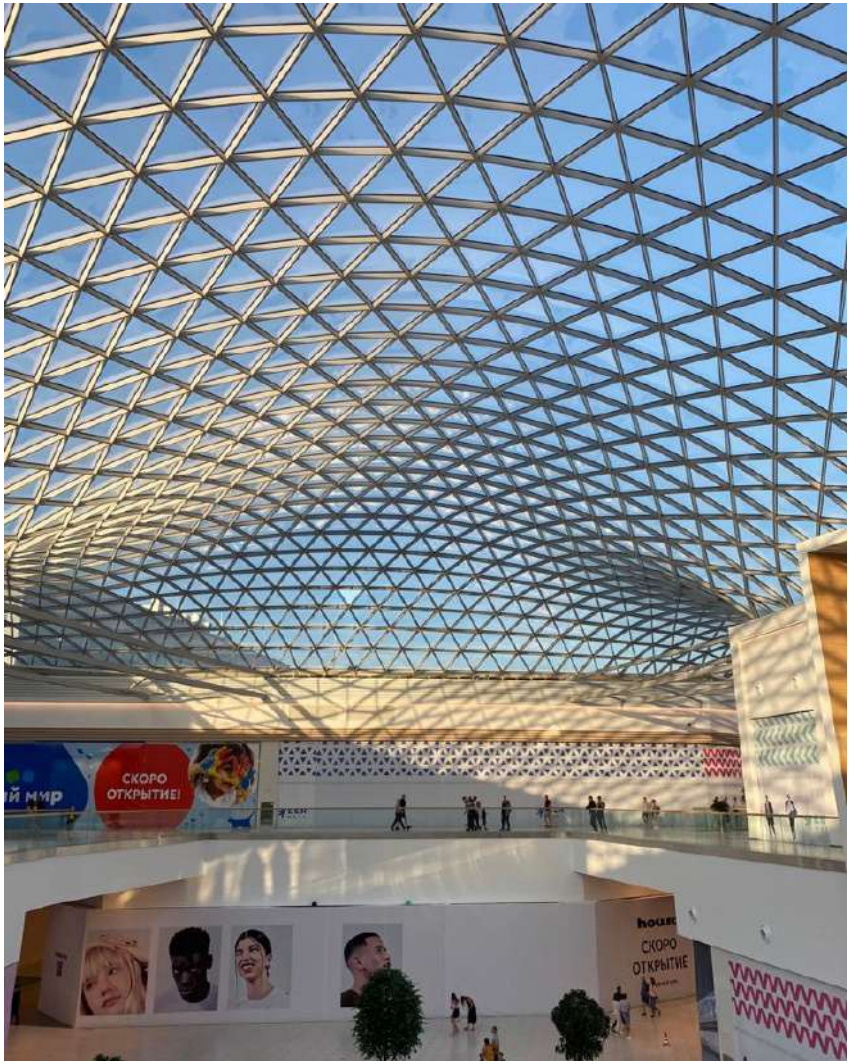

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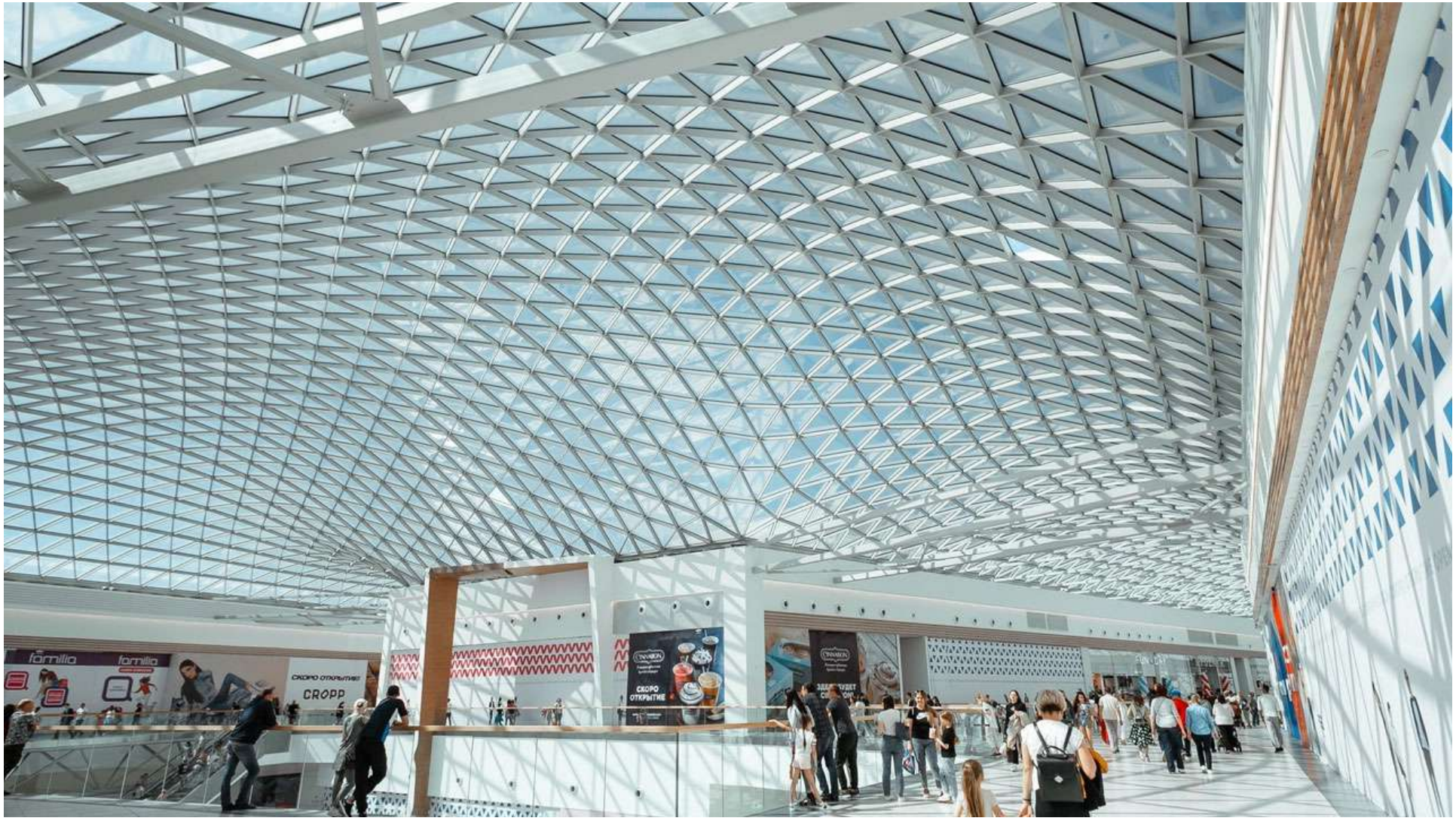

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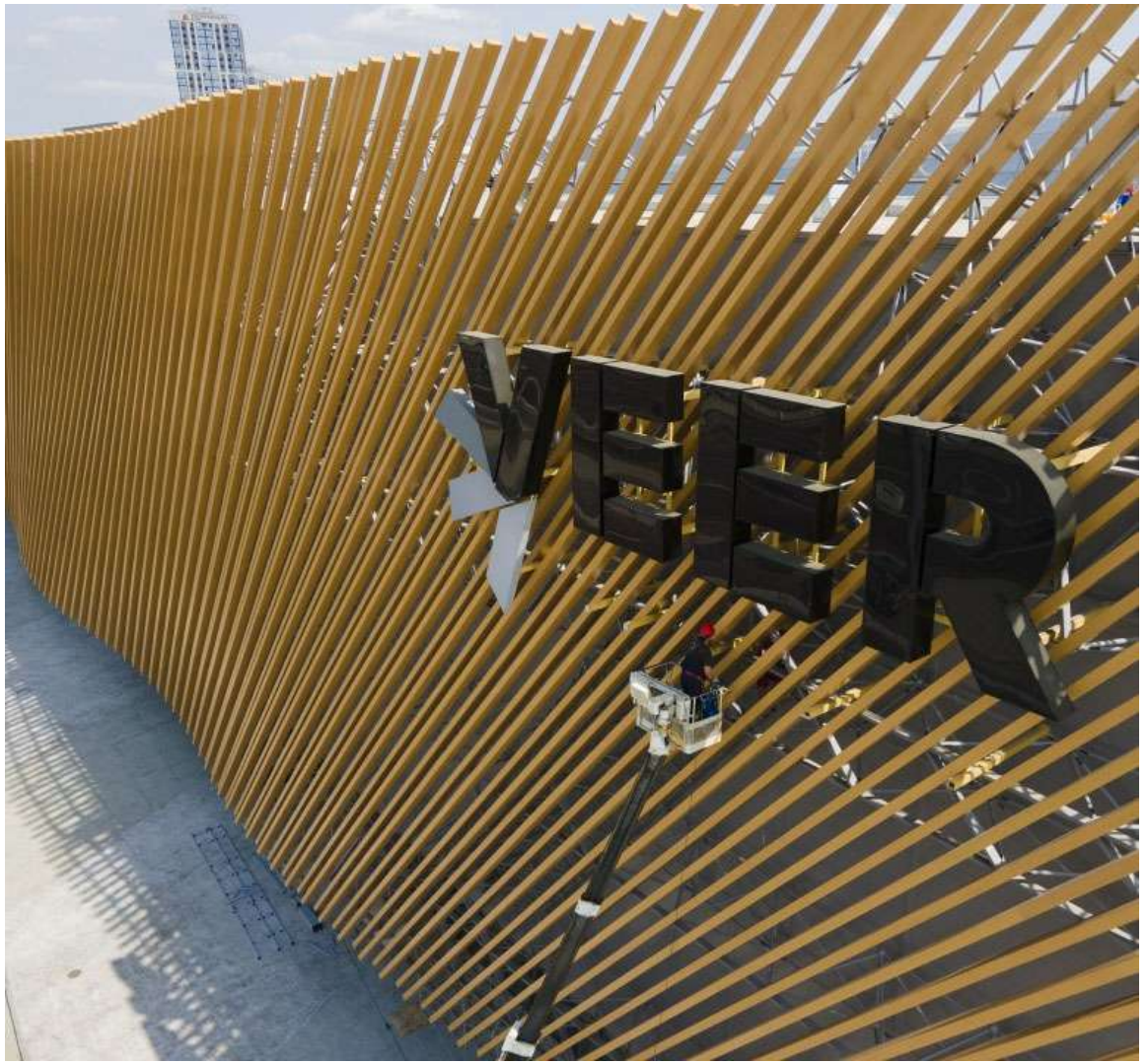
Veer mall, Yekaterinburg, Russia

Reference list

Veer mall, Yekaterinburg, Russia

Reference list

Veer mall, Yekaterinburg, Russia



Reference list

Veer mall, Yekaterinburg, Russia

НЕСУЩИЕ СИСТЕМЫ

Reference list

Planeta shopping mall, Perm, Russia

Reference list

Planeta shopping mall, Perm, Russia

Project activities :

-Design
(Schematic drawings
Workshop drawings
Detailed design model);
-Free form skylight manufacturing and on-site supervision;

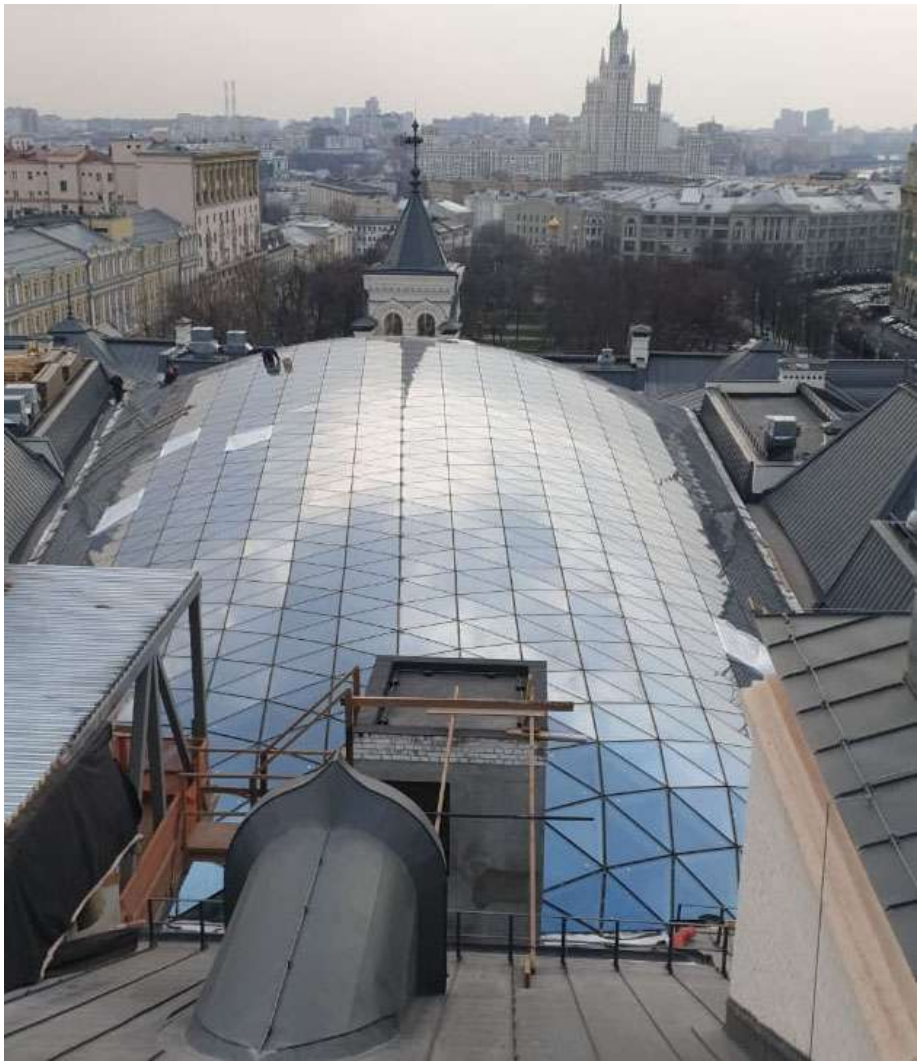
Surface area: 15500 sqm

Reference list

Planeta shopping mall, Perm, Russia

Reference list

Polytechnical Museum (south court), Moscow, Russia



Reference list

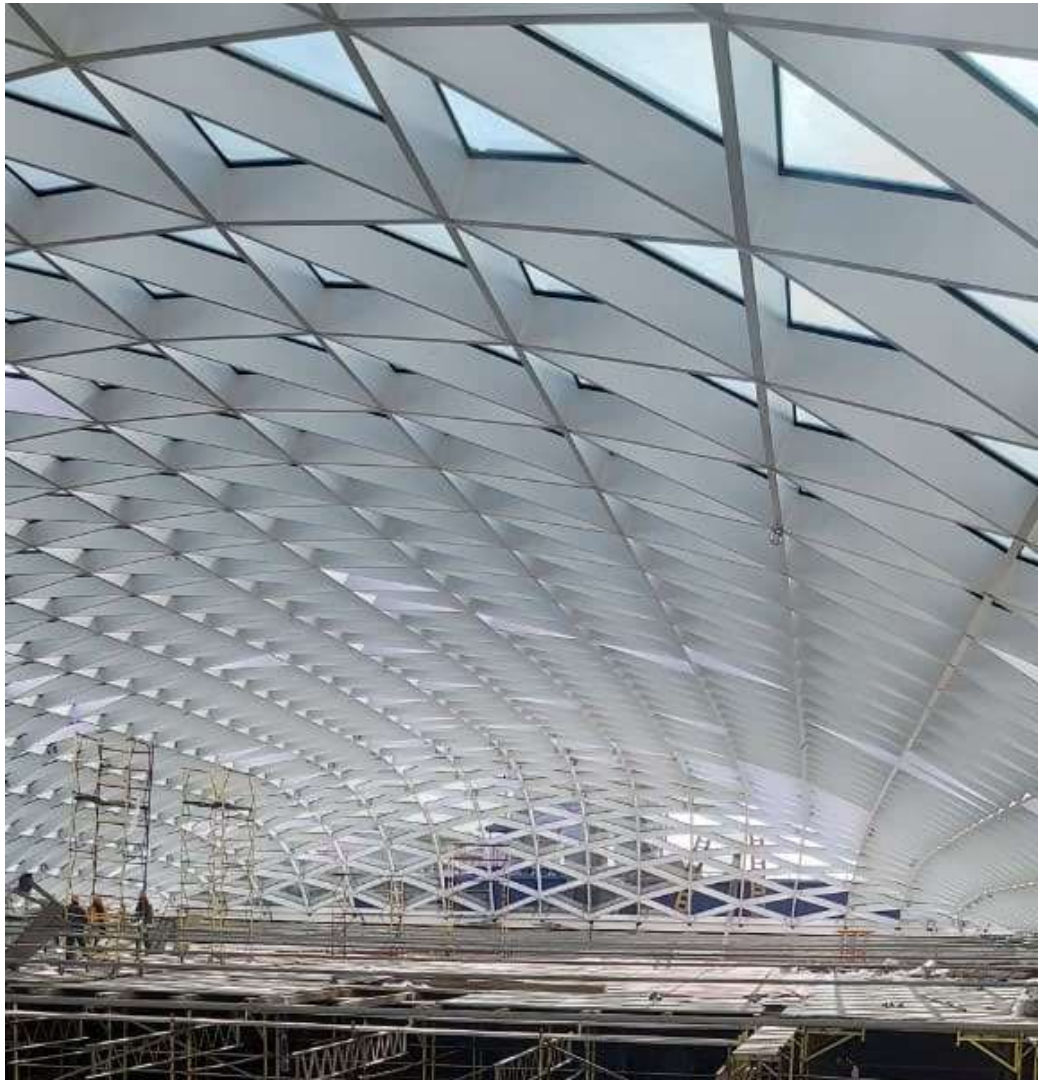
Polytechnical Museum (south court), Moscow, Russia

Project activities :

-Design
(Schematic drawings
Workshop drawings
Detailed design model);
-Free form skylight
manufacturing and on-site
supervision;

Surface area: 3000 sqm

Client: PolytechStroy



НЕСУЩИЕ СИСТЕМЫ

Reference list

Polytechnical Museum (south court), Moscow, Russia

НЕСУЩИЕ СИСТЕМЫ

Reference list

Simferopol International airport, Russia

Reference list

Simferopol International airport, Russia

Project activities :

-Design
(Schematic drawings
Workshop drawings
Detailed design model);
-Free form façade manufacturing and on-site supervision;

Surface area: 13000 sqm

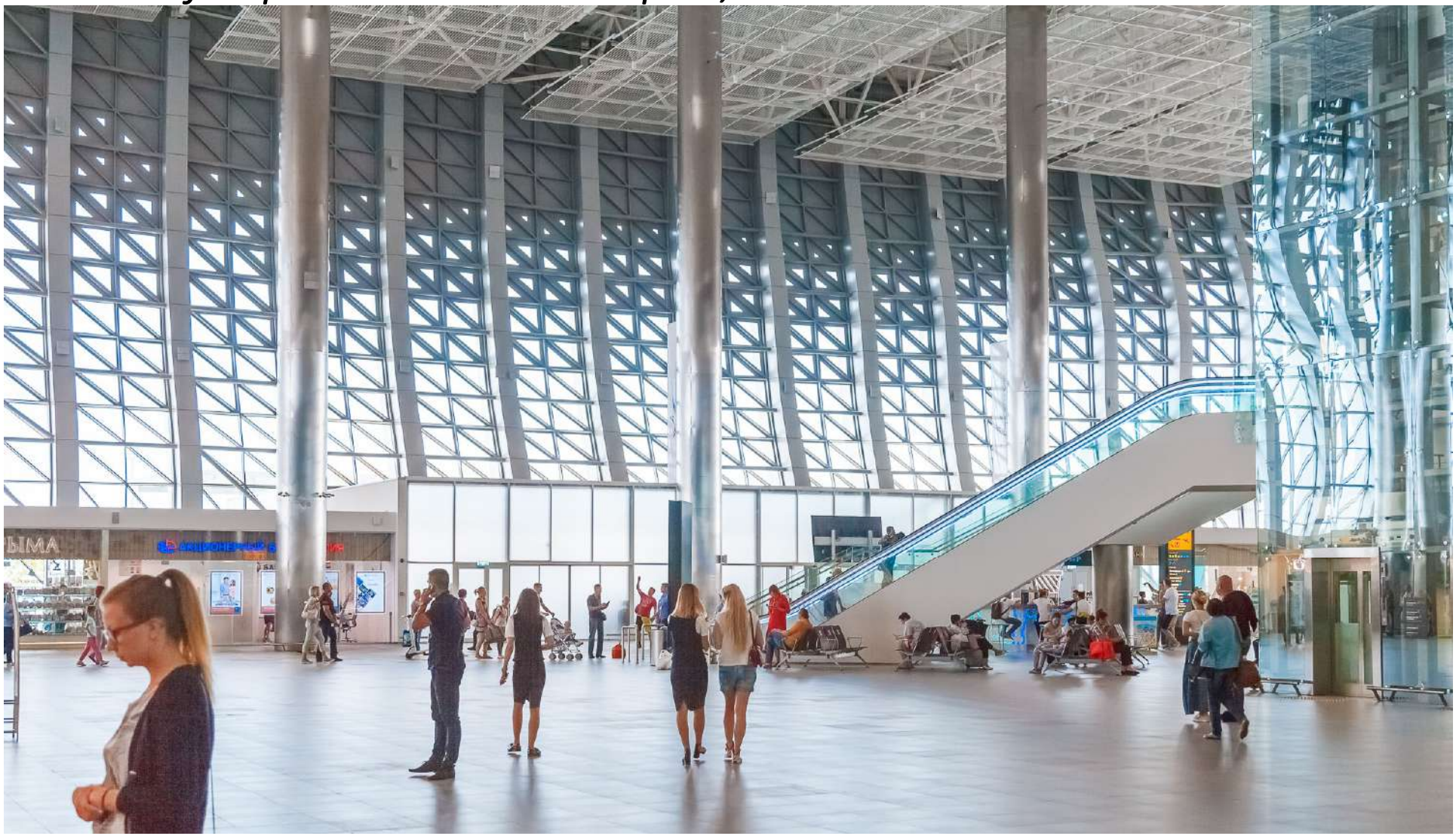
Client: AlphaStroy

Reference list

Simferopol International airport, Russia

Reference list

Simferopol International airport, Russia



Reference list

Simferopol International airport, Russia

June 2017

October 2017

Execution of work - 5 month

Reference list

Igora Drive leisure center, St. Petersburg, Russia

Reference list

Igora Drive leisure center, St. Petersburg, Russia

Project activities :

-Design
(Schematic drawings
Workshop drawings
Detailed design model);
-Free form skylight manufacturing and on-site supervision;

Surface area: 3700 sqm

Client: Alumstroy

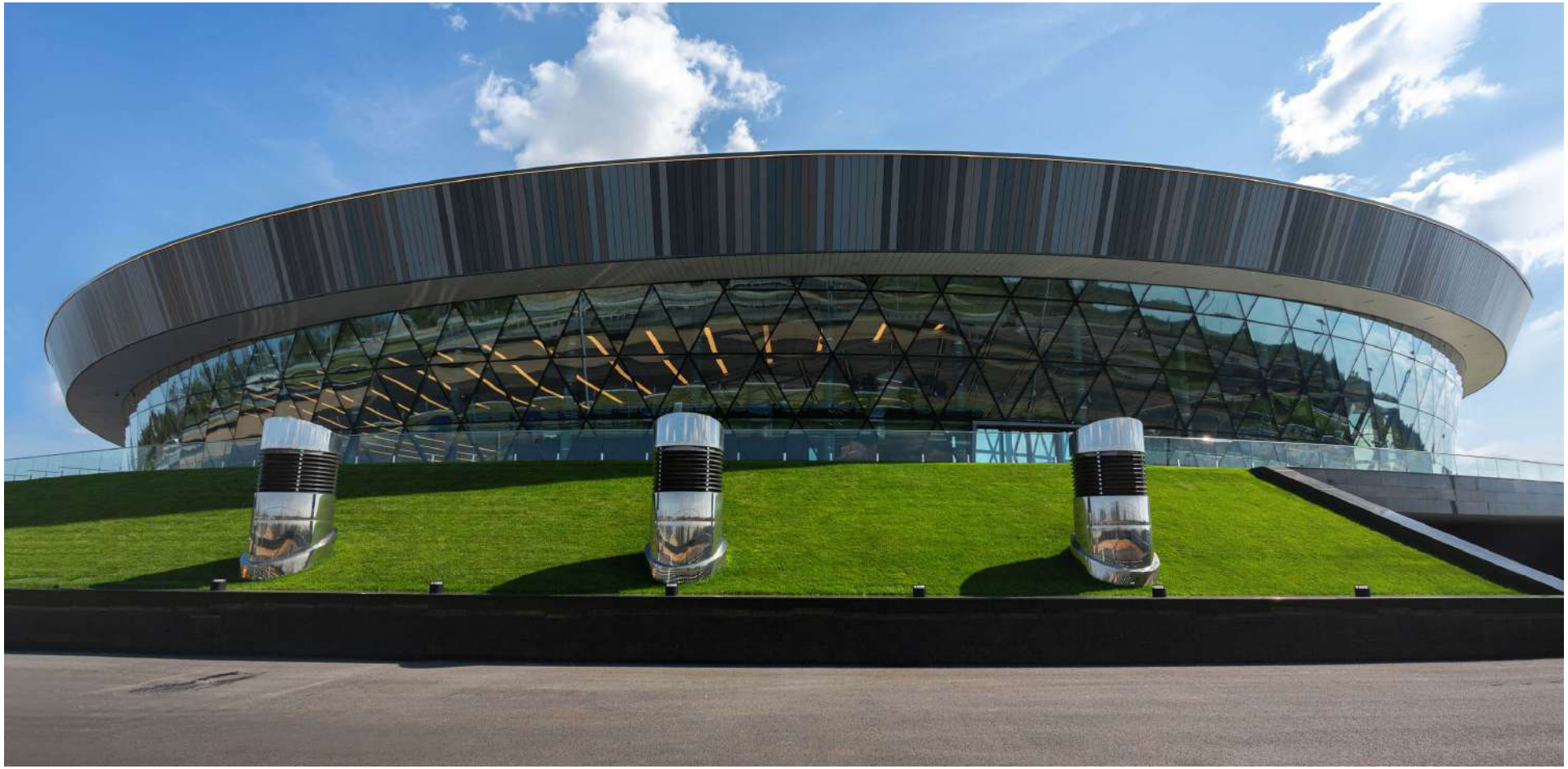
НЕСУЩИЕ СИСТЕМЫ

Reference list

Igora Drive leisure center, St. Petersburg, Russia

Reference list

Igora Drive leisure center, St. Petersburg, Russia



НЕСУЩИЕ СИСТЕМЫ

Reference list

Igora Drive leisure center, St. Petersburg, Russia

НЕСУЩИЕ СИСТЕМЫ

Reference list

Moscow Metro Coordination center, Moscow

Reference list

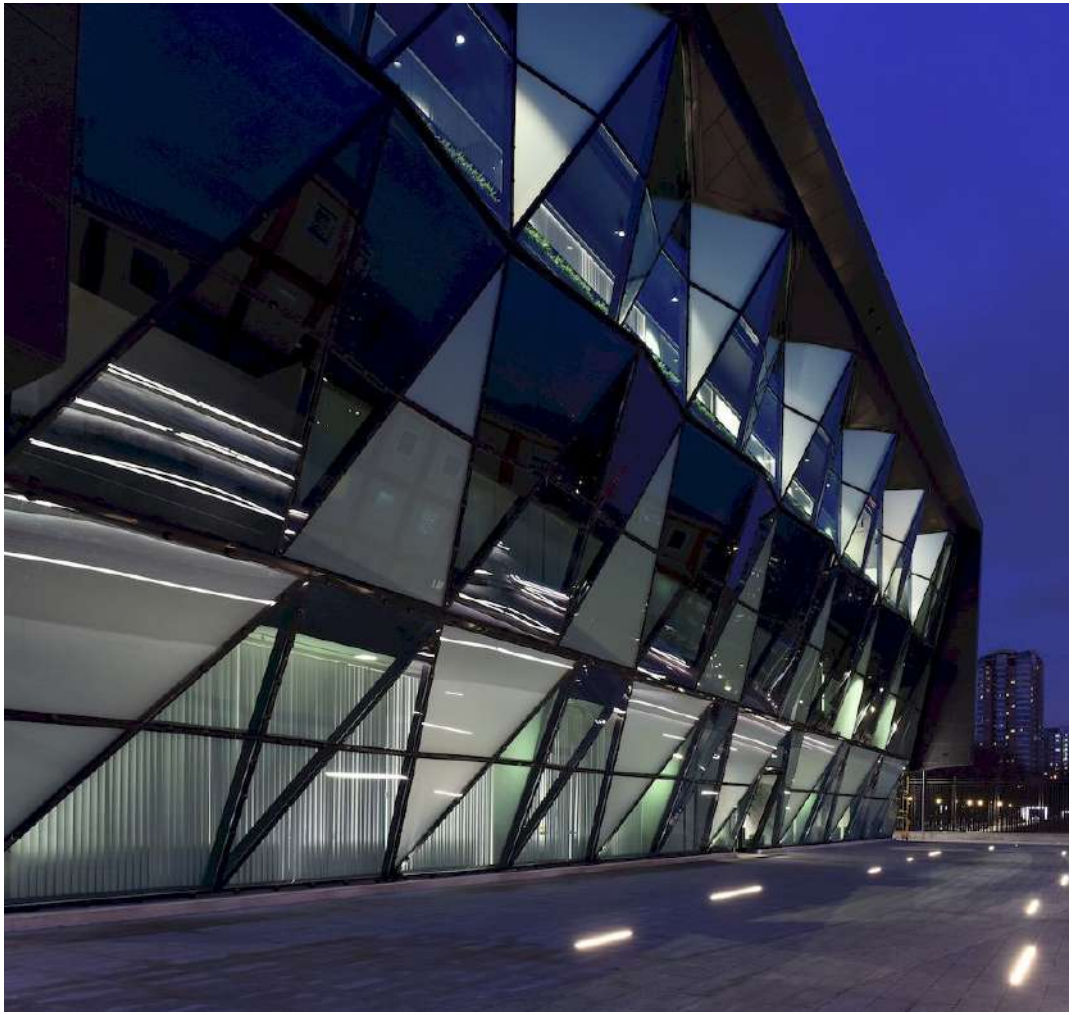
Moscow Metro Coordination center, Moscow

Project activities :

-Design
(Schematic drawings
Workshop drawings
Detailed design model);
-Free form skylight manufacturing and on-site supervision;

Surface area: 800 sqm

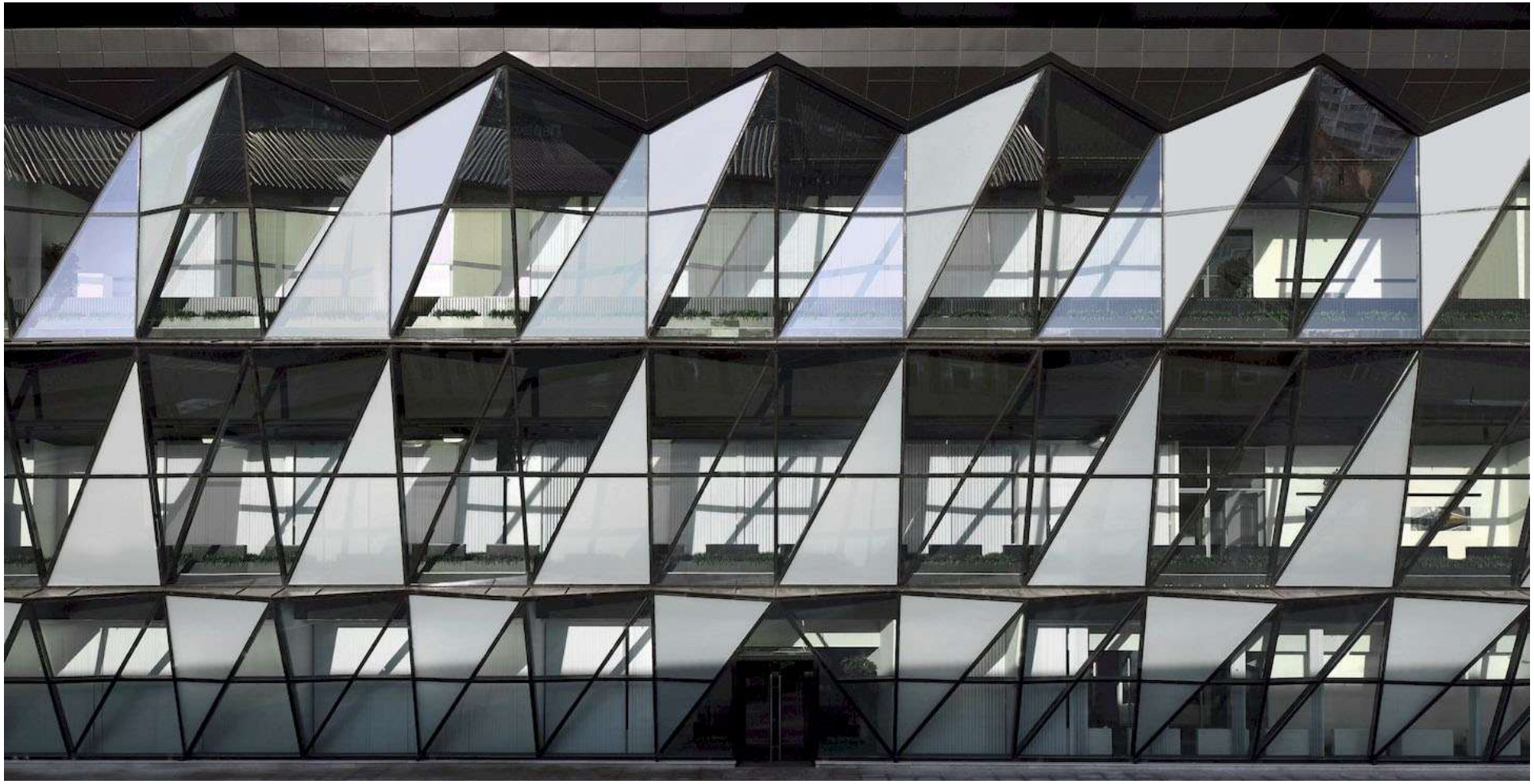
Client: FGUP SVEKO



НЕСУЩИЕ СИСТЕМЫ

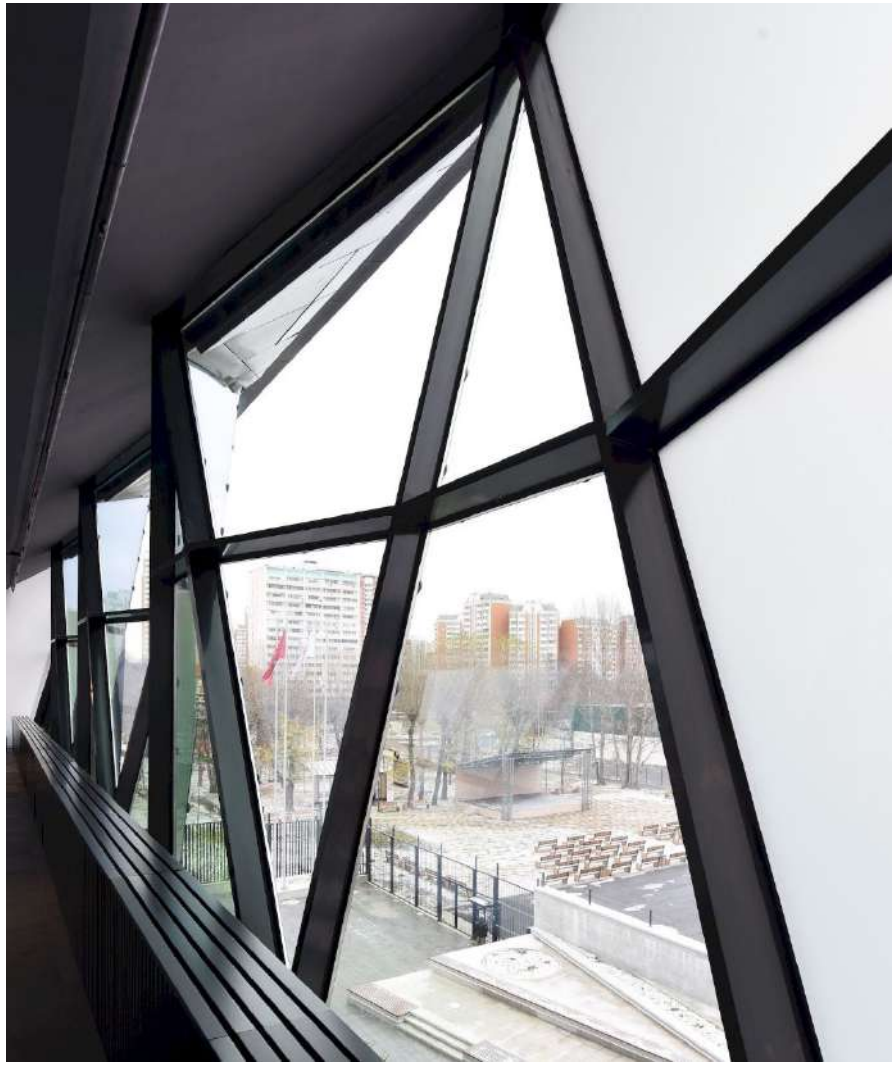
Reference list

Moscow Metro Coordination center, Moscow



Reference list

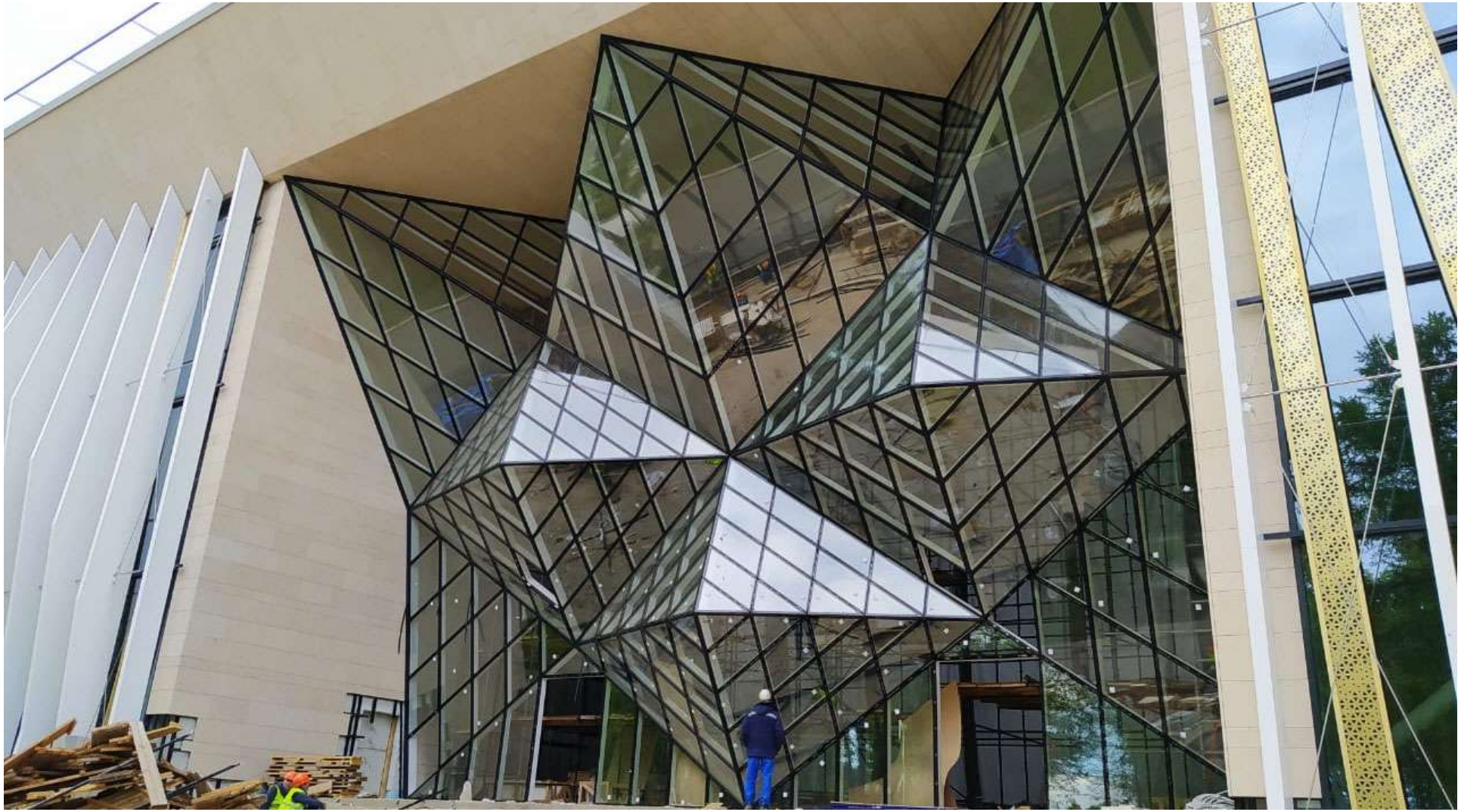
Moscow Metro Coordination center, Moscow



НЕСУЩИЕ СИСТЕМЫ

Reference list

Kristall hockey arena, Moscow, Russia



Reference list

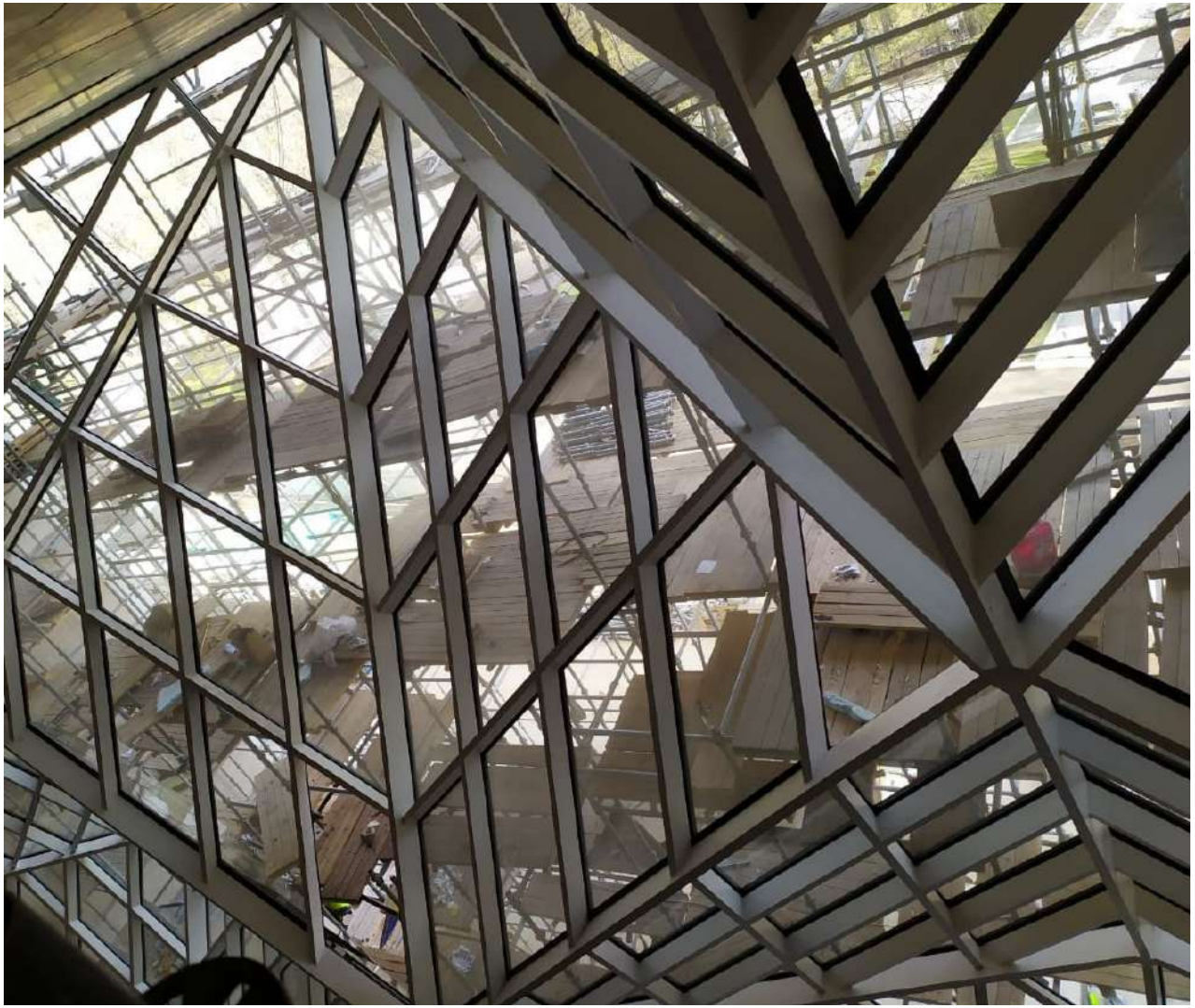
Kristall hockey arena, Moscow, Russia

Project activities :

-Design
(Schematic drawings
Workshop drawings
Detailed design model);
-Free form facade manufacturing and on-site supervision;

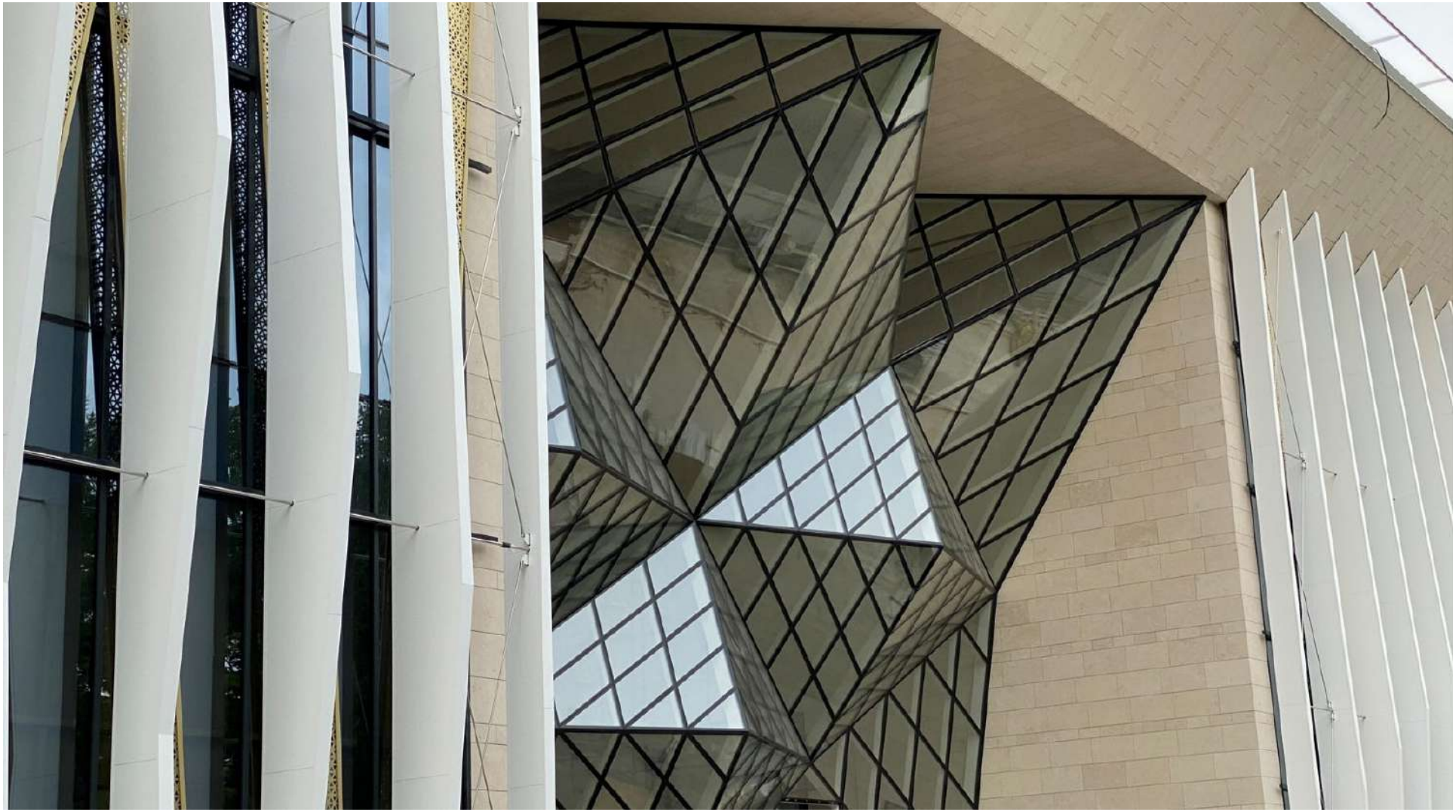
Surface area: 600 sqm

Client: Kvalitet



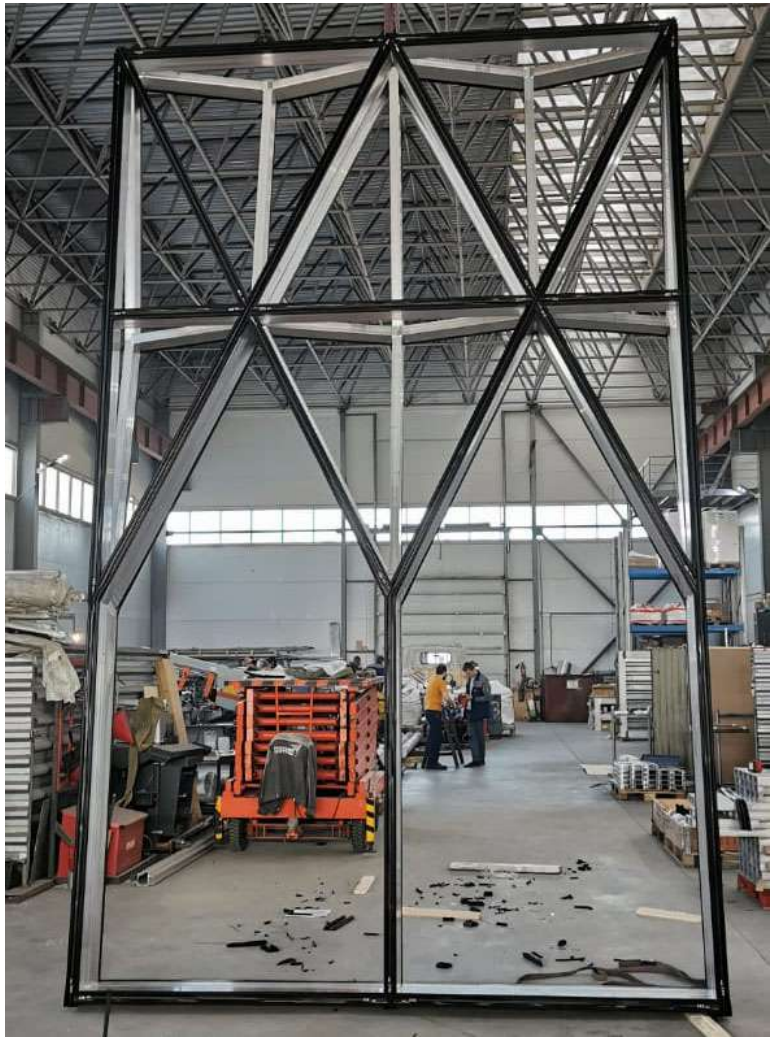
Reference list

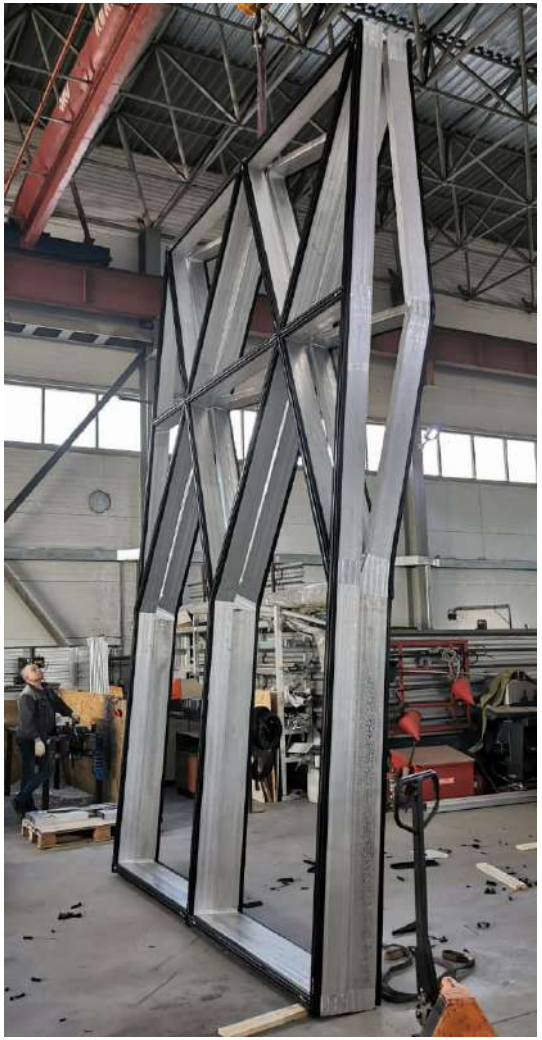
Kristall hockey arena, Moscow, Russia



Reference list

Mock-up





НЕСУЩИЕ СИСТЕМЫ