

Case Study Leutschenbach School

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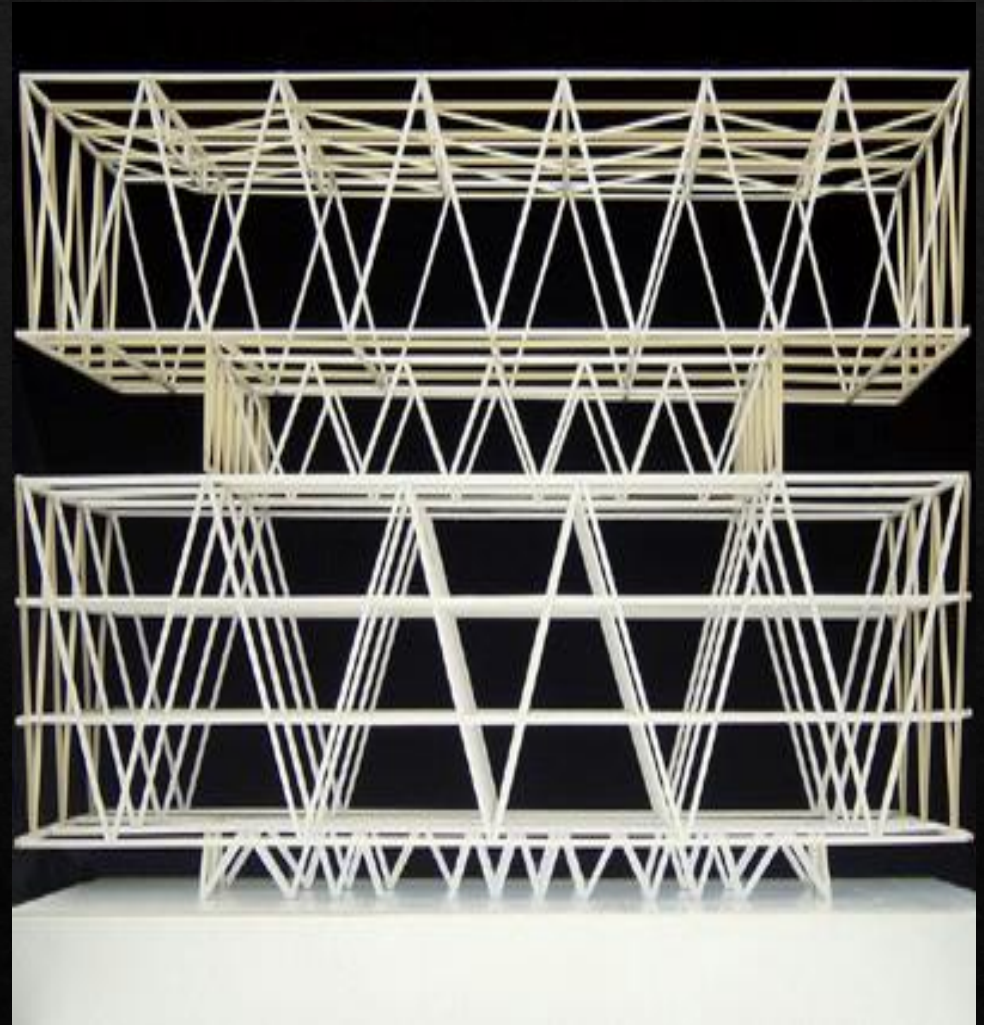
Main structural system

Other building system

Structural analysis

Loads diagram

Multi-frame analysis



OVERVIEW

- **Structure : Leutschenbach School**
- **Architect : Christian Kerez**
- **Location : Zurich, Switzerland**
- **Site Area : 11500.0 sqm**
- **Size : 105,900 sq.ft. / 9840 m2**
- **Construction Date : August 2002**
- **Structural engineers :**
Dr. Schwartz Consulting with DSP,
Walter Kaufmann, Mario Monotti
- **Total construction cost**
\$51 million !!!



Architect, **Christian Kerez**



Born : Maracaibo, Venezuela

Educated :

**M.Arch in Swiss Federal Institute of
Technology Zurich in 1988**

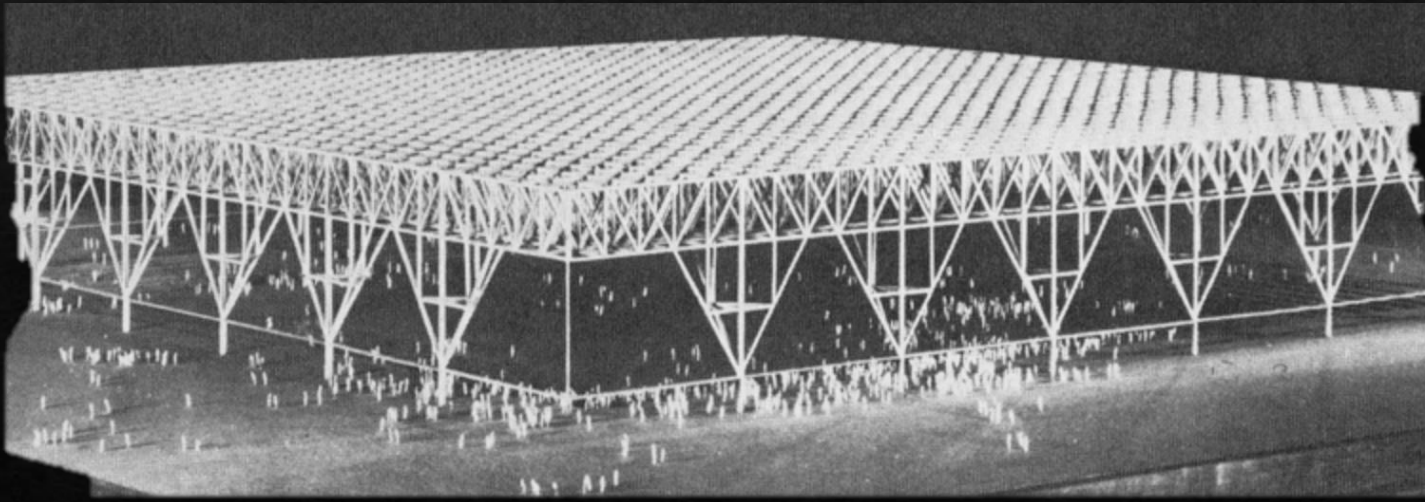
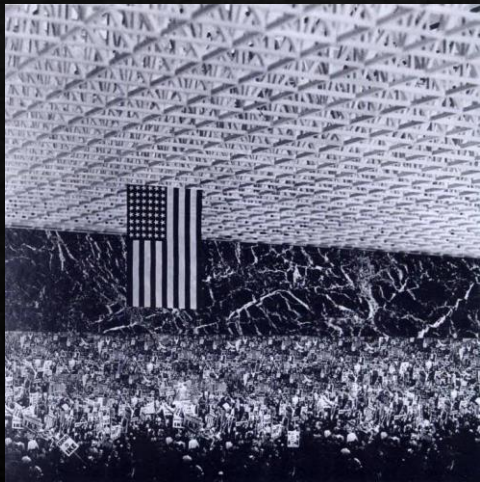
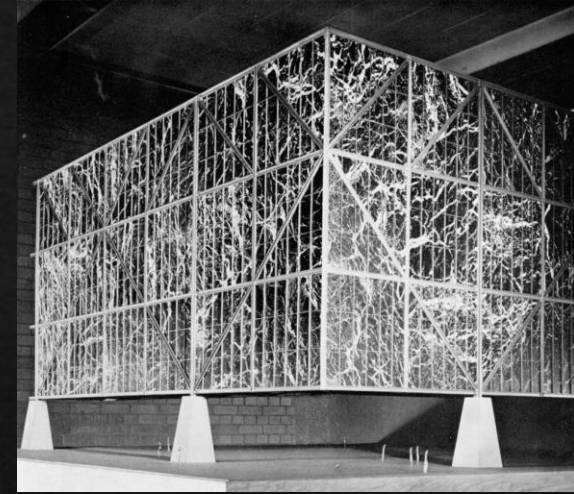
Architect, Writer, Photographer, Professor

**Works : Liechtenstein Art Museum,
Schools in Breiten and Leutschenbach,
Warsaw Museum of Modern Art, Holcim
Competence Center**

**Works have been linked to the rawness of
concrete art and to the bareness of
infrastructural works for which he has an
admitted fascination.**

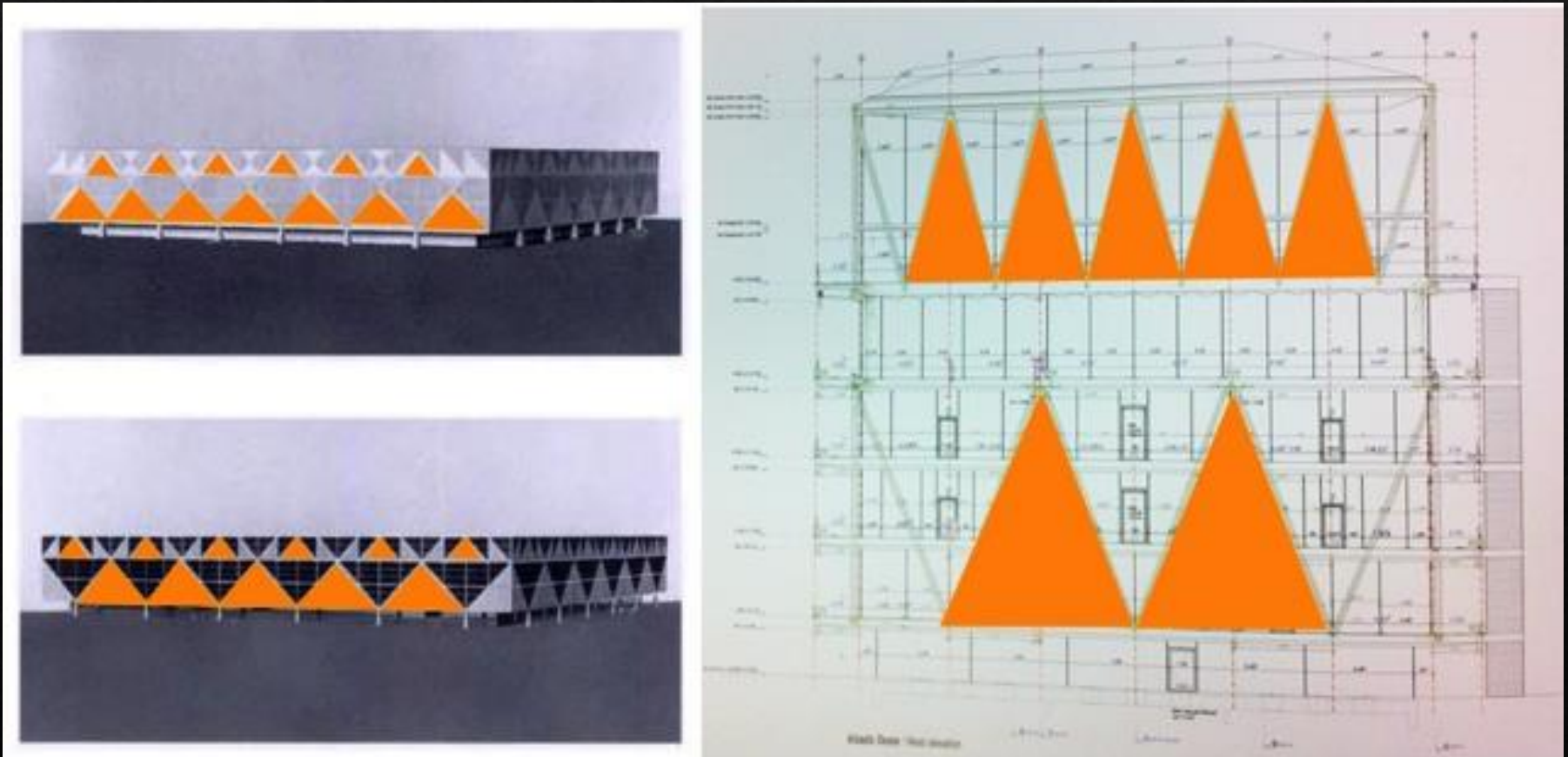
PRECEDENTS

Mies van der Rohe's projected Convention Hall in 1953, Chicago



PRECEDENTS

Compared to Convention Hall and Leutschenbach School



PRECEDENTS

Characteristics of Steel Construction in School Buildings

Relatively Short Construction Period (In case of a thirty-classroom building)

Reinforced concrete construction takes about **10.2** months.

The same building can be built in about **2.8** months with steel construction.



PRECEDENTS



Adaptability of the Structure

- **Flexibility**
- **Adaptability of space**
- **Allows for additional constructions, expansions, and renovations**

PRECEDENTS

Siegfridvon Vegasack School - Germany

- Large flexible space taking advantage of the long spans
- Façade free from structure – allows for extensive use of glass to let light in



SITE ANALYSIS

Zurich, Switzerland

Lows range from 14 °F to 41 °F

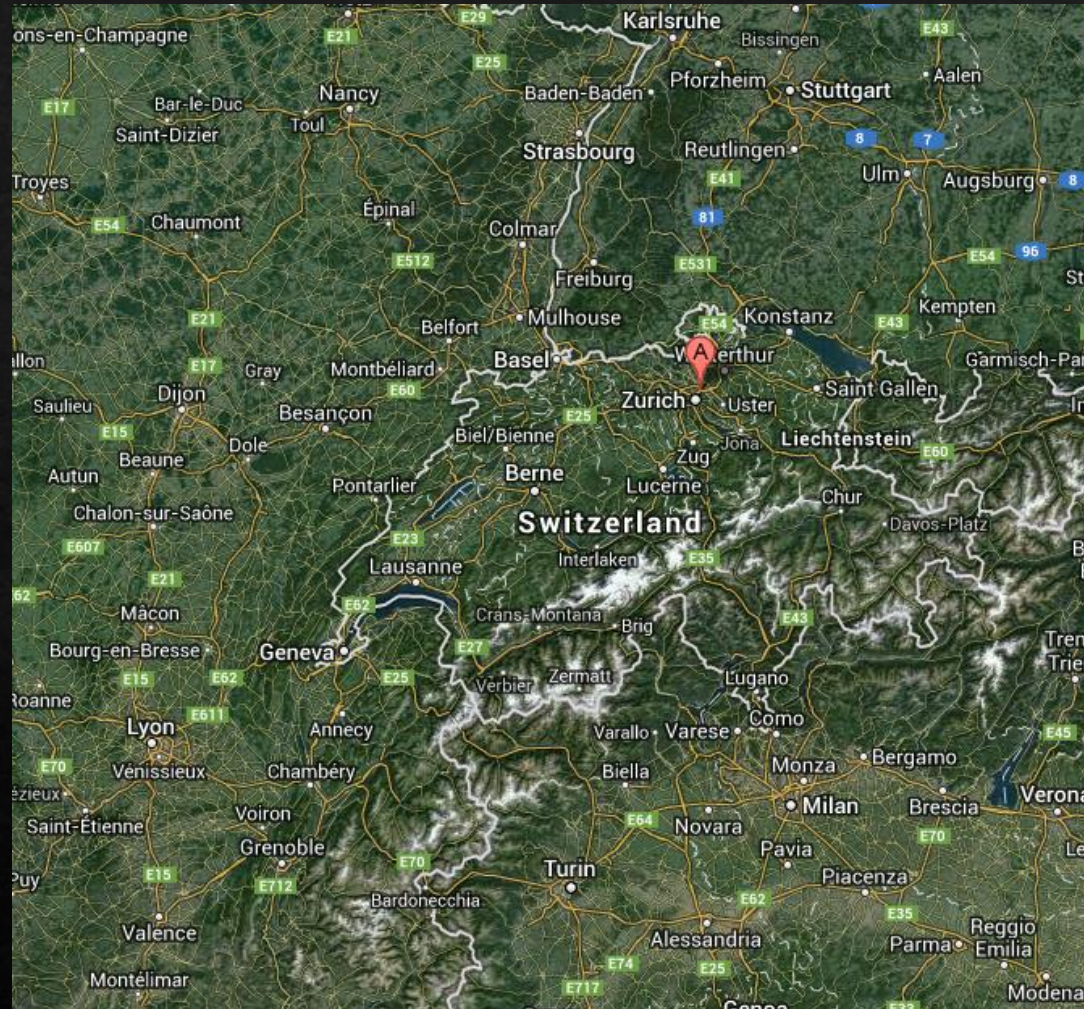
Highs range from 59 °F to 86 °F

Not in Flood Zone

Moderate Earthquake Hazard

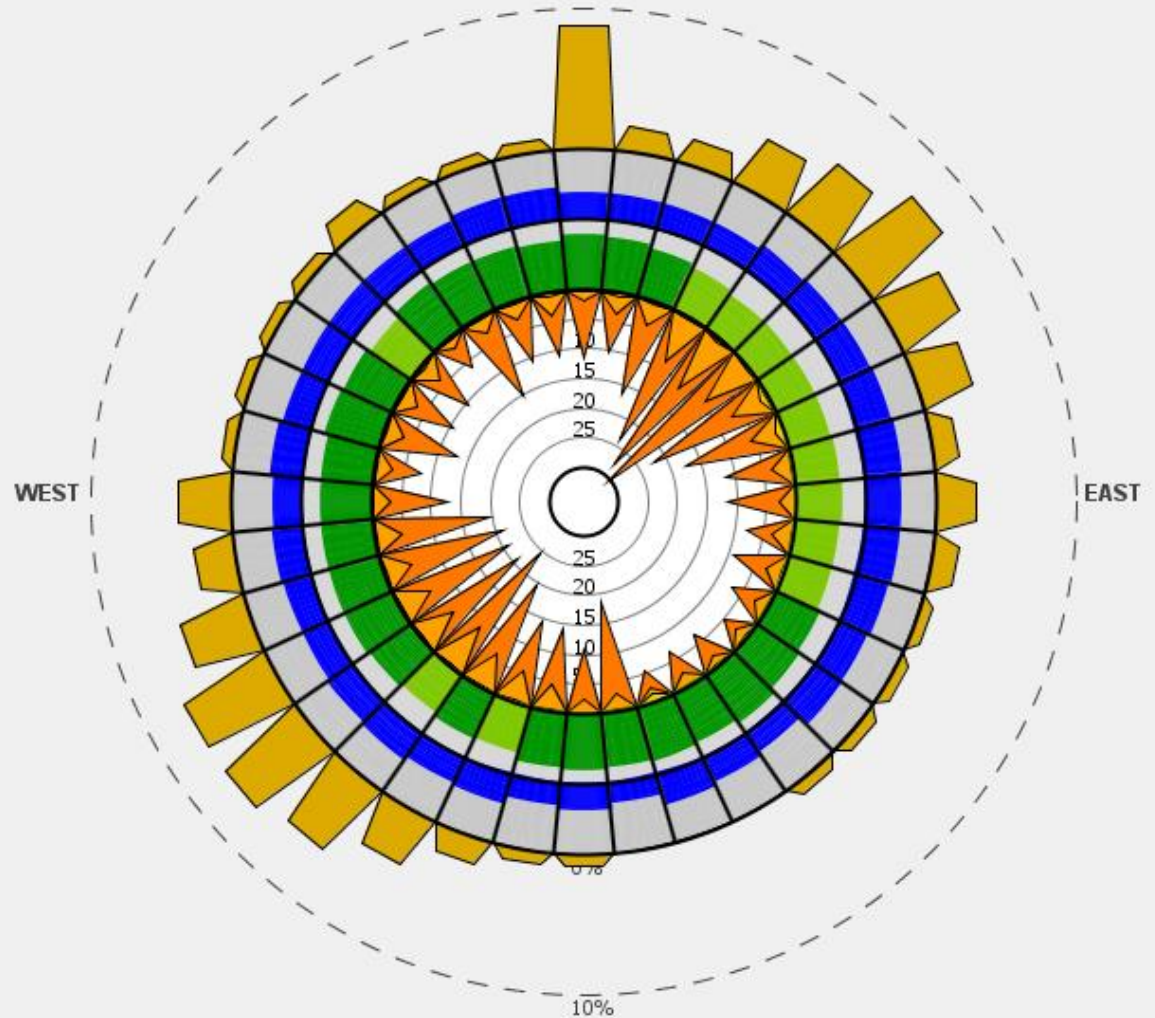
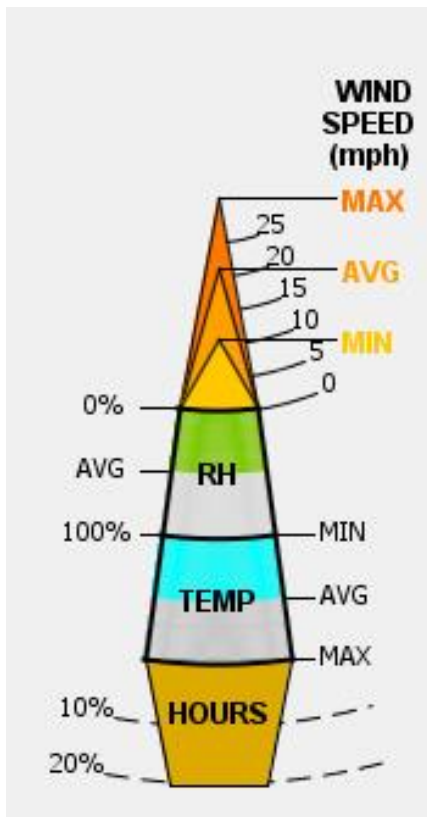
Moderately well drained soil

- Calcareous silt



SITE ANALYSIS

Wind Wheel



SITE ANALYSIS

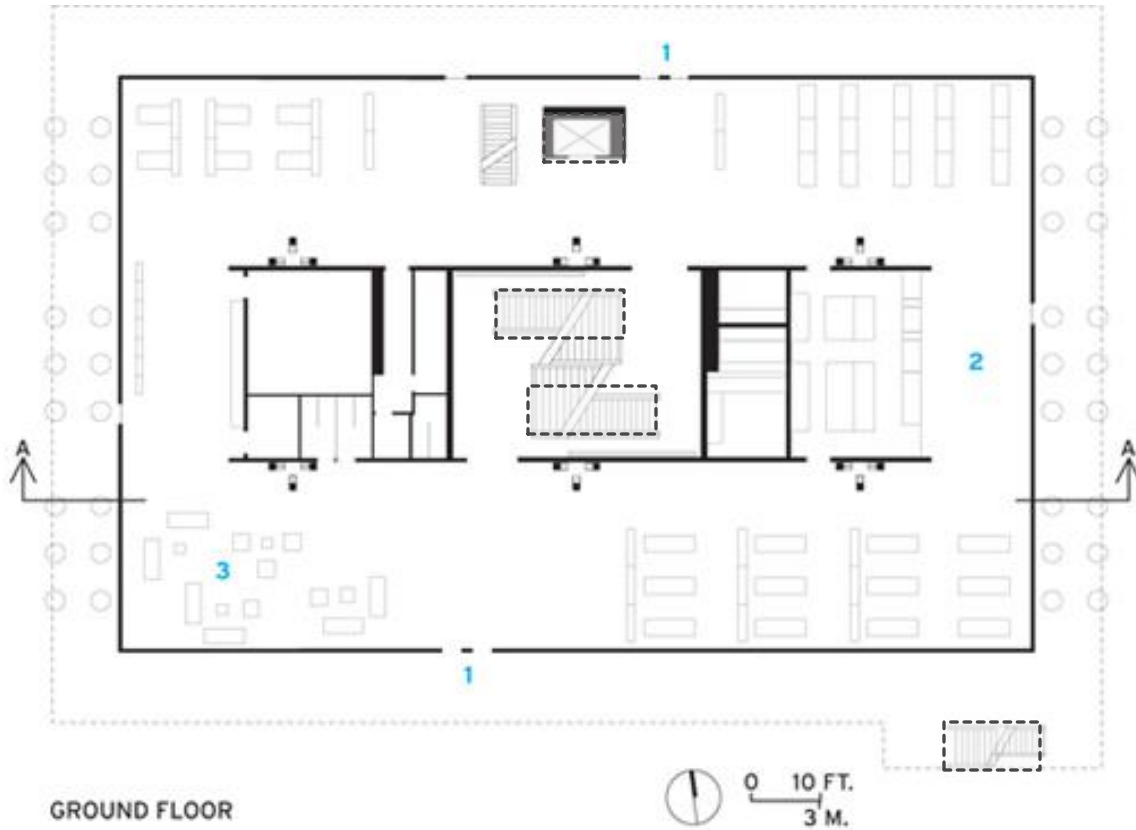
Zurich, Switzerland
North Eastern edge of Zurich
Industrial and Residential



SPATIAL ORGANIZATION

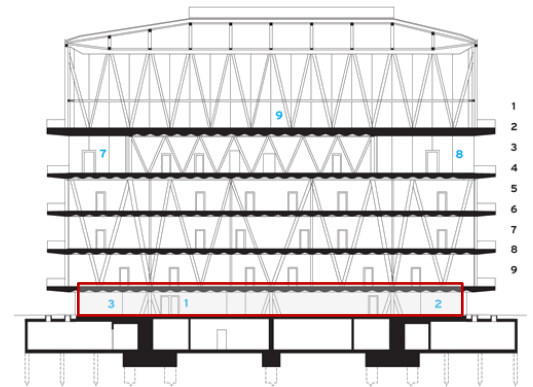


GROUND FLOOR



GROUND FLOOR

- | | | | |
|---|------------------------|---|--------------------|
| 1 | ENTRANCE | 6 | STAFF ROOM |
| 2 | KITCHEN/CAFETERIA | 7 | LIBRARY |
| 3 | MEETING/WORK/PLAY AREA | 8 | MULTIFUNCTION ROOM |
| 4 | COMMON HALLWAY | 9 | GYM |
| 5 | CLASSROOM | | |

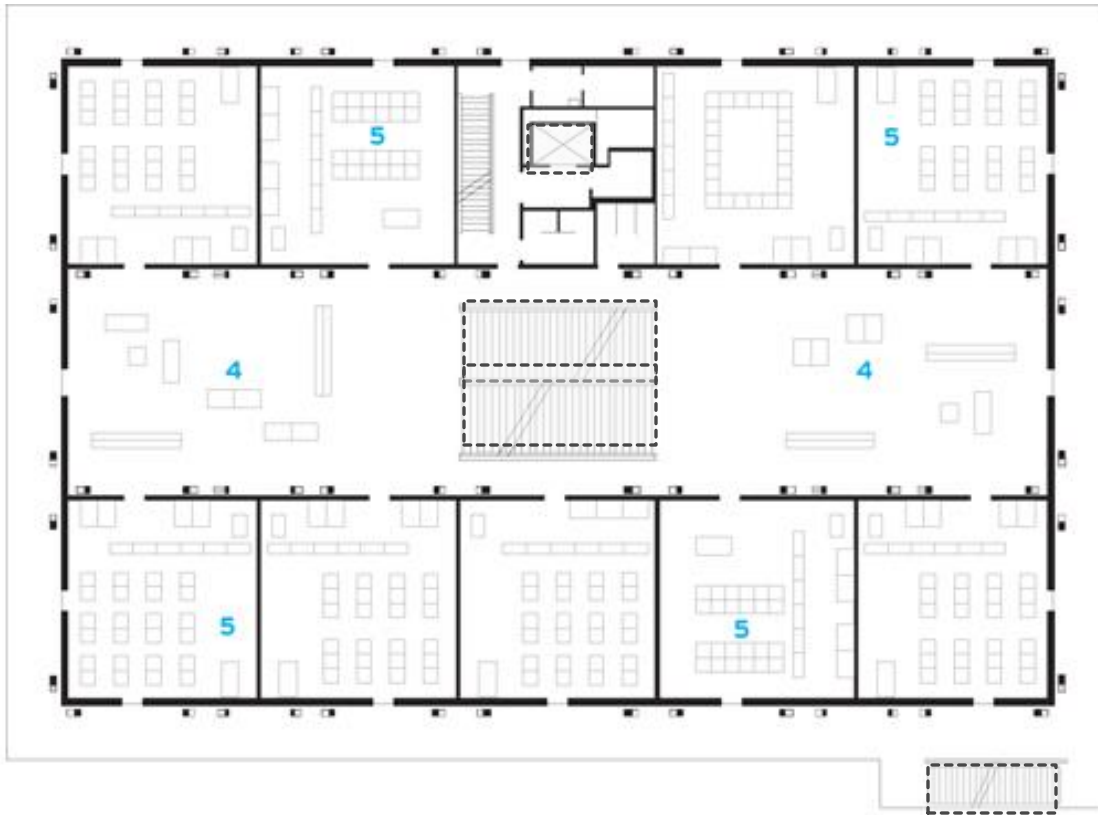


GROUND FLOOR

The children enter on either side of the ground level, which is basically a core with a wide, open area around it. This is where they eat and hang out after class—completely surrounded by unobstructed spans of glass, as if outdoors.

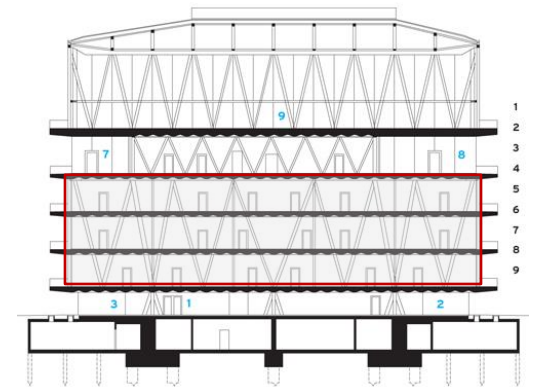


1st, 2nd, & 3rd FLOORS



FIRST FLOOR

- | | | | |
|---|------------------------|---|--------------------|
| 1 | ENTRANCE | 6 | STAFF ROOM |
| 2 | KITCHEN/CAFETERIA | 7 | LIBRARY |
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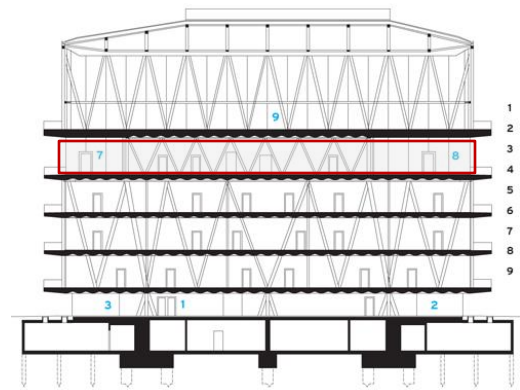
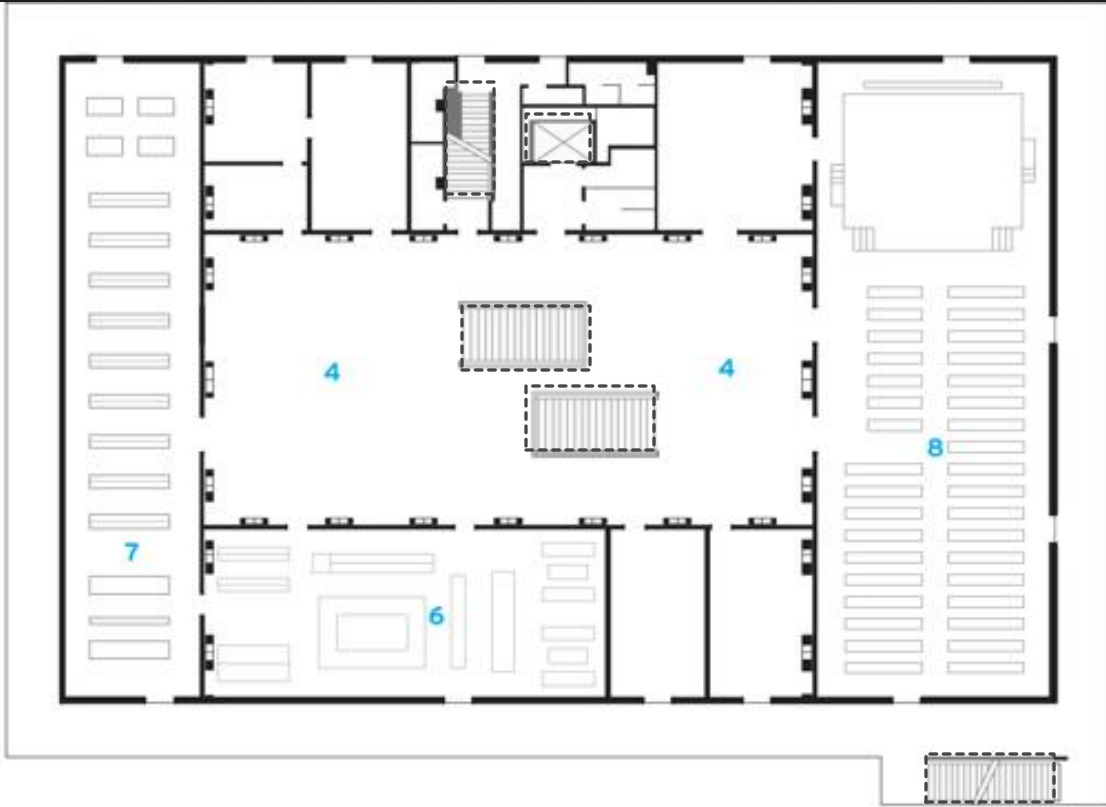


1st . 2nd . & 3rd . FLOORS

**Nine classrooms lining the sides of each floor.
Rather than the typical corridor though, he carved a generous
communal area between them for group activities and lessons.**



4th FLOOR



FOURTH FLOOR

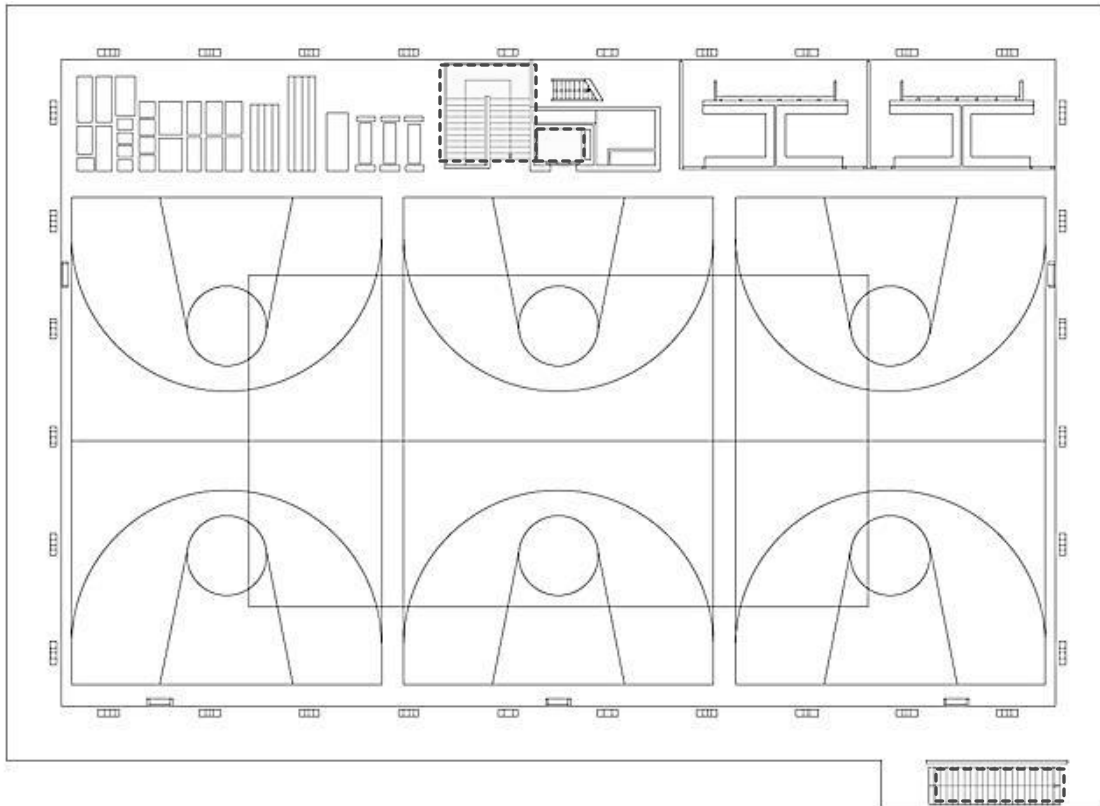
- 1 ENTRANCE
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- 9 GYM

4th. FLOOR

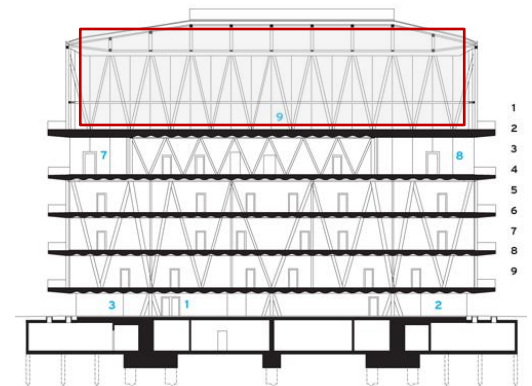
On the fourth floor, the two stairways running in opposite directions meet at a large foyer which provides access to all the public areas, such as the auditorium and library. The gymnasium, the largest and highest space, crowns the whole building...



5th FLOOR



Leutschenbach, 5th floor, sportshall

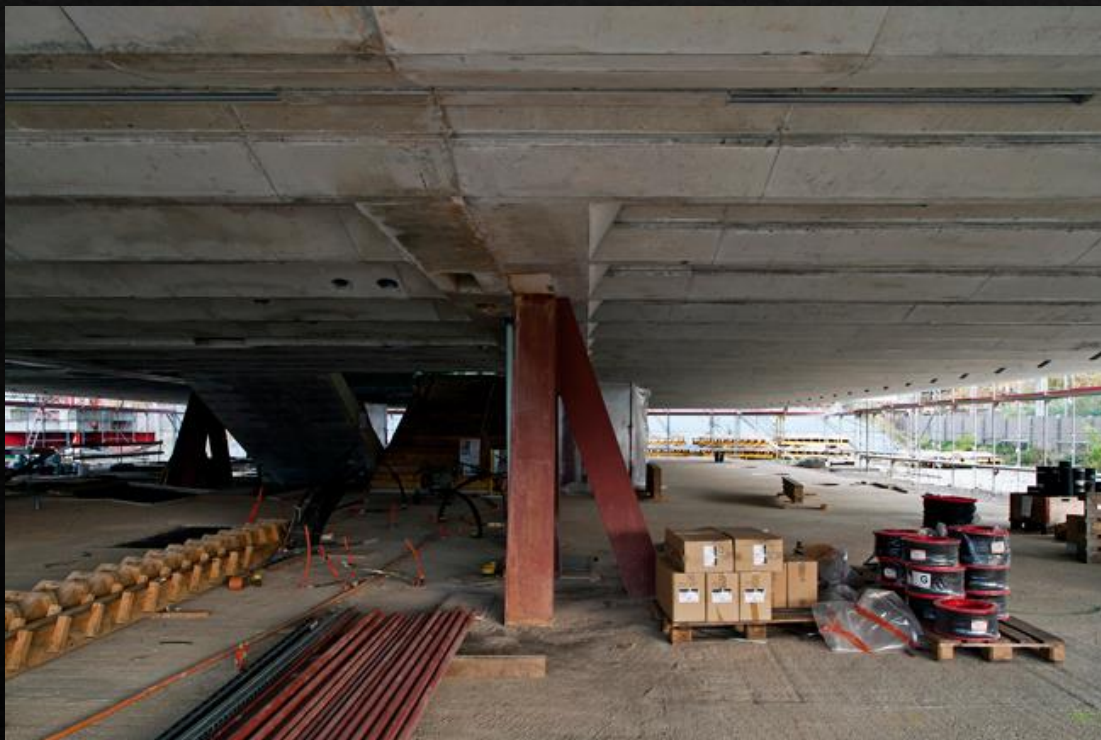
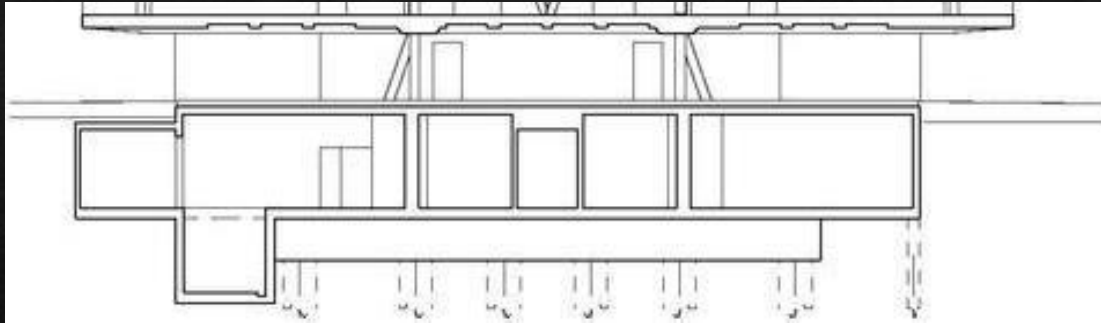




5th FLOOR

The gym crowns the building and achieves a sense of elation, floating above the immediate site, with views of the mountains that frame Zürich. Not surprisingly, says Kerez, when he asks pupils what they like most about the school, nearly all say the gym.

FOUNDATION

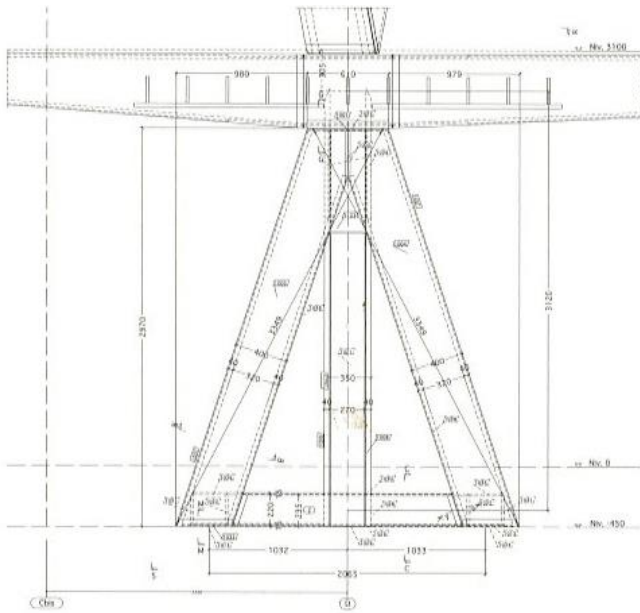


Waterproofed Basement

- 50% recycled concrete
- Sika® Permaton

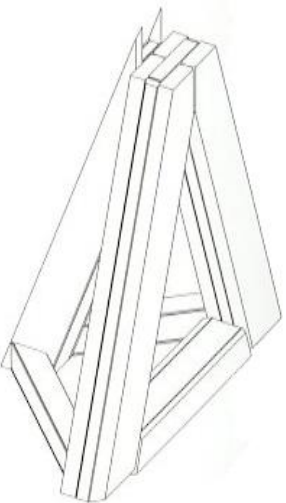
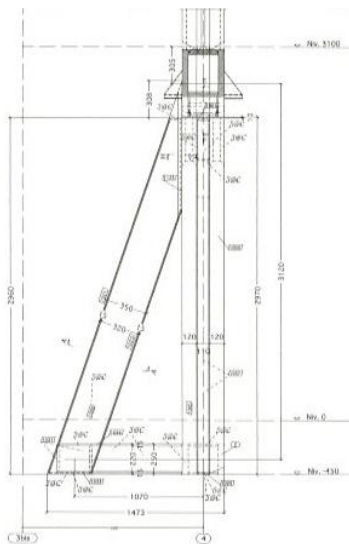
Pier foundations

- basement restoring on pile caps



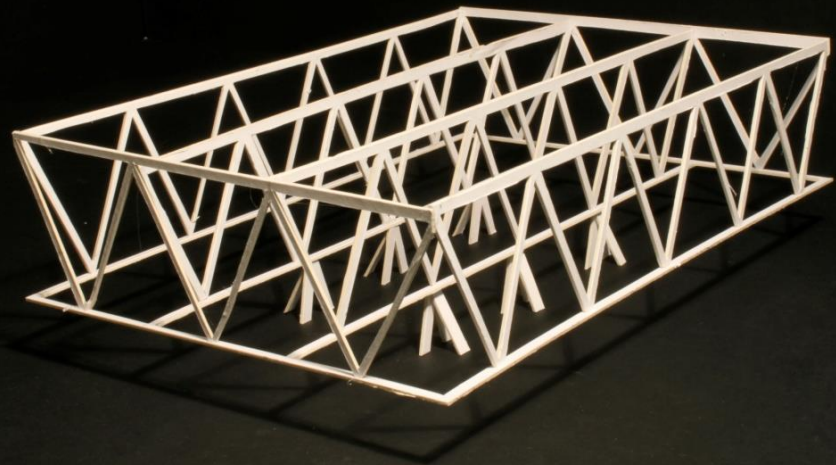
Ground Floor

- 6 Tripod Columns
- Side Braced



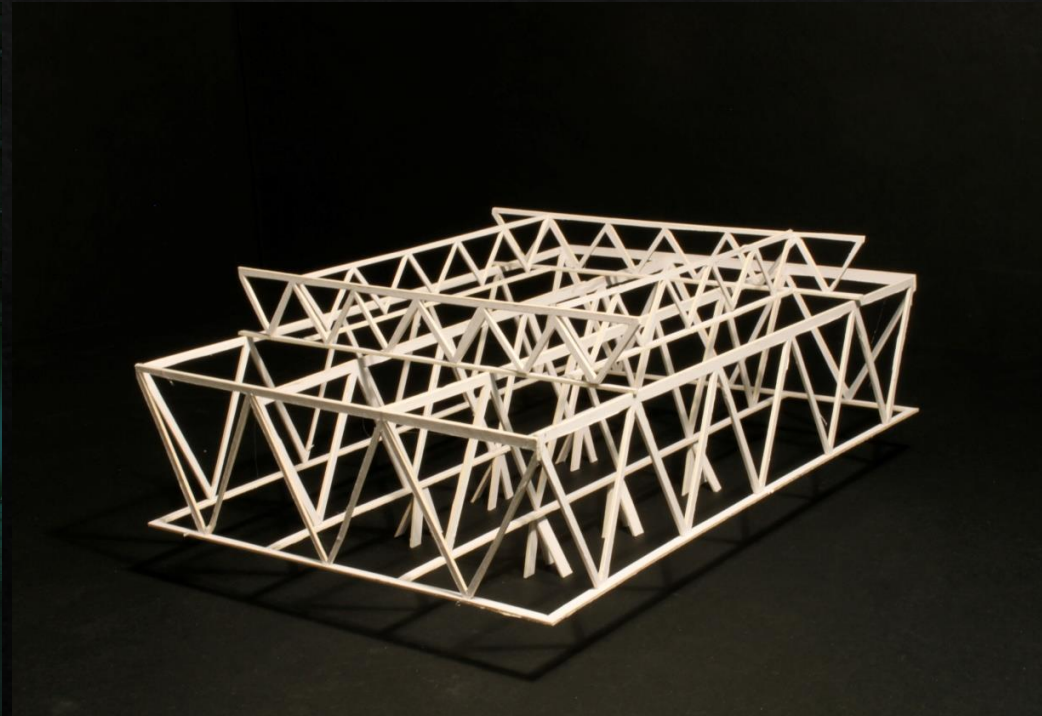
2nd – 4th Floor

- Classrooms
- 2 Girders resting on the 6 Columns
- Truss supported by the Girders



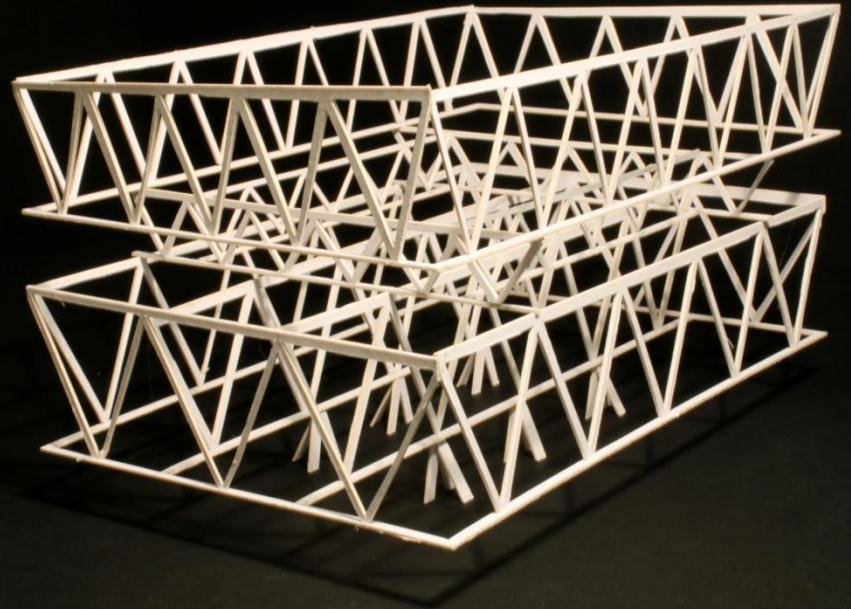
5th Floor

- **Library & Multifunction room**
- **4 Trusses resting on 6 trusses from 2nd and 4th floor**



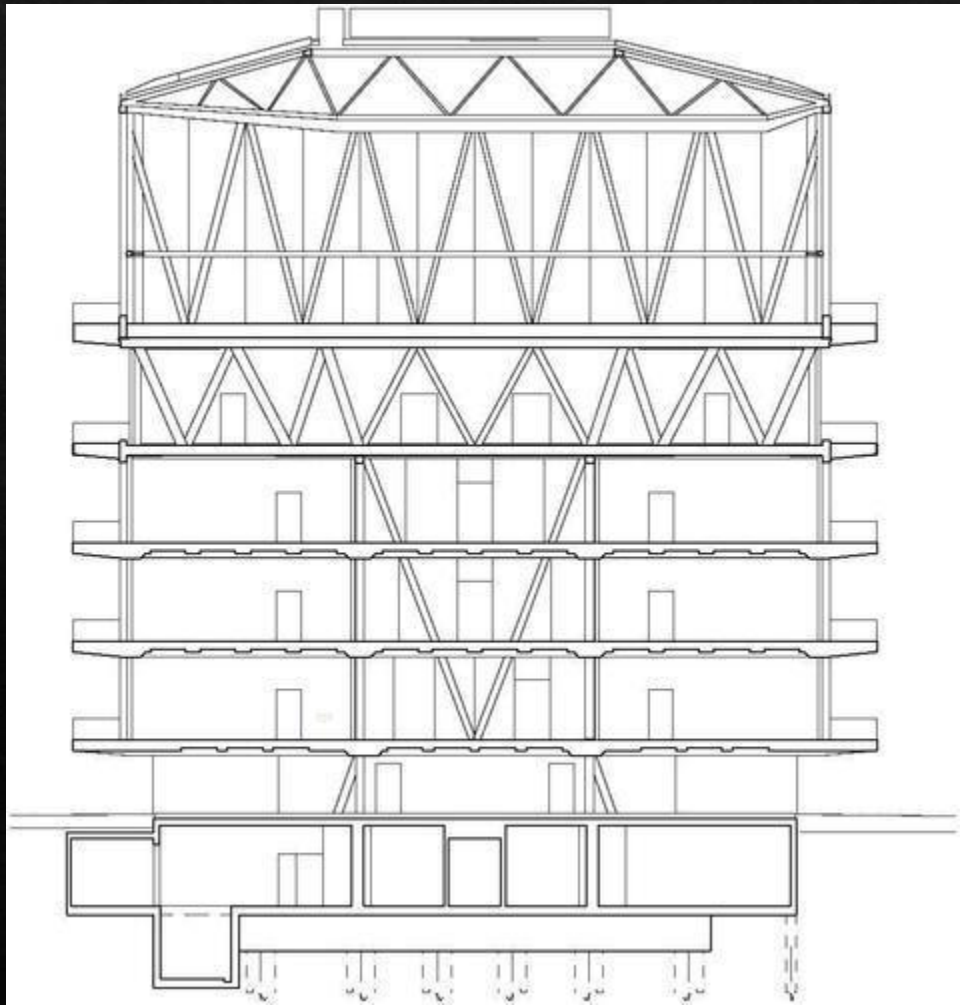
6th Floor

- 2 Trusses supported by the 5th floor's 4 trusses
- 2 Trusses supported by the 2 Trusses



Roof

- 2 Trusses resting on the 6th floor
- Solar panels, chimney, etc.



Detail Study

1:20

This detailed study focuses on the concrete ribbed floor and how the floors connect together, and with the other elements. It is a section taken through the second and third floor

30-50mm artificial-stone slab paving

2.5m exterior cantilevered balcony, outside circulation space

Concrete reinforced cantilevered floor

300/300mm steel square hollow section (SHS), connects the steel truss to the floor and is supported to the next column

Glazed barrier

Concealed aluminum window frame

Gutter

Concrete reinforced cantilevered floor
Concealed aluminum window frame

80mm rock-wool insulation slab

Damp proof membrane (DPM)

800mm steel channel section

Solar blind

Triple glazing to fit in with the Minergie Standards

Diagonal truss members, steel hollow section

Steel I-beam 160mm deep

280mm reinforced concrete floor

480mm reinforced concrete floor

Triple glazing

Glass fin, supporting the triple glazing and transferring the load back to the concrete floor

100mm concrete screed

Under floor heating

50mm impact-sound insulation

Ventilation outlet

Acoustic layer on 48mm mineral underlayer

Loudspeaker

Sprinkler

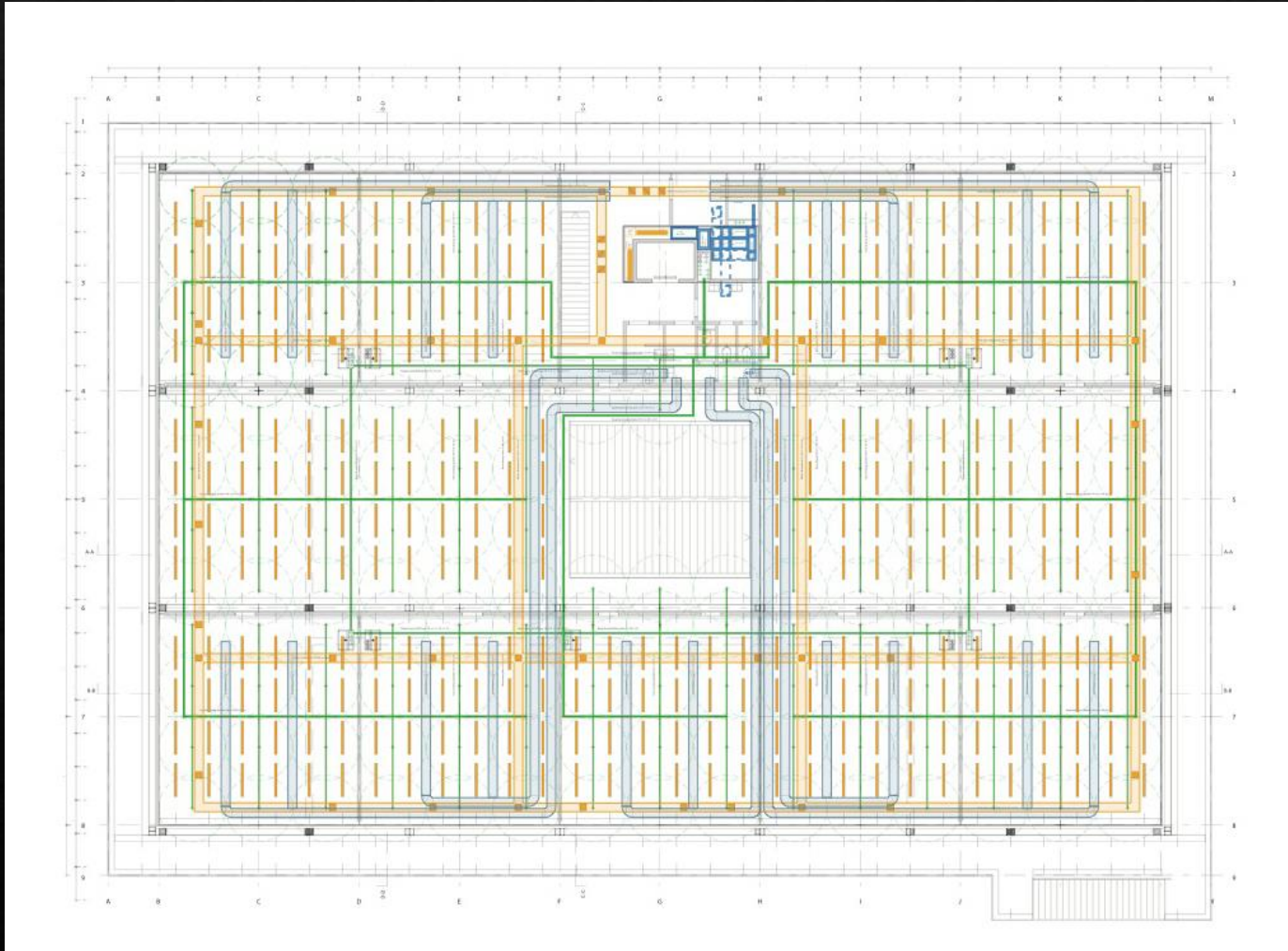
Light

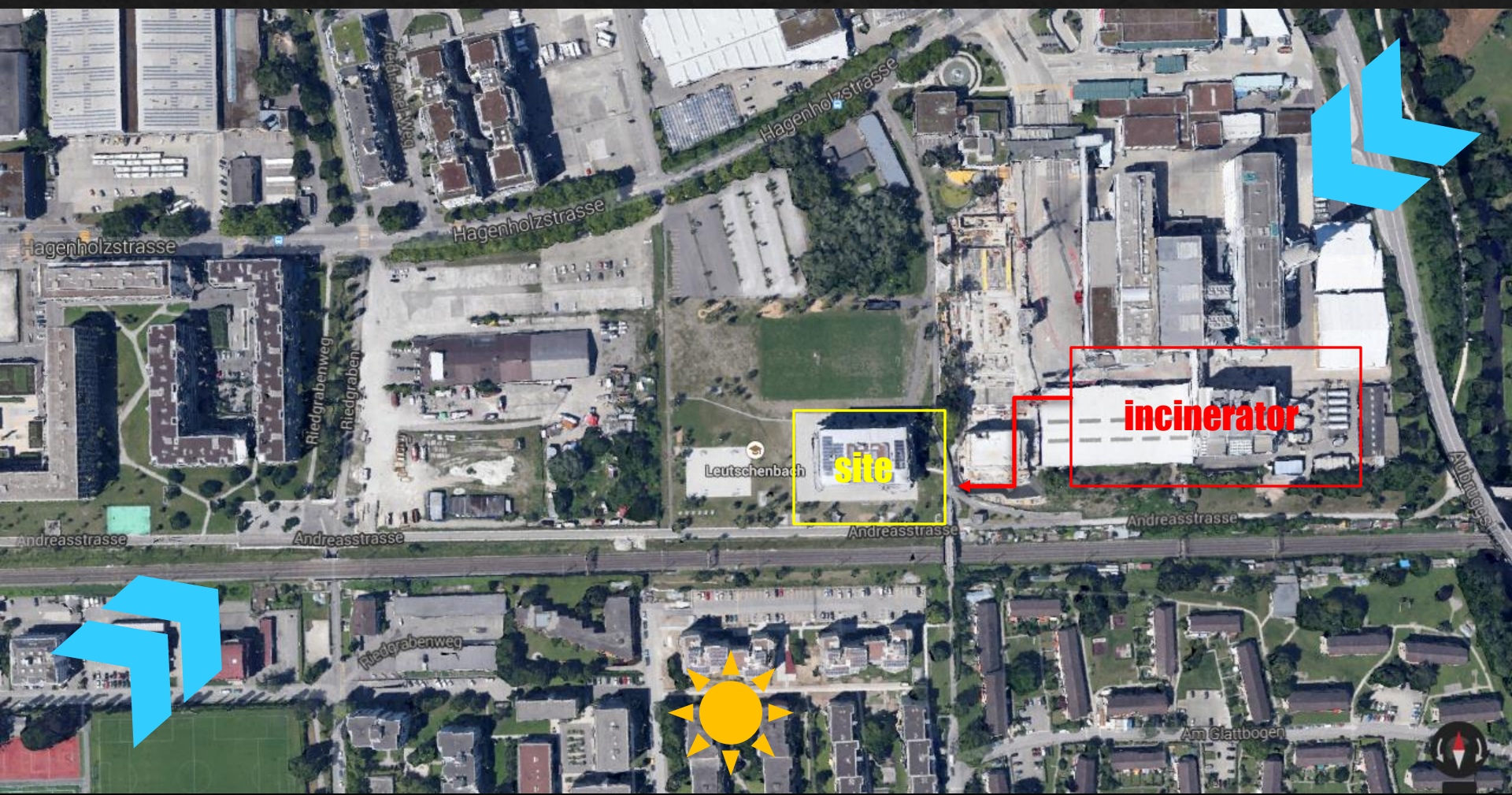
Steel I-beam 160mm deep

**System slab
3D detail**

Heated floor system

- Shaft located on the North
- Heat transferred from an adjacent incinerator





Hagenholzstrasse

Hagenholzstrasse

Hagenholzstrasse

Riedgrabenweg

Riedgrabenweg

Leutschenbach

site

incinerator

Andreasstrasse

Andreasstrasse

Andreasstrasse

Andreasstrasse

Riedgrabenweg

Am Glattbogen



System Glass

Interior

- Semi-translucent
- Triple skin Profilit panels



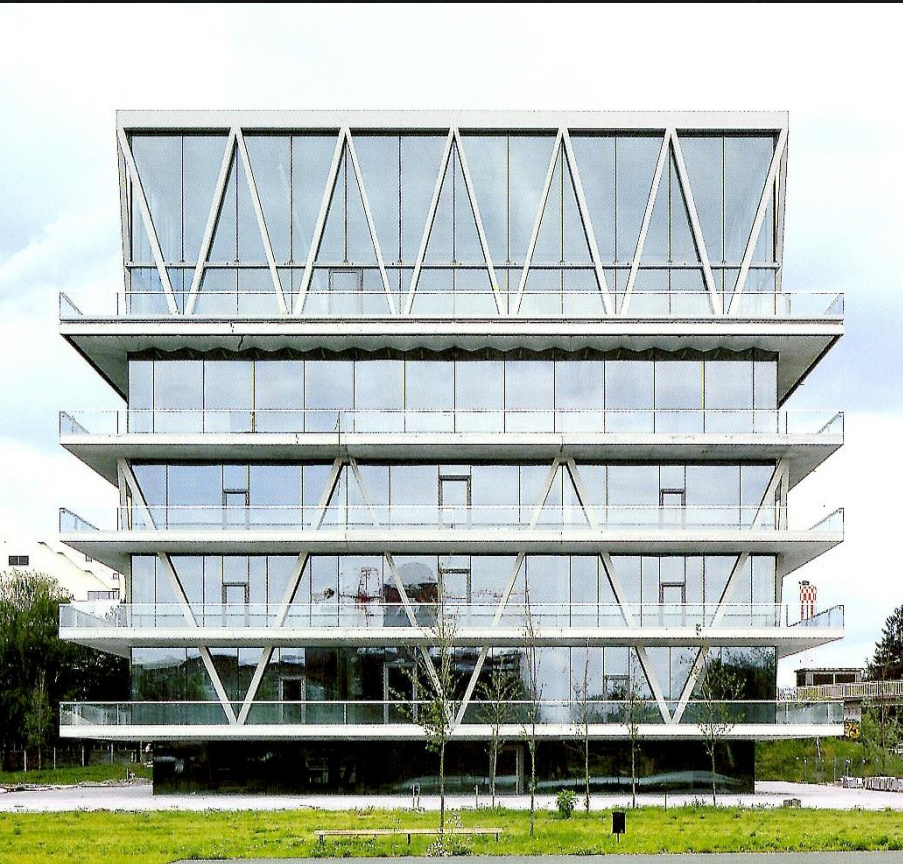
Exterior

- Concern with conductivity than reflectivity
- Double glazed, translucent channel-glass

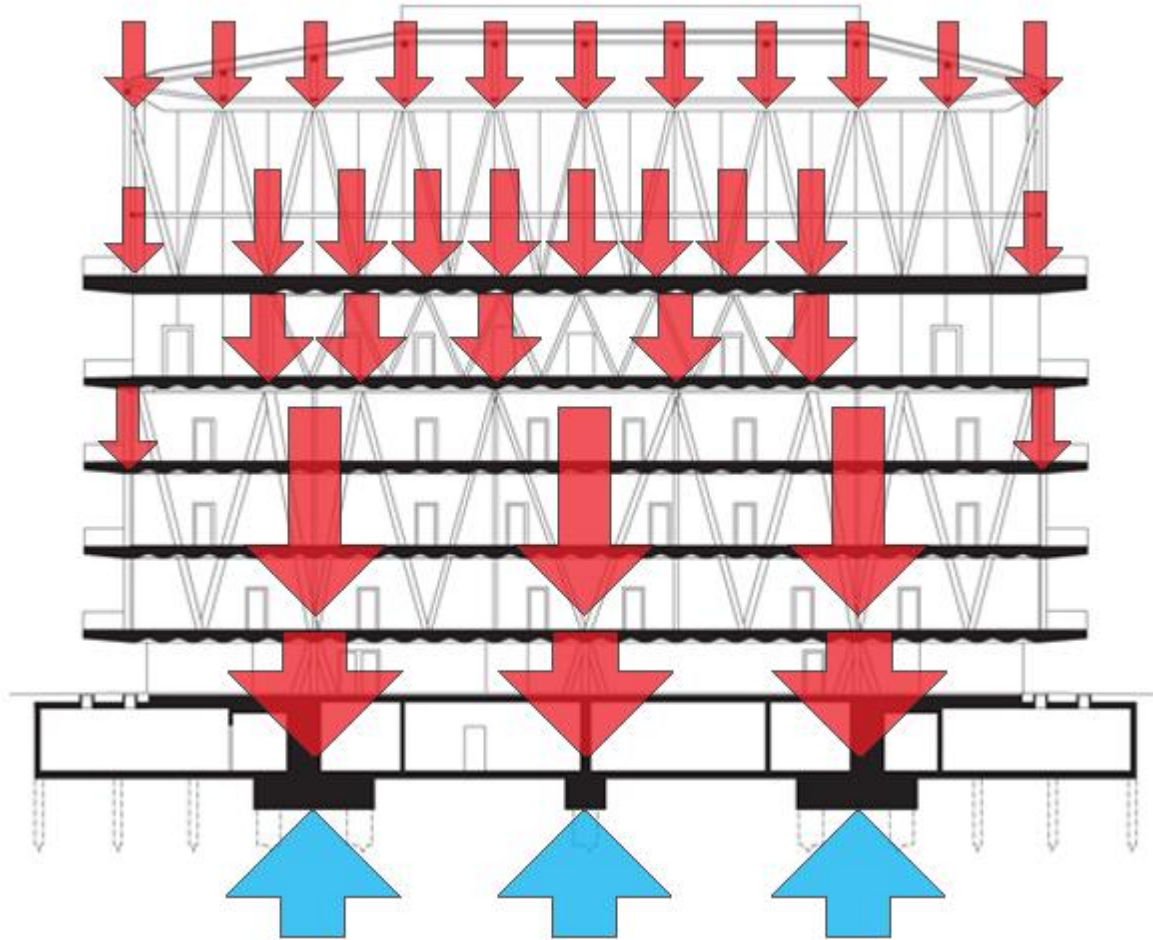


System of Mezzanines

- Sun shade (S > N)
- Extended public functions
- Alternative Egress

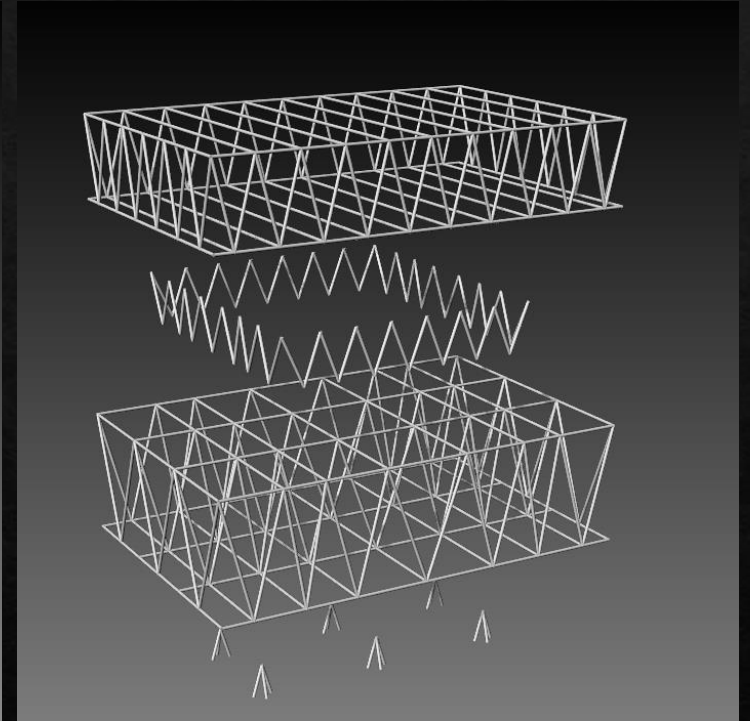
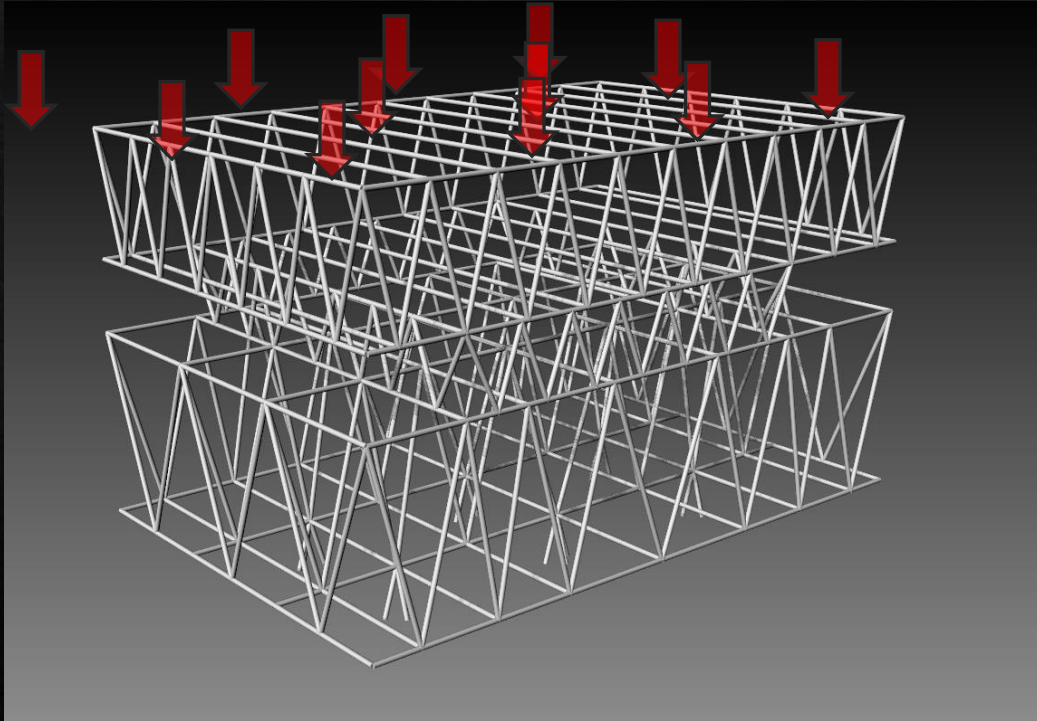


LOAD TRACING DIAGRAM



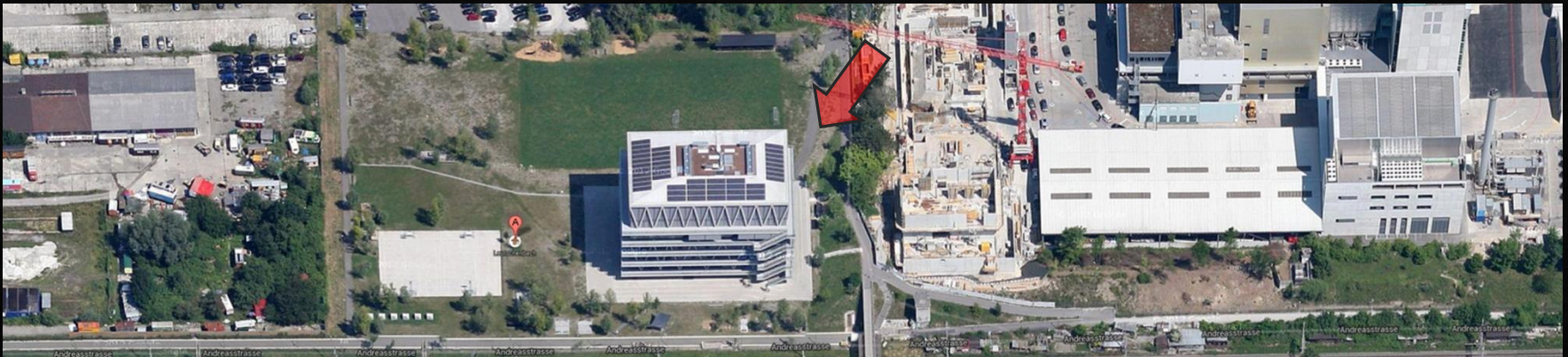
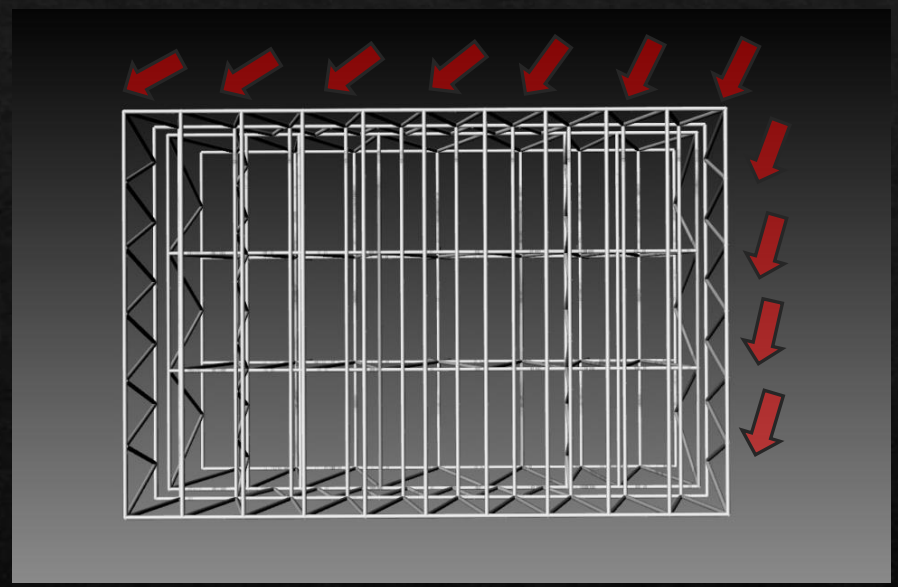
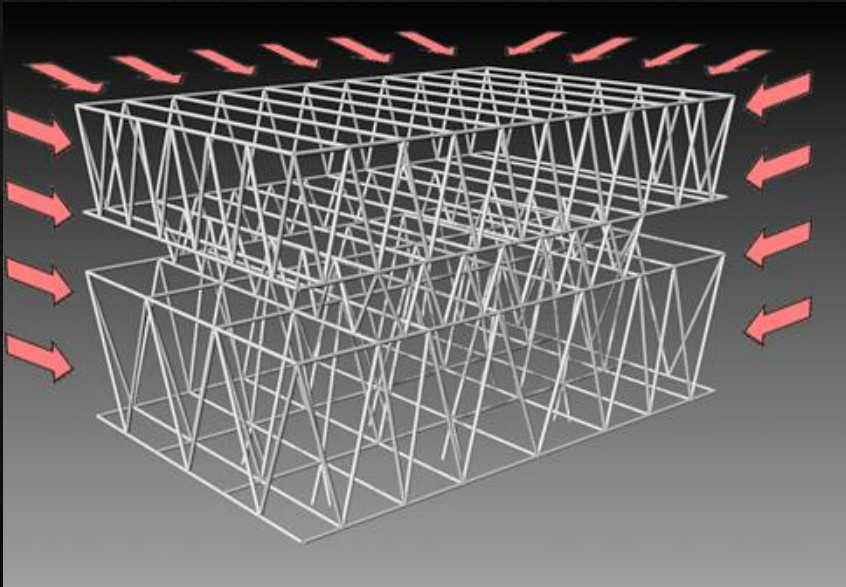
MULTI-FRAME ANALYSIS

SNOW LOADING



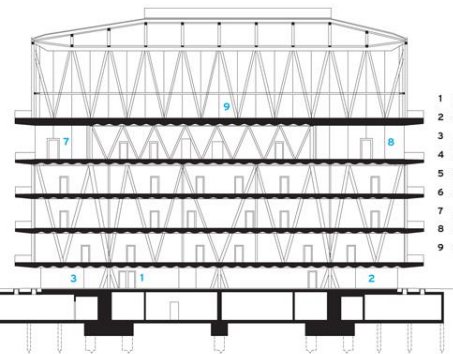
MULTI-FRAME ANALYSIS

WIND LOADING



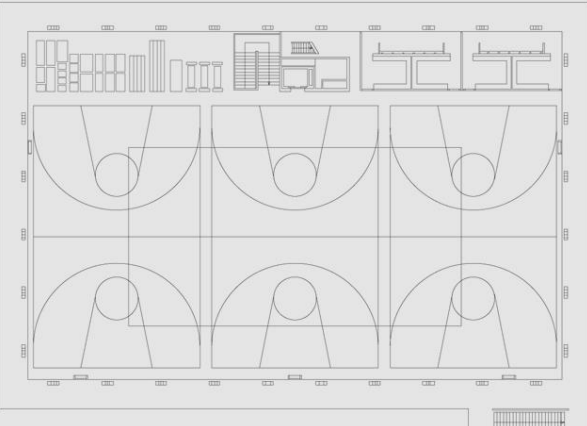
MULTI-FRAME ANALYSIS

LIVE LOADING

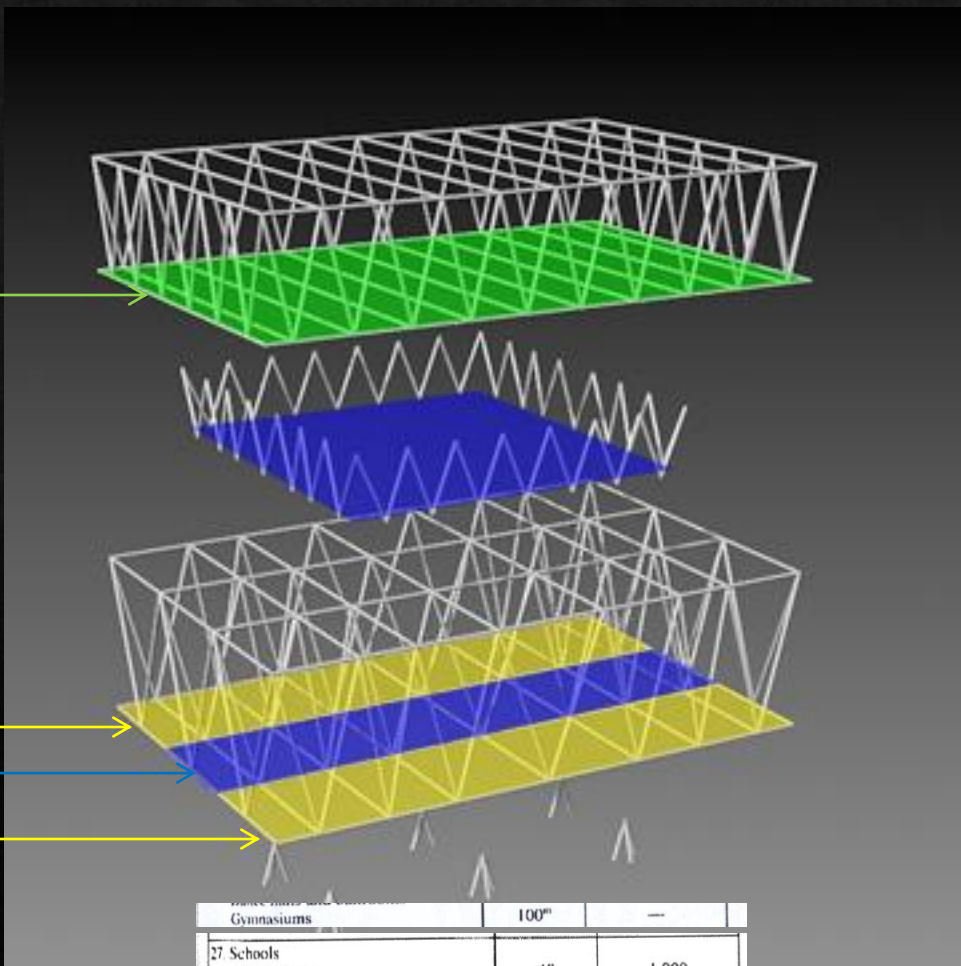
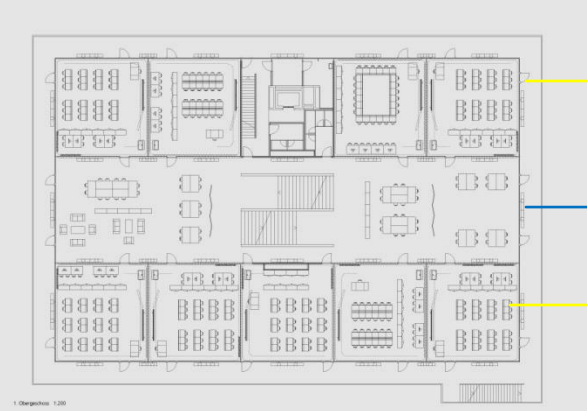


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LONGITUDINAL SECTION A-A



Leutschenbach, 5th floor, sportshall



Gymnasiums	100m ²	—	—
27 Schools			
Classrooms	40	1,000	
Corridors above first floor	80	1,000	
First-floor corridors	100	1,000	

MULTI-FRAME ANALYSIS

MOMENT SIMULATION

