



Construction Applied to Heritage



Erasmus+

Construction Applied to Heritage

3 ECTS

SH

Sustainable Heritage

EC

Elective Courses



Construction Applied to Heritage

SH

Sustainable Heritage

EC

Elective Courses

1. Foundations.
2. Retaining Works.
3. Drainage and Sewerage Systems.
4. The Porous Loadbearing System.
5. The Porous Loadbearing System. Walls.
6. The Porous Loadbearing System. Grid Structures.
7. The Compact Loadbearing System.
8. The Porous and Mixed Horizontal Loadbearing System. Slabs.
9. The Porous and Mixed Horizontal Loadbearing System. Grid slabs.
10. Roofs.
11. Sloping Roofs.
12. Flat Roofs.
13. Façades. Porous System. Ventilated Façades.
- 14. Façades. The Compact System. Curtain Walls.**
15. The Internal Partitioning Layout. Construction Process.

Construction Applied to Heritage



3 ECTS

**14 FAÇADES.
THE COMPACT SYSTEM.
CURTAIN WALLS**

- Curtain walls

 - Studs and transoms system

 - Modular façade system

 - Structural glass system

- Union with slabs

- Insulation

- Openings formation

- Fire resistance

- Complementary elements

 - Façade fixing and anchorages

 - The framing

 - The glass

FAÇADE FUNCTIONS

- Waterproofing.
- Insulation:
 - hygrothermal (thermal transmission, surface and interstitial condensation),
 - acoustic (airborne noise and impact noise).
- Solar radiation, solar protection, greenhouse effect, optical performance.
- Compatibility of elements. (Mechanical, chemical, dimensional). Interaction of the structure with the façade. Stability and structural resistance. Deformability.
- Durability. Dirtying factor.
- Fire resistance.
- Safety of use.
- The integration of solar energy capture systems. Ventilation, lighting, etc.

FAÇADE TYPOLOGIES

HEAVY FAÇADES. POROUS

- Simple walls.
- Double walls.
- Double walls with inserted outer leaf.
- Double walls with through outer leaf.
- Double walls with hanging outer leaf.

LIGHTWEIGHT FAÇADES.

- VENTILATED FAÇADE

A.- Open joint panels system.

POROUS

- Stone cladding.
- Ceramic cladding.
- Wooden lightweight cladding.
- Concrete.

COMPACT - Metallic panels.

- CURTAIN WALLS. COMPACT SYSTEM:

B.- Studs and transoms system.

C.- Modular façade system.

D.- Structural glass system.

- COMPLEMENTARY ELEMENTS.

Framing.

Glass.

SIMPLE WALLS.

DOUBLE WALLS:

- WITH INSERTED OUTER LEAF
- WITH THROUGH OUTER LEAF
- WITH HANGING OUTER LEAF



FAÇADES TYPOLOGY

HEAVY FAÇADES

DOUBLE WALLS

- The Anglo-Saxon solution of the CAVITY WALL, with interior load-bearing wall and self-supporting exterior leaf starting from below, with anchorage keys to the internal wall. It is limited to a maximum of 4 floors.
- The Spanish solution of the capuchin wall, with ceramic or metallic keys.

The solutions of non-structural walls differ according to how the support of the outer leaf of the façade on the edge of the slab is solved:

- **Inserted leaf:** Both leaves are inserted between two successive slabs.
- **Through outer leaf -heavy-:** The exterior leaf is supported by cantilever brackets projected in front of the edge of the floor slab.
- **Hanging outer leaf -light-:** the support system on the slabs is replaced by a system of anchors (hanging and retention).

SIMPLE WALLS.

DOUBLE WALLS:

- WITH INSERTED OUTER LEAF
- WITH THROUGH OUTER LEAF
- WITH HANGING OUTER LEAF

FAÇADES TYPOLOGY

HEAVY FAÇADES

DOUBLE WALLS WITH INSERTED OUTER LEAF

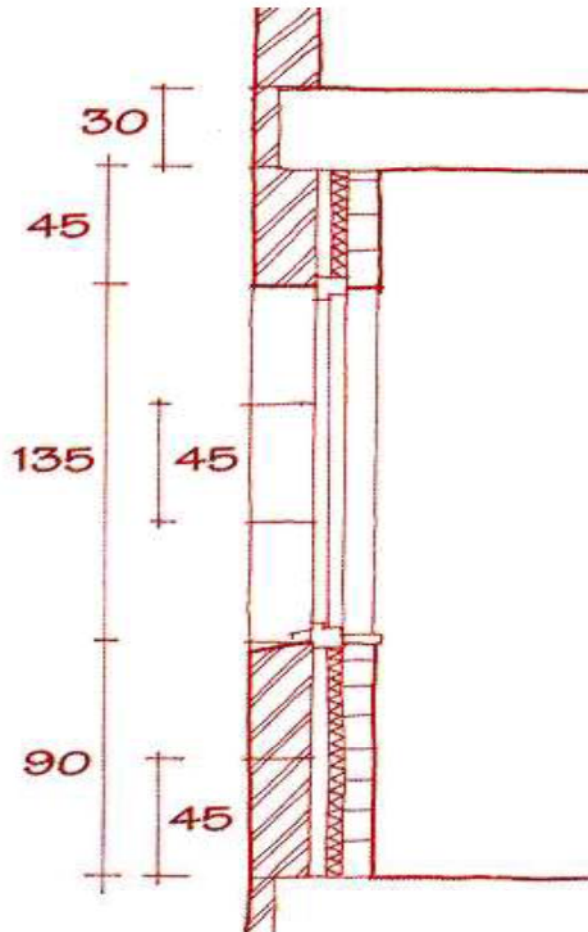
Both layers are inserted between the successive slabs.

It is the current conventional façade: heavy outer layer sheet of facing + air chamber + inner partition wall.

The outer sheet is plastered inside with cement mortar to improve the watertightness, since the humidity can reach its full thickness and reach the chamber.

The outer sheet rests directly on the edge of the slab, with a small overhang to cover the front of the slab with the same appearance as the rest of the façade. In this solution, the support always interrupts the continuity of the outer layer, the insulation and the air chamber.

It is necessary to check that in the calculation of the floor slab is limited to the deformation of the edge (either beam or strap) so that it is compatible with the rigidity of the brick wall.



SIMPLE WALLS.

DOUBLE WALLS:

- WITH INSERTED OUTER LEAF
- **WITH THROUGH OUTER LEAF**
- WITH HANGING OUTER LEAF

FAÇADES TYPOLOGY

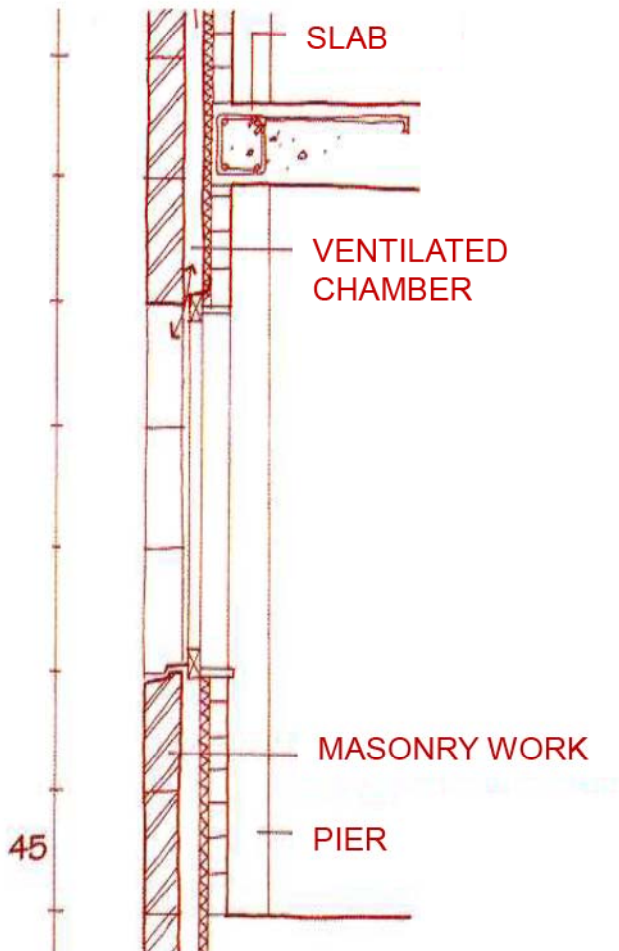
HEAVY FAÇADES

DOUBLE WALLS WITH THROUGH OUTER LEAF

The outer sheet is supported by cantilever brackets in front of the slab edge. The bracket can be a L-shape metal profile, a concrete heel protruding from the slab itself or a sturdy and resistant ceramic bracket.

These brackets reduce the thermal bridging.

In this solution, only the outer layer or the insulation can pass through. The air chamber is interrupted by the supports on each slab level. In rainy climates, a solution for the bottom of the chamber must be provided (waterproof flanching and water outlet).



SIMPLE WALLS.

DOUBLE WALLS:

- WITH INSERTED OUTER LEAF
- WITH THROUGH OUTER LEAF
- **WITH HANGING OUTER LEAF**

FAÇADES TYPOLOGY

HEAVY FAÇADES

DOUBLE WALLS WITH HANGING OUTER LEAF

The system of support on slabs is replaced by a system of anchors (hanging and retention) that supports the weight of the outer layer and transfers that weight (together with the action of wind) to the inner support leaf.

The outer layer can be made of stone cladding pieces, hydrofuged wood board, metal cladding, ceramic cladding.

The outer layer is not adhered to the support but hung at a certain distance in order to create the necessary space for the air chamber and the layer of thermal insulation. The thermal insulation can pass in front of the slab and completely eliminate the thermal bridges of the conventional solution.

SIMPLE WALLS.

DOUBLE WALLS:

- WITH INSERTED OUTER LEAF
- WITH THROUGH OUTER LEAF
- **WITH HANGING OUTER LEAF**

FAÇADES TYPOLOGY

HEAVY FAÇADES

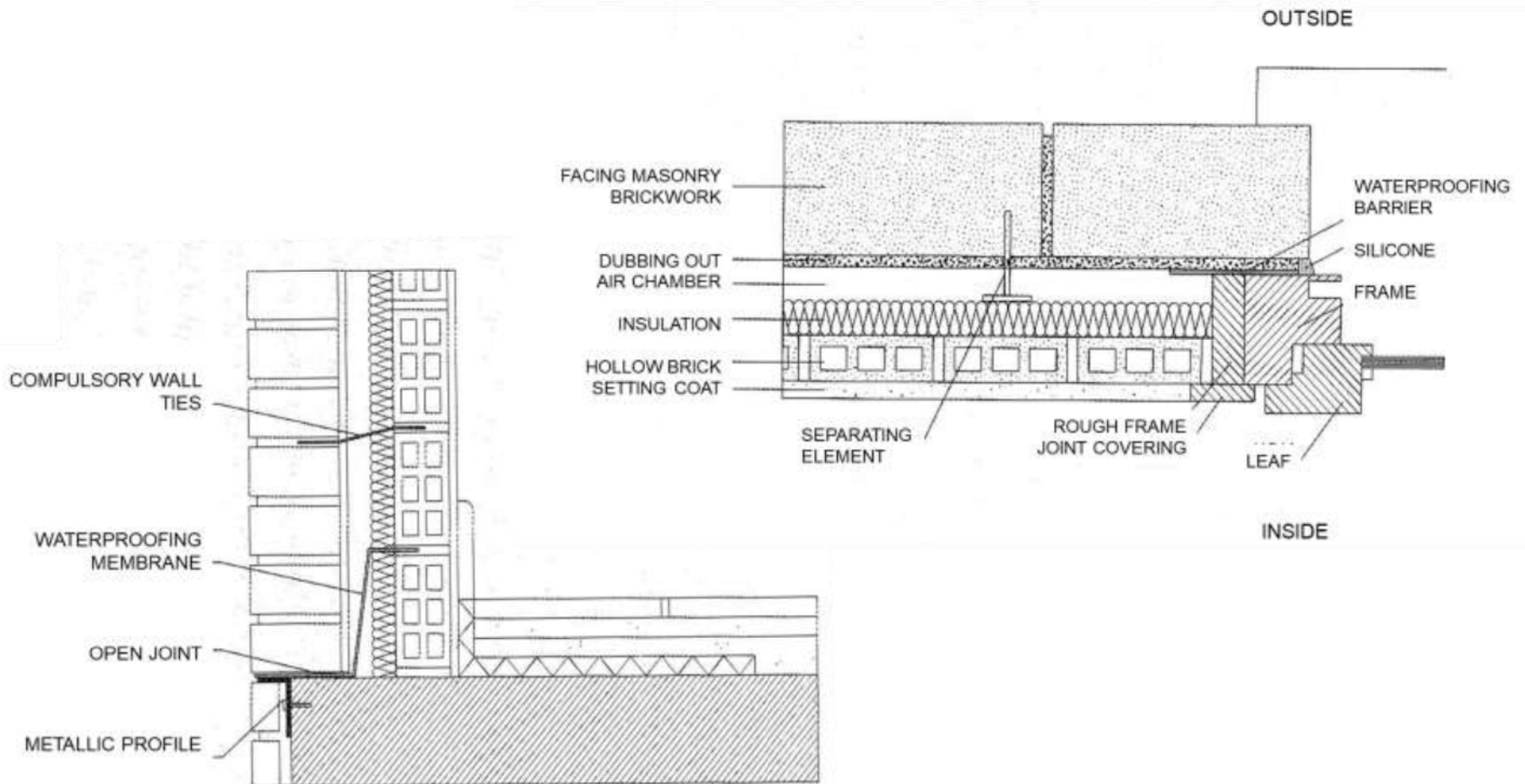
DOUBLE WALLS WITH HANGING OUTER LEAF

Solutions for outer leaf hanging from the interior support:

- Concrete panels.
- Ventilated stone façade: Facade tiles with open joints, anchored to direct fixings on the internal supporting wall.
- Same, with indirect anchors to a grid studs framework that is fixed at various points to the internal supporting wall.
- Same, with a substructure of profiles fixed to the slabs edges or pier lines.

POROUS HEAVY FAÇADES

CERAMIC FAÇADES. CONNECTIONS



CURTAIN WALLS ISSUES

- Compatibility of structure-façade movements.
- Limit and service resistance.
- Lighting excess(glare).
- Heat losses in winter.
- Heat gains in summer.
- Watertightness.
- Air permeability.
- Acoustic insulation.
- Fire performance.
- Safety, maintenance and durability.



TYPES OF CURTAIN WALLS

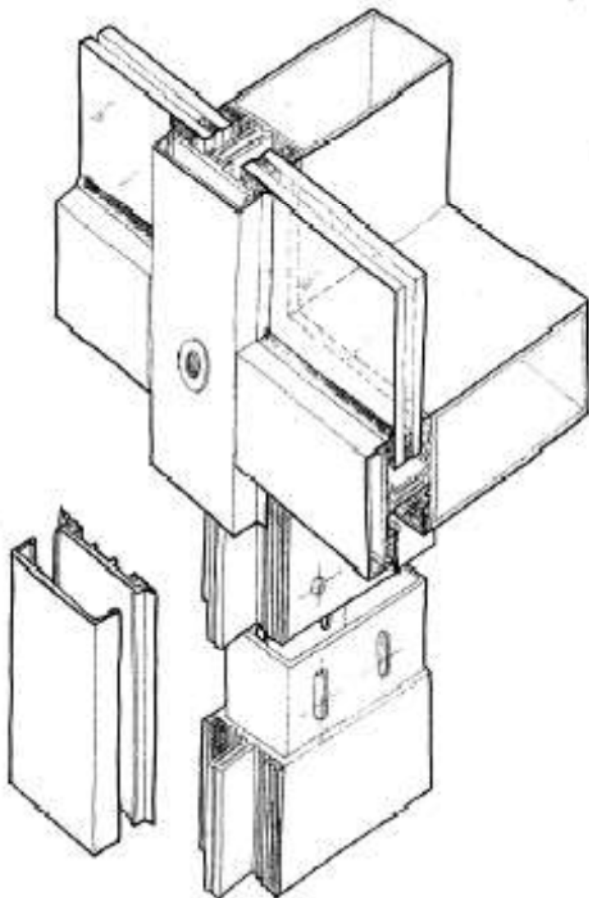
STUDS AND TRANSOMS SYSTEM

CONCEPTS:

- Hanging facade (not supported).
- Vertical expansion between different floors.
- Horizontal expansion between studs.
- Facade-structure adjustments: anchorage to the edge of the slab.
- Loads: wind, death load, life load.
- Not loadbearing glass (filling element).

ADVANTAGES:

- Common solution in the market.
- Minimum supply costs.
- Minimum project and supply time.
- Easy delivery of extra components.
- Two plants can be closed with only one stud.



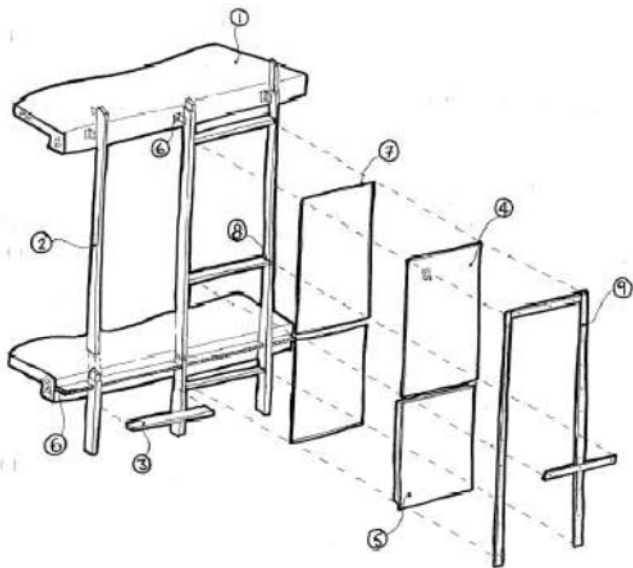
TYPES OF CURTAIN WALLS

STUDS AND TRANSOMS SYSTEM



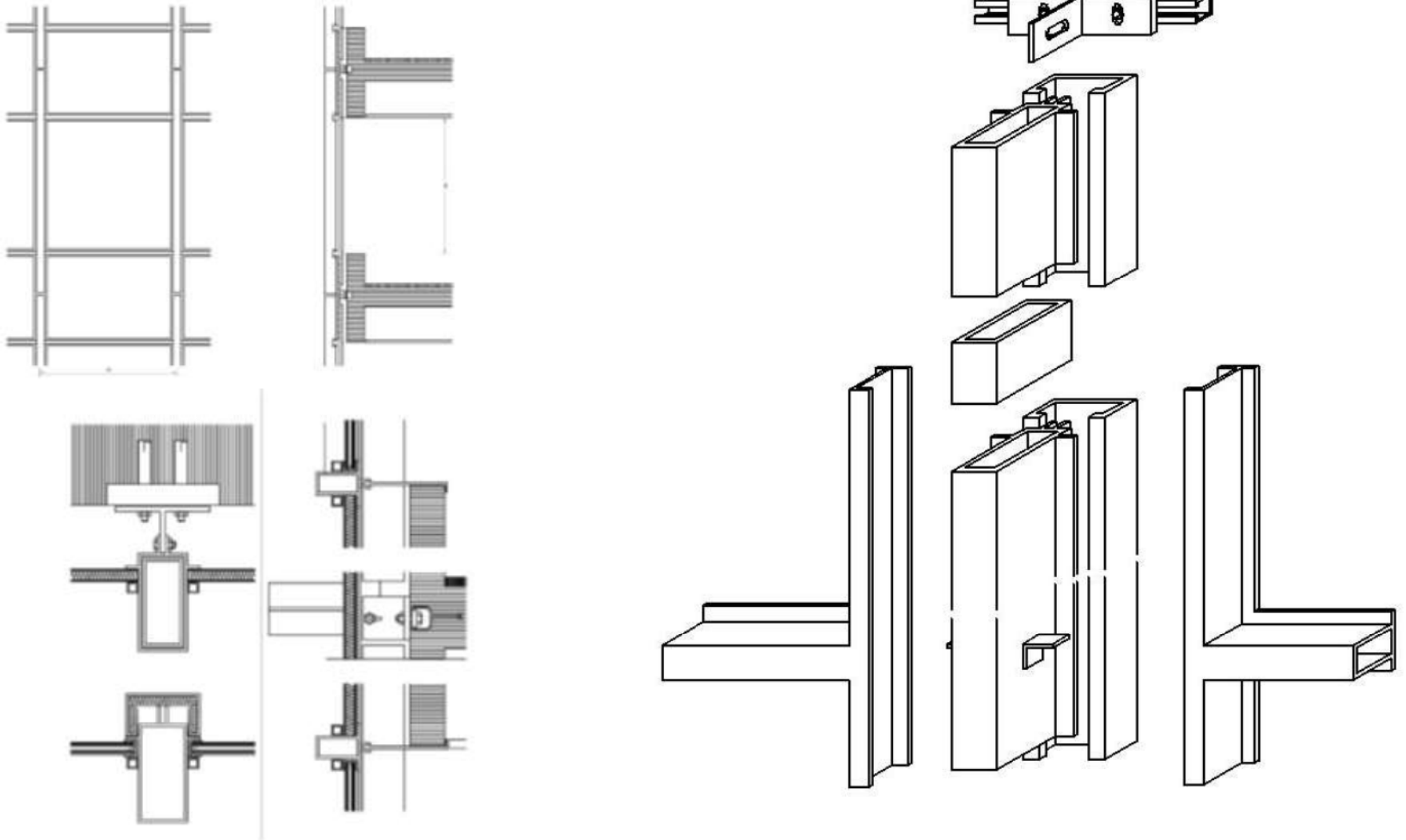
DISADVANTAGES:

- Simple architectural solution.
- Tendency to attract low quality facades.
- The assembly is carried out with scaffolding (cost and time).
- High assembly time.
- Quality of the assembly difficult to control.
- Materials must be stored on site.
- Studs without the capacity to absorb large horizontal movements.
- Sealing of joints on site, not easy a good quality control.
- Filling panels with rubber gaskets, possibility of water inlet.
- Fixing of the glass from the outside.
- Cutting and assembly of not perpendicular profiles is difficult and provide poor final results.



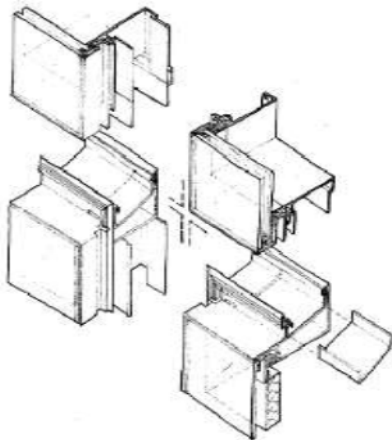
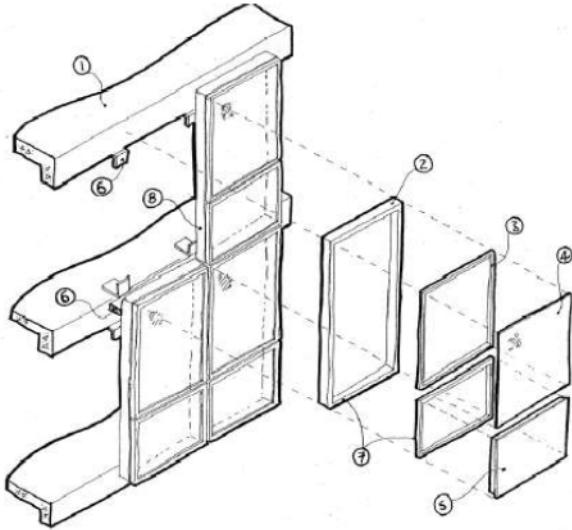
STUDS AND TRANSOMS SYSTEM

CURTAIN WALL WITH STUDS AND TRANSOMS STRUCTURE



TYPES OF CURTAIN WALLS

MODULAR FAÇADE SYSTEM



CONCEPTS:

- Hanging facade (not supported).
- Vertical expansion between different floors (double transom).
- Horizontal expansion between semi-studs.
- Facade-structure adjustments: anchorage to the edge of the slab.
- Loads: wind, load weight, live weight.
- Not loadbearing glass (filling element).

DISADVANTAGES:

- Higher supply cost (not always) than a studs and transoms system.
- Longer project time and pre-delivery.
- Requires more skilled site personnel.
- Transportation and crane planning for unloading and lifting panels on site.

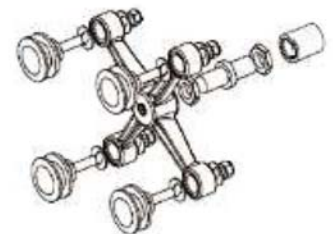
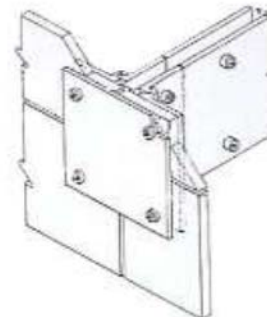
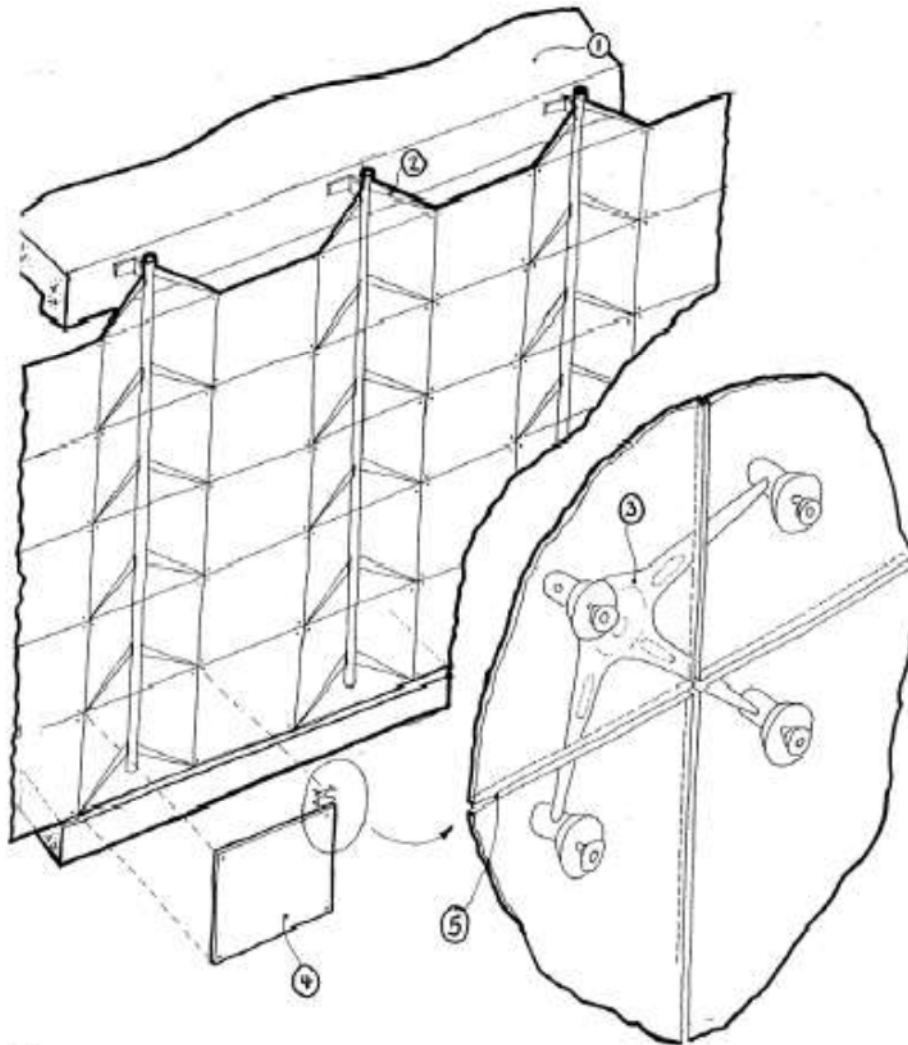
TYPES OF CURTAIN WALLS

STRUCTURAL GLASS SYSTEM



COMPONENTS:

1. Main structure.
2. Supporting structure of the enclosure:
 - Metallic pillar.
 - Connecting rods.
 - Glass studs.
3. Glass fixing hubs:
 - Spider.
 - Swivel.
4. Glass:
 - Monolithic, laminated or double glazing.
 - Toughened with HST.
5. Sealed with neutral silicone.



COMPLEMENTARY ELEMENTS. FRAMING

MATERIALS:

- ALUMINUM.

The most used.
Variable quality.
If the same price, less reliable than PVC.

- WOOD.

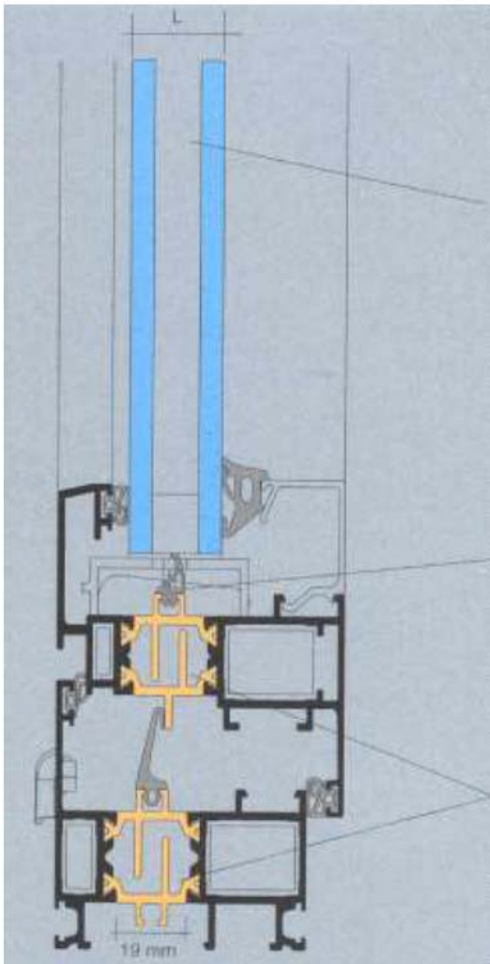
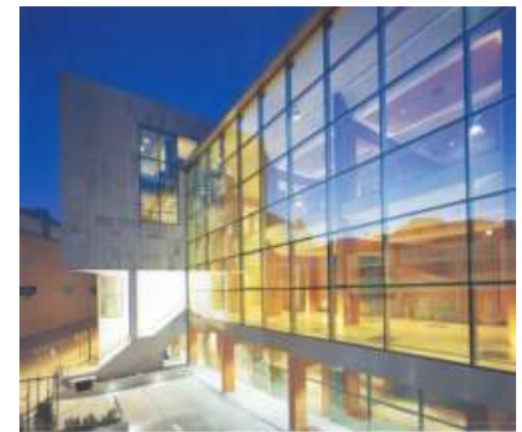
The least used.
High quality.
1000 times less conductivity than aluminium.

- PVC.

Intermediate used.
Medium quality.
3 times more expansion than aluminium.
1000 times less conductivity than aluminium.
High thermal and acoustic insulation.

- Beads. EPDM (ethylene propylene dimethyl monomer).

- TBB (thermal bridge breakage) polyamide 6.6 (reinforced with glass fiber).



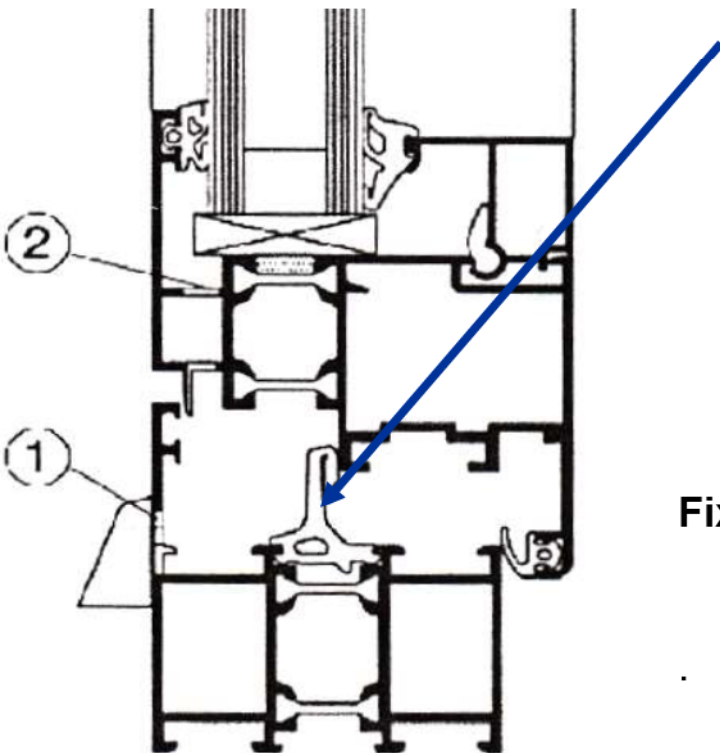
COMPLEMENTARY ELEMENTS. FRAMING

Ironmongery and fixings.

- European standard ironmongery chamber.
If a quality carpentry is prescribed, the fittings are not “European” (preventing them from being interchangeable).

Watertightness:.

- There must be two chambers, with a central sealing.
- The drainage covers (1) must be placed.
It is necessary to install drip edge flashings.
In curtain walls, rain flashings should also be placed in the upper part of the window.
- In the case of a heavy rains climate, rubber gaskets can be placed on both sides and bottom profile.



Fixings or closing points.

- For high > 1.2 m, 3 fastening points per side.
- For length > 1 m., 1 fixing point above and below.



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