KULIT BANGUNAN

(Building Enclosure)

PERTEMUAN 14 : MK. Perancangan Bangunan Fungsi Campuran

Baju Arie Wibawa, ST, MT

1 PENGERTIAN

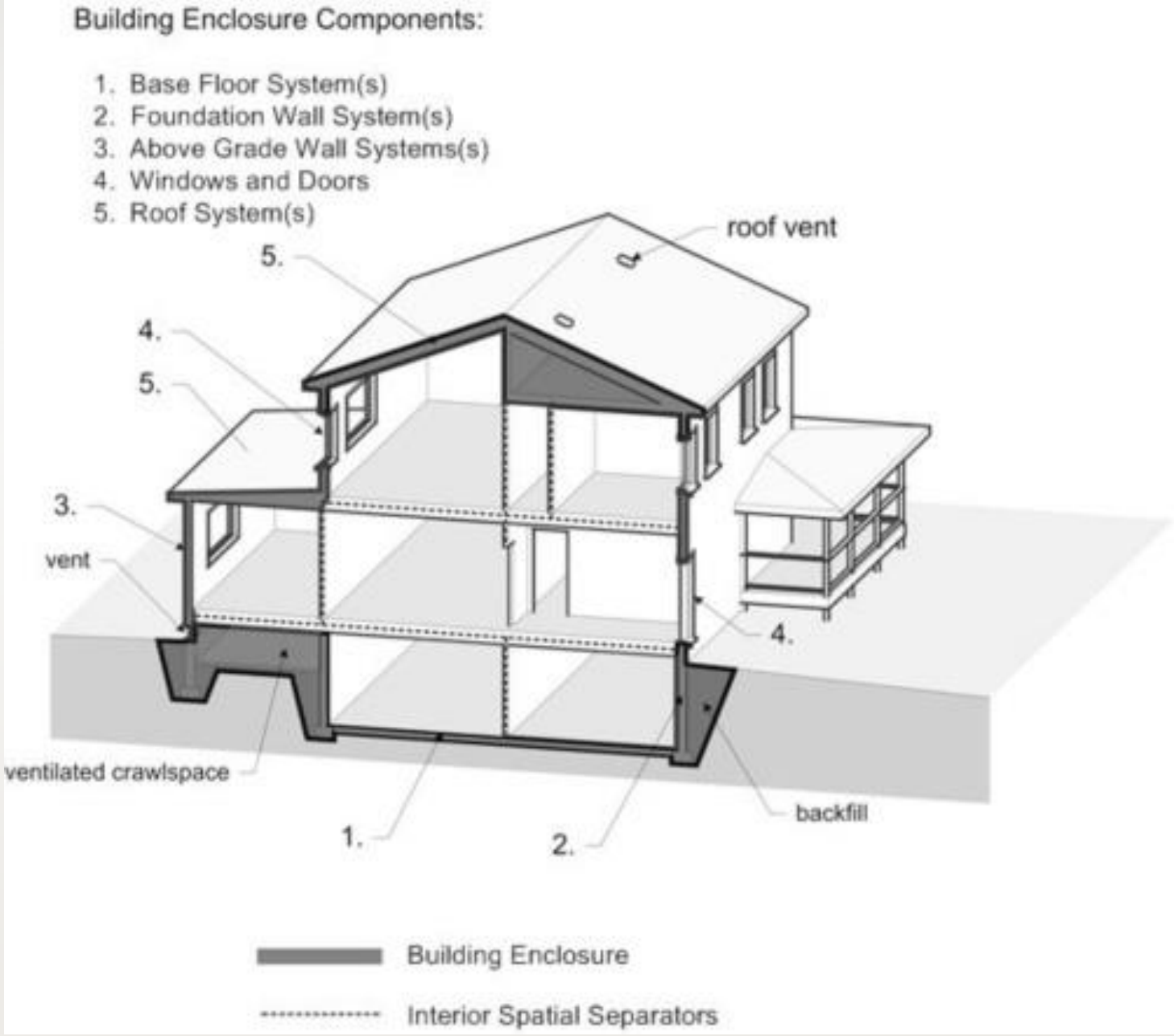
PENGERTIAN

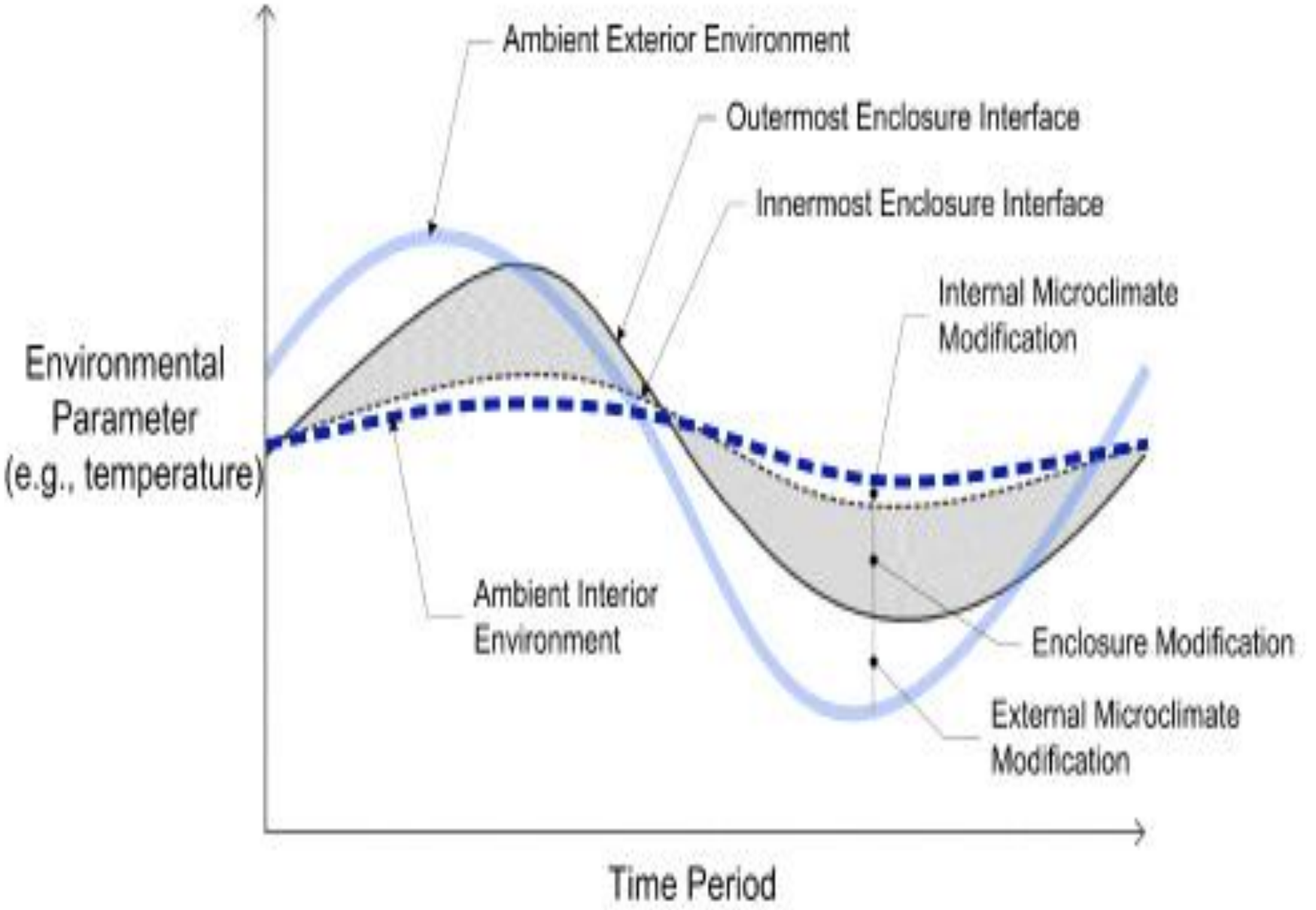
Kulit bangunan (*building enclosure*) adalah bidang yang terbuat dari bahan tertentu yang berfungsi melindungi bagian dalam bangunan dari pengaruh luar bangunan.

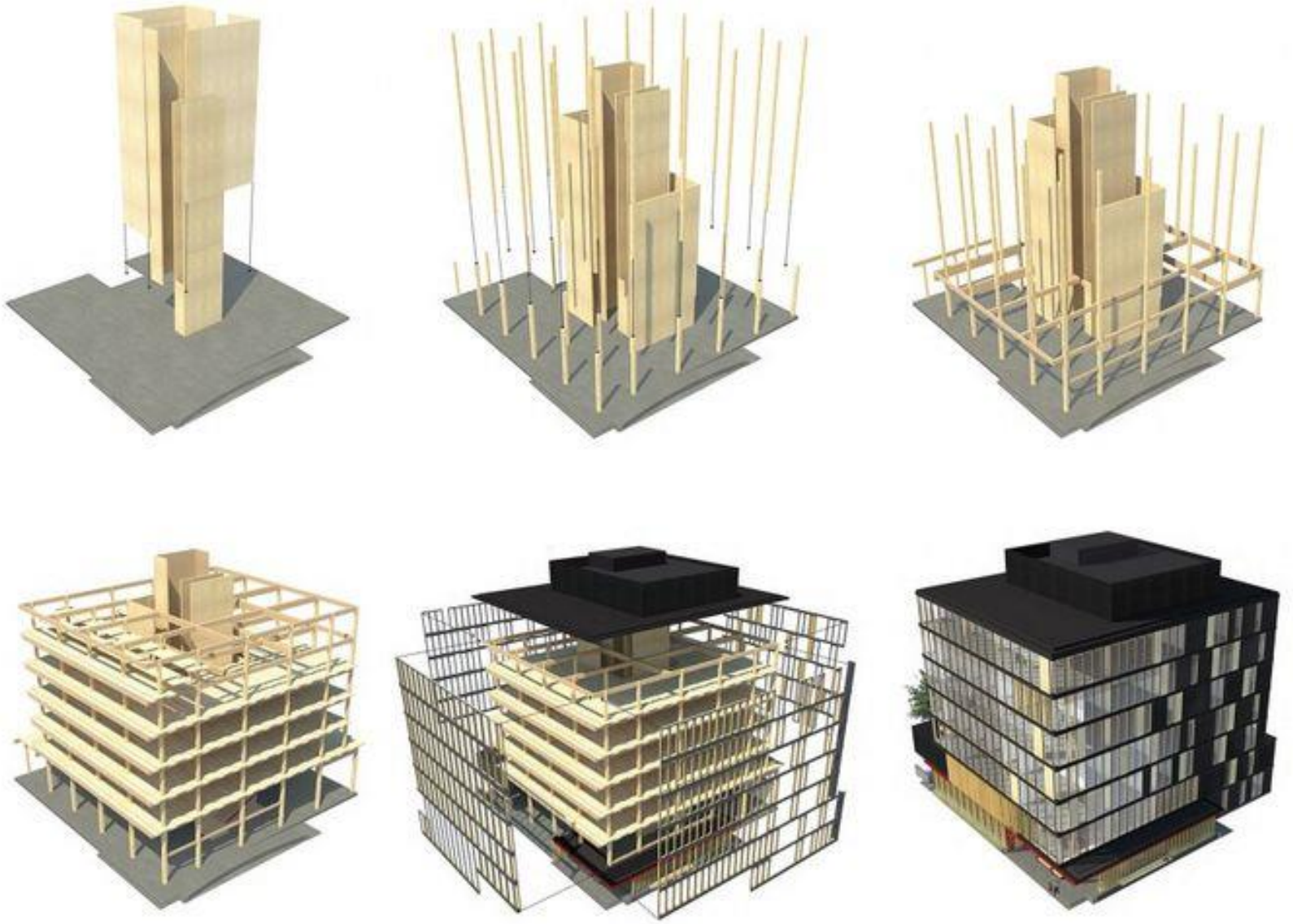
Tujuan dibuatnya kulit bangunan adalah untuk memisahkan lingkungan dalam (*indoor environment*) dari lingkungan luarnya, dimana lingkungan dalam dapat dirawat dan disesuaikan dengan kebutuhan penghuninya (Allen & Iano, 2004).

Komponen building enclosure:

- Lantai bangunan
- Dinding luar bangunan (perimeter wall)
- Atap bangunan
- Jendela




Ambient Exterior Environment
Outermost Enclosure Interface
Innermost Enclosure Interface
Internal Microclimate Modification
Environmental Parameter (e.g., temperature)
Ambient Interior Environment
Enclosure Modification
External Microclimate Modification
Time Period



FUNGSI 2

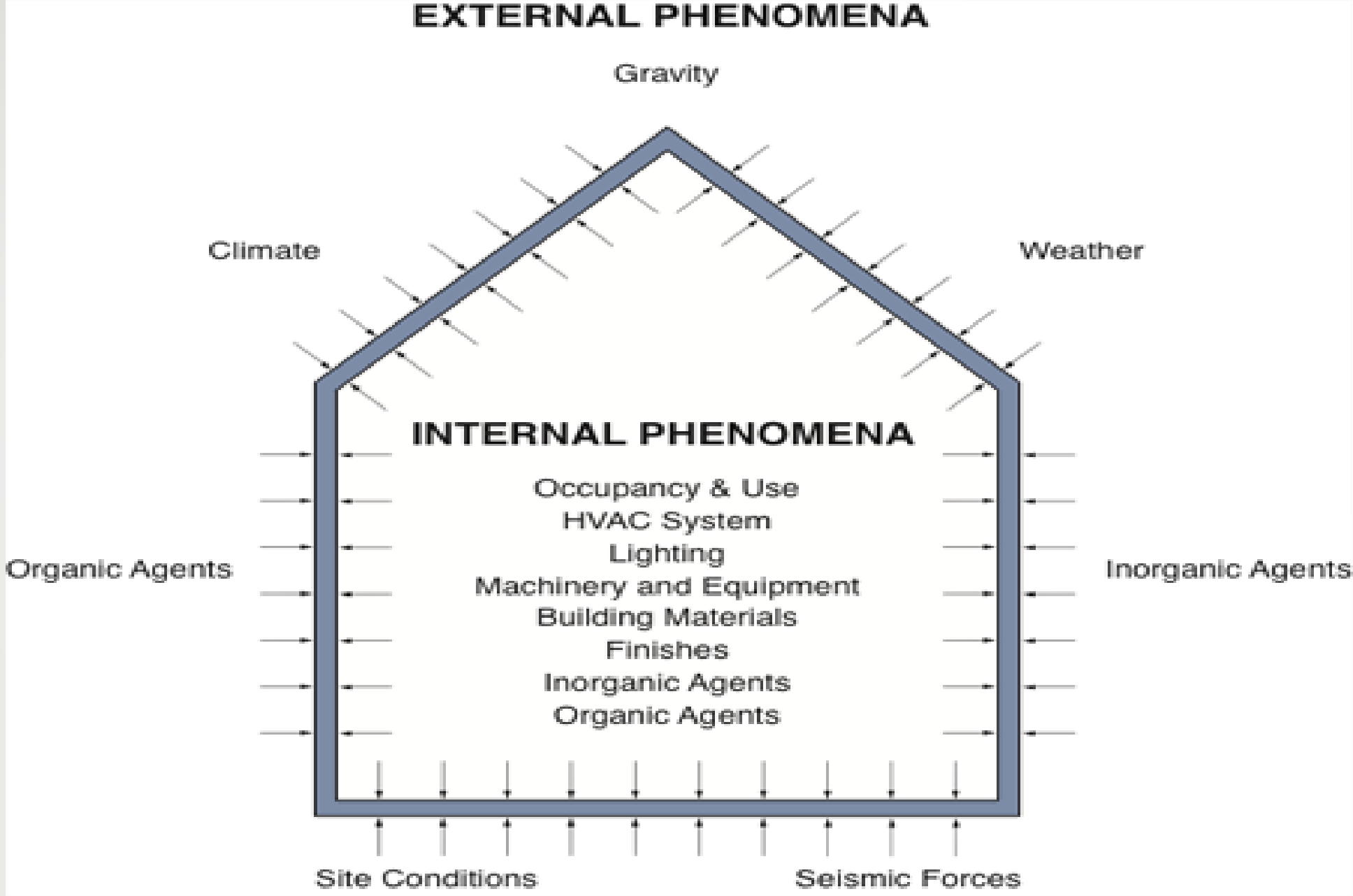
PRINSIP Building Enclosure

The requirements for wall performance were outlined some half a century ago (Hutcheon 1963)[iii], and are applicable to all enclosure systems and components. The major considerations were identified as:

1. **Strength and rigidity**
2. **Control of heat flow**
3. **Control of air flow**
4. **Control of water vapor flow**
5. **Control of liquid water movement**
6. **Stability and durability of materials**
7. **Fire**
8. **Aesthetic considerations**
9. **Cost**

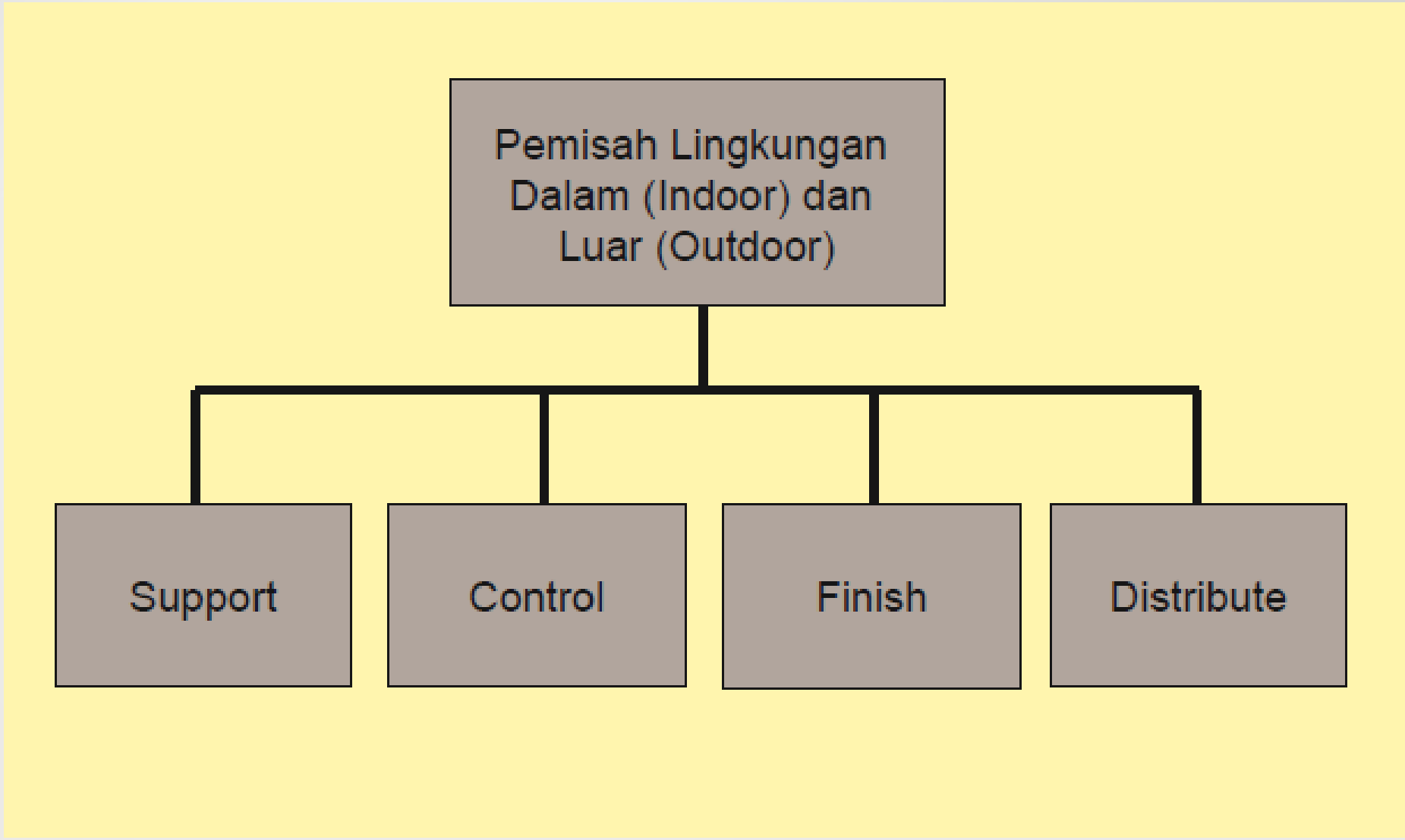
REQUIREMENT	PARAMETERS	
Structural Strength/Rigidity	• Loadbearing/Non-loadbearing • Wind Loading	• Seismic Loading • Thermal Effects
Control of Heat Flow	• Effective Thermal Resistance	• Thermal Bridging
Control of Air Flow	• Stack and Wind Pressures • Normalized Leakage Area	• HVAC Influences • Internal Partitioning
Control of Moisture Flow	• Rain Penetration • Vapour Diffusion	• Air Leakage • Condensation Potential
Control of Solar Radiation	• Opacity/Emissivity • Solar Orientation	• Fenestration • Shading Devices
Control of Sound Transmission	• Airborne Sound	• Vibration
Control of Fire	• Fire Rating	• Combustibility
Durability*	• Ultraviolet Degradation • Corrosion • Carbonation • Freeze/Thaw • Abrasion • Fatigue • Instability/Incompatibility	• Biological Attack (mould, insects, animals, plants) • Chemical Attack (soils, contaminants, pollutants) • Efflorescence • Subflorescence • Spalling
Security	• Blast Protection • Ballistic Protection	• Wind Induced Projectile Protection
Economy	• Initial Cost • Maintenance Cost	• Operating Cost • Life Cycle Cost
Environmental Impacts	• Resource Depletion • Environmental Degradation • Reduction of Biodiversity	• Greenhouse Gases • Pollutants
Buildability (Ease of Construction)	• Seasonality • Tolerances	• Coordination • Sequencing
Aesthetics	• Visual • Tactile	• Acoustic • Olfactory

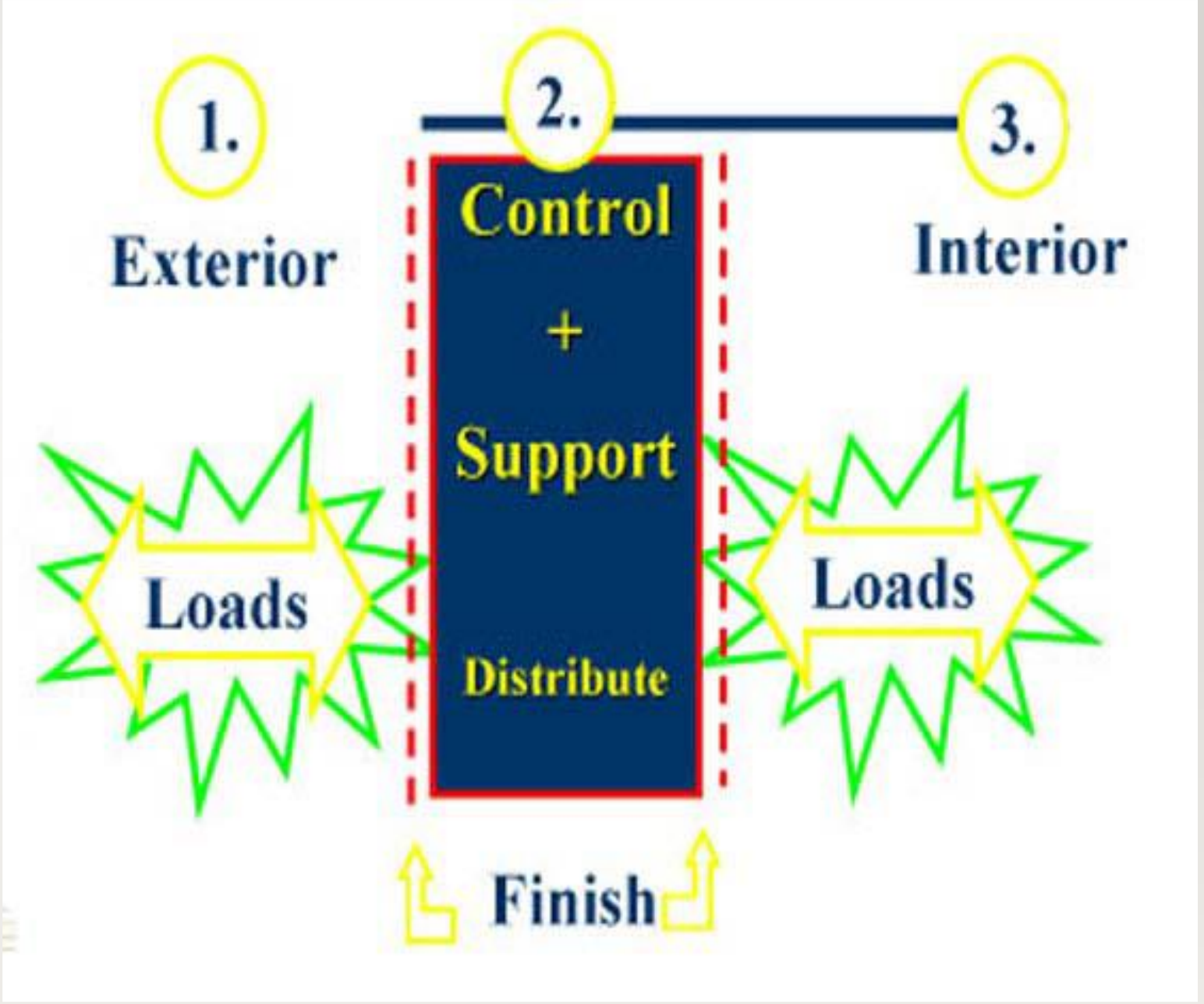
* Another aspect of durability related to envelope assemblies is differential durability (Kesik 2002), a term used to describe how useful service life differs - both between components, and within the assemblies and materials comprising components. [Kesik, T., 2002. *Differential Durability and the Life Cycle of Buildings*. Proceedings of the ARCC/EAAE 2002 International Conference on Research, May 22-25, 2002, McGill University, Montreal, Canada (CD-ROM).]

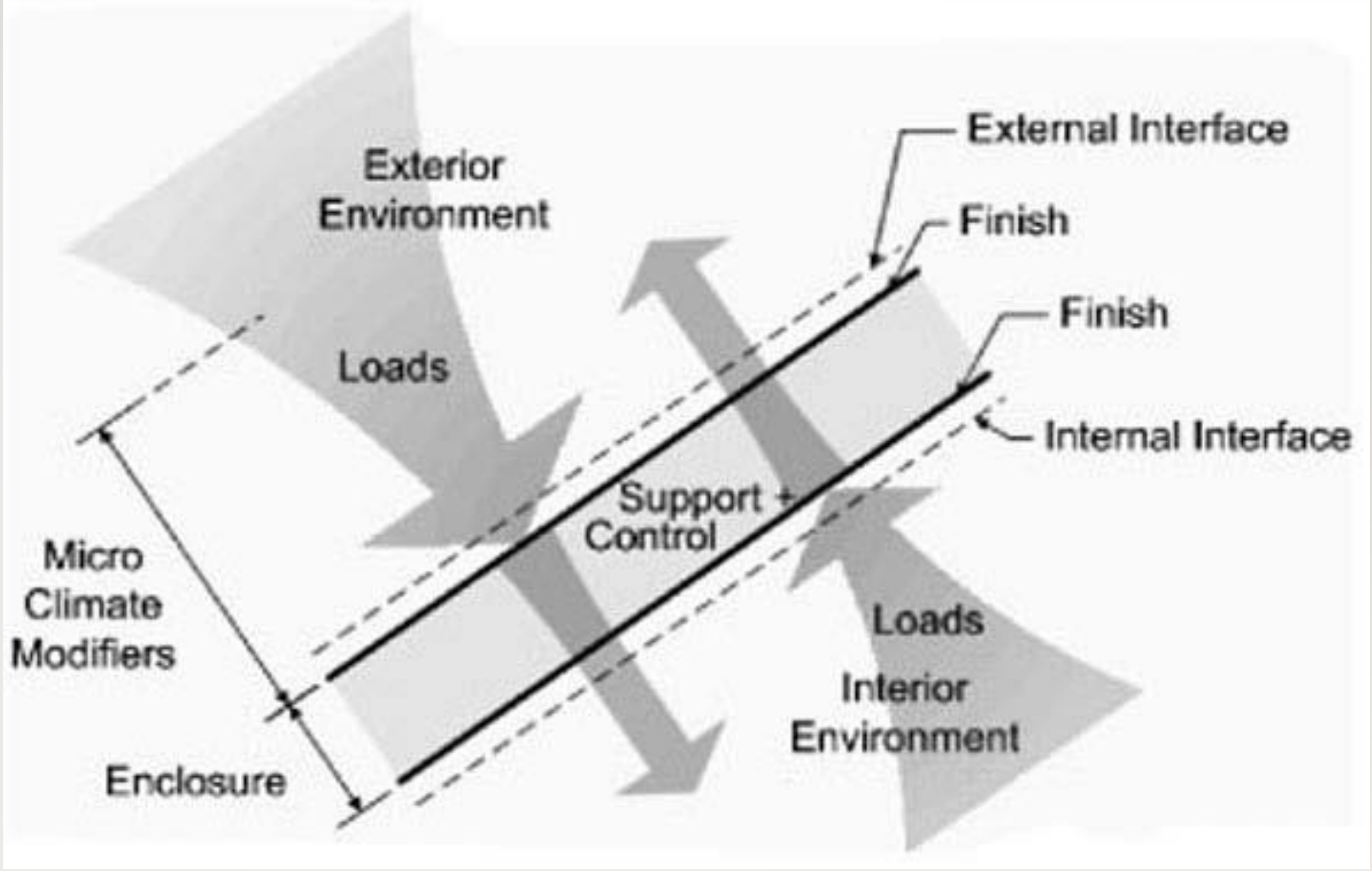

EXTERNAL PHENOMENA
Gravity
Climate
Weather
INTERNAL PHENOMENA
Occupancy & Use
HVAC System
Lighting
Machinery and Equipment
Building Materials
Finishes
Inorganic Agents
Organic Agents
Organic Agents
Inorganic Agents
Site Conditions
Seismic Forces


PRINSIP
3

Fungsi Building Enclosure



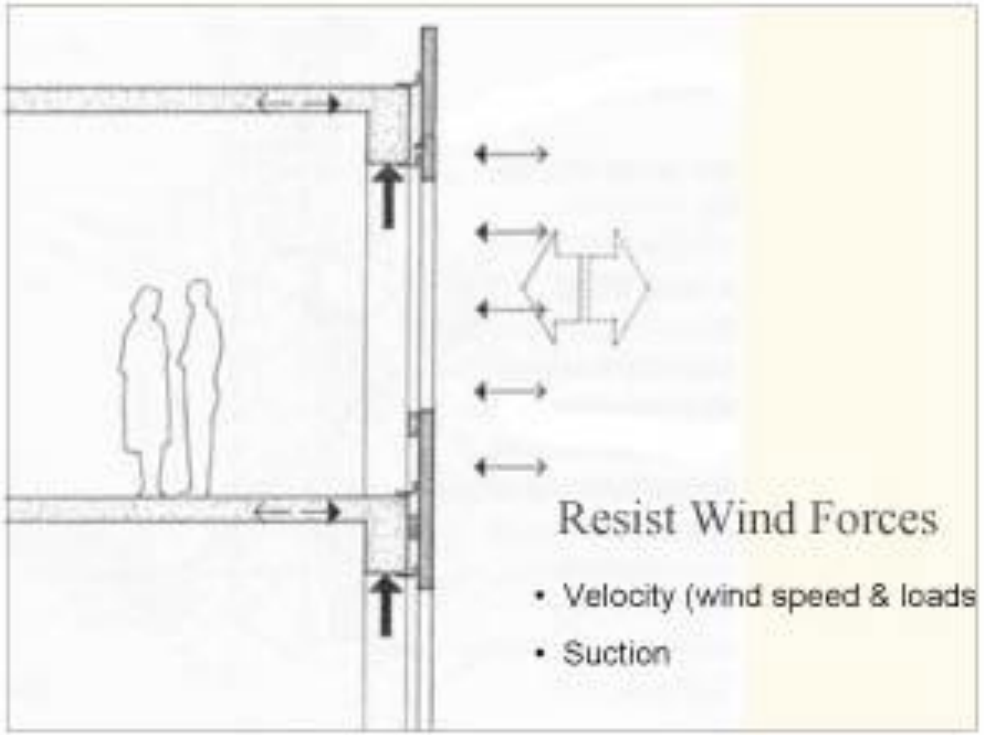

1.
2.
3.
Exterior
Control
+
Support
Distribute
Interior
Loads
Loads
Finish

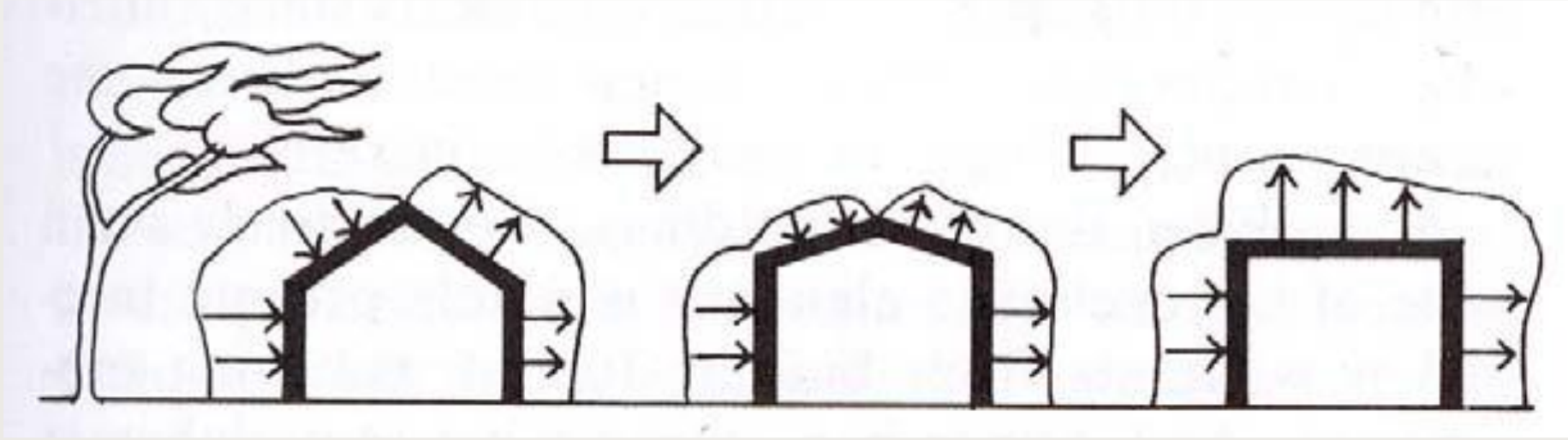

External Interface
Exterior Environment
Finish
Finish
Loads
Internal Interface
Support + Control
Micro Climate Modifiers
Loads
Interior Environment
Enclosure

1. SUPPORT

Menahan dan mentransfer gaya-gaya fisik dari dalam dan luar, berupa:

- **Lateral (angin, gempa)**
- **Gravity (beban mati)**
- **Rheological (temperature, moisture)**
- **Impact**
- **wear/ abrasion**

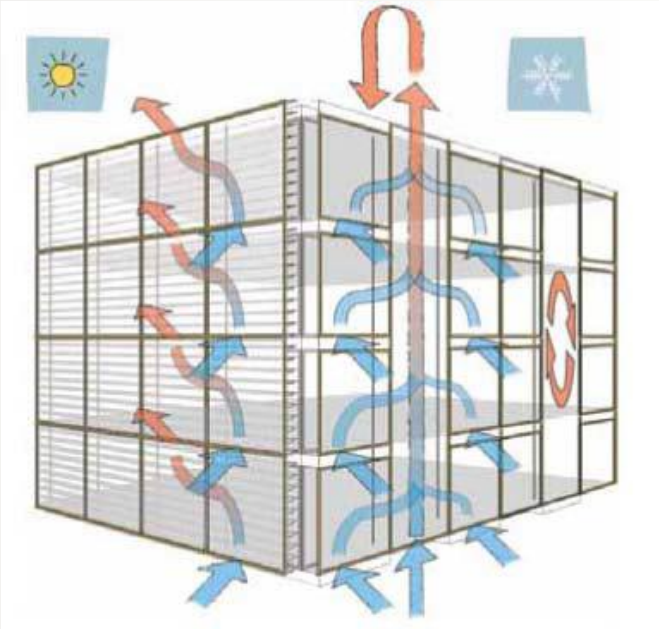


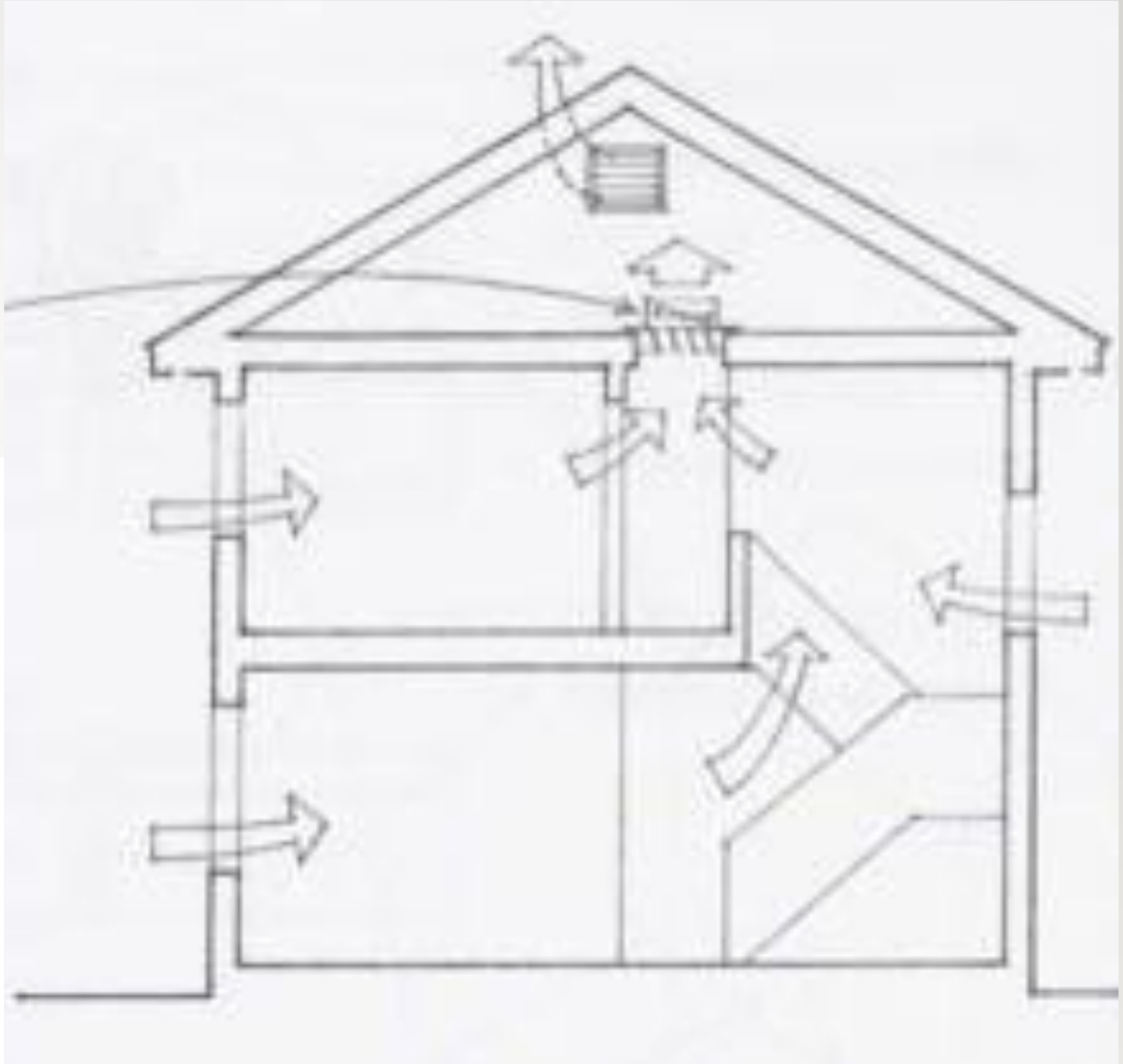


2. CONTROL

Mengontrol aliran massa (mass) dan energi, berupa:

- **Panas (heat)**
- **Udara**
- **Uap air**
- **Hujan**
- **Suara**
- **Api**
- **Serangga**
- **Akses**





3. FINISH

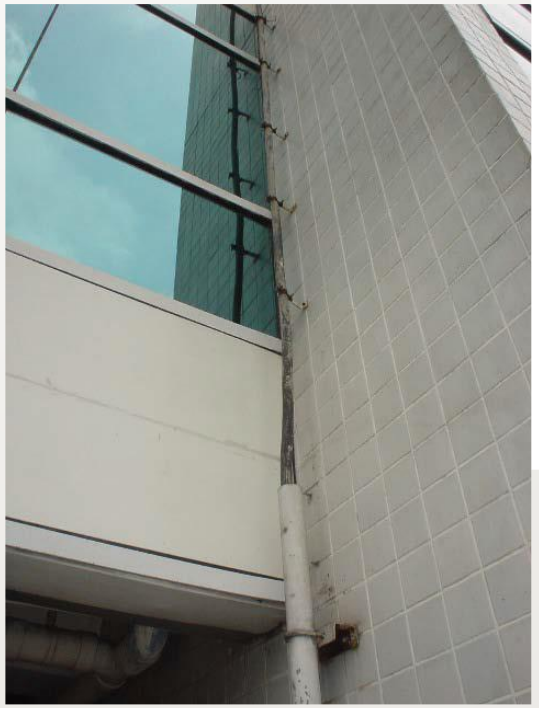
Sebagai permukaan interior dan eksterior untuk manusia, yang dapat diolah dalam:

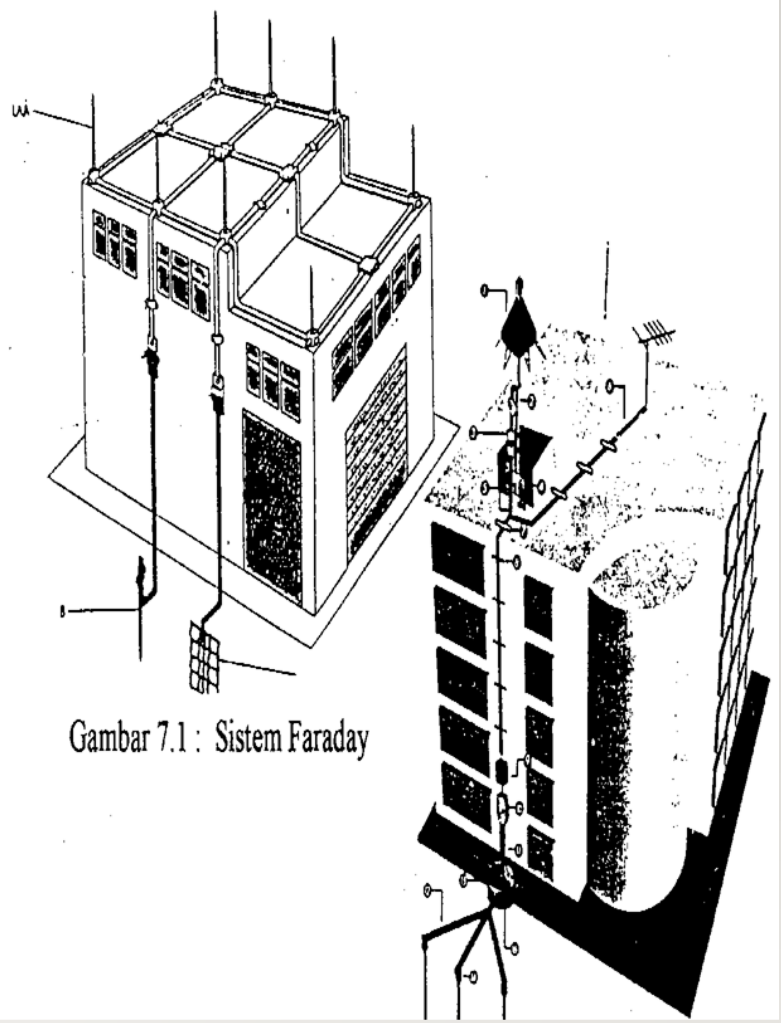
- **Color**
- **Texture**
- **Reflectance**
- **Pattern**
- **Speculance**

4. DISTRIBUSI

Mendistribusikan utilitas (services):

- **Electricity**
- **Communication**
- **Plumbing**
- **Air ducts**
- **Gas lines**
- **Roof drains**





Gambar 7.1 : Sistem Faraday

Perubahan Building Enclosure

Dahulu kulit bangunan hanya digunakan untuk dinding saja, tetapi sekarang dapat digunakan berbagai macam (sesuai ke-4 building enclosure).

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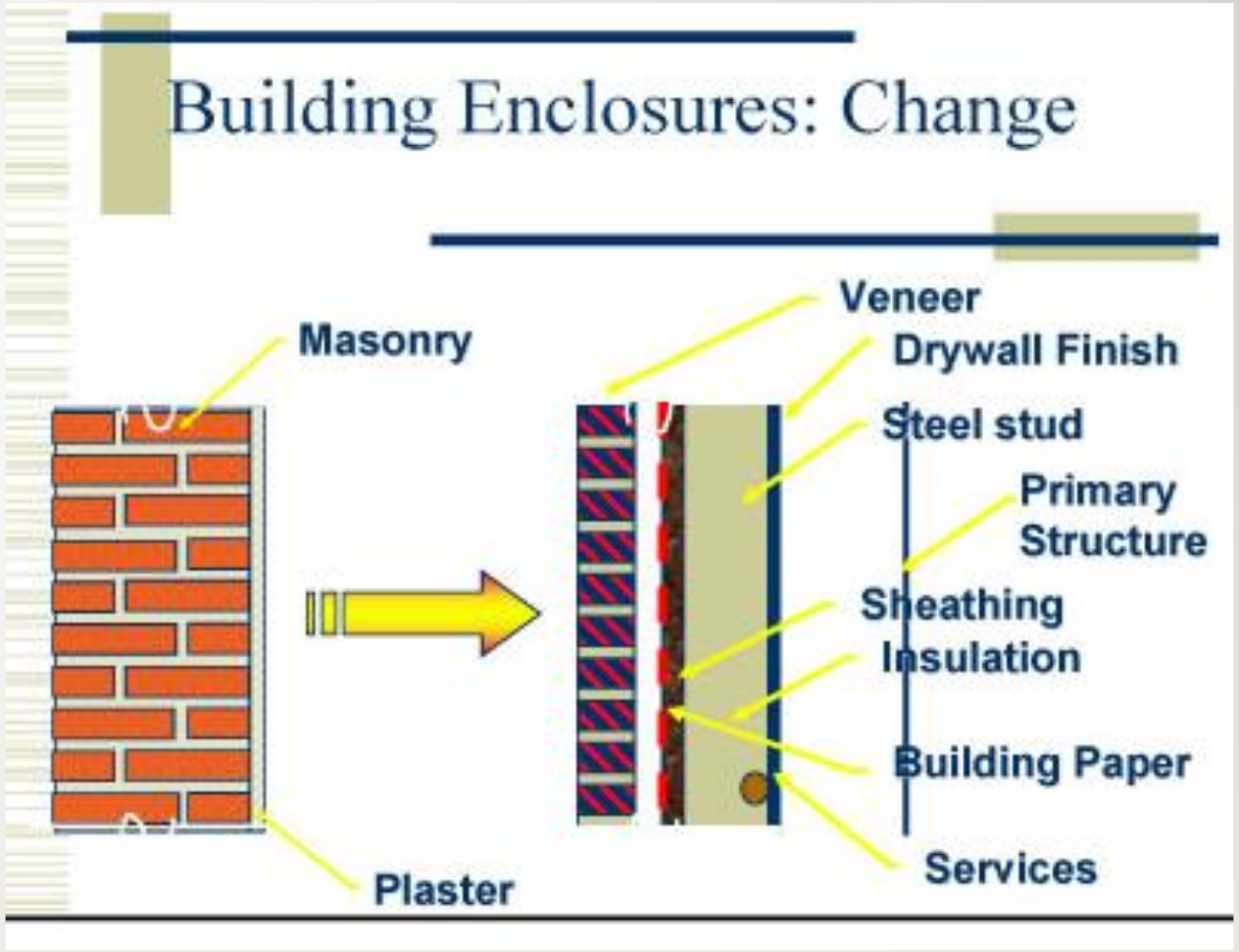
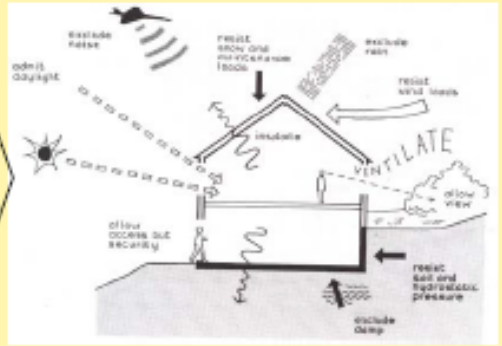


Faktor-Faktor yang Mempengaruhi Perubahan

DESAIN BANGUNAN

PENGARUH LUAR BANGUNAN
- Iklim: Suhu udara, angin, Radiasi matahari, sinar matahari, lembab, Hujan
- Flora & Fauna: binatang, serangga, tumbuhan
- Manusia
- Lingkungan:
  - Bunyi
  - bau
- Tanah: gempa bumi, air tanah



1. BAGIAN DALAM BANGUNAN
- Aman:
  - Kuat
  - Melindungi
  - Selamat
- Nyaman: thermal, Visual, audial
- Sehat
- Hemat energi
- Sustainable

2. BAGIAN LUAR BANGUNAN
- Tidak merusak lingkungan

Data (input)
- Data iklim (t, v, I, E, Rh hujan)
- Data lingkungan
- Data geomorphologi
- Data hidrologi
- Data masyarakat

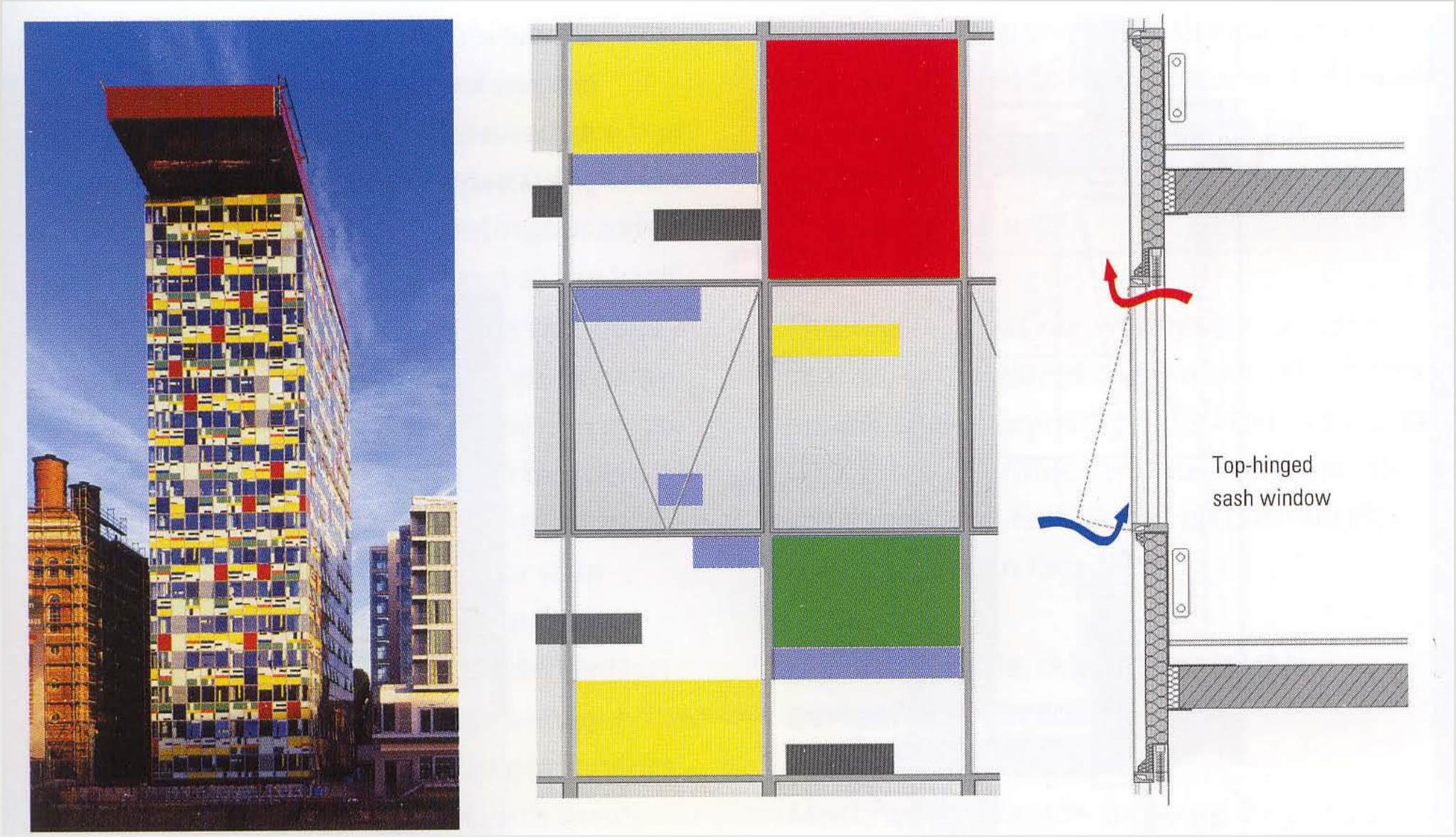
Analisis (proses)
- Perhitungan
- Komparasi
- Dengan software
- Model lab.
- Simulasi
- statistik

Hasil (output)
- Solusi desain yang aman, nyaman, hemat energi, sustainable, dan tidak merusak lingkungan:
  - Rancangan sistem
  - Rancangan detal
  - Dll

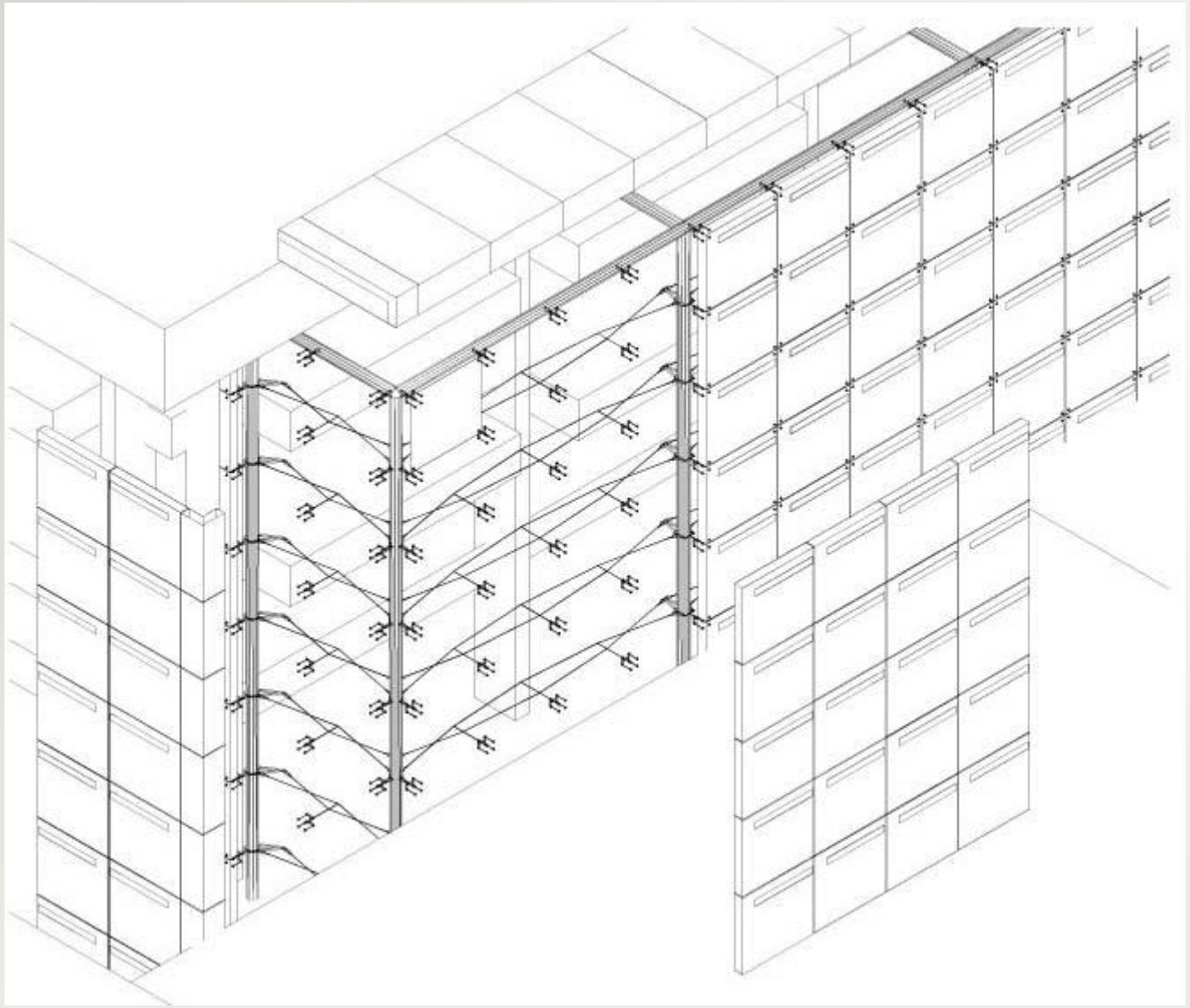
TIPE KULIT BANGUNAN

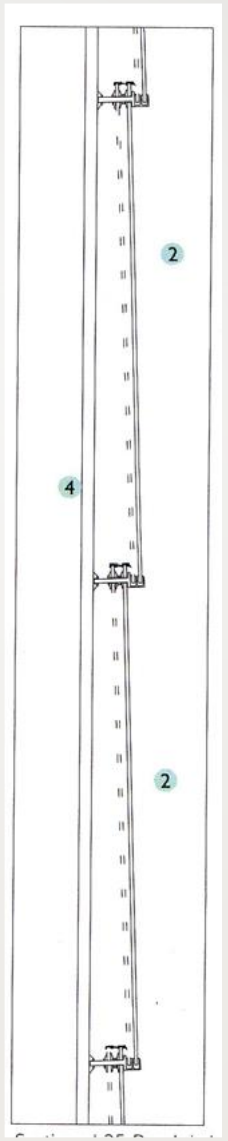
4

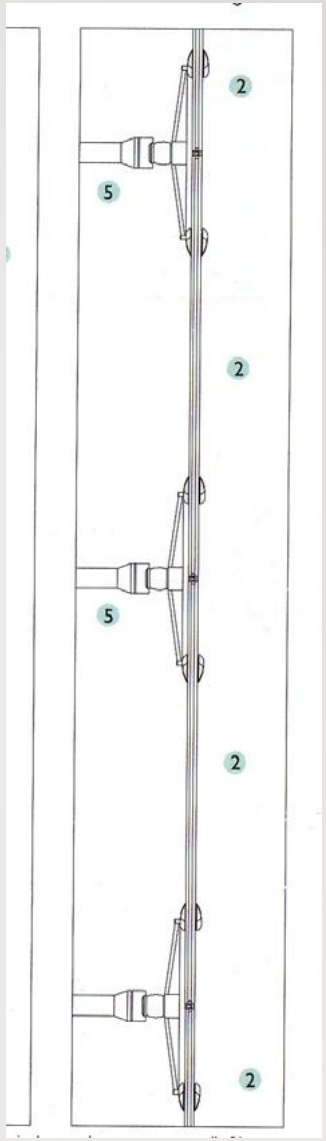
1. Frame



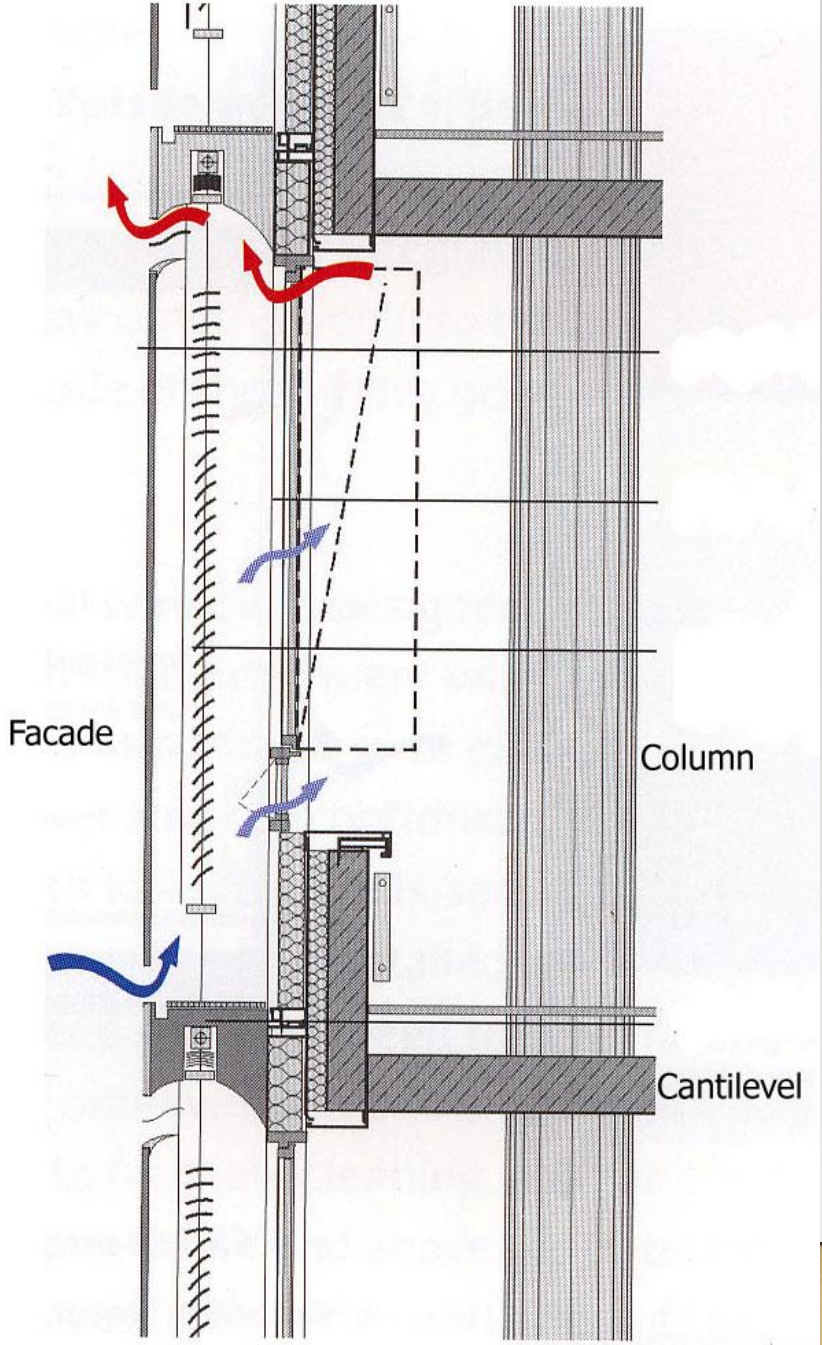
2. Suspend



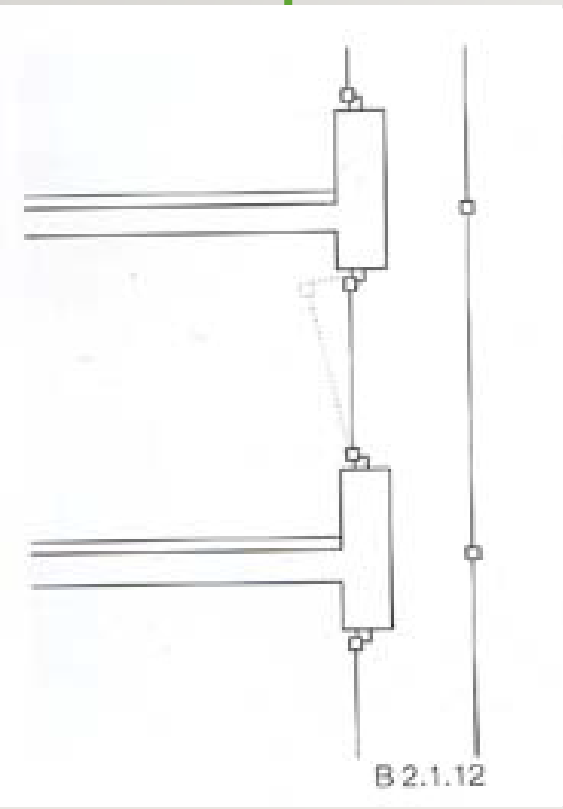


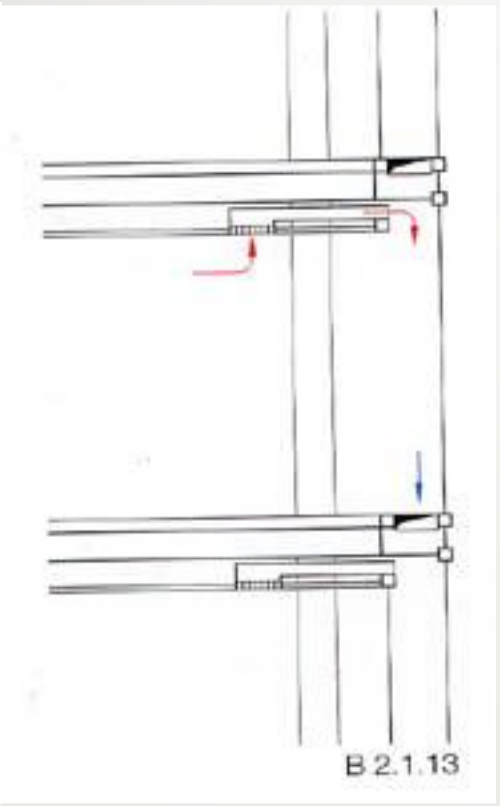


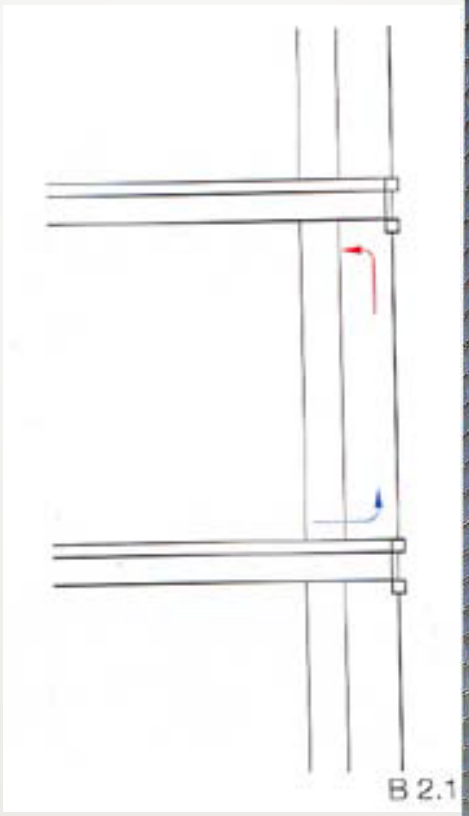
3. Cantilever

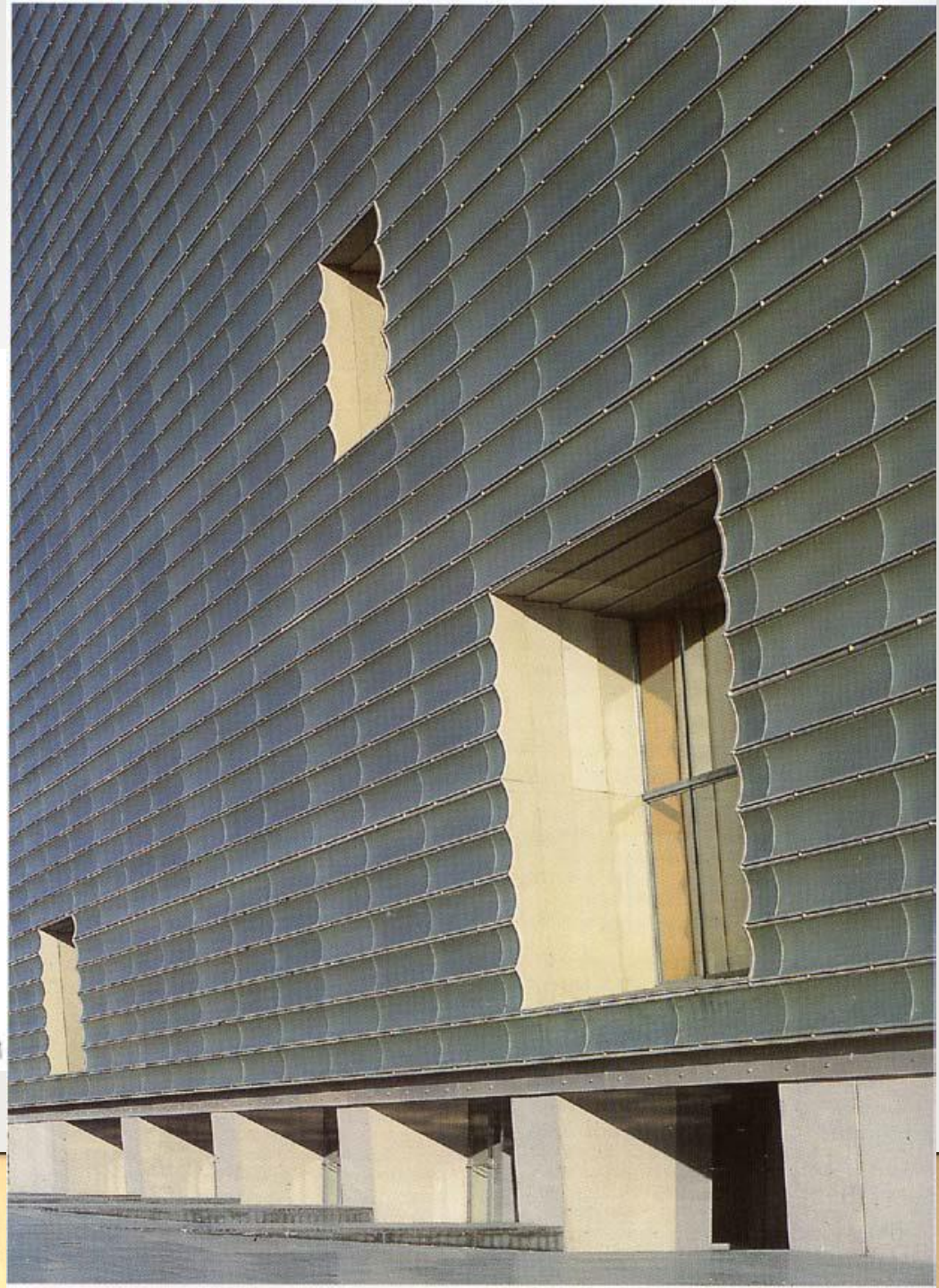


4. *Secondary Skin*









DESIGN KULIT BANGUNAN

5

Tipe-Tipe Façade

1. **Frame façade**
2. **Suspended façade**
3. **Cantilever façade**
4. **Secondary skin façade (double skin façade)**

Kriteria Perancangan

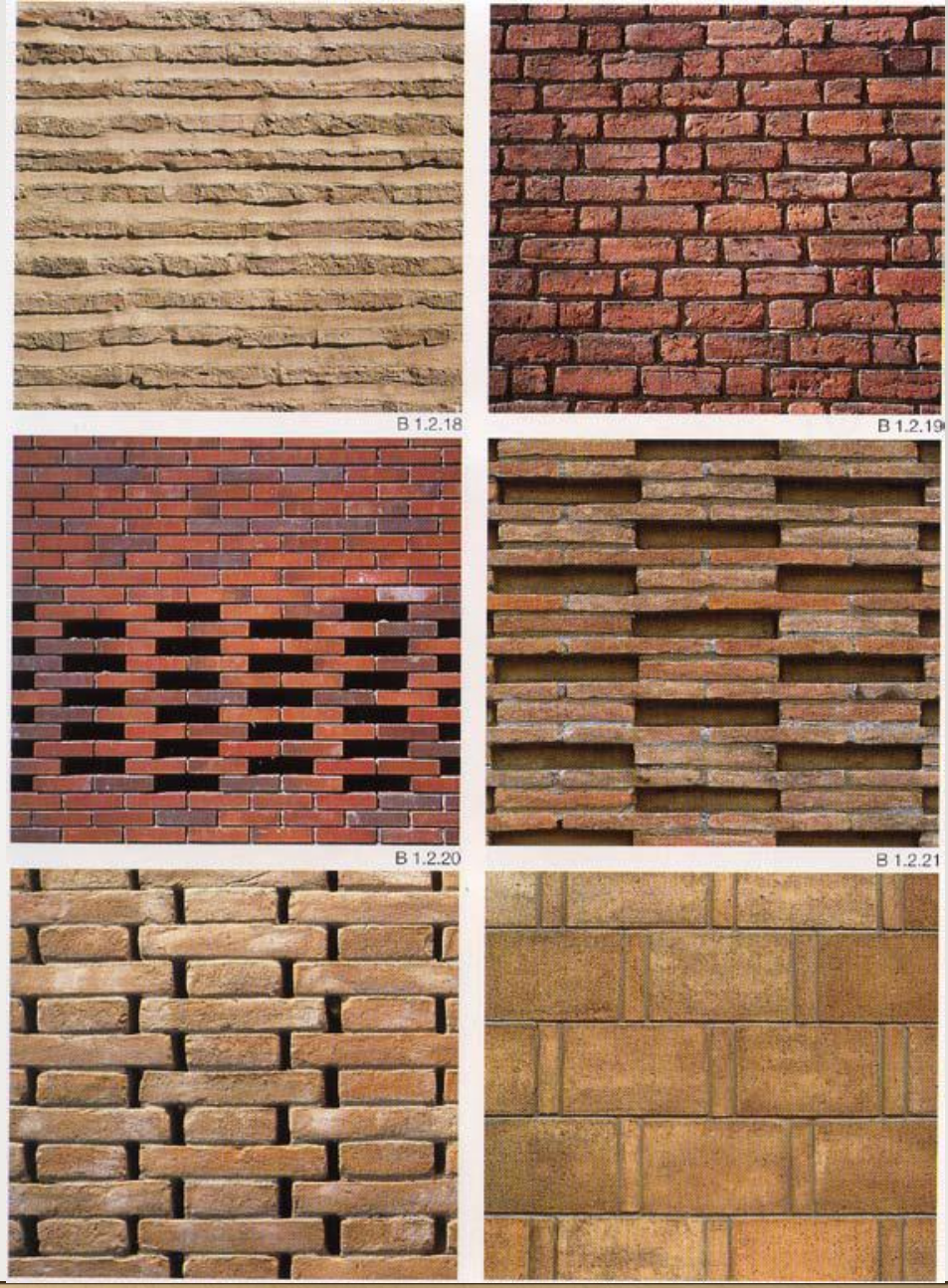
- **Biaya (cost)Initial cost**
- **Operational cost (penggunaan energy akibat façade)**
- **Maintenance cost**
- **•Iklim (thermal comfort, visual comfort, acoustic comfort, ventilation)**
- **•Struktur bangunan**
- **•Material (terkait dengan estetika)**
- **•Tenaga kerja**
- **•Fungsi bangunan**
- **•Perawatan (maintenance)**
- **•Lain-lain (peraturan tata kota, safety))**

MATERIAL

- **Bata**
- **Natural stone**
- **Beton cor**
- **Beton prefab**
- **Metal: baja, aluminium, dll**
- **Kaca**
- **Plastik**
- **Tensile (tenda)**
- **Kayu**
- **kombinasi**

BATA

- **Dapat digunakan sebagai pendukung struktur**
- **Economic**
- **Texture**
- **Pola**



BETON

- **Texture**
- **Color**
- **Pola**

BETON PREFAB

- Unit size
- Monoton
- Fabrikasi
- Pembangunan cepat

METAL

- **Fleksibilitas**
- **Geometri**

KACA

- **Tranparan**
- **Dinamika Warna (visual effects)**

PLASTIC

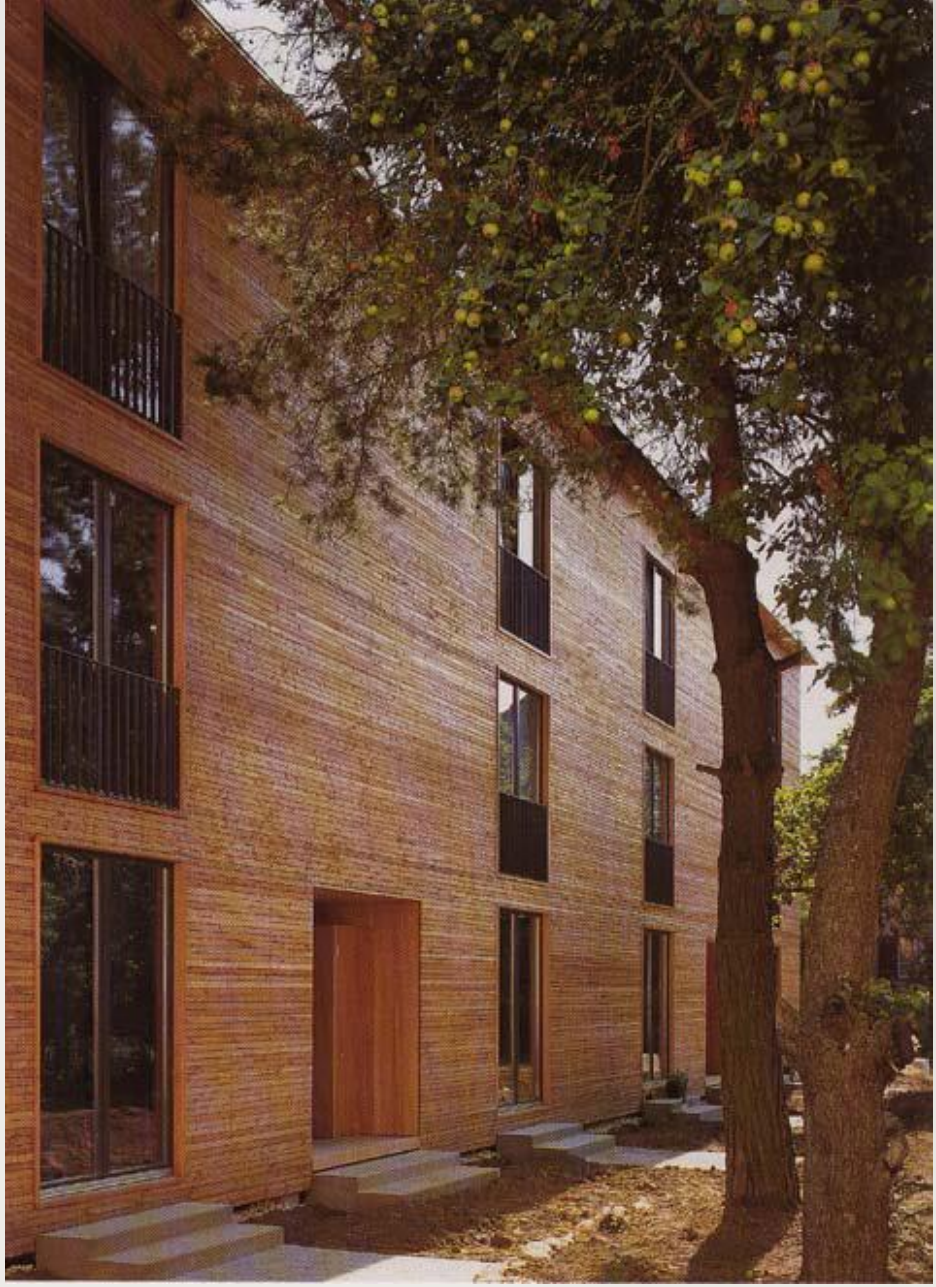
- **High elasticity**
- **Transparansi**
- **Low density**
- **Low water absorption**
- **Good electrical insulation**
- **Permukaan dapat diwarnai, dll**

TENSILE

- **Elegan•**
- **Dinamik•**
- **Transparan, dll**

KAYU

- **High thermal resistance**
- **High strength with low weight**
- **Teknik sambungan beragam**



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