

Building envelope design optimisation for refurbishment projects

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New construction & refurbishment complex projects.



- **TECHNICAL ANALYSIS:**
- Engineering and technical design development for bespoke façade projects.



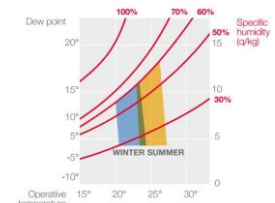
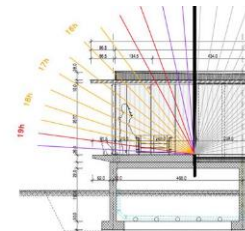
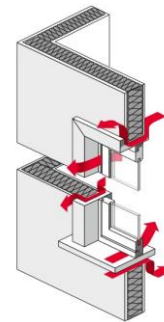
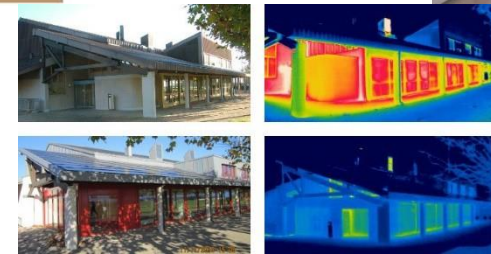
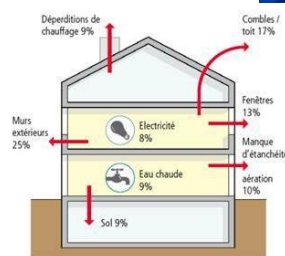
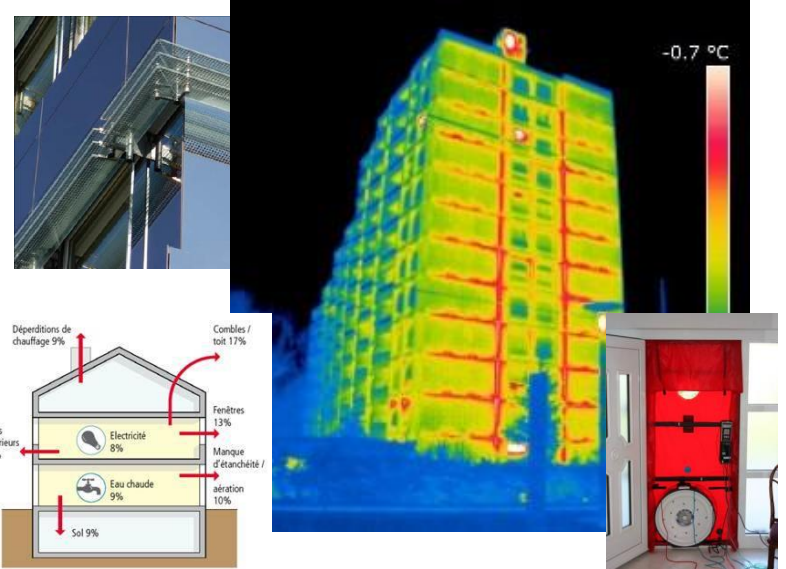
- **BUILDING PHYSICS:**
- Studies and analyses of existing buildings achieving tailored sanitation solutions



- **WORKS SUPERVISION:**
- Project management and prototype supervision with special attention to programme and cost



- **EXPERTISE**
- Determinate faults, seek out their cause, suggest remedies and budgeting cost repair. Address responsibility.



Analyze refurbishment possibilities & possible Energy-efficient solutions

- Total or partial refurbishment
- Envelope performance improvement and aesthetics objectives
- Client's strategic goals
- Clients budget awareness

Project type & client's necessities

- Determine faults
- Enquiry current users about main issues (thermal, comfort, water leaks, etc.)
- Required maintenance and costs
- Materials durability, life expectancy
- Asbestos

Existing conditions

Refurbishment possibilities & strategies

- Standards
- Envelope performance (thermal, light, water tightness, air permeability, resistance, acoustics, fire, security, building movements, etc.)
- Local authorities (aesthetics, performance, room, etc.)
- Site conditions (access, plant, etc.)

Design technical constrains

- Present different refurbishment options along with budgets estimations
- Building up a programme of works
- Take advantage of all existing elements

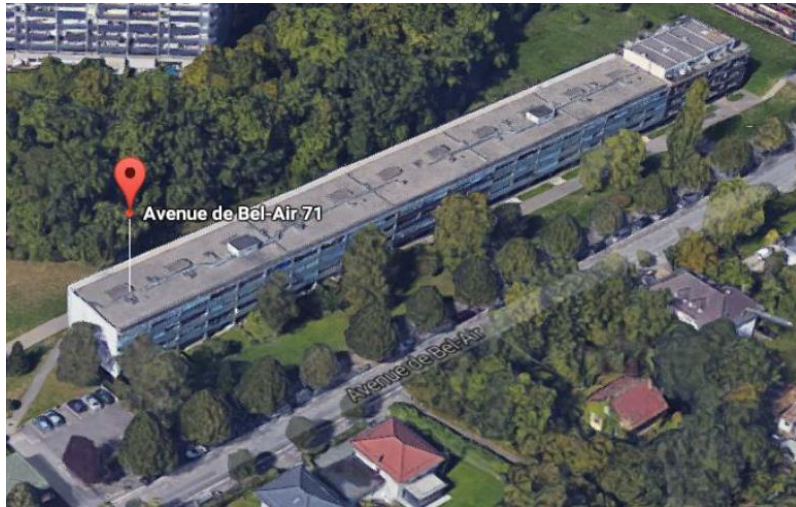
Envelope audit

Technical concept study

Ensure Clients necessities accomplished

Present several possibilities and budgets

Analyze refurbishment possibilities & possible Energy-efficient solutions



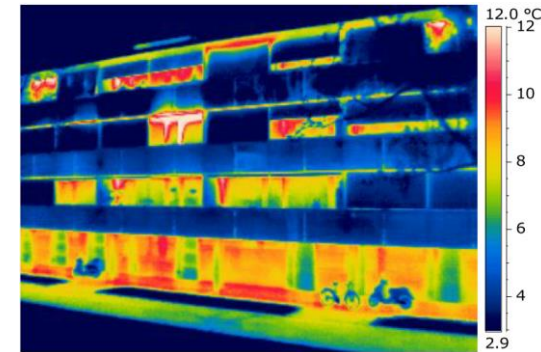
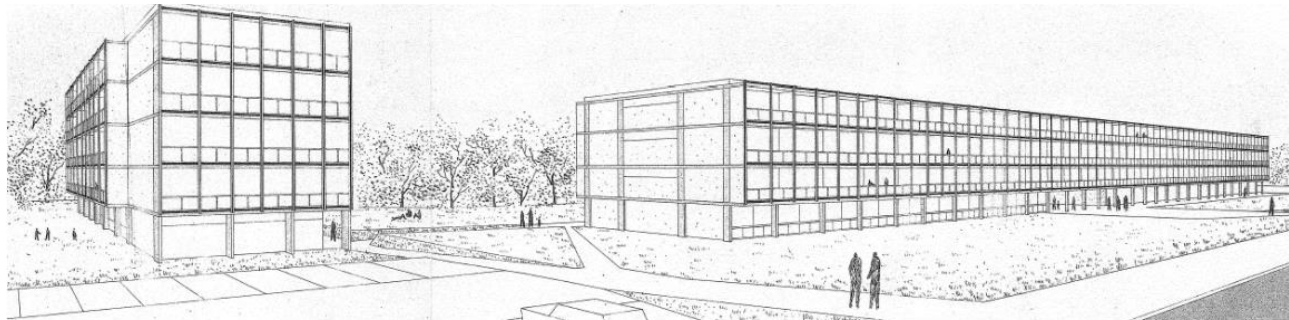
Construction 1960

• Technical issues

- Roof issues: Insulation, protection, plants
- Entrances without insulation and single glazing
- Windows with double glazing but permeability issues.
- Skylight without solar shadings.
- Detrimental ventilation system.

• Consequences

- Thermal and acoustic comfort complaints
- No proper ventilation
- Aesthetics
- Life expectancy



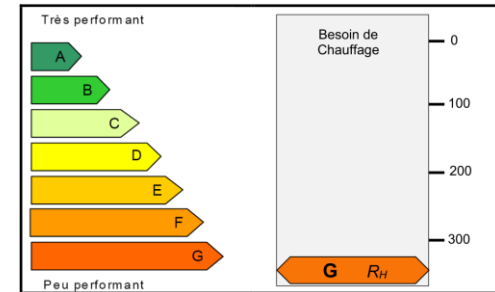
Proposal of adapted solutions, budgets & amortization

• Constrains

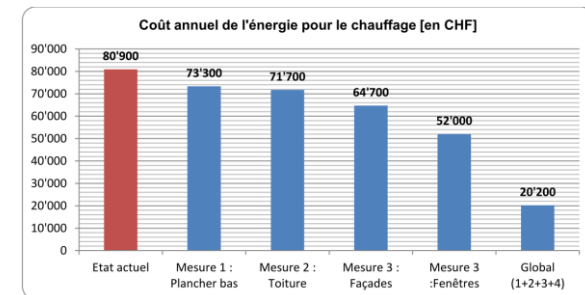
- Local Standards: Energy, fire, security, acoustics, etc
- Minimising implications and internal retrofit works
- Asbestos

• Proposed solutions

- Improvement thermal insulation almost for all envelope areas
- Replacement of windows and glazed areas
- Keep openable windows
- Electrochromic glass for skylights
- Set up of heating system with users instructions
- PV panels on the roof
- Replacement ventilation system
 - ✓ Comfort, aesthetics and others
 - ✓ Reduction 75% heating energy
 - ✓ Amortization of 80% of investment



élément d'enveloppe contre	Valeurs limites U_{lj} W/(m ² .K)		Valeurs cibles U_{lc} W/(m ² .K)	
	l'extérieur ou enterré à moins de 2 m	locaux non chauffés ou enterré à plus de 2 m	l'extérieur ou enterré à moins de 2 m	locaux non chauffés ou enterré à plus de 2 m
éléments opaques (toit, plafond) (murs, sol)	0,25	0,28	0,15	0,20
éléments opaques avec système de chauffage intégré	0,25	0,28	0,15	0,20
fenêtres, portes-fenêtres	1,3	1,6	0,90	1,1
fenêtres avec corps de chauffe en applique	1,0	1,3	0,80	1,0
portes	1,3	1,6	1,1	1,3
portes supérieures à 6 m ²	1,7	2,0	1,2	1,4
caissons de store	0,50	0,50	0,30	0,30



Dealing with special projects

Historic Building BIT - Geneva

Construction 1970

- **Technical issues**
 - Thermal insulation
 - Watertightnes and airtightness
 - Obsolete window blinds
- **Consequences**
 - Thermal and acoustic comfort complaints
 - High maintenance costs
 - Aesthetics
 - Life expectancy
- **Constrains**
 - **Historic building:** Identical aesthetics and geometry
 - Large project with several phases
 - High raise building and scaffoldings
 - Presence of hazardous materials
 - Structural façade elements
 - Alcast elements installed in the 70's



ANALYSE MULTICRITERES			A-A		B-B		C-C	
			Soumission de BASE		VARIANTE 1 : FENETRE RESPIRANTE		VARIANTE 2	
N°	Critères	%	Note	Résultat	Note	Résultat	Note	Résultat
1	Architecture	400 20.0%	10	4000	7	2800	7	2800
2	Fonctionnalité	300 15.0%	10	3000	7	2100	10	3000
3	Système statique	10 0.5%	10	100	7	70	7	70
4	Résistance des matériaux	10 0.5%	10	100	10	100	10	100
5	Isolation thermique hiver	50 2.5%	10	500	7	350	7	350
6	Isolation thermique été	50 2.5%	10	500	7	350	7	350
7	Inertie thermique	50 2.5%	10	500	7	350	7	350
8	Protection solaire	50 2.5%	10	500	7	350	7	350
9	Etanchéité à l'eau	100 5.0%	10	1000	4	400	4	400
10	Perméabilité à l'air	100 5.0%	10	1000	7	700	7	700
11	Protection acoustique int-ext	10 0.5%	10	1000	7	700	7	700
12	Protection acoustique étage	50 2.5%	10	1000	7	700	7	700
13	Protection acoustique raccord paroi	100 5.0%	10	1000	4	400	4	400
14	Dilatation	10 0.5%	10	1000	10	1000	10	1000
15	Protection feu	10 0.5%	10	1000	7	700	7	700
16	Mise à terre	50 2.5%	10	1000	1	100	1	100
17	Nettoyage des coques Alcast	50 2.5%	10	1000	4	400	4	400
18	Mise en œuvre	100 5.0%	10	1000	4	400	4	400
19	Durée de vie	100 5.0%	10	1000	7	700	7	700
20	Energie grise	100 5.0%	10	1000	10	1000	10	1000
21	Ecobilan	100 5.0%	7	700	7	700	7	700
22	Santé des collaborateurs	100 5.0%	10	1000	10	1000	10	1000
23	Attaches échafaudages	50 2.5%	10	1000	1	100	1	100
24	Entretien	50 2.5%	10	1000	4	400	7	700
TOTAL		2000 100.0%		24900		15870		17070
Notes				9.9		6.3		6.8

Dealing with special projects

Historic Building BIT - Geneva

- **Challenges**

- Defining required properties within a Swiss changeable environment.
- Performance improvement.
- Removing dangerous materials and their contribution to the fire performance.
- Keeping all architectural design intent. No geometry changes.
- Structural façade performance and current standards.



- **Proposed solutions**

- Development of new systems with improved performances but same esthetics.
 - System developments
 - New aluminum casts
 - New materials
- Window type: Breathing windows with internal openable leaf for blinds access.
- Scaffolding installation and Alcast cleaning.





Road - Dirt - Mud -
Grass - Sand - Water

Retrofit:
Adaptation to
field conditions

Dealing with special projects

OPAM – Concorde in Geneva

NEW REGULATIONS – OPAM (Prevention Organism of Major Accidents)

Road hazards:

- VCE explosion: Propane, hydrocarbures, vinylchlorid, etc.

Several architectural strategies:

- Create retention walls
- Increase distance to hazards
- Reduce type and quantity of dangerous materials
- Change building activity
- Escape ways to protected areas

Several envelope strategies:

- No openable windows
- No combustible materials
- Envelope performance

Required façade performance:

- Blast performance 200 mbar



Dealing with special projects OPAM – Concorde in Geneva

BLAST SIMULATIONS

ISSUES

- Architectural constraints with large size panes
- No accredited solutions
- High budget estimations

Research and simulations:

- Determination of blast threat (VCE) and envelope required performance.
- Dynamic non linear simulations and determination of envelope response.
- Design and concept adaptations

Conclusions:

- Glass composition changes slightly.
- Increase general resistance: aluminum system, clipping arrangements, etc.
- Some glasses require structural bonding.
- Adapting and enhancing fixings and connections.
- RESPECT ARCHITECTURAL CONCEPT.
- COST SIMILAR TO STANDARD PROJCTC.
- TENDER PHASE WITHOUT ANY ISSUE.
- UPDATED STUDY FOR CONSTRUCTION PHASE.
- CONFORMITY OF AUTHORITIES

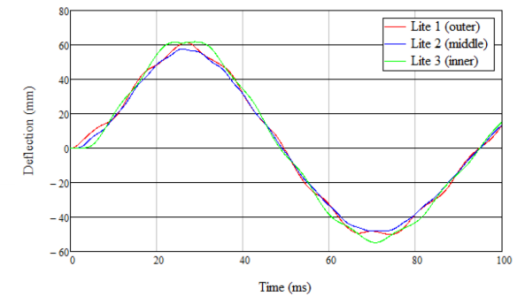
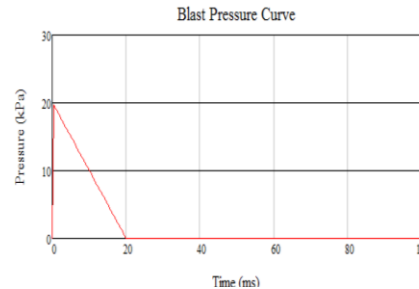
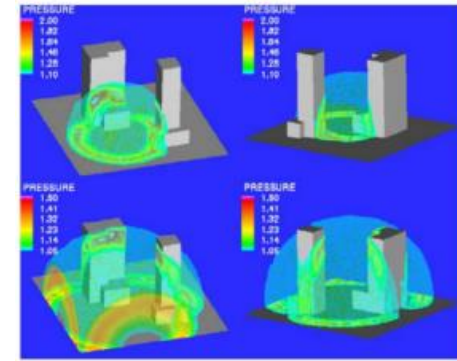
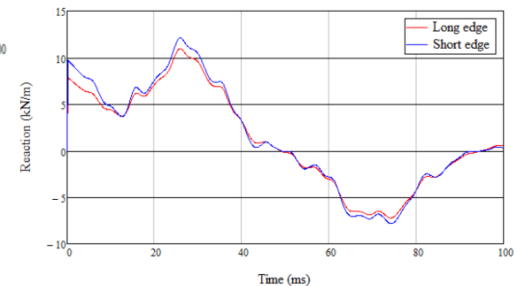


Figure 3-3: Glazing panel G1 deflection history



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THANK YOU - QUESTIONS?

