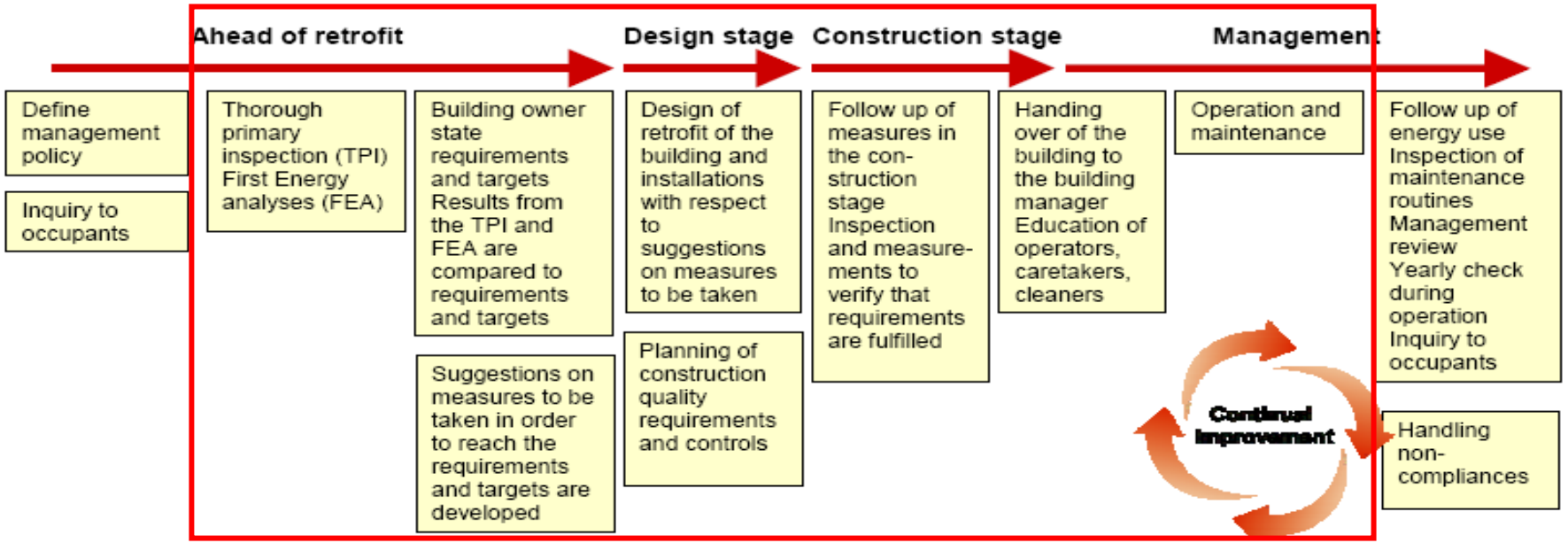
WP 6
Application of the QA-system in pilot projects

SPAIN

Sant Joan de Malta

PILOT PROJECT


Pre-Renovation
Requirements
Design
Construction
Commissioning
Management
Inspection and investigation of building status.
Energy analysis of the existing building.
Defined objectives and targets according to legal and normative requirements and the SQUARE System.
Advanced targets respect actual rules.
Design building structures and installation system.
Energy engineering.
Project schedule.
Plan quality control.
Systematic construction-management.
On going awarness-training.
Scheduled hand-over.
Verification and testing.
Hand-over inventory documents.
Hand-over operation and maintenance documents.
Monitoring energy consumption and indoor environment.
Questionnaires to users.
Establish operation and maintenance routines.


Ahead of retrofit
Design stage
Construction stage
Management
Define management policy
Inquiry to occupants
Thorough primary inspection (TPI) First Energy analyses (FEA)
Building owner state requirements and targets Results from the TPI and FEA are compared to requirements and targets
Suggestions on measures to be taken in order to reach the requirements and targets are developed
Design of retrofit of the building and installations with respect to suggestions on measures to be taken
Planning of construction quality requirements and controls
Follow up of measures in the con-struction stage Inspection and measure-ments to verify that requirements are fulfilled
Handing over of the building to the building manager Education of operators, caretakers, cleaners
Operation and maintenance
Follow up of energy use Inspection of maintenance routines Management review Yearly check during operation Inquiry to occupants
Continual Improvement
Handling non-compliances

AHEAD OF RETROFIT → **DESIGN STAGE** → **CONSTRUCTION STAGE**

SPANISH PILOT PROJECT. The development consists of a 4 storey building, located in Barcelona (Sant Joan de Malta street)

The main characteristics of the target building were:
- existing building with a need for an integral renovation
- high replication potential of the developed renovation model
- developer organisation with the aim to go beyond the actual energy regulations

The renovation of the selected building included the following aspects:
- structural: floors, roof, internal divisions
- thermal envelope: insulation, windows
- services: all the building services, including specific improvements (e.g. forced ventilation).

Establishing pre-renovation conditions

The old building was in very bad general condition, without permanent tenants. Hence, the analysis of the pre-renovation conditions has been focused on structural aspects, while other pre-renovation procedures, like residents' questionnaires or Thorough Primary Inspection (TPI), were not applicable.

First Energy Analysis (FEA) defined the existing energy conditions.

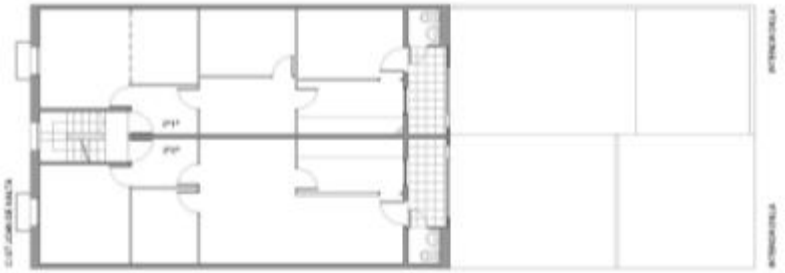
Pre-Renovation

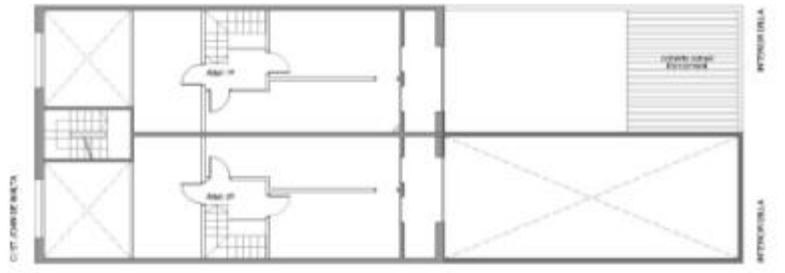
Inspection and investigation of building status.

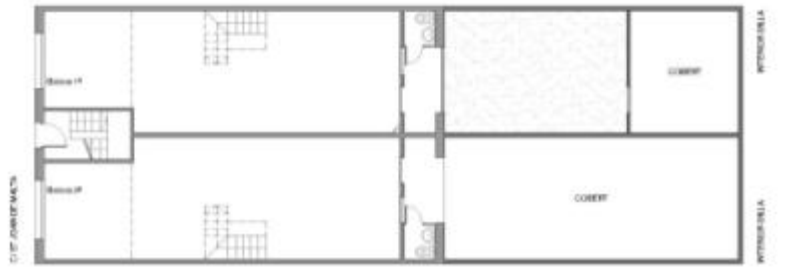
Energy analysis of the existing building.

AHEAD OF RETROFIT → DESIGN STAGE → CONSTRUCTION STAGE

Pilot Project Building Block	Initial state
Address	Sant Joan de Malta street. Barcelona
Number apartments	6
Year of construction	Around 1890
Materials	Brick and stone (walls), wood (beams), flat tiles (roof)
Orientation	45º SW
General systems	Electricity, water and sewer
Situation	Block with two external façades and two dividing walls
Ownership	Private (Residencial Sardana as a developer)





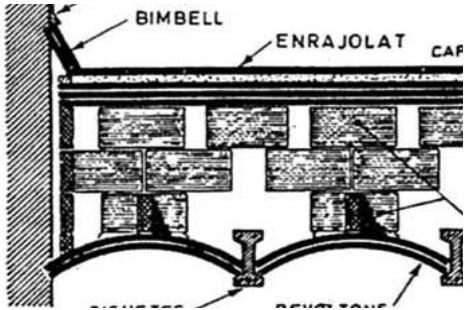


Formulation of requirements and targets prior to renovation (1)

• POMA and TTA defined the values for the main thermal and indoor environment quality parameters. Most of them are current requirements set in recent building regulations (CTE and RITE).

Further -more strict- requirements were also introduced as part of the pilot project added value, like:

•better global U-value
•better performance of thermal generation
•better performance of the ventilation system
•Achieve B energy qualification.
•Use of collected rain water.



Formulation of requirements and targets prior to renovation (2)

The project revision carried out by TTA made several proposals in order to improve the energy efficiency and the indoor environment quality.

- consider the external thermal insulation on the main façade to keep the wall mass to storage energy.
- insulate the internal walls surrounding not heated spaces, and the basement floor
- consider a vented roof
- correct thermal bridges and the capillary moisture from the ground.
- introduce a collective heating system (instead of individual boilers in each flat) and collective hot water generation
- introduce high efficiency boiler (condensation)
- introduce hot water and heating metering (each apartment)
- centralise ventilation (roof air entrance and evacuation) with individual energy recovery from renovated air flow
- introduce free cooling

And POMA added some global architectural and sustainable targets:

- No over loading vertical structure.
- Not subjecting existent structure (walls) to new efforts.
- Compatible construction solutions with existent.
- Election of the wood as a material that has low emissions of CO_2.

HIGHLIGHTS OF THE RETROFITTING STRATEGY

Reinforced existing beams. Construction of new ceilings

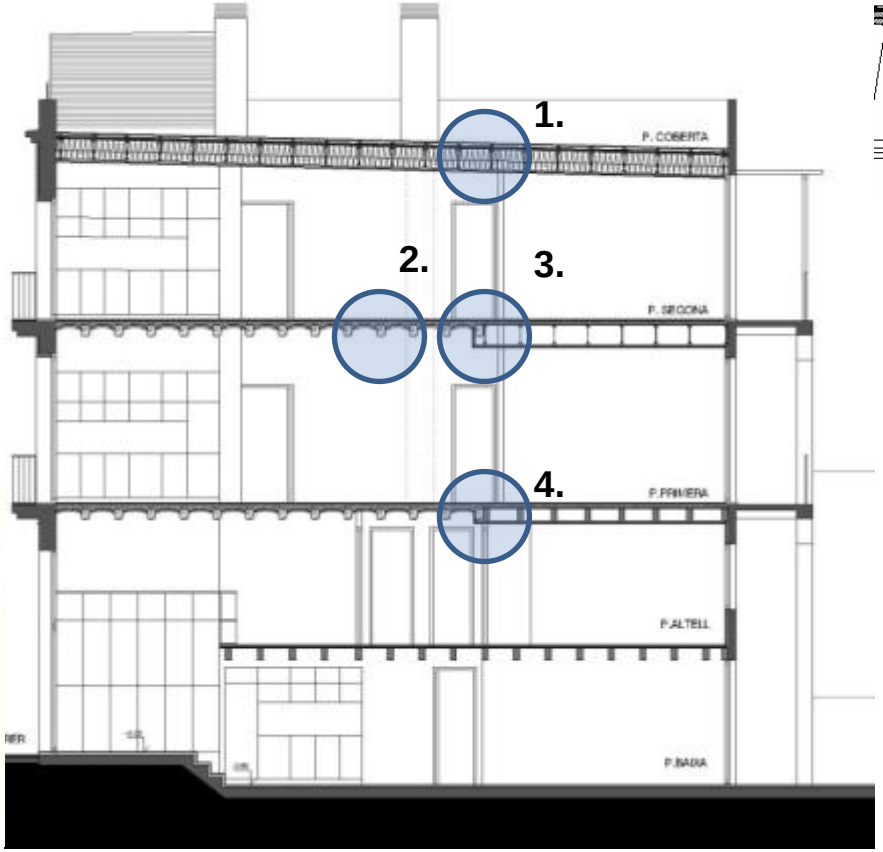
Design

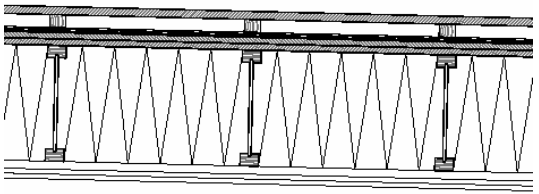
Design building structures and installation system.

Energy engineering.

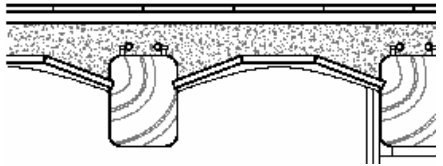
Project schedule.

Plan quality control.





1.



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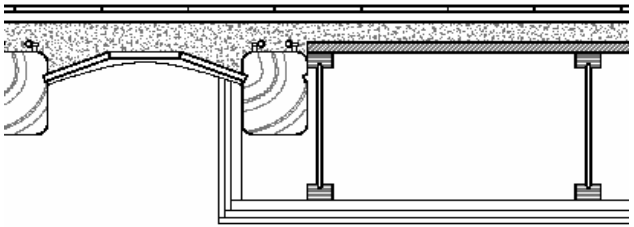

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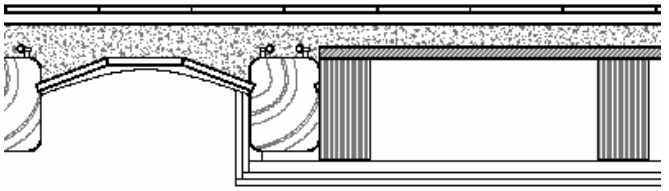
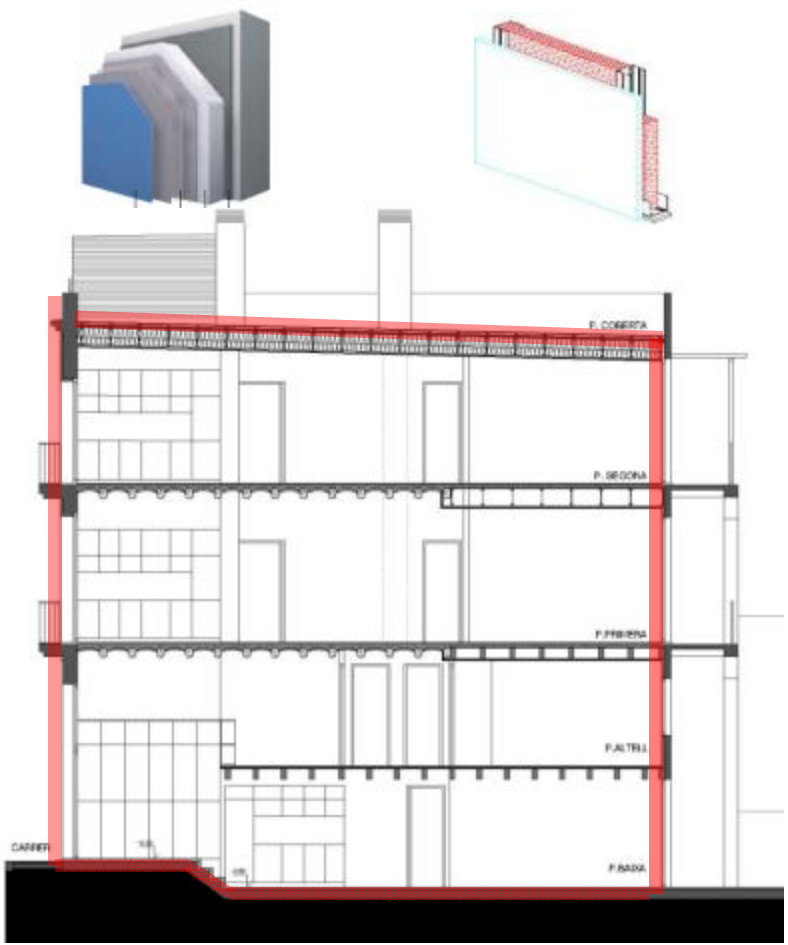
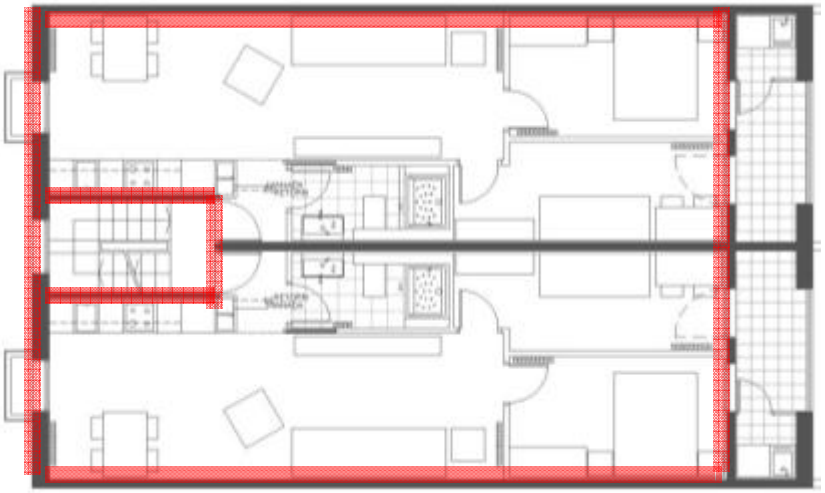


4.

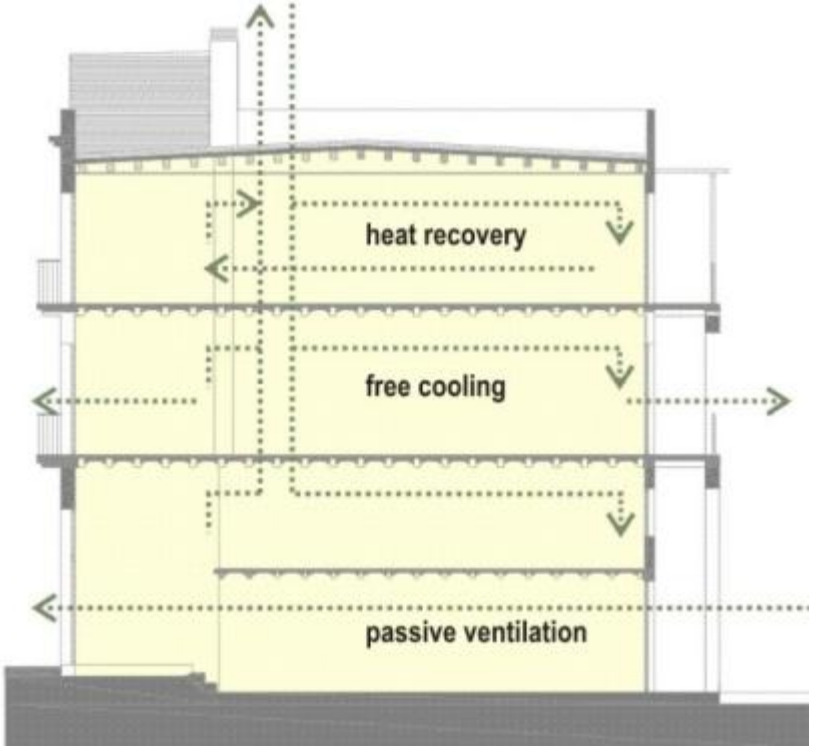
External thermal insulation on the main façade. Insulate internal walls, inside façade and roof.

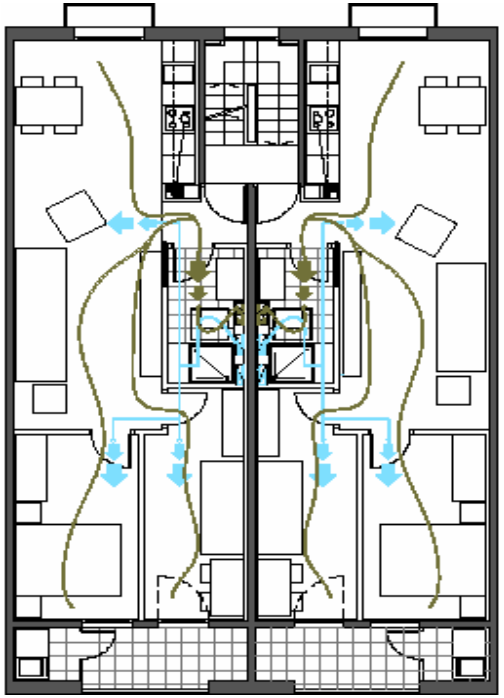


ENVELOPE	U before retrofit (W/m2ºC)	U after retrofit (W/m2ºC)
external north	1,70	0,50
external south	1,70	0,50
dividing wall east	1,70	1,70
dividing wall west	1,70	1,70
roof	2,00	0,30
basement floor	2,70	0,30
wall touching stairs	2,00	0,80
windows	4,20	2,60
internal walls	2,00	2,00
internal floors	2,70	2,00



Centralise ventilation (roof air entrance and evacuation) with individual energy recovery from renovated air flow. CO2 probe incorporated in every unit. Introduce free cooling. Natural ventilation**:** Crossed ventilation controlled by the users.





Air energy recovery unit: HRE- 350 ECH High efficiency >90%

- Free cooling bypass
- 1 unit per apartment
- air intake and evacuation on the roof

-Blue: supply air ducts.

-Black: by plenum.

Improve tightness:
New windows specified in the construction project were 50% more tight than the required by local rules.

La permeabilidad al aire de las carpinterías, medida con una sobrepresión de 100 Pa, tendrá unos valores inferiores a los siguientes:

a) para las zonas climáticas A y B: 50 $m^3/h\ m^2$;

b) para las zonas climáticas C, D y E: 27 $m^3/h\ m^2$.

CTE

Código Técnico de la Edificación

Apartados **DB-HE**

DB-HE1
Limitación de la demanda energ.
DB-HE2
Rendimiento de las inst. térmicas
DB-HE3
Eficiencia energética de iluminación
DB-HE4
Contribución solar mínima de agua
DB-HE5
Contribución fotovoltaica mínima

AENOR

COMITÉ TÉCNICO DE CERTIFICACIÓN **VENTANAS, FACHADAS LIGERAS, PUERTAS, PERSIANAS Y SUS COMPONENTES**

AENOR Asociación Española de Normalización y Certificación

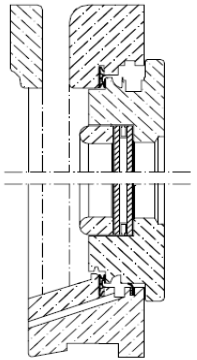
Ficha Técnica de la ventana con Marca AENOR certificados nº: 047/000256 y 047/000257

Producto Certificado **Ventanas**

Ventana de madera, abatible de eje vertical y horizontal indistintamente.
Serie AC

Fabricante: **CARPINTERÍA COUTO, S.L.**
Fábrica: VITORIA (Álava)

SECCIÓN VERTICAL DE LA VENTANA A ESCALA ½ - ¼



CARACTERÍSTICAS TÉCNICAS DE LA VENTANA

1º.- SISTEMAS DE APERTURA
Cremona con tres puntos de cierre.

2º.- PERFILES DE MADERA
MATERIA PRIMA: Iroko
ACABADO DE SUPERFICIE:
PROTECCIONES: Vacsolizado
CERTIFICACIONES DE CONFORMIDAD:
DIMENSIONES MÁXIMAS: 1.500 mm x 2.300 mm

3º.- HERRAJES DE APERTURA
MATERIALES:
SISTEMA: Cremona
PROVEEDORES: Taner, Roto
CERTIFICACIONES DE CONFORMIDAD

4º.- ACCESORIOS DE ENSAMBLAJE

DESCRIPCIÓN	MATERIALES
Armado de marcos y hojas	Cola D3 EN 204

5º.- ELEMENTOS DE ESTANQUIDAD

DESCRIPCIÓN	MATERIALES
Juntas de estanquidad	Caucho Neopreno
Sellado del acristalamiento	Silicona

6º.- ACRISTALAMIENTO

TIPO	ESPESOR MÁXIMO	PESO MÁXIMO
Doble aislante	20 mm	

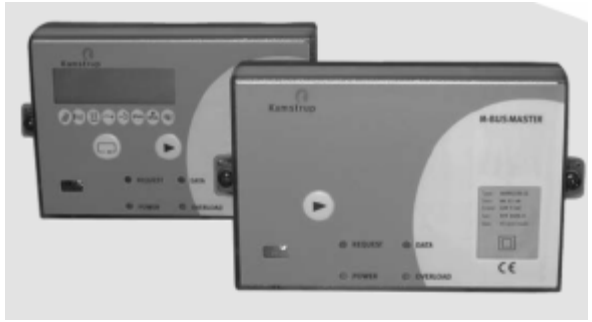
PRESTACIONES CERTIFICADAS DE LA VENTANA

VE	RESISTENCIA AL VIENTO	UNE-EN 12210	Clase C5 (1.500 mm x 1.500 mm) Clase C4 (1.500 mm x 2.300 mm)	
HH	ESTANQUIDAD AL AGUA	UNE-EN 12208	Clase 5A	
HA	AISLAMIENTO ACÚSTICO	UNE-EN ISO 140-3	Ensayo ventana 2 hojas 1200 x 1200 con vidrio aislante 5 / 12 / 6	R_W = 34 (-2 ; -4) dB R_A = 33,1 dbA
HE	PERMEABILIDAD AL AIRE	UNE-EN 12207	Clase 3	
	AISLAMIENTO TÉRMICO Valor U ($W/m^2 \cdot K$)	UNE-EN ISO 12567-1	Ensayo ventana 2 hojas 1200 x 1200 con vidrio aislante 5 / 12 / 6	3,10 W/m^2 K
		UNE-EN ISO 10077-1	Cálculo	
	DURABILIDAD	UNE-EN 12400	Clase 3 (20.000 ciclos)	

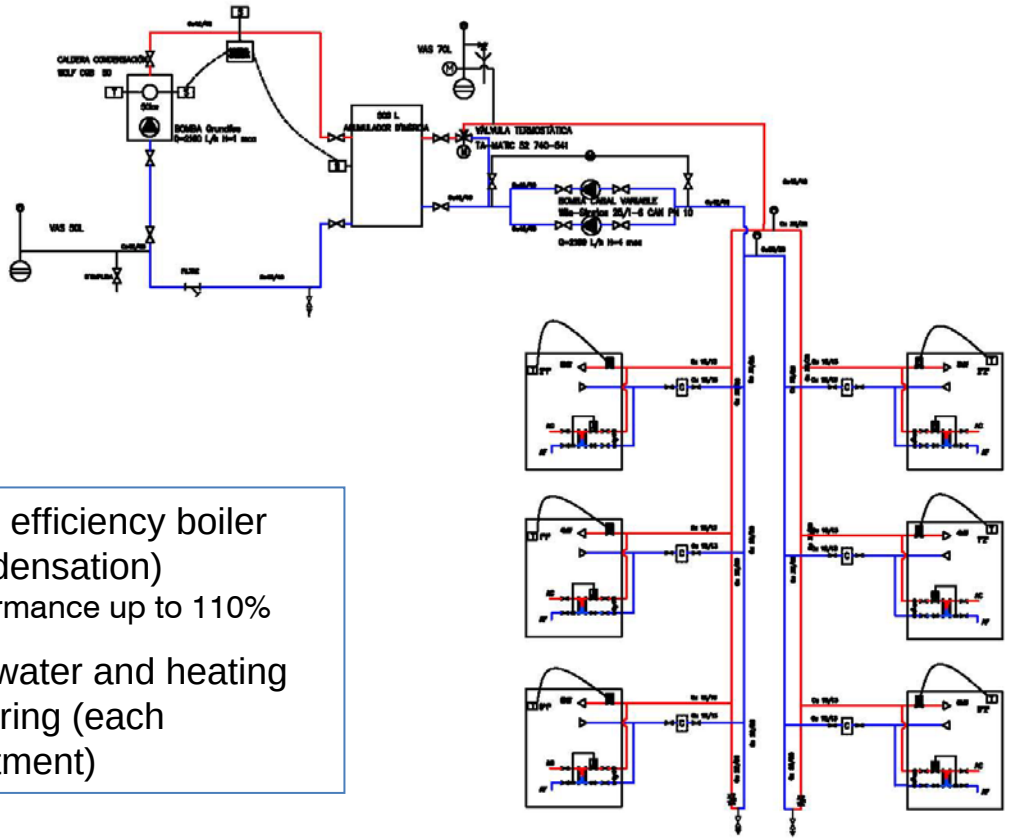
Francisco José Sanz Iglesias, Presidente del AEN/CTC-047, **CERTIFICA** que la ventana cuyas características técnicas y prestaciones figuran en esta Ficha Técnica, fabricada por **CARPINTERÍA COUTO, S.L.** en su factoría de **VITORIA**, está en posesión de la Marca AENOR para ventanas.

Comité Técnico de Certificación 047
AENOR Asociación Española de Normalización y Certificación
Secretaría: **ASEFAVE**
Príncipe de Vergara, 74
28006 Madrid

En Madrid, a 22 de noviembre de 2005

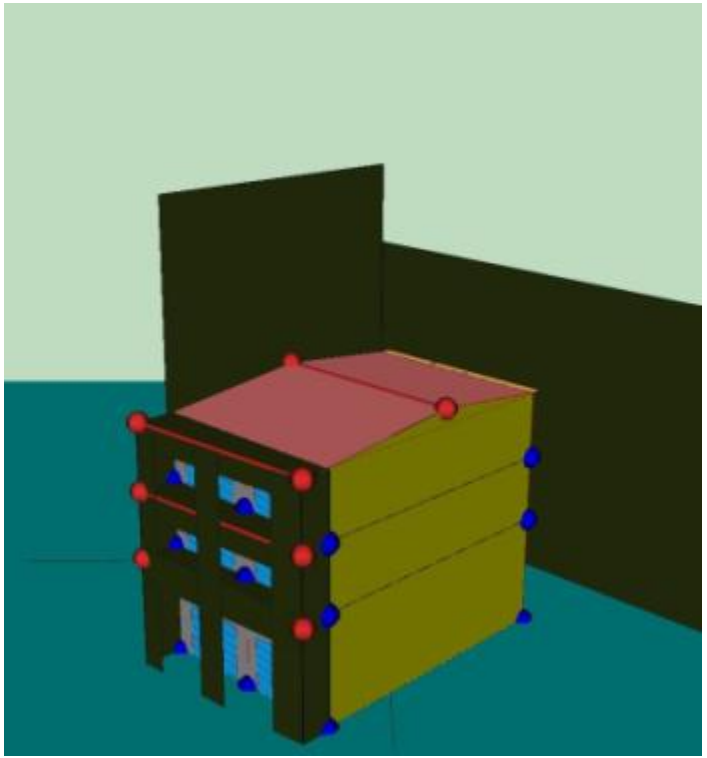


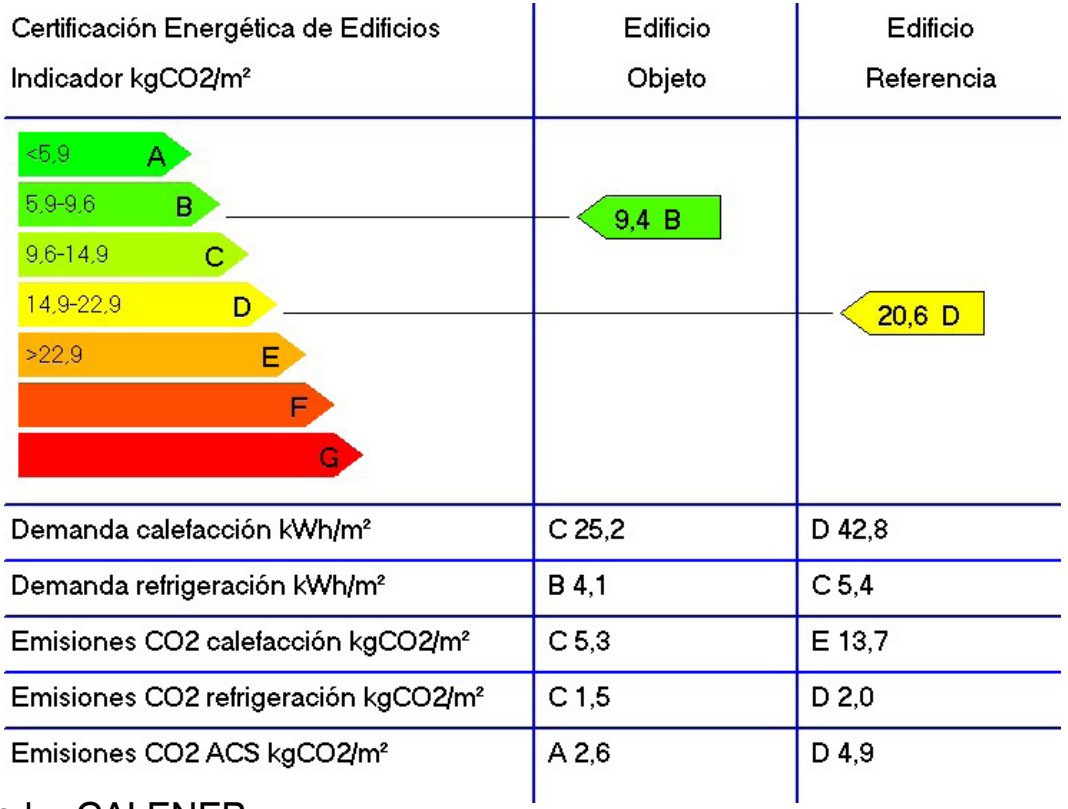
New collective heating system (instead of individual boilers in each flat) and collective hot water generation



- high efficiency boiler (condensation)
  Performance up to 110%
- hot water and heating metering (each apartment)

The reformulated project has been tested with official software in order to verify the accomplishment of Spanish Building Energy requirements (CTE) and later to calculate its Energy Certificate





Demanda calefacción kWh/m²	C 25,2	D 42,8
Demanda refrigeración kWh/m²	B 4,1	C 5,4
Emisiones CO2 calefacción kgCO2/m²	C 5,3	E 13,7
Emisiones CO2 refrigeración kgCO2/m²	C 1,5	D 2,0
Emisiones CO2 ACS kgCO2/m²	A 2,6	D 4,9

Simulation by LIDER and Energy Certificate by CALENER

The actors of the construction stage were:

- **DEVELOPER.** Residencial Sardana S.L.
- **ARCHITECT:** POMA Arquitectura.
- **ENERGY CONSULTANT:** TTA Trama Tecnoambiental.
- **MAIN CONSTRUCTOR:** Construccions Vives.
- **SYSTEMS INSTALLER**: La Moderna.

TESTING DURING CONSTRUCTION:

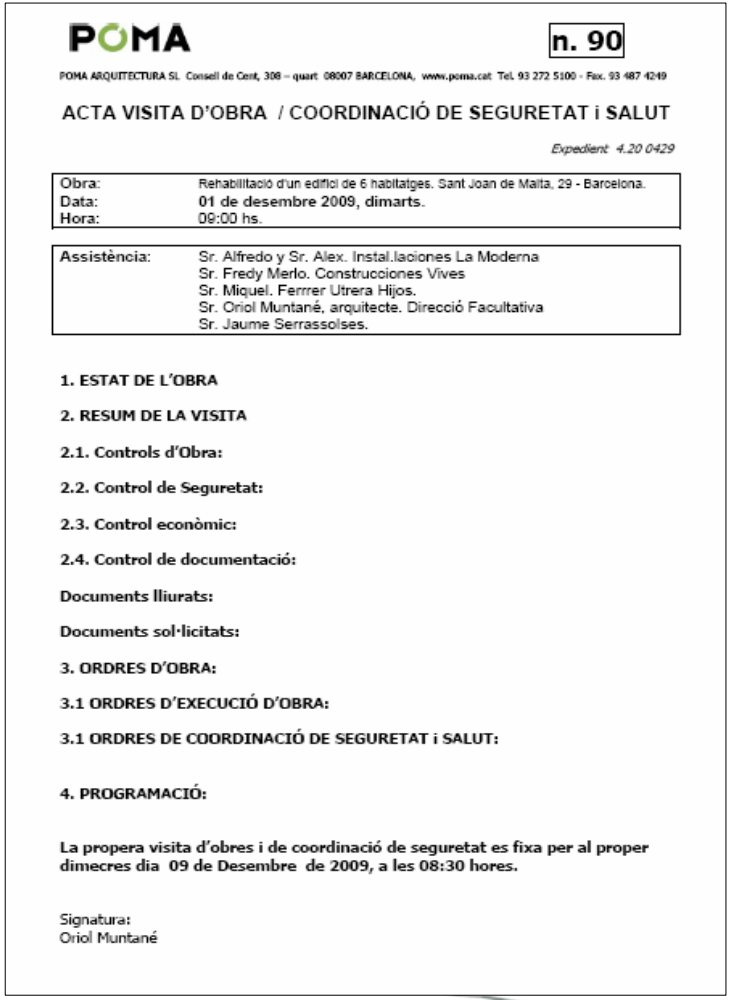
AWARENESS
The architect and the consultant in charge of energy retrofitting must transmit to the construction company the influence and importance of their work on the results of the indoor environment and energy efficiency.

It is important to discuss and agree the solutions and construction details with the every actor.

CONTROL
Request a certificate of technical characteristics on materials, equipments … comply with the project requirements. Especially those related to energy use and indoor environment.

Test the solutions during construction.

To collect and to document the results.
Examples:
- air tightness
- moisture content of different parts of the building.
- sound levels of the facilities.
- scheduled air renewals.



POMA **n. 90**

POMA ARQUITECTURA SL Consell de Cent, 308 – quart 08007 BARCELONA, www.poma.cat Tel. 93 272 5100 - Fax. 93 487 4249

ACTA VISITA D'OBRA / COORDINACIÓ DE SEGURETAT i SALUT

Expedient 4.20 0429

Obra:	Rehabilitació d'un edifici de 6 habitatges. Sant Joan de Malta, 29 - Barcelona.
Data:	01 de desembre 2009, dimarts.
Hora:	09:00 hs.

Assistència:	Sr. Alfredo y Sr. Alex. Instal.laciones La Moderna Sr. Fredy Merlo. Construcciones Vives Sr. Miquel. Ferrer Utrera Hijos. Sr. Oriol Muntané, arquitecte. Direcció Facultativa Sr. Jaume Serrassolses.

1. ESTAT DE L'OBRA

2. RESUM DE LA VISITA

2.1. Controls d'Obra:

2.2. Control de Seguretat:

2.3. Control econòmic:

2.4. Control de documentació:

Documents lliurats:

Documents sol·licitats:

3. ORDRES D'OBRA:

3.1 ORDRES D'EXECUCIÓ D'OBRA:

3.1 ORDRES DE COORDINACIÓ DE SEGURETAT i SALUT:

4. PROGRAMACIÓ:

La propera visita d'obres i de coordinació de seguretat es fixa per al proper dimecres dia 09 de Desembre de 2009, a les 08:30 hores.

Signatura:
Oriol Muntané

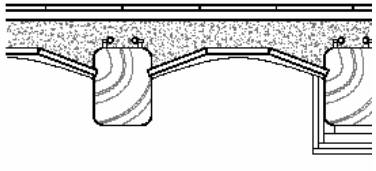
Demolishment and preventive works: Construction the new sewer

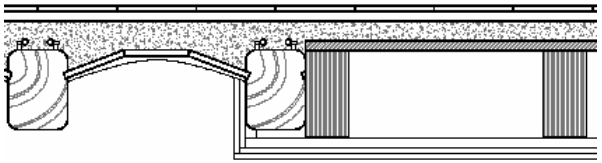
Construction

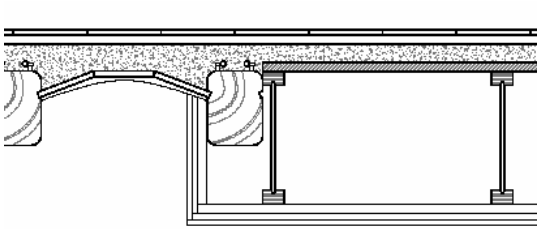
Systematic construction-management.

On going awarness-training.

Reinforced existing beams and new timber beans.







Avoid the capillary moisture from the basement. Waterproofing and keep vented roof. Façade and internal walls insulation.






The main constructor and all the workers were awareness of the importance to achieve an excellent quality. Daily checks were carried out to verify the works. Every revision has been documented and filed.

Improved airtight. New windows: wood frame, 4 -9- 5 double glazing

Air tightness: 4 Class

Thermal U value: 2,7 W/m2K

Air tightness tape between the wood frame and wall.

PERSIANES i PORTES MIQUEL

JOAN MIQUEL FELIP COM A GERENT DE L'EMPRESA PERSIANAS MIQUEL SA. AMB NIF A25026022, SITUADA A CARRETERA NII, KM 479 DE SIDAMON (LLEIDA)

CERTIFICA:

Que el material servit CARPINTERIA VIMET, S.A. amb NIF A08850646, SITUADA A C/ENCLUSA, S/N N-A-1 A-2 POG. COMELLES SUD, reuneix les següents característiques:

- **FINESTRES AMB FUSTA**
  - Permeabilitat al aire — **CLASE 4**
  - Estanquitat al aigua — **E1050**
  - Resistència a la càrrega del vent — **CLASE C4**
  - Índex de reducció sonora — **Rw (C;C_{Tr})** — **32 (-1;-4) dB**
  - Transmitància Tèrmica Normalitzada — **$U_{h,t}$ (Uw)** — **2.7 W/(M^2K)**
  - Secció vestiments — **11.5x7**
  - Secció finestres — **7.6x5.7**
  - Persiana de llibret de lama fixa col·locada al marc amb anubes i falleba negra.
  - Envernissat al aigua a poro obert 3 mans color roure.

I perquè així consti firmo aquest certificat.

Sidamon, 5 de Novembre de 2008

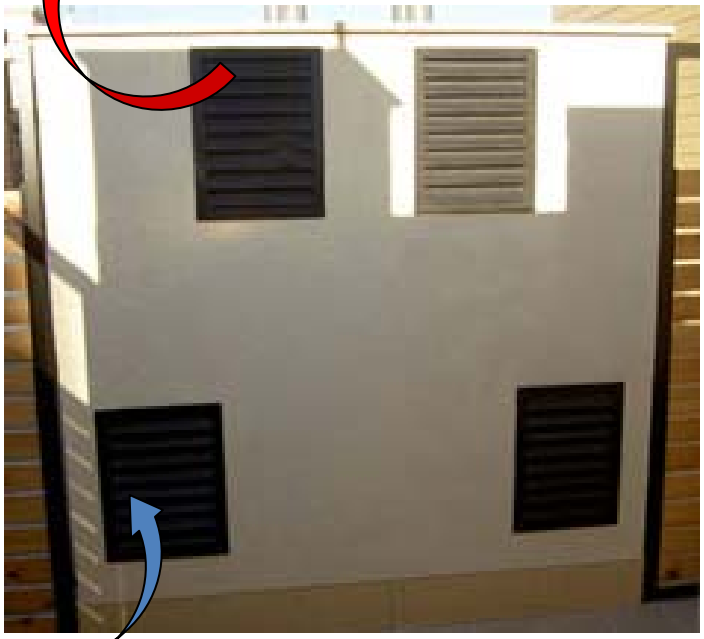
PERSIANES i PORTES MIQUEL SA

Joan M. Miquel Felip
Gerent
Persianas Miquel SA
JM/mm

Heat recovery

Used air flows by plenum to bath, where the energy recovery unit exchange thermal energy with input fresh air and vent the exhaust air to the roof.

Checks were carried out during construction stage.



Natural Gas Central Condensation boiler

•Space heating by radiators.

•Hot water production.

•Individual heat meter to monitor how much energy each user spends.

Controls of temperature in radiators and differences between air and walls have been done in every apartment.

Other parameters: sound insulation, rainwater collection, LED and low consumption lighting technology and eficient mixer taps, water-based paint.

MANAGEMENT

Commissioning

Scheduled hand-over.

Verification and testing.

Hand-over inventory documents.

Hand-over operation and maintenance documents.

Management

Monitoring energy consumption and indoor environment.

Questionnaires to users.

Establish operation and maintenance routines.

Every flat can meter the consumption of:
•Heat: heating and hot water .
•Electric energy.
•Water.

In the building there is one gas meter. The gas bill should be divided proportionally to the individual consumption.

Management

Monitoring energy consumption and indoor environment.

Questionnaires to users.

Establish operation and maintenance routines.

Vertical property vs horizontal property:

- Housing association vs the community ownership
- Rented dwelling vs sold properties.
- Property Manager is in charge of monitoring and distribute the community expenses.

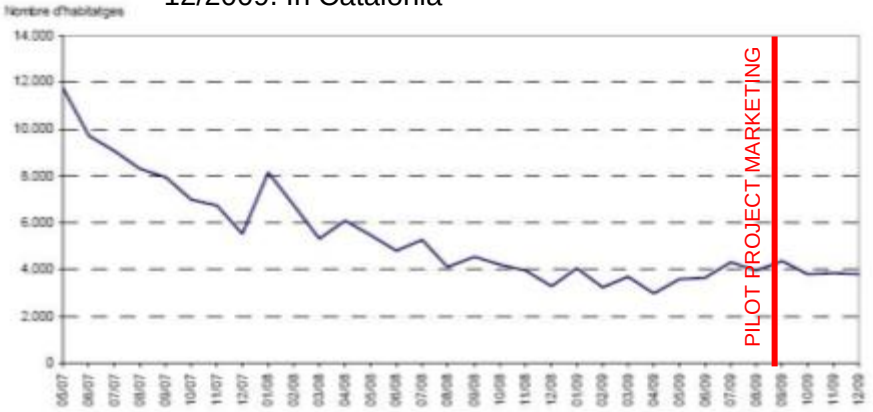
CONCLUSION

Dwelling Price Evolution between 1988-2009.
In Barcelona, €/m2

Nota: l'any 2008 es produí un canvi metodològic i una ampliació del nombre de municipis estudiats.

Font: Secretaria d'Habitatge, a partir dels treballs de l'Instituto APOLDA i TECNIGRAMA.

Sold Dwelling Evolution between 05/2007-12/2009. In Catalonia



Font: *Estadística de Transmissions de Drets de la Propietat* de l'Institut Nacional d'Estadística (INE).

THE IMPLEMENTATION OF SQUARE QA system to the Spanish pilot project has offered the possibility to the developer to:

- Establish an ambitious energy policy.
- Adopt a tool to plan and organize the targets, the construction stage and the management.
- Improve the monitoring of the construction process and the metered parameters
- More efficient and systematic construction control and commissioning.
- More complicity between the actors: builders - technical – property (developer).
- Generate detailed information about maintenance, management and operation to new owners.
- Offer a high quality dwelling without increase of prices.
- Be able to sell (because of the improvements compared to others) in a moment that the market is completely frozen.

Intelligent Energy Europe

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THANKS FOR YOUR ATTENTION

POMAARQUITECTURA

tta Trama TecnoAmbiental