GMIT OFFICE BUILDING, DUBLIN

1/100
14-5-2012

Plan Title: BSC ARCHITECTURAL TECHNOLOGY YEAR 3

Gundo Sohn, Emer Maughan

DESIGN AND DETAIL STUDIES 3

Subject: SECOND FLOOR

S.1: "Kone R3" PULLEY TYPE LIFT WITH LOADING CAPACITY OF 10 people/800 kg MAX. INTERNAL CAR DIMENSIONS: 1300 x 1400 WITH 900 mm CLEAR DOOR OPENING. CLEAR UNOBSTRUCTED AREA OF 1800 x 1800 mm AT EVERY ELEVATOR. ALL ELEVATORS CONTINUOUS TO THE BASEMENT TO THE CARPARK.

S.2: "Ecocem GGBS" 300 mm THICK IN-SITU LOAD BEARING SHAFT CONTINUOUS DOWN TO BASEMENT FOUNDATION. FIRE RESISTANCE OF 60 min MINIMUM.

S.3: REYNAER CURTAIN WALL. FIXED BY PRESSURE PLATES. FIXED TO INTERNAL R.C. COLUMNS TO MANUFACTURER'S RECOMMENDATIONS AND SPECIFICATION. ALL REYNAER SYSTEMS TOP HUNG WINDOW (GLASS FROM 23-34 MM) AND POW (GLASS FROM 22-28 MM).

S.4: ALUCOBOND COMPOSITE PANEL CONSISTING OF TWO ALUMINIUM COVER SHEETS AND A PLASTIC CORE. SLIMLINE STEEL BRACKETS FACTORY FITTED TO ENSURE QUICK AND SAFE CONSTRUCTION. BRACKETS FIXED TO 100MM C CHANNELS WHICH ARE BOLTED BACK TO 300 MM. R.C STRUCTURAL PROTECTED STAIR SHAFT 100MM XTRATHERM HIGH DENSITY POLYURETHANE INSULATION WITH TYVEK SUPRE BREATHER MEMBRANE.

S.5: "PP COLUMNS WITH STEEL REINFORCEMENT CONTINUOUS TO BASEMENT FOUNDATION SPREAD AROUND THE BUILDING PRIMARILY AT 6 m GRID.


INTERNAL GLAZED PARTITION SPEC (S.8): 15 MM THICK "GYPROC FIRELINE" PLASTER BOARD EACH SIDE OF 48 MM THICK "GYPFRAME C" STUDS AT 600 MM C/C WITH 50 MM THICK ACOUSTIC ROLL IN CAVITY PROVIDING 60 MIN OF FIRE PROTECTION. COLOR FINISH TO DESIGNER'S CHOICE.

REYNOLDS CURTAIN WALL FIXED BY PRESSURE PLATES FIXED TO INTERNAL R.C. COLUMNS TO MANUFACTURER'S RECOMMENDATIONS AND SPECIFICATION ALL REYNOLDS SYSTEMS TOP HUNG WINDOW (GLASS FROM 23-34 MM) POWER (GLASS FROM 22-28 MM)

WALKWAY
PAINTED GALVANISED STEEL WALKWAY IN 2950*605mm SECTIONS BOLTED TO SUPPORT BRACKETS.

EACH SECTION MADE FROM 100*16mm FLAT ENDS WELDED TO 100*65*10mm FRONT AND REAR ANGLES SUPPORTING 30mm THICK STAINLESS STEEL GRATING ON RUBBER ISOLATING STRIP.

STAIRS TO MEET TGD PART K OF THE BUILDING REGULATIONS.
CLASSIFICATION OF SEMI-PUBLIC RECOGNISED.
BALUSTRADE TO BE 25MM RADIUS STAINLESS STEEL.
GLASS GUARDING TO COMPRISE OF 10MM TOUGHENED GLASS AND EMBEDDED IN TO HANDRAIL BY RUBBER SEAL AND GLUE SYSTEM.
GLASS GUARDING VERTICAL STEEL SUPPORTS BOLTED TO CONCRETE STAIRS.
CONC.STAIRS CAST IN-SITU WITH NON-SLIP CERAMIC TILE TO TREADS.

RETAINING WALL
12.5mm PLASTERBOARD INNER LINING.
25mm CAVITY AND 50mm RIGID URETHANE INSULATION BETWEEN 50*75mm SOFTWOOD BATTENS.
300mm THICK R.C.RETAINING WALL.
BITUMINOUS SHEET TANKING MEMBRANE WITH DRAINAGE COIL AT FOOT OF WALL.
EGGCRATE TYPE DRAINAGE SHEET.

GABION RETAINING WALLS.
STONE FILLED GALVANISED STEEL GABION CAGES.
0.25 MICRON POLYTHENE CARRIED VERTICALLY TO PROTECT TIMBER AGAINST GROUND MOISTURE AND DRESSED OVER TOP OF GABION OVERLAID AND PROTECTED BY GEOTEXTILE MEMBRANE.

SEDUM PLANTING BLANKET ON 75 MM SUB STRATUM LAYER ON SOIL PARTICLE FILTER FLEECE ON 20MM DRAINAGE / STORAGE MAT WITH MOISTURE STORAGE GRAVEL ON 2 LAYERS OF SYNTHETIC DISCONNECTING FOIL ON CHEMICALLY TREATED STEEL DISTRIBUTION LAYER ON 100MM THICK RIGID INSULATION TO 2% FALL ON CONCRETE SUMMER ON CONCRETE SLAB ON 70MM ELEVATION.

SINGLE OFFICE
FF: CARPET

POST/FAX ROOM
FF: CARPET

LOUNGE AREA
FF: CARPET

RESEARCH LIBRARY
FF: CARPET

MAIN ENTRANCE
FF: PORCELAIN STONEWARE

CANTEEN
FF: TILES

DELI AREA
FF: TILES

CHEF OFFICE
REST ROOM

LECTURE ROOM
FF: CARPET

CANTEEN
FF: TILES

DELI AREA
FF: TILES

CHEF OFFICE
REST ROOM

LECTURE ROOM
FF: CARPET

RECEPTION
FF: PORCELAIN STONEWARE

MALE WC
FF: PORCELAIN STONEWARE

FEMALE WC
FF: PORCELAIN STONEWARE

LEARNING ROOM
FF: CARPET
ALUCOBOND composite panel consisting of two aluminium cover sheets and a plastic core. Slimline steel brackets factory fitted to ensure quick and safe construction. Brackets fixed to 100mm C channels which are bolted back to 300 mm R.C structural protected stair shaft. 100mm Xtratherm high density polyurethane insulation with Tyvek Supro breather membrane. Guttermarter SnapLok wall capping. Fixed to lined and levelled substructure, with suitable austenitic stainless steel countersunk or low-profile head fasteners via LBS2 SnapLok bracket + level retaining bracket. Brackets secured to structure at capping joint locations and at maximum 1500mm ctrs.

Gingo Sohn, Emer Maughan

BSC ARCHITECTURAL TECHNOLOGY YEAR 3

GMIT OFFICE BUILDING, DUBLIN

DESIGN AND DETAIL STUDIES 3

Subject:
DETAIL DEVELOPMENT, FACADE SECTION.

Date: 1/20

Scale: E 1:20

Checked By:

Drawn by:
FACADE SECTION NORT WALL DETAIL GREEN ROOF

Sedum Planting Blanket on 75 mm Substratum Layer on Soil Particle Filter Fleece on 20 mm Drainage / Storage Mat with Moisture Storage Gravel on 2 Layers of Synthetic Disconnecting Foil on Chemically Treated Bitumen Adhered to Root Barrier on Between Adhered Steam Distribution Layer on 150 mm Thick Rigid Insulation to 2% Fall on Vapour Barrier on 75 mm Concrete Screed on In-Situ Concrete Roof Slab.

ALUCOBOND Composite Panel Consisting of Two Aluminium Cover Sheets and a Plastic Core. Sedum Steel Brackets Factory Fitted to Ensure Quick and Safe Construction. Brackets Fixed to 100 mm C Channels Which Are Bolted Back to 300 mm R.C Structural Protection Stair Shaft 100 mm XTRATHERM High Density Polyurethane Insulation with TYVEK Supro Breather Membrane.

ALUCOBOND Composite Panel consisting of two aluminium cover sheets and a plastic core. Sedum steel brackets factory fitted to ensure quick and safe construction. Brackets fixed to 100 mm C channels which are bolted back to 300 mm R.C structural protection stair shaft 100 mm XTRATHERM high density polyurethane insulation with TYVEK Supro breather membrane.
INTERMEDIATE FLOOR DETAIL CONSISTED OF AN EXTERNAL DOUBLE GLAZED CURTAIN WALL CONNECTED BY A IPN BEAM WITH A GALVANIZED STEEL WALKWAY GRILL TO THE IN SITU CONCRETE SLAB STRUCTURE WITH FIXING ANCHORS AND FORCING SCREWS. THE CURTAIN WALL IS CONNECTED TO THE STRUCTURE BY HORIZONTAL AND VERTICAL MULLIONS. THE GLASS IS FIXED BY STRUCTURAL SILICONE.

THE VENTILATION SYSTEMS CONSIST OF SOME MECHANICAL OPENING WINDOWS. THE FRONT OF THE SLAB IS COVERED BY ALUCOBOND COMPOSITE PANEL CONSISTING OF TWO ALUMINIUM COVER SHEETS AND A PLASTIC CORE. THE BRAQUETS ARE FIXED TO 100mm POLYURETHANE INSULATION WITH TYVEK BREATHER MEMBRANE.

THE FLOOR CONSISTED OF A RAISED FLOOR PANEL WITH THERMAL INSULATION SEPARATED TO THE SLAB BY RAISED FLOOR PEDESTALS.

REYNAER CURTAIN WALL FIXED BY PRESSURE PLATES FIXED TO INTERNAL R.C. COLUMNS TO MANUFACTURER'S RECOMMENDATIONS AND SPECIFICATION. ALL REYNAERS SYSTEMS TOP HUNG WINDOW (GLASS FROM 23-34 MM) FOR GLASS FROM 22-28 MM.
Treshold detail consisted of a external double glazed curtain wall connected by a IPN beam with a galvanized steel/umagray grill to the in situ concrete slab structure with fixing archers and forcing screens and the external curtain wall botivated by structural silicone. The ventilation systems consist of some mechanical opening windows connected to the alucobond composite panel consisting of two aluminium cover sheets and a plastic core. The brackets are fixed to 100mm polystyrene insulation with tyvek supro breather membrane. The floor consisted of a raised floor panel with thermal insulation separated to the slab by raised floor pedestals.

Reyner curtain wall fixed by pressure plates fixed to internal R.C. columns to manufacturer's recommendations and specification. All reyners systems top hung window (glass from 23-34 MM/foil/glass from 22-28 MM).
FACADE SECTION SOUTH WALL DETAIL GRAVEL ROOF

GUTTERMARTER SNAPLOK WALL CAPPING. FIXED TO LINED AND LEVELLED SUBSTRUCTURE, WITH SUITABLE AUSTENITIC STAINLESS STEEL COUNTERSUNK OR LOW-PROFILE HEAD FASTENERS. VALLEYS SNAPLOK BRACKET + LEVEL RETAINING BRACKET. BRACKETS SECURED TO STRUCTURE AT CAPPING JOINT LOCATIONS AND AT MAXIMUM 1500MM CTRS.

GRAVEL ROOF COMPOSED OF ALTERNATING LAYERS OF BITUMEN AND REINFORCING FABRICS THAT CREATE A FINISHED MEMBRANE ON A LAYER OF LIGHTWEIGHT AERATED CONCRETE. THE BITUMEN TYPICALLY USED IS ASPHALT EDAY OF HIGH DENSITY THERMAL ISOLATION AND A FINAL LAYER OF GRAVEL.

ALUCOBOND COMPOSITE PANEL CONSISTING OF TWO ALUMINIUM COVER SHEETS AND A PLASTIC CORE. SLIMLINE STEEL BRACKETS FACTORY FITTED TO ENSURE QUICK AND SAFE CONSTRUCTION. BRACKETS FIXED TO 100MM C-CHANNELS WHICH ARE BOLTED BACK TO 300 MM RC STRUCTURAL PROTECTED STAIR SHAFT 100MM XTRATHERM HIGH DENSITY POLYURETHANE INSULATION WITH TYVEK SUPRO BREATHER MEMBRANE.
REYNAER CURTAIN WALL, FIXED BY PRESSURE PLATES, FIXED TO INTERNAL R.C. COLUMNS TO MANUFACTURER'S RECOMMENDATIONS AND SPECIFICATION. ALL REYNAER SYSTEMS TOP HUNG WINDOW (GLASS FROM 23-34 MM) POW (GLASS FROM 22-28 MM).

ALUCOBOND COMPOSITE PANEL, CONSISTING OF TWO ALUMINIUM COVER SHEETS AND A PLASTIC CORE. SLIMLINE STEEL BRACKETS FACTORY FITTED TO ENSURE QUICK AND SAFE CONSTRUCTION. BRACKETS FIXED TO CHANNELS WHICH ARE BOLTED BACK TO 300 MM R.C. STRUCTURAL PROTECTED STAIR SHAFT 100MM XTRA THERM HIGH DENSITY POLYURETHANE INSULATION WITH TYVEK SUPER BREATHING MEMBRANE.

PAVEMENT OF CERAMIC TILES CONNECTED TO THE SLAB ON A SAND/CONCRETE LAYER.

G Fucked sohn, Emer Maughan

DESIGN AND DETAIL STUDIES 3

Gundo Sohn, Emer Maughan

DETAIL DEVELOPMENT, FACADE SECTION.

GROUND FLOOR PLAN

SHARED OFFICE
FF: CARPET

SHARED OFFICE
FF: CARPET

MALE WC
FF: PORCELAIN STONEWARE

FEMALE WC
FF: PORCELAIN STONEWARE

LECTURE ROOM
FF: CARPET

CANTEEN
FF: TILES

DELI AREA
FF: TILES

KITCHEN
FF: TILES

CHEF OFFICE
REST ROOM

SINGLE OFFICE
FF: CARPET

POST/FAX ROOM
FF: CARPET

LOUNGE AREA
FF: CARPET

RESEARCH LIBRARY
FF: CARPET

RECEPTION
FF: PORCELAIN STONEWARE

MAIN ENTRANCE

VOID OVER GROUND FLOOR

WAITING AREA

ATRIUM OPENING ABOVE STAIRWELL

STAIRWELL

STAIRWELL

STAIRWELL

WINDOW DETAIL INTERMEDIATE FLOOR

PAVEMENT OF CERAMIC TILES CONNECTED TO THE SLAB ON A SAND/CONCRETE LAYER.
ALUCOBOND COMPOSITE PANEL, CONSISTING OF TWO ALUMINIUM COVER SHEETS AND A PLASTIC CORE, FACTORY FITTED TO ENSURE QUICK AND SAFE CONSTRUCTION. BRACKETS FIXED TO 100MM C CHANNELS WHICH ARE BOLTED BACK TO 300 MM R.C STRUCTURAL SHAFT. XTRATHERM HIGH DENSITY POLYURETHANE INSULATION WITH TYVEK EURO BREATHER MEMBRANE.

PAVEMENT OF CERAMIC TILES CONNECTED TO THE SLAB BY CEMENT MORTAR ON A SAND/CONCRETE LAYER.
**GMIT OFFICE BUILDING, DUBLIN**

**IRIA XTOUBANOVA MARTINEZ**

**Plan Title:** BSC ARCHITECTURAL TECHNOLOGY YEAR 3

**DESIGN AND DETAIL STUDIES 3**

**Subject:** DETAIL DEVELOPMENT, FACADE SECTION.

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**FACADE SECTION SOUTH WALL**

**E 1:5**

- **RETAINING WALL**
  - 12mm PLASTERBOARD INNER LINING
  - 25mm CAVITY AND 38mm RIGID URTHANE
  - R.C.RETAINING WALL
  - BITUMINOUS SHEET TANKING MEMBRANE
  - WITH DRAINAGE COIL AT FOOT OF WALL
  - DRAINAGE SHEET.

- **GABION RETAINING WALLS**
  - STONE FILLED GALVANISED STAINLESS STEEL GABIONS
  - 0.25 MICRON POLYTHENE CARRIED VERTICALLY TO PROTECT TIMBER AGAINST GROUND MOISTURE AND DRESSED OVER TOP OF GABION OVERLAID AND PROTECTED BY GEOTEXTILE MEMBRANE.

- **CERAMIC TILES**
  - CONNECTED TO THE SLAB BY CEMENT MORTAR ON A SAND/CONCRETE LAYER.
DET.1

SEDUM PLANTING BLANKET ON 75 MM SUB
LAYER ON SOIL PARTICLE FILTER FLEECE
ON 20MM DRAINAGE / STORAGE MAT WITH
MOISTURE STORAGE GRAVEL ON 2 LAYERS
OF SYNTHETIC DISCONNECTING FOIL ON
CHEMICALLY TREATED BITUMEN ADHERED
TO ROOT BARRIER ON BITUMEN ADHERED
STEAM DISTRIBUTION LAYER ON 150MM
THICK RIGID INSULATION TO 2% FALL ON
VAPOUR BARRIER ON 75MM CONCRETE
SCREED ON SOMA Sp02 ACCESS FLOOR ON
200MM REINFORCED IN-SITU CONCRETE
ROOF SLAB.

DET.2

ALUCOBOND composite panel
CONSISTING OF TWO
ALUMINIUM COVER SHEETS
AND A PLASTIC CORE.
SLIMLINE STEEL BRACKETS
FACTORY FITTED TO ENSURE
QUICK AND SAFE
CONSTRUCTION. BRACKETS
FIXED TO 100MM.C CHANNELS
WHICH ARE BOLTED BACK TO
300 MM. R.C STRUCTURAL
PROTECTED STAIR
SHAFT100MM XTRATHERM
HIGH DENSITY
POLYURETHANE INSULATION
WITH TYVEK SUPRO
BREATHER MEMBRANE.

DET.3

REYNAER CURTAIN
WALL.FIXED BY
PRESSURE PLATES.FIXED
TO INTERNAL R.C.
COLUMNS TO
MANUFACTURER'S
RECOMMENDATIONS AND
SPECIFICATION.ALL
REYNAERS SYSTEMS
TOP HUNG WINDOW
(GLASS FROM 23-34 MM)
POW(GLASS FROM 22-28
MM)
WALKWAY
PAINTED GALVANISED STEEL
WALKWAY IN 2950*605mm
SECTIONS BOLTED TO
SUPPORT BRACKETS.
EACH SECTION MADE FROM
100*16mm FLAT ENDS WELDED
TO 100*65*10mm FRONT AND
REAR ANGLES SUPPORTING
30mm THICK STAINLESS STEEL
GRATING ON RUBBER
ISOLATING STRIP.
SEDUM PLANTING BLANKET ON 75 MM SUB STRATUM LAYER ON SOIL PARTICLE FILTER FLEECE ON 20MM DRAINAGE / STORAGE MAT WITH MOISTURE STORAGE GRAVEL ON 2 LAYERS OF SYNTHETIC DISCONNECTING FOIL ON CHEMICALLY TREATED BITUMEN ADHERED TO ROOT BARRIER ON BITUMEN ADHERED STEAM DISTRIBUTION LAYER ON 150MM THICK RIGID INSULATION TO 2% FALL ON VAPOUR BARRIER ON 75MM CONCRETE SCREED ON SOMA S402 ACCESS FLOOR ON 200MM REINFORCED IN-SITU CONCRETE ROOF SLAB.

REYNAL CURTAIN WALL FIXED IN PRESSURE PLATES FIXED TO INTERNAL R.C. COLUMNS TO MANUFACTURER’S RECOMMENDATIONS AND SPECIFICATION. ALL REYNAL SYSTEMS TOP HUNG WINDOW (GLASS FROM 23-34 MM) POW (GLASS FROM 22-26 MM)

ALUCOBOND composite panel consisting of two aluminium cover sheets and a plastic core. Slimline steel brackets factory fitted to ensure quick and safe construction. Brackets fixed to 100MM C CHANNELS which are bolted back to 300 MM R.C STRUCTURAL PROTECTED STAIR SHAFT 100MM XTRATHERM HIGH DENSITY POLYURETHANE INSULATION WITH TYVEK SUPRO BREATHER MEMBRANE.

ALUCOBOND composite panel consisting of two aluminium cover sheets and a plastic core. Slimline steel brackets factory fitted to ensure quick and safe construction. Brackets fixed to 100MM C CHANNELS which are bolted back to 300 MM R.C STRUCTURAL PROTECTED STAIR SHAFT 100MM XTRATHERM HIGH DENSITY POLYURETHANE INSULATION WITH TYVEK SUPRO BREATHER MEMBRANE.
WALKWAY
PAINTED GALVANIZED STEEL
WALKWAY IN 1000x900x15mm
SECTIONS BOLTED TO
SUPPORT BRACKETS.
EACH SECTION MADE FROM
100x16mm FLAT ENDS WELDED
TO 100x8x12mm FRONT AND
REAR ANGLES SUPPORTING
30mm THICK STAINLESS STEEL
GRATING ON RUGGED
IRON ATTING STRIP
HERMETICALLY SEALED DOUBLE GLAZING (6+16+6)
FOR A VENTILATION IN OFFICES

FRAME

MOTOR HIDDEN IN THE WINDOW FRAME WHICH OPENS A GLAZING PARALLEL DRaining AND WITH MATCHING CILL AT LOWER LEVEL, WITH A CONCEALED THERMALLY BROKEN ANODIZED ALUMINIUM CURTAIN WALL SECTION, SELF

PANELLING

19519x734 mm.

INSIDE SKIN

COLOUR

OUTSIDE SKIN

CURTAIN WALL TYPE 8

SIZE

22432x7232 mm.
COMPARATIVE STUDY BETWEEN STRUCTURES AND TECHNOLOGIES IN IRELAND & SPAIN.

(DOUBLE SKIN FAÇADE)

BSC Architectural Technology year 3
Alumno: Iria Xoubanova Martínez
Directores: Emmer Maughan & Gundo Sohn.
Asignatura: Design & Detail Studies
Date: 28-5-2012
Contents:

1. Introduction.
   1.1. Double skin facade. Introduction to this facade system.
   1.2. Small introduction to the studied building.
   1.3. Spanish double skin facade buildings.

2. Comparative between the structure and the facade solution in the studied building with the climatic conditions of Spain.
1. INTRODUCCIÓN:

The aim of this comparative report is to show the differences between the constructive systems in Spain and in Ireland, and how a new system (the double skin facade) can change depending on the climate conditions and the requirements of the building to make it suitable to work and reduced use of energy in the same time.

In Spain this kind of system is relative new and in this kind of system is starting in the latest office buildings, as we can see in the examples of Spanish buildings with this kind of façade, and one of the reasons is the highest price of build with glass instead of using bricks, as we used to do. So we only can see this system in office buildings where the construction budget is high and to make sustainable buildings, according to the new regulations of energy efficiency.

1.1 DOUBLE SKIN FACADE. INTRODUCTION TO THIS FACADE SYSTEM.

The Double Skin Façade is a system that consists of an external screen, a ventilated cavity and an internal screen. Solar shading is positioned in the ventilated cavity. The external and internal screens can be single glass or double glazed units, the depth of the cavity and the type of ventilation depend on environmental conditions, the desired envelope performance and the overall design of the building including environmental systems.

The external and internal skins do not need to be hermetic, the exterior cavity surface is usually, fully glazed (single glazing). The interior surface of a naturally ventilated facade is composed of an opaque wall and an operable window to enable the natural ventilation.

In winter the cavity forms a thermal buffer zone which reduces heat losses and enables passive thermal gain from solar radiation.

This system could be classified in three big groups:

- **Naturally Ventilated Wall**: An extra skin is added to the outside of the building envelope. In periods with no solar radiation, the extra skin provides additional thermal insulation. In periods with solar irradiation, the skin is naturally ventilated from/to the outside by buoyancy (stack) effects. This type of façade cannot be recommended for hot climates.

- **Active Wall**: An extra skin is applied to the inside of the building envelope; inside return air is passing through the cavity of the façade and returning to the ventilation system. In periods with solar radiation the energy, which is absorbed
by the blinds, is removed by ventilation. In periods with heating loads, solar energy can be recovered by means of heat exchangers. Both during cold periods with no or little solar irradiation and during periods with solar gains or cooling loads, the surface temperature of the inner glass is kept close to room temperature, leading to increased occupant comfort in the perimeter zone, near the façade. This type of façade is recommended for cold climates, because of the increased comfort during the cold season and the possible recovery of solar energy.

- **Interactive Wall**: The principle of the interactive is much like that of the naturally ventilated wall with the significant difference that the ventilation is forced. This means that the system works in situations with high ambient temperatures, as it does not depend on the stack effect alone. The system is thus ideal for hot climates with high cooling loads. During cold periods with no solar irradiation (during night-time) the ventilation can be minimized for increased thermal insulation. Apart from the advantages in terms of solar and thermal performance the system allows the use of operable windows for natural ventilation, even in high rise buildings.

The façade ventilation modes depend of the HVAC (heating, ventilating and air conditioning) system.

- Full HVAC system (the Double Façade is not a part of the HVAC) which can result in high energy use. On the other hand, the user can select whenever he prefers a controlled mechanically conditions inside or natural ventilation with the use of the Double Skin Façade.
- Limited HVAC system (the Double Façade contributes partly to the HVAC system or is playing the major role in creating the right indoor climate).
- **No HVAC**. The Double Facade fulfills all the requirements of an HVAC system. This is the ideal case that can lead to low energy use.

- **1. External air curtain**. In this ventilation mode, the air introduced into the cavity comes from the outside and is immediately rejected towards the outside. The ventilation of the cavity therefore forms an air curtain enveloping the outside facade.

- **2. Internal air curtain**. The air comes from the inside of the room and is returned to the inside of the room or via the ventilation system. The ventilation of the cavity therefore forms an air curtain enveloping the indoor facade.
-3. **Supply air.** The ventilation of the facade is created with outdoor air. This air is then brought to the inside of the room or into the ventilation system. The ventilation of the facade thus makes it possible to supply the building with air.

-4. **Exhaust air:** The air comes from the inside of the room and is evacuated towards the outside. The ventilation of the facade thus makes it possible to evacuate the air from the building.

The ventilation mode is independent of the type of ventilation applied. The facade can adopt several ventilation modes at different moments, depending on whether or not certain components integrated into the facade permit it.

In conclusion, doing a combination the different ventilation system you can save in heating and cooling systems, and prevent the “sick building syndrome” (SBS) associated with an individual’s place of work (office building) and related to poor indoor air quality.

Sick building causes are frequently pinned down to flaws in the heating, ventilation, and air conditioning (HVAC) systems. Symptoms are often dealt with after the fact by boosting the overall turn-over rate of fresh air exchange with the outside air, but the new green building design goal should be able to avoid most of the SBS problem sources in the first place, minimize the ongoing use of VOC cleaning compounds, and eliminate conditions that encourage allergenic, mold growth.

We can use the **External air curtain system** in summer of cold climates where the outside temperature is not so high and the air chamber, makes the temperature of the inside of the building became optimal. This system in warm climates, where the external temperature is so high would refresh and control the internal temperature. The best in warm climates is adding to the facade some system of brise-soleils.

The **Internal air curtain system** is indicated in winter to clear the internal air without opening windows and losing the heat of the building.
To control the HVAC, the building uses a “Building Management System” (BMS) is a computer-based control system installed in buildings that controls and monitors the building’s mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems.

A BMS is most common in a large building. Its core function is to manage the environment within the building and may control temperature, carbon dioxide levels, and humidity within a building. As a core function in most BMS systems, it controls heating and cooling, manages the systems that distribute this air throughout the building (by operating fans or opening/closing dampers), and then locally controls the mixture of heating and cooling to achieve the desired room temperature. A secondary function sometimes is to monitor the level of human-generated CO2, mixing in outside air with waste air to increase the amount of oxygen while also missing heat/cooling losses.

- **AIR SUPPLY STRATEGY BY THE FACADE.**

  - PREHEATED AIR.

    During the heating periods the outdoor air can be inserted from the lower part of the facade and be preheated in the cavity. The exterior openings control the airflow and thus the temperatures. Then, through the central ventilation system the air can enter the building at a proper temperature. During the summer, the air can be extracted through the openings from the upper part of the facade. This strategy is applied usually to multi storey high Double Skin Facades. This type provides better air temperatures during the winter but during the summer the possibility of overheating is increased.

  - AIR SUPPLY INDIVIDUAL PRE-HEATED

    The possibility to use the Double Skin Façade as an individual supply of the preheated air also exists. An exhaust ventilation system improves the flow from the cavity to the room and to exhaust duct. Extra conditioning of air is needed in every room by means of VRV system or radiators. This solution is not applicable for the summer conditions since the air temperature inside the cavity is higher than the thermal comfort levels.

- **AIR EXTRACTION STRATEGY BY THE FACADE.**

  - AIR EXTRACTION.

    During the whole year, the double skin façade cavity can be used only as an exhaust duct without possibility of heat recovery for the HVAC system. It can be applied both during winter and summer to the same extent. The main aim of this configuration is to improve the insulation properties in the winter and to reduce
the solar radiation heat gains during the summer. There are no limitations in individual control of the windows openings.

- **VENTILATED AND AIR EXTRACTION**

Finally, the Double Skin Façade cavity can be used as a central exhaust duct for the ventilation system. The air enters through the lower part of the cavity and from each floor. Supply ventilation system stimulates the flow through the room to the cavity. The recovery of air is possible by means of heat pump or heat regenerator on the top of the cavity. The windows cannot be operable due to the not fresh air in the cavity.
1.2 BRIEF INTRODUCTION TO THE STUDIED BUILDING.

The studied building, Riverside 1, occupies a prominent location in the South Docklands with profile directly onto the River Liffey. The building is directly opposite the new National Convention Centre and adjacent to the new Samuel Beckett Bridge.

Recognising the importance of the light, the building incorporates a centrally circular atrium above roof level. All internal partitions are glazed crystal. At night LED lighting is used to emphasized the timber blinds. This low energy lighting mounted within the twin wall permits an infinite variety of multi color scenes to reflect the particular activity conduced within. The overall result is a distinctive building on the Dublin waterfront.

The building was projected by the architecture studio “Scott Tallon Walker architects”

The project size is 11,711m² and the cost was 50 m€, in other hand the duration was 21 months.

The essence of the design is that the building frame together with its intricate and dynamic façade act as part of the overall building services systems with the expressed intent of influencing the rate of heat gain or loss from the building in a positive way to minimise the overall demand of energy.
1.3 SPANISH DOUBLE SKIN FACADE BUILDINGS.

First of all, it is important to know the construction with that kind of façade in Spain is relatively new, and we can see office buildings with the double skin façade now because of new regulations of sustainability and energy efficiency. In Spain the most common way of construction is using the ventilated ceramic façade, using bricks and ceramic tiles to recover the building because of its low cost and easy on-site installation, and for the Spanish climate the lack of natural light is not a real problem.

However, nowadays the construction with that façade is starting in the office buildings constructions for its energetic benefits and the aesthetic attributes of the glass. Some sources claims that, the first instance of a Double Skin Curtain Wall appears in 1903 in the Steiff Factory in Giengen, Germany. According to her, “the priorities were to maximize daylighting while taking into account the cold weather and the strong winds of the region.

Some examples of Spanish buildings with this kind of façade are this: (as we can see the dates are very recent.

1-The building “Torre Espacio”

- Architects: Pei, Cobb Freed & Partners
- Floors: 57 above ground level, 6 underground level.
- Height: 236 metros
- Area: 60,142 m²
- Location: Madrid, Spain.
- 2004-2006
- The structural system of the underground garage is completely different from the tower: its columns, beams and floors are made of pre-cast concrete pieces, while the tower is built with in-situ poured concrete. The building’s elevation features cosine curves on two sides, forming a transition between its square base and elliptical roof plan.
2- The corporate building Indra.

- Architects: Fermín Vázquez, Carlos Rubio, Enrique Álvarez-Sala (R&AS)
- Location: Barcelona, España
- Floors: 13 above ground level, 1 underground level.
- Area: 10,375m²
- 2004-2006

The Indra Building’s façade is a large glass curtain wall of panels, which flood each office in the building with natural light. Some of the glass panels open in to allow natural ventilation throughout the building. The exterior has been treated with a multi-purpose decorative shell and the glass skin is encased with a golden mesh fabric made from panels of stainless steel. The mesh fabric protects the interior from solar gain and has a shade coefficient of 50%. It also creates privacy during daytime, and a light and airy appearance to the façade. About a quarter of the golden screens have 90 centimeter spherical cuts in them, some convex and some concave. At night, when interior lights are illuminated, the building then becomes almost transparent.

4- Health department of Bilbao.

- Arquitectos: Coll-Barreu Arquitectos
- Location: Bilbao, España
- Floors: 8 above ground level, 3 underground level.
- Area: 9,200m²
- 2004-2008
- A double facade solves not only zoning rules requirements but also energetic, fire-resistant and acoustic insulation ones. This duplicated plane is not just a wrapper but a volume between Bilbao and the inner space. This element allows to breath the building. In the other hand, that folded element
produces multiple views of the city, and changing its appearance depending on the point of view, the hour and the season. The objective of this element is to introduce the mutability, the dynamic spirit of the city.

3- Endesa Building.

- Arquitectos: Rafael de la Hoz
- Location: Madrid, España
- Floors: 7 above ground level, 2 underground level.
- Area: 100,000 m²
- 1999-2004

The eight-story atrium at the center of this corporate headquarters is actually a kind of condenser, combining aspects of identity, urbanity, and climate control in much the same way as the traditional patio in southern Spain does. Its main floor, surrounded by services and overlooked by the changing drama of light filtering through the roof’s louvers and struts, brings a measure of urban intensity to its suburban setting. And with its sophisticated control of sun, heat, and air, it makes effective use of the traditional patio’s climatic benefits, offering a model for office-building energy conservation. This last is a particularly appropriate feature, since Endesa is one of the country’s major electric producers.

The project had to create a strong identity for Endesa on a limited budget (the total cost, according to La-Hoz, was $81.6 million). This required, for example, the use of standard components for the facades to partially compensate for the extra expenditure of the atrium. The design had to contend with isolation, noise, and pollution.

KPF, which has designed several atrium-centered projects in the colder climates of northern Europe, and La-Hoz divided the office floor area into two continuous blocks embracing the atrium. These are concrete structures with modular plans and floor plates over 50 feet deep. Open offices predominate, lit by continuous floor-to-ceiling windows. The layering of the facades, and the shadows they cast, further enlivens the indoors. The facades vary according to the exposure, with fixed aluminum brise-soleils on southern elevations of the comb-shaped block that faces away from the highway, with its northern corners marked by crisp folded planes of white Córdoba limestone.
2. **Comparative between the Structure and the Facade Solution in the Studied Building with the Climatic Conditions of Spain**

In this section, we will analyze the solutions that we might use in the studied building in case of this will be built in Spain instead of in Dublin, and how the weather may influence in the materials and structure solutions.

As we have said before, the main characteristic of that facade system is the energy and economical saving with the diary use, and at the same time, the thermal and acoustic comfort properties afforded by the facade technology.

This facade is recommended in areas where the light is a needed factor to avoid the use of electric light, but in areas with so much impact of solar radiation, it can benefit using new technologies to save energy like using photovoltaic cells, so one of the main differences between the building in Ireland or in Spain is the installation of **solar panels in the roof** nowadays we can use new technologies like transparent photovoltaic cells, based on organic molecules similar to dyes and pigments, tailored to absorb only the near-infrared spectrum and have the potential to transform that light into electricity at relatively high efficiency.

In other hand, the common construction in Spain is made with bricks and ceramic ventilated facades because it low cost. In Spain is not necessary to import this products from other parts, and the lack of light is not a real problem, the worst problem is the hot weather and the needed of a good ventilation to have the appropriate climatic conditions inside of the building.

Is for that reason that the Spanish construction uses that kind of facade solution instead of glass facades. However the use of the double skin facade is now one of the most facade systems used in office buildings due to its visual impact and the new energy efficiency regulations.

This way, the work will focus on the double skin facade technology, and try to describe the differences will need to be considered to solve the problems of Spanish climate.

We will take as example the Endesa building that establishes great solutions to the high solar impact in Spanish climates.
The double skin curtain walling provides the occupants with the ability to open windows to allow for passive cooling and ventilation with an additional plane outside which acts as a shield to the sounds of a busy city centre.

The thermal Insulation in this kind of construction is an important factor for the energy efficiency and is solved by the double and the considerable void, the double skin system does provide the envelope with a better u-value.

Nevertheless, in the Spanish climate the problem is the heat excess in summer, and for that reason the building will incorporate some solutions to solve this problem.

For the Spanish climate we will add an extra system to supply fresh air into the building using geothermal energy. Fresh air supplied to the atrium is cooled by underground ducts that are connected to fresh-air inlets. Offices have operable windows for natural ventilation. During the summer, hot air in the atrium vents at the glazed, louvered perimeter and roof-mounted wind towers remain open to increase airflow through the
space. In the winter, the wind towers extract air during the day and are closed at night.

Triple-glazed windows with a low-E coating optimize daylight penetration and minimize heat gain. Different shading devices were applied to each façade based on orientation. To protect from and excessive solar gain the building will have fixed aluminum louvers or motorized brise soleil to reduce solar gain during warmer seasons and allow passive solar heating during the winter.

Another solution is doing the facade using tinted glass, and depending of the colour we can have different heat/light transmission.

The primary purpose of the gray tint is to reduce solar heat gain. But, it also reduces visible light transmission compared to Double-Glazed with Clear Glass or even other standard tinted glass products such as green and blue tints which offer significantly higher visible light transmission.

This figure illustrates the characteristics of a typical double-glazed window with a low-solar-gain low-E glass with argon gas fill. These windows are often referred to as spectrally selective low-E glass due to their ability to reduce solar heat gain while retaining high visible transmittance. Compared to most tinted and reflective glazings, this low-E glass provides a higher level of visible light transmission for a given amount of solar heat reduction. Variants on low-solar-gain low-E coatings have also been developed which may appear slightly tinted. This type of low-E product reduces heat loss in winter and substantially reduces solar heat gain both in winter and in summer. Low-solar-gain low-E glazings are ideal for buildings located in cooling-dominated climates.

**low-solar-gain low-E glazings**

- **TINTED GREY GLASS**
  - Solar transmission: Light $\rightarrow$ 55.5 %
    Heat $\rightarrow$ 43.7 %
  - Solar Reflecting: Light $\rightarrow$ 6 %
    Heat $\rightarrow$ 5.2 %

**normal glazings**

-$\Upsilon$-factor $= 0.24$

- SHGC $= 0.27$
  27% of solar heat transmitted

- VT $= 0.64$
  64% of visible light transmitted

-$\Upsilon$-factor $= 0.49$

- SHGC $= 0.76$
  76% of solar heat transmitted

- VT $= 0.81$
  61% of visible light transmitted
- TINTED GREEN GLASS  - Solar transmission: Light → 75.5% - 65.5%
               Heat → 44.7% - 32.7%
- Solar Reflecting:  Light → 7.1% - 6.6%
               Heat → 5.3% - 5%

Other option based in the latest technologies are the “smart energy glass” (SEG) based on a polymer coating that is placed between two layers of glass. These layers together form the external pane of an insulated glazing unit. By applying an external voltage to the coating, it is possible to control the optical properties of the window within less than a second. SEG can be switched into three different states: a bright state, a dark state and a translucent state.

http://www.peerplus.nl/default/index/index/language/2

Finally the green roof could be a solution to reduce the “Heat Island effect” apart from giving beauty to the building; it provides functional improvements to the building and the environment. The Green Roof recuperates thousands of litres of rain water. On the other hand, the Green Roof improves the thermal behavior of the building and the photosynthesis of the plants reduces the emission of gases. In Spain the lack of rain water could be solved using native plant green roof similar to the native ecosystems found on and adjacent to the site before construction to avoid the high maintenance.

In most cases designers install drip irrigation inside the substrate which consumes less water than spray irrigation. When available they use non-potable water sources such as recycled city water. Water from underground cisterns that collect excess roof water during the rainy season is used to irrigate green roofs in the dry season. Others irrigate with excess water of air conditioning condensing units that are already on the roof.