7

Revitalization

Refurbishing of existing buildings

EUROPEAN
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Revitalization

Refurbishing of existing buildings

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ALLPLAN GmbH
MARCQ & ROBA
TROUVIN S.A.
HL-TECHNIK AG
TALOS ENGINEERING S.A.
HOMAN O'BRIEN ASSOCIATES
INTERTECNO
GOBLET LAVANDIER & ASSOCIÉS
TECHNICAL MANAGEMENT
TECHNO CONSULT
AGUILERA INGENIEROS SA
RW GREGORY AND PARTNERS
COSENTINI ASSOCIATES

January 2002

Other technical reports prepared by top E include:

1 New Technical Concepts for Atria.
2 The Sky-Scraper - Naturally Ventilated?
3 Healthy Buildings
4 Operation and Maintenance Engineering.
5 Static Cooling.
6 Less is More, Energy Efficient Building with less installations

This report is the seventh in a series of technical papers by top E.

Contents

1. Introduction

top E comprises a European Engineering group with a further partner in the United States. The worldwide activities depicted in this brochure demonstrate the range of expertise available, especially in the field of revitalization.

Refurbishments covered in this brochure include those of listed (buildings with a preservation order) or historical buildings as well as more modern buildings, i.e. those erected in the last few decades.

2. General

‘Panta rhei’ the historical words leads us to the situation of now a days. Change – determined by greater demands in the level of comfort and building operation, is occurring far quicker than any stage before. This therefore means that buildings require adaptation during their life cycle. Even the shortest usage lifespan of a building is more than 20 years, with the average exceeding 50 years. Historical buildings, which due to our heritage are now protected, are for the most part all over 100 years old, yet still in use.

In order to meet the required standards of safety, security, thermal comfort, energy saving, telecommunication, e-commerce and e-business, it is necessary to upgrade existing buildings to a higher standard with improved functionality.

In this brochure a broad range of different building usages are presented, all of which have undergone major revitalization, i.e. Museums, Concert Halls, Universities, Schools, Offices, Market and Trading-centres. Refurbishment of more recent buildings, together with buildings, which are over two centuries old, i.e. ‘palazzi’, demonstrates a broad scope of different projects, all executed by top E partners.

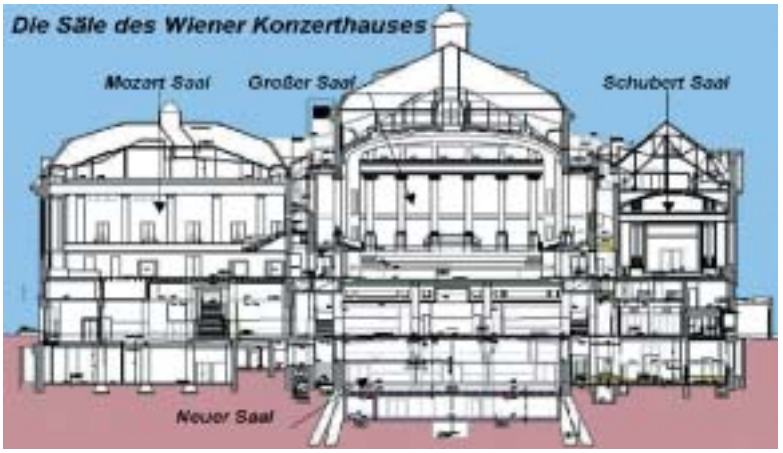
For engineers, the revitalization of existing buildings is one of the greatest and most fulfilling challenges they will face during their career. Consideration has to be given to both building function change i.e. from industrial hall to theatre, and historical restrictions (i.e. maintaining the existing façade) as well as technological changes required in order to meet the new usage requirements and operational standards.

3. top E - references

3.1 ALLPLAN GmbH (AUSTRIA)

NAME

The Vienna Concert Hall



PROJECT

The Viennese Concert Hall is one of the most famous concert halls in the world.
Arch.Ludwig Baumann designed this structure, the ' Konzerthaus' between 1911 and 1913.
The Concert Hall was built for the common Viennese people in order to provide them with entertainment and a venue to celebrate their events as opposed to the traditional 'Musikverein',
which was the concert hall for the "crème de la crème".

The need for the refurbishment was based on the following:

- To meet the requirements of security
- To increase the capacity and thereby comfort for its patrons
- To upgrade the lighting and acoustic systems
- To create new wardrobe rooms for performers
- To create a new stage for teaching and rehearsals
- To create a new hall for performances
- To preserve the historic building

ARCHITECT

Prof. Arch.Dipl.Ing.H. PUCHHAMMER

TOTAL REVITALIZATION COSTS 35,000.000,-

– Technical Installation 10,000.000,-

DURATION OF THE PROJECT

– Feasibility Study 1996
– Design work and tendering 1997-1998
– Realisation 1998 - 2001
– Completion of the project August 2001

Foto: Renovated Schubertsaal, Oct. 1998 – (Swingenschlögl, Wien)

DETAILS

In 1996 Allplan GmbH elaborated the feasibility study for the Vienna Concert Hall based on the existing architectural concept. The main purpose of the study was to evaluate the possibility of adapting the Concert Hall utilising a state of the art building technique. The basic requirements of the Concert Hall management was that the newly planned building operation concept (including all technical adaptation measurements in acoustics, electric installations, air conditioning etc.) would be fully integrated into the existing building substance, preserving the old and protected features such as halls, foyers etc.

The project design of the Vienna Concert Hall was realized for the following reasons:

The project was realized mainly during the summer months 1998/1999/2000 to avoid any influence on the day to day operation of the Concert Hall.

Based on the promising technical and economic experience gained from the feasibility study Allplan GmbH was assigned the project implementation in 1997. Within three years Allpan GmbH carried out all major project phases like Pre-design and Design, Commissioning, Design Specification and Tendering according to EU procedures, Tender Evaluation and Procurement, and On-site Supervision. This project was realized mainly within the summer season while maintaining the operability of the Concert Hall during the rest of the year.

Technical Data

– Heating (district heating)	1.400	KW	installed output
• radiators	700	KW	
• ventilation and air conditioning	800	KW	
– Ventilation and air conditioning	26	units	
• total air volume,	250.000	m3/h	
– Smoke exhaust installation - pressure ventilation for the foyer	150.000	m3/h	
– Cold air	800	KW	
– Installed sanitary infrastructure	250	units	
• new installation of fire-hydrants and fire-fighting equipment			
• new installation of the sewerage system for waste- and rainwater			
– Technical data	2.400	Data points	
control system	12	sub-stations	

3.2 MARCQ & ROBA (BELGIUM)

NAME **Arenberg**

PROJECT

The Arenberg Complex is a combination of 19th and 20th century structures which is typically representative of central Brussels architecture. The complex is divided into three parts:

- The Arenberg buildings which were constructed by the Deutsche Bank in 1912. These buildings were linked with the well known 'Rue des Bouchers' in 1953.
- The Wolfers building which was constructed in 1909 by the well known architect Victor Horta and then transformed by the KBC Bank in 1973. The Wolfers building originally housed a goldsmith practice and was latterly adapted to accommodate representative banking activity.
- The buildings of the 'Rue de la Montagne', most of which were built in the 12th century and modernised in the 19th (1856 - 1860) and early 20th century, have always been utilised for residential accommodation.

ARCHITECT **ARCHI-2000 – P.Verdussen**

SURFACE	34.787 m²
– Arenberg office	21.097 m²
– Wolfers office	5.186 m²
– Residences	8.004 m²
– Parking	500 m²

TOTAL REVITALISATION COST 28.750.000,-

Divided in :

– Climate installations	3.600.000,-
– Chilled ceiling	1.500.000,-
– Electrical installations	2.600.000,-
– Transport installations	675.000,-
– Sanitary installations	750.000,-

DURATION OF THE PROJECT

– Preparation	8 months
– Realisation	36 months
– Completion of the project	2003

DETAILS

The actual revitalization transforms the two former sectors, namely the Arenberg and the Wolfers buildings to high performance office accommodation. The later sector of the 'Rue de la Montagne' will be refurbished to provide highly desirable luxurious residential accommodation.

The Arenberg buildings will incorporate chilled ceilings in order to provide high levels of comfort, which will function harmoniously with the existing architecture. The patio will be cooled with a displacement system, integrated within the architectural infrastructure. Indirect lighting fixtures will achieve homogeneously distributed 'mild light'.

The Wolfers building will be cooled with a VAV system and ventilo-convectors. These systems will also be integrated within the architectural infrastructures. The lighting system will also achieve the 'mild light' ambience.

The residential properties will incorporate decoratif heating elements. As well as HVAC and electricity, all three sectors of the Arenberg complex will be fitted with a fire detection system and with access control. The office zones will possess the flexibility to allow the adaptation of open space to individual offices without interference or adaptation to the technical installations.

The glass in the original facades will be replaced for reasons of energy conservation, with appropriate consideration being given to the preservation of the original appearance of the façade. Special attention will also be given to increase the overall insulation of the existing building. Free cooling will also be utilised to reduce energy consumption.

The technical rooms will be integrated within the existing infrastructure on some of the garrets in order to preserve the original character of these features.

3.3 TROUVIN S.A. (FRANCE)

NAME

Musée d´Orsay

PROJECT

At the inauguration of the 'Gare d'Orsay' a railway station on the banks of the river Seine in Paris, an artist was heard to suggest exchanging the new station, which he thought superb, for the 'Palais des Beaux-Arts', an art centre which he considered looked more like a railway station.

Although not an easy transition as it faced numerous hurdles and obstacles, this suggestion has now come into fruition in the form of the Musee d'Orsay, the most recent incarnation of the former Gare d'Orsay. This venue now receives record numbers of visitors from all over the world, who come to admire the vast and multifaceted panorama of 19th century art – particularly that generated between 1848 and 1914.

The main attraction is the wide portfolio of Impressionist painters, supported by historical, academic and realist schools, photography, early cinema, graphic art, posters, decorative art, furniture, sculpture and architecture from all over the world. The ornate and typically turn-of-the-century décor of some of the rooms in the Hotel du Palais d'Orsay, adjoining the station, was also incorporated in the new museum.

DETAILS

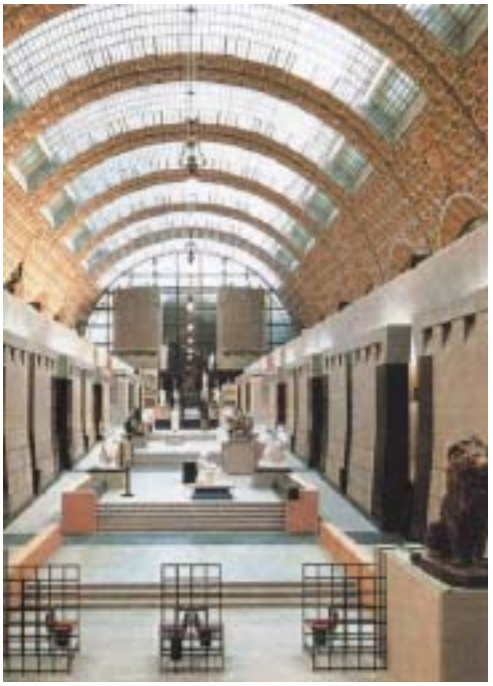
The transformation of the enormous, dilapidated railway station was a tremendous task involving many different disciplines and trades, the resources of modern technology and a great deal of imaginative design.

A Public Authority was established for the construction of the Museum, who in turn appointed TROUVIN as Consulting Engineers for energy systems and operation and maintenance organisation.

The vast and magnificent décor of the original arrival and departure hall has been retained at the heart of this modern temple of art. The most imposing feature within this area is a nave, which stands 32 metres high and 138 metres in length, supported by 12,000 tonnes of metallic structure and 35,000 square metres of glass roofing.

The enormity of the hall combined with the enormous surface area of the glazed roofing require specialist cooling capacities and air conditioning systems in order to provide a safe and comfortable environment to accommodate the large number of visitors.

A thermal energy storage system has been installed in order to cope with the extensive variations between internal and external heatloads. This consists of two chilled water storage tanks with flexible separation membranes, each of which has a capacity of 600 cubic metres.



3.4 HL-TECHNIK AG (GERMANY)

NAME

Concert Hall Essen

PROJECT

From Industrial Hall to Theatre

The former VIII Friedrich Krupp Works mechanical workshop in Essen was built between 1898 and 1902 and formed the gateway into 'Kruppstadt' together with the hall complex opposite. The exterior measurements are 105 metres by 50 metres. The structure is defined by the steel construction of the middle hall, which was reinforced with several bridges, each with a load-bearing capacity of up to 40 tonnes. The tree-aisle is divided into two aisles with balconies and a central aisle with a height of 28 metres to the ridge of the roof. The brickwork façade has been structurally articulated in keeping with its symbolic importance.

When its production utilisation came to an end in the 1980s, the hall was issued with a preservation order. From mid 1995 work commenced on the conversion of the hall into a musical Theatre designed by Kohl and Kohl Architects, Essen.

The theatre provides a transformation machine type environment for three-dimensional technical, virtual and real worlds. The hall is divided into orchestra and balcony sections with 1,000 seats in the orchestra section and 550 in the balcony. The steel supports, loading bridge and glazed roof gives the hall its strong character. The lobby was left unchanged and is separated from the main theatre by a metal-clad wall. This wall, positioned within the room capacity, marks the transition from the preserved historical industrial hall to the theatre enclosure.

ARCHITECT **KOHL & KOHL Architekten, Essen**

DETAILS

The design had to consider and incorporate two important factors.. Firstly, the structural system of the original steel construction was to be preserved, and secondly, the theatre components were to be recoverable. These structural, conservation and economic considerations led to the application of two building approaches. The orchestra and balcony levels are constructed independently as a cantilevered gallery. The three new levels in the five-storey rear building combine as a steel construction with the existing steel building into a structural and architectural system. To operate within the permissible load for the existing structure, all new walls are of light construction.

There were a further two prerequisites for the façade, i.e. to maintain the visual appearance of the single glazed steel windows and to provide natural ventilation for the office areas. A second façade was added behind the original façade. Louvered glass leaves were installed at the base of the original glazing with grating being installed near the roof in order to create a fresh air flow in front of the new façade.

The new façade replicates both the proportions and sectioning of the multi-storey original façade. It is structurally independent and can be removed to return the building to its original condition. In the lobby areas, the historic design of single glazing is preserved. Along the west side, some windows that had been bricked in were reopened and a new façade created to restore the overall appearance of the building.

3.5 TALOS ENGINEERING (GREECE)

NAME **Central Market of Athens**

PROJECT **Municipality of Athens**

A magnificent example of 19th century architecture is epitomised in the Old Central Market of Athens. This is situated in Athinas Street which makes up one of the three main sectors of the city and represents the focal point of the commercial centre of Athens.

The Market comprises a rectangular building with a large covered central atrium (housing the fish market and 74 shops and 109 stands)and three surrounding arcades along the perimeter of the building (the meat market with 75 shops and 192 stands).

ARCHITECT **NIKOS FINTIKAKIS**
SYNTHESIS & RESEARCH Ltd.

SURFACE
– Building 3.300 m^2

INSTALLATION COSTS 1.000.000,-
total approx.
Divided in:
– Climate installations 800.000,-
– Electrical installations 200.000,-

DURATION OF THE PROJECT
– Preparation Completed
– Realisation Under negotiation
– Completion of the project expected 2002

DETAILS

Design consideration had to be given to several passive and active features which would improve the thermal and temperature comfort together with the aesthetics of the building, without drastically increasing the existing low energy consumption. After extensive evaluation and deliberation, the following features were selected for incorporation into the innovative rehabilitation of the Market;

The use of the symmetric four towers at the corners of the building as 'air chimneys' for the supply and exhaust of air, to and from the market.

The installation of waste heat recovery units to boost the heat requirements during the winter period and the use of appropriate filters in the air paths to ensure the protection of both the internal and external environment from pollution.

An increase in the transparent element area of the roof and the use of diffuse glazing of 20% illuminance, thereby increasing daylight and reducing solar gains during summer.

The installation of 'environmental panel' shading devices above the transparent elements of the building. Deciduous plants cover this panel and its upper frame consists of water pipes with water injectors. Water is sprayed on to the plants (irrigation) and then drops down to the inclined transparent roof elements where it is collected by gravity for re-circulation using a small pump.

- The application of a non-transparent roof panel (on the upper and lower inclined roofs) to reduce the thermal losses during winter and the solar gains during the summer periods.

- The installation of thermostatically controlled adjustable louvers at the terrace level and at the upper part of the inclined roof and of 'air curtains' at the main entrances of the Markets.

- The installation of photovoltaic elements for the supply of electricity to automation control.

- The incorporation of a hybrid system for cooling and heating, consisting of an earth-to-air heat exchanger (earth pipe), a series of solar air heaters and an air distribution system with ducts, filters, fans and air diffusers.

The selected passive and active elements require a very low energy demand (for the ventilation fans and the air curtains), are easily incorporated and totally sympathise with the traditional architectural character of the building. Additionally, as such, these principles can be applied to other traditional buildings of similar construction and function.

3.6 HOMAN O'BRIEN ASSOCIATES (IRELAND)

NAME

Earlsfort House Dublin

PROJECT

This office building was originally constructed in 1963. The building was fully air conditioned with a four pipe fan coil system positioned internally at ceiling level, discharging outwards towards the perimeter. The external glazed units were sealed and unopenable.

The building was let by the Revenue Commissioners and in the 1980s, the building became notorious as Dublin's 'Sick Building' with a very high rate of absenteeism and eventually home to union pickets outside the entrance. In 1989, the building was purchased by the Bank of Ireland who appointed Homan O'Brien Associates as part of the design team to refurbish the building.

DETAILS

The following recommendations by Homan O'Brien Associates were implemented in the refurbishment:

- Openable windows were provided at the perimeter.
- A perimeter radiator installation
- The existing chiller plant was retained to serve an internal core area with new VAV air conditioning installation.
- A raised access floor was provided for electrical distribution
- New ceilings and category two light fittings were provided throughout
- Upgraded fire alarm and emergency lighting installations

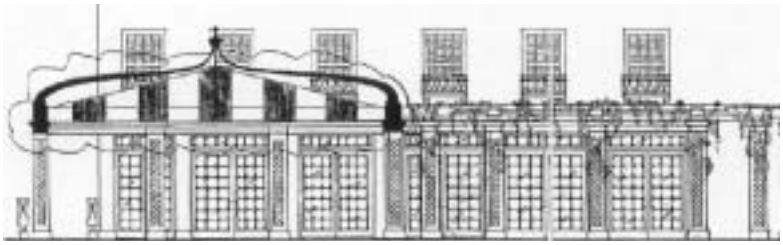
The Bank of Ireland subsequently let the building to the accountancy firm of Deloitte & Touche.

Deloitte and Touche still occupy the building. They have found the building very adaptable to changing methods of data cabling etc. and from a comfort point the ability of the occupant to turn off a radiator, to open a window or to change the internal temperature via a wall thermostat, has been extremely effective for occupant satisfaction.

The building owner purchased the building at a reduced price as a result of the on-going problems. The building value has increased substantially in recent years and is still operating successfully ten years after its refurbishment.

3.7 INTERTECNO (ITALY)

NAME **Hotel Europa & Regina, Venice**



PROJECT

This project consists of the complete renovation of the hotel on the left bank of the Grand Canal, very close to San Marco Square. The hotel boasts a unique position facing one of the most well known sights in Venice, namely the 'Basilica of Santa Maria Della Salute'.

The main entrance to the hotel is from a small court 'Barozzi' with a second access from the Grand Canal.

The hotel comprises five different buildings with 168 rooms, 13 suites, lounges, bar and a new restaurant with a centrally positioned 'open' kitchen and a terrace at the Grand Canal level. The total building area is around 17.000 m^2.

CLIENT **STARWOOD HOTEL GROUP**

ARCHITECT **HIRSCH & BEDNER ASSOCIATES - Atlanta**

– Hotel	181 rooms
– building volume	55.000 m^3

TOTAL REVITALISATION COST 20,000.000,-

DURATION OF THE PROJECT

– Preparation	1995
– Realisation	1996 - 1997
– Completion of the project	1998

DETAILS

The works have been implemented in three phases with minimum disruption to the smooth operation of the hotel and its guests. The majority of the disruptive and noisy elements of the refurbishment have taken place during the winter months.

The typical Venetian atmosphere is combined with up-to-date building service installations which are mandatory to meet the environmental comfort, safety and communication capacity requirements of international clients.

In order to meet the design requirements by the Client and Architect and to satisfy constraints imposed by the Fine Art Authority and the Commission for Venice Preservation, the Mechanical and Electrical systems are as unobtrusive as possible.

In order to sympathise with the particularly quiet venetian nights, special care was given in designing and installing all the equipment and fan coils in the guestrooms. As a result the noise level is lower than 28db (a).

Services by INTERTECNO

- Project Management
- Preliminary design and application for building permit
- Final Design and preparation of Bid Documents
- Bid Management
- Supervision of Construction Works
- Reporting
- Acceptance Tests

3.8 GOBLET LAVANDIER & ASSOCIÉS (LUXEMBOURG)

NAME **Historical Museum, City of Luxembourg**

PROJECT

In 1986 the City of Luxembourg announced that it intended to create a historical Museum in the city. After much deliberation a site for the museum was identified within some historical houses on the renowned 'Holy Ghost'Street. The houses had initially been built during the 13th Century. One of the objectives of this project was to preserve the outer walls and existing façade whilst incorporating a modern museum within. Unfortunately much of the main internal section of the houses had to be demolished in order to accommodate a functional museum within.

After a detailed archeological and architectural analysis on the preservation of the existing buildings, the architectural design was started.

SURFACE 5.700 m^2

INVESTMENTS TECHNICAL

- HVAC installations 2.700.000,-
- Sanitary installations 250.000,-
- Elevator and electrical installations 2.600.000,-

DURATION OF THE PROJECT

- Completion of the project 1996

DETAILS

Goblet Lavandier & Associés provided the following consultancy services in the revitalization and transformation of existing buildings into a new museum:

- High quality air conditioning
- Medium and low voltage
- Fire detection
- Security installations
- Sound-systems
- Access control
- Camera supervision and intercom installations
- Panorama elevator
- Multimedia system
- Sanitary installations
- Fire protection (sprinkler installations)
- Refrigeration system with NH_3

Goblet Lavandier & Associés's objectives were as follows:

- Design of all technical installations
- Determination of necessary quantities and preparation of tender documents
- Evaluation of offers
- Technical supervision, co-ordination of works
- Cost and budget control
- Final inspections and commissioning

One of the major features of the new museum is a hydraulic elevator. As the major concept of the museum was for its visitors to take a 'walk back in time' through the history of Luxembourg, this elevator with the capacity to hold 130 people, was specifically designed with this in mind.

3.9 TECHNICAL MANAGEMENT (NETHERLANDS)

NAME **World Trade Center, Amsterdam**

PROJECT

The project consists of a new tower and entrance building together with the renovation and extension of the platform.

The existing complex already included certain energy saving facilities amongst which a gas-driven heat pump plus an emergency electrical stand-by installation.

In the renovated situation these will be maintained.

CLIENT **Trimp & Van Tartwijk in Utrecht**
(in name of ING and Kantorenfonds Nederland)

ARCHITECT **Kohn Pedersen Fox (Great Britian) together with Van den Oever, Zaaijer, Roodbeen en Partners (Netherlands)**

SURFACE 110.000 m^2 (partly renovation and partly 25.000 m^2 new offices).
– Building 80.000 m^2
– Parking garage 30.000 m^2
This is exclusive a new building with a surface of 40.000 m^2 (in preliminary design phase)

INSTALLATION COSTS 17,270.000,-
Divided in :
– Climate installations 11.000.000,-
– Electical installations 4.360.000,-
– Transport installations 2,050.000,-
– Facade cleaning equipment 320.000,-

DURATION OF THE PROJECT

– Preparation	6 months
– Realisation	24 months
– Completion of the project	end of 2001

DETAILS

The facades of the existing towers will also be renovated. A new building automation system together with a new light ignition system have also been installed.

An extensive energy/environmental research programme has been carried out in relation to the extension and renovation resulting in many energy saving devices, these include:

- a double-skin façade
- energy saving lighting with a daylight depending and present control system.
- energy saving humidification
- heat supply through a district heating connection
- heat recovery in the air treatment installation

3.10 TECHNO CONSULT (NORWAY)

NAME

Oslo Cathedral School

PROJECT

The project comprised the revitalization of a high school building originally built in 1903. Techno Consult achieved the highest accolade in the form of a technical award for their design concept on this project for the excellent interaction between preservation demands and the state of the art technical solutions. The award committee highlighted the following salient points all of which contributed towards the Techno Colsult being the recipient of this prestigious award.

"Techno Colsult has the best project, with the main aggregate in an underground room in the school yard,with vertical air ducts fitted inside the former air shafts or in new shafts slotted into the existing concrete walls. The solution will not damage any part of the architectural interior or exterior expression. The solution will guarantee minimum noise emission levels. The solution is simple, the documentation is excellent, nice looking presentations and a reasonable cost estimate have convinced the jury that the solution will work in practical life"

CLIENT

Oslo municipal represented by the School Authority (Skolesjefen i Oslo)

ARCHITECT

Siv.ing. Thor Saetre

SURFACE

28.400 m^2

DETAILS

A fully designed new air conditioning plant has been installed in the building. Special care and due consideration has been given to the buildings structure due to preservation reasons. Tubes, pipes and other technical installations have been fitted into the existing old building without damaging either the architectural interior or exterior. The main machinery and aggregates are installed in an existing underground room in the school yard. This solution is ideal for the containment of noise and offers perfect conditions for maintenance.

Due to a lack of space in the vertical ventilation shafts, all the air ducts were restricted to a diameter of 180 mm. The air velocity can reach a maximum of 11 m/s with the sound levels in the classroom reaching a maximum of 31dB(A). In order to obtain this level, the ducts comprise a minimum of angles with a sound absorber at the end of each air duct.

An electrical boiler plant is installed in the main aggregate room, (in the school yard). A water based heating coil was preferred for the ventilation aggregate to obtain a better control accuracy.

The inlet temperature into the classrooms is 18 degrees celsius with reheating being implemented with the help of electric radiators.

Foto: Oslo Cathedral school, built in 1903

Foto: Vertical air ducts were built into the old ventilation shafts

Total ventilation capacity 70.000 m^3/h

Ventilation capacity per classroom 1.000 m^3/h (Area per classroom: 50 m^2, ceiling 3.6 m)

3.11 AGUILERA INGENIEROS SA (SPAIN)

NAME **Banco Bilbao Vizcaya Argentaria, Madrid**

PROJECT

Operations centre

The building hosts mission-critical operations for BBVA such as their central computer room, treasury and trading rooms and their logistics and fulfillment centre.

CLIENT

BBVA, is a leading Spanish bank with strong presence in Latin America and a market capitalisation of 50.654 million.

SURFACE

– Building	28.000 m^2
– Parking garage (exterior)	5.000 m^2

INSTALLATION COSTS (total approx)	19,170.000,-
Divided in :	
– Electrical installations	8,000.000,-
– Air conditioning and Mechanical Installations	6,250.000,-
– Architectural interior works and Structural works	4,300.000,-
– Fire Protection and Fire alarm installations	510.000,-
– Elevators	110.000,-

DURATION OF THE PROJECT

– Design	8 months
– Construction	3 years (three phases)
– Completion of the project	November 1999

DETAILS

The Client required complete phased replacement of MEP installations in order to achieve the highest levels of reliability. The renovation was completed whilst maintaining continuous and full operation of the building.

For each section of the building, the existing installations were maintained as fully operational until the new installations were commissioned.

Careful attention was given through design and construction to minimize noise emission and to integrate the new installations with the existing architecture and city environment.

Project Construction Strategy

The project was completed in three phases:
Phase I: Structural works including structural steel reinforcement of slabs and roof slabs, reconditioning of foundation pads and slab coring to provide space for 4.500 m2 of new MEP rooms and installation risers.
Phase II: Installation of services at MEP rooms, risers and main distribution systems.
Phase III: Fit-out works.

Project Design Concept and Installation features

<u>Electrical Installation</u>
The building has resilient power supply for computer rooms and critical operations comprising the following system elements:

- Independent grid power supply with 2 Redundant 1600 KVA transformers.
- 3 Redundant 400 KVA UPS.
- Standby Redundant Emergency Electrical Power generation: with a 1200 KVA Cogeneration power plant and a 1200 KVA Diesel power generator.

Air Conditioning

The installation features independent air conditioning systems for office spaces and for computer rooms and critical spaces.

Chilled Water is supplied to computer rooms and critical spaces from four redundant sources:

- One dedicated computer room Chiller (700.000 Frig/h)
- A stand-by cogeneration unit with an Absorption Chiller (700.000 Frig/h)
- One Ice production Chiller with thermal storage facilities (350.000 Frig/h)
- A piping bypass and Building Control System interlock for emergency use of office spaces' chillers (1.500.000 Frig/h)

Fire Protection System and Fire Alarm System

Proactive, very early warning and fire protection of mission-critical infrastructure and assets was the number one priority to maintain service continuity.

The Building fire protection system includes a state of the art Water Mist Fire Extinguishing system for computer rooms and special areas and a Sprinkler Pre-action system for paper storage rooms and archives.

The fire protection system works in conjunction with the latest generation of aspiration smoke detection technology to detect fire at pre-combustion stage. The VESDA system (Very Early Smoke Detection Alarm) interfaces with an addressable point detection system and a fault tolerant communications network.

Building Control System

The Building Control System is of critical importance for the building performance reliability as it sequences the operation of the standby redundant equipment in case of system failure.

The Building Control System has been configured in a high-availability architecture. Redundant servers operate in a hot standby mode and dual communication paths assure reliable and continuous operation of the Building Control System.

3.12 RW GREGORY AND PARTNERS (UNITED KINGDOM)

NAME

Royal & Sun Alliance, London

PROJECT

88,St. James' Street London is a Grade II listed building, situated at the end of Pall Mall opposite St. James Palace, in the centre of London.

Built at around the turn of the 19th Century and designed by Architect, Norman Shaw, the building style is typical of this period and provides up to 20 individual apartments with self contained kitchen and bathrooms and common areas such as a Banking Hall and Dining facilities.

R.W. Gregory and Partners were approached in March 1998 as lead Consultants to project manage the refurbishment and upgrade of the building. The client's brief was undefined at the initial appointment, but the principle was to refurbish the building whilst being sympathetic to the building form and in the style of a period English Town House. Additionally, the building was to be remodeled internally with the services updated and replaced to meet modern day standards, including comfort cooling and modern data cabling systems.

DETAILS

The initial task was to compile all existing information of the Building and Services. The Client instructed the Team to undertake a full survey of the Building and Services to ensure accuracy of the drawings and 'As Fitted' information, and to obtain further information that was of use. This investment at the offset of the project proved invaluable as it reduced the occurrence of 'unknowns' at design stage and assisted in the construction works on site.

Once the building had been stripped ready for the refurbishment work a walk around meeting was undertaken with relevant parties to essentially 'mark out' the positions of fixtures and fittings, i.e. lighting, sockets, pipe runs, etc. This allowed the co-ordination of all the different trades and services prior to work commencing and reduced the number of queries from site during the construction phase.

As rooms were being completed, the Management Contractor offered rooms for inspection and the design team did this collectively with the Management Contractor. Inspection defect lists were provided to the Management Contractor but as they were in attendance at all times of inspection, they essentially acted to rectify defects immediately.

A zero defects policy was adopted and small labels were used to highlight any blemishes or marks to walls, ceilings, etc. Additionally Operational Check Sheets were deployed for each room confirming the satisfactory operation of bathrooms, kitchens, etc. As a further test each apartment was used and occupied for a few days to establish any faults or operational problems.

It could be said that the key elements of the success of the project were:

- Extensive survey of existing Building and Services
- Appointment of Specialist Consultants and Professionals
- Careful consideration and 'design' of Security, off-loading, site logistics, during construction
- Extensive protection of existing structure and building
- Integrated design approach to services
- High quality and standard of drawings providing elevational arrangements
- Intensive site cleaning policy
- Controlled defect rectification clearance policy

3.13 CONSENTINI ASSOCIATES (U.S.A)

NAME

Harvard University
Barker Center for the Humanities
Cambridge

PROJECT

This 15.5 million dollar project entailed the renovation of Harvard's historic Union Building, a 80,000 sq.ft. Georgian style building, that was originally used as a meeting house and later served as a student dining hall. The renovation transformed the building to accommodated 12 academic departments. One challenging aspect of the project involved reducing the floor-to-ceiling height of the building's central hall and other first floor rooms from 34ft to 16ft.

ARCHITECT **GOODY CLANY ASSOCIATES**

TOTAL COST (approx.) 18,000.000,-

COMPLETION OF THE PROJECT 1997

DETAILS

By dropping the ceilings in these rooms and reclaiming two stories of attic space, the team was able to create five habitable floors from what was once originally only two and a half floors. The incorporation of HVAC ductwork was challenging due to the very limited space conditions. The centre includes administrative, lounges, seminar rooms and a café. Cosentini provided MEP/FP and telecommunication design services for the project.

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