This chapter investigates the possibilities to minimize the generation of demolition waste, and to avoid demolition of existing building structures by optimizing building lives through proper maintenance of existing buildings and reusing building structures.

Proper Maintenance

The advantages of maintaining existing buildings properly are:

- The building lifespan can be extended (consider façade, structure and services).
- Improved appearance of the building (cleaner image of the building, district and the city).
- Improved neighborhood atmosphere.
- Improved safety conditions.

In Hong Kong, the majority of the residential buildings built in the 1970s have poor façade maintenance. Buildings can get damaged rapidly by the climate, and the poor quality of concrete (old standards). But nowadays, most modern office buildings have proper maintenance and supervision.

Reuse Building Structure

The objective is to keep as much as possible any of the building components or structure, and to reuse them to minimize waste generation. Therefore landfill disposal is avoided and the action of reuse and recycle is considered.

The concept of reusing buildings includes:

- Different ways of reusing building structures such as renovation, restoration, extension and rehabilitation.
- Different types of components of the building can be considered: structure, services and equipments, external façade, internal finishes and fitting out.

The hierarchy of building reuse for structures is:

- Reuse in place and remodeling.
- Relocating and remodeling.
- Deconstruction for reuse.
- Demolition for recycling.

Chapter 4.1

Delay the Generation of Demolition waste: Optimizing Building Lives of Existing Buildings

4.1.1. Proper Maintenance of the Buildings
4.1.2. Reuse Building Structures: Renovation, Extension, Rehabilitation

Reuse of building structure can reduce the total costs of building and minimize waste disposal at landfills. Environmental considerations are also important and participate to the concept of reusing building structures.
The concept of reusing buildings might not be a good solution for every building and development; especially in Hong Kong where space is scarce, land is expensive and new plot ratios are implemented, but it is worth considering the concept to preserve the local history.
In fact, it increases the notion of historical and cultural heritage and creates a special atmosphere in a city that gives sense of space. Therefore it preserves neighborhoods and local history. In Hong Kong most of the historical buildings have already been demolished, but there are still many buildings that can be reused such as old historical buildings and fairly recent industrial buildings. There is a dictum that says: "better late than never", which corresponds to the situation in Hong Kong.
Also it is reinforced by the government's will to promote conservation of architectural heritage in Hong Kong.
"To foster a sense of belonging and identity, we need to promote our heritage, which is valuable cultural legacy. We need also to look at ways of better presenting to the world our distinctive heritage, much of which is on show in our historical buildings and our archeological sites."
Extract from the 1998 policy address of the Chief Executive, HKSAR, the Honorable Tung Chee Hwa.

"The rapid urbanization of the modern age offers opportunities as well as creates problems. There are new opportunities to erect new buildings, to develop new towns, and to evolve new architectural style and planning concepts. There are existing problems to maintain old buildings as it is increasingly difficult to find traditional building materials and experienced craftsmen to work on repairs of old buildings. There are new problems to control the development, to maintain a quality standard and above all to achieve the objective of retaining the local identity of a place."
(Source: Conservation of Architectural Heritage in Tomorrow's City, Wong Shiu-Kwan, Architectural Services Department, 2001).

Top: The Hong Kong and Shanghai Bank building maintenance, Central, Hong Kong.
Bottom: The YMCA building maintenance, Tsim Sha Tsui, Hong Kong.

4.1.1. Proper maintenance of the buildings

According to a Survey conducted in 2001, by the Department of Civil and Structural Engineering of the Hong Kong Polytechnic University, the second cause that reduces the life of a building, after construction fault, is material failure. Material failure can be the cause of poor quality and non-durable materials, but can also be by lack of proper maintenance.

Objectives

- **To provide proper maintenance to buildings to extend their lives.**
- **Avoid and delay demolition of buildings by preventive maintenance.**

Waste Type

Types of waste generated during demolition stage:

- Concrete.
- Reinforcement bars.
- Woods.
- Metals.
- Bricks.
- Soils and sands.

Strategies

- Consider proper maintenance for all types of building components such as: structures, services and equipments, external façades, and internal finishes.
- Ensure proper maintenance to extend a building's lifespan and prevent material failure and fast degradation.
- Provide regular examinations of the buildings to act as preventive measures.
- When the building is damaged, choose renovation over demolition (see next chapter 4.1.2).
- When selecting materials for renovation or rehabilitation, consider easy and cheap maintenance as well as durable materials. (See next chapter and chapter 5, "Material selection to minimize waste").
- Allow regular joint ownership meetings to take early decisions for building maintenance.

Benefits

Cost

- Savings can occur by extending the building lifespan and avoiding demolition costs.
- Maintenance requires continuous and long-term financial investment, but it extends the building life and avoids building degradation that generates demolition cost.

Environment

- Proper maintenance optimizes building lives and delays the generation of demolition waste disposed of at landfills.
- Therefore it extends landfills' lifespan and avoids pollution through transportation of disposal waste and energy used as well as noise.

Others

- Proper maintenance provides safety for the neighborhood and is more appealing to viewers.
- It avoids visual and material degradation, which also affects the image of the district and the city.

This page: Lee Garden building maintenance, Causeway Bay, Hong Kong.
Next page: Residential building facade in Causeway Bay, Hong Kong.

Regulation

Practice Notes for Authorized Person
PNAP 11, Landlord & Tenants (Consolidation) Ordinance, March 1994.

References

Web site

- Buildings Department
http://www.info.gov.hk/bd/
- Services on "Existing Building" (Building Department)
http://www.info.gov.hk/bd/english/services/exit_build.html
- Guidelines for the Removal of Typical Unauthorized Building Works and General Maintenance of External Walls:
http://www.info.gov.hk/bd/english/services/doc/TECH_G_ENG.pdf
- An Introduction to the Coordinated Maintenance of a Building Scheme
http://www.info.gov.hk/bd/english/documents/code/cmbs_e.pdf

Other references

Inside

- Refer to chapter 4.1.2 "Renovation and restoration".
- Refer to chapter 4.2.1 "Optimizing design lives".
- Refer to chapter 5 "Material selection to minimize waste".

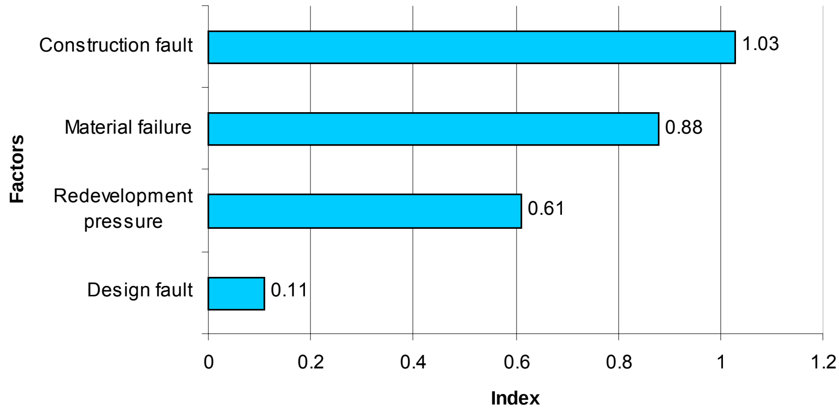
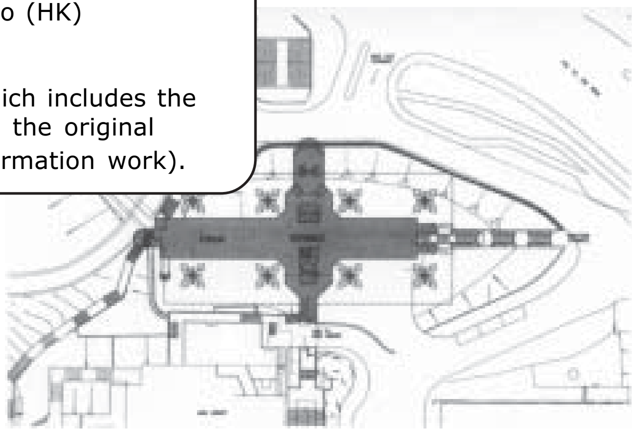


Figure 9: Causes that reduce the life of a building in Hong Kong (Source: Hong Kong Polytechnic University survey, 2001).

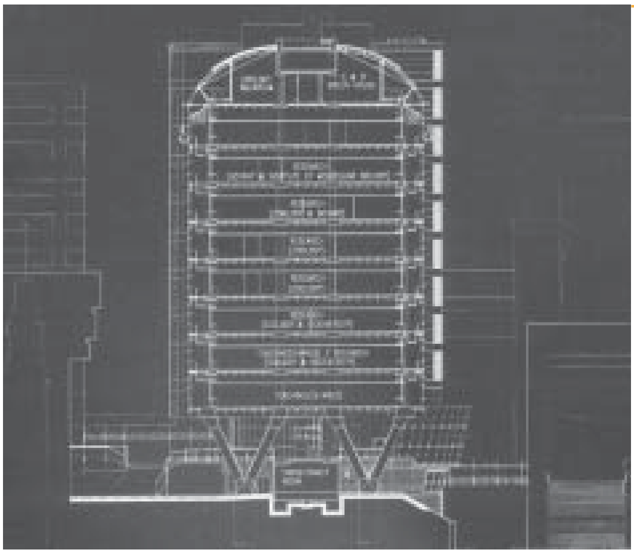
Case Study 01

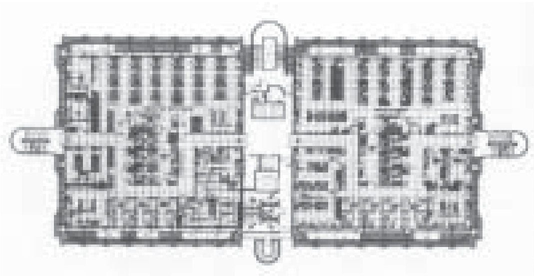
Kadoorie Biological Sciences Building, The University of Hong Kong

Project:	Kadoorie Biological Sciences Building.
Location:	The University of Hong Kong.
Client:	The University of Hong Kong.
Donor:	The Kadoorie Charitable Foundation.
Architects:	Leigh & Orange Architects Ltd.
Structural, civil, geotechnical, acoustic and fire engineer:	Ove Arup & Partners
Laboratory specialist:	Laboratories Investigation Unit.
Main Contractor:	Laing-Hip Hing Joint Venture.
Cost consultant:	Davis Langdon and Seah (HK).
Landscape Architect:	Hassel Ltd.
External glazed screen:	Joseph Gartner & Co (HK)
Year:	1996-2000
Cost:	HK$500 million (which includes the cost of demolishing the original building and site formation work).



Left page: Kadoorie Biological Sciences building second skin system facades site plan (source: Building Journal Hong Kong China, May 2000, *Kadoorie Biological Sciences Building, Beneath the Second Skin,* Tam Angela).
Right page: Kadoorie Biological Sciences building second skin system facades, section and typical laboratory floor plan (source: Building Journal Hong Kong China, May 2000, *Kadoorie Biological Sciences Building, Beneath the Second Skin,* Tam Angela).





The design of this building allows ease of maintenance with its second skin facade system. Besides many other functions, it provides an external access walkway for the maintenance of the building, which facilitate its maintenance without interfering the activities inside the building (mainly laboratories). It also allows for more flexibility inside the building.
For more information, refer to those articles: Tam Angela, *Kadoorie Biological Sciences Building, Beneath the Second Skin*, Building Journal Hong Kong China, May 2000; and Tam Angela, *Intelligent Buildings*, Building Journal Hong Kong China, May 2000.

"The building was designed with seven key issues in mind, namely: functionality, flexibility, safety, energy efficiency, sustainability, lifetime economy, buildability and ease of maintenance.
Second skin system. The building is clad in a combination of silver grey ceramic tiles and glass and steel double skin. The north and south facades are clad in ceramic tiles and windows are protected by sunshading devices. External maintenance walkways surround the building at each floor level, providing safe and easy access for maintenance personnel.
The east and west facades are clad in a double-skin curtain wall which serves several functions. It acts as a screen for the building services installations distributed around the exterior of the building in order to provide a flexible interior for the laboratories. Having the building services installed on the exterior means maintenance can be carried out without disturbing laboratory users and laboratories are less likely to be contaminated. The security of the laboratories is further enhanced by the provision of access to the building services through external ducts and staircases.
Source: "Beneath the second skin", http://www.building.com.hk/features/more/kadoorie/kadooriedown.html

Top: (Left) Orsay Museum canopy restoration, 2001
(Right) Louvre Museum facade restoration, 2001, Paris, France.
Bottom: The Prince Building refurbishement, LPT Architects Ltd, 1999, Central, Hong Kong.

4.1.2. Reuse building structures: renovation and restoration

Building renovation and restoration can minimize the generation of waste by avoiding demolition of the building.
Explanation of renovation and restoration:

- Renovation is when the function of the building remains the same, and repairs and changes are made such as for new façade material…
- Restoration is mainly used for repairing historical buildings to maintain it's authentic style with original materials and techniques. It requires traditional building materials and construction methods, and experienced craftsmen to repair old buildings.

Objectives

- **Allow renovation of existing buildings rather than demolition, which generates more waste.**
- **Allow for the lifespan of buildings to be extended.**
- **Allow a new image for the building by generating less waste.**

Waste Type

Types of waste generated during the demolition stage:

- Concrete.
- Reinforcement bars.
- Woods.
- Metals.
- Bricks.
- Soils and sands.

Strategies

- Consider different options for the building renovation such as structure, services, skin (façade) and internal fitting out according to the building condition.
- Check the existing building state, the structure, services and equipment, and external façade.
- Consider the building quality and performance, and check it's lifespan.
- Consider updating the building regulations.
- Check if the services and equipment are suitable for easy changes and fit the new needs of the building.
- Consider new materials that are durable, easy and cheap to maintain, easy to dismantle for repair, for recycle or reuse… (See chapter 5, for more details)
- Consider reusing original materials from the existing building site or from other sites.
- Consider cost comparison between renovation and new buildings and include the life cycle cost analysis.
- Consider the benefits mentioned below.

Benefits

Cost

- Renovation may be less expensive than new building construction (including demolition cost) depending on the type of renovation required.
- It may be difficult to budget, but it extends the building life span and waste stays away from the waste stream.
- Benefits from reusing original materials from the existing site or other sites.

Top: (left) The old China Bank building, Central, Hong Kong.
(right) The court of final appeal, Central, Hong Kong.
Bottom: The Clock Tower, part of the old train station, 1922, Tsim Sha Tsui, Hong Kong.

Environment

- Most of the time, less waste is generated if the building structure is reused.
- Less waste is generated when reusing original materials.
- Therefore less waste is disposed of at landfills, which extends their life span.
- It reduces the transportation of waste disposal, pollution, energy used, and noise.

Others

- It provides a new image for the building, which can be a marketing advantage.
- It enhances the image of the company with less waste generation.
- It also enhances the image of the district and the city.
- It promotes the notion of historical and cultural heritage, and contributes to a sense of place in the city, which is a government will (1998-policy extract, see chapter "Introduction").

Regulation

British Standards
BS 7913, (1998) Guide to the Principles of the Conservation of Historic Buildings (available on BS web site http://bsonline.techindex.co.uk)

Other references

Inside

- Refer to chapter 4.1 on "Extension" and "Rehabilitation" in this chapter.

The Legislative Council Building, Central, Hong Kong.

Case Study 02

United Center External Renovation, Admiralty, Hong Kong

Project:	The United Center Renovation.
Location:	Admiralty, Hong Kong.
Year:	2001

General view and details of the facade renovation.

Case Study 03

Honest Motors Building External Renovation, Causeway Bay, Hong Kong

Project:	The Honest Motor Building External Renovation.
Location:	Causeway Bay, Hong Kong.
Architects:	Michaelchan Architecture & Interiors Ltd.
Year:	1996

Views of the external renovation. The original building is the brown part of the building. A new skin has been added to the original facade.

Top: Vertical extension of the Sun Hung Kai Center, Wanchai, Hong Kong.
Bottom: Horizontal extension, Convention and Exhibition Center, Wanchai, Hong Kong.

4.1.2. Reuse building structures: extension

Extension of buildings can minimize waste generation by avoiding demolition. The extension of buildings, which are also called building additions, are mainly related to the needs of the future occupants and the availability of space. There are two types of extension, horizontal and vertical (whether it is underground or above ground).
Hong Kong has practiced various types of extensions for many years for the quest of land and space!
In actual fact, Hong Kong has always had and still has pressure on development, land space issues and population growth issues (natural growth and immigration). Hong Kong is a dense city where space is scarce and land reclamation (extension of land over the sea) is a common practice. At a smaller scale it is also quite common to see illegal extensions on facades and rooftops of residential buildings in Hong Kong.

Objectives

- **Avoid demolition of the existing building structure and allow its extension to meet new needs or functions for the building.**
- **Allow the building life span to be extended.**

Waste Type

Types of waste generated during demolition stage:

- Concrete.
- Reinforcement bars.
- Woods.
- Metals.
- Bricks.
- Soils and sands.

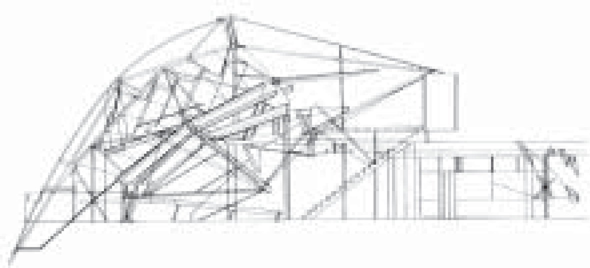
Strategies

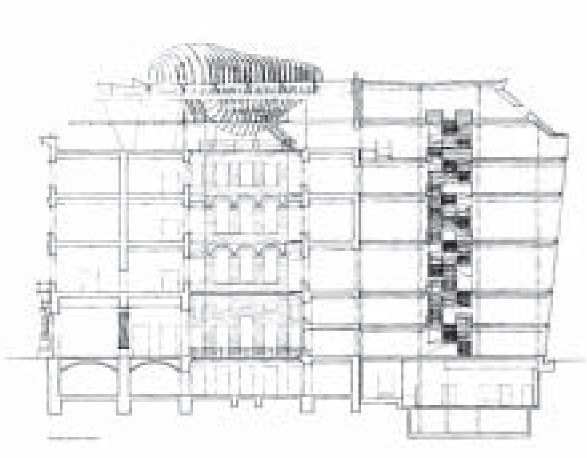
- Consider the new functional requirements and the needs of the future occupants (services, spaces, and accesses…)
- Consider possibilities for vertical extensions (need of structural reinforcement) and/or horizontal extensions of the building (sufficient spare site available).
- Consider the existing building state to correspond with the new requirements, structure, services, equipments, and external façade...in terms of durability, performance, quality, and regulations…
- Consider cost comparison between extension and new building construction, and include the life cycle cost analysis to see long-term benefits. Comparisons can be made also by evaluation of different choices such as adding to the existing building, buying or leasing another building, demolishing for constructing a new building.
- Consider the benefits mentioned below.
- Extension of a building can be planned in advance and scheduled, if future needs and the capacities of the building are known. Examples can be found on university campuses, airports… E.g. the horizontal extension of the airport in France "Roissy" where buildings are successively added.

Benefits

Cost

- Extensions may be less expensive than constructing new buildings, depending on the existing building conditions and the new requirements.
- It can extend the existing building life span.


Environment

- Demolition of the building structure is avoided and less waste is disposed of at landfills.
- Therefore the life span of landfills is extended.
- It reduces transportation of waste disposal, pollution, energy used and noise.

Others

- It provides a new image for the building, which can be a marketing advantage.
- It enhances the image of the company with less waste generation.
- It also enhances the image of the district and the city.
- It promotes the notion of historical and cultural heritage, and contributes to a sense of place in the city.

References

Books

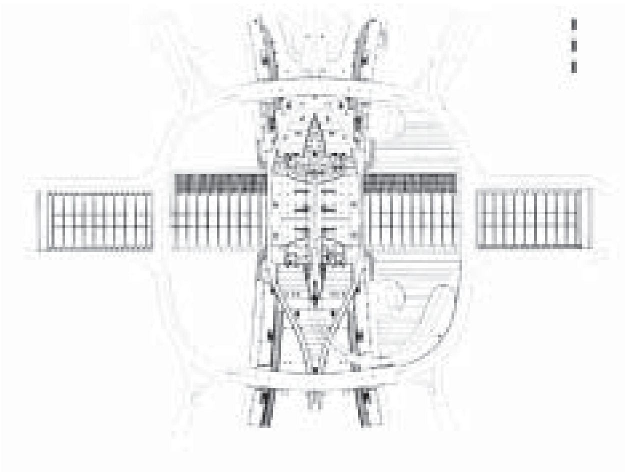
- Brand S., How Buildings Learn: What Happens After They're Built, New York, Viking, 1994.

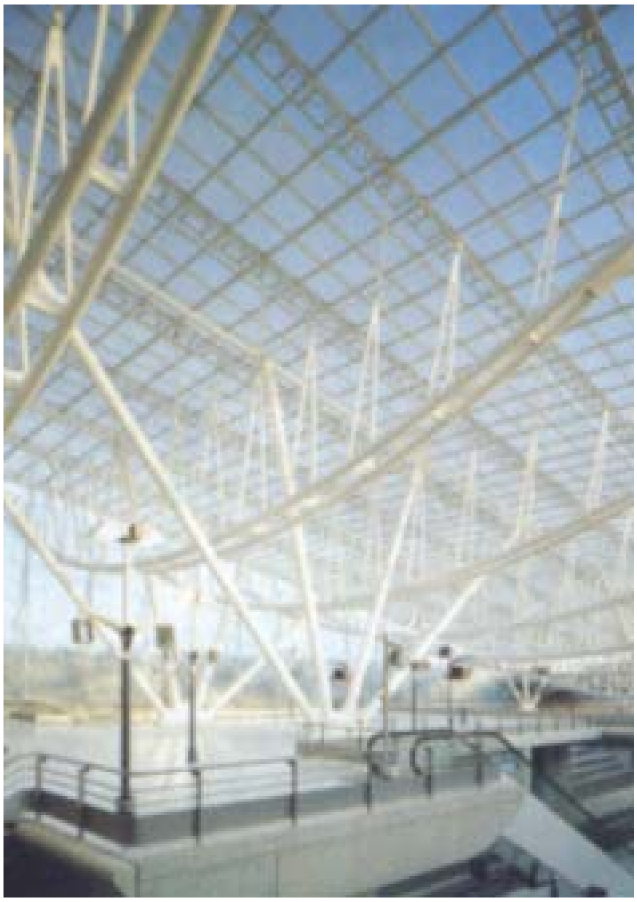
Other references

Inside

- Refer to "Rehabilitation" in this chapter.

Left page: (Top) Vertical extension, Vienna, Austria, architects Coop Himmeulblau, 1990. (Source: Panorama de líArchitecture Contemporaine, Konemann, photos: Coop Himmeulblau). (Bottom) Vertical extension, ING Bank, Budapest, Hungary, architect Erick Van Egeraat, 1995. (Source: Panorama de líArchitecture Contemporaine, Konemann, photos: Christian Richters).
Right page: Charles De Gaulle Airport horizontal extension, Paris, France, architects ADP Paul Andrew, Jean-Marie Duthilleul. (Source: Panorama de líArchitecture Contemporaine, Konemann, photos: Paul Maurer).





Case Study 04

Peninsula Hotel Vertical Extension, Tsim Sha Tsui, Hong Kong

Project:	Peninsula Hotel extension.
Location:	Tsim Sha Tsui, Hong Kong.
Contractor:	Gammon Construction HK.
Year:	Started construction in June 1990, and completed in December 1994.
Year of origin:	Construction started in 1922, and completed in 1926, opened in 1928.

"When the hotel first welcomed the public, on December 11, 1928, it was already a survivor. Construction work had begun on January 2, 1922. The completion date was changed from 1924 to 1926. When the British rushed troops to Hong Kong for possible military action against the Kuomintang, the Military Authorities saw the Peninsula, with it's structural work complete, as an ideal location for temporary barracks. For the next 14 months, the British occupied it. When the soldiers eventually moved out, repair teams moved in to replace the flooring and all the bathtubs."

"In June 1990 work on a 30-storey tower of the Peninsula began. It was completed in 1994 and made the Pen a more lucrative investment, without lowering its standards of excellency".

Extract from the web site, http://www.cosmopolis.ch/english/cosmo5/peninsula.htm

Louvre Museum horizontal extension, Paris, France

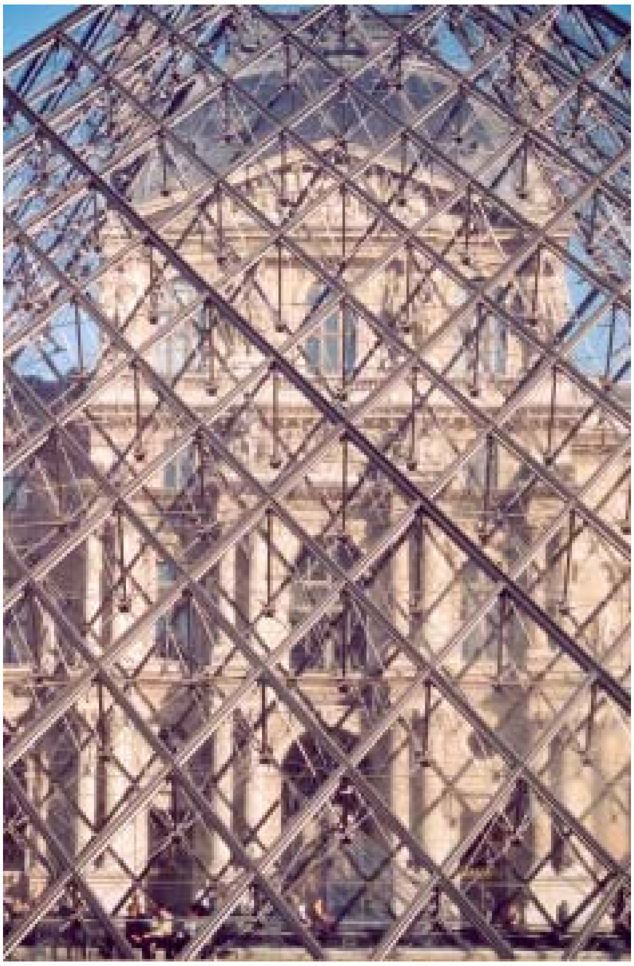
Project:	Louvre Museum extension, Louvre pyramid.
Location:	Paris, France.
Architects:	I.M. Pei.
Site area:	40 hectares
Year:	1982-1989
Cost:	6.9 billion FRF

"The Grand Louvre Project represents over fifteen years of work (1981-1999). The budget of 6.9 billion FRF, which is financed by the Government, provided the means to realize a project which will enable the exhibition areas of the museum to be doubled in size, to 60,000 m2, to increase the scientific, technical and administrative working areas fivefold, and the reception and service areas intended for the public.

Architect Pei's pyramid, surrounded by fountains, which marks the entrance to the new museum, thus only constitutes a very small part of renovation works and enlargements of unprecedented scale. They include the restoration of the buildings, tranformation into exhibition areas of the former Finance Ministry, creation of an underground parking area of 80 coaches and 600 private cars, a shopping area ("Carrousel du Louvre"), the French Museum Research Laboratory, the amphitheatre of the Ecole du Louvre, spaces for the Union des arts décoratifs, technical equipment and fashion presentation rooms.

At road level, the jardin du Carrousel has been redesigned, and the terrace covering the former avenue du Général-Lemonier will form a continious area linking up the jardin des Tuileries, which has also been completely restored. This will create 30 hectares of garden area."

Extract from the web site, http://www.louvre.fr/anglais



Tea Ware Museum, Central, Hong Kong.
ìCompleted in 1846, the Flagstaff House was originally the home of the commander-in-chief of the British Forces, and today is the Hong Kongís oldest surviving colonial building. It was converted into a museum in 1984, with an extension of new wing, the K.S. Lo Gallery, built in 1995.î

Orsay Museum rehabilitation, Paris, France.
ìOn the eve of the 1900 World Fair, the French government ceded the land to the Orleans railroad company, who, disadvantaged by the remote location of their Austerlitz station, planned to build a more central terminus station on the site of the ruined Palais díOrsay. The station and hotel designed by the architect Victor Laloux, were built within two short years, and inaugurated for the World Fair on July 14th, 1900. The open porch and lobby continued into the great hall which was 32 m high, 40 m wide and 138 m long.
In 1975, the Direction des MusÈes de France already envisioned installing a new museum in the train station. The building was classified a Historical Monument in 1978 and a civil commission was created to oversee the construction and organization of the museum. The museum was inaugurated on December 1986.î
Extract from the web site, http://www.musee-orsay.fr:8081

London Bridge relocated for touristic attraction, Lake Haavasa City, Arizona, USA. (1831-1971).
ìIn the late 60ís, the London Bridge was sinking into the clay of London, Englandís Thames River. Built in 1831, it was victim of it own immense weight. Robert Mc Culloch and a buddy purchased the falling down bridge in London, then flew its bricks to America where they were hauled to the lake Haavasa City where they were reassembly. The bridge was ready in 1971 and is one of Arizonaís biggest attractionî.
Extract from the web site, http://www.outwestnewspaper.com/london.html

4.1.2. Reuse building structures: rehabilitation

Building rehabilitation can avoid total demolition of the building and therefore minimize the generation of waste. The term "adaptive reuse" is common to describe rehabilitation, as the building structure is reused. Also the terms "recycling building or space" or "remodeling building" are often used as the function of the building change.
Explanation of building rehabilitation: when the function of building change, and the structure remains the same or changes such as building extension. There are different types of rehabilitation, in place, in the same location or relocated. Rehabilitation is common in Europe where cultural and historical heritage is a strong value; and many buildings are converted into museums and art centers, schools, and even residential buildings. In Hong Kong the situation differs as available space is little, land is expensive and new regulations and plot ratios are implemented, but still there are a few examples.

Objectives

- **Avoid total demolition of existing building and prefer rehabilitation.**
- **Therefore avoid large quantities of demolition waste generated.**
- **Extend the life span of the building.**

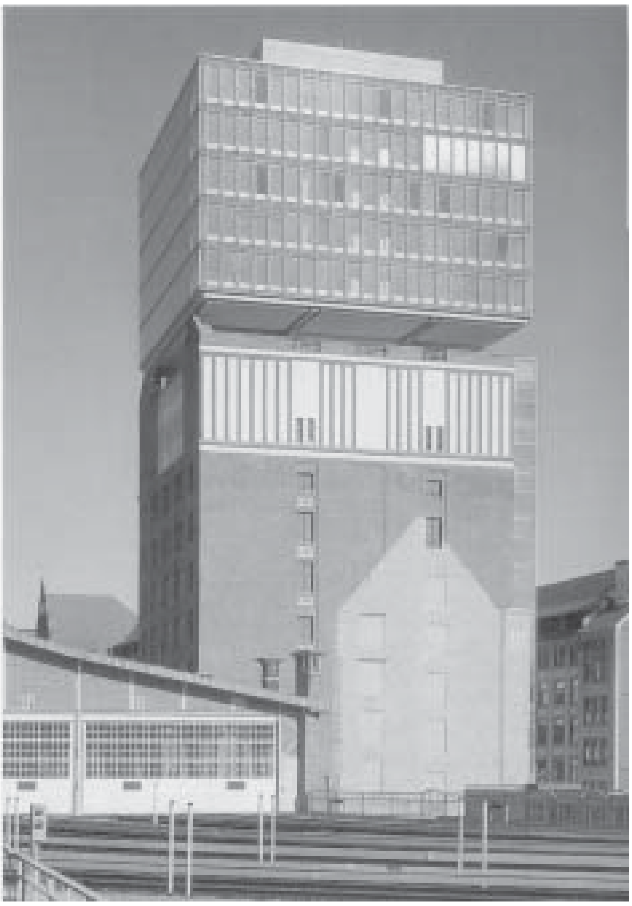
Waste Type

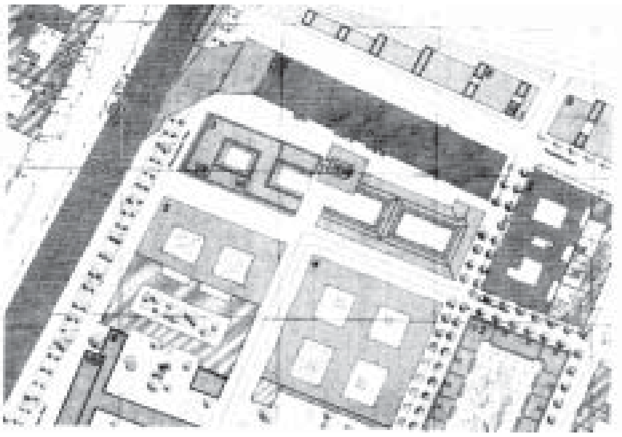
Types of waste generated during demolition stage:

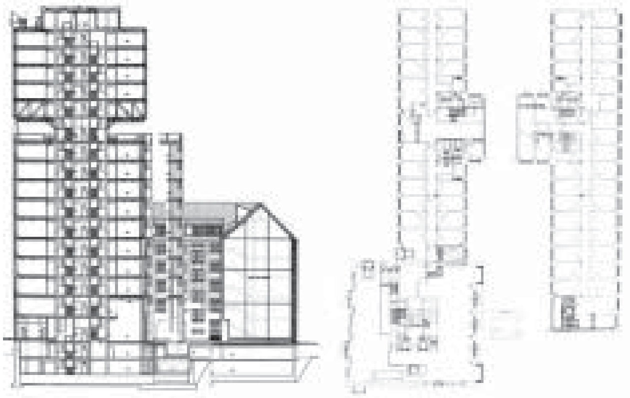
- Concrete.
- Reinforcement bars.
- Woods.
- Metals.
- Bricks.
- Soils and sands.

Strategies

- Consider the new functional requirements to be housed and the needs of the future occupants (services, spaces, and accesses…).
- Consider possibilities for vertical extensions (need of structural reinforcement) and/or horizontal extensions of the building.
- Consider reusing the whole building structure or parts as the facades…
- Consider the existing building state to correspond with the new requirements, structure, services, equipment, and external façade...in terms of durability, performance, quality, and regulations…
- Consider the reuse of original materials or building components on site or other sites.
- Consider cost comparison between rehabilitation and new building construction, and include the life cycle cost analysis to view long-term benefits.
- Consider the benefits mentioned below.
- The structure doesn't necessary need to be a historical building to be reused, simple concrete structures can also be reused, such as in studios in Kortrijk, and even small-scale structures can be reused such as in the Tower House in Brasschaat.







Left page: (top) Office tower in Berlin, site plan, sections, Schweger & Partner, Germany. The former work site comprises new offices, housing and commercial properties. The existing listed buildings erected between 1903 and 1908 were initially used by the Osram company. (Source: Detail serie 200.7, Refurbishement). (Bottom) Residential buildings rehabilited into commercial buildings and shops, Causeway Bay, Hong Kong.

Right page: Former police station rehabilited into restaurant, Stanley, Hong Kong. The building was built in 1859 and is protected by the Antiques and Monuments Ordinance.

Benefits

Cost

- Rehabilitation may be less expensive than constructing a new building, depending on the existing building and the type of project it is (total or partial building reused).
- It can extend the existing building life span.

Environment

- Total demolition of the building structure is avoided and less waste is disposed of at landfills.
- Therefore the life span of landfills is extended.
- It reduces transportation of waste disposal, and reduces pollution, energy used and noise.

Others

- It provides a new image for the building, which can be a marketing advantage.
- It enhances the image of the company with less waste generation.
- It also enhances the image of the district and the city.
- It promotes the notion of historical and cultural heritage, and contributes to a sense of place in the city, which is also a government will.

References

Books

- Brand S., How Buildings Learn: What Happens After They're Built, New York, Viking, 1994.

Journals

- DETAIL magazine No. 6, 2000, on Rehabilitation.

Other references

Inside

- Refer to "Extension" in this chapter.
- Refer to chapter 4.2 on "Design for reuse and recycle", and chapter 5 on "Reclaimed materials".

Outside

- Web site on material exchange to find reused or recycled materials in Hong Kong.(http://www.building.com.hk/bpf/bpfront.htm)

Museum of Coastal Defense, rehabilitation of a fort, Hong Kong

Project:	Museum of Coastal Defense.
Location:	Lei Yue Mun, Hong Kong.
Architects:	Architectural Services Department, Kenneth Tam.
Contractor:	Leighton Asia.
Year:	Started in 1993, construction October 1997 and completed in June 1999.
Year of origin:	1887
Cost:	HK$273 million
Site area:	12.9 Ha.

This project reuses the building structure of an old fort to accommodate the museum of costal defense. Almost no major demolition was required and additional access and facilities were provided to the magnificent site. The existing building containing a network of underground chambers used as exhibition rooms is covered with a tension structure, which provides a great volume for the museum preserving the original architecture of the building.
This project also reuses old bricks from the Sai Ying Pun old mental hospital, to repair the battery brick wall. The site provides promenades and great sea view, facing one of the accesses of the Harbour.

Left page: (top) General view of the museum former fort.
(Middle) Museum entrance. (Bottom) Site with promenades and sea view.

Right page: (top left) Tension structure roof. (top right) Battery brick wall repair with bricks from the Sai Ying Pun old mental hospital.
(Middle) inside the museum. (Bottom) Tower lift access to the museum.

"Built by the British in 1887 to defend its interests against the hawkish French and Russians, it was also the site of a fierce World War II battle between the British, Canadian and Indian soldiers entrusted with the task of defending Hong Kong and 20,000 Japanese soldiers who crossed the Gin Drinker's Line into territory.
The site had been used as a holiday camp since it was handed over to the Urban Council in 1987 but was otherwise closed to the public. The Civil Aviation Department and Hong Kong Observatory also had equipment set up there to collect data on aircraft movements and the weather. Being under the fight path of the old airport, the site was also subject to civil aviation height restrictions. Despite theses constraints on development, the potential of the site, with its history as well as spectacular sea view and greenery, was simply too great to be ignored."
"Apart from a large courtyard and various tunnels and passages, the 1,600 sq m redoubt has more than ten underground casemates which were originally used as the soldiers' quarters, kitchen and ammunition store. It was subject to ten days of heavy bombardment by the Japanese during the war, an episode in its history to which the many bullets holes can testify. However, although it was damaged, the redoubt was still structurally sound, so a decision was taken to preserve it and convert it into a museum."
"The architect decided to enclose the area with a tension structure…allowing preservation of the artifacts in an optimum environment with minimum interference with the site."
"The underground casemates, which used to accommodate approximately 100 soldiers and other facilities, have been converted into exhibition rooms, offices and an audio-visual theatre offering information on Hong Kong's coastal defense over the last 600 years."
"Apart from the redoubt, the 6,200 sp m site also includes other military installations of great interest."
"There is a battery where bullet holes in the crumbling brick wall, at the eight of an average person's head, suggested it might have been used for executions in the past. The brick wall has been repaired using bricks from the demolished mental hospital in Sai Ying Pun, another 19th century structure, and the battery is now used to exhibit a range of period cannons."
"In order to improve the accessibility and attractiveness of the museum, new structures and facilities were added. The most important of these is a lift tower which was built at the entry point to the park which provide access via the Island Eastern Corridor and is served by a small car park providing drop off for coaches and shuttle buses…The lift tower leads to a footbridge which replaces the original retractable bridge leading to the redoubt."
Extract from the Building Journal, www.building.com.hk/features/more/coastal/coastaldown.html

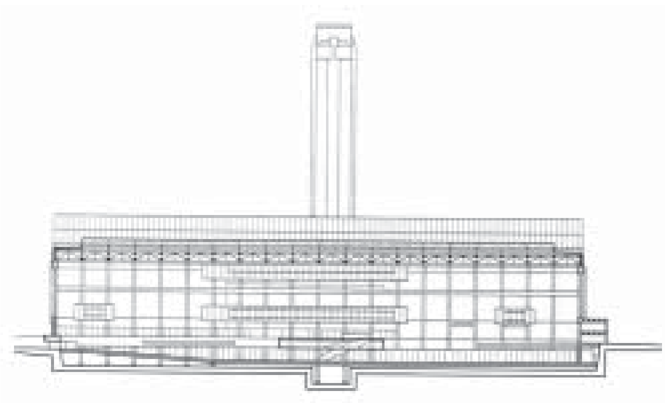
Tate Modern, rehabilitation of the former Bankside Power Station, London, UK

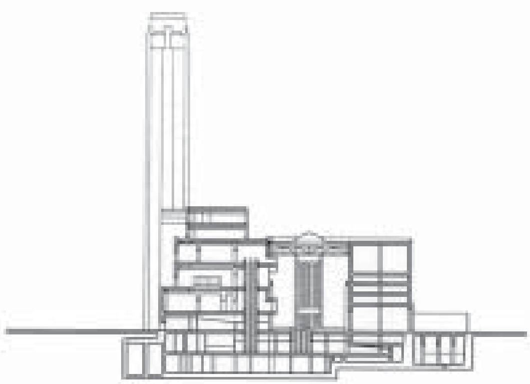
Project: Tate Modern Museum.
Location: London, UK.
Architects: Herzog & de Meuron, Jacques Herzog, Pierre de Meuron, Harry Gugger, Christine Binswanger.
Construction manager: Schal, a division of Carillion plc.

Year: 1995-2000
Year of origin: built in two phases 1947 and 1963, and closed in 1981.
Architect: Sir Giles Gilbert Scott.
Site area: 3.43 Ha

Rehabilitation of the former Bankside Power station (including vertical extension).
The building consists of a brick-clad steel structure, constructed from more than 4.2 million bricks. The height of the central chimney is 99 m, and the northern frontage of the building is over 200m long.
The architect team, Herzog & de Meuron, have respected the integrity of the original building, keeping the existing structure and adding bridges, balconies, new floor and wall systems and a two-storey glass structure and light beam spanning the length of the roof.
New volumes and surfaces have been created to fit in with the new function of the building avoiding major demolition of the building structure. A dialogue has been created between old and new architecture and materials enhancing the image of the building.
The Total internal floor area of 34,500 m2 including:

- Gallery suites for display and exhibitions of 7,827 m2.
- The former Turbine Hall as a "covered street" of 3,300 m2, where works of art may be shown.
- A special exhibition suite of 1,300 m2.
- A 240 seats auditorium.
- 2 cafes.
- 3 shops of 500, 300 and 150 m2.
- An education area of 390 m2.
- A member room of 150 m2.
- 1,350 m2 of offices.
- A support services/art handling area of 1,500 m2.
- 9 passenger lifts of which 4 are for public use.
- 6 escalators.





Left page: Site plan and sections (Source: Detail, Serie 2000,7, Refurbishement).
Right page: General view and external view with extension (Source: Detail, Serie 2000,7, Refurbishement).

"Herzog and de Meuron's design respects the integrity of the original building. Rather than erasing the pre-existing fabric to leave themselves a blank canvas Herzog and de Meuron worked with and celebrated the vernacular building. Using the existing structure, they have added bridges and balconies, a new system of floors and walls, varying ceiling heights and floor surfaces and a wide range of light sources, from huge floor to ceiling windows to a vast glass roof spanning a spectacular six story high entrance hall. The result is a breathtaking spectrum of galleries, project spaces, concourses, auditoria, cafes, bars, shops and break-out rooms where the public can encounter, discuss and study, or contemplate." "A cost of 134.5 million, the work began in 1995 with the removal of the power station machinery, leaving the brick walls supported by a steel skeleton. During the following two years, further demolition and enabling works took place such as the removal of both the old Boiler House and the Turbine Hall roofs, the demolition of a number of out-buildings and the sandblasting and repairing of the remaining steelwork. The original planning of the building into two portions was preserved and the interior retains the power station's vast Turbine Hall, with the new galleries inserted along the building's north side." "Works on the construction commenced in October 1997, beginning with a vast concrete raft, which forms the foundation on which the museum sits. This was followed by the fabrication of the structural steel framework in the former boiler house, creating the seven floors and effectively forming a new building inside the walls of the old. The seven gallery floors fully support the existing brick façade and thus allowed the removal of the original boiler house trusses. The two uppermost floors are enclosed by a new glass roof structure known as the "light beam" which provides natural light to the galleries on the top floors by day and sets the London sky aglow by night. As a beacon above this new roof, a light designed by Michael Craig-Martin in collaboration with Herzog and de Meuron, illuminates the top of the Tate Modern's chimney." "Within the limited palette that Herzog and de Meuron allowed themselves there is remarkable variety, within which the dialogue between old and new is the most pronounced. The Tate Modern opened on 12 May 2000 and has brought hope that art and architecture can counter the once poor, dilapidated surroundings, acting as a catalyst for the regeneration of this key area of central London." Hinge Vol.73, 2000.

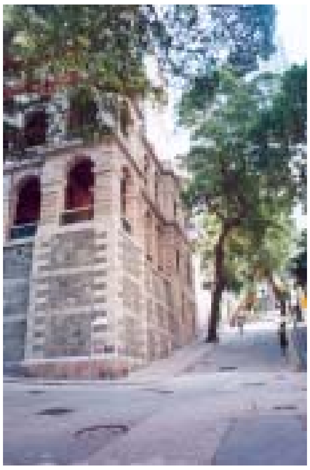
Sai Ying Pun Community Complex, Rehabilitation of the Old Mental Hospital, Hong Kong

Project:	Sai Ying Pun Community Complex.
Location:	Sai Ying Pun, Hong Kong.
Architects:	Architectural Services Department.
Structural engineer:	Mouchel Asia.
E&m engineer:	Architectural Services Department.
Contractor:	Gammon Construction Ltd.
Quantity surveyor:	Architectural Services Department.
Year:	2001
Year of origin:	1897

This rehabilitation project demonstrates the option by constructing a new building and keeping the existing façade, which represented the most important historical element of the building. This approach and the site conditions allow the construction of a larger building (taller and longer than the original one) providing space and flexibility for the new functions and new requirements. It avoids total demolition of the building and enhances historical heritage and vitality to the district of Sai Ying Pun.

Left page: (top) Former facade of the old mental hospital (Source ASD brochure). (Bottom) New facade of the Community Complex.

Right page: (top left) Arcades. (top right) Facade of the old mental hospital. (Middle) Details of the facade and junction with new building. (Bottom) Detail of stones.



Extract from Building Journal, www.building.com.hk/features/syp/sypdown.htm

"Built in 1891, the mental hospital in Sai Ying Pun was actually used as nurses' quarters until the Second World War. It was turned into a mental hospital after the war and continued to function as such until 1962, when the completion of Castle Peak Hospital removed the strain of rising numbers. It switched back to outpatient services until 1971, when operation ceased."

"Challenges to preservation. Except for the old granite façade, therefore, the rest of the old mental hospital was demolished, to give way to the Sai Ying Pun Community Complex. Three options were considered, noted the Architectural Services Department architects responsible for the project. On option was to follow the approach of the Peninsula Hotel extension in using new materials and methods, which nonetheless echoed the old. The second was to imitate the old by adopting the same design and materials. The third option was to adopt a design, which would offer a contrast with the old, like IM Pei's pyramid at the Louvre. The Peninsula approach was eventually chosen as it was considered the most suitable for the project.

Resulting community complex features a similar architectural rhythm expressed through modern materials. The fact that reinforced concrete columns and slab can support larger spans than granite columns and arches is reflected in the wider spans of the new building. The scale of the new structure, which is longer and taller, allows a proportional column grid, to be established which also echoes the rhythm of the old façade.

The bigger building may have dwarfed the historical structure, but this is avoided by the use of the central lift core to break down the volume of the new building, by dividing it into two wings. This treatment also has functional advantages, as it adds flexibility to the internal layout. The community center needs this flexibility to accommodate the many facilities it will contain, which include an early education training center on the lower ground floor; group work unit on the ground floor; elderly homes on the first and second floors; a community hall; and a children day care center on the third floor. There are also facilities for the mentally handicapped and a singleton hostel on the upper floors."

"The architects noted that the preservation in Sai Ying Pun Community Complex has sparked a sense of history, sustainable architecture and rejuvenation for the district. With the community landmark once again serving the Hong Kong people, the designers expressed hope that the area's profile will raised and its built heritage recognized."

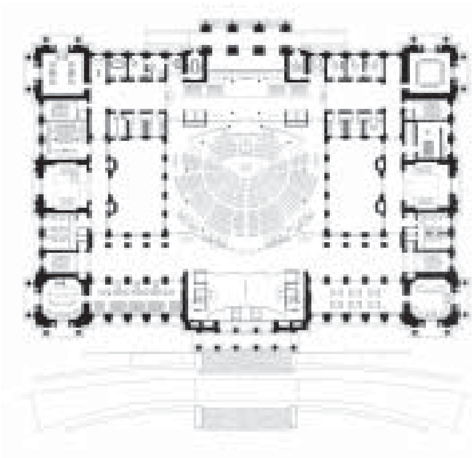
Case Study 09

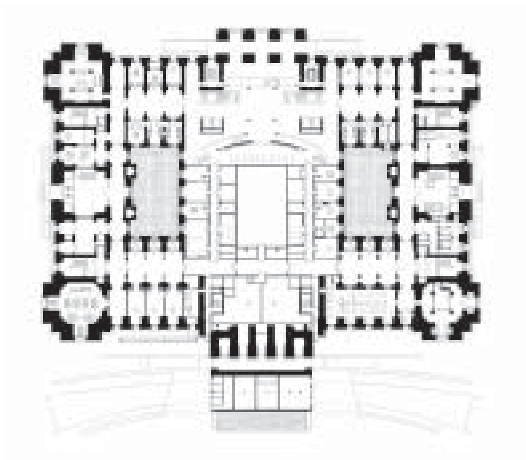
Reichstag Rehabilitation, Berlin, Germany

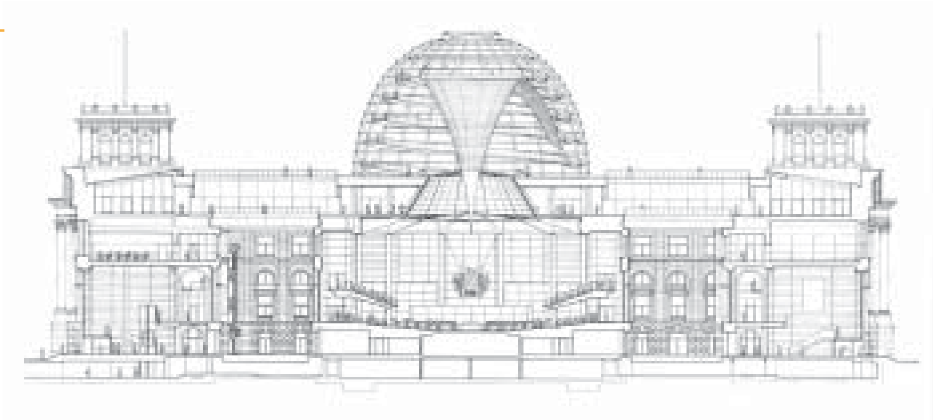
Project:	Reichstag rehabilitation.
Location:	Berlin, Germany.
Client:	Bundesrepublik Deutschland.
Architects:	Foster & Partners.
Collaborators:	David Nelson, Mark Braun, Dieter Muller, Ingo Pott.
Year:	1999 (construction date)
Year of origin:	1894

"The project is a fruit of the initiative to move the German parliament from Bonn to Berlin and to rehouse it in the Reichstag. A competition was convened in 1992 for the construction of an area of 353,500 square feet, almost 100% more than the Reichstag could contain. Subsequently, the total area was reduced to about 96,000 square feet. The teams initially selected were those of Pi de Bruijn, Santiago Calatrava, and Norman Foster. After deliberation on the part of the jury, Foster & Partners won the contest.
The Project consisted in designing a plenary hall inside the Reichstag - a building officially inaugurated in 1894, burnt in 1933, partially destroyed in 1945, restored in the sixties, and "hidden in 1995". The complexity of the initial brief was further increased by the posteriori decision to modify the building's environmental qualities. This involved designing an energy-efficient structure that would generate its own heat and reduce the emission of polluant residues.
The main level of the parliament has been moved to the historical first floor, while the second floor contains the chairman's rooms and the Council of Elders. The third floor accommodates the meeting rooms for the different parties and the pressroom. The terrace above these work areas allows the public access to the restaurant and the dome. Inside the dome, two helicoidal ramps lead up to a raised platform from which it is possible to enjoy views of the city".
(Source: Ecological Architecture, Bioclimatic Trends and landscape Architecture in the Year 2001).

Left page: (top) The dome. (Bottom) Plans. (Source: Ecological Architecture, Bioclimatic Trends and Landscape Architecture in the Year 2001, Photos, Dennis Gilbert, Nigel Young).
Right page: (top) Section. (Middle) The dome from inside. (Bottom) External view. (Source: Ecological Architecture, Bioclimatic Trends and Landscape Architecture in the Year 2001, Photos, Dennis Gilbert, Nigel Young).







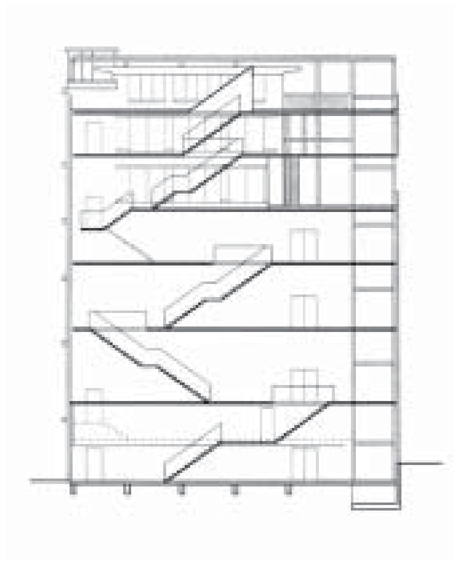

DEM DEUTSCHEN VOLKE

Case Study 10

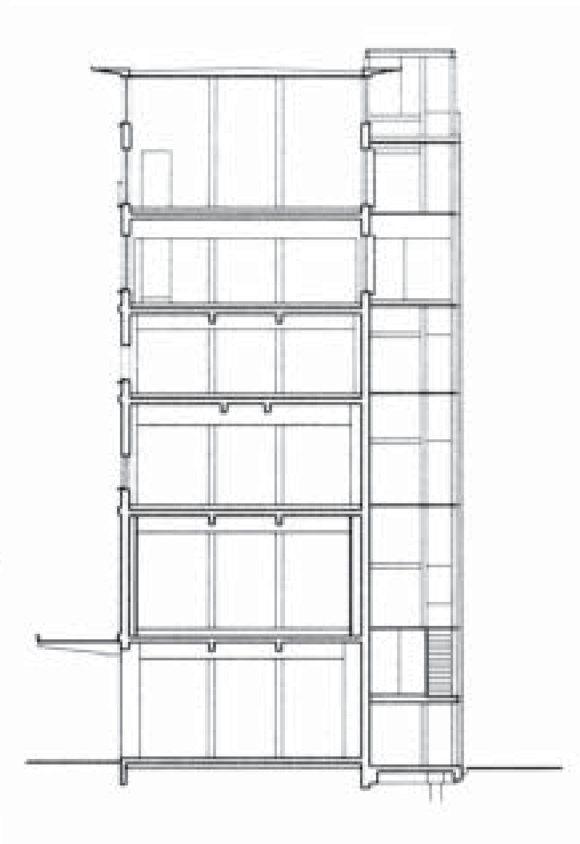
Studios in Kortrijk, Rehabilitation of a Brewery Building, Belgium

Project: Studios.
Location: Kortrijk, Belgium.
Architects: Stéphane Beel & Lieven Achtergael.

"This former brewery building has reinforced concrete skeleton frame structure with brick infill panels. The large, column-free internal spaces can be flexibly divided and offer ideal working conditions for the artists who now use them. The foyer, additional circulation areas, sanitary facilities, common rooms and discussion spaces are housed in a new tract with a steel load-bearing structure. This fully glazed strip is three metres deep and extends over the entire width and height of the south face of the existing building. The old facade remains visible as a second plane through the new glazed skin. The stairs within the extension - a series of irregular links between storeys of different height - create a further layer that accentuates the complex appearance of this face". (Source: Detail, series 2000, 7, Refurbishement).

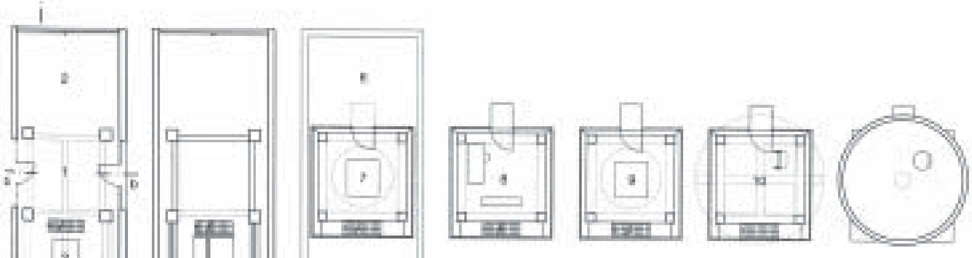


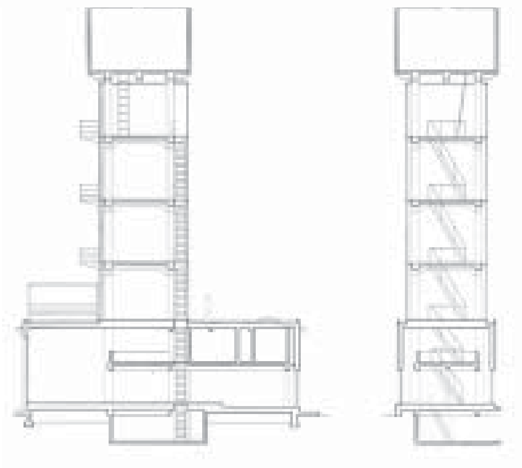
(Top) Site plan. (Middle) Long section. (Bottom) Plans and short section.
(Source: Detail serie7, 2000, Refurbishement).

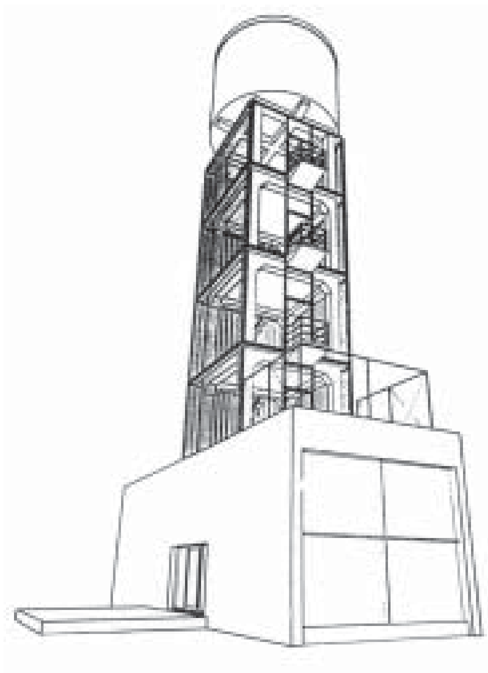


Tower House in Brasschaat, Belgium

Project:	Tower house (former water tower).
Location:	Brasschaat, Belgium.
Architect:	Jo Crepain Architekt NV.
Interior architect:	Machteld Raes
Year:	1994-1998
Year of origin:	Beginning of the 20th century.







Left: Plans, sections, axonometric view. Right: Original water tower and new tower house. (Source: Detail serie7, 2000, Refurbishement and Architecture IntÈrieure CrÈÈ).

"Erected near Antwerp at the beginning of the 20th century, this water tower was one of the first to be built in concrete. It was taken out of service in 1937 and subsequently fell into a state of dilapidation. It consists of a 4-meter-high cylindrical water tank raised on four 23-meter-high columns, with three square intermediate platforms 4x4 m in size. At the base is a plinth structure that originally contained filter plant and a reservoir. The plinth and tower have now been completely refurbished and converted into a house. The kitchen is situated on the ground floor, with an intermediate level inserted above this accommodate cupboard space and a large bathroom, The living room at the other end has a 5-metre-high window overlooking the park landscape. The bedroom is situated in the tower at the first floor level, from where there is access to the roof terrace. On the other levels are study, a guest room and a conservatory. The tower has been enclosed in glazed walls, consisting of U-section glass elements on three sides and a clear-glass facade to the south. A narrow steel staircase was inserted on the north side, with flaps at floor level to close off access. The water cylinder itself has not yet been ised, but it remainsaccessible. The visible concrete structure of the tower is complemented by elements in steel and glass in a way that has allowed the original character to be retained". (Source: Detail series 7, 2000, Refurbishement).

Case Study 12 Relocation and Rehabilitation of the Murray House, Stanley, Hong Kong

Project: Relocation and rehabilitation of the former Murray House
Location: Stanley, Hong Kong.
Architects: Development & Construction Branch, Housing Department.
Structural engineer: Development & Construction Branch, Housing Department.
E&m engineer: Development & Construction Branch, Housing Department.
Contractor: Shui On Building Contractors Co. Ltd.
Quantity surveyor: C.S. Toh & Sons & Associates.
Year: 2001
Year of origin: 1891

"The original location of the building was in Garden Road, Admiralty where Bank of China is located. It used to be a soldier barrack and later was used as a government office. It was demolished in 1982 to give way for development in Central. The granite stone façade was carefully disassembly and stored in Tai Tam as reusable materials. In recent years, the government of Hong Kong decided to reconstruct the building in Ma Hang (Stanley) and to use it as a commercial building for restaurants, retail and exhibition." In addition to the external granite stone, the building consists of other reusable materials.

- *The eight stone chimneys are originated from the old mental hospital in Sai Ying Pun.*
- *The twelve covered walkway columns are from the LDC Shanghai Street Redevelopment site.*
- *The flagpoles are transferred from the old Tamar battle ship.*
- *Besides, the stone columns in promenade are from a private collection.*

Source: Low Waste Building Technologies web site (case studies): www.cse.polyu.edu.hk/~cecspoon/lwbt

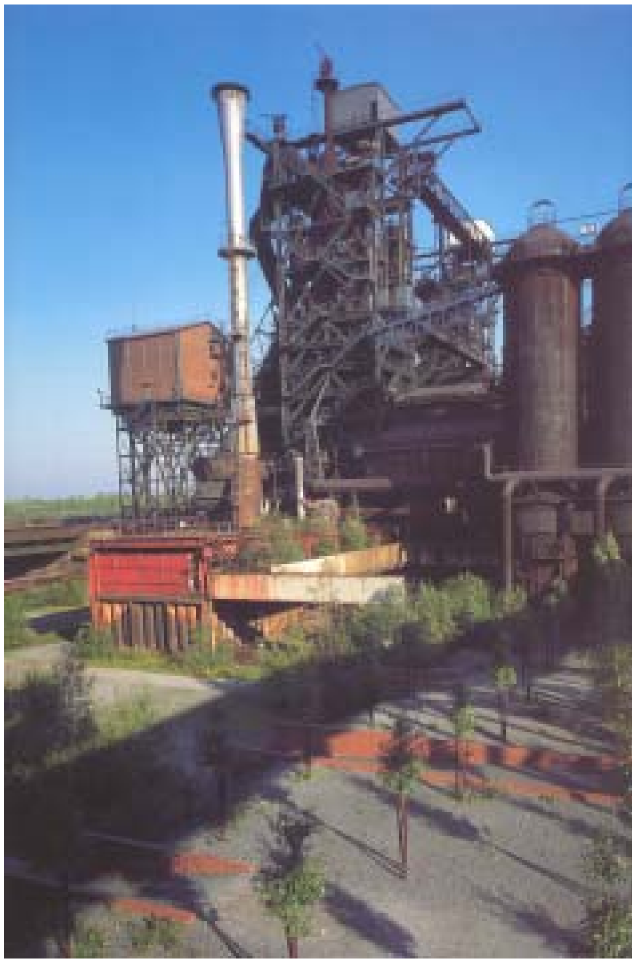
Left page: (top) General view. (Bottom) Left, Flagpoles from the old Tamar battle ship. Right, General view.

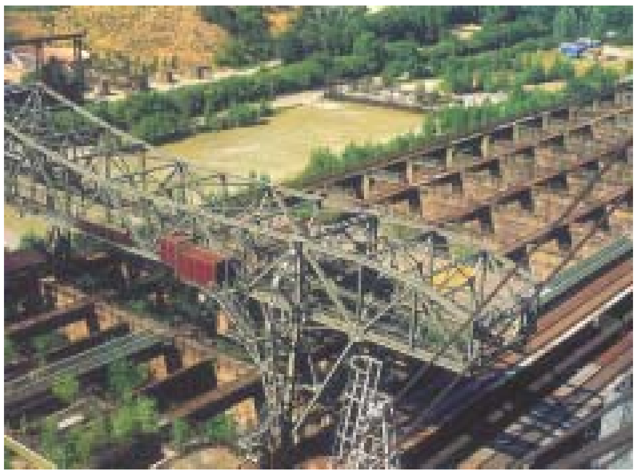
Right page: (top) Detail and columns. (Bottom) Main access to the new building and angle view.

Case Study 13

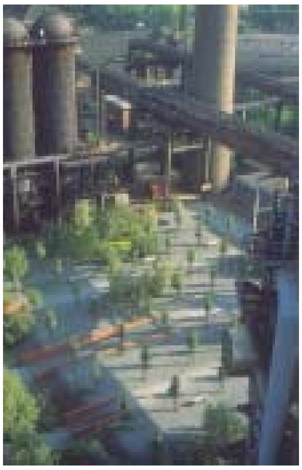
Duisburg-Nord Park, Nordrhein-Westfalen, Germany

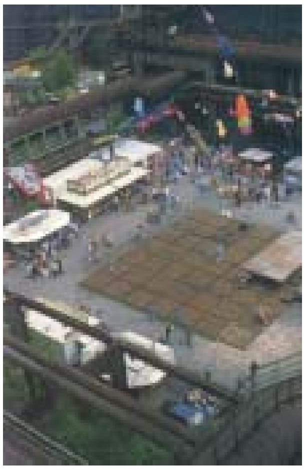
Project:	Duisburg-Nord park.
Location:	Duisburg, Nordrhein-Westfalen, Germany.
Client:	Development Company of Nordrhein-Westfalen and the city of Duisburg.
Architects:	Latz and Partners
Collaborators:	IBA (International Bauaustellung), IG Nordpark, Society for Industrial Culture and the Parks Department of Duisburg City Council.
Year:	1992-2000

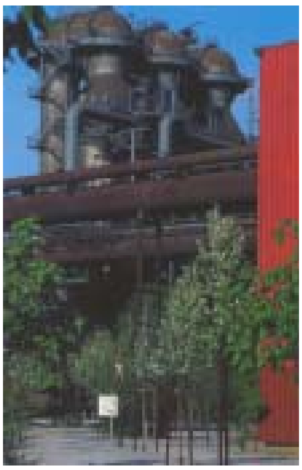




"This project for Duisburg-Nord Parks forms part of a huge green zone in the region of Emscer and was developed for the International Architecture Exhibition of 1999. The German Federal State of Nordrhein-Westfalen and various cities in the region of Emscher have initiated several projects with the ultimate goal of refurbishing old industrial areas in the Ruhr basin.
The Duisburg-Nord Park is situated between the cities of Meiderich and Hamborn in a zone of heavy industries (coal and steel) between the urban agglomerations of Duisburg and Oberhausen in the Ruhr basin. With a population of five million inhabitants, the area is one of the country's major industrial zones. The former site of the Thyssen foundry has preserved all the paraphernalia that is so typical of the industry: a smelting furnace, warehouses, and rail installations, now in disuse. Latz & Partners won the 1990 international competition to update the area and provide its dense population with recreational, sports and cultural amenities.
The project revives the landscape and the old industrial installations. It respects the complex's important historical value and treats it as an archaeological window into the coal and the steel industries. The intervention preserves the remains of the old installations as valuable heritage, and makes them available for public enjoyment. The enormous structures are now landmarks in their own right. One of the original ideas was to turn them into integral elements of the park, places to be used and enjoyed by the residents.
The fragmented, rundown structures were never meant to be reconstructed. They present certain independent sytems whose connections could be functional in some cases and visual in others. The systems are connected by a railway park with raised walkways, an aquatic park in the lowest part and promenades that link the park with various city districts. Other elements, like small gardens, terraces, towers, footbridges and plazas, connect the larger zones.
The magnitude of the project called for piece-by-piece interventions that are opened to the public as they are completed. As much as possible, on-site materials have been used, both directly, and recycled, as in the case of the iron in the footbridges, platforms and gates. Other materials have been used for paving or for mixing concrete for the new walls. The huge hematite sheets that cover the ground of the Plazza Metallica were taken from the smelting furnaces."
(Source: Ecological Architecture, Bioclimatic Trends and Landscape Architecture in the Year 2001).







Left page: The aquatic park. A canal uses the bed of an old main drain. Clean water is provided for the various gardens, using wind-powered energy.
Right page: (top) Piazza metallica. (Bottom) Industrial buildings and vegetation.
(Source: Ecological Architecture, Bioclimatic Trends and Landscape Architecture in the Year 2001, photos: Latz & Partner, Christa Panick, Peter Wilde, Michael Latz and Angus Parker).