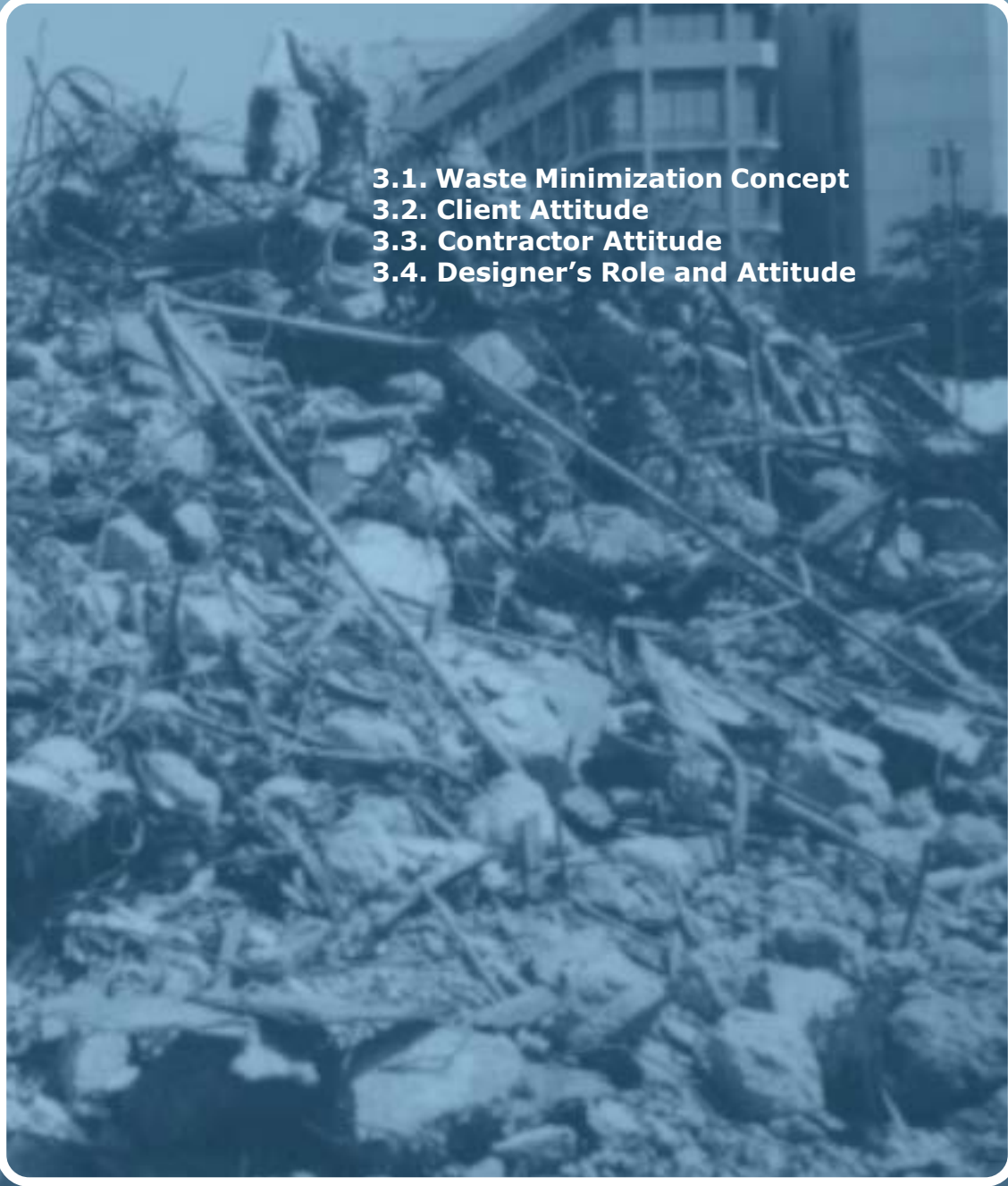




Client, Contractor and Designer Attitude

- 
- 3.1. Waste Minimization Concept
 - 3.2. Client Attitude
 - 3.3. Contractor Attitude
 - 3.4. Designer's Role and Attitude

3.1. Waste minimization concept

Waste minimization involves all the following issues and must be considered as one of the goals in project development. Targets and responsibilities must be clearly defined in advance, for all parties involved in the building process.

- Early concept.
- Work team concept.
- Design concept.
- Concept running through the entire building process.
- Concept running through the entire building life.

Early concept.

Waste minimization should be considered before the waste is generated to facilitate the waste minimization process and reduce its cost. Therefore it is important to consider it at an early stage of the design and include it as one of the goals of the project.

Work team concept

Waste minimization needs to be considered by all parties involved in the building process (including demolition), at an early stage of the design in order to work together as a team and to exchange ideas, view points, professional experience and knowledge. The "charrette" concept can be used to avoid linear process. There must be a commitment between clients, designers, consultants and contractors to minimize waste.

Therefore the following aspects are important to be considered:

- Make early decisions as mentioned above.
- Improve on early planning.
- Better communication between architects, engineers, contractors, clients and developers to avoid linear design process.
- Consider design and constructibility at the same time, looking at materials and construction method selection. (Designer's knowledge of buildability needs to be broader)

"Non-stop" concept.

Waste minimization is a concept running through the entire building process, and must be involved at all stages, to provide total efficiency when concerning reduction of waste. Efforts should be seen all the way and by all parties to minimize waste and to consider it as a goal in the project. It is also a process running through the entire life of a building from design to demolition. The planning of reusing materials from the existing site should start at the site clearance stage. It is a cycle process from demolition of the existing building to the demolition of the new building in the future. Maybe in the future architects will be required to specify the demolition process, and how to dismantle the building and reuse and recycle materials before the construction of the building.

"As pointed out in earlier parts of the report, the design stage is a critical stage which sets the parameters for many downstream activities and in many ways determines the final outcome of the project. Proper consideration given to relevant factors at this stage will give the widest scope for better project performance. To enhance the environmental performance of the project during the construction phase and post-commissioning, we need to give due consideration to various issues such as the life-cycle costs, buildability, maintainability, repairability, upgradability, choice of materials and their recyclability, construction methods, energy efficiency, and users' health and comfort before the design is finalized. This calls for closer cooperation among design team members from different disciplines (e.g. architects, structural engineers, civil engineers and building services engineers) to facilitate the development of well-considered design solutions."

(Source: Henry Tang, "Construction for Excellence", Report of the Construction Industry Review Committee, January 2001).

3.2. Client attitude

The client should be concerned by the environmental impacts of building construction and development, and be aware of the waste situation in Hong Kong to consider waste minimization in a better way. It is important to notice that soon, a charge will be implemented in Hong Kong for the disposal of waste at landfills. Therefore waste reduction should be considered as part of the project issues.

According to a survey conducted in 2001, by the Department of Civil and Structural Engineering of The Hong Kong Polytechnic University, last minute client requirements is the major factor of design modifications that generates waste. Therefore clients should consider waste minimization and take early decisions to avoid the production of waste.

In order to inform and guide the client on waste minimization processes, a checklist is developed as follows:

Client's checklist

Waste minimization involvement

- ❑ Consider the waste situation in Hong Kong (landfill disposal charge will be implemented very soon).
- ❑ Consider the waste minimization concepts and prevention of waste as a goal, at an early stage. This should be included in the brief.
- ❑ Ensure that the brief requires the designer and the contractor to consider waste minimization at the early stages of design and construction (waste management plan required for the contractor).
- ❑ Make sure that all stages of the building project and all parties will consider waste minimization as a priority.

Design

- ❑ Consider all aspects of waste minimization mentioned in chapter 4 "Design" (reuse building structures, optimizing design lives, flexibility...), in chapter 5 for material selection and in chapter 6 for the construction method selection.

Demolition

- ❑ Use a specialist demolition contractor that has knowledge in selective demolition to carry out procedures safely, and with maximum reuse, recycle and sale of the materials.

Land issues

- ❑ Use cut and fill concept to reuse maximum amount of excavated soil for site formation and landscaping. Consider uses on site and other sites.
- ❑ Be aware of contaminated land. Contact relevant authorities for further information.

Planning

- ❑ Improve planning by allowing sufficient time for design and preparation (avoid time pressure during construction).

Last minute changes

- ❑ Avoid changes during construction and last minute requirements, as it is a major cause of design variations that generates waste.

Benefits and image

- ❑ Consider the marketing advantage that may be created by reducing the generation of waste.
- ❑ Consider the benefits (costs, environmental...) of waste minimization and the enhancement of the image of the client's company.

References**Books**

- **Managing and Minimizing Construction Waste, A Practical Guide**, J Ferguson, N Kermode, C L Nash, W A J Sketch and R P Huxford, Thomas Telford Publications, London, 1995.
- **A Client's Guide to Greener Construction**, CIRIA Special Publication 120, London, 1995.

3.3. Contractor attitude

Contractors should consider waste prevention and recycling. For further information refer to chapter 3 "Client attitude" and "Designer attitude", to review the client's and the designer's checklist.

Contractor's checklist

This checklist is intended for the contractor to monitor the site performance and the effectiveness of the waste management plan.

Waste prevention

Work team

- ❑ Communication between all parties (client, designer, contractor...) at an early stage of the project is vital, to improve design and allow for sufficient planning to minimize waste. The work team should be considered as a whole to avoid linear process of the building project. Professionals should work together to exchange ideas and knowledge.

Design

- ❑ Consider at an early stage, simultaneously design, material selection and construction method selection in order to reduce waste generation.
- ❑ Consider alternative options for the design to minimize waste generation on site.
- ❑ Consider design that uses materials efficiently.
- ❑ For detailed information refer to chapter 4 "Design".

Material selection

- ❑ Consider material selection at an early stage regarding dimensional coordination, reuse and recycle, optimizing building life, cheap and easy maintenance... (Refer to chapter 4 "Design"), e.g. design that uses materials efficiently.
- ❑ Prefer good quality materials to avoid material failure, and over ordering.
- ❑ Prefer materials with little or no packaging whenever possible. Consider also sufficient packaging system to avoid material wastage through breaking in transportation and handling.
- ❑ When possible arrange with suppliers to reuse and take back packaging.
- ❑ For detailed information see chapter 5 "Material selection to minimize waste".

Construction method selection

37

- ❑ Prefer construction methods that minimize waste generation such as reusable and recyclable formworks (metal or aluminum formworks), prefabrication or modularization.
- ❑ If construction on-site is transferred off-site (in factories), less waste is generated on site in urban areas and therefore creates less pollution. Prefabrication provides cleaner activities on site.
- ❑ Refer to chapter 6 "Construction method selection to minimize waste" and web site on low waste building technologies, <http://www.cse.polyu.edu.hk/~cecspon/lwbt>

On site action

- ❑ Education on site is necessary for successful waste management planning. All workers should be aware of the plan and consider actions on site.
- ❑ Select practices on site that will minimize waste.
- ❑ Prepare sorting facilities (waste bins and containers with clear labeling and access, and sufficient space for sorting).
- ❑ Allow proper storage and handling of materials to avoid wastage.
- ❑ Reuse material on-site whenever possible.
- ❑ Consider material control (see chapter 5 "Material selection to minimize waste").

Reuse and salvage

- ❑ As mentioned previously, give preference to reusing materials on site. This can reduce waste and supply costs.
- ❑ Check the quality of the reused items, as this would affect the extension of the building life.
- ❑ Check with the demolition contractor (from this site or other sites) if there are any possibilities to reuse or recycle materials. This should be carried out before demolition works proceed.
- ❑ When reusing materials from demolition, consider selective demolition. Careful removal is essential for an efficient reuse process.
- ❑ Check availability of materials via the Internet.

Plan

- ❑ Prepare a waste prevention plan to be included in the waste management plan that sets goals and targets. It should be provided early at the design stage (before construction starts).
- ❑ Provide waste management plan before construction starts.
- ❑ Estimate the type and the amount of waste that may be generated during the construction stage.
- ❑ Estimate the type and amount of materials, which may be reused on site or other sites, and recycled.
- ❑ Also, the plan should include final destination of wastes whether it is reused, recycled, sold or disposed of.
- ❑ Make clear the requirements to all members of the building team. Specify waste management goals in subcontractor agreements.

Waste management plan should include:

- ❑ Waste management goals.
- ❑ Analysis of the project waste (types and quantities).
- ❑ Disposal methods for each material.
- ❑ Material handling procedures (removal, sorting, transportation, reuse, recycle or disposal).
- ❑ Education and promotion.

Waste management plan described in PNAP 243, the plan may cover:

- The type of waste and their estimated quantities.
- The timing of waste arising.
- Measures for reducing waste generation.
- On-site waste separation.
- On-site and off-site material reuse.
- Areas for waste storage.
- Quantities of waste requiring off-site disposal.
- Disposal outlets.
- Monitoring and auditing program.
- Organization structure for waste management.
- A list of materials to be reused or recycled with estimated quantities.
- Implementation of the trip ticket system.
- Method of processing, storing and disposal of hazardous waste.
- Method of dealing with packaging material.

Savings

- ❑ Cost reduction by reusing and recycling materials on site, or by selling them off site.
- ❑ The analysis should include: estimation of type and quantity of waste, waste from demolition stage of the project, reuse and recycle options and resale.
- ❑ A new regulation concerning waste disposal charge will soon be implemented, hence it is important to check the cost of waste disposal and the options available (disposal sites, transportation cost, environmental impact).
- ❑ Consider benefits mentioned in chapter 2 "Waste minimization".

Recycling and reuse plan

Actions need to be taken during the construction and demolition stage, but it should be considered and planned in advance.

- ❑ Analysis of the project waste (types, quantities and schedules of wastes arising).
- ❑ Investigate recycle and reuse opportunities and facilities.
- ❑ Saving analysis should consider cost comparison between normal construction waste disposal and recycling, to examine feasibility.
- ❑ Designate responsible persons to perform the plan effectively (check bins for proper sorting and contamination, manage schedules of bins...). This should be included in project documents.
- ❑ Refer to on site action above.
- ❑ Promotion and education is very important. Educate on site staff about waste management issues and provide written information for reference (different languages are sometimes required).

Regulation

Practice Notes for Registered Contractors
 . PNRC 21, Tropical Hardwood Timber, July 1992.

Practice Notes for Authorized Persons
 . PNAP 243, Construction and Demolition Waste, June 2000.

Technical Circulars from Works Bureau:

- . No.5/98: On Site Sorting of Construction Waste on Demolition Sites.
- . No.5/99 & 5/99A: Trip-Ticket System for Disposal of Construction and Demolition Material.
- . No.19/99: Metallic Site Hoardings and Signboards.
- . No.29/00: Waste Management Plan.
- . No.31/00: Specifications Allowing the Use of Recycled Inert Construction and Demolition Material.

39

British Standard

- . BS 7750, 1992 and 1994: Specification for Environmental Management Systems.

References

Books

- . **A Guide for Managing and Minimizing Building and Demolition Waste**, C.S. Poon, T.W. Yu, L.H. Ng, The Hong Kong Polytechnic University, May 2001.
- . **Contractors' Guide to Preventing Waste and Recycling**, 2000, King County Solid Waste Division, Seattle (available on their web site, <http://www.metrokc.gov>)
- . **Managing and Minimizing Construction Waste, A Practical Guide**, J. Ferguson, OBE, N. Kermode, C. L. Nash, W A J Sketch and R P Huxford, Thomas Telford Publications, London, 1995.

Web sites

- . Low Waste Building Technologies,
<http://www.cse.polyu.edu.hk/~cecspon/lwbt>



Source: Contractors' Guide to Preventing Waste and Recycling, 2000, King County Solid Waste Division

3.4. Designer's role and attitude

"Who is the leader on a ship crossing the ocean? The leader of that ship is the designer of that ship, because you can be the best captain in the world, but if your ship is not designed to be seaworthy, you are going down, Peter Senge."

William McDonough, "Design: As if Life Depends on it", Lessons Learned High Performance Buildings.

Waste Design is described in CIRIA SP 134 as:

Waste arising from construction sites both by acts and by omissions on the part of the designer, including opportunities to reduce waste lost by not using reclaimed materials.

Designer's role

The designer has an important role to play in waste minimization. Designers can influence the design concept and measures, material selection and construction methods to reduce the generation of construction waste as well as demolition waste.

They can promote the principle of waste reduction in the construction industry and encourage clients to adopt waste reduction initiatives. Demonstration projects should be encouraged by both private and government sectors to promote and show the advantages of waste minimization.

Waste minimization requires changes in the traditional approach to design practices, to material selection and to waste. Designers need to open their mind to look at cleaner practices to reduce waste generation; analysis, research, thoughts about present and upcoming issues, communication between all parties, and also new knowledge such as assembly for disassembly, buildability, etc.

"Research would play an increasingly important role in developing innovative architectural, functional and technological ideas that would enable the design of buildings to scope with the challenges of future demands...

In the area of technology, there is much scope for research in the area of environmental protection. Research is an essential methodology to identify and develop a system of theoretical knowledge and application technique that would satisfying the growing need for "green" designs in architecture, that, is designs which are sensitive to energy and ecological concerns. The large size of high-rise building projects in Hong Kong means that it is critical to use building materials and construction methods that are as environmentally friendly as possible...

Hence, the enormous and varying design needs of such buildings in Hong Kong do require the necessary research in order to identify and develop the building technologies that would help to produce environmentally-friendly and energy-efficient designs."

Stephen Lau Siu Yu, The Role of Architects in the 21st century, Professional Practice for Architects in Hong Kong, 1997.

Considering waste minimization as well as sustainable design, reinforces the principle of building for the need of future generations. Vision of the future is essential to become an architect considering sustainable development.

"The architect must be a prophet, a prophet in the true sense of the word; if he can't see at least ten years ahead, then don't call him an architect"

Frank Lloyd Wright, (source: Green Architecture, James Wines, Taschen, 2000)

Designer's checklist

Review the "client's checklist" and the "contractor's checklist", for further information.

41

Waste minimization involvement

- ❑ Consult the client concerning the waste minimization approaches used, together with the benefits, responsibilities and issues.
- ❑ Raise the client's awareness of the waste minimization issues in Hong Kong and its consideration as a goal for the project.
- ❑ Make sure that all stages of the building process and all parties will consider waste minimization as a priority.
- ❑ Early involvement is necessary to achieve waste prevention and minimization. Decisions should be taken before the generation of waste at an early stage of the design, and sometimes even before, to promote reuse and recycle at the demolition stage.

Work team

- ❑ Allow clear communication between all parties (client, designer, contractor...) at an early stage of the project for better design and planning to minimize waste.
- ❑ Avoid linear process of the building project within the work team. The work should be carried out simultaneously side by side to exchange ideas and knowledge.

Design

- Review Chapter 4 for detailed information.
- **Delay the generation of demolition waste through optimizing existing building lives:**
 - ❑ Consider to the fullest possibilities to reuse building structures through renovation, extension and rehabilitation.
 - ❑ Consider cost comparison between adaptive reuse and new building.
 - ❑ Consider the benefits of reusing structures (historical architecture heritage, economy by reusing materials, less waste disposal...)
 - ❑ Consider proper maintenance to extend building life span.
- **Delay the generation of demolition waste through optimizing new building lives:**
 - ❑ Consider optimization of building lives through: design and loading flexibility, durable materials, and separating layers of building.
 - ❑ Consider design flexibility for longevity to suit occupant needs for as long as possible.
 - ❑ Consider oversized structures and especially foundations to allow building alterations.
 - ❑ Consider design for reuse and recycle through design of dismantling, ease of assembly and disassembly, ease of recycling or reuse materials.

➤ **Minimize waste from construction in the design:**

- ❑ Consider dimensional coordination and standardization to avoid extra cutting on site.
- ❑ Consider modular architecture to simplify construction, and move on site construction off site.
- ❑ Minimize temporary works and consider alternative forms of design and construction methods available.
- ❑ Consider in advance design modifications to avoid abortive works.
- ❑ Consider more detailed designs to avoid abortive works.

Site issues

- ❑ Review contractor checklist to consider waste management on site (reuse and recycle opportunities, etc).
- ❑ Allow cut and fill balance on site.
- ❑ Reuse as much as possible of the excavating spoil material on site (or on other sites) for site formation and filling.
- ❑ Identify areas of contaminated land.
- ❑ Use contractors who reuse, recycle and salvage materials on site or on other sites.
- ❑ Consider selective demolition to increase the amount of reuse and recycle.

Materials

- ❑ Review chapter 5.
- ❑ Consider material control through material management, waste management plan, recycling and reusing, education, ordering, delivery and on site considerations.
- ❑ Consider material selection to minimize waste through durable, reusable and recyclable materials.
- ❑ Consider the use of reclaimed materials (from the original site, other sites or other industries) in new building construction.

Construction methods

- ❑ Review chapter 6.
- ❑ Consider on site low waste technologies such as metal formworks...(Check the related web site).
- ❑ Consider off site construction methods such as prefabrication and modular construction.

Regulation

British Standards

- BS 7750, Specification for Environmental Management Systems.

Practice Notes for Authorized Person

- PNAP 243, Construction and Demolition Waste, June 2000.
- PNAP 245, Waste Minimization – Provision of Fitments and Fittings in New Buildings, December 2000.

Technical Circulars from Works Bureau:

- No.5/98: On Site Sorting of Construction Waste on Demolition Sites.
- No.5/99 & 5/99A: Trip-Ticket System for Disposal of Construction and Demolition Material.
- No.19/99: Metallic Site Hoardings and Signboards.
- No.29/00: Waste Management Plan.
- No.31/00: Specifications Allowing the Use of Recycled Inert Construction and Demolition Material.

References**Books**

- . **Waste Minimization and Recycling in Construction, Design Manual**, CIRIA Special Publication SP 134, 1999.
- . **Managing and Minimizing Construction Waste, A Practical Guide**, J. Ferguson, OBE, N. Kermode, C L Nash, W A J Sketch and R P Huxford, Thomas Telford Publications, London 1995.
- . **Green Guide to the Architect's Job Book**, Sandy Halliday, RIBA Publications, 2000.
- . **Professional Practice for Architects in Hong Kong**, Pace Publishing Limited, Hong Kong, 1997.

43**Web sites**

- . Low Waste Building Technologies
<http://www.cse.polyu.edu.hk/~cecspoon/lwbt>
- . Checklist for Environmentally Responsible Design and Construction (few issues on waste).
<http://www.buildinggreen.com/ebn/checklist.html>
- . Waste Reduction Committee
<http://www.info.gov.hk/wrc>
- . Buildings Department
<http://www.info.gov.hk/bd>