3 MINIMISING AND MANAGING BUILDING WASTE – GOOD MANAGEMENT AND OPERATING PRACTICES

Waste minimisation involves material, procedural and operational practice implementation. In these instances, the implementation usually involves documentation changes, site practices changes and training.

3.1 Causes of Building Waste on Site

Recent research indicates that about 5-10% of building materials end up as waste on building sites. There are many contributory factors to this figure, both human and mechanical, and these are outlined below:

	Causes of Building Waste on Site	**Examples**
Site Management and Practices	➢ Lack of a quality management system aimed at waste minimisation	e.g. lack of waste management plan
	➢ Untidy construction sites	e.g. waste materials are not segregated from useful materials
	➢ Poor handling	e.g. breakage, damage, losses
	➢ Over-sized foundations and other elements	e.g. over design leads to excess excavation and cut-offs
	➢ Inadequate protection to finished work	e.g. finished concrete staircases are not protected by boarding
	➢ Limited visibility on site resulting in damage	e.g. inadequate lighting in covered storage area
	➢ Poor storage	e.g. pallet is not used to protect cement bags from contamination by ground water
	➢ Poor workmanship	e.g. poor workmanship of formwork
	➢ Waste generation inherited with traditional construction method	e.g. timber formwork, wet trade
Delivery of products	➢ Over-ordering	e.g. over ordering of concrete becomes waste
	➢ Method of packaging	e.g. inadequate protection to the materials
	➢ Method of transport	e.g. materials drop from forklift
	➢ Inadequate data regarding time and method of delivery	e.g. lack of records concerning materials delivery

Table 3.1 Causes and examples of building waste on site

Figure 3.1 – 3.14 show the causes and examples of building waste on site.

Figure 3.1 & 3.2 Hacking off concrete becomes concrete waste

Figure 3.3 Broken bag of crush stone

Figure 3.4 Improper stacking of tiles

Figure 3.5 Left over mortar becomes waste

Figure 3.6 Wooden package disposed

Figure 3.7 Cutting waste of reinforcement

Figure 3.8 Waste materials are not segregated from useful material

Figure 3.9 Damage of dry wall panels

Figure 3.10 Cutting waste of dry wall

Figure 3.11 Lost of plaster while applying

Figure 3.12 Improper stacking of blocks

Figure 3.13 Damage of sanitary fitments

Figure 3.14 Cutting waste of tiles

3.2 Estimation and Auditing of Building Waste Generated from the Construction of New Buildings

3.2.1 Estimation

The first step in implementing a waste minimization programme is to estimate the quantity of construction wastes that will be generated from building projects. It can be done using a standard form, and an example is shown in Appendix A. The estimate provides information on the quantities of the different types of waste that will be generated. Based on this information, the direct cost of materials wastage and the consequent cost of waste removal and treatment, for example, sorting can be calculated for the purpose of cost

control.

- Concrete Waste

  The amount of concrete waste, for example, can be estimated if the material wastage level of concrete is known. Recent research indicated that the average wastage level is about 4%, which is considered the norm for the concreting trade in this guideline. However, it could be reduced to 3% if careful material ordering and handling is applied. The amount of waste can be estimated according to:

  Quantity of Concrete Works (m^3) x Material Wastage (%)

- Waste from blockwork and brickwork

  Inert granular waste generated by blockwork and brickwork is estimated to be 10% of the quantity of this work required in the building project. The estimate can be calculated according to:

  Quantity of work done (m^2) x thickness (m) x Material Wastage (%)

- Waste from screeding and plastering

  A higher wastage of 15% is given as the norm since these trades are difficult to control. The estimate can be calculated according to:

  Quantity of work done (m^2) x thickness (m) x Material Wastage (%)

- Waste from timber formwork

  Timber formwork is assumed to have been used at least 12 times before being discarded. The timber waste can be estimated according to:

  Quantity of Formwork (m^2) x thickness (m) ÷ 12 (no of uses)

- Packaging Waste

  Building contractors have little control on the quantity of packaging wastes produced, which is estimated at 5% of the volume of the materials that required packaging, hence

  Volume of packaged construction materials x 5%

- Other Wastes

  There are blank rows in the standard form for the provision of estimates for other types of wastes.

Recent results for the percentage wastage by different trades for public housing projects and private residential buildings are shown in Tables 3.2 and 3.3 for reference.

Trade	Material	Percentage wastage
Concrete	Concrete	3-5%
Formwork	Timber broad	5%
Reinforcement	Steel bars	3-5%
Masonry	Brick and block	6%
Dry Wall	Fine aggregate	5%
Wall screeding	Ready-mix cement	7%
Floor screeding	Ready-mix cement	1%
Wall plastering	Plaster	2%
Ceiling plastering	Plaster	2%
Floor tiling	Tiles	6%
Wall tiling	Tiles	8%
Installation of bathroom fitting	Sanitary fitting	2%
Installation of kitchen joinery	Kitchen joinery	1%

Table 3.2 Percentage wastage of materials for various trades on public housing projects

Trade	Material	Percentage wastage
Concrete	Concrete	4-5%
Formwork	Timber broad	15%
Reinforcement	Steel bars	1-8%
Masonry	Brick and block	4-8%
Dry Wall	Fine aggregate	6-10%
Wall screeding	Ready-mix cement	4-20%
Floor screeding	Ready-mix cement	4-20%
Wall plastering	Plaster	4-20%
Ceiling plastering	Plaster	4-20%
Floor tiling	Tiles	4-10%
Wall tiling	Tiles	4-10%
Installation of bathroom fitting	Sanitary fitting	1-5 %
Installation of kitchen joinery	Kitchen joinery	1-5 %

Table 3.3 Percentage wastage of materials for various trades for private residential building

Based on waste generation per GFA, it has been found that the generation rate of construction waste is in the range of $0.125m^3$ to $0.25m^3$ (waste index) per gross floor area GFA (m^2).

A contractor uses the following figures:

Private housing projects Waste index = 0.250 m^3/m^2 GFA

Government housing projects Waste index = 0.175 m^3/m^2 GFA

Commercial office projects Waste index = 0.200 m^3/m^2 GFA

And,

The total waste generated from the project (W) = GFA of the project x Waste index (depending on the type of the project

3.2.2 Auditing

The actual amount of waste produced will be dependent on the practice and experience of each company. The wastage level should be compared with the norm, i.e. the average performance of the industry. More importantly, material and waste audits should be carried out in order to identify areas that can be improved in subsequent projects. The procedure for carrying out a material and waste audit is as follows:

- Record the quantities of materials employed on construction sites,
- Record the storage for the materials periodically,
- Record the quantities of work done using each material periodically,
- With the data available, monitor the material wastage level periodically by comparing the quantities of materials used with the corresponding quantities of work done,
- Investigate the causes of material wastage,
- Evaluate the effectiveness of corrective measures,
- Compare with the company material wastage level standard,
- Recommend preventative measures to reduce material wastage levels,
- Recommend methods to reduce construction waste, and
- Set up a computerized data collection system for material and waste audit purposes.

(mainly sourced from Cheung, 1993)

The following are four examples of calculation methods of wastage levels and waste indices:

1. Calculating the waste index

Objective

The following information and calculations are aimed at helping the Project Manager to anticipate the quantities of waste to be produced on a project in order to establish awareness of waste management, to develop good planning on resources and environmental management and to reduce the wastes generated during all stages of a construction project.

Methodology

1. (V) = Truck volume (m^3)
2. (N) = Total no. of trucks loads for waste disposal
3. (W) = Total waste generated by the project (m^3) = (V) x (N)
4. (C) = Waste index = (W)/ GFA

i.e. $1m^2$ area of GFA generates (C) m^3 of waste

Please enter (1) to (3)

(1) GFA of the project:	20000.00	m^2
(2) truck volume:	13.00	m^3
(3) total no. of trucks for waste disposal:	300.00	no.

total waste generated from the project: 3900.00 m^3

waste index 0.195 m^3/m^2 GFA

2. Calculating total waste generated by a project

Formula

total waste generated by a project = GFA of the project x waste index

Please enter the following data:

GFA of the project:	20000.00	m^2
waste index:	0.13	m^3/m^2 GFA

estimated total waste generated from the project: 2600.00 m^3

3. Calculation of Wastage Level - Concrete

formular

(1) Cumulative order quantity

(2) Cumulative workdone

(3) = (1) - (2) = wastage

(4) = (3) / (2) = wastage % including disposed and reused materials

please enter (1), (2) and the program will automatically calculate (3), (4)	January	February	March	April	May	June	July	August	September	October	November	December
(1) Cumulative quantity of ordering (m^3)	48,000	55,000	60,000	64,000	68,000	72,000	78,000	83,000	90,000	94,000	99,000	120,000
(2) cumulative workdone (m^3)	46,500	53,000	57,500	62,300	65,500	70,500	75,500	80,500	86,500	90,500	95,500	115,000
(3) wastage (m^3)	1,500	2,000	2,500	1,700	2,500	1,500	2,500	2,500	3,500	3,500	3,500	5,000
(4) actual wastage percentage	3.226%	3.774%	4.348%	2.729%	3.817%	2.128%	3.311%	3.106%	4.046%	3.867%	3.665%	4.348%

allowable wastage level: 4%

4. Calculation of Wastage Level - Reinforcement

formular

(1) cumulative quantity

(2) cumulative workdone

(3) calculated materials on site = (1)-(2)

(4) measured materials on site

(5) wastage = (3) - (4)

(6) wastage level % = (5)/(2)

Please enter (1), (2) and (4) and the program will automatically calculate (3), (5) and (6)

	January	February	March	April	May	June	July	August	September	October	November	December
(1) cumulative quantity of ordering (kg)	3,840,000	4,900,000	7,450,000	9,850,000	12,200,000	15,000,000	17,670,000	20,300,000	22,930,000	25,560,000	28,500,000	31,200,000
(2) cumulative workdone (kg)	2,080,000	3,160,000	5,660,000	7,810,000	9,960,000	12,460,000	14,960,000	17,460,000	19,960,000	22,460,000	24,960,000	27,460,000
(3) calculated materials on site (kg)	1,760,000	1,740,000	1,790,000	2,040,000	2,240,000	2,540,000	2,710,000	2,840,000	2,970,000	3,100,000	3,540,000	3,740,000
(4) measured materials on site (kg)	1,670,000	1,650,000	1,580,000	1,723,000	1,866,000	2,016,000	2,166,000	2,316,000	2,496,000	2,596,000	2,696,000	2,776,000
(5) wastage (kg)	90,000	90,000	210,000	317,000	374,000	524,000	544,000	524,000	474,000	504,000	844,000	964,000
(6) actual wastage level %	4.33%	2.85%	3.71%	4.06%	3.76%	4.21%	3.64%	3.06%	2.37%	2.24%	3.38%	3.51%

allowable wastage level: 4%

3.3 Reduction of Materials Wastage

Support from the management is vital in order to be successful in the reduction of materials wastage. The following guidelines can be used for the reduction of material wastage.

Material Ordering and Handling	◆ Purchasing inventory should be carefully controlled to prevent wastage of materials.
	◆ Adopt just-in-time ordering and to ensure materials arrive on site when they are needed, thereby avoiding damage while stored on site and additional moving of materials.
	◆ Order appropriate material sizes to minimize cutting, and order appropriate quantities to avoid excess.
	◆ Designate central areas for cutting and storage so reusable pieces can easily be located,
	◆ Do not use tropical hardwood for temporary works. Use metal falsework instead.
	◆ Avoid buying poor quality materials. If the wear-out rate is high, another source of supply should be considered.
	◆ Whenever possible, packaging materials should be returned to the supplier for reuse. In some cases the supplier holds a deposit until the pallets are returned.
	◆ Avoid overloading limited storage space on site
	◆ Avoid unnecessary handling
	◆ Whenever using timber for a specific purpose, try to avoid treating it with chemicals and using nails, as this will make it difficult to reuse/recycle the timber afterwards.
Site Management and Practices	◆ Coordinate with designer and specification writer to ensure dimensional coordination of building design with materials and components to minimize cutting waste.
	◆ Coordinate with designer and specification writer to use alternative materials instead of timber.
	◆ Provide training to workers to improve their skill in handling materials and performing construction work.
	◆ Review waste management periodically to identify additional waste reduction alternatives.
	◆ Consider reduction of construction waste and awareness of environmental protection as basic requirements in building management.
	◆ Improve building construction technology by research or adoption.
	◆ Employ competent subcontractors and skill labourers.

Table 3.4 Measures for Reduction of Material Wastage

Materials	Reason for likely waste	Preventative action
Vegetable Soil	Wrong position of spoil heap and extra handling due to wrong level and mixed with harmful material. Imported soil not correctly checked.	Pre-plan area for temporary soil heaps. Avoid double handling. Storing in moulds over 2m high. Avoid disturbance of spoil heaps.
Hardcore	Excessive excavation using it for production waste.	Dig to correct levels. Record quantities used and costs.
	Quantities not correctly checked	Check vehicles by seeing load and docket.
	Unsuitable material	Ensure in accordance with specification. Avoid sulphate prone material.
Aggregates	Misuse in lieu of hardcore for temporary work. Lost in mire.	Store in prepared areas on bunker boards (or concrete bases of road, etc.) Use membrane if no soil underneath.
Timber Formwork	Maximum no. of uses not realized. Use for other purposes	1.Careful moving from set to set, floor to floor. 2. Spare bin of off cuts available for other purposes.
Scaffolding and formwork sundries	Losses in ground	Care in handling, use of cage, when dismantling.
	Loss unaccounted for	Checking of timber on and off site to avoid accounting errors.
	Misuse of scaffold boards	Scaffold boards use to be controlled.
Concrete site-mixed	Loss by unclean batching plant	Batching plant to be on hard standing
	Over-mixing losses	Mixing to be controlled to operations in progress.
	Movement losses	Careful movement, no overloading.
	Loss at workplace	Care in placing, droppings to be collected before they harden.

Materials	**Reason for likely waste**	**Preventative action**
Concrete Ready mixed	Careless ‘dribbling’ Unloading	Care when vehicle unloads. Loads to be ordered in accordance with operations. Reserve operations for surplus of load.
	Excess load waste Loss at workplace	Care in placing droppings to be collected before they harden.
Reinforcement	Damage to mesh and bars	Careful placing on clear surface by type and weight. Ideally on racks.
	Loss in mud	No bars to be left at workplace.
	Excess use of tying wire	Use reels and save surplus for odd lengths.
Bricks	Losses at all stages	Care in every movement, square and firm stacking.
	Tipping and form of stacking.	Avoid tipping any bricks, care in stacking all bricks.
Blocks	Losses at all stages	(As before for bricks)
Mortar	Hardened mortar at workplace	Avoid over-mixing particularly towards the end of working day
Asphalt roofs & paving	Minute damage – consequential leaks etc.	Avoid walking over finished work particularly carrying heavy loads or long pipes which can hit ground.
Timber (carcassing)	Loss in handling to and on site	Care in unloading, stacking off ground by size.
	Long off cuts	Careful scheduling to trade sizes.
	Loss by other use	Careful scheduling to trade sizes. Provide bins for off cuts to avoid cuts to longer pieces.
Timber (joinery grade)	Substitution	Control use of timber from site storage.

Materials	Reason for likely waste	Preventive Action
Boarding	Waste in stacks	Stack horizontally off ground under cover.
	Cutting waste	Save ‘off-cut’ for smaller parts of nearby work.
Nails, screws	Losses at workplace	Use nail boxes or pouches.
Ironmongery	Losses from stores	Correlate issues from stores to size of operations.
Joinery fittings Doors & windows	Damage in handling	Care in handling, lay flat, cover & protect, always keep on shores
Plasterboard	Damage (unloading)	Care in removing from lorries.
	During movement	Always keep flat, do not overload forklift.
	Excess cutting	Usually design waste – try to obtain recompense.
Plaster & Cement	Broken bags	Care in handling and keep in dry.
	Partly used bags	All part-used bags to be returned to store after operation complete or at end of day, keep dry when using during operation.
Glass Double & pre-glazed windows	Damaged stack	Care in stacking, avoid catches cracking adjacent panes.
Pipes	Broken sockets	Keep stack away from movement area.
	Pipes falling off when bands cut.	Stack on level surfaces; do not release bands until pipes to be used.
Drain ware Goods	Broken at stack	Site stacking area away from corners where likely to be hit by site vehicles.

Table 3.5 Schedule of materials – additional data for waste control
(Source: Skoyles, 1987)

Table 3.5 indicates the likely reasons for waste generation of each material and provides the preventive actions.

It is important to store materials correctly to avoid damaging them. If materials are damaged by poor storage, they may not meet the specification and therefore become waste. Good storage saves time and money and wastes fewer raw materials. Use the raw material storage table (Table 3.6) to guide the storage decision. It can help in reducing the amount of wastage – and help contractors keep to allowable wastage percentages.

Materials	**Store Under cover**	**Store in secure area**	**Store on pallets**	**Store material bound**	**Special Requirements**
sand, gravel, rock, crushed concrete					Store on hard standing base to reduce wastage. Store in bays if large quantities
plaster, cement	✔		✔		Avoid material getting damp
concrete, paviors				✔	Store material in original packaging until used, and protect from vehicle movements
bricks			✔	✔	Store material in original packaging until used, and protect from vehicle movements
clay pipes, concrete pipes			✔	✔	Use stoppers and spacers to prevent rolling, and store in original packaging until used
wood	✔	✔		✔	Protect all types of wood from rain
metals	✔	✔			Store in original packaging until used
any internal Fittings	✔	✔			Store in original packaging until used
cladding	✔	✔			Wrap in polythene to prevent scratches
sheet glass, glazing unit		✔	✔		Protect glass from breakage due to bad handing or vehicle movements
paints		✔			Protect from theft
bituminous felt	✔	✔			Usually store in rolls and protect with polythene
insulting material	✔	✔			Store under polythene
ceramic tiles	✔	✔		✔	Store in original packaging until required
glass fibre	✔			✔	
ironmongery	✔	✔			
oils		✔			Store in bowers, tanks or cans according to quantity – protect container from damage to reduce likelihood of spillage – use a bund
kerbstones				✔	Protect from vehicle movements & tar spraying to reduce damage
clay & slate tiles		✔	✔	✔	Keep in original packaging until used
topsoil, subsoil					Store on hardstanding base to reduce wastage and keep segregated from potential contaminants
precast concrete units					Store in original packaging, away from vehicular movements

Table 3.6 Raw Material Storage Table

(Source: CIRIA Special publication 133, 1997)

Figure 3.15 – 3.20 shows some good examples for storage of materials.

Figure 3.15 Basin in wooden boxes

Figure 3.16 Stacking of blocks on pallet

Figure 3.17 Pallets to be returned to supplier

Figure 3.18 Stacking of glass cutting scrap for selling

Figure 3.19 Storage of cement bags

Figure 3.20 Storage of in wooden box

The possibilities for wastage of materials, and therefore its prevention, can also be identified by following the processes of a building activity. Figure 3.21 shows a flow chart for tiling works that highlights the generation of waste at each stage.

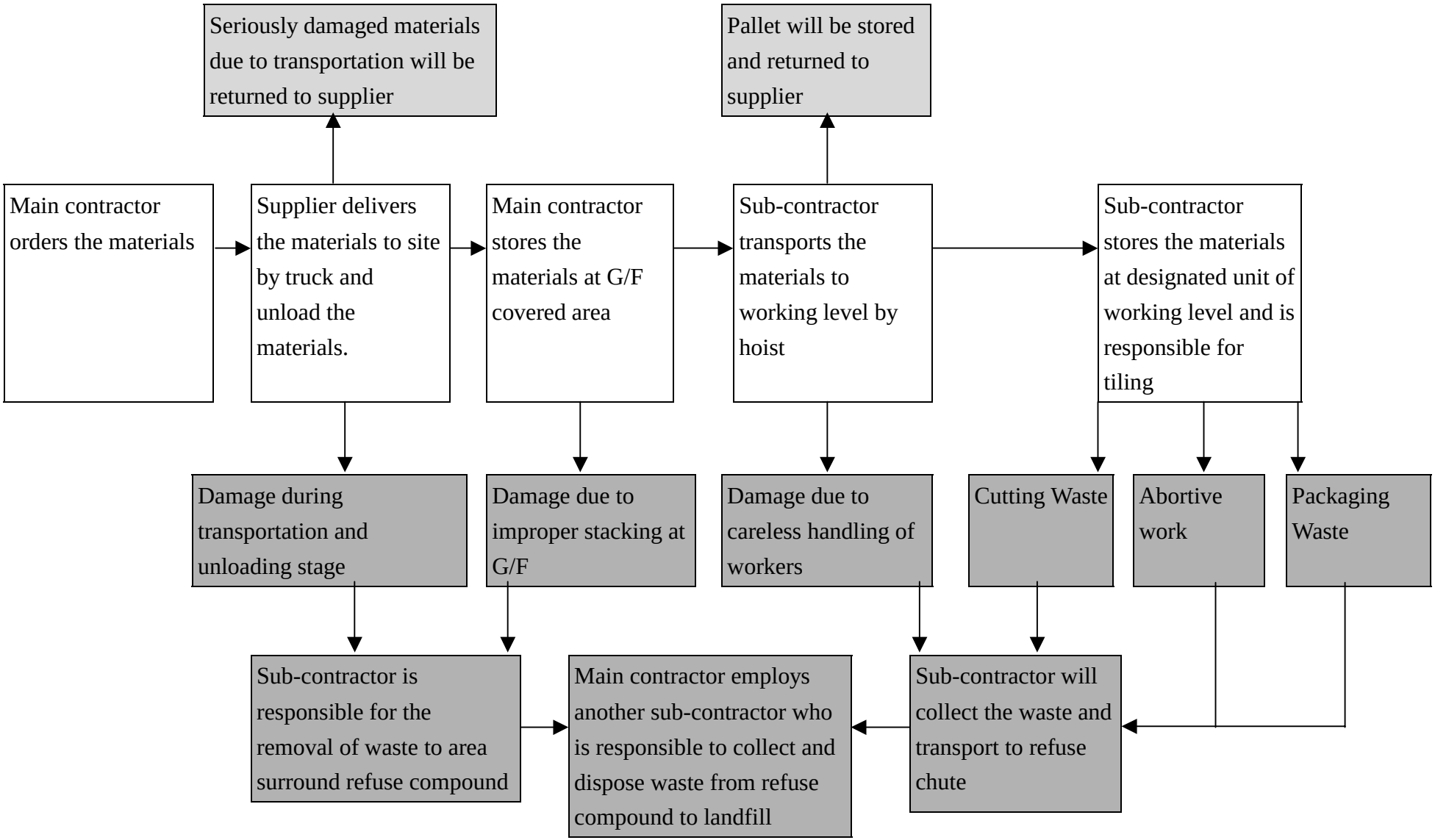

Figure 3.21 Flowchart showing tiling work processes

Recommendations for minimizing waste generated from tiling works:

- ✧ The contractor should give instruction to the workers on the proper materials handling and stacking methods, e.g.
  - avoid over supply of material to the working area by creating a trial sample floor
  - always store on a firm and level base
- ✧ Packaging is designed to protect the materials and may also provide integrity to load, so only remove it when the tiles are required for use.
- ✧ The cutting waste can be reduced by improving size co-ordination and better material utilization.

3.4 Waste Management Plan

Before the commencement of work, the contractor should prepare a Waste Management Plan, which provides an overall framework for waste management and reduction. It identifies major waste types and defines ways for waste reduction.

The following are the areas that may be covered in a Waste Management Plan:

1. Organizational chart with responsibilities identified;
2. Designation of an on-site waste management manager;
3. A meeting, monitoring and auditing programme;
4. Types of waste generated, their estimated quantities and timings;
   - site clearance waste
   - excavation
   - building waste
   - demolition waste
   - chemical waste

- general refuse

4. A statement of measures taken to reduce, salvage, reuse and recycle waste material on and off site;

5. A list of materials to be salvaged, reused or recycled with estimated quantities;

6. Methods of sorting, segregation, labeling, storing, protecting and disposing of all the various types of waste materials generated. The various waste materials may include but are not limited to the following:

   a) Surplus excavated material
   b) Vegetable matter
   c) Topsoil and subsoil
   d) Rock
   e) Hardcore/rubble
   f) Concrete
   g) Cement dust
   h) Masonry/bricks/concrete blocks
   i) Tiles and paving
   j) Steel and other metals
   k) Timber
   l) General refuse
   m) Hazardous wastes (oils, paints and chemicals)
   n) Packaging materials

7. The location, layout and details of designated sorting and storage areas. Describe necessary adaptations as the works progress;

8. For materials delivered to site, a statement that packaging materials and pallets will be reused, recycled or returned to the supplier;

9. Methods of removing waste from buildings including details of refuse chutes and ground floor waste holding areas;

10. A method statement of how the site will be kept clean with debris

minimised;

11. Quantities of waste requiring off-site disposal and disposal outlets;

12. A method of maintaining records for the monitoring of the disposal of all materials.

13. A method statement for implementing the Trip-ticket System with the names of the Public Fill and Landfill destinations identified and the predicted frequency of disposal at each site. Fully describe the method of separating inert and non-inert waste;

14. A statement of alternatives to the disposal of wastes at landfills with the estimated number of trips to landfill sites saved;

3.5 Role of Site Waste Manager

While all people involved should be encouraged to contribute their ideas and suggestions on ways to minimize waste, one person (or the Environmental, Health and Safety Manager) should act as the Site Waste Manager, responsible for overseeing the management of building wastes. This person will be responsible for managing waste reduction initiatives and coordinating the activities of other employees.

The key role of a site waste manager is as follows:

- Ensure that all relevant legislation and the contractor’s duty of care is complied with.

- Initiate waste reduction, reuse and recycling.

- Ensure all site personnel know their responsibilities for site waste management.

- Co-ordinate waste management on site, gather data about waste on site, keep accurate records on waste movement on and off site.

- Ensure that all waste storage areas and containers are properly labelled to show site workers where to deposit specific materials.

- Be aware of the construction activities currently taking place on site and the activities planned in the short term. Conduct a survey of wastes likely to be generated on site and keep a record of them for planning ahead.

- Whenever possible, ensure the re-use or recycling of material already on site before it is carted away or new materials are imported.

- Obtain a list of potential buyers or collectors of materials to be re-used or recycled.

- Encourage all site personnel to use their initiative in coming up with ideas of how to reduce, reuse and recycle wastes. Set up an 'Ideas Board' where people can have their say and record suggestions that they may have for reducing, reusing and recycling wastes.

- Inform designers so that waste can be reused and recycled on site or on another site.

(mainly sourced from CIRIA Special publication 133, 1997)

3.6 Managing Subcontractors

It can be very difficult to coordinate waste management on sites where there are a large number of subcontractors. The following are some supervision suggestions:

- Many sites are now using a system of allowable waste percentages. In the early pre-work agreements the site manager decides how much waste is acceptable, and agrees a percentage with the subcontractor.

  If they waste more than the agreed amount, they can be charged the extra costs. This is a great incentive to reduce wastes by efficient use of

materials. The lower the allowable percentage, the more care people will take with materials. Setting the right level is crucial. Allowable wastage percentages can be applied to all materials or restricted to those that are expensive or commonly generate excessive wastage.

- Make subcontractors responsible for both purchasing the raw materials they need, and disposing of any waste material from their activities. This will give them a direct financial incentive to use materials efficiently with the minimum of wastage.

- Make subcontractors aware of wastage and the costs involved in dealing with wastes.

- Hold regular meetings to discuss wastage on site.

(mainly sourced from CIRIA Special publication 133, 1997)

3.7 Sorting and Separation of Building Waste

Building waste can be sorted on-site or off-site. Where off-site sorting is chosen, the mixed waste materials will be transported to an intermediate sorting plant for processing. Execution of waste sorting is quite difficult as all the waste has already been mixed together.

Where on-site sorting is chosen, there are three on-site construction waste sorting methods available. The contractor may choose the appropriate sorting method depending on the site space available, site layout, cost of refuse chutes, labour available, the time required and site safety.

Alternative 1:

- Two refuse chutes for each building block: one for inert waste and the other for non-inert waste;
- Separate collection of inert waste and non-inert waste from the refuse chutes:
- Inert waste and non-inert waste are clearly transported by different trucks and disposed of at public filling area and landfills separately.

Issues to be considered:

- ✧ Source separation facilitates for sorting of inert and non-inert waste material.
- ✧ Cost of provision of two sets of refuse chutes
- ✧ If the refuse chutes are installed inside the building, two sets of slab openings are required. Extra cost is needed to concrete the openings at a later stage.
- ✧ Extra space for two sets of collection pits at ground floor.
- ✧ Prevention of remixing of waste at collection pits.

Alternative 2:

- ■ One refuse chute for each building block;
- ■ Only one type of waste, either inert or non-inert waste will be collected separately and removed within a period of time (e.g. every one or two days).

Issues to be considered:

- ✧ Frequency of collecting the inert and non-inert waste at different times, extra management is required.
- ✧ Extra space and cost for two sets of collection pits at ground floor.
- ✧ If one collection pit is provided, the collected waste must be removed before the next different set of waste is lowered down. The grabber truck may mot be fully loaded in this case.
- ✧ Prevention of remixing of waste at collection pits.

Alternative 3:

- ■ One refuse chute for each block;
- ■ A sizable pit for waste storage on the ground level;
- ■ Manual sorting of waste at the pit;
- ■ Separate removal of sorted wastes.

Issues to be considered:

- ✧ Location and availability of site space for the waste storage pit and containers for different type of waste.
- ✧ Site safety of waste sorting workers; setting up of a shelter to protect the workers.
- ✧ Labour requirement and availability

- ✧ Cost for extra workers to carry out the sorting of waste.
- ✧ Sorting of mixed waste is more difficult than source separation.

3.8 Trip Ticket System

For more effective control, the Works Bureau has established a system, known as the Trip-ticket System in public works contracts for the proper disposal of C&D waste at public filling facilities or landfills. For details of the system, refer to the Works Bureau Technical Circular No.5/99 at Works Bureau's web site@www.wb.gov.hk.

A brief description of the system is as follows:

1. At the planning stage of a contract, the project officer seeks confirmation from the Public Filling Sub-committee (PFSC) of the Environment and Foods Bureau on the public filling facilities that are available for disposal of the C&D waste and the acceptance criteria.

2. The project officer also seeks confirmation from the Environmental Protection Department (EPD) on the landfills that are available for disposal of the C&D waste and the acceptance criteria.

3. The project officer then specifies the names of the facilities and acceptance criteria in the tender documents.

4. Upon commencement of construction, the Contractor shall produce a Construction and Demolition Material Disposal Delivery Form for every vehicular trip transporting the C&D waste to the designated public filling facilities and/or landfills. An example of the delivery form is attached at Appendix C.

5. For each vehicular trip, the Contractor shall obtain a receipt from the operator of the public filling facility or landfill. The contractor is required to submit the original receipt to the Architect's/Engineer's Representative who carry out the reconciliation based on the monthly summary reports provided by either PFSC or EPD.

The particular specification of the above arrangement is attached in the Appendix B for reference.

The system has been adopted by the Housing Authority and the Works Departments. Many sub-vented organizations, such as KCRC and MTRC will also adopt the system in their new contracts. It is strongly recommended that the system be implemented in private sector projects for better control of C&D waste disposal. The project administrators for private developments could apply, through PFSC and EPD, for designated public filling facilities or landfills for the disposal of their C&D waste.

3.9 Relevant Government's Practice Notes and Technical Circulars on C&D Waste Management

The Buildings Department has issued Practice Notes and the Works Bureau has issued Technical Circulars for the minimisation and management of C&D waste. Furthermore, the Lands Department and Planning Department together with the Buildings Department have also issued Joint Practice Notes on Green and Innovative Buildings. This section briefly introduces and describes the relevant Practice Notes and Technical Circulars.

3.9.1 Relevant Practice Notes from Buildings Department

- No. 153 Tropical Hardwood Timber

  This Practice Note is concerned with reducing the use of tropical hardwood timber in Hong Kong. Alternative materials are suggested for use in hoardings, temporary formwork and internal finishes.

- No.170 Metal Refuse Chutes at Construction Sites

  This Practice Note points out that old metal barrels are commonly used as refuse chutes in building construction sites. It suggests alternative materials should be used and chutes should be installed in internal areas of the site so as to reduce the noise levels.

- No.243 Construction and Demolition

  This Practice Note reminds readers of the need to consider waste generation and its management at the planning and design stage as well as at the construction stage of a building development. The Waste Management Plan concept and the Trip Ticket System are introduced.

- No. 245 Waste Minimisation
  Provision of Fitments and Fittings in New Buildings

  A working group (WG) comprising government officials and representatives of the building industry has studied the issue of provision of sanitary fitments in new buildings. The WG has recommended that modification of the relevant building regulations be considered so as not to necessarily require certain sanitary fitments to be installed at the time of issuing an occupation permit. Individual cases to be judged on their merits.

3.9.2 Relevant Technical Circulars from Works Bureau

- No.4/98 and No. 4/98A Use of Public Fill in Reclamation and Earth Filling Projects

  This Circular promulgates policy which requires reclamation or earth filling projects with imported fill requirements of 300,000 m^3 or more, to consider using public fill.

- No.5/98 On Site Sorting of Construction Waste on Demolition Sites

  This Circular promulgates that, as from 1st April 1998, all demolition contracts shall include a requirement for on-site sorting of all C&D material prior to disposal. A particular specification clause shall be included in the tender documents for mandatory on-site sorting, processing and disposal of the same.

- No. 5/99 & 5/99A Trip-ticket System for Disposal of Construction and Demolition Material

  This Circular promulgates the policy for implementing a Trip-ticket system in PWP contracts for the proper disposal of C&D material at public filling facilities or landfills.

- No.19/99 Metallic Site Hoardings and Signboards

  This Circular establishes a policy requiring the use of metallic site hoardings and signboards in order to reduce the quantity of timber used on construction sites.

- No. 29/00 Waste Management Plan

  This Circular introduces the requirement that contracts must include the preparation and implementation of a waste management plan.

- No. 31/00 Specification Allowing the Use of Recycled Inert Construction and Demolition Material

  This Circular promulgates a corrigendum to the General Specification for Civil Engineering Works (1992 Edition) with a view to allowing the use of suitable recycled inert construction and demolition (C&D) material in PWP projects.

3.9.3 Relevant Joint Practice Note from the Buildings, Lands and Planning Departments

- No.1 Green and Innovative Buildings

  This joint Practice Note sets out the incentives provided to encourage the incorporation of green features in building development, and the procedures for application for them under the Buildings Ordinance, the Lease Conditions and the Town Planning Ordinance, where relevant.