The need for effective waste management planning on site

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Declaration by student

I, the undersigned, hereby confirm that the attached treatise is my own work and that any sources are adequately acknowledged in the text and listed in the bibliography.

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Signature of acceptance and confirmation by student
Abstract

Title of treatise: The need for effective waste management planning on site.

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The effective monitoring of wastes generated, placed and removed is most of the time not done. The latter means that time, money, fast and effective removal, recycling of waste contamination, health, theft and safety are sacrificed. This study concentrated on the main problem of too much waste generated on site due to various different reasons.
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1. Introductory chapter

1.1 Background

The cleaning manager is responsible to adopt on-site sound waste management practices.

The effective monitoring of wastes generated, placed and removed is most of the time not done. The latter means that time, money, fast and effective removal, recycling of waste contamination, health, theft and safety are sacrificed.

According toe Bahu, Crittenden and O’Hara (1997:7) the discipline of management can be generalized as data gathering/planning/monitoring and implementing all of the necessary steps to achieve a given objective within certain constraints.

1.2. Main problem

The results of ineffective construction waste management are huge volumes of waste generated, big numbers of waste placement areas and difficulty in economical, fast and effective disposal of waste on a big building site.
1.3. **Sub problems**

a. What is the financial implication of proper waste management principles?

b. How can training of staff and sub-contractors improve health/safety/waste disposal on site and have a minimal impact on the environment?

c. How the best areas for waste loading and offloading are identified/allocated and how can you provide security to prevent theft from the site?

d. On-site recycling methods and minimising methods of waste generation

1.4. **Hypotheses**

a. Saving costs through good/proper and sound waste management planning.

b. Training will vastly improve staff and sub-contractors and their workers health/safety/waste disposal practises on-site and impact on the environment.
c. With good/sound and proper planning of waste areas the sub problem of identifying/allocating of waste loading and offloading points will be addressed and incorporating of high technology will prevent theft on-site.

d. Innovative technology for recycling waste and briefly explain waste minimising practises and methods?

1.5. **Delimitations**

This research is limited to knowledge and know how gained as a first encounter, as a newly qualified Quantity surveyor at UP (University of Pretoria), on the construction site of the new Department of Foreign Affairs in Soutpansberg road Pretoria (DFA).

1.6. **Definition of terms**

1.6.1 **Management**

The principal of management can be generalized as data gathering, planning, monitoring and implementing all of the necessary steps to achieve a given objective within certain constraints.
1.6.2 Waste Management Planning

Waste management should be an integral part of a project's development. Each of the principal project participants—the Owner, their Architectural and Engineering (A/E) services (or Construction Management consultant), the Contractor, and Subcontractors—will engage in waste management to some degree throughout the project. Initially, the Owner and their A/E must establish waste reduction goals and define what levels of diversion are achievable and reasonable under the project's conditions.

1.6.3 Construction Waste

Waste materials generated by construction activities, such as scrap, damaged or spoiled materials, temporary and expendable construction materials, and aids that are not included in the finished project, packaging materials, and waste generated by the workforce.

1.6.3.1 Waste Materials

The vast majority of construction waste and demolition debris materials can be reused on site, salvaged for reuse on-site or elsewhere, or recycled. Diverting 90% of construction jobsite waste and over 80% of demolition debris from landfill disposal is not uncommon. These materials include:
- Landscape and land clearing debris (green wood materials)
- Asphalt pavement
- Gravel and aggregate products
- Concrete
- Masonry scrap and rubble (brick, concrete masonry, stone)
- Metals (ferrous and nonferrous)
- Clean wood (dimensional lumber, sheet goods, millwork, scrap, pallets)
- Plastics (films, containers, PVC products, polyethylene products)
- Asphalt / bituminous roofing
- Insulation materials
- Glass (un-tempered)
- Door and window assemblies
- Carpet and carpet pad
- Fibrous acoustic materials
- Ceiling tiles
- Plumbing fixtures and equipment
- Mechanical equipment
- Lighting fixtures and electrical components
- Cardboard packing and packaging
- Others
1.6.4 Other definitions

- **Land Clearing Debris:** Vegetative waste materials removed from a site.

- **Disposal (or Land filling, or Landfill Disposal):** Depositing materials in a solid waste disposal facility licensed for the subject materials (in this case, C&D materials).

- **Recycling:** Introducing a material into some process for remanufacture into a new product, which may be the same or similar product or a completely different type of product.

- **Salvage:** Recovery of components, products, or materials for the purpose of reusing them for the same or similar purposes as their original use.

- **Reuse:** The subsequent use of a material, product, or component upon salvage.

- **Deconstruction:** The systematic disassembly of a building, generally in the reverse order of construction, in an economical and safe fashion, for the purposes of preserving materials for their reuse.

- **Source Separation (or Segregation):** Keeping materials separated by type from the time they become scrap or waste until the time they are salvaged or recycled.

- **Off-Site Separation:** Sorting and separating commingled waste at a location other than the
construction jobsite, that location having been established for the purpose of recycling.

- **Commingled:** Materials of varied types deposited into the same receptacle or pile, or mixed together during demolition.

- **Waste:** Any (a) substance which constitutes a scrap material or an effluent or other unwanted surplus substance arising from the application of any process and (b) any substance or article which requires to be disposed of as being broken, worn out, contaminated or otherwise spoiled. (Section 75 of EDP 1990)

### 1.6.5 Research method

**a. Literature research**
- Research and development reports
- Journals
- Newspapers
- Text books
- Reference works
- Electronic media

**b. Human information resources**
- Consultants on-site (DFA Pretoria) through questionnaires
- Lecturers
- Discussions
- Consultation with experts
Chapter two

Saving costs through good/proper and sound waste management planning

2.1 Introduction

The financial implication of waste management on site is one of the most important aspects of waste management. It is also the financial effect that waste accumulation and waste removal on site has on the contractor/company. Meaning: what are the financial implications cost wise, for the contractor to get the waste placed and removed?

2.2 What are the financial implications of proper waste management principles?

2.2.1 The financial effect for the contractor of waste removal on site.

The contractor plays a big part in the waste removal process. It is the contractor who at the end of the day will be responsible for the removal of all the waste generated on site. The contractor will therefore be responsible for the cost of the waste removal. On a big building site this cost can be very
high due to the huge volumes of waste generated from
the building work done by the sub-contractors.

A construction site generates huge volumes of waste.
This waste is from paper in the office to building
rubble on site. At the DFA Pretoria there are huge
amounts of waste generated from various sub-
contractors that is placed in, depending on the
progress stage, sometimes, in difficult accessible
areas.

2.2.1.1 DFA Scenario A:

The following were my observations at the DFA in
Pretoria;
At the DFA (Department of Foreign Affairs) project in
Pretoria the main contractor is CONCOR. The joint
venture is with Illima, Matheo and Trencon
construction firms for a design and building
contract. The practical completion date is end of
May 2009.

At the DFA site, CONCOR is dealing with a huge
wastage problem on a daily basis. Huge amounts of
waste are generated and dumped everywhere, but in the
waste bins.

According to the waste management plan, CONCOR has
allocated waste bins on seven specified places but
the sub-contractors seem to ignore them. The cost implication of the latter is unnecessarily high.

Examples of some of the waste generated in an ordinary building contract situation are the following:

- Broken ceiling boards
- Broken Partitioning boards for partitioning
- Replaced tiles
- Old insulation material used in the ceilings
- Building rubble (blocks/bricks etc.)
- Old cement dagha
- Used cement bags
- Twisted electrical PVC conduit pipes
- Packaging material

Each bin that is filled one hundred percent with the same type of waste material is costing CONCOR a thousand rand to be removed by a waste removal company. There are fifteen waste bins on site. Waste is removed on Tuesdays and Thursdays. This means CONCOR is paying thirty thousand rand per week just for the removal of waste. On a monthly basis it amounts to hundred and twenty thousand rand. The cost per year comes to almost 1, 5 million Rand’s worth of waste.
There is also a labour and a time component coupled to the financial implication. A lot of workmen/women are used for the cleaning process. On average it takes two labourers half a day to fill up a waste bin.

2.2.1.2 DFA Scenario B:

A pile of partitioning boards takes two labourers half a day to remove from the dumping site into a waste bin. A tipper is also needed for the removal process if they are not going to remove it by hand. The tipper also cost money. The hiring of it, the operator and fuel for the time it is working must be paid for. All of the above mentioned cost can be calculated and added up to give a sum total. This amount the cost to CONCOR to remove the specific pile of waste in half a day.

2.2.1.3 Mixed items per waste bin

A waste bin with mixed construction waste costs 50% more to remove than a waste bin with construction waste of the same kind.

2.3 How the contractor can save costs by applying effective and productive waste management principles on site
2.3.1 The following can be done to save money for the contractor and implement good and sound waste management principles:

- Providing an effective training programme.
- Agree with sub-contractors to request waste bins at specified places to ensure fast and effective removal of waste.
- Agree with sub-contractors to incorporate a paper trailing system to trace each sub-contractor’s waste generated and removed.
- To minimise waste production through proper placing of waste bins in accessible areas that can be reached quickly and easily.
- Jobsite waste reduction- waste minimization-up to 10-12% of a project's construction waste stream can be cardboard alone. While protecting new materials is necessary, the Contractor can direct their subcontractors and suppliers to reduce extraneous packing material.
- Use scrap in lieu of cutting full new materials.
- Direct subcontractors and trades to collect and keep scrap at cutting and fabricating locations.
- Collect paints and liquids from almost-empty containers; avoid disposing of useable materials simply because there is not enough in one container to finish a job.
- For materials that are heated, mixed, exposed to environmental conditions, or otherwise subject to spoilage, limit preparation of these materials to
quantities which can be installed within their expiration times. Working in smaller batches will reduce the necessity to throw out expired or spoiled materials.

- Ensure volatile materials, and materials that degrade when exposed to heat, cold, or moisture are protected from spoilage and are not wasted.
- Recycle damaged components, products, and materials, or disassemble them into their constituent materials for recycling.
- Establish a return or buy-back arrangement with suppliers. Alternatively, unused, or used but serviceable materials and products can be sold to architectural salvage or used materials retail outlets.
- Donations to a non-profit outlet, such as a Habitat for Humanity (HFH) are usually tax-deductible.
- Identify various waste streams.
- Realise the value of your waste to you through rebates via recycling initiatives.
- Reduce waste to landfill.
- Identify any possible overcharging.
- Periodically check the amount of waste generated.
- Use of compactors to decrease the volume of certain wastes – for example packaging material.
- There are a variety of ways a contractor can divert construction waste or demolition debris at the jobsite. The following general practices are common:
• Purchase materials in bulk where possible. Avoid individual packaging for volume purchases.

• Use returnable containers and packing materials.

• Reuse non-returnable containers on the jobsite to the maximum extent possible. Develop one-hundred-and-one-uses for plastic barrels, buckets, and tubs.

• Give away non-returnable containers. Contact local and community organizations (schools, youth groups, community service groups, Habitat for Humanity, others similar.

2.4 **Summary**

The contractor can curb costs of waste generation, waste placing and waste removal by improving ordering, handling, re-use, recycling, and disposal of construction waste.

2.5 **Conclusion**

The fact remains that there are a number of methods and opportunities to save money for the contractor when dealing with waste.

If the 2000’s are hailed as the decade of the last opportunity to save the environment, we must take ownership of how effective we use the remaining resources and how much, where and how we dispose of the waste.
2.6 Testing of hypothesis

My hypothesis was the following:

**Saving costs through good/proper and sound waste management planning.**

It is evident after researching construction waste generation and disposal thereof, at the new DFA building site in Pretoria, that there are many ways to improve on less waste generated and foremost, cutting of costs for the contractor.

2.7 Bibliography


Chapter three

Training will vastly improve staff and sub-contractors and their workers health/safety/waste disposal practises on-site and impact on the environment

3.1 Introduction

Effective training for sub-contractors will improve their health/safety and waste disposal practises on-site. If they are properly informed about all the health and safety risks regarding the waste disposal processes on-site it will lead to more effective and more productive waste disposal on-site. The Contractor will by investing a little money in good training, make more money than ever before. The sub-contractors will know exactly what they may and may not do.
3.2 How can training of staff and subcontractors improve health/safety/waste disposal on site and have a minimal impact on the environment?

3.2.1 Health and safety training
The following are the main objectives for health and safety of Concor at the DFA site in Pretoria:

- To work towards the prevention of all injuries and work-related ill health by ensuring that all concerned are familiar with both generalized and site specific risks. This is communicated through job-specific risk assessments and work methodologies.
- To provide a safe and healthy working environment.
- To establish and maintain safe working practices throughout each and every contract process.
- To provide properly engineered facilities, plant and equipment.
- To regularly assess and review risks associated with site practices in an effort to afford continuous improvement.
- To acknowledge and work with Governmental, Local Authority and Professional Bodies in order to promote improved health and safety.
• To provide essential training for all employees, sub-contractors and associates, including basic first aid and A & E procedures.
• To effectively investigate and report all incidents with potential to cause injury.
• To plan effectively the prevention of accidents at all key stages of the contract process, including design, installation and commissioning of systems.

3.2.2 **Concor will:**

• Undertake suitable and sufficient assessment of risks, and implement control measures to reduce those risks to an acceptable level. Risk assessments will be updated as circumstances change.
• Provide appropriate work equipment, safe systems of work, work instructions, training, and supervision, to ensure that employees can effectively & safely utilize the items provided and the procedures implemented
• Ensure, as far as is reasonably practicable, the safe storage, handling, use and transport of hazardous substances

3.2.3 **Employees & Sub-Contractors will:**

• Comply with this Policy, to safeguard the Health & Safety of themselves and others affected by their actions
• Cooperate with the Company in the implementation of this Policy
• NOT interfere with or misuse anything provided in the interest of Health & Safety
• Use Company provided Personal Protective Equipment (PPE), and other items as identified by risk assessment

On 18 June 2009 (11:00) an interview was conducted with Jacqueline Pentz the safety officer on site. She provided me with the following information regarding training in connection with health and safety.

She said that too many accidents are occurring on construction sites. The main cause of this is that people are not informed as well as poor supervision. That is why Concor initiated this training programme at the DFA to prevent accidents from happening.

3.2.4 Here are some of the safety rules on site:

• Do not wear loose or torn clothing.
• Ensure that you are equipped with all your P.P.E before entering the site.
• Wear approved safety shoes.
• Wear your safety hard hat at all times.
• Wear your gloves at all times.
• Wear your safety glasses where necessary.
- Wear your dust mask when dust is visible.
- Wear your ear plugs when working in a noisy area.
- When working at heights insure that you wear your safety harness and that you have been trained in.
- When working on scaffolding, ensure that there is a ladder to climb up and down. **DO NOT CLIMP UP THE SIDE OF THE SCAFFOLDING.**
- When working on a deck that has been casted, a safety harness is not required when working within two meters from the edge and the edge is barricaded.
- Any person not obeying the rules of the safety harness on site will be disciplined.
- When working on a ladder ensure that the ladder is in working order and that you have a helper to support it whilst you conduct your work.
- Ensure that all electrical cords and equipment are in order before you commence work.
- Scaffolding will only be erected by a trained and competent scaffold erector.
- No person will be allowed to build or modified any scaffolding on site.
- All excavations to be barricaded off safely.
- Do not enter any area that is out of bounds or which is demarcated.
- Do not climb over any fences or trespass on private property.
• Do not enter the construction site if you are under the influence of alcohol, dagga or any drugs.
• Please complete the safety induction booklet on the middle page and hand the page to the safety officer.
• Ensure that you read the safety induction booklet in your own time, as to understand the contents.

3.2.5 Environment Management Plan

All contractor management on site will be handed a copy of the E.M plan and it will be the responsibility of the manager/supervisor of that company to insure that all their people are trained. The following is applicable:
• All topsoil that is removed will be placed in a dedicated area.
• No person except the security personnel will be housed on site.
• No fires will be allowed on site.
• All waste and refuse to be placed in a bin supplied on site.
• The site to be cleaned at all times. Littering of waste will not be tolerated.
• All refuse bins to be water tight. No bins to be left open.
3.2.6 Safety/Health and Environment Plan

The following is applicable to waste management:

- No work will be conducted if a S.H.E file has not been submitted.
- All workers to be trained in their relevant risk assessments.
- All workers to be trained in their relevant safe work procedures.
- All workers to be trained in the S.H.E fall protection and emergency plan.
- All workers to conduct their own daily toolbox safety talk.
- All workers to attend a weekly group safety talk.
- No alcohol is allowed on site.
- Only certified trained people to operate machinery.
- All edges of excavations and sides of construction area to be barricaded off.
- All workers will be held responsible for their own health and safety on site.

The Health and Safety at Work Regulations 1999 make it a legal requirement for employers to carry out a risk assessment of their undertaking to identify the measures they need to have in place to comply with their duties under Health and Safety law. Selection of contractors and their personnel operating the site on behalf of a local authority is important. Before contracts are agreed you should ensure they...
have the right level of technical and safety competence.

Having a system for managing health and safety may involve the implementation of the Occupational Health and Safety Management System (OHSMS) 18000 standards or the introduction of an in-house system to guarantee commitment to:

- Compliance with applicable health and safety legislation and regulations;
- Continuous improvement in health and safety within an authority.

### 3.2.7 Waste disposal training

The DFA provided training facilities on-site. They put up a container where all the admin was administered. Along with this they got the personnel to provide the training. Now the only that was still missing was the students. From this training facility the following objectives were set out.

#### 3.2.7.1 Training for artisans/bricklayers and labourers.

Before brickwork started on site, Concor got couple of young students to enrol in this training programme.
This programme provided for students to become expert artisans/bricklayers depending on themselves. Concor set out an area for the students to practice. The students got a plan from where they must build. If the student’s work was not up to standard, the assessor came and broke it down, where they had to rebuild it.

After the students passed they were used with the bricklaying sub-contractors on site. Through this process Concor got BEE points and created a working opportunity for the students. After the programme everything were broken down and made space for a part of the building.

If the relevant sub-contractors who used the students thought that they performed well enough, the students were then taken in by the sub-contractors to go and work for them on another project. This was a great opportunity for a student to make his mark as a trained bricklayer in the construction industry.

3.2.7.2 Training to sub-contractors to effectively dispose waste so that it has ‘n minimal impact on the environment.

The second objective was to provide training for sub-contractors to effectively dispose waste on-site. The following were taught to them:
- How to minimise your waste during the erection of the specific material/product, so that minimal contra charges would exist against the specific sub-contractor.
- How to dispose your waste at allocated points and not in other working areas.
- How to dispose your waste so, that traffic is not affected by it.
- Disposing of waste to have a minimal impact on the environment.
- Disposing of waste so that the Contractor can easily remove waste from site.
- How to dispose waste so that it will not become a hazard to the working labourers.

3.2.7.3 Staff training to effectively manage this whole process.

The training of site operatives to understand the requirements of compost producers and contamination issues with building waste and rubble is necessary for the effective and efficient management of building waste collections at the DFA site, whether this training be delivered in house or externally.

Site operatives need to be able to recognize the materials that contaminate building waste, so the collected material meets the compost
producers/contractors specification and avoids loads being rejected. This can include visits for site operators to composting facilities.

On site training is also important, to ensure staff remain enthusiastic and conscious of the equipment on site and the environment in which they work. Most site operatives at the DFA received a minimum induction and health and safety training. In addition some site contractors provide extensive on and off the job training to ensure their operatives appreciate the purpose of recycling and what happens to material after it has been collected. This means they have the correct information that can be passed on to the public.

Some local authorities have supplemented training for site operatives by providing specific customer service training to help improve confidence when dealing with the public on site.

3.2.8 Site waste management plan (SWMP)

Every site has got to have a SWMP.

The purposes of a SWMP are:

3.2.8.1 Improving materials resource efficiency, by promoting the economic use of construction materials and methods so that waste is minimized and any waste that is produced can be re-used, recycled or recovered in other ways before disposal options are explored; and
3.2.8.2 Reducing fly-tipping, by restricting the opportunities available for the illegal disposal of waste by ensuring compliance with existing legal controls and providing a full audit trail of any waste that is removed from the construction site. SWMP will record how waste is disposed of, reused, recycled or recovered in other ways. When an interview was conducted with Jacqueline she was about to finish of the SWMP due to the fact that the project were coming to an end.

The following were taken from www.defra.gov.uk-2009

3.2.9 Who should write and implement a SWMP?

The client is responsible for ensuring that the plan is prepared before construction work begins. For many projects it will be appropriate for the designer to write the SWMP on behalf of the client, as this will assist in recording any decisions that have been taken at the design stage. This were the case at the DFA due to the fact that it was a design and construct contract.
3.2.10 **What should be recorded in a SWMP?**

A SWMP will need to forecast how much of each type of waste will be produced on site and how it will be managed. But before this, decisions may already have been taken on the design, construction method and materials that will reduce the amount of waste. Such decisions should be recorded in the plan before addressing the waste that cannot be avoided.
For this residual waste, explore the options for reusing or recycling on-site before you consider any off-site possibilities for re-use, recycling, and other types of recovery or disposal.

The plan also needs to identify the location of the site and the individuals responsible for preparing and implementing it. A summary of the details required in the first draft of the plan is set out below:

Responsibilities

1. The client.
2. The principal contractor.
3. The person who drafted the plan.

Description of the Construction Works

4. The location of the construction site.
5. The estimated cost of the project.

Materials Resource Efficiency

6. Any decision taken before the SWMP was drafted to minimize the quantity of waste produced on site.
7. Describe each waste type expected to be produced during the project.
8. For each waste type estimate the quantity of waste that will be produced.
9. For each waste type identify the waste management action proposed (Including re-use, recycling, other types of recovery and disposal) Waste Controls and Handling.

10. A declaration that all waste produced on the site is dealt with in accordance with the waste duty of care.

11. A declaration that materials will be handled efficiently and waste managed appropriately.

The following were taken from www.netregs.gov.uk-2009

3.2.11 How to create your own SWMP?

1. Make someone responsible for the SWMP (Jacqueline Pentz were responsible for this task).
2. Waste identification.
3. Identifying your waste management options.
4. Identify where and how you will dispose of your waste.
5. Make sure your on-site materials and waste handling is well organised.
6. Communicate the plan and carry out the right training.
7. Measure your waste.
8. Monitor the success of the SWMP.

3.2.12 The Impact That Proper Training to improve waste disposal has on the environment

Before training was provided on-site, the rubble and waste were laying all around on-site, as can be seen in figure 1 below. This created numerous problems on-site. **Firstly** traffic problems arise. Sub-contractors could no longer get into the site due to the fact that the rubble was laying in the agreed access roads. **Secondly** the waste set off a chemical reaction that went into the ground. This caused problems for vegetation to grow effectively.
Thirdly trees within the site (and particularly the Wild Seringa’s (Burkea Africana) were damaged due to traffic problems arising from waste laying around on-site and not in the allocated bins. Fourthly the rubble lying around caused a delay in the starting of the landscaping contract on the South side of the building. Fifthly site containers that were scheduled to be taken off at the end of May 2009 were delayed due to the fact of all the rubble lying around. This caused an increase in the project’s preliminaries and general account.
Sixthly several new tracks have been cut across the conservation area by construction vehicles due to the scattered waste on-site. Figure 2 clearly shows it.

Figure 3: Showing vegetation in the section of the conservation area
Source: DFA Head Office Accommodation, Environmental Control Report 21
Seventhly storm water pipes were blocked by all kinds of waste like ceiling boards etc. Eighthly trucks had to come in, in an area that was not previously used and remove the waste. The public complained of the extra noises that the trucks created.

One advantage of the scattered waste on-site was that it destroyed weed species like the Morning Glory (Ipomoea purpurea, Thorn Apple (Daura spp.) with the Lantana camara also present. DFA Head Office Accommodation Environmental Control Report 21 recommended the following to be done to decrease the impact on the environment.

- General cleanup of the site is required.
- Adequate waste skips (bins) for collection of waste should be provided within the construction area.
- Intrusions into conservation area should be restricted to the currently disturbed areas and no further intrusions into the conservation area should be allowed.
- In cases where leaks are detected from construction vehicles, drip trays must be used to collect oils.
- Spraying of category listed weed species should commence.
3.3 **Summary and conclusion**

When training provided to sub-contractors on site it will improve their health and safety on site. Training on how to minimize waste generation etc on site. When this training is provided it will reduce waste production overall on site and the contractor will spend less money on waste removal.

3.4 **Testing and hypothesis**

Through this it can be seen that training has a great role to play in improving the staff’s and sub-contractor’s health and safety. Health and safety measures were also set up to regulate the labourer’s health and safety. Training provided to improve waste disposal practices were also provided which greatly contributed to a saving in cost for Concor. There was also a great impact on the environment before waste skips were provided.
3.5 **Bibliography**

d. www.google.co.za

e. www.parkway.com

f. www.netregs.gov.uk

g. Norlands Foundation Best Practice guide, 2003

h. www.defra.gov.uk

i. Interview with Jacqueline Pentz (Safety officer on-site)

j. DFA Head Office Accommodation, Environmental Control Report 21

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**Chapter four**
With good and proper planning of waste areas the allocation of waste loading and offloading points will be addressed and incorporating of high technology will prevent theft on-site.

4.1 Introduction

The allocation of waste areas on site is very important for effective loading and offloading of waste to the waste disposal site. With well allocated bins, traffic will flow better on-site and trucks can remove more bins per day without a problem like been stuck in mud etc will not occur. If there are more trucks that remove waste then waste generated can go directly into the bins and will not lie around on-site creating all sorts of problems.

Theft on-site is a huge problem everywhere. Construction sites are often targets for material theft such as copper, tools and equipment. This causes loss of time, money and productivity. The stolen items are then transported from the site in the waste bins.

It is the contractor’s responsibility to incorporate high technology to prevent theft. Methods like metal detectors; infrared lasers etc are just some of the technology that can be used.
4.2 How the best areas for waste loading and offloading are identified/allocated and how can you provide security to prevent theft from the site?

It is very important to allocate waste bins in the correct areas on-site. The problem occurred at the DFA was that there were not enough bins on-site. It created a huge waste problem. The sub-contractors dumped their waste at the nearest possible position available. Concor then had to hire more labourers to remove the waste on a daily basis. Instead of just getting more bins on-site and allocating it at the right areas which then would not have resulted in a waste problem.

Figure 4: Here can be seen that a bin should have been provided to minimise waste on-site.
Source: Christo Olivier
conclusion is that more bins should have been provided to minimise waste on-site. If there were sufficient bins on-site the trucks could have come in, picked up the waste and leave immediately, minimising traffic and other congestions on-site. This was not the case at the DFA.

As can be seen in figure 4 there were huge waste piles lying around on-site. Traffic was a huge problem on-site. This delayed work heavily.

An interview was conducted with Paul Jacobs on the 28 of July 2009 and the following has been said:

Due to the nature of the site it was very difficult to render effective service, problems eg. traffic, cranes and rubble all over. In the future it is advised that one area is located for all rubble. Areas should have a low traffic and other movement.
The waste generated from the building which can clearly be seen in figure 5 had a huge impact on the site:

- Traffic on the south road came to a halt.
- It cost Concor additional money to get labourers to remove the waste.
- Landscaping were to be undertaken at that specific area but were halted due to the fact of all the waste.
- The P&G’s of the site increased due to the fact of all additional costs to remove waste on-site.

Figure 6: Figure indicating re-using and recovery of waste on-site
Source: www.bandneslocalplandevelopment.co.uk

![Diagram](Reduction
→
Reuse
→
Recovery (composting, recycling, energy)
→
Disposal)

Figure 6 indicates the process of dealing with waste on-site. This process was NOT followed at the DFA.

The following information were taken from: www.bandneslocalplandevelopment.co.uk-2009

4.2.1 Reduction- reduction of waste through various methods. Methods like training of sub contractors. Making the labourers aware of all the different bins on-site.

The scope for effectiveness of the town and country planning system in reduction and re-use of solid or liquid wastes is limited. The planning system is
principally concerned with regulating the development of land in the public interest. Waste reduction and re-use is a matter largely of change in socio-economic behavior and values. The Government has implemented a range of initiatives aimed at reducing waste including the Producer Responsibility for Packaging Waste legislation. Whilst this and other initiatives will have some impact on future need for waste management facilities, its effect is at present uncertain. The Pretoria Council intends to build on its record in recycling by introducing trials to collect and compost green waste and investigate ways to reduce, repair and re-use wastes through implementation of policies and setting of targets in its Waste Management Strategy.

The planning system can have most impact on reduction and re-use in terms of waste generated during the development of land. Policy WM.3 (not discussed) places a requirement on prospective developers of schemes involving a land area of more than 0.5ha or 10 houses (0.4ha or 1000m2 floor space in the case of industrial and/or commercial development) to submit a "waste audit" with their planning applications.

Developers will be expected to provide an estimate of the type and quantity of waste likely to be generated and to consider, in consultation with the Waste Planning Authority, ways of reducing or eliminating its generation and of re-using unavoidable waste on
4.2.2 Re-use - this will not be possible on-site due to the fact that the project is not an alteration job.

4.2.3 Recovery - also not possible on-site.

This part of the waste hierarchy incorporates recycling, composting and energy recovery. The three categories of recovery do not share equal status in respect of national policy. Government advises that incineration with energy recovery is expected to be considered after opportunities for recycling and composting have been explored. As a Beacon Authority for waste recycling, Pretoria Council supports this objective (see policy WM 10) (not discussed).

Having regard to Pretoria Council’s commitment and growing reputation in household waste recycling, it is important that every effort is made to build on current success. Central government has, for B&NES, imposed statutory performance standards for household waste recycling of 33% by 2003/4 and 36% by 2005/6 – far in excess of national targets of 25% by 2005 and 30% by 2010. These targets are likely to increase demand in the district for new or expanded Household Waste Recycling Centre facilities (see Policy WM 10).

One of the most difficult problems in increasing the quantity of waste recycled is the segregation of...
different materials so that cross-contamination is minimized. The collection and sorting of mixed recyclable materials can be labour-intensive and expensive, and whilst this may create employment it equally can undermine the economic viability of initiatives. New development proposals will therefore be expected to incorporate facilities for the segregation and collection of waste materials within their design. This will help to increase the quantity of wastes available for recycling in the district. In order to assist determination of planning applications, information detailing the provision for long-term management of the facilities will be required. Planning obligations will be sought where necessary.

Policy WM.4—Department of waste management in Pretoria

Development of:

a. housing sites of more than 0.5 ha in area or 10 houses; or

b. industrial and/or commercial sites of more than 0.4 ha or 1000 m² floor space; or

c. sports, recreation or similar facilities such as and including those in Policies SR2 (not discussed) and SR5 (not discussed) of this Plan will only be permitted where provision is made as an integral part of the development for:
i. Facilities within individual or groups of properties or premises for the separation and storage of wastes for collection and for composting; and/or

ii. Public facilities for the separation and storage of wastes for collection and/or composting of waste.

At a broader level, the effects of the Landfill Tax escalator, implementation of the EC Landfill Directive and introduction the Aggregates Levy are likely to stimulate demand for more Materials Recovery Facilities (MRFs). Apart from Pretoria’s Council-run sites and scrap yards, there are only two operational recycling facilities in the district of the DFA at present. Both accept only inert construction and demolition wastes.

Inappropriately designed and located MRFs (not discussed) can give rise to environmental problems as a result of traffic, noise, visual intrusion and other amenity impacts. MRFs should ideally be sited in areas designated for industrial or waste management uses. In operational terms, the processing and stockpiling of materials should take place under cover in order to control noise and dust emissions and to reduce visual impact.
In some instances redundant agricultural buildings may be capable of accommodating facilities of this type. This will depend upon the siting of the buildings together with their quality and design. The control of noise from a MRF located in a quiet rural area may be a particular difficulty as will generation of atypical levels and/or types of traffic. Impact on residential amenity and the environment will be important considerations. Proposals will be assessed against relevant policies of the Plan.

Waste Transfer Stations (WTS) are often associated with MRFs, although the two activities are distinct. The primary purpose of a WTS is to "bulk up" wastes from smaller to larger containers for onward transit to a processing or disposal site. This reduces costs and can be less damaging to the environment. The environmental and amenity impacts of a WTS are broadly similar to those which can be expected from a MRF.

### Policy WM.5—Department of waste management in Pretoria

Development of Materials Recovery Facilities and/or Waste Transfer Stations will only be permitted where:

i. The facility is located within an area
designated for waste management development or
within an appropriate existing or allocated
employment site or area, or appropriate existing
agricultural building; and
ii. The use and ancillary activity will as far as is
practicable take place within appropriately
designed or converted buildings; and
iii. The site is close to the source of the waste to
be recovered, recycled or transferred and the
markets to be served.

The recovery of materials brought to landfill sites
is a paradox. Whilst the benefits may seem obvious,
it may be that the site has been permitted for a
temporary period in order, for example, to improve
derelict land or restore a quarry. Landfill sites are
normally located in comparatively remote, rural
areas. If recovery of materials would have the effect
of reducing the rate of fill at such a site the
result may be that the environmental impact of the
landfill would be unacceptably prolonged. A balance
must therefore be struck between the desire to
recover materials which otherwise would be lost and
the desire to see restoration of a site take place
quickly and effectively. If permission is granted for
materials recovery, linked to the life of the
landfill, and subsequently an application is received
to significantly extend the life of the landfill this
is likely to be unacceptable unless the proposal represents the BPEO for the waste streams involved.

**Policy WM.6—Department of waste management in Pretoria**

Development involving the recovery of materials from wastes brought to landfill sites will only be permitted for the consented duration of the landfill development provided the recovery of materials will not conflict with completion of the site within its scheduled timescale and the site is close to the source of the waste(s) to be recovered and the markets to be served.

Household Waste Recycling Centres (HW&RCs—formerly called "Civic Amenity" sites) have a crucial role to play in meeting B&NES’ recycling targets and making management of waste generated in the district more sustainable. Pretoria Council has a legal obligation to provide HW&RCs. In development terms, the principal planning issue raised by HW&RCs centres on traffic (access, maneuverings, loading and offloading). HW&RCs must be sited carefully to avoid traffic congestion and unsustainable cross-city car journeys. Other potential issues include noise and odor. Alongside general development control considerations in policy WM19, the criteria for
consideration of any new site are set out in **policy WM11**.

<table>
<thead>
<tr>
<th>Policy WM.7—Department of waste management in Pretoria</th>
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<tbody>
<tr>
<td>Proposals for development of Household Waste Recycling Centers will only be permitted where:</td>
</tr>
<tr>
<td>i. the site is located on previously developed or underused land within urban areas; and</td>
</tr>
<tr>
<td>ii. the site is located so as to be readily accessible by the population to be served by the facility without giving rise to material increases in cross-city or cross-town traffic; and</td>
</tr>
<tr>
<td>iii. the use would not have a detrimental effect on existing land-uses adjoining the site; and</td>
</tr>
<tr>
<td>iv. There is adequate provision for the waiting, loading and offloading of vehicles visiting the site.</td>
</tr>
</tbody>
</table>
Policy WM.9—Department of waste management in Pretoria

Proposals for the development of community composting facilities will only be permitted where:

i. the use would, in the first instance, be for a period of 3 years or less;
ii. the use would not have an adverse effect on existing land-uses adjoining the site;
iii. the facility is on publicly accessible land;
iv. there is adequate provision for the waiting, loading and offloading of vehicles visiting the site and the use will not be to the detriment of highway safety or local amenities by reason of traffic generation.

Policy WM.10—Department of waste management in Pretoria

Proposals for development of facilities for thermal treatment with energy recovery will only be permitted where:

i. the feedstock comprises residues remaining after re-use, composting or recycling and/or comprises waste materials which are unsuitable for such treatment; and
ii. thermal treatment is the BPEO for the wastes to be managed; and
ii. the site is located within an area designated for waste management development or within an appropriate existing or allocated employment site or area; and

iv. proven technology is used; and

v. The plant is of appropriate scale and design having regard to the site location and setting.

Policy WM.11—Department of waste management in Pretoria

Proposals for development of facilities for thermal treatment of wastes without pre-treatment recovery of re-useable, recyclable or compostable materials and without energy recovery will not be permitted.
4.2.4 Disposal—that happened a lot on-site.

Figure 7: Another waste pile at the DFA (Pretoria)
Source: Christo Olivier

4.2.5 Disposal to land

Unless it represents the Best Practicable Environmental Option, disposal of waste to land represents the bottom rung of the waste hierarchy. It is nevertheless likely to remain the principal method of waste management during the plan period. There will always be a need for facilities of this nature for disposal of residues remaining after recovery of
materials and/or energy or for disposal of wastes which do not readily lend themselves to such treatment (for example, subsoil’s from construction work). Owing to the range of variables involved (including the EC Landfill Directive and the Aggregates Levy), it currently is not possible to predict with any degree of confidence the reduction in demand for void space or airspace that may result.

Pretoria Council considers that disposal of waste to land should be undertaken principally with the objective of improving or restoring degraded land to an environmentally beneficial and appropriate after use. In this context, it should by its nature be a temporary activity and demonstrably be a means to an end rather than an end in itself.

In many cases disposal to land takes place in association with or following mineral extraction. It is important to note that it is not always the case that filling a disused quarry will bring about an environmental benefit, particularly if the site has naturally regenerated and has nature conservation, recreational or geological value.

The district historically has experienced intensive extraction of coal, stone and fuller’s earth by underground mining. In contrast, surface mineral working has and continues to be low-key in nature. This is partly attributable to the geology of the district and the absence of deposits of limestone’s
generally suitable for volume production of aggregates.

**Policy WM.12—Department of waste management in Pretoria**

Disposal of wastes to land (landfill) will only be permitted where the proposal relates to:

i. mineral working sites in accordance with approved schemes of working and restoration where filling with appropriate materials is required to achieve restoration of the site; or

ii. sites identified in Section C4 (Minerals) where there is a requirement for appropriate fill materials to achieve restoration and where filling is limited to that which is required to achieve the restoration objectives of this plan; or

iii. treatment of agricultural land subject to Policy WM16;

and where:

iv. the wastes to be deposited are unsuitable for re-use or recovery or comprise rejects and/or residues of waste treatment; and

v. disposal to land is the BPEO for the wastes to be managed; and

vi. provision can be made, as appropriate, for the recovery of landfill gas for conversion to
Policy WM.13—Department of waste management in Pretoria

Disposal of wastes by raising the level of land above its natural level (land raising) will only be permitted where the proposal:

i. would assist the preparation of land for other approved development proposals; or

ii. would assist the restoration of derelict or degraded land; and

iii. the wastes to be deposited are unsuitable for re-use or recovery or comprise rejects and/or residues of waste treatment; and

iv. disposal to land is the BPEO for the wastes to be managed; and

v. provision can be made, as appropriate, for the recovery of landfill gas for conversion to energy either on site or elsewhere; and

vi. there is sufficient material available to complete the development within a reasonable period of time; and

energy either on site or elsewhere; and

ii. here is sufficient fill material available to complete the development within a reasonable period of time; and
The development is temporary and will result in a beneficial after use of the site.

Disposal of inert wastes to land can often take place as a means of improving agricultural productivity. In some instances whether or not a material improvement results is open to doubt. Pretoria Council considers that a more rigorous approach to the evaluation of planning applications of this nature is needed.

Applicants should be able to demonstrate that the land is in need of improvement, that other methods of improvement are not feasible and that there is sufficient availability of suitable fill materials. Planning applications will be expected to be supported by information prepared by a suitably qualified independent person(s) demonstrating:

That improvement is reasonably necessary for the purposes of agriculture within the agricultural unit;

How the proposed development will significantly improve the land;

Why the improvement cannot practicably (excluding financial reasons) is achieved by other land management methods.
The Landfill Tax has inadvertently diverted a great deal of inert waste material formerly used for agricultural improvement schemes to projects exempt from waste management licensing and tax. Increased recycling is likely to reduce further the availability of materials of this type. It will in many cases be undesirable to allow significant time extensions to complete schemes if the site is sensitively located and the original decision was finely balanced having regarded to environmental or amenity considerations.

**Policy WM.14—Department of waste management in Pretoria**

Development involving the treatment or "improvement" of agricultural land by the deposit of imported controlled wastes will only be permitted where:

i. the land is not Grade 1, 2, or 3a in the MAFF Land Classification System; and  
ii. the development is reasonably necessary for the purposes of agriculture within the agricultural unit; and  
iii. the development will result in a material improvement; and  
iv. the waste to be deposited is inert and comprises predominantly soils, subsoil’s or soil-forming materials unsuitable for re-use or recovery at source or the residues of such processing; and
v. the development is for a temporary period; and
vi. there is sufficient availability of suitable waste materials to complete the site within the period proposed; and

vii. The volume of waste to be deposited is the minimum necessary to improve the land whilst leaving an appropriate final landform.

Applicants will need to take a realistic view of the availability of suitable materials together with the time needed to undertake the proposed work, and plan accordingly. Conditions will be imposed requiring appraisal of the likelihood of work being completed within the permitted time. If the appraisal suggests that further time is needed and "low level" restoration is feasible there will be a requirement for submission of schemes for completion of work using materials already deposited on the site. Applications for time extension will be refused where it appears to the Local Planning Authority that the land can be restored to an acceptable standard using materials already deposited.
### Policy WM.15—Department of waste management in Pretoria

Planning applications to extend the period of time needed to complete permitted landfill, land raise or agricultural improvement schemes will only be permitted where insufficient materials have already been deposited to restore or improve the site to an acceptable standard having regard to the approved after use.
Figure: 8 The role of landfill in the waste management system

Figure: 9 General B landfills
Source: minimum requirements for waste disposal by landfill (internet-address unknown)
4.3 How can you provide security to prevent theft from the site?

We have all driven past a construction site at some point or another in our lifetime. There are men and women in hard hats operating heavy machinery or carrying tools. Few people stop to think that the types of machines being used such as cranes and bulldozers are very expensive and in most cases are left on the job site overnight. This has given rise to construction site equipment theft as well as vandalism. For the worker it can be disheartening to come to work to find your livelihood has been stolen. For the company owner it can mean financial ruin, loss of revenue and loss of contracts. For the criminal who steals construction equipment, it can mean a hefty fine and a long jail sentence.

Considering the average cost for a bulldozer can be anywhere from R 1 000 000 all the way up to over R 3 000 000, it is wise to take any and all steps necessary to secure construction site property. This in itself may be difficult for several reasons. For one, construction equipment is normally brought to a location via a large truck and is stored on the jobsite. It's not like an operator can just drive the machine home and park it in their driveway. Another reason is that the way the machines are designed provides very little security. More often than not they are made with safety as the top priorities,
while security takes a back seat. Just as a criminal can hot wire a car or motorcycle, the same can be done with construction equipment. Savvy thieves know that the payoff for construction equipment is far greater than the cost of a normal car. What makes it worse is job sites are often in secluded areas where the average person wouldn't dare go to. This provides the perfect opportunity for a thief to load the stolen goods onto a truck without anyone seeing. Once you factor in the models that don't have locks on them, or may not even have a door, you can see how easy it is to steal them.

Once equipment has been sold it's very difficult to determine where the machine came from. In the case of other types of automobiles, it would be easy to determine if a vehicle was stolen or not by the license plates or VIN number.

So what are the options for securing property on construction sites? Unfortunately there isn't much that can be done to prevent it. However, you can protect yourself by using surveillance to catch criminals who have stolen property. Regardless of the public privacy debates that normally take place when dealing with video surveillance, it still works. It works for a deterrent to thieves who don't want to be filmed stealing and also in catching those who do steal.
With technology rapidly bringing the cost of electronic security lower and lower, this is the best cost effective insurance you can have on a construction site.

Theft at the DFA was a huge problem. They stole all kinds of material. From shovels to bricks. The following measures were installed to prevent theft on-site:

- Africec Security Systems were the security contractor on-site.
- The site was closed off with a concrete fence and electricity on top of it.
- All the doors are sliding doors that has a fingerprint scan button for access into the building.
- At the basement they installed “spikes” where the cars travel over them.
- Booms were also installed at the gates.
- The personnel have access cards to get into their specific part of their building.
- At the conference centre there is a tunnel that goes directly to the conference centre that has high security and meant for all the ministers to travel in.
- X-ray machines.
- Alarm systems.
Here are ten safety tips that the DFA published especially for the DFA in Pretoria during construction operations.
- The following were from (www.10 safety tipsmht.co.za-2009)

10 Safety Tips for Protecting Plant Equipment and Tools on Building Sites

- Stamp or engrave your driver’s licence number on all tools, equipment and plant. This will help in identifying the owner of recovered equipment.

- Paint your logo or identifying marks on the roof or rollover-protection devices of equipment. This will help police spot equipment from the air.

- Spray-paint small tools, ladders, cords, etc. with a distinctive colour for easy identification and die-stamp them with an ID number where possible.

- Disable all equipment at night by removing the battery or using a similar method.

- Remove any piles of debris before leaving the site. Debris piles provide a place for small
tools or materials to be stashed unnoticed for later retrieval.

- Remove all tools from the job site or lock them in a storage container with a proper heavy-duty padlock. Park a piece of heavy equipment in front of the door.

- Park equipment in wagon train formation, with more mobile equipment in the centre and heavier or less valuable equipment on the outer.

- Engage all earthmoving attachments (buckets, augers, etc.) into the ground. This makes the equipment more difficult to move without starting up the engine.

- Keep stacks of timber or other materials away from perimeter fencing. Ensure that the outside of perimeter fencing is kept clear of objects that would help a trespasser climb over the fence.

- If you are new in an area, identify yourself to the local police. Let them know who you are, when and where you will be working, and how to get in touch with you if they should

- Spot a problem. Also introduce yourself to any surrounding neighbors.
Figure 10: One of the safety door locks installed at the DFA

The following is from www.limtech.co.za (August 2009)
Polished brass 5-lever fingerprint lock

Chrome single-lever fingerprint lock
Here are some of the items that can be stolen on-site:

The following is from [www.canton-mi.org/publicsafety-2009](http://www.canton-mi.org/publicsafety-2009)

### 4.3.1 What is stolen?

The following are among the many types of items stolen from construction sites:

- Heavy equipment – backhoes, Ditch Witches
- Utility trailers
- Lumber
- Mortar mixers
- Hand and power tools
- Appliances and furnishings – air conditioners, kitchen appliances, carpeting, light fixtures, cabinets, etc.
- Copper
- Drywall
- Tile

### 4.3.2 Residential Development Crime Prevention Initiatives

The following are a number of possible crime prevention initiatives for the protection of construction sites and residential areas:
• Have a pre-construction crime prevention meeting with the developer and possibly builders. Discuss possible crime prevention initiatives and encourage active participation.

• The developer might provide nighttime and weekend security officers until the residential development is substantially completed.

• Move quickly to form a Neighborhood Watch program and encourage residents in new homes to watch homes under construction. For some residential developments, the initial construction phase may be the most vulnerable time for theft and loss.

• When wooden construction packages are delivered, have them marked immediately with bright paint. This wood construction material will eventually be covered up inside the home.

• For heavy equipment on the construction site, recommend the following measures:

  □ The name of the company owning the heavy equipment should be die stamped underneath the serial number of the piece of equipment.

  □ The company name should be die cast in two (2) or more hidden areas on the piece of equipment.
All heavy equipment should be identified with non-removable weather proof seals.

The company name should be welded onto the equipment.

Keys should be removed from the equipment when it is not in use.

Removing ignition wires or the battery and lowering all blades or buckets can immobilize large equipment.

Theft prevention devices to disable fuel, hydraulic, and/or electrical systems can be installed in heavy equipment.

Wheel locks or immobilizers can be installed on smaller wheeled vehicles, generators or compressors, and pickup trucks.

Lojack or Teltrac Systems can be installed in heavy equipment.

• It may be a requirement that persons cannot have construction materials in their possession on the job site without a receipt for same.
• Vehicle entrances into the residential development could be gated and locked during evening and weekend hours.

4.3.3 **Capital Construction Crime Prevention Strategies**

• **Identify Assets and Property**
All assets on a construction site should be identified (marked), inventoried (records), and tracked as closely as practical. A company identification numbering system should be developed.
This could be the company tax identification number. Corporate equipment should have some type of logo/advertising prominently displayed. Employees should be strongly encouraged or even required to have their personal property engraved with an identification number (usually driver’s license).

• **Signing For Deliveries Requires Serious Attention**
A standard procedure for checking material on and off the job site should be established and followed.

□ One person should be assigned the responsibility of maintaining tight inventory control of all materials and tools delivered, and only sign for each delivery after carefully checking the invoice for shortages.
Critical material should not be stored on the job site any longer than necessary. Whenever possible, the delivery of high value material or those in critical supply should be timed on an as needed basis for delivery.

Materials and equipment should be spot checked frequently. Empty cartons should not be allowed to accumulate as they may be used to carry supplies or material off the job site. Trash removal should be supervised so tools and materials cannot be hidden in containers and then removed from the job site.

- **Supervisory Personnel Should Control Keys**
  The control of keys is essential on a construction job site. Keys should be issued to as few people as possible. The company crime prevention coordinator or his/her representative should maintain a record of issued keys. Included in this record or log should be a listing of the type of key issued, to whom, on what date and for what purpose. Unissued keys should be secured and extra keys should be kept to a minimum. Keys should not be hidden on the job site and key control numbers should be removed from padlocks. To prevent unauthorized duplication, keys can be “plugged” with a rivet through the bow as a means of preventing alignment needed for machine duplication.
• **Lock or Guard Gates When Not in Use**
Gates to the construction job site should be kept to a minimum. Strange or unrecognized vehicles on the job site should be challenged. If possible and practical to do so, uniformed guards should be utilized during working hours to check vehicles entering and leaving the job site. Gates should be closed and locked at night and on weekends.

• **Secure Tools and Equipment when Not in Use**
Storage sheds or fenced areas should be provided on the job site for the secure storage of tools and equipment. When vehicular equipment is not in use, their cabs should be locked and ignition keys removed. Use metal shields on equipment windows to reduce vandalism. Oil and gas tank caps should be locked. Machines can be disabled with hidden ignition cutout switches.

• Construction equipment should be engraved or marked in at least two (2) obvious and one hidden location. Use a hardened steel punch or etching tool to mark the serial numbers on the equipment. Report the loss of construction equipment to the police immediately.

• **Not All Thefts are From the Outside**
Gang boxes and supply sheds should be locked at all times. To avoid losses, the company should maintain a good tool “check in and out” system.
- **Encourage Employees to Mark Their Own Tools**

Using either die stamps or etching tools (made available by the company) employees on the job site should be strongly encouraged or even required to mark with an identification number their personal tools.

- **Lighting the Construction Job Site**

The effective use of lighting can be an effective deterrent to theft and vandalism on the construction job site. It is particularly effective in deterring the casual or impulse offender. Among the points on the job site that should be highlighted by lighting are the office trailer(s), equipment storage trailer(s), material storage yard and any equipment storage areas. These areas should be illuminated to a minimum of one foot-candle at ground level ideally; these areas should be visible from the most heavily traveled road bordering the construction job site.

Lighting systems triggered by a motion detector or a passive infrared sensor are also recommended for the job site. Such lighting gives the impression an intrusion has been detected and may also warn neighbors of potential intruders. Lighting on the job site should be periodically checked to insure it is appropriate and operative.
· **Fencing on the Job Site**

Fencing is particularly important on the construction job site. Ideally, the entire job site should be enclosed in sturdy fencing. If it is not practical to enclose the entire job site, at a minimum the area around trailers and material storage should be enclosed. If possible, there should only be one or two accesses or gates through the job site fencing. This makes access control easier. Chain link fencing topped by multiple strands of barbed wire is recommended. Chain link fencing allows for surveillance by security patrols, police and by neighbors. Special attention should be given to the fencing of areas used to store hazardous materials, poisons, solvents, explosives, flammables, etc. It is recommended that employee’s either park their personal vehicles outside the construction fence or have a specifically designated parking area within the fence. The objective of this recommendation is to minimize the theft of tools, material and equipment.

· **Alarm Systems**

Electronic alarm systems can be an effective means of providing security on the job site, particularly for office and storage trailers or for material storage areas. Portable alarm systems are available that will detect motion, activate lights and sound alarms. Unless are
very isolated, it is recommended that alarms sound locally. This may serve to scare off the perpetrator and draw the attention of a neighbor or passer-by. Alarms can also activate telephone calls to the contractor, private security services or the local police with a pre-recorded message. Before making such alarm installations, however, the local law enforcement agency should be contacted to insure there is no law or policy prohibiting alarm installations that make calls directly to them.

- **Security Companies and Guard Dogs**

It may be advisable to employ the services of a credible, bonded and insured security company either to maintain guard staff on-site or to make periodic patrols of the construction job site. Police departments often do not have the staff to make periodic patrols of the construction job sites or may be tied up dealing with emergencies or other priorities. An advantage of using a contract private security service is that they can be given access to patrol inside the job site as well as the perimeter. They can also be given the responsibility for checking lighting and alarm systems on the job site, as well as the integrity of fencing. Guard dogs are usually not recommended on the construction job site. The guard dog may not be able to differentiate between authorized or unauthorized persons. If used
on the job site, guard dogs should be contained within a strictly off limits area.

• General Security Recommendations
Enlist the support of employees in minimizing theft and vandalism. Explain to them the consequences and that insurance carried by the company either has a deductible for coverage or does not cover pilferage of tools and material on the job site. Report all vandalism and theft to the appropriate law enforcement agency immediately. Have serial numbers and information about markings on the equipment available when the responding officer(s) arrive. Make sure there is a complete record of model and serial numbers of all equipment assigned to the project. If possible, remove graffiti from the job site as soon as possible. Graffiti often spawns or encourages further graffiti. “No Trespassing” signs should be prominently displayed on fencing or the perimeter of the job site. Such signs discourage unauthorized intrusion onto the job site and if correctly worded aids in the prosecution of apprehended trespassers. “No Trespassing” signs and other warnings of danger can help protect the company from liability exposure for possible injuries to strangers or trespassers. The local law enforcement agency or an attorney may be consulted for appropriate wording of warning signs. Such “No Trespassing” and/or warning signs need to be easy to read and large enough to be seen from a distance.
4.3.4 Theft of bins:
It cost Concor R 460 000 to remove 5739 cubes of rubble. Through this there was theft of the waste in the bins also. I came up with a few ideas of preventing theft of the waste in the bins:

- Make the bins transparent.
- Then put the bins through x-ray machines to see exactly what is hidden in the bins.
- At the gates the guards must check the bins thoroughly.
- Provide different bins for different material.
- At the gate the guards must check the invoice number of that specific load.

4.4 Summary and conclusion
Allocations of waste bins in areas that are accessible for waste removal trucks contribute to good and sound planning of waste areas. When the areas has been selected trucks can easily access the areas and will improve housekeeping on site due to fast and quick removal of waste.
When incorporating high technology on site like a finger print lock, it will improve theft on site. This will lead to a more secure and safe working
environment which will increase productivity at the end of the day.

4.5 **Testing of hypothesis**

With good/sound and proper planning of waste areas it lead to identifying and allocating of waste loading and offloading points. Through this it can be seen that is very important to have enough waste bins on-site but also in the right areas. This will prevent traffic congestions as described by Paul Jacobs. The waste can then effectively and quickly be removed to the right areas.

The incorporation of high technology will prevent theft on site. In the above some of the methods the DFA followed to secure the property and prevent theft were mentioned. These are all high technology methods that is very expensive but will surely prevent theft on-site and keep the property free from trespassers.
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Chapter Five

Innovative technology for recycling waste and briefly explain waste minimising practices and methods.

5.1 Introduction

Recycling involves processing used materials into new products to prevent waste of potentially useful materials, reduce the consumption of fresh raw materials, reduce energy usage, reduce air pollution and water pollution by reducing the need for "conventional" waste disposal, and lower greenhouse gas emissions as compared to virgin production. Recycling is a key component of modern waste and is the third component of the "Reduce, Reuse and Recycle" waste hierarchy.

At the DFA they used a stone crusher machine to crush all the excess building material. They then used that crushed material as G5 material under surface beds. In that way they save costs on G5 material. The other building materials that can be used again were sold. The money was then used to pay phone bills etc.

They also recycled drywalls in a crusher machine where the end product could be used as composting
material. The excess steel on site was collected and taken away to be reused again. The benefits of recycling is energy saving and saves money. Aluminium was also recycled. Aluminium is one of the most efficient and widely-recycled materials. Aluminium is shredded and ground into small pieces of crushed into bales.

5.2 On-site recycling methods and minimising methods of waste generation

5.2.1 Why recycle?
- To recover waste building material on site.
- To limit the quantity of tips and quarries for the extraction of raw materials.

The following are some of the materials that were recycled on site or taken away for recycling:
- Steel
- Aluminium
- Drywalls
- Bricks and blocks
- Paper in the office
5.2.2 What is re-use and recycling?

Waste management is built around a series of options:

- Reduce the generation of waste; this is the most effective solution;
- Re-use the product in its original form; examples include wooden pallets and bricks;
- Recycle the material for another purpose; examples include crushed concrete as aggregate and metal sent for scrap; and
- Only if there is no other option should the material be disposed of to landfill.

There is a wide range of opportunities to re-use a number of materials on-site. This is a win-win situation, saving money on both raw material and disposal costs. It also saves on the energy required to transport and reprocess the waste materials. Materials which can be recycled include: metals, paper, glass, plastic, wood, concrete and other construction materials such as bricks, rubble, plasterboard and asphalt.
5.2.3 Why is waste generated in the first place?

Often you can cut down on the amount of waste generated on-site by just asking why it is there in the first place, and rethinking how materials are used on-site. For example, many construction sites over order materials and the excess goes to waste at the end of the project. There is a double cost to this – once when you pay for materials which aren’t required, and secondly when you pay to dispose of them. If you find this is happening on your site, speak to the person in charge of ordering materials to find out if this could be managed more efficiently, although this may have to be balanced with the availability of materials and the ability for your suppliers to turn around deliveries quickly. Similarly, you may discover that there are large amounts of off cuts which are being thrown away. This might be avoided by ordering materials in more appropriate lengths or sizes.

5.2.4 What record keeping systems are in place?

It is important that adequate records are kept as proof of good waste management. A record-keeping system would typically include a file of consignment notes including hazardous wastes, records of waste produced by a particular sub-contractor and storage records highlighting any problem wastes.
which may be stored for a long period. This was not
done at the DFA. The type of records that are
required will depend on the layout of the site, the
type of construction work, and the types of waste
produced. Ensure that anyone
who has a responsibility for waste is aware of the
different records which are necessary.

Steps to reduce your waste:
- Assess your waste.
- Consider site health and safety.
- Appoint a nominated waste representative or team.
- Set targets.
- Involve site workers.
- Look at all stages of the project.
- Put record keeping systems in place.
- Regularly review waste management practices.

The previous steps were not implemented at the DFA.

5.2.5 Handy tips for on-site waste reduction, re-use
and recycling

- Reclaimed bricks and tiles that meet the
relevant building standards can be re-used
on-site for construction. Lower quality
reclaimed bricks can be used in other ways,
such as landscaping. Bricks and tiles that
you cannot use can be offered, through
recycling schemes.
- Cardboard packaging can be re-used for temporary internal floor covering to protect from site traffic. This should then be recycled at the end of its useful life;

- Transport pallets should always be re-used or reclaimed by the supplier. Many pallet firms will pay for slightly damaged or irregular sized pallets;
- Consider re-sizing and using loose timber for formwork;

- Concrete and demolition rubble can be crushed, screened and re-used as recycled aggregate in a range of applications from bulk fill to use in new concrete. Mobile plant can be hired to do this on-site. However, different materials must first be separated – wooden fixtures, windows, plumbing and wiring should be removed and recycled separately;

- Topsoil can be reclaimed and re-used for landscaping or as compost once all the necessary tests (for physical properties, chemical composition and moisture content) have been carried out; and
- Regularly review all construction, demolition and excavation waste being generated onsite for possibilities of re-using it elsewhere.

5.2.6 Recycling methods:

Wood
Wood can be reclaimed from many demolition, refurbishment and subsequent new build sources, including floorboards, rafters, and doors, frames, off cuts, temporary works, fencing, posts, poles and railway sleepers. It can be re-used directly or sent to recycling depots for cleaning, de-nailing and resizing or being turned into chipboard.

Plasterboard
The plasterboards were either recycled through a crusher machine or taken away to a dumping site. The recycled plasterboard was used as composting material.

Bricks and tiles
There was wastage due to cutting and setting out that were incorrectly done.
The Bricks and blocks that could be used again were sold to new upcoming builders at a lower price. Waste tiles were also sold.

Concrete, brick, asphalt, soils and stones
Stones and excess soils were used for G5 material.
Due to over ordering of concrete, there was a lot of excess readymix on site. This cost CONCOR a lot of money. They could have used the concrete for something else. The concrete amount to 1000 cubes more or less.

**Plastic**
An idea is to smelt all the plastic to create dpc that can be used as waterproofing in a building.

**Formwork**
Another major material that was used at the DFA was timber boards, mainly for circular formwork. The main causes of wastage are the natural deterioration resulted from usage and cutting waste. CONCOR used a lot of excess wood that were laying around again for formwork to circular concrete.

**5.2.7 Training**
Training was given to the staff on how to effectively recycle the recycled building material.

**5.2.8 Waste minimization**
Since waste minimization methods minimize the amount of waste generated, and also the amount subject to regulation, these practices can help a business comply with the requirements and save money:
The following is a list of some common waste minimization methods for the building construction industry:

- Commit the owner or manager to waste minimization and extend that commitment on to the employees.
- Train employees in waste minimization, hazardous material handling, and emergency spill response.
- Establish incentive programs to encourage employees to design and use new waste minimization ideas.

5.2.9 Recycling and resource recovery Material Substitution

- Use aqueous cleaners instead of petroleum based solvent cleaners.
- Use biodegradable cleaners instead of cleaning solvents to eliminate the accumulation of solvent-contaminated rags, waste cleaning and empty solvent containers.
- Use non-chlorinated paint and varnish stripper to decrease the amount of volatile organic compounds (VOC’s) emitted to the atmosphere.
- Use low VOC water based epoxy concrete seal to decrease the amount of VOC’s entering the atmosphere.
**Process modification**

- Replace current roofing processes with alternatives that reduce the quantity of bituminous material to potentially minimize the amount of solvents used.
- Reduce over spraying in painting operations to improve material usage by training employees in proper spray painting techniques.
- Combine used solvents with new extend solvent life.
- Recycle old and unused latex paint.
5.2.10 **Composting**

Except for paper, wood and some textiles, most biodegradable waste cannot be recycled.
Under the right conditions and with proper management most can be composted to produce a substitute for peat and fertilizer.

Composting facilities can be large and centralized or be designed to serve a particular community, or simply be a heap or bin in the back garden. There are several composting techniques, ranging from the "low tech" open-air window system and simple bins to more "high-tech" in-vessel methods involving computer-controlled temperature regulation and purpose-designed silos.

Regardless of scale, all have an important role to play in making the management of B&NES’ waste more sustainable. An emphasis on composting is particularly timely having regard to the implications of the Landfill Directive for the land filling of bio-degradable wastes.

Composting can be both environmentally safe and economically successful provided that the facility is properly managed and the end-product is marketable. Badly managed composting potentially can result in ground and surface water pollution if leachate is not controlled adequately. Odor and vermin can result if the process is not properly designed and monitored. Large piles of unprocessed waste can be visually unattractive. A satisfactory working and management plan for the facility including provision for annual review and having particular regard to
minimizing environmental impact and to site security
is likely to be required as part of any planning
application.

At present the biggest obstacle to successful
commercial-scale composting is market resistance. In
the past, waste-derived compost products have varied
considerably in quality and this has affected sales.
A major problem facing commercial composters is
contamination of raw materials, principally with
plastics. This is not a matter directly for the
development plan, but the Council is considering what
steps it may be able to take to minimize this problem
in respect of its HW&RCs and waste collection rounds.

Centralized or community composting facilities must
be carefully sited. Large-scale recycling centers and
landfill sites can be suitable locations for
centralized facilities subject to relevant policies.
Community composting facilities clearly must be
located in publicly accessible areas. They must have
regard to safeguarding amenity together with traffic
control and management. The facility must be
compatible with adjoining land-uses. Land adjoining
allotments, market gardens or leisure facilities such
as sports centers or libraries may have potential, as
may underuse or brown field land. In line with Policy
WM8 new housing developments should make provision
for community composting facilities in their design.
Alongside problems outlined at community composting facilities may face the additional problem of fly-tipping if the site is not secured when not in use. It is therefore essential that the facility is responsibly managed. In order to safeguard local amenities and to ensure that potential problems are minimized planning permission for community composting facilities should in the first instance normally be granted on a temporary basis. Permission for establishment of permanent community composting facilities should be considered on their merits and in light of responses to consultation and other material considerations.

Pretoria Council will produce guidance on establishing and managing community composting facilities.
Proposals for the development of composting facilities will only be permitted where:

i. the facility is located within an area designated for waste management development or within an appropriate existing or allocated employment site or area, or appropriate existing agricultural building; and

ii. the use and ancillary activity will as far as is practicable take place within appropriately designed or converted buildings; and

iii. The site is close to the source of the waste to be recovered, recycled or transferred and the markets to be served.

5.2.11 Energy recovery

Energy can be recovered from waste either by direct treatment or as a by-product of other forms of waste management. The most common form of direct treatment is mass burn incineration, but other methods of thermal processing such as gasification, paralysis and plasma arc heating are emerging. By-products are combustible gases (principally methane) recovered from landfills and anaerobic digestion - a form of
accelerated composting. The gases can be collected and burned to generate electricity.

Depending on the scale of the plant, mass burn incinermators commonly need a guaranteed feedstock of 100,000 - 400,000 tones per annum and long-term disposal contracts in order to make investment in development and the cost of staffing, running and maintaining the plant economically viable.

It is considered in some quarters that an increasing emphasis on recycling and composting, which may remove materials with high calorific value from the potential feedstock, casts doubt on the long-term future of mass-burn incineration. On the other hand, the consequences of implementation of the Landfill Directive may encourage more proposals for this type of development to come forward. Having regard to comparatively small arising of suitable waste in B&NES, the overarching policy direction centering on recycling and composting, and the lack of suitable sites in suitable locations, it is considered unlikely that proposals for development of a mass burn incinerator in the district will come forward during the plan period.

Whilst the processes involved in gasification and paralysis are not new, the application of these techniques to waste management is comparatively recent. Both processes are currently in a process of transition between small experimental pilot schemes
and commissioned full-scale plants. It is clearly important that any proposal which comes forward uses technology that is tried and tested at full scale over a reasonable period of time for specified waste streams.

It is considered that direct thermal treatment of wastes arising in B&NES should more appropriately take the form of these smaller, more flexible treatment methods. Treatment of wastes by these methods would follow recycling and composting, focusing on wastes unsuitable for such treatments, and consequently would be unacceptable other than in a supporting role. Proposals for thermal treatment without energy recovery would be unsustainable and unacceptable.

5.3 **Summary and conclusion**

At the DFA there were numerous recycling methods used to recycle the excess building material to be re used again for future purpose. The more you concentrate on waste minimization the less you have to concentrate on recycling methods on site; thereby you will spend less money on solving the recycling question. That saved money could be used for example to plant trees and increase bird life.
5.4 Testing of hypothesis

It is evident innovative technology for recycling waste was used at the DFA. Technology like stone crushing machines etc. So if you apply this technology on a construction site you will get a site that is recycling friendly.

Waste minimizing practices and methods can also be applied to a construction site and will decrease your waste that you generate and thereby spend less money on recycling machines.

So my hypothesis that I had was correct.

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Chapter six

1. Brief overview

1.1 Background to waste management

The cleaning manager is responsible to adopt on-site sound waste management practices.

The effective monitoring of wastes generated, placed and removed is most of the time not done. The latter means that time, money, fast and effective removal, recycling of waste contamination, health, theft and safety are sacrificed.

According to Bahu, Crittenden and O’Hara (1997:7) the discipline of management can be generalized as data gathering/planning/monitoring and implementing all of the necessary steps to achieve a given objective within certain constraints.

6.1 Introduction

I learned from my experience on a building site that there is a great waste management problem with related problems areas. From the previous chapters discussed the waste management problem and related problem areas could clearly be seen. Photos verified the problem. The related problems are the following:
• Huge volumes of waste generated and the subsequent access problems for fast and effective removal of waste from collection points.

• Unforeseen excessive waste generated from incorrect setting out of plans – breakdown and removal of incorrect placement of building material wastage.

• Loss of perfect workable building material by means of theft via waste removal services and/or inexperienced/untrained workforce.

At the end the contractor loses a great amount of money due to penalties to be paid because of loss of production. This motivated me to do waste management on site.

6.2 Summary

a. What is the financial implication of proper waste management principles?

b. How can training of staff and sub-contractors improve health/ safety/waste disposal on site and have a minimal impact on the environment?

c. How the best areas for waste loading and off loading are identified/allocated and how can you provide security to prevent theft from the site?
d. On-site recycling methods and minimising methods of waste generation.

6.3 Conclusion

6.3.1 Main problem

The results of ineffective construction waste management are huge volumes of waste generated, big numbers of waste placement areas and difficulty in economical, fast and effective disposal of waste on a big building site.

The following problem solving techniques will solve the main problem:

- Provide training to staff, sub-contractors etc. so that the workmanship can increase and that they will do the job the first time right. This will produce less waste at the end.
- Provide more bins on site.
- Put the bins in more accessible places to avoid traffic congestions.
- Make bins transparent and make safety a main priority to avoid theft on site.
- Make sure the foreman’s have the correct updated drawing before setting out the work to avoid unnecessary breakage and at the end excessive wastage.
• Make sure that the waste that is created be recycled effectively and be reused again. This is all to strive to a zero waste and clean environment.

• Use crusher machines to crush bricks and mortar to be used as G5 material underneath surface beds.

• Make sure that all the workers on site know where the allocated bins are situated and that they do not dump it on other places.

• Provide different bins for recycling.

• Providing effective training programmes.

• Agree with sub-contractors to request waste bins at specified places to ensure fast and effective removal of waste.

• Agree with sub-contractors to incorporate a paper trailing system to trace each sub-contractor’s waste generated and removed.

• Proper placing of waste bins in accessible areas that can be reached quickly and easily.

• Jobsite waste reduction- waste minimization-up to 10-12% of a project's construction waste stream can be cardboard alone. While protecting new materials is necessary, the Contractor can direct their subcontractors and suppliers to reduce extraneous packing material.

• Use scrap in lieu of cutting full new materials.

• Direct subcontractors and trades to collect and keep scrap at cutting and fabricating locations.
• Collect paints and liquids from almost-empty containers; avoid disposing of useable materials simply because there is not enough in one container to finish a job.

• For materials that are heated, mixed, exposed to environmental conditions, or otherwise subject to spoilage, limit preparation of these materials to quantities which can be installed within their expiration times. Working in smaller batches will reduce the necessity to throw out expired or spoiled materials.

• Ensure volatile materials, and materials that degrade when exposed to heat, cold, or moisture are protected from spoilage and are not wasted.

• Recycle damaged components, products, and materials, or disassemble them into their constituent materials for recycling.

• Establish a return or buy-back arrangement with suppliers. Alternatively, unused, or used but serviceable materials and products can be sold to architectural salvage or used materials retail outlets.

• Donations to a non-profit outlet, such as a Habitat for Humanity (HFH). Restore, are usually tax-deductible.

• Identify various waste streams.

• Realize the value of your waste to you through rebates via recycling initiatives.

• Reduce waste to landfill.
• Identify any possible overcharging.
• Periodically check the amount of waste generated.
• Use of compactors to decrease the volume of certain wastes—for example packaging material.

• Contractor must purchase materials in bulk where possible. Avoid individual packaging for volume purchases.
• Contractor must use returnable containers and packing materials.
• Contractor must reuse non-returnable containers on the jobsite to the maximum extent possible. Develop one-hundred-and-one-uses for plastic barrels, buckets, and tubs.
• Contractor must give away non-returnable containers. Contact local and community organizations (schools, youth groups, community service groups, Habitat for Humanity, others similar).

• Implement a site waste management plan to be used by management.
• Begin a control environment report for each month.

General cleanup of the site is required
Adequate waste skips (bins) for collection of waste should be provided within the construction area
Intrusions into conservation area should be restricted to the currently disturbed areas and no
further intrusions into the conservation area should be allowed
In cases where leaks are detected from construction vehicles, drip trays must be used to collect oils. Spraying of category listed weed species should commence.

The following measures were installed to prevent theft on-site.

- Africec Security Systems were the security contractor on-site
- The site was closed off with a concrete fence and electricity on top of it.
- All the doors are sliding doors that has a fingerprint scan button for access into the building
- At the basement they installed “spikes” where the cars travel over them.
- Booms were also installed at the gates. The personnel have access cards to get into their specific part of their building.
- At the conference centre there is a tunnel that goes directly to the conference centre that has high security and meant for all the ministers to travel in.
- X-ray machines.
10 Safety Tips for Protecting Plant Equipment and Tools on building Sites

- Stamp or engrave your driver’s licence number on all tools, equipment and plant. This will help in identifying the owner of recovered equipment.

- Paint your logo or identifying marks on the roof or rollover-protection devices of equipment. This will help police spot equipment from the air.

- Spray-paint small tools, ladders, cords, etc. with a distinctive colour for easy identification and die-stamp them with an ID number where possible.

- Disable all equipment at night by removing the battery or using a similar method.

- Remove any piles of debris before leaving the site. Debris piles provide a place for small tools or materials to be stashed unnoticed for later retrieval.

- Remove all tools from the job site or lock them in a storage container with a proper heavy-duty padlock. Park a piece of heavy equipment in front of the door.
• Park equipment in wagon train formation, with more mobile equipment in the centre and heavier or less valuable equipment on the outer.

• Engage all earthmoving attachments (buckets, augers, etc.) into the ground. This makes the equipment more difficult to move without starting up the engine.

• Keep stacks of timber or other materials away from perimeter fencing. Ensure that the outside of perimeter fencing is kept clear of objects that would help a trespasser climb over the fence.

• If you are new in an area, identify yourself to the local police. Let them know who you are, when and where you will be working, and how to get in touch with you if they should

• Spot a problem. Also introduce yourself to any surrounding neighbors.

The following are a number of possible crime prevention initiatives for the protection of construction sites and residential areas:

• Have a pre-construction crime prevention meeting with the developer and possibly builders. Discuss possible crime prevention initiatives and encourage active participation.
- The developer might provide nighttime and weekend security officers until the residential development is substantially completed.

- Move quickly to form a Neighborhood Watch program and encourage residents in new homes to watch homes under construction. For some residential developments, the initial construction phase may be the most vulnerable time for theft and loss.

- When wooden construction packages are delivered, have them marked immediately with bright paint. This wood construction material will eventually be covered up inside the home.

- For heavy equipment on the construction site, recommend the following measures:

  - The name of the company owning the heavy equipment should be die stamped underneath the serial number of the piece of equipment.

  - The company name should be die cast in two (2) or more hidden areas on the piece of equipment.

  - All heavy equipment should be identified with non-removable weather proof seals.
• The company name should be welded onto the equipment.

• Keys should be removed from the equipment when it is not in use.

• Removing ignition wires or the battery and lowering all blades or buckets can immobilize large equipment.

• Theft prevention devices to disable fuel, hydraulic, and/or electrical systems can be installed in heavy equipment.

• Wheel locks or immobilizers can be installed on smaller wheeled vehicles, generators or compressors, and pickup trucks.

• Lojack or Teltrac Systems can be installed in heavy equipment.

• It may be a requirement that persons cannot have construction materials in their possession on the job site without a receipt for same.
• Vehicle entrances into the residential development could be gated and locked during evening and weekend hours.

• Then put the bins through x-ray machines to see exactly what is hidden in the bins.
• At the gates the guards must check the bins thoroughly.
• Provide different bins for different material.
• At the gate the guards must check the invoice number of that specific load.
• Then put the bins through x-ray machines to see exactly what is hidden in the bins.
• At the gates the guards must check the bins thoroughly.
• Provide different bins for different material.
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The following is a list of some common waste minimization methods for the building construction industry:

• Commit the owner or manager to waste minimization and extend that commitment on to the employees
• Train employees in waste minimization, hazardous material handling, and emergency spill response.
• Establish incentive programs to encourage employees to design and use new waste minimization ideas.

5.2.5 Handy tips for on-site waste reduction, re-use and recycling

• Reclaimed bricks and tiles that meet the relevant building standards can be re-used on-site for construction. Lower quality reclaimed bricks can be used in other ways, such as landscaping. Bricks and tiles that you cannot use can be offered, through recycling schemes.

• Cardboard packaging can be re-used for temporary internal floor covering to protect from site traffic. This should then be recycled at the end of its useful life;

• Transport pallets should always be re-used or reclaimed by the supplier. Many pallet firms will pay for slightly damaged or irregular sized pallets;

• Consider re-sizing and using loose timber for formwork;
Concrete and demolition rubble can be crushed, screened and re-used as recycled aggregate in a range of applications from bulk fill to use in new concrete. Mobile plant can be hired to do this on-site. However, different materials must first be separated - wooden fixtures, windows, plumbing and wiring should be removed and recycled separately;

Topsoil can be reclaimed and re-used for landscaping or as compost once all the necessary tests (for physical properties, chemical composition and moisture content) have been carried out; and regularly review all construction, demolition and excavation waste being generated onsite for possibilities of re-using it elsewhere.
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