



WASTE MANAGEMENT

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CDW GENERATION IN THE EUROPEAN UNION

Year 2001

CDW generation in the EU (Kg/inhab/year)

Germany	720
Denmark	600
Spain	450
Netherlands	730
United Kingdom	530
Ireland	285
Belgium	700
Austria	650
France	427
Italy	350
Portugal	n/d
Greece	200
Sweden	235
Finland	200
Luxembourg	n/d
Average EU	480

Percentages of reuse/recycling and dumping/incineration

Germany	17	83
United Kingdom	45	55
France	15	85
Italy	9	91
Spain	<5	>95
Netherlands	90	10
Belgium	87	13
Austria	41	59
Portugal	<5	>95
Denmark	81	19
Greece	<5	>95
Sweden	21	79
Finland	45	55
Ireland	<5	>95
Luxembourg	n/d	n/d
Average EU	28	72



Regulation framework for waste

European

Directive 1999/31/EC about waste disposal to dumps

Decision 2014/955/EC about waste classification

Decision del Consejo 2003/33/EC, about criteria and procedures for waste admission in dumps

Directive 2008/98/EC about waste

National

Waste (England and Wales) Regulations 2011 (Amended in 2012)

Environmental Permitting (England and Wales) Regulations 2010

**Hazardous Waste (England and Wales) Regulations 2005
(Amended in 2009)**



- 1. Types of waste**
- 2. Waste minimisation**
 - Design**
 - Materials management**
- 3. Site Waste Management Plan**



1. TYPES OF WASTE

Waste (DIR 2008/98/EC)

“Any substance or object which the holder discards or intends or is required to discard. ”

The following shall be excluded:

- Gaseous effluents emitted into the atmosphere
- Uncontaminated soil and other material excavated during the construction activities which will be used for the construction in its natural state on the site from which it was excavated
- Radioactive waste
- Decommissioned explosives
- Faecal matter



1. TYPES OF WASTE

Hazardous waste

“Waste which displays one or more of the hazardous properties listed in Annex III.”

H1.- Explosive

H2.- Oxidizing

H3- A.- Highly flammable

H3-B.- flammable

H4.- Irritant

H5.- Harmful

H6.- Toxic

H7.- Carcinogenic

H8.- Corrosive

H9.- Infectious

H10.- Toxic for reproduction

H11.- Mutagenic

H12.- Waste which releases toxic gases in contact with water, air or an acid

H13.- Sensitizing

H14.- Ecotoxic

H15.- waste that can react and result in any of these characteristics



1. TYPES OF WASTE

Non-hazardous waste

Non-hazardous waste

It does not present any of the characteristics listed in Annex III

Inert waste

This non-hazardous waste that:

- does not present any significant physical, chemical or biological change,
- is not soluble nor flammable
- Is not biodegradable
- Does not affect any other material in contact with it



1. TYPES OF WASTE

Non-hazardous waste in construction

Plaster

Metals

Timber

Organic fibers

Silicones

Some plastics (poliprolone, melamine)

Ironmongery



1. TYPES OF WASTE

Inert waste (non-hazardous waste) in construction

Natural stone: limestone, slate, clay, marble, granite, etc.

Processed products: lime, concrete, mortar, etc.

Materials originated during excavation (non-hazardous)

Ceramics: bricks, porcelain, refractory products

Glass



1. TYPES OF WASTE

Hazardous waste in construction

Lead	Fluorescent tubes, lamps
Asbestos	and light bulbs
Mineral wool	Tar
Paint and varnish	Timber with creosote
Solvent	Electric transformer centre/station
Release agent	Glue and adhesive agents
Hydrocarbon	Oils



European Waste Catalogue

EW C Code

Waste is classified with a 6 number code:

XX. Section

XX.XX. Sub-section

XX.XX.XX. Type of waste

CDW are in Section 17

CODE	IDENTIFICATION
17.01	Concrete, bricks, tiles and ceramics
17.01.01	Concrete
17.01.02	Bricks
17.01.03	Tiles and ceramics
17.01.06*	Concrete, bricks, tiles and ceramics (alone or in mixtures) containing dangerous substances
17.01.07	Concrete, bricks, tiles and ceramics in mixtures not containing dangerous substances
17.02	Timber, glass and plastic
17.02.01	Timber
17.02.02	Glass
17.02.03	Plastic
17.02.04*	Glass, plastic and timber containing dangerous substances or mixed with them
17.03	Bituminous mixtures, coal tar and tar
17.03.01*	Bituminous mixtures containing coal tar
17.03.02	Other bituminous mixtures
17.03.03*	Coal tar and tarred products

CODE	IDENTIFICATION
17.04	Metallic waste, including cable
17.04.01	Copper, bronze and brass
17.04.02	Aluminium
17.04.03	Lead
17.04.05	Iron and steel
17.04.06	Tin
17.04.07	Mixed metals
17.04.09*	Metals containing dangerous substances
17.04.10*	Cables containing oil. coat tar and other dangerous substances
17.04.11	Other cables
17.05	Soil, contaminated soil, stones and dredging spoil
17.05.03*	Soil and stones containing dangerous substances
17.05.04	Other soil and stones
17.05.05*	Dredging spoil containin dangerous substances
17.05.06	Other dredging spoil

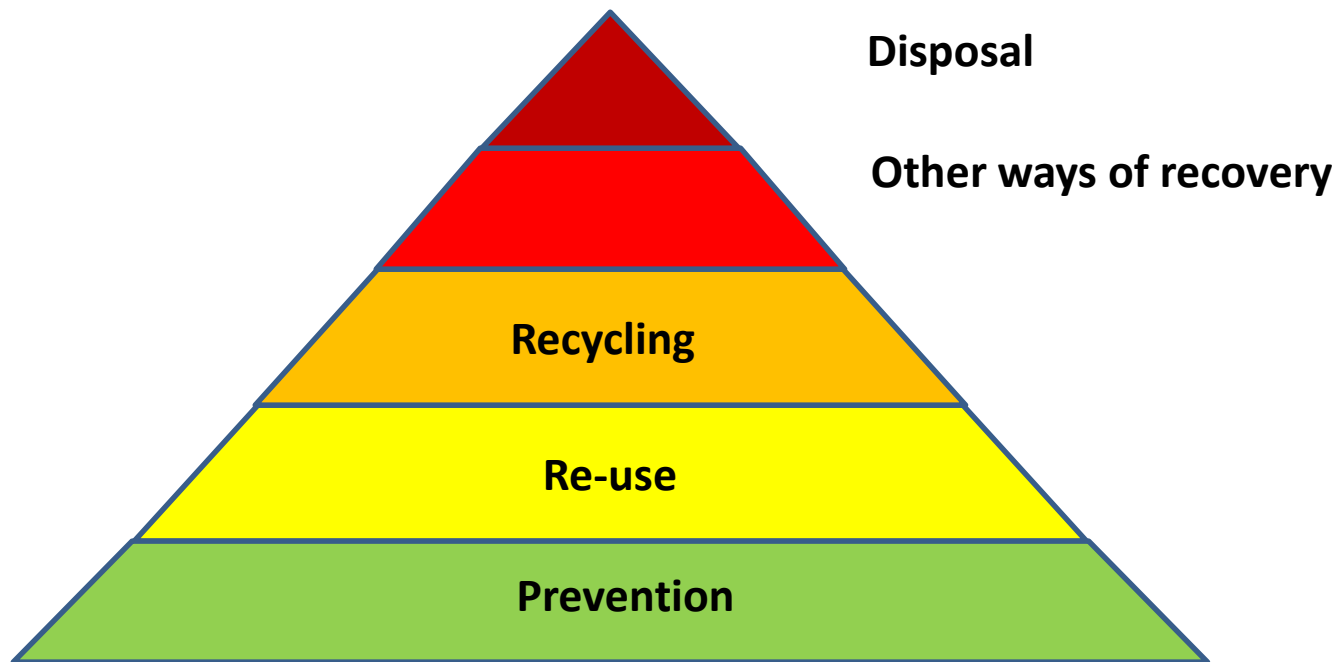
CODE	IDENTIFICATION
17.06	Insulation and asbestos materials
17.06.01*	Insulation containing asbestos
17.06.03*	Other insulation containing dangerous substances
17.06.04	Other insulation materials
17.06.05*	Other construction materials containing asbestos
17.08	Gypsum
17.08.01*	Gypsum materials containing hazardous materials
17.08.02	Other gypsum materials
17.09	Cement
17.09.03*	Un-used or un-set cement
08.01	Paints and varnishes
08-01-11* (20.01.27*)	Containing organic solvents or other dangerous substances
08-01-12 (20.01.28)	Not containing organic solvents or other dangerous substances
08-01-21*	Paint or varnish remover
PWRS*	Paint cans

CODE	IDENTIFICATION
08.04	Adhesives and sealants
08.04.09* (20.01.27*)	Containing organic solvents or other dangerous substances
08.04.10 (20.01.28)	Not containing organic solvents or other dangerous substances
PWRS*	Adhesive or sealant containers

PWRS*: Refer to packaging waste and recyclables section



Priorities for waste recovery





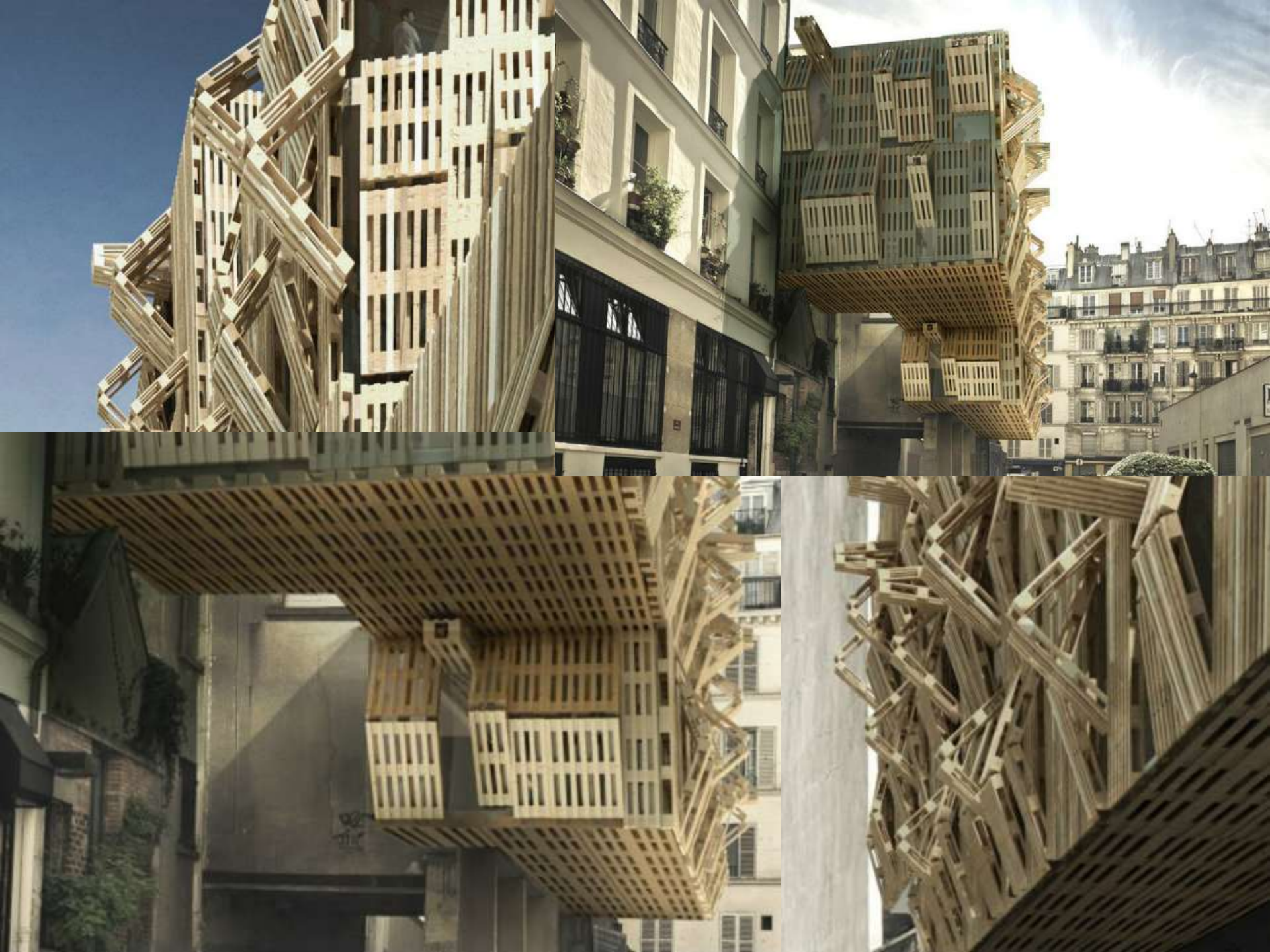
Re-use

Recovery of tiles, bricks, timber beams, metallic structures, installations, etc.

Based on de-construction

Construct to de-construct

- Very important the way to construct







Recycling

We introduce treatments to waste

- Recycled gravels and sand
- Recycled paper insulation
- New ceramics
- Metals
- Bricks with plastic particles
- New plastics
- Etc.





EXERCISE 1

CALCULATION OF THE QUANTITY OF CDW IN TONS AND CUBIC METERS

Calculate the quantity of CDW of each code generated in the demolition of a concrete structure in 2 floors (ground and first) composed as follows:

Built-up area:

2 rectangular floors of 15x30 m.

Parts to demolish:

- Foundation: raft foundation. Thickness 0.8 m. Steel quantity 10 Kg/m²
- Structure: reinforced concrete, flat two-way slabs, thickness 30 cm. Columns of 30x30 cm. in a grid of 5x5 m. Height 3.5 m. Steel quantity 15 Kg/m².



EXERCISE 1

Foundation: Raft foundation. Thickness 0.8 m. Steel quantity 10 Kg/m²

Codes:

17.01.01. Concrete

$$15 \times 30 \times 0.9 = 405 \text{ m}^3$$

$$405 \text{ m}^3 \times 2.4 \text{ t/m}^3 = \mathbf{972 \text{ t.}}$$

$$972 \text{ t} / 1.5 \text{ t/m}^3 = \mathbf{648 \text{ m}^3}$$

17.04.05 Steel

$$450 \text{ m}^2 \times 0.010 = \mathbf{4.5 \text{ t.}}$$

$$4.5 \text{ t} / 1.5 = \mathbf{3 \text{ m}^3}$$



EXERCISE 1

Structure

Codes:

17.01.01. Concrete

Slabs: $2 \times 15 \times 20 \times 0.30 = 180 \text{ m}^3$

Columns: $12 \times 0.3 \times 0.3 \times 3.5 = 3.78 \text{ m}^3$ Total: 183.78 m^3

$183.78 \text{ m}^3 \times 2.4 \text{ t/m}^3 = \mathbf{441.1 \text{ t}}$

Vap: $441.1 \text{ t} / 1.5 \text{ t/m}^3 = \mathbf{294.1 \text{ m}^3}$

17.04.05 Steel

$15 \times 20 \text{ m}^2 \times 0.015 = \mathbf{4.5 \text{ t.}}$

$4.5 \text{ t} / 1.5 = \mathbf{3 \text{ m}^3}$



WASTE MINIMISATION

Prevention of waste at the construction site

- Design considerations
- Materials management



WASTE MINIMISATION

How can we improve waste
minimisation at the project design?



WASTE MINIMISATION

DESIGN CONSIDERATIONS

- Use standard material dimensions
- Simplicity of approach for multiple application
- Specification and assembly of materials consistent with re-use and recycling
- Design for flexible usage



WASTE MINIMISATION

DESIGN CONSIDERATIONS

- Prefabrication (minimises cut off waste)
- Packaging
 - Ease of delivery
 - Clear branding
 - Security
 - Protection
 - Site safety
 - Dust reduction



WASTE MINIMISATION

DESIGN CONSIDERATIONS

Designing for long life

Means of encouraging/promoting waste minimisation

- Industry (designers) to team of with material producers/suppliers
- Multi functional materials (e.g. materials providing both sound and heat insulation at the same time)
- Durable materials (resilient conditions/corrosion)
- Repair and refurbishment in preference to demolition



WASTE MINIMISATION

MATERIALS MANAGEMENT

All the action that is necessary to:

1. Purchase competitively materials of the specified quality
2. Ensure that materials are delivered to site when needed
3. Unload and handle materials to the workplace economically and without damage
4. Minimise waste



WASTE MINIMISATION

MATERIALS MANAGEMENT

TASKS ASSOCIATED WITH MATERIALS MANAGEMENT

	TASK	HOW	WHO	DOCUMENT
1	List materials required	Analyse bills or quantities	Buyer/scheduler	Buying schedule
2	Determine when required and delivery period	Consult programme	Planning	Buying schedule
3	Take off materials	Measure drawing and specification	Scheduler	Take off form requisition
4	Obtain quotations	Send out enquiries	Buying	Enquiry
5	Place order	Select from quotations	Buying	Order
6	Expedite deliveries	Telephone/letter visit	Site	Raising file correspondence
7	Quality inspection	At works, on delivery, testing	Site	Q.A. procedure



WASTE MINIMISATION

MATERIALS MANAGEMENT

TASKS ASSOCIATED WITH MATERIALS MANAGEMENT

	TASK	HOW	WHO	DOCUMENT
8	Quantity check	Inspection upon delivery	Site	
9	Site distribution storage	Compatible equipment	Site	
10	Fixing	Safe clean work-place	Site	Q.A. Procedures
11	Protect/prevent damage	Protection	Site	
12	Monitor waste	Materials reconciliation	Site	
13	Payment	Site measure Client agreement and payment	Surveying/ Accounts	Certification



WASTE MINIMISATION

MATERIALS RECONCILIATION

Accounting is needed on a regular basis

Loss and waste must be kept under control

This should be carried out on high value, high volume materials

Reconciliations should be carried out monthly/weekly

Responsibility for reconciliation – site manager



Example on a traditional house
The approximate cost of materials percentage wise

Material	Approx percentage
Bricks and blocks	18.3
Sawn softwood	13.7
Windows/doors/frames	13.7
Kitchen fittings/worktops	4.3
Wrought timber/stairs	8.7
Plasterboard	5.3
Concrete foundations and slabs	7.9
Hardcore substructure/roads	4.5



SITE: DATE:

[illegible]



Site measure and valuations

We must consider materials stored on site + materials incorporated in the works

Goods received note made out on site will indicate delivery

Then passed from site to head office and checked against the invoice received

CONCRETE RECONCILIATION

TOTAL
MEASURED

TOTAL
DELIVERED

M³

1100

1000

900

800

700

600

500

400

300

200

100

0

QUANTITY M³

ACTUAL
DELIVERED

MEASURED
IN DWG OR BILL

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 WEEK NO

YEAR

TIME

[illegible]

MATERIAL SCHEDULE

APPENDIX 2/3/6B
(1 OF 1)



PROCUREMENT SCHEDULE FOR BLOCK
SWANSEA CITY COUNCIL

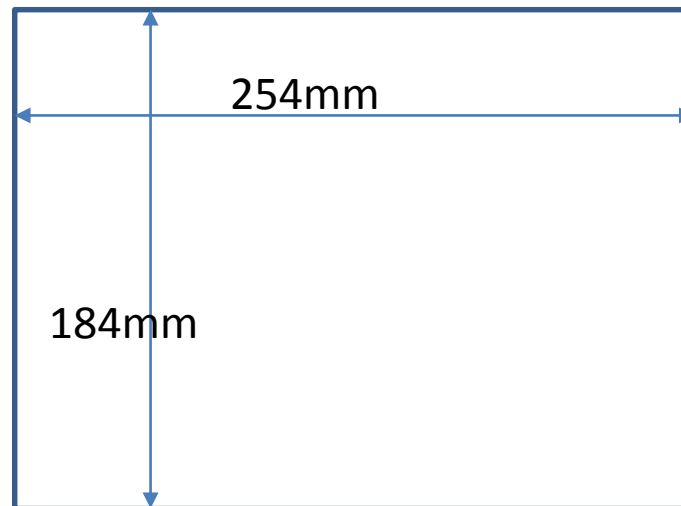
DIRECT WORKS





EXERCISE

We want to pave the toilets of 192 studios with ceramic tiles. The floor area per flat is 44.7 m^2 . The dimensions of the standard studio are as follows:





EXERCISE

We also know the following information:

Three operators can finish paving 3 studios per day.

Delivery of pavement lasts 1 week.

I can store up to 300 m² of pavement on the site.

The supplier prepares his invoice at the end of every month.

I can choose ceramic tiles between sizes 250x250, 300x300 and 400x400 mm.

The cost of operator hour is £12, working 8 hours a day. The cost of the ceramic tiles is £10 per m².

Calculate the following:

Decide about the size of the ceramic tiles and justify the answer saying which generates less cut-off waste.

Calculate the cut-off waste generated per studio.

Plan the execution and delivery of ceramic tiles.

Calculate the price of paving every studio.

Calculate the supplier invoices for every month.



SITE WASTE MANAGEMENT PLANS

A SWMP covers:

Who will be responsible for resource management

What types of waste will be generated

How waste will be managed (reduced, re-used or recycled)

Which contractors will be used to ensure the waste is correctly recycled or disposed of responsibly and legally

How the quantity of waste generated by the project will be measured



SITE WASTE MANAGEMENT PLANS

STEP ONE. PLAN AND PREPARE

During the concept and design of the project

Questions like:

- Purchase materials with less or returnable packaging
- Pre-order materials to specification
- Enough storage space for waste segregation
- Reuse of materials

Record all decisions



SITE WASTE MANAGEMENT PLANS

STEP TWO. ALLOCATE RESPONSIBILITIES

Someone must be appointed to take overall responsibility for SWMP

- The client in the pre-construction phase
- Transferred to the principal contractor when construction starts

This person is responsible for updating the plan and have the authority to ensure that others will cooperate

The client and the principal contractor must sign a declaration that they will handle materials efficiently and manage waste appropriately



SITE WASTE MANAGEMENT PLANS

STEP THREE. IDENTIFY YOUR WASTE

Identify types and quantities of waste that the project will produce

Estimate how much waste and set realistic targets about how much waste you can reuse, recycle or dispose of.

Waste hierarchy

On-site and off-site options for handling the waste

Any special arrangements for hazardous waste

Use the data form at the planning stage and then throughout the project

Waste data must be updated regularly

**Site Waste Management Plan data sheet**

Project name:

Date when this sheet was filled out:

Stage of project (eg planning stage, during project delivery, end of project):

Report number (projected waste arising should be report number one etc):

Project address / location:

Estimated cost of the project:

Client:

Principal contractor:

Person responsible for waste management on site (name and job title):

Person and company completing this form, if different:

Sites your waste is going to (including permit, licence or registered exemption reference number and details):

A	B	C	D (add more boxes if needed)
---	---	---	---------------------------------

Details of the people removing waste from your site (including their waste carrier registration number):

A	B	C	D (add more boxes if needed)
---	---	---	---------------------------------

		Quantity (specify volume or weight, eg m³, kg, T, number of skips)								
Types of waste arising (add more rows if needed):	EWC** code	Reused		Recycled			Disposed of		Relate to boxes above (ie insert A or B etc)	WTN † completed?
		on site	off site	for use on site	for use off site	Sent to recycling or	land-fill	other than landfill (eg		

[illegible]



SITE WASTE MANAGEMENT PLANS

STEP FOUR. IDENTIFY HOW TO MANAGE YOUR WASTE

Work out the best options for recycling and disposing

Where, when and what sort of materials you can reuse, recycle or dispose

- On-site
- Off-site

Store and dispose of all waste responsibly

- don't mix different types of waste.
- Segregate them as they are generated

Keep signed waste transfer notes (WTN) or consignment notes for all waste that you dispose of or transfer from your site

WTNs must be kept for at least 2 years

Consignment notes for at least 3 years

(they can be an appendix to your plan)



SITE WASTE MANAGEMENT PLANS

STEP FIVE. IDENTIFY WHERE AND HOW TO DISPOSE OF YOUR WASTE

Make sure you know where and how to dispose of your waste

Waste disposal contractors: you must make sure they dispose of it safely and legally

Check the following:

- Anyone transporting your waste is registered as a waste carrier with your environmental regulator (record their waste carrier legislation number on your plan)
- All sites receiving your waste have an appropriate permit, licence or registered exemption (record them on your plan)



SITE WASTE MANAGEMENT PLANS

STEP SIX. ORGANISE YOUR MATERIALS AND WASTE

Plan the materials you need for your project

Avoid over-ordering

Pre-order materials to specification at the design stage to reduce waste from off-cuts

Consider any limitations of your location

Consider using recycled or previously used materials

Record all decisions you make to minimise waste



SITE WASTE MANAGEMENT PLANS

STEP SEVEN. COMMUNICATE THE PLAN AND CARRY OUT TRAINING

Plan the materials you need for your project

Avoid over-ordering

Pre-order materials to specification at the design stage to reduce waste from off-cuts

Consider any limitations of your location

Consider using recycled or previously used materials

Record all decisions you make to minimise waste



SITE WASTE MANAGEMENT PLANS

STEP EIGHT. MEASURE YOUR WASTE AND UPDATE YOUR SWMP

You need to update the SWMP regularly

Keep track of all movements of waste within and from your site

- Types of waste taken
- Who removed them
- Where they took the waste

Keep your waste documents as an appendix to your plan

Update your plan with the totals of waste handled to reflect the progress of the project

Measure how well the plan is working (more or less waste generation)



SITE WASTE MANAGEMENT PLANS

STEP EIGHT. MEASURE YOUR WASTE AND UPDATE YOUR SWMP

Possibility to compare to future projects

- Volume

- Value

- Weight

Record waste costs against:

- Value of project

- Area of build floorspace

- Volume of building



SITE WASTE MANAGEMENT PLANS

STEP NINE. REVIEW THE SUCCESS AND LEARN LESSONS FOR THE FUTURE

At the end you will have accurate record of your materials and waste management

The information in your plan will be useful for future construction projects

You can write a report of the results of the SWMP and actions points for the future, which you can:

- send to staff and customers
- use to help you plan future projects

You must keep the SWMP for at least 2 years after the project has finished