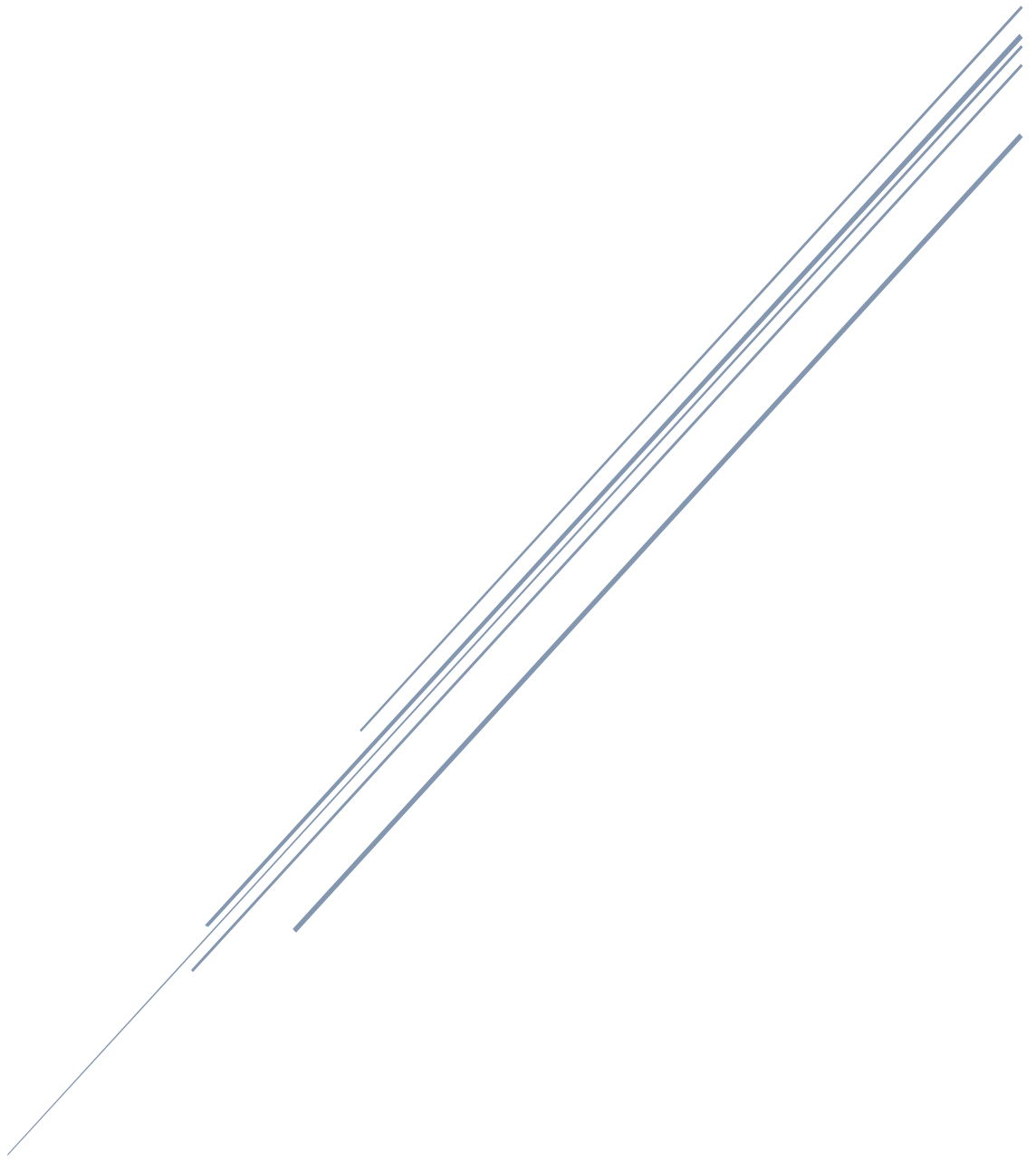


SITE WASTE MANAGEMENT PLAN (SWMP)

Paxton Street Car Park, Swansea

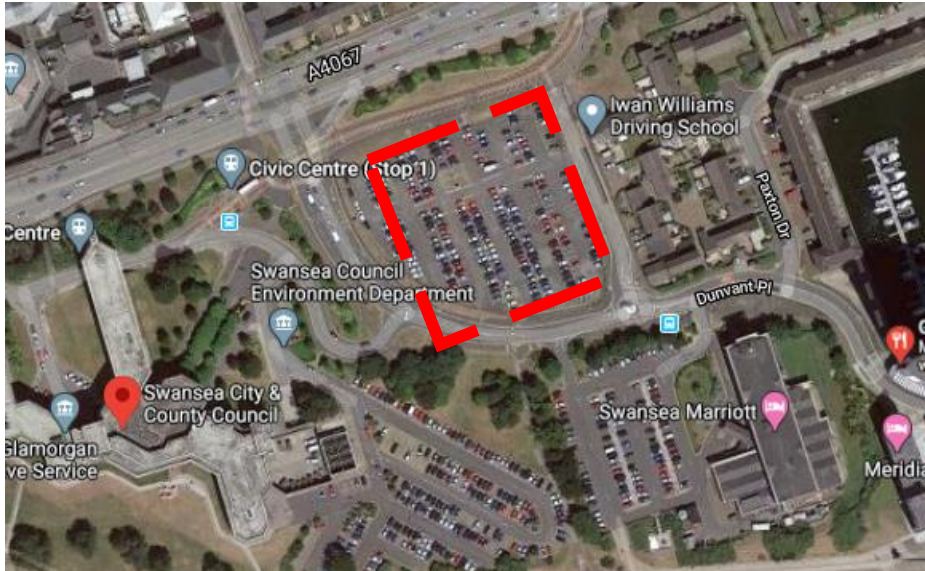


JW Construction Ltd

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1.0 Project Description

The project is the construction of a squared 20 storey building, which includes a three storey underground car-park. This is to be located at Paxton Street Car Park, Swansea and built by JW Construction Ltd. This area is near the Swansea Marriot Hotel and Swansea County Hall (which is shaded in red, in the image below). The building will be used for office spaces, so will be a commercial property.



(Google Maps, 2020)

The site is bounded by the A4067 to the north and Dunvant Place to the south. The site has direct access to Dunvant Place, which then leads onto the A4067. The site is currently a car park with no previous history of development.

2.0 Construction Methods and Materials Used

The materials and construction methods used will impact the use of the site waste management plan. The project has been split into 5 sections of construction;

1. Excavation
2. Foundations
3. Basement
4. Superstructure Frame
5. Cladding

2.1 Excavation

During the excavation phase, soil will be removed from the ground to make room for the basement and foundations. This will be done using excavators, whilst dumpers will be used to re-locate the soil on site in a designated location.

2.2 Foundations

The foundations for this project will be raft foundations, this is due to the property being a high rise building and the load of the structure has to be distributed over a large area (900m²). Raft foundations consist of a large reinforced concrete slab that provides support for the many columns and load bearing walls. The materials used in this system will be concrete and steel (rebar).

2.3 Basement

In the basement, diaphragm walls will be installed as the frame. A diaphragm wall is a structural concrete wall built in a trench, with deep excavation. In this case the excavation will be 13-14m deep. This is a frequently used construction method, which will provide enough support for the 3 storey basement to be used as a car park. The materials used in this method, will be concrete and steel (rebar).

2.4 Superstructure

This building has a steel frame, which is designed and manufactured off-site. It is then delivered to site in sections and erected using a large crane. A steel frame has been selected as it has a relatively low weight and can be erected quickly, whilst also providing a lot of strength. Also, a profile deck system is to be used for the floor construction method. This will also provide a lot of strength and will be required at each floor level. Due to these construction methods, steel will be used for the frame and concrete and steel will be the materials used in the floor construction.

2.5 Cladding

The final element is the cladding for the structure. The cladding at this project will be pre-fabricated curtain walling. This is a system that consists of an aluminium frame with glass panels fixed onto it. This construction method is produced off-site and delivered to site, then installed with a crane. When using curtain walling, aluminium and glass are the materials used.

3.0 Legislation

Environmental Protection Act 1990 (EPA 1990) – The most important environmental legislation and it is control of many aspects of how the environment is protected and regulated. The EPA 1990, which was amended in 1995, provides the main statutory framework in relation to waste on a site. Most of the waste leaving JW Construction's sites is either construction and demolition waste or controlled waste. Controlled waste is listed in the EPA 1990 as the waste arising from household, commercial or industrial premises.

In the EPA 1990, Section 34 imposes a 'duty of care' on producers and handlers of waste, 'to take reasonable measures to prevent the unauthorised deposit, treatment or disposal of waste'. This implies the following:

- JW Construction must keep records of how much waste it is generating
- JW Construction must ensure that a registered carrier collects their waste
- JW Construction must make sure that all transfer notes are completed and filed detailing the type of waste for disposal. These must be kept for two years (three for hazardous waste consignment notes)
- Ensure that all waste is dealt with in accordance with the 'Duty of Care'. Breach of duty of care is a criminal offence and can incur penalties of up to £20,000 or an unlimited fine if convicted.

EU Landfill Directive – A major source of Methane is landfill. Methane is a powerful greenhouse gas contributing to climate change which is produced when biodegradable materials such as paper, food wastes and green wastes, decompose in the absence of oxygen. As such, the Government and our partners in Europe have agreed the EU Landfill Directive. In 2000, the Government produced a national waste strategy which outlines the need for change towards a more sustainable approach to dealing with the large amount of waste produced in the UK on a yearly basis. JW Construction is aware of both the general purport of the directive and the specific requirements of the Regulations and is starting to reduce both the amount of waste it creates and the number of which gets sent to landfill.

Waste (England & Wales) Regulations 2011 – All waste produced by JW Construction is controlled.

Hazardous Waste (England & Wales) Regulations 2016 – JW Construction monitors the amount of hazardous waste being produced and registers each site if they feel the threshold is likely to be reached.

4.0 Roles and Responsibilities

Below lists the roles and responsibilities of the construction team.

	CRITERIA:	PRE-COMMENCEMENT RESPONSIBILITY:	MID-JOB REVIEW:	END OF JOB REVIEW:
1	Consider modern methods of construction and off-site fabrication to reduce waste.	Design team.		
2	Specify materials whose waste can be easily recycled.	Design team.		
3	Ensure drawings can be used to facilitate accurate quantity take-offs.	Design team.		

4	Ensure accurate take-offs and requisition of correct materials.	Site manager, buyer.		
5	Ensure material orders reflect take-off and requisition.	Buying team.		
6	Waste reduction targets and methods to reduce waste to be included in sub-contractor orders.	Quantity Surveying team.		
7	Effective material control on site to avoid duplicate orders.	Site manager.		
8	Accurate take-off of excavations and ground levels to balance cut & fill to avoid cart away of inert material.	Design team.		
9	Remediation strategy for contaminated sites to consider treatment or burial of material on site to avoid cart away of hazardous waste.	Design team.		
10	Specify segregated skips for timber, plasterboard, card and paper.	Buying Team		

Before the project starts, it is the joint responsibility of the client and the main contractor (JW Construction Ltd) to ensure there is a site waste management plan (SWMP) in place. Once the project commences, it is the responsibility of the client to notify the appoint sub-contractors of the SWMP and use it. The sub-contractor is then required to not leave any unrequired material at their workplace and place into the designated skips. This is to be communicated to the staff and sub-contractors via email, site inductions, toolbox talks and site notice boards/signs.

5.0 Types of Waste

The table below lists the types of waste during the specific construction stages and the waste target of each material. At JW Construction, we try to minimise waste as much as possible.

Excavation (for foundations and diaphragm walls)

EWC Code:	Key Group:	Materials:	Monitor waste material:	Waste reduction target:	Method to reduce waste:	Divert from landfill target:	Method to divert from landfill:
1705	Inert	Excavated material, mixed rubble	YES	0%	N/A	70%	Re-use 30% on site as general fill to rise levels

Foundations

EWC Code:	Key Group:	Materials:	Monitor waste material:	Waste reduction target:	Method to reduce waste:	Divert from landfill target:	Method to divert from landfill:
170101	Concrete	Reinforced concrete	YES	3%	Good stock control. Order correct amount	100%	Re-use on site as hard core below paths
170405	Steel (rebar)	Rebar in raft foundation	YES	3%	Good stock control. Order correct amount	100%	Accurate calculations in engineers report

Diaphragm Walls

EWC Code:	Key Group:	Materials:	Monitor waste material:	Waste reduction target:	Method to reduce waste:	Divert from landfill target:	Method to divert from landfill:
170101	Concrete	Reinforced concrete	YES	3%	Good stock control. Order correct amount	100%	Re-use on site as hard core below paths

170405	Steel (rebar)	Rebar in diaphragm walls	YES	10%	Good stock control. Order correct amount	100%	Accurate calculations in engineers report
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Frame

EWC Code:	Key Group:	Materials:	Monitor waste material:	Waste reduction target:	Method to reduce waste:	Divert from landfill target:	Method to divert from landfill:
170101	Concrete	Reinforced concrete	YES	3%	Good stock control. Order correct amount	100%	Re-use on site as hard core below paths
170405	Steel (rebar)	Rebar in profile deck floor and steel frame	YES	3%	Good stock control. Order correct amount	100%	Accurate calculations in engineers report

Cladding

EWC Code:	Key Group:	Materials:	Monitor waste material:	Waste reduction target:	Method to reduce waste:	Divert from landfill target:	Method to divert from landfill:
15018	Packaging	Packing from curtain walling	YES	0%	Request suppliers use minimum packaging	100%	Sub-contractor to take away all packaging with them
1704	Metals	Aluminium frame for curtain walling	YES	0%	Manufactured off site, all to be made to measure	100%	Accurate calculations in curtain walling calculations
170204	Glass	Glass from curtain walling	YES	0%	Manufactured off site, all to be made to measure	100%	Accurate calculations in curtain walling calculations

6.0 Waste Volumes and Masses

The below tables include the approximate calculations of waste from the construction works during each stage. The calculations for these values can be found in **Appendix A – Volume and Masses**.

<u>1) Excavation</u>					<u>Volume of waste</u>	<u>Mass of waste</u>
Material	Total Volume (m3)	Bulk Factor	Bulk Volume (m3)	To remain on site (m3)	To be removed from site (m3)	To be removed from site (tonne)
Soil (non-contaminated) - for basement, foundations etc	9000	1.2	10800	3240	7560	9450
Soil (non-contaminated) - for diaphragm walls	840	1.2	1008	0	1008	1260

<u>2) Basement</u>					<u>Mass of waste</u>
Material	Total Volume (m3)	Waste %	To be removed from site (m3)	Conversation factor	To be removed from site (tonne)
Concrete - Diaphragm walls	840	3	25.2	1.24	31.25
Concrete - Basement floors	2700	3	81	1.24	100.44
					<u>Mass of waste</u>
Material	Total Area (m2)	Waste %	Mass of waste (kg)	Conversation factor	To be removed from site (tonne)
Steel - Diaphragm walls	1680	3	5040	1000	5.04
Steel - Basement floors	2700	3	8100	1000	8.1

<u>3) Frame</u>					<u>Mass of waste</u>
Material	Total Volume (m3)	Waste %	To be removed from site (m3)	Conversation factor	To be removed from site (tonne)
Concrete - Profile deck floor	3600	3	108	1.24	133.92
					<u>Mass of waste</u>

Material	Total Area (m2)	Waste %	Mass of waste (kg)	Conversation factor	To be removed from site (tonne)
<i>Steel - Profile deck floor</i>	<i>18000</i>	<i>3</i>	<i>54000</i>	<i>1000</i>	<i>54</i>

In addition to these figures, there is also an approximation that there will also be minimum waste from the steel frame and curtain walling. But as these items are to be manufactured off site and fitted by sub-contractors, the waste will very minimum as they will be made to measure, there will only be off cuts. As a result, an allowance of 1 mixed skip per element (2 in total) has been made. As part of the sub-contractor appointment, they will be required to take all packaging with them and dispose of, not on site, this also reduces waste on site.

7.0 Minimise Waste

There are many ways to minimise waste on site. One way to minimise waste is to recycle any materials where applicable. For example, when the site is being prepared, but removing the soil for the foundations and basement, 30% of this soil (assumption) is to be re-used at the end of the project, for landscaping areas. This has approximately reduced the muck away off site by 3,240m³. Other ways to reduce the amount of waste is to bear in mind the size of materials when initially designing a project, to reduce the number of off-cuts. This could mean reducing or enlarging the room sizes.

Also, the site team has a duty to store materials correctly on site, this can be done by storing items in correct locations, such as plasterboard, in a dry cool location. This will mean the material doesn't get damaged or become unusable, resulting in waste and more material being ordered. The site team also have a responsibility of not ordering too much material, this will also result in less waste on site.

Another action that can also be done is when designing the project, the architect and contractor/client could discuss the option of choosing building products that only require minimal packaging, this will reduce the waste on site. Also, at the design stage, it could be discussed that alternative construction methods are used. For example, a steel frame (as used above) will have less waste than a concrete frame building. This is because an engineer will design the frame, and the materials will be made to measure, resulting in only 'off-cuts' being produced as waste. This is also the case for the curtain walling, as it will be pre-fabricated off site and made to measure, there will be very minimal waste. The sub-contractor will also be required to remove all packaging with them, thus also resulting in less waste.

8.0 Destination of Waste

At JW Construction Ltd, we try to reduce the amount of waste that goes to the landfill as much as possible by reducing, reusing or recycling as much of the material as we can. The table below lists the wastage materials and their final destination. Please note, a wastage percentage of 3% has been applied.

Type of Waste	Total Volume (m3)/Area (m2)	Total Mass (tonne)	Dealer	Final Destination	Comments
Soil - Excavation	8,568	10,624.32	John Jones Ltd	70% to landfill 30% on site for landscaping	30% to be used for landscaping
Concrete – foundations and basement floor	214.20	265.61	Tarmac Ltd	Recycled	To either be recycle for concrete on site in different location or different pour. Or a credit note can be given for the concrete returned to supplier. Once the supplier has all the unused concrete, it can be crushed down into hard core.
Steel – in foundations/steel frame/profile deck floor		67.14	Ellis Haul Ltd	Recycled	Either be recycled for steel on different location on site. Or returned to supplier who can melt down and recycle for other steel. There is also the option of taking the excess steel to a scarp merchants who will give money for any excess steel
Packages	Nil				
Aluminium – Curtain Walling	Nil				
Glass – Curtain Walling	Nil				
Pallets	Nil				

As mentioned previously in the SWMP, it is agreed that all sub-contractors remove from site all packaging (covers, pallets etc) associated with the product they are installing. As a result, there is no provision allowed for the frame or curtain walling as only off cuts will be produced as waste on site.

I have used previous costs we have occurred for the costs of the dealers, and these are listed below:

- John Jones Ltd (Muck away) - £200/load. A 'load' is equal to 20 tonne (8 wheeler lorry)
- Tarmac Ltd (premixed concrete) – Average costs are £65-£85/M3, therefore an average of £75/m3 has been allowed
- Ellis Haul Ltd (Steel such as rebar) – Average cost is £300/tonne

9.0 Budget for Waste Management

A budget is required for the waste management to identify the cost of the wasted materials and how that can affect the project.

The table below lists the budget for waste management on this project.

Please note:

- *No allowance has been made for packaging, pallets etc as these are to be removed from site by the sub-contractors*
- *As the steel frame is made to measure, a 4 yard skip has been allowed for cut offs*
- *A 4 yard skip has been allowed for the curtain walling for cut offs, as this is pre-fabricated off site*
- *30% of soil excavated is to be used for landscaping use*
- *As the concrete will be delivered in a ready mix concrete wagon, the unused material will be taken back to the supplier. But the contractor gets charged for a full wagon, as the concrete is made specific for that project, as per the engineer's requirement in the report. As a result, for the budget, JW Construction use the cost of concrete (average £75/m3). This is also the case for the wastage of steel, JW Construction use an average cost of £300/tonne*

<u>1) Excavation</u>					
Material	Total Volume (m3)	Total Mass (tonne)	Number of cart away	Cost/cart away	Total Cost
Soil (non contaminated) - for basement, foundations etc	7560	9450	473	£ 200.00	£ 94,600.00
Soil (non contaminated) - for diaphragm walls	1008	1260	63	£ 200.00	£ 12,600.00
<u>2) Basement</u>					
Material	Total Volume (m3)	Total Mass (tonne)	Total m3 of waste	Cost/m3	Total Cost
Concrete - Diaphragm walls	25.2	31.248	25.2	£ 75.00	£ 1,890.00
Concrete - Basement floors	81	100.44	81	£ 75.00	£ 6,075.00

Material	Total Area (m2)	Total Mass (tonne)	Total mass of waste (tonne)	Cost/tonne	Total Cost
Steel - Diaphragm walls	1680	5.04	5.04	£ 300.00	£ 1,512.00
Steel - Basement floors	2700	8.1	8.1	£ 300.00	£ 2,430.00
<u>3) Frame</u>					
Material	Total Volume (m3)	Total Mass (tonne)	Total m3 of waste	Cost/m3	Total Cost
Concrete - Profile deck floor	108	133.92	108	£ 75.00	£ 8,100.00
Material	Total Area (m2)	Total Mass (tonne)	Total mass of waste (tonne)	Cost/tonne	Total Cost
Steel - Profile deck floor	18000	54	54	£ 300.00	£ 16,200.00
Material	Total no. skips	Skip Type	Maximum tonne	Cost/Skip	Total Cost
Off cuts - Steel Frame	1	Steel/mixed	6.3	£ 220.00	£ 220.00
Material	Total no. skips	Skip Type	Maximum tonne	Cost/Skip	Total Cost
Off cuts - Curtain Walling/Miscellaneous	1	Mixed	6.3	£ 220.00	£ 220.00

As a result, the total budget for waste management on this project is £143,847.00. But this is only a budget figure, so this means that the project team at JW Construction Ltd will do everything in their power to minimise this cost. If the site team can agree a price with a scrap merchant, they can look to turn the £16,200 costs of waste from steel, actually into a profit as the scrap merchant will purchase the excess steel from them.

10.0 Implementation, Monitoring and Review Actions

The site manager is responsible for the site waste management plan. The site waste management plan should be sent to all sub-contractors so they understand their role before they enter site. This can be done via email. It will also be listed in their contract with JW Construction Ltd that they must adhere to the SWMP and remove all packaging themselves from site. Also, another way to implement the SWMP is that all staff and sub-contractors will be informed of all the environmental measures and issues that are specific to the activity they will be carrying out. The site manager will also have correct signage, to distinguish the segregated waste skips. This is to be

communicated to the staff and sub-contractors via email, site inductions, toolbox talks and site notice boards/signs.

In order to monitor the SWMP, there will be a review during the projects life (midway). This will identify if the project is on target to achieve the targets wastes that are set during the pre-construction stage of the projects life. John Jones Ltd, the waste management contractor, will provide data sheets (monthly) which will breakdown the waste groups generated from the waste removed from site. This will then be measured against the targets agreed pre-construction.

Once the project has been completed, the project team at JW Construction Ltd will hold a meeting reviewing the SWMP. This will involve checking the waste target for each material, compared to the actual waste for the material. Then there will be actions from the meeting stating what could have been done better and/or to improve the SWMP procedure.

11.0 References

Jones, J., 2020. John Jones Haulage. [Online]

Available at: <http://www.haulage-plant-hire.co.uk/>

[Accessed 3 March 2020].

recycle, I., 2020. lets recycle. [Online]

Available at: <https://www.letsrecycle.com/news/latest-news/site-waste-management-plan-regulations-repealed/>

[Accessed 28 March 2020].

12.0 Appendix A – Calculations for Waste

	WASTE CALCULATIONS
(1)	EXCAVATION;
	SOIL = $m^3 = L \times W \times d.$
	= $30 \times 30 \times 10$
	= $9'000 m^3$
	= $9'000 \times BF$
	= $9'000 \times 1.2$
	= $10'800 m^3$
	Removed from ground
	= 30% used for landscaping
	= $10'800 \times 30\%$
	= $3'240 m^3$
	= $10'800 - 3'240$
	Remove from site = $7'560 m^3$
	$m^3 \rightarrow t = \times 1.25.$
	= $7'560 \times 1.25$
	= $9'450 t$
	Waste volume = $7'560 m^3$
	Waste mass = $9'450 t$

SOIL - BASEMENT

$$M^3 = L \times W \times d$$

$$= 30 \times 0.5 \times 14$$

$$= 210 \times 4 \text{ sides}$$

$$= 840 M^3 \times (\text{Bulk Factor})$$

$$= 840 \times 1.2$$

$$\text{Waste Volume} = 1'008 M^3 \quad (\times 1.25\%)$$

$$\text{Waste Mass} = 1'260 t$$

2) BASEMENTDIAPHRAGM WALLS - CONCRETE

$$= 30 \times 0.5 \times 14 = 210 M^3 \times 4 \text{ SIDES}$$

$$= 840 M^3 \quad (\text{ASSUME 3\% WASTE})$$

$$\text{Waste Volume } 3\% = 25.20 M^3 \quad (\times 1.24\%)$$

$$\text{Waste Mass} = 31.25 t$$

DIAPHRAGM WALLS - STEEL

$(100 \text{ kg}/M^2)$
OF CONCRETE

$$M^2 = 30 \times 14$$

$$= 420 M^2 \quad \text{CONCRETE / SIDE}$$

$$= 1'680 M^2 \quad \text{CONCRETE}$$

$$= 1680 \times 100 \quad (100 \text{ kg}/M^2)$$

$$= 168'000 \text{ kg}$$

$$3\% = 5040 \text{ kg}$$

$$\text{Waste Mass } 3\% = 5.04 t$$

	<u>BASEMENT - CONCRETE^{IN} FLOORS</u>
•	ASSUME FLOOR IS 1M THICK.
	$= 30 \times 30 \times 1$
	$= 900 \text{ m}^3 / \text{FLOOR} \quad (\times 3)$
	$= 2700 \text{ m}^3$
	Waste Volume 3% = 81 m^3
	$= 81 \text{ m}^3 \times (1.24 \text{ t})$
	3% = 100.44 t Waste Mass
	<u>BASEMENT - STEEL IN FLOORS</u>
	(Reinforce) 100 kg/m^2
	$= 30 \times 30$
	$= 900 \text{ m}^2 / \text{FLOOR}$
	$= 2700 \text{ m}^2 \times 100$
	$= 270000 \text{ kg}$
	3% = 8100 kg
	3% = 8.1 t Waste Mass
3)	<u>FRAME</u>
	<u>PROFILE DECK - FLOOR</u>
-	ASSUME 30M WIDE + 200M DEPTH
	$= 30 \times 30 \times 0.2$
	$= 180 \text{ m}^3 \times 20 \text{ (Floors)}$
	$= 3600 \text{ m}^3$
	3% = 108 m^3 Waste Volume
	$= 3600 \times 1.24 \text{ t}$
	$= 4464 \text{ t}$
	3% = 133.92 t Waste Mass

•	<u>STEEL - IN PROFILE DECK</u>	100 kg/m ²
	= 30 x 30	
	= 900 m ² / FLOOR	
	= 900 x 20	
	= 18'000 m ² x 100 (kg)	
	= 1'800'000 kg	
	= 1800 t Steel	
	3% = 54t	Waste Mass
•	<u>FOUNDATIONS- RAFT</u>	
	<u>CONCRETE</u>	
	= 30 x 30 x 1	
	= 900 m ³	= 3% = 27 m ³ Waste
	= 900 x 1.24t	Volume
	= 1'116 t	
	3% = 33.48t	Waste Mass
•	<u>STEEL</u>	100 kg/m ²
	= 30 x 30	
	= 900 m ² x 100	
	= 90'000 kg / 1000	
	= 90 t	
	3% = 2.7t	Waste Mass
•		