Case Study



Macro-objective 2:
Resource efficient and circular material life cycles

Indicator
2.2 Construction and Demolition Waste and Materials

The following case study is based on the information from the scenario described in the introduction module; Company CO. Office Building in Madrid.



Level 1: Conceptual Design Assessment



During the concept design, the construction and demolition waste efficient design concepts have been reviewed using the checklist from section *L1.4 Checklist of relevant design concepts* within **User Manual 3** of **indicator 2.2**. Below is a brief description of how these aspects were taken into account during discussions and decision-making at the concept design stage.

1. Target setting and KPIs in line with the EU waste hierarchy and the European List of Waste:
The design team has reviewed the Level(s) guidance and has thereafter defined the following objectives for the construction waste:

- ≤10% landfill disposal for non-hazardous waste,
- ≥90% material recovery and or reuse through appropriate segregation on-site and selecting the appropriate waste hauler/manager that will demonstrate a recovery rate higher than 90% for all non-hazardous materials for last year data.

2. Project type and influence on Construction and Demolition Waste constraints:
The project will be a new-build construction on a greenfield site. Through the geotechnical reports, it has been confirmed that:

- There is no contaminated soil on site.
- Excavated soil will be reused on site as much as possible.
- The site has enough space for appropriate collection of waste in a segregated manner.

3. Pre-demolition audit:
It is a greenfield without any existing buildings, so demolition is not applicable.

4. Good construction practice:
Over-ordered materials will be a KPI for the project and the contractor will be encouraged to try to negotiate buy-back options with suppliers for over-ordered materials for a fixed % of the original purchase price.

Onsite training will be provided, and there will be a designated person on site to review the appropriate segregation of waste in different containers on a daily basis. Waste will be monitored

monthly to assure that the quantities of the different waste and final recovery rates are in accordance with the initial objectives.

5. Site Waste Management Plan (SWMP):
A professional specialised in construction waste management will develop the Waste Management Plan from the design stage. They will provide reviewed/updated versions of the document while the design is being developed. In addition, they will monitor real waste data during construction to assure that it is in line with initial objectives.

Level 2: Detailed Design and Construction



During the design stage, the following construction waste was estimated for the office building within the *2.2 Construction and Demolition waste and materials calculator:*

Tip: Cells with a white background must be filled in manually with the information collected from the project. The orange shaded cells are calculated automatically.

The following table is an excerpt of this calculator and shows the estimated construction waste for the building:

L2 CW (Construction Waste) estimate tab:

vTier 1 building aspect	Tier 2 building aspect	Description of material / element	BoQ (number of units)	BoQ conversion factor (and optional material cost)	BoQ (kg)	Estimated wastage (CW) rate (%)	Estimated over ordering (OO) rate (%)	Estimated CW (kg)	Estimated OO material (kg)	Optional: unit price (€ /kg)	Optional: "cost" of CW	Optional "cost" of OO	Nature of waste	List of waste code	Best outcome for CW	Probable outcome for CW	Best outcome for OO	Probable outcome for OO
Shell	Foundations (substructure)	Poured concrete	600m^3	1200kg/m^3 (& €100/m^3)	720000	7.0%	13.0%	50400	93600	0.08	4032	7488	Inert	17 01 01	Onsite recycling	Onsite recovery as backfill/ landscaping	Offsite recycling	Offsite recycling
Shell	Foundations (substructure)	Iron rebar	600m^3 (concrete)	100kg/m^3 concrete (& €500/t)	60000	10.0%	2.0%	6000	1200	0.50	3000	600	Non-haz	17 04 05	Preparation of CW for reuse onsite or offsite	Offsite recycling	Reuse of OO material offsite or return	Reuse of OO material offsite or return
Shell	Loadbearing structural frame	Poured concrete	1250m^3	2400kg/m^3	3000000	15.0%	5.0%	450000	150000	0.08	36000	12000	Inert	17 01 01	Onsite recycling	Onsite recovery as backfill/ landscaping	Offsite recycling	Offsite recycling
Shell	Loadbearing structural frame	Iron rebar	1250m^3 (concrete)	100kg/m^3 concrete (& €500/t)	125000	10.0%	2.0%	12500	2500	0.50	6250	1250	Non-haz	17 04 05	Preparation of CW for reuse onsite or offsite	Offsite recycling	Reuse of OO material offsite or return	Reuse of OO material offsite or return
Shell	Façades	Bricks	1400m^2	60 bricks/ m^2 & 3.5kg/ brick (& €1.5/ brick)	294000	10.0%	5.0%	29400	14700	0.40	11760	5880	Inert	17 01 02	Onsite recycling	Offsite recovery as backfill/ landscaping	Reuse of OO material offsite or return	Offsite recycling
Shell	Façades	Glass	700 m^2	3000kg/m^3 & 30mm thick (& €80/m^2)	63000	5.0%	0.0%	3150	0	0.90	2835	0	Inert	17 02 02	Onsite recovery as backfill/ landscaping	Inert waste landfill	Reuse of OO material offsite or return	Offsite recovery as backfill/ landscaping
Shell	Façades	Aluminium frame	500m	2.5kg/m (& €2100/t)	1250	15.0%	0.0%	187.5	0	2.10	393.75	0	Non-haz	17 04 02	Offsite recycling	Offsite recycling	Reuse of OO material offsite or return	Reuse of OO material offsite or return
Shell	Roof	Asphalt shingles	200 m^2	12kg/ m^2 (& €30/m^2)	2400	10.0%	3.0%	240	72	2.50	600	180	Non-haz	17 03 02	Offsite recycling	Non-hazardous waste landfill	Reuse of OO material offsite or return	Reuse of OO material offsite or return
Core	Fittings and furnishings	Wood laminate flooring	1700 m^2	7,5kg/m^2 (& €12/m^2)	12750	10.0%	5.0%	1275	637.5	1.60	2040	1020	Non-haz	17 02 01	Offsite recycling	Waste to energy plant	Reuse of OO element offsite or return	Waste to energy plant
Core	Fittings and furnishings	Gypsum-based materials	1000 m^2	640kg/m^3 & 12.5mm thick, 8kg/m^2 (& €5/m^2)	8000	20.0%	5.0%	1600	400	0.63	1000	250	Non-haz	17 08 02	Offsite recycling	Non-hazardous waste landfill	Reuse of OO element offsite or return	Offsite recycling
Core	Fittings and furnishings	Door elements (containing wood, metal and glass)	80 doors	35kg/door (& €115/door)	2800	4.0%	5.0%	112	140	3.29	368	460	Non-haz	17 09 04	Reuse of OO element offsite or return	Waste to energy plant	Reuse of OO element offsite or return	Reuse of OO element offsite or return

These estimates result in 40.9 kg/m^2 of Construction Waste which is within the normal range according to the type of building.
The comparative parameter has been extracted from *Table 1. Influence of project type and location on Construction and Demolition Waste*, **User Manual 3** for this indicator.

	Sum of sub-chapters			Specific sub-chapters of CW+OO to be reported on									
	Mass (kg)	**Mass (kg/ m^2)**	**Fraction**	**Concrete, brick, tile, ceramic etc.**	**Wood**	**Glass**	**Plastic**	**Haz. wood, glass, plastic**	**Bituminous mixtures**	**Metals**	**Insulation materials**	**Gypsum**	**Mixed**
Reruse	3912	0.2	0.5%	0	0	0	0	0	72	3700	0	0	140
Recycling	277388	13.9	33.9%	258300	0	0	0	0	0	18687.5	0	400	0
Material recovery (backfill)	529800	26.5	64.8%	529800	0	0	0	0	0	0	0	0	0
Energy recovery	2025	0.1	0.2%	0	1912.5	0	0	0	0	0	0	0	112
Disposal - of which	4990	0.2	0.6%	0	0	3150	0	0	240	0	0	1600	0
Inert	3150	0.2		0	0	3150	0	0	0	0	0	0	0
Non-haz	1840	0.1		0	0	0	0	0	240	0	0	1600	0
Hazardous	0	0.0		0	0	0	0	0	0	0	0	0	0
Total (kg)	**818114**	**41**	**100.0%**	**788100**	**1912.5**	**3150**	**0**	**0**	**312**	**22387.5**	**0**	**2000**	**252**
Building GFA (m^2)			**20000**										
Normalised CW (kg/m^2)			**40.9**										

Level 3: As-built and In-use



During the construction stage, the information integrated in the *2.2 Construction and Demolition waste and materials calculator* will be based on collection receipts for the waste produced and actual project information.

Useful Tips

What if...

Your building is residential/renovation?
There are no significant differences for this type of building. For any type of building, the same example could apply as the way to estimate and monitor waste to avoid landfill and encourage recycling.



Related indicator tips:

- Already as of the design stage, it is recommended to integrate different measures to reduce materials and associated waste, having in mind circular economy principals.
- Being aware of the waste that will be generated is a key step in order to identify which are the main waste streams and choose the appropriate hauler/waste manager to achieve the best outcome for the construction waste.
- It is recommended to do a deep review of the current haulers available in the region where the project will be located to ensure potential recycling opportunities and the best recovery rates.
- Training the construction staff about appropriate waste management is one of the key issues for successful recycling during the whole construction phase.
- The space on site for appropriate waste segregation is very important for promoting recycling as well as to reduce costs for managing less commingled or mixed waste, as this waste needs to be segregated off-site with associated costs.
- Where space on site is too limited to allow waste materials to be segregated, a waste contractor may be used to separate and process recyclable materials off-site. Similarly, manufacturers' take-back schemes could also be used. Where this is the case, it is recommended to have sufficient documentary evidence which demonstrates that segregation of materials is carried out to the agreed levels and that materials are reused or recycled as appropriate.

Other related indicators:

Please see other related indicators such as **2.1 Bill of quantities, materials and lifespans**, **2.3 Design for adaptability and renovation** and **2.4 Design for deconstruction**.