

**Table 1** Comparison of construction waste generation in various countries

Country	Concentration of Construction waste in total waste (in%)	C&D waste recycled (in%)	Sources
Australia	44	51	[8]
Brazil	15	8	[8]
Denmark	25-50	80	[8]
Finland	14	40	[8, 9]
France	25	20-30	[8, 9]
Germany	19	40-60	[8, 9]
Japan	36	65	[8, 9]
Italy	30	10	[8, 9]
Netherlands	26	75	[9]
Norway	30	7	[8]
Spain	70	17	[8]
United Kingdom	Over 50	40	[8]
United States of America	29	25	[8, 9]

**Table 2** Generation of the C&D by Major Work Trade

Major Work Trade Groups	Works Performed by Relevant Work Trades
1. Preliminaries	General Site Cleaning, Removal of all Construction Debris and Waste Erection of Site Hoarding and Scaffolding (metal / bamboo) Works
2. Earthworks	Excavation and Backfilling
3. Formwork Installation	Erection and Striping of Formwork (timber / metal / system formwork)
4. Concrete Work	In-situ casting concrete
5. Wet-finishing Works	Brick/Block laying, masonry (wall and floor screed + tile or stone installation works), Painting work, and Installation of Sanitary wares (bathtub, toilet and wash basin) and related plumbing works
6 Dry-finishing Works	Carpentry & Joinery Work, Ironmongery, Glazing and other decorative works

**Table 3 Summary of Case Studies of Three Building Projects in Waste Management Criteria**

	<b>Case 1</b>	<b>Case 2</b>	<b>Case 3</b>
<b>Project Description</b>	<p><b>- Nature of the project:</b> Public Project – Residential housing tower</p> <p><b>- Project Size: Large</b> Five 48-storey residential towers stand on large suburban site</p> <p><b>- Contract Period: Reasonably sufficient</b></p>	<p><b>- Nature of the project:</b> Public Project – Institutional building</p> <p><b>- Project Size: Medium</b> Single institutional building of 7 storeys stands on medium-sized suburban area.</p> <p><b>- Contract Period: Reasonably sufficient</b></p>	<p><b>- Nature of the project:</b> Private Sector Development – Residential tower</p> <p><b>- Project Size: Small</b> Single residential tower of 30 storeys stands at a corner site between two streets in the city.</p> <p><b>- Contract Period: Comparatively short</b></p>
<b>Earthwork for pile cap and drainage installation</b>	Excavated materials for pile cap and drainage works were used for backfill. Surplus inert and non-inert excavated materials were removed to public fills and landfills respectively. No sorting was carried out on site.	Excavated materials for pile cap and drainage works were used for backfill. Surplus inert and non-inert excavated materials were removed to public fills and landfills respectively. No sorting was carried out on site.	Excavated materials for pile cap were removed off site to either public fills or landfills allowing working space for pile cap construction. Backfilling material was imported as required to suit pile cap construction. Drainage work was very minimal; no specific record was taken. No sorting was carried out on site.
<b>Superstructure</b>	Cast in-situ concrete with abundant amounts of precast concrete elements like facade, cladding and precast staircases.	Due to complexity of the project design, a traditional cast in-situ construction method was adopted.	Traditional construction method was adopted as the structural element and the building was enveloped by curtain wall cladding.
<b>Formwork</b>	One set of system formwork per tower. The formwork is made of large aluminium and steel panels for vertical members. Steel table-form for slab construction. The formwork has been used for more than 40 repetitive cycles.	Timber formwork is used in only 4 repetitive construction cycles. Three full sets of timber formworks have been used.	Timber formwork is used in 7 repetitive construction cycles. Five full sets of timber formworks have been used.
<b>Waste Management actions</b>	<i>Metal formwork reused in other projects and scrap metal could all be sold in the recycled market.</i>	<i>Large-sized dismantled formwork was sorted and reused in small-scale concreting work. Timber waste was disposed of at landfills.</i>	<i>N.A. Dismantled timber formwork materials were mixed with other construction waste and disposed of at landfills.</i>
<b>Concreting Work</b>	Batch plant was erected in the construction site to serve this project. Ready mixed concrete was delivered to the location by mixer trucks.	Used ready mixed concrete from outsourced concrete supplier.	Used ready mixed concrete from outsourced concrete supplier.
<b>Waste Management actions</b>	<i>Concrete residues were recycled by washing and screening on site and remixed in the batching plant for miscellaneous concrete works and products like cooking bench, kicker block and road curb.</i>	<i>Concrete residues from the last truck load and slump tests were used for paving temporary site access. Surplus was sorted in concrete clumps and disposed of at public fills for reclamation works.</i>	<i>N.A. Concrete residues from the last truckload and slump tests were used for paving temporary site access. Surplus was mixed with other construction waste and disposed of at landfills.</i>
<b>Wet- Finishing Works</b>	- <i>Cement mortar:</i>	- <i>Cement mortar:</i>	- <i>Cement mortar:</i>
<b>Waste Management action</b>	<i>The on site batch plant mixed mortar to serve this project, so surplus is kept to minimum.</i>	<i>Purchased ready-mixed mortar from outsourced supplier; surplus mortar was dumped at ground level in the sorting area for sorting as inert material.</i>	<i>Purchased ready-mixed mortar from outsourced supplier; surplus mortar was dumped at ground level and mixed with other construction waste for disposal at landfills.</i>
	- <i>Brick and Block:</i> <i>Supplied 45° brick at edge to reduce cutting waste</i>	- <i>Brick and Block:</i> <i>Supplied 45° brick at edge to reduce cutting waste</i>	- <i>Brick and Block:</i> <i>Cutting waste was dumped at ground level and mixed with other construction waste for disposal at landfills.</i>
	- <i>Tiles:</i> <i>Constantly collected surplus materials at working levels and redistributed it to other working level. Cutting waste was dumped at ground level in the sorting area for sorting as inert material.</i>	- <i>Tiles:</i> <i>Surplus materials were collected when tiling work was completed and removed to company's godown for sale or future reuse. Cutting waste was dumped at ground level in the sorting area for sorting as inert material.</i>	- <i>Tiles:</i> <i>Surplus materials were collected when tiling work was completed and removed to company's godown for sale or future reuse. Cutting waste was dumped at ground level and mixed with other construction waste for disposal at landfills.</i>

<b><i>On Site Waste Sorting</i></b>	<i>Two large enclosed waste storage areas were located within the site area, one for inert waste and the other for non-inert waste. Sorting work was diligently carried out and the sorted material and waste were removed to public fills and landfills respectively.</i>	<i>Two containers were located at ground level and labelled as inert and non-inert waste as collection points. Sorting work was carried out sluggishly and the sorted material and waste were removed to public fills and landfills respectively.</i>	<b><i>N.A.</i></b> <i>All wastes were accumulated in a refuse compound located at ground level and disposed of at landfills without sorting.</i>
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