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# Potential and Challenges of Using C&D Waste as Alternative Raw Material for Construction in India

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(GIZ) GmbH

## SMART CITIES SUSTAINABLE CONSTRUCTION



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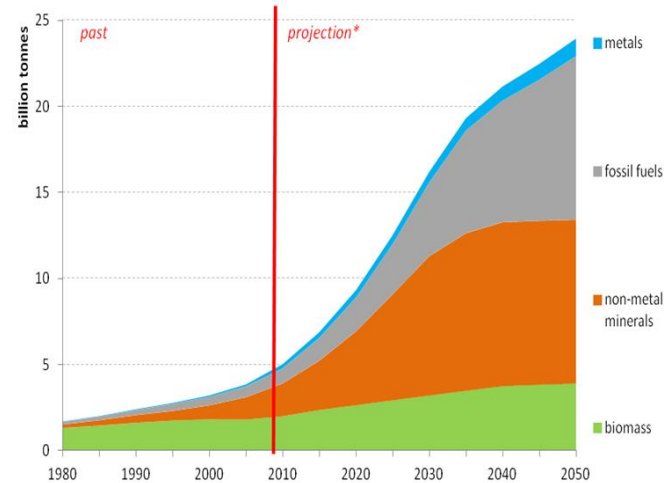
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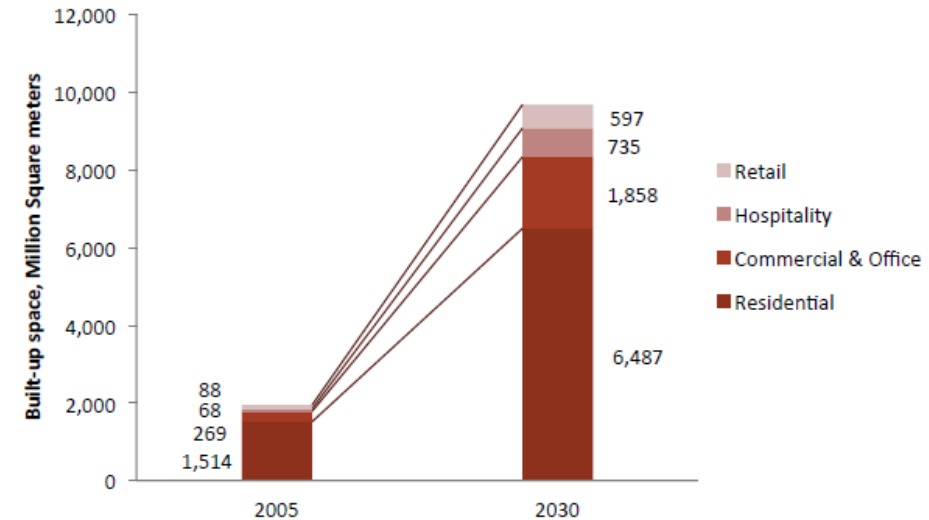
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## Background of construction sector in India



\*Main assumptions: India follows typical material use pattern during development process; economic growth rates of about 8% p.a. until 2030, thereafter around 7% p.a. until 2035 and 6% p.a. until 2050. Data sources: Dittich, 2012; SEI, 2011; TERI, 2012; UNdata, 2012; Worldbank, 2012

Projected material demand in India  
(IGEP, 2013)



Projected increase in built-up area  
(Climate Works Foundation, 2010)

- Most important resources: soil, sand, stones, limestone
- Already facing serious problems: environmental impacts, social conflicts, illegal mining, bans and restrictions, shortages and price spikes



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## The “Resource Efficiency” project

- Bilateral project of GIZ India on behalf of the German Federal Ministry of Environment (BMUB) and the Ministry of Environment, Forest & Climate Change (MoEF&CC)
- Commissioned in May 2014, 3 years duration till April 2017
- Partnership Landscape:
  - German Knowledge Partners
    - 
    - 
  - Indian Knowledge Partners
    - 
    - 
- Selected Sectors: Construction and Mobility
- Project Goals:
  - Market study and analysis
  - Pilot projects and advisory services
  - Policy recommendations to the government



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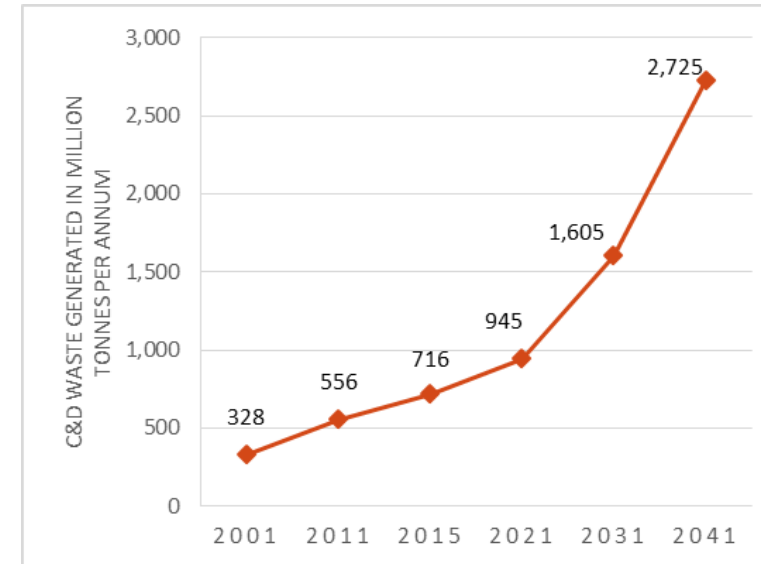
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## C&D waste generation in India v. other countries

Country	Generation (million tonnes/ Annum)	Per Capita Generation (tonnes/ Capita)	Year
China	2,190	1.63	2011
(Lu, 2014)			
EU-27	461	0.94	2005
(European Commission (DG ENV), 2011)			
India	530	0.423	2013
(CSE, 2014)			
USA	170	0.585	2003
(Calkin, 2009)			
Japan	123	1.04	2007
(Zimring, 2014)			
England	100	1.573	2012
(DEFRA, 2015)			



CDW generation projection in India based on urban growth rates

- Government study (TIFAC, 2001) found 10-15 million tons/y; considered dated and underestimate
- No reliable and comprehensive nationwide estimate



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## C&D waste generation in selected Indian cities

City	Population (Census 2011)	CDW Generation (T/Day)	CDW Generation (Million T/Annum)
Mumbai	12.4 million	2,500	0.750
Delhi	16.8 million	4,600	1.380
Kolkata	14 million	1,600	0.480
Chennai	4.6 million	2,500	0.750
Bangalore	8.7 million	875	0.263
Jaipur	3.5 million	200	0.060
Patna	2.5 million	225	0.060
Ahmedabad	5.6 million	700	0.210
Bhopal	1.9 million	50	0.015
Coimbatore	2.6 million	92	0.028

- In most cities, there were no comprehensive and reliable records
- Better data in Delhi, Ahmedabad, Chennai



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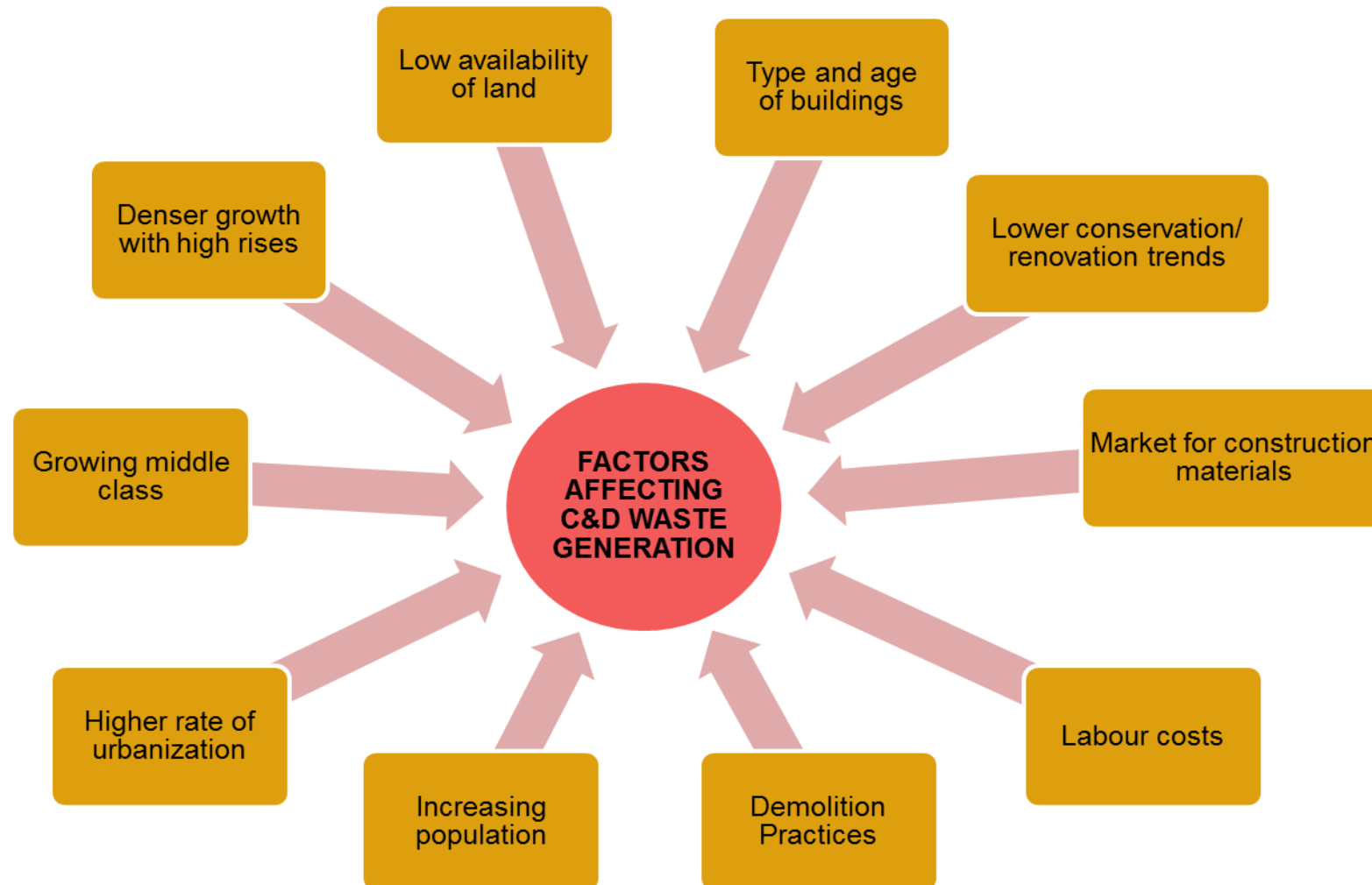
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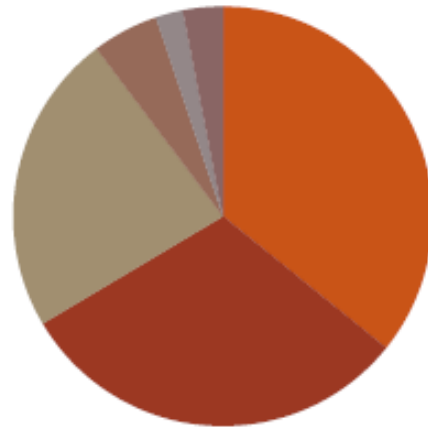
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## C&D waste composition and fate in India



- Soil, Sand & Gravel (36%)
- Bricks & Masonry (31%)
- Concrete (23%)
- Metals (5%)
- Wood (2%)
- Others (3%)

(TIFAC, 2001)

- Metals, wood, almost always salvaged for sale
- Sometimes tiles, bricks, stone slabs also salvaged for sale
- But rest (biggest share) is discarded – either in designated landfills or illegally
- Illegal dumping creates eyesore and myriad environmental problems
- An unknown but probably significant fraction is used as “fill”
- High recycling potential of currently discarded fractions remains unutilized







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## Best practice in C&D waste utilization: Germany



- More than 90% of C&D waste is utilized
- High cost of disposal and strict enforcement
- 4 categories of applications:
  - Gardening and landscaping
  - Earth work
  - Civil engineering
  - Structural engineering
- Detailed standards and restrictions: engineering + environmental
- Policy support: e.g., preferential procurement





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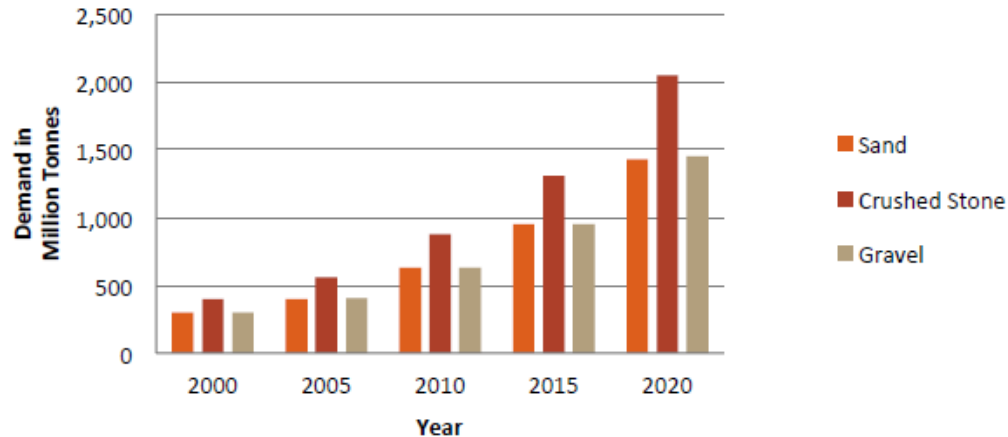
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## C&D waste reuse potential in India



Projected demand for aggregates in the Indian construction sector  
(The Freedonia Group, 2013)

- Current sand demand ~ 1,000 MT/y; aggregate demand ~ 1,300 MT/y
- Current C&D waste generation ~ 500 MT/y (CSE, 2014)
- A significant portion of C&D waste can be used to make sand and aggregates
- Sand and aggregate market facing shortages and price spikes due to restrictions on mining/quarrying
- Already m-sand is economically competitive in some places



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## Examples of C&D waste utilization in India

**2000 TPD Delhi plant  
(since 2009)**

**300 TPD Ahmedabad plant  
(since 2014)**

### Challenges:

- Inadequate management of chain-of-custody of C&D waste
- C&D waste typically of mixed and variable composition
- Lack of widely accepted quality standards
- Weak demand for products due to perception of inferiority





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## Recommendations

- Comprehensive municipal guidelines for collection, segregation, inventorization and tracking (supplemented by monitoring and enforcement)
- Collaborative frameworks with developers and builders
- Technical standards and certification
- Awareness and green marketing
- Technical support to potential entrepreneurs
- Policy support for new products: e.g., preferential procurement, sales tax rebates, etc.
- **New SWM Rules will mandate it!**





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# Thank you!

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