3R in Construction and Demolition Waste (CDW) – potentials and constraints

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Agenda

- Definition of Construction and Demolition Waste (CDW)
- Relationship between the 3R concept and CDW
- Situation in Germany
- Examples in Asia
  - Indonesia
  - Thailand
  - India
- Possible applications
- Conclusion
Construction and Demolition Waste

- **Construction waste**: mainly leftovers from new construction materials (e.g. cut-offs, damaged materials), packaging waste, used materials during construction and all other wastes typical for activities on a construction site.

- **Demolition waste**: collection of all construction materials from a building, after removal of certain (hazardous) parts (e.g. asbestos, mercury containing parts, tar, PVC).

- DW is much larger in volume than CW.
Facts around CDW

- **Concrete** is the second most consumed material after water and is the basis for the urban environment
  - Consumption worldwide:
    - 1950: less than 2 to 2.5 billion tonnes
    - 2006: between 21 and 31 billion tonnes

- **CDW** can constitute up to 50% of the MSW

- In many industrialized countries reuse and recycling of CDW is an integrated part of their SWM schemes and achieve recycling quotas of up to 90% and more

- Countries such as the Netherlands and Japan achieve near complete recovery of waste concrete
Negative Impacts of CDW (1)

Uncontrolled Management of CDW

Environment
- Water, Soil
- Flora and Fauna
- Air pollution
- Climate change

Economy
- Loss of primary resources
- International reputation
- Effect on tourism
- Fuel consumption (transport)

Public health and social life
- Health hazards
- Use of public space
- Proliferation of pests
- Working safety

Source: Fimpel Consult
Negative Impacts of CDW (2)
Solutions for CDW according to 3R

- **Reduce**: e.g. multi-purpose buildings, reusable building structure, prefabricated buildings
- **Reuse**: e.g. Reuse door frames, pipes, windows, etc.
- **Recycle**: e.g. Aggregate steel, wood
- **Incinerate/Dispose**: e.g. Incineration with/without energy recovery, garbage dump, sanitary landfill
Predesigned and prefabricated houses

Reusing doors and frames

Sorted wood for recycling

Recycled aggregate

Demolition material

CDW landfills

Estimated aggregate

Reused doors and frames
Close-loop solution for CDW

- **Reduce**
  - Natural resources
  - Production of primary building material
  - Construction of new buildings and structures
  - Use of buildings and structures

- **Reuse**
  - Production of secondary building material
  - Selective demolition

- **Recycle**
  - CDW treatment
  - Recyclable CDW

- **Dispose**
  - Non recyclable CDW
  - Controlled disposal
  - Emissions to the environment
  - CDW recycling outside of construction industry

Reduce → Reuse → Recycle → Dispose
Economic advantages

- **Economic impulses**
  - Improvement of the income situation of the recycling industry
  - More jobs for workers with low and high qualification levels
  - Recovery of costs associated with transportation and tipping fees
  - Good quality of waste materials stimulated by better prices

- **Reduction of disposal costs**
  - Less wastes end up in landfills, increasing lifetime and reducing costs

- **Conservation of natural resources**
  - Return of waste materials into the materials’ cycle
  - Reduction of the dependency on primary materials

- **Lower costs of new constructions**
  - Lower prices than new materials
Environmental advantages

- **Natural resources →**
  - Less primary resources, smaller raw materials warehouse, lower landscape consumption

- **Reduction of CO₂-Emissions →**
  - Less production energy when recycling
  - Smaller transport distances

- **Elimination of illegal and unauthorised dumping →**
  - Recycling discourages illegal dumping and reduces negative environmental effects upon groundwater, surface-water, air, flora & fauna and landscape

- **Improvement of air quality →**
  - Controlled disposal of non-mineral CDW means to be able to prevent ignition and incineration of e.g. rubber and plastic
Social and health advantages

- **Reduction of health hazards generated by illegal deposits**
  - Reduction of proliferation of pests if CDW is deposited on controlled sites
  - Emissions into the air or leaching of toxic substances into the soil and/or groundwater affect the population
  - Unstable dumps and deposits are dangerous for civilians and workers

- **Reduction of health hazards generated by incineration**
  - Uncontrolled incineration of CDW can cause emissions of toxic compounds or substances such as dioxins

- **Better use of public space**
  - Lower growth rate of landfills and more space for productive uses, e.g. green or living areas
Instruments

- **Life Cycle Analysis (LCA)** → consider each state of the product’s life
  - environmental criteria: resource use, embodied energy, embodied pollution, recyclability, material efficiency, product life

- **Design and planning** → considerations around new projects
  - resource saving, flexibility for future changes, durable and non-toxic products, recycled products, labelling of products, no overestimation of quantities, planning future deconstruction

- **Tendering** → clarify major requirements before beginning projects
  - certified contractors, minimize waste, management plans, payment on fulfilment

- **During and after construction** → waste minimization
  - organized site, supply just in time and with minimum packaging, separation of materials, appropriate disposal

- **During renovation and deconstruction** → waste minimization
  - licensed contractors, renovation or deconstruction plan, separation of wastes, controlled deconstruction
Prerequisites

- **Research and development**
  - universities, research institutes and private companies

- **Legislation and enforcement**
  - legal framework, licensing, sanctions and fees

- **Economic incentives to support the market**
  - high landfill taxes, taxes for quarrying, import duties for raw materials, etc.

- **Establishment of professional associations**
  - representation of members and industry in legislative venues; facilitation of interaction between members and organizations; provide information

- **Certification**
  - quality assurance

- **Information exchange**
  - workshops, seminars, training programmes to achieve progress

- **Promotion of CDW reuse and recycling**
  - gain general acceptance, e.g. campaigns, green procurement mandatory for government and communal buildings
Situation in Germany

- CDW recycling was introduced beginning the 1980s
- Generation (2007): 201.8 Mio.tons (57% of the total generated wastes)
  - 64% soil from excavation, 25% mineral CDW, 8% from road rehabilitation; 3% construction waste
- Recycling rate (2007): 89.2%
- Extensive legislation and administrative directives on reuse and recycling of CDW;
  - e.g.: source separation at construction and selective demolition are compulsory
- Extensive monitoring system on quality and quantities
  - self-commitment on achieving high recycling rates
- Decreasing CDW intensity (kg CDW / GDP)
Reusing Berlin Wall in a recycling plant

Separation during demolition

Garden and Landscape architecture in Munich
Examples in Asia (1)

- Indonesia
  - Treatment, reuse, recycle of debris waste generated by the Indian Ocean Tsunami (around 854,000 m³)
  - Common CDW
    - Partnerships with the Ministry of Environment, local government agencies, civil society organizations, technology suppliers and other agencies
    - DEBRI-Project (UNEP) with three key pillars:
      - (a) technology support
      - (b) capacity building
      - (c) economic instruments

Reparation of window frames and doors
Examples in Asia (2)

- Thailand
  - No legislation on CDW management
  - No CDW recycling facility or CDW-disposal site in Bangkok
  - Debris wastes from the tsunami were disposed in landfills
  - Reusable items are removed and marketed by private companies
  - ✓ 2007: Baseline study on quantities of CDW produced in Bangkok
  - ✓ 2009: Estimation of CW generation and management in Thailand
  - ✓ Joint project between Ministry of Environment and GTZ with recommendations on CDW management
  - ✓ The Bangkok Metropolitan Administration plans CDW processing facilities and introduction of collection, transportation and disposal fees
Examples in Asia (3)

- India
  - Manual on MSW Management includes a chapter on CDW but states that CDW is not reused or recycled in India
  - TIFAC reports that some demolition contractors have recovery rates from 25% in old buildings to 75% in new buildings, but that these activities are not widely practiced
Possible applications

- Information exchange → good practices of other countries
- Awareness campaigns
- Research and development technologies → waste mapping, standards
- Institutional and legal basis → consider participation of the industrial branch
- Required infrastructure → consider privatisation
- Strengthening the market → taxes on landfilling, importing raw material and quarrying virgin material, tax exemptions for recycled materials
Conclusion

- **Reduction of energy consumption as well as of CO$_2$-Emissions**
  Production energy of recycled materials is considerably less than the energy used to produce and transport primary construction materials.

- **Reduction of environmental degradation**
  Illegal dumping of waste and excessive extraction of natural resources has negative environmental effects.

- **Reduction of health hazards generated by illegal deposits**
  Proliferation of pests can be reduced if CDW is reduced, reused, recycled and minimal quantities are deposited on controlled landfills.

- **Improvement of air quality**
  Emissions due to production and uncontrolled disposal or burning are reduced.
Thanks for your attention!

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