Sustainable Infrastructure (SDG 9 and SDG11)

Recycling and Reuse of Construction & Demolition (C&D) Waste in Sustainable Construction

by:

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Indian Scenario of C&D Waste

- Global annual C&D waste generation is about 2.1 billion tonnes (UNEP).
- India generates ~ 350 million tonnes of C&D wastes every year.

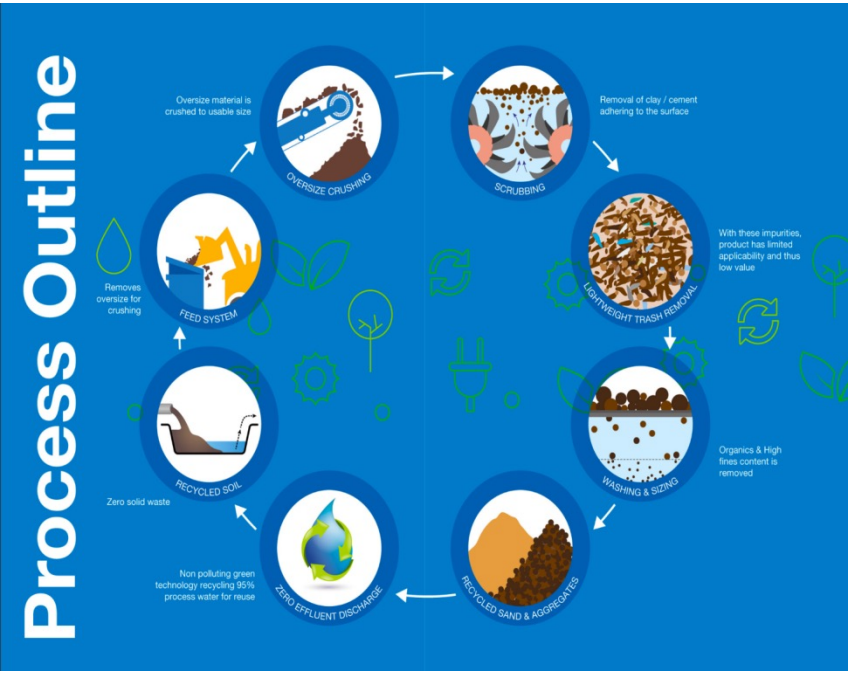
C & D Waste Generation

Source of waste	(kg/sqm)
Waste generated by new construction	40–60
By demolition, renovation	300–500
By building repairs	40–50

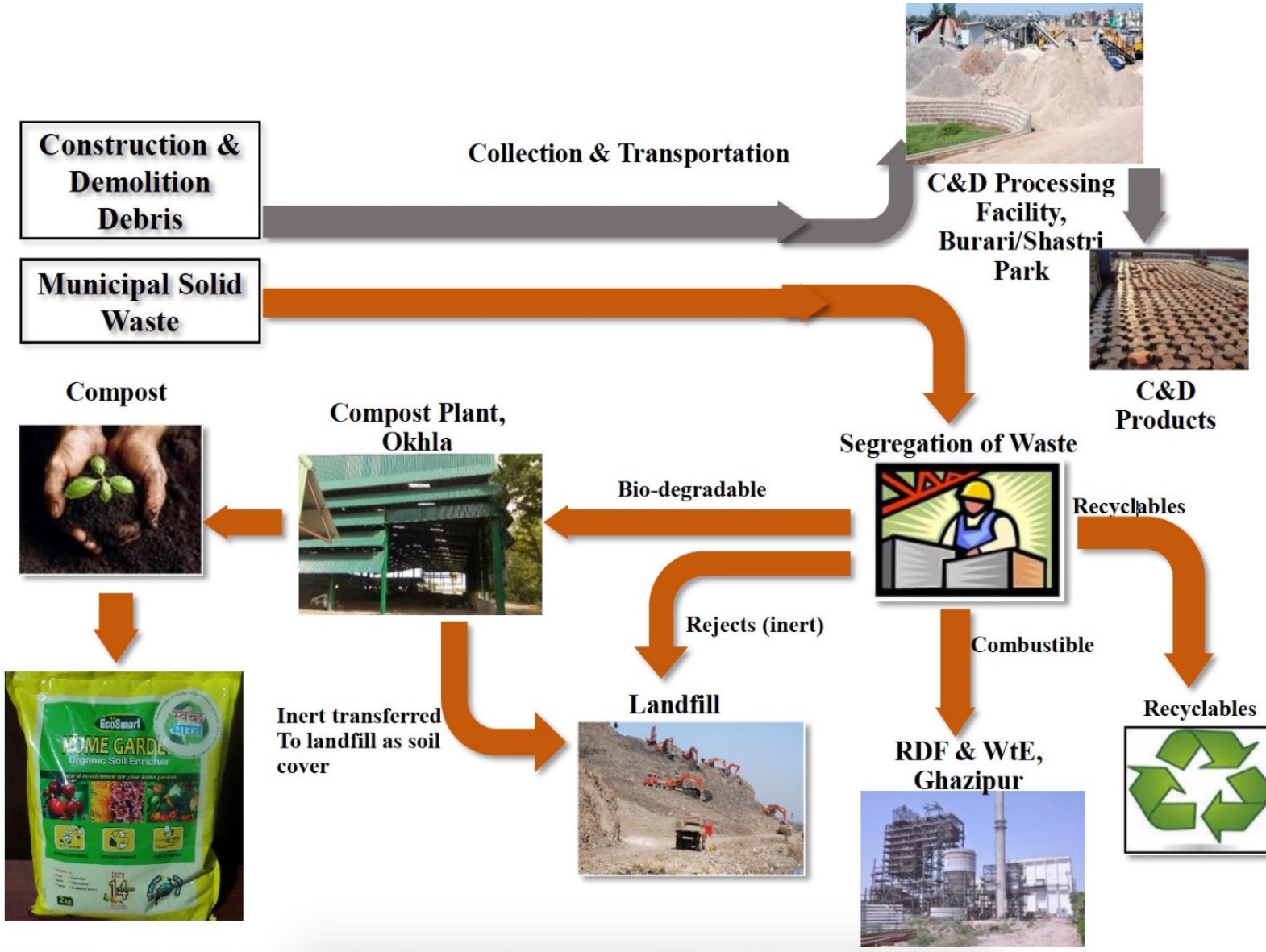
City wise Scenario

Major city	C&D wastes (tons/day)
Delhi	5000
Mumbai	3000
Chennai	2500
Kolkata	1600
Bangalore	875
Ahmedabad	700
Coimbatore	292

Processing of C&D Waste



Recycled Concrete Aggregates



Characteristics of Recycled Aggregates

Collection of C&D waste

Separation of impurity

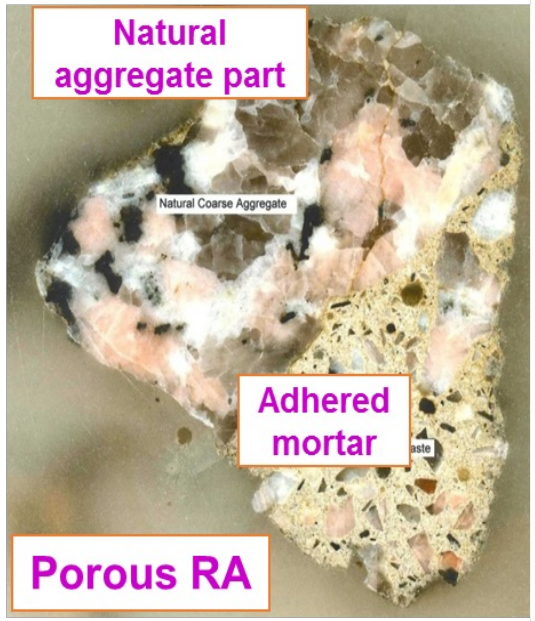
Crushing

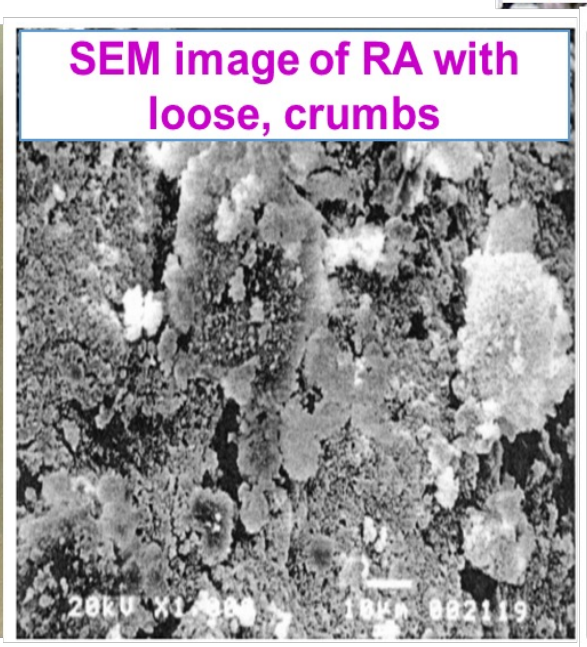
Gravity separation

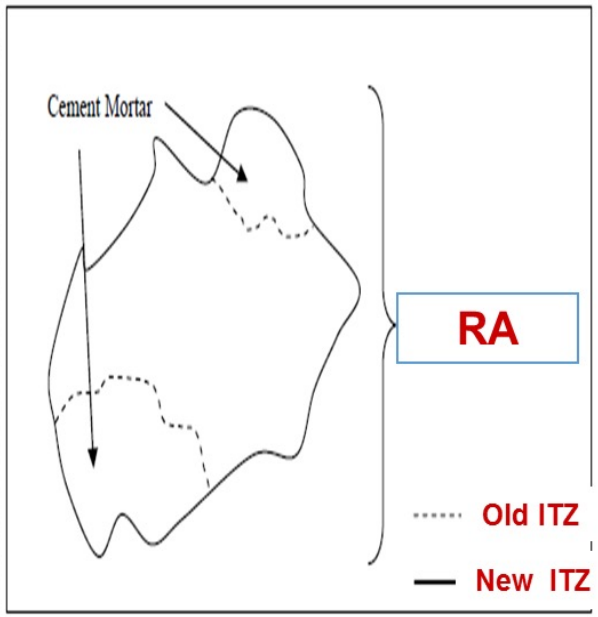
Fine Separaton

Heap of different size RA

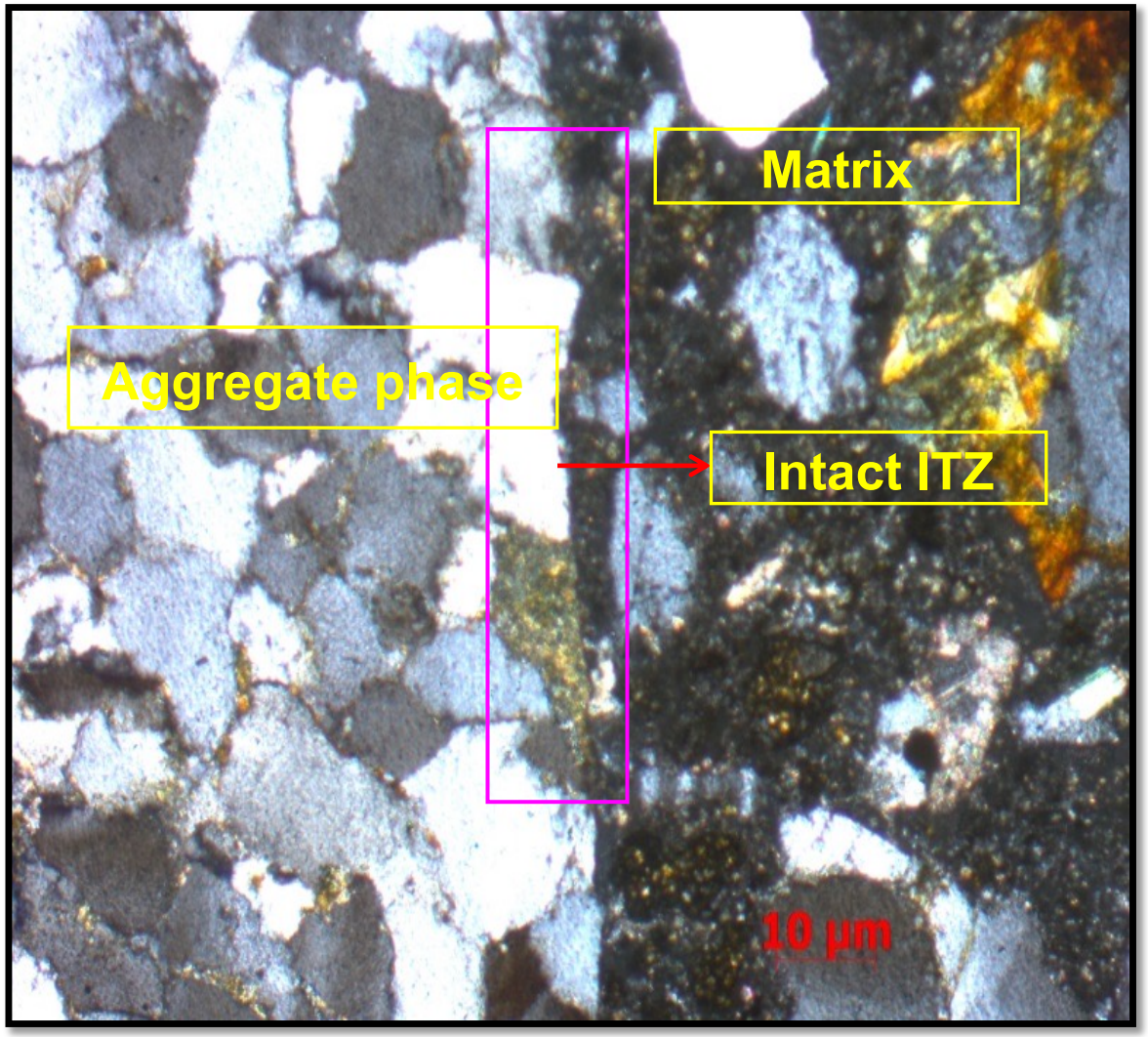
- Large amount of loosely adhered mortar
- Porous in nature
- High absorption tendency
- Weak interfacial transition zone (Two ITZs)
- Presence of cracks, pores and fissures
- Poor grading



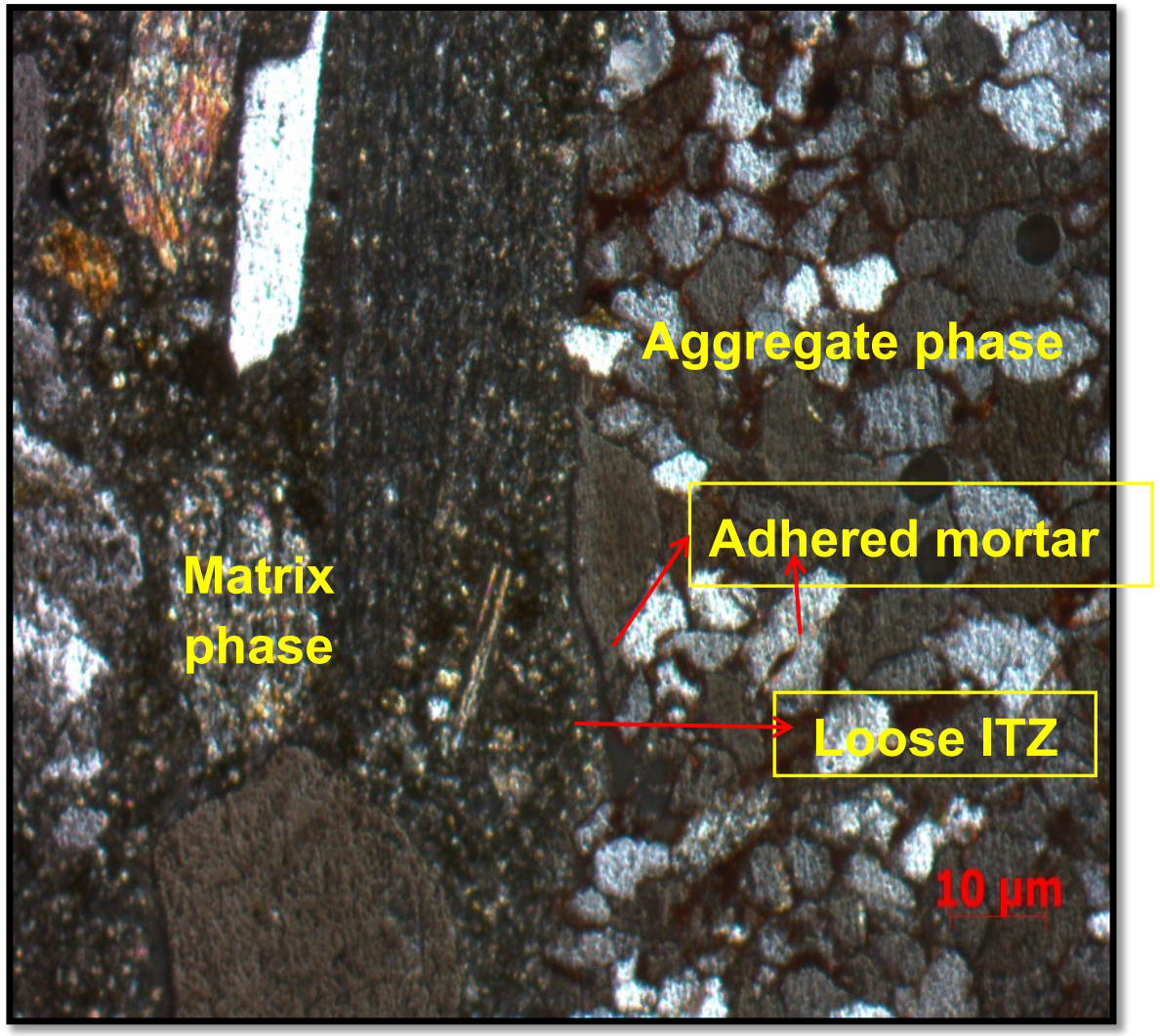




Processing of Recycled Aggregates



Natural Aggregate based Concrete



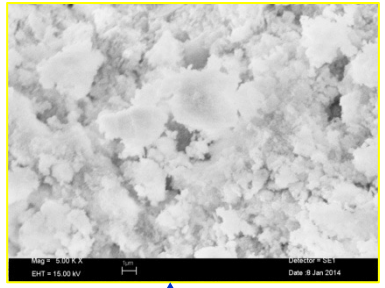
Recycled Aggregate Concrete

Processing of Recycled Aggregates

Processing of Recycled aggregate for removal of adhered mortar:

Abrasion, Heat Treatment, Micro-wave, chemical, thermo-chemical, mechano-chemical etc.

Untreated



RFA

Treated

Thermo-Chemical Treatment Method:

Treated RCA (Pre-heating at 500°C with 0.7M)

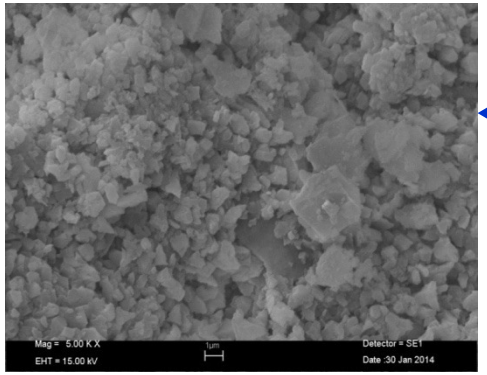
Treated RFA (Pre-heating at 600°C with 0.4M)

Soaking the RA in water

Heating RA at different temperature

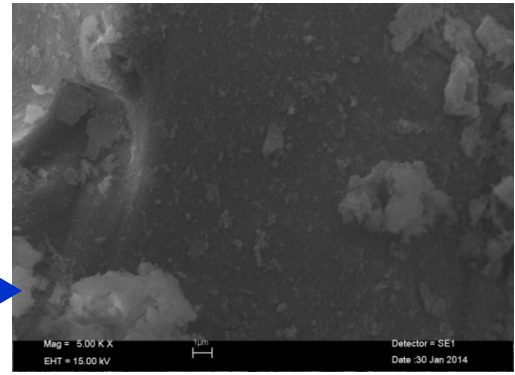
Soaking the RA in HCL acid

Soaking the RA in water

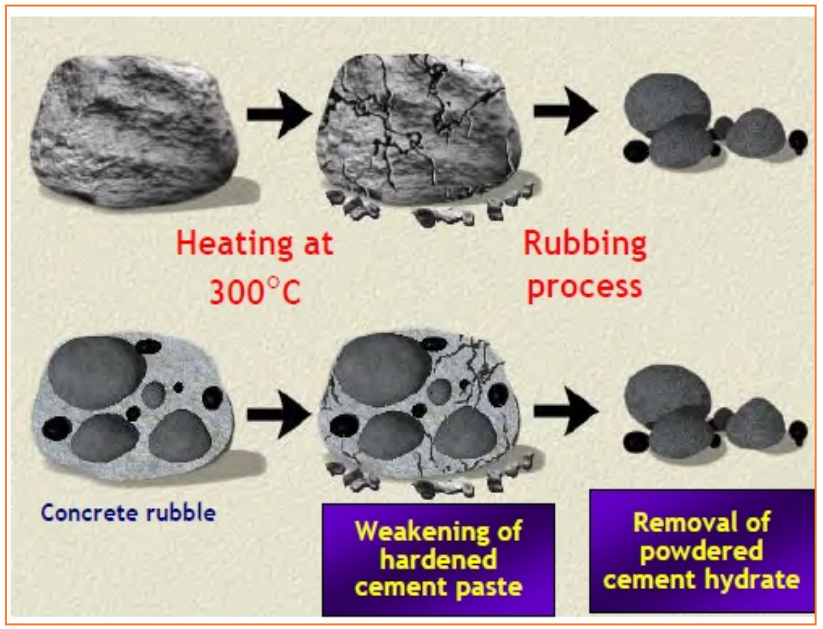


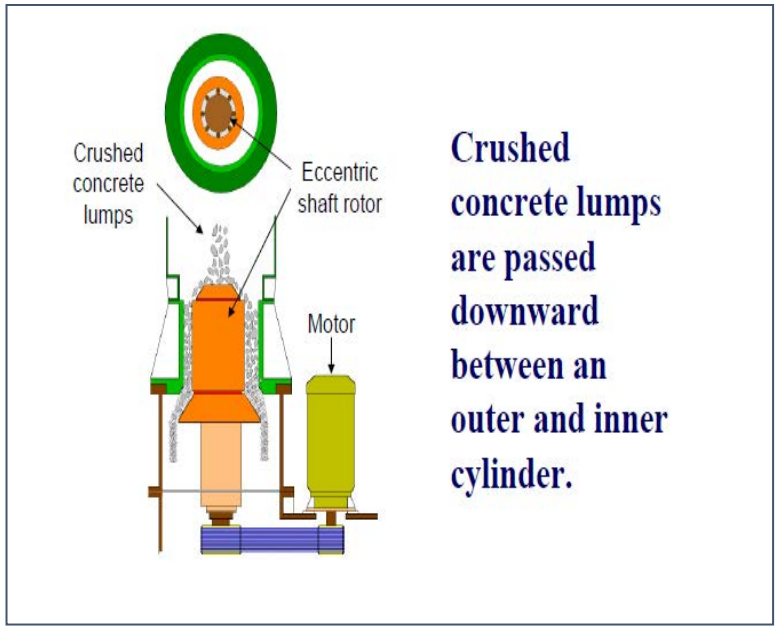
Untreated RCA

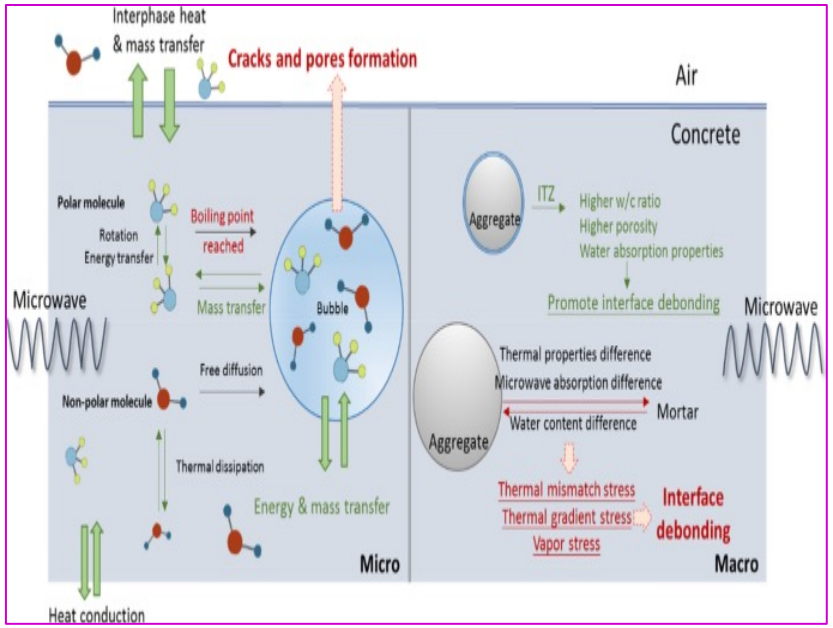
Treated RCA



C&D Waste Processing



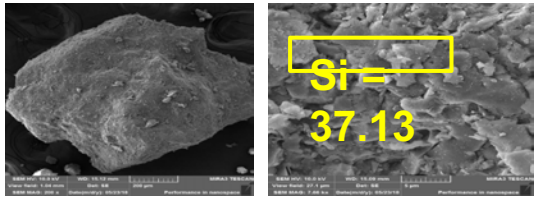




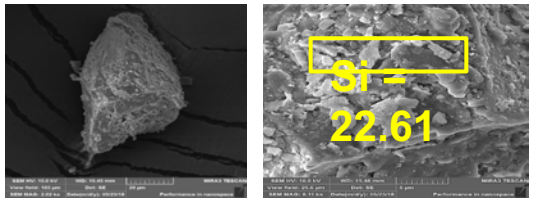
Heating and rubbing method

Eccentric shaft rotator

Microwave method



River Sand



Recycled fine sand

RFA

C&D Waste Generation & Utilisation

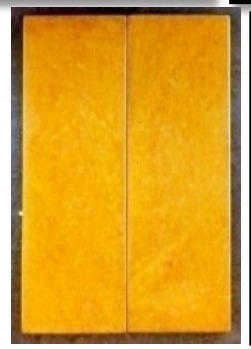






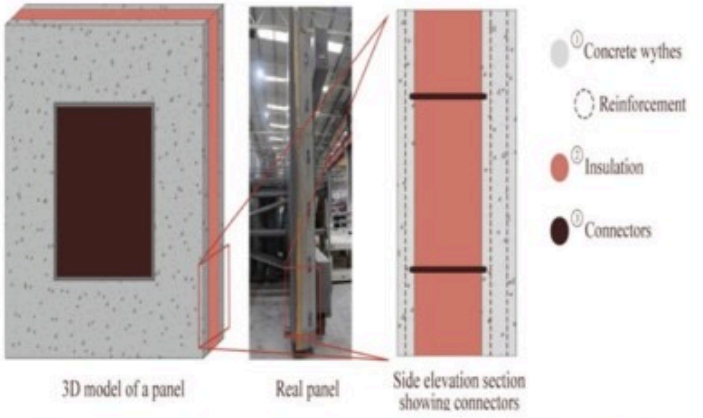


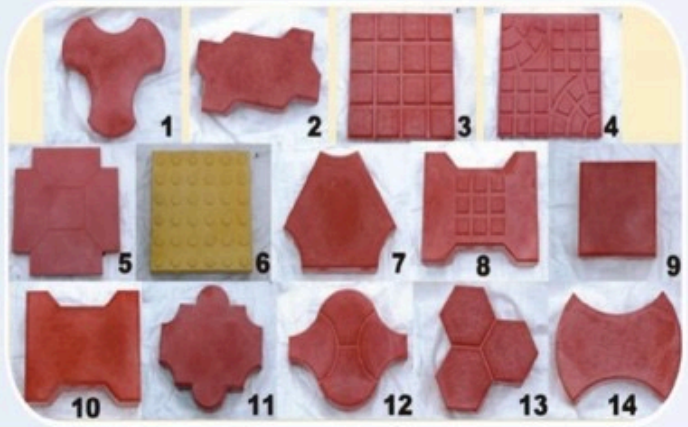





Demolition of Twin Tower Noida, NCR Delhi generated around 80,000 tonnes of C&D wastes for processing & utilisation

C&D Waste Building Products

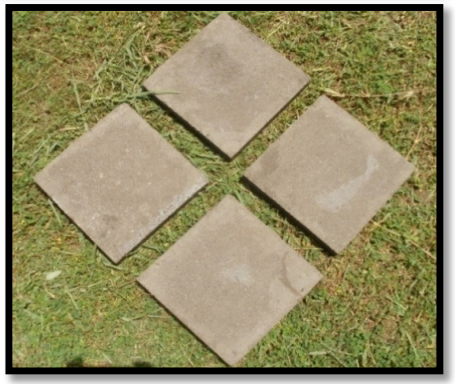




C&D Waste based Products

- Size : 200 mm X 160 mm X 75 mm
- Method : Compaction
- Recycled Coarse Aggregate : 50 % (12.5 mm)
- Compressive Strength : 35 – 40 MPa
- Water Absorption : 3 – 4 %
- Abraison : 2.2 mm
- Meets requirements of IS : 15658 – 2006

PAVING BLOCKS



- ✓Size : 150 mm X150 mm X 20 mm
- ✓Method : Compaction
- ✓Recycled Coarse Aggregate : 50 % (10 mm)
- ✓Compressive strength : 7.5 – 10 MPa
- ✓Water Absorption : < 6.0 %
- ✓Meets requirements of IS : 1237 – 2012

FLOORING TILES

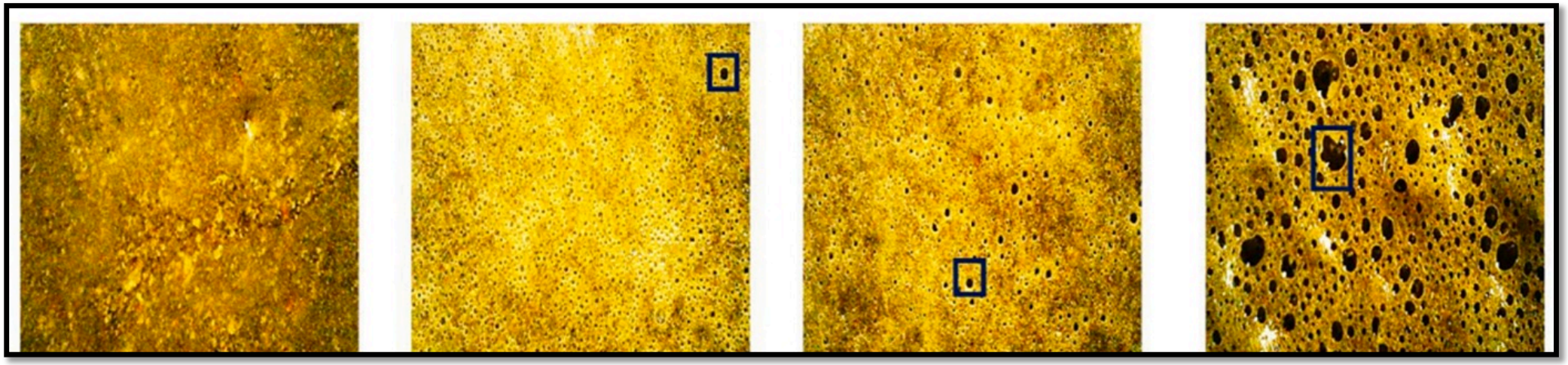
- Size : 190 mm x 90 mm x 90 mm
- Method : Vibration-Compaction
- Recycled Fine Aggregate : 50 % (3 - 4.75 mm)
- Compressive strength : 8.0 – 9.0 MPa
- Water Absorption : <10 %
- Meets Requirement of IS : 1077 – 1992

BRICKS

C&D Waste Aggregates based Products

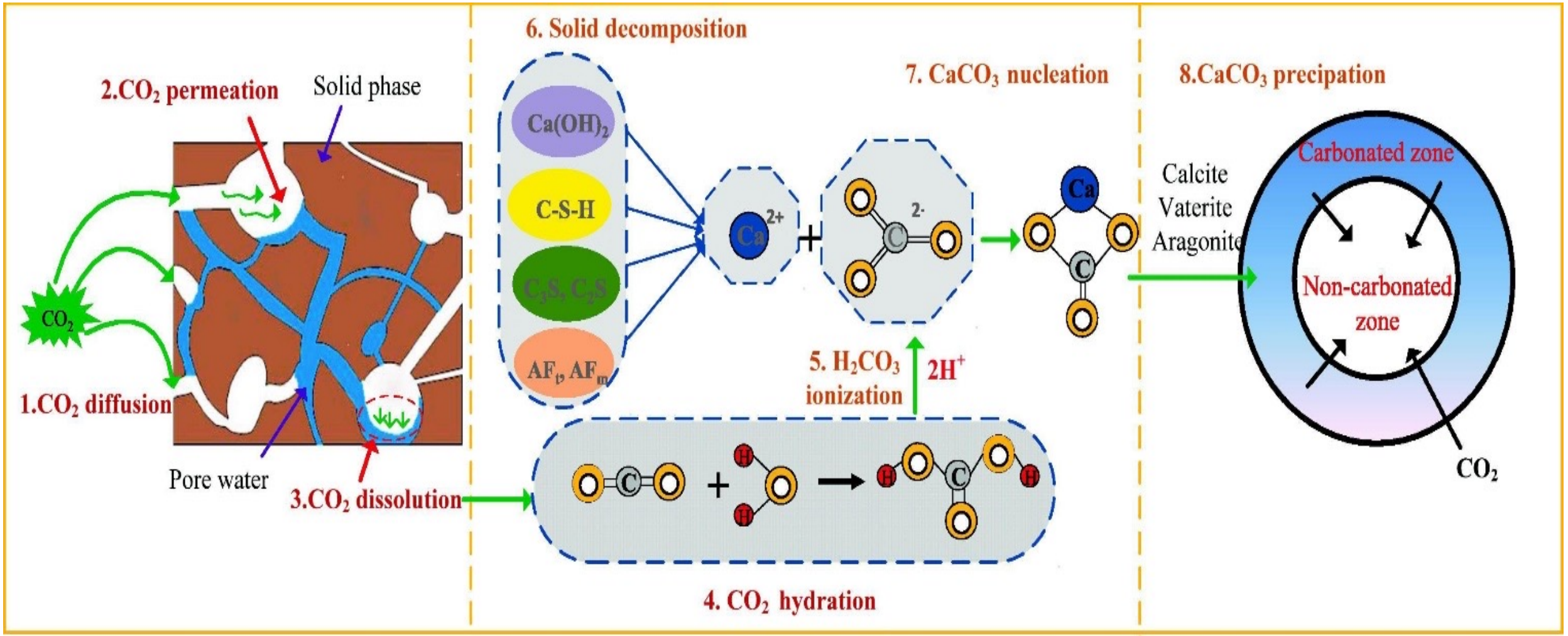
- ✓ Methods proposed to quantify the amount of adhered mortar/cement paste to identify its quality
- ✓ C&D waste based light weight concrete and pervious concrete developed
- ✓ Flowable fill made with recycled fine particles developed

Pervious Concrete



Micrograph of Recycled Materials based Cellular Light Weight Flowable Fill (RM-CLWF)

Valorisation of Recycled Aggregates



Carbonation treatment of Recycled Concrete Aggregate

Demonstration &Technology Transfer

- 20,000 Paver blocks casted using recycle aggregates and used in pavement at a mass housing site

Compressive strength: 35-40 MPa
Water absorption: 3-4 %
Abrasion : 2.2 mm

- 100% replacement of NA with RA
- Medium traffic purpose (as per IS:15658)

- A wall constructed using C&D waste blocks at Geothermal Building at a Mass Housing Site

- Process know how to develop paver blocks and other building components from construction and demolition waste" transferred to industries.

Industry Connect in India

- **Industry Meet:** 13.06.2024 at IHC, New Delhi.
- **Interaction:** Attended by 30 industry partners, 30 stockholders and 20 CSIR scientists.
- **Aim:** Address crucial aspects of sustainable construction practices and the effective utilization of C&D waste.
- **Panel discussions:** Discuss various dimensions of C&D waste management and sustainable utilisation.
- **Outcome:** A platform to converge, exchange knowledge, and a path towards sustainable C&D waste based construction.

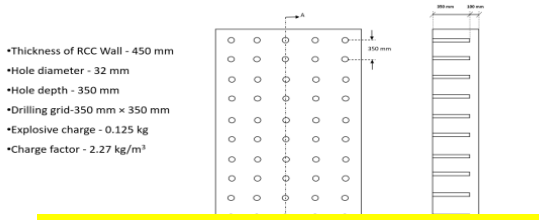
International Collaborations

- SINTEF, Norway and CPWD for C&D Waste processing
- C-Flow (CDE Asia) collaboration for the research
- Controlled & Safe demolition collapsed Wangchu Bridge, Bhutan by CSIR

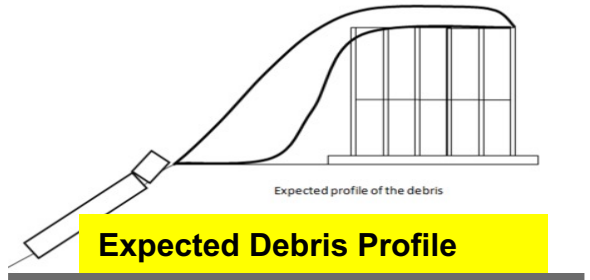
Collapsed Wangchu Bridge

Damchu Side

HAA Side



Drilling Pattern for RCC Wall



Expected Debris Profile

THANK YOU