

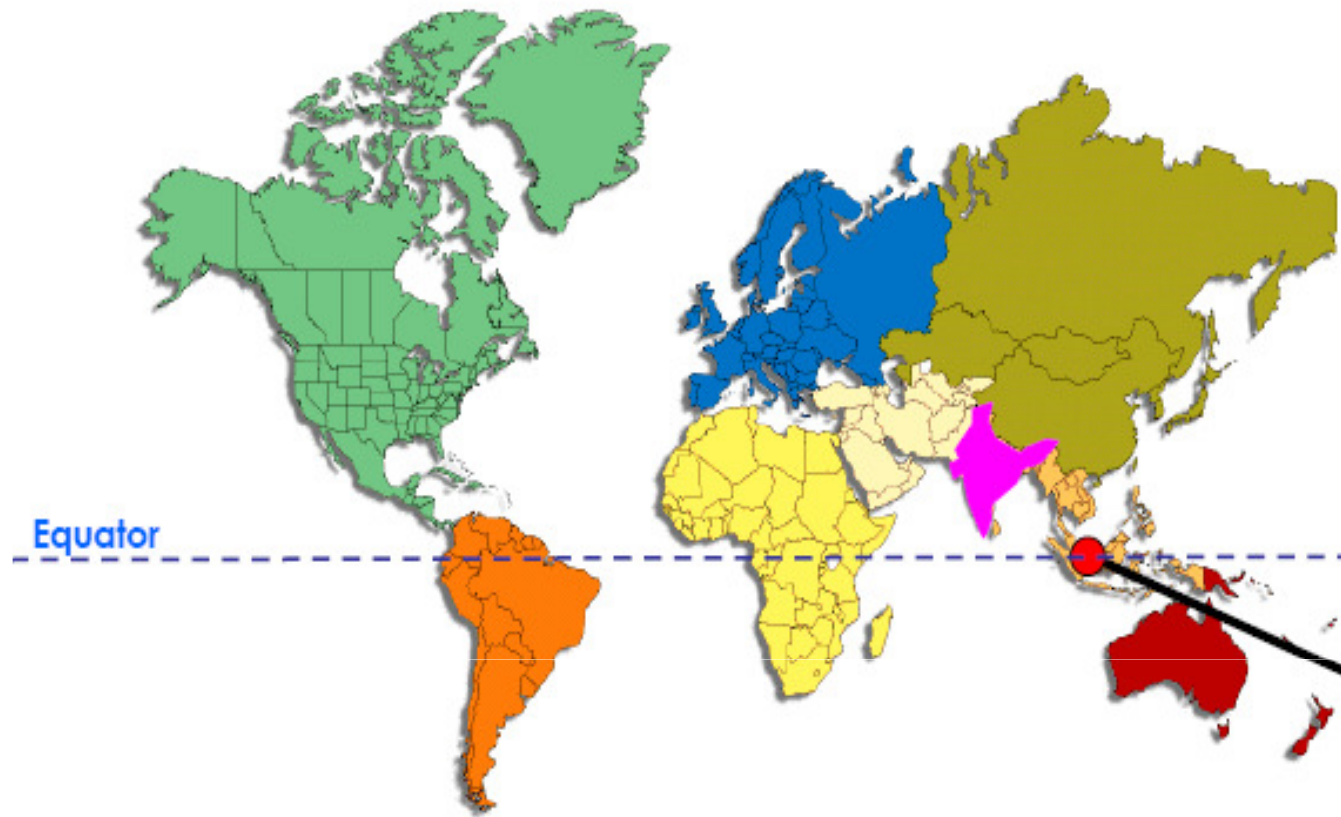
Sustainable Construction Strategies: A Singapore Perspective

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Country Information



Singapore

Land Area : 710.2 km²

Population: 4.8 mil

Density : 6800 /km

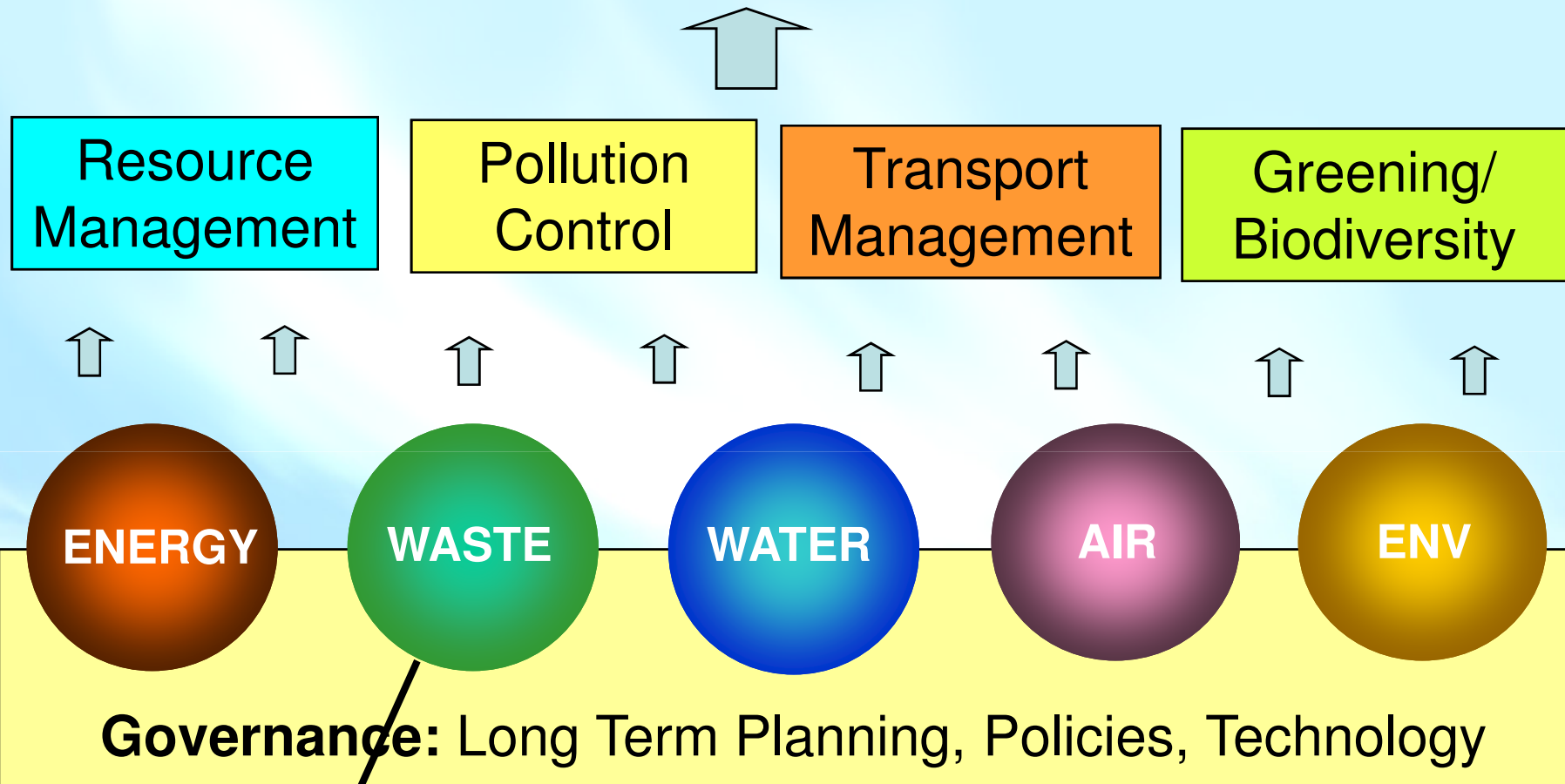


Our Challenges

- **Island city-state**
- **No natural resources**
- **Small & densely populated**



Sustainable Development

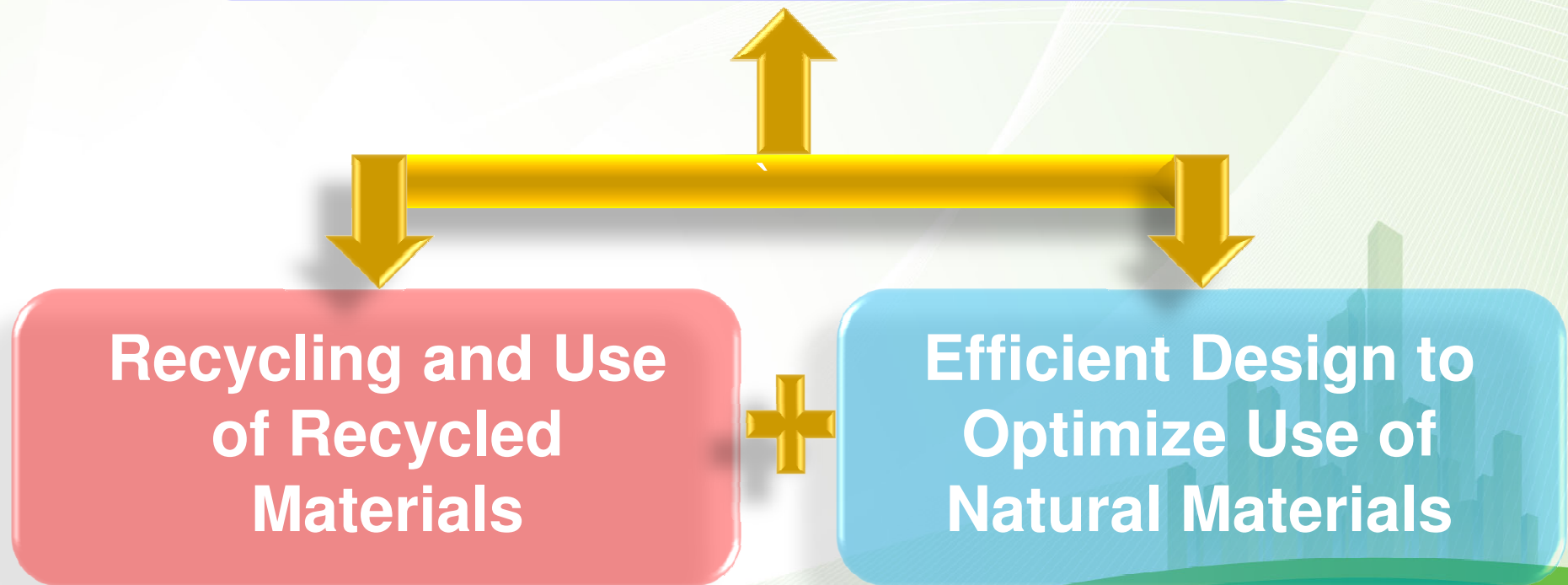


**Waste – Towards Zero Landfill
70% Recycling Rate in 2030**

Understanding Sustainable Construction

- Adoption of environmentally friendly building designs, construction methods and materials
- Reduce use of natural resources
- Increase use of recycled materials

Reduction of 30% in Use of Natural Aggregates in Building Projects by 2020



**Increase use of
recycled & eco-
friendly building
materials**

**Encourage
efficient design &
use of building
materials**

Government Taking The Lead

Promoting SC in Private Sectors

Building Industry Capabilities via Collaborations

Strategic Profiling & Raising Awareness

Minimum Standards through Legislation

Government Taking the Lead

Sustainable Construction Steering Group (SCSG)

Government Taking
The Lead

Promoting SC in
Private Sector

Building Industry
Capabilities

Strategic Profiling &
Raising Awareness

Minimum Standards
through Legislation



- *Adopt demolition protocol for resource recovery*
- *Use of recycled concrete aggregates in non-structural building elements, and aircraft pavement construction*
- *Use of IBA for roads*

Promoting SC in Private Sector

Government Taking
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Recognition under national Green Building Rating Scheme

Incorporated into **BCA's Green Mark**

- Concrete usage index (CUI); and
- Adoption of recycled / alternative materials



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Green & Gracious Builders Award

Award to recognise the efforts of builders to adopt environmentally friendly and green practices in construction work



"Build it Green!"



Building Industry Capabilities via Collaborations

Capability Development

Exploring funding support to build up industry capabilities:

- Demolition Contractors
- C&D Waste Recyclers
- RMCs

Accreditation of Recyclers

Industry-led accreditation scheme to upgrade quality and recycling standards

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Waste Management
and Recycling
Association of
Singapore



Building Industry Capabilities via Collaborations

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Pilot Projects

- Eco-structure demonstration project with private sector
- Recycled materials & green cement for structural use



*Samwoh
Eco-structure*



*Tampines
Concourse*



*Goodwood
Residences*

Strategic Profiling & Awareness

Raising Public Awareness

Government Taking
The Lead

Promoting SC in
Private Sector

Building Industry
Capabilities

Strategic Profiling &
Raising Awareness

Minimum Standards
through Legislation

- BCA Gallery:
 - Showcase materials and technologies for sustainable construction
 - Public outreach platform, especially to younger generation



Setting Min. Standards through Legislative Requirements

Government Taking
The Lead

Phase 1: Establish Standards for Recycling & Require Declaration of Waste Generation

Promoting SC in
Private Sector

Phase 2: Introduce Protocols to Encourage Greater Recovery and Recycling

Building Industry
Capabilities

Phase 3: Consider Legislation for Recycling of Demolition Waste

Strategic Profiling &
Raising Awareness

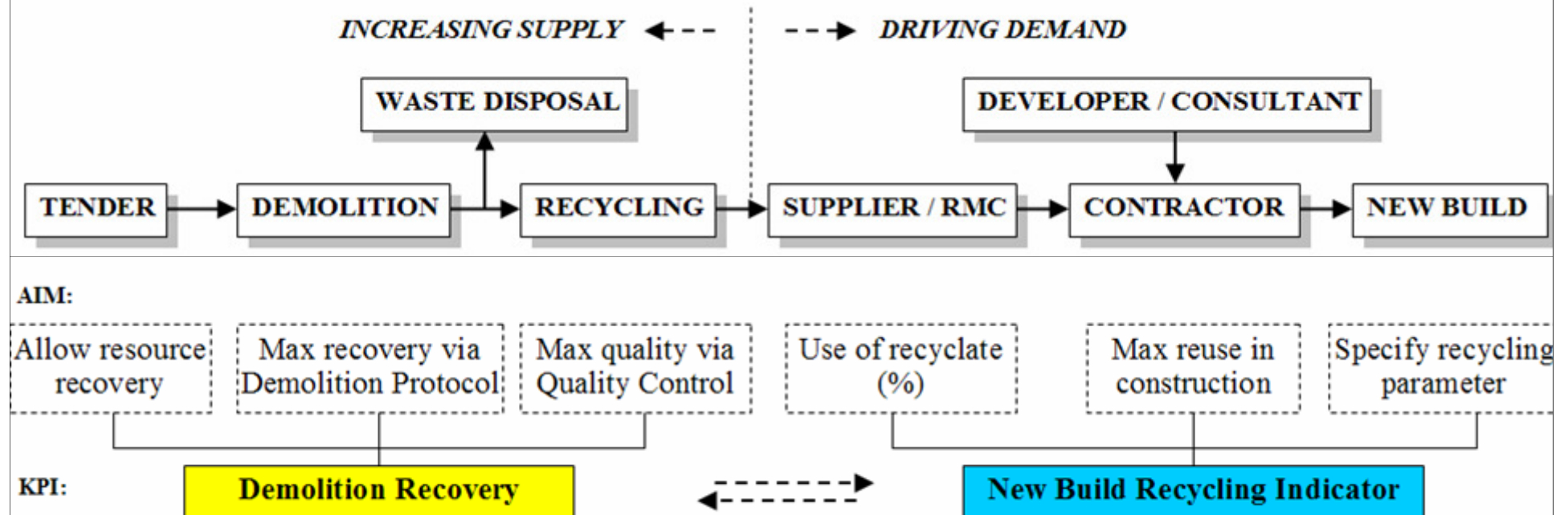
Minimum Standards
through Legislation

Potential Waste Materials for Alternative Aggregates

Waste Generated in 2007		Quantity (T/yr)
1.	Steel Slag	0.1 M
2.	Milled Waste	0.5 M
3.	Copper Slag	0.4 M
4.	Demolition Waste	2.0 M
5.	Incineration Ash	0.5 M
6.	Dredged Material	0.5-2 M
TOTAL		4-5.5 M

Waste to Resource: From Demolition to New Build

KEY APPROACHES: WASTE TO RESOURCE



Key initiatives in increasing supply:

- **Demolition Protocol**
(to maximize resource recovery)



- **Quality Control**
(to provide quality consistency)

- **Alternative Materials**
(to achieve resource efficiency)



Demolition Protocol

Guidance on how demolition wastes should be treated as a resource in new build:

Pre-Demolition Audit

- *Framework for identifying potential resources available*
- *Identifying appropriate steps for demolition and targets for recovery / recycling*

Sequential Demolition

- *To optimize the resource recovery*

Waste Segregation

- *To obtain max resource quality for processing*

Quality Control

- Accreditation Scheme for Recycled Aggregates
 - Class 1 : RCA meeting SS EN 12620
 - Class 2 : General usage
 - Classification System:

Recycled Aggregates with % masonry content

- Crushed concrete from structural components
- Crushed concrete / crushed brick / crushed tiles
- Crushed concrete / other constituents



- Assurance in quality consistency of end products
- Source of reliable suppliers for all
- Greater product acceptance & marketability

Alternative Materials

- **Recycled Concrete Aggregates (RCA)**

- *For struc use:* max 20% replacement of coarse agg
- *For non-struc use:* at least 50% replacement

- **Washed Copper Slag**

- *For struc use:* max 10% replacement of fine agg
- *For non-struc use:* at least 50% replacement

- **Steel Slag**

- *For roads surfacing aggregates: wearing course*

- **Green Cements**

- *OPC replacement using GGBS, fly ash, silica fume*

- **Others: IBA, Dredged Material**

Key initiatives in driving demand:

- **Linkage** (*between demolition and new build phases*)



- **Policy instruments on use of recycled materials**

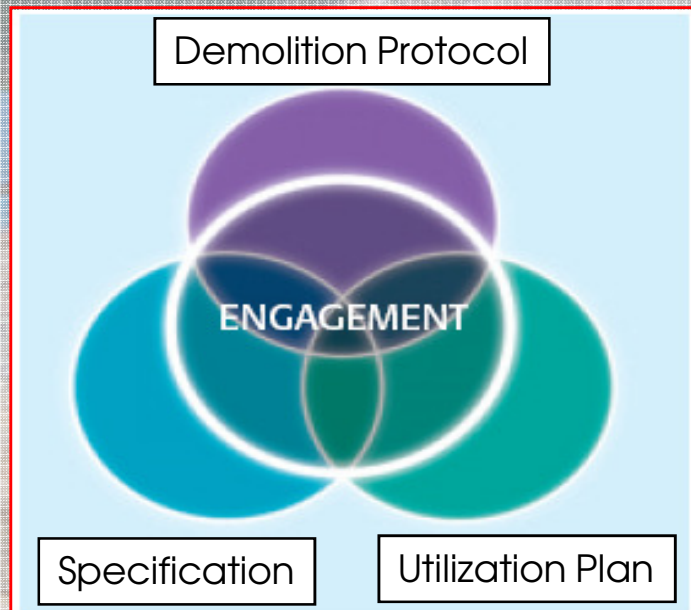
- **Guidance, best practices and case studies**



Linkage (Demolition <-> New Build)

A mechanism to relate demolition and new build :

- **Demolition and New Build**
 - *Demolition Protocol and Recyclate Utilization Plan*
- **New Build only**
 - *Specification on min % use of Recycled Materials*

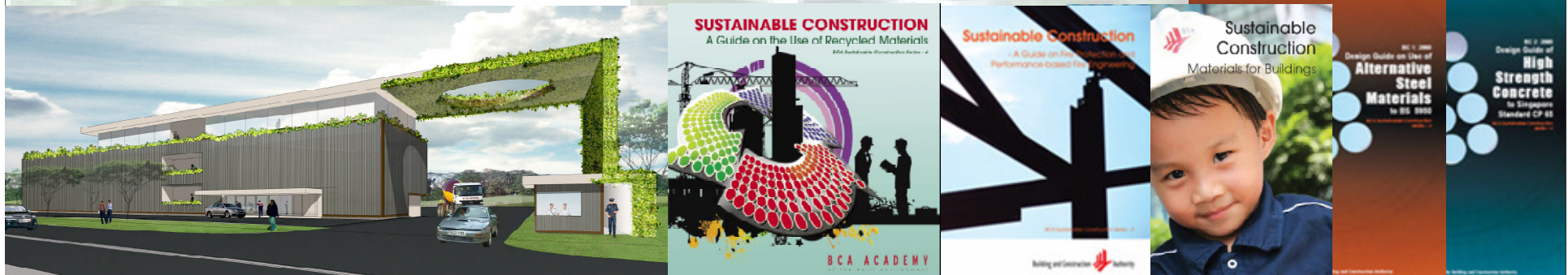


Instruments – “driving demand”

Key instruments that influence design:



- **Regulatory Mechanism:** *Green Mark Scheme*
- **Code and Standards:** *SS EN 12620 , BS 8500-2, CP 11*
- **Promotion and Education**
 - *Guidebooks on best practices*
 - *Demo and pilot projects*
 - *Training courses, workshops*
 - *Seminars, exhibitions*
 - *Incentive scheme to build up capabilities*





Research Projects

3-Storey Commercial Building using RCA

- Live case study to evaluate the use of Recycled Concrete Aggregates (RCA) in structural concrete for buildings

Synthetic Aggregates from Dredged Materials

- Convert dredged materials and industrial wastes into synthetic sand and aggregates using crystallization technology

Sustainable and Cost Effective Wall

- Production of hollow core wall panels using recycled materials and extrusion technology

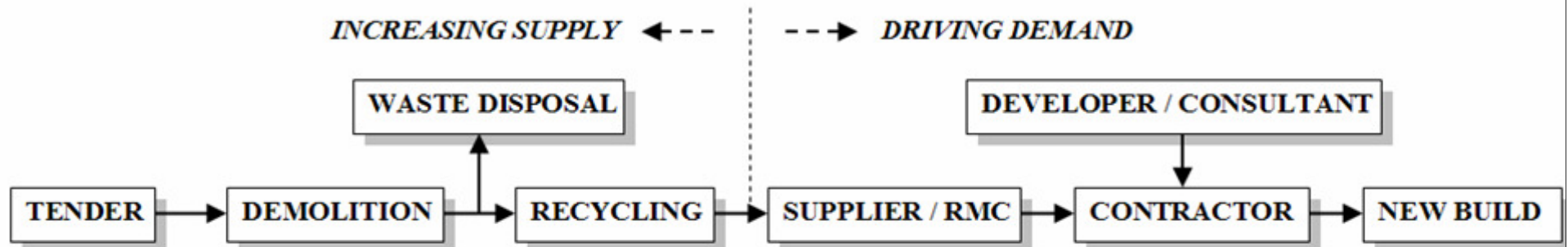
Specification and Classification of RCA

- Evaluate the effect of the quality of RCA on properties and performance of concrete



Key Initiatives

KEY APPROACHES: WASTE TO RESOURCE



KEY INITIATIVES

DEMOLITION
PROTOCOL

CLASSIFICATION
SYSTEM

INCENTIVES

NEW MATERIALS
or METHODS

RECYCLATE
UTILIZATION PLAN

DEMO
PROJECTS

GUIDANCE
PUBLICATION

INCENTIVES

Specification and
Classification of RCA

Synthetic Aggregates from
Dredged Materials

3-Storey Commercial
Building using RCA

Sustainable and Cost
Effective Wall

- green • environmental friendly • reduce reuse recycle • sustainable built environment

Thank You

