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Availability of raw materials from secondary sources: a key aspect of circular economy
24 April 2018, Palais des Nations, Geneva

A methodology for the viability of secondary raw materials' recovery and circularity in the construction sector

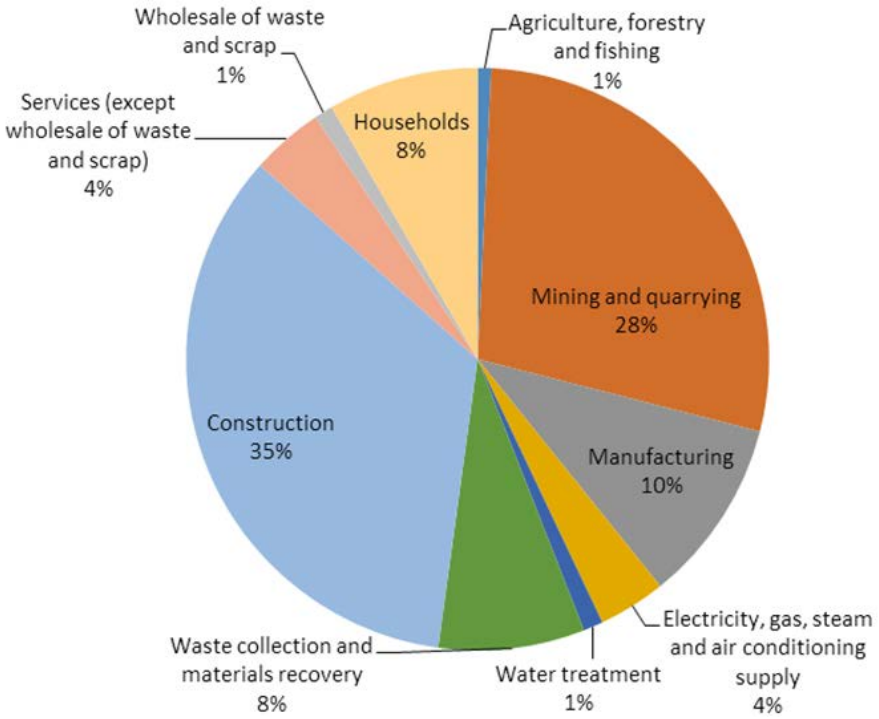
Mohamed OSMANI

Architectural Engineering & Design Management Programme Director
Loughborough University, United Kingdom

OVERVIEW

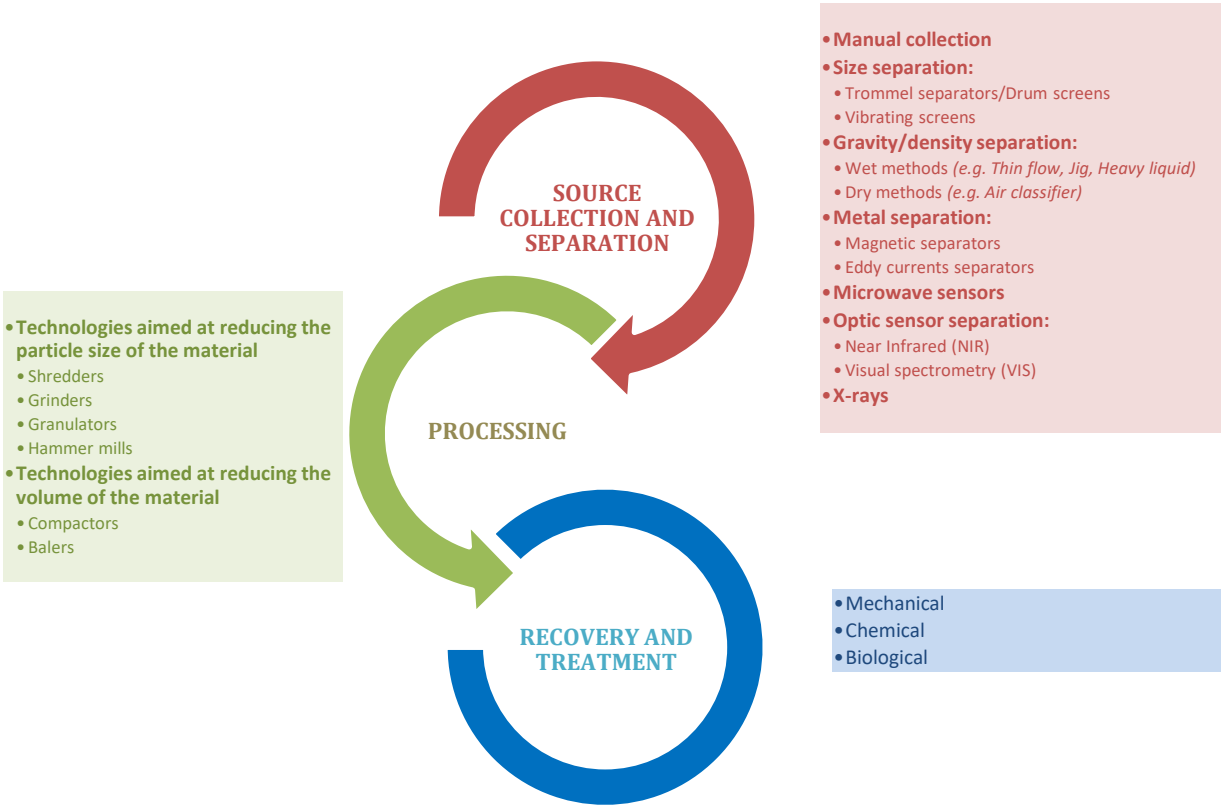
1. Context
2. Construction and Demolition Waste Performance, Economic & Environmental Recovery Assessment (**CDW-PEERA**) Methodology
3. CDW-PEERA Validation

CONTEXT



Waste generated per economic activity in EU-28

CONTEXT



Current construction and demolition waste recovery methodologies and technologies

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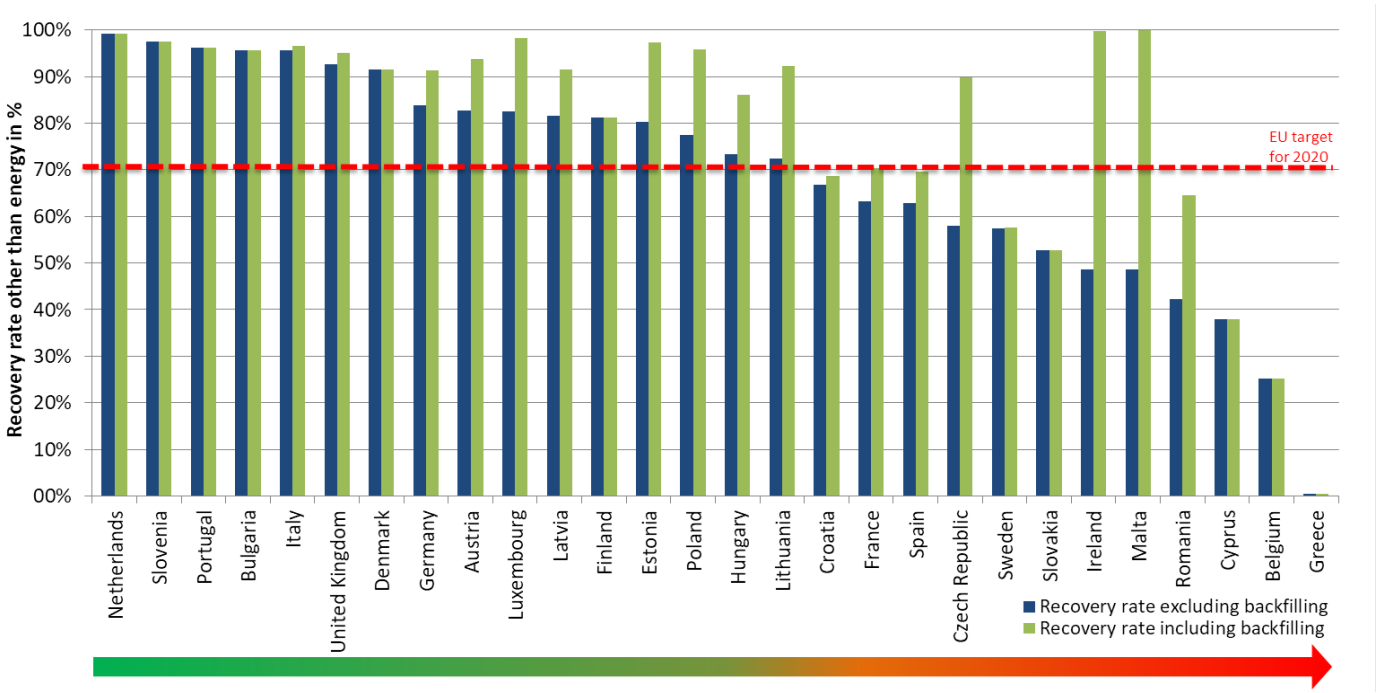

Performance against WFD construction and demolition waste recovery target : 70% reduction of CDW by weight by 2020 through: *preparing for re-use, recycling and other material recovery, including backfilling operations*

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Construction and Demolition Waste Performance, Economic & Environmental Recovery Assessment (CDW-PEERA) Methodology

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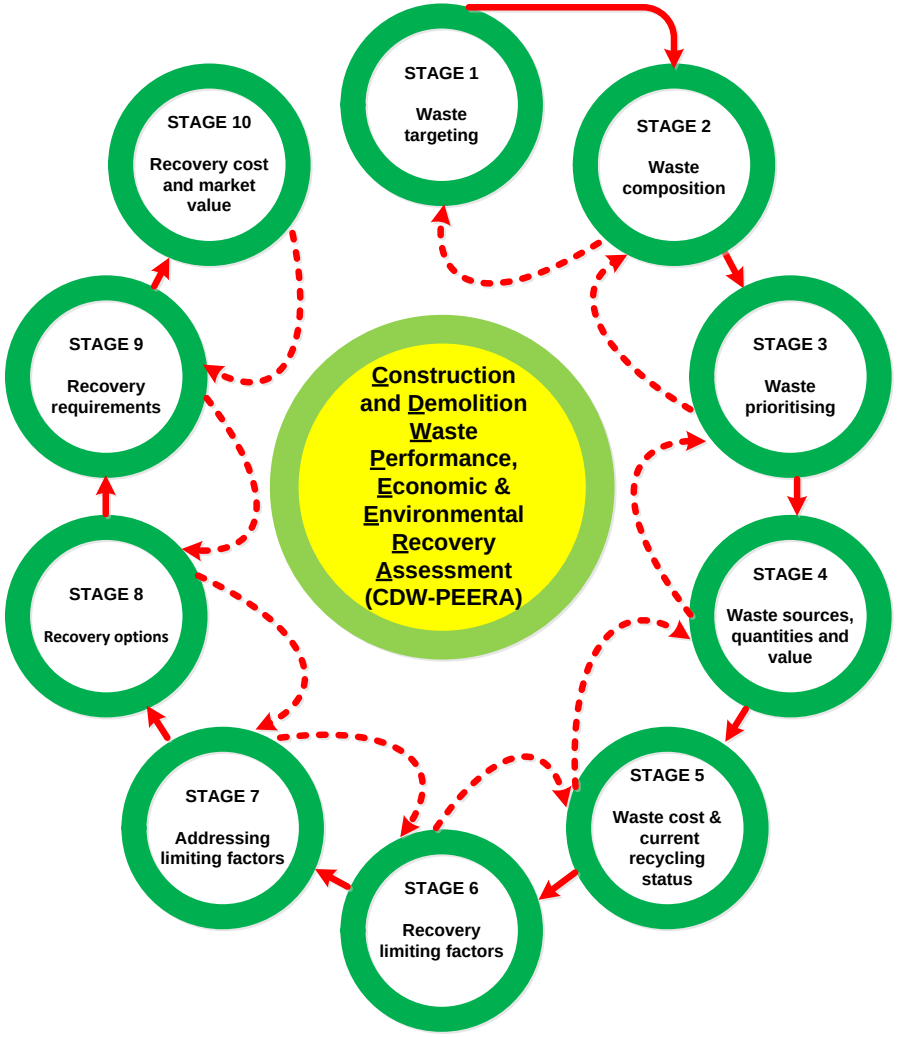


CDW-PEERA Methodology Stage 1: Waste Targeting

Waste Targeting

Sector/process

- ○ Manufacture
- ○ Distribution
- ○ Point of use
- ○ End of life

CDW-PEERA Methodology Stage 2: Waste composition

Waste composition

Waste material	Waste composition	Is waste sent to landfill?
		○ Yes ○ No
		○ Yes ○ No
		○ Yes ○ No
		○ Yes ○ No
		○ Yes ○ No
		○ Yes ○ No

CDW-PEERA Methodology Stage 3: Waste prioritising

Waste material	Recovery drivers	Recovery barriers	Recovery potential ranking

CDW-PEERA Methodology Stage 4a: Waste sources

Waste descriptions and causes

Waste material ____

"Wet waste" ○ **"Dry waste"** ○

	Descriptions	Causes	Rank (quantity)
○ Manufacture			
○ Distribution			
○ Storage			
○ Point of use			
○ End of life			

CDW-PEERA Methodology Stage 4b: Waste quantities and value

Waste material _____

	Quantity		Market value	Is waste segregated?
	Details/ranking*	Tonnage	Euro/Ton	
○ Manufacture				○ Yes ○ No
○ Distribution				○ Yes ○ No
○ Storage				○ Yes ○ No
○ Point of use				○ Yes ○ No
○ End of life				○ Yes ○ No

* High (over 50%), medium (25% - 50%), low (<25%)

CDW-PEERA Methodology Stage 5a: Waste costs

Waste material

Disposal cost

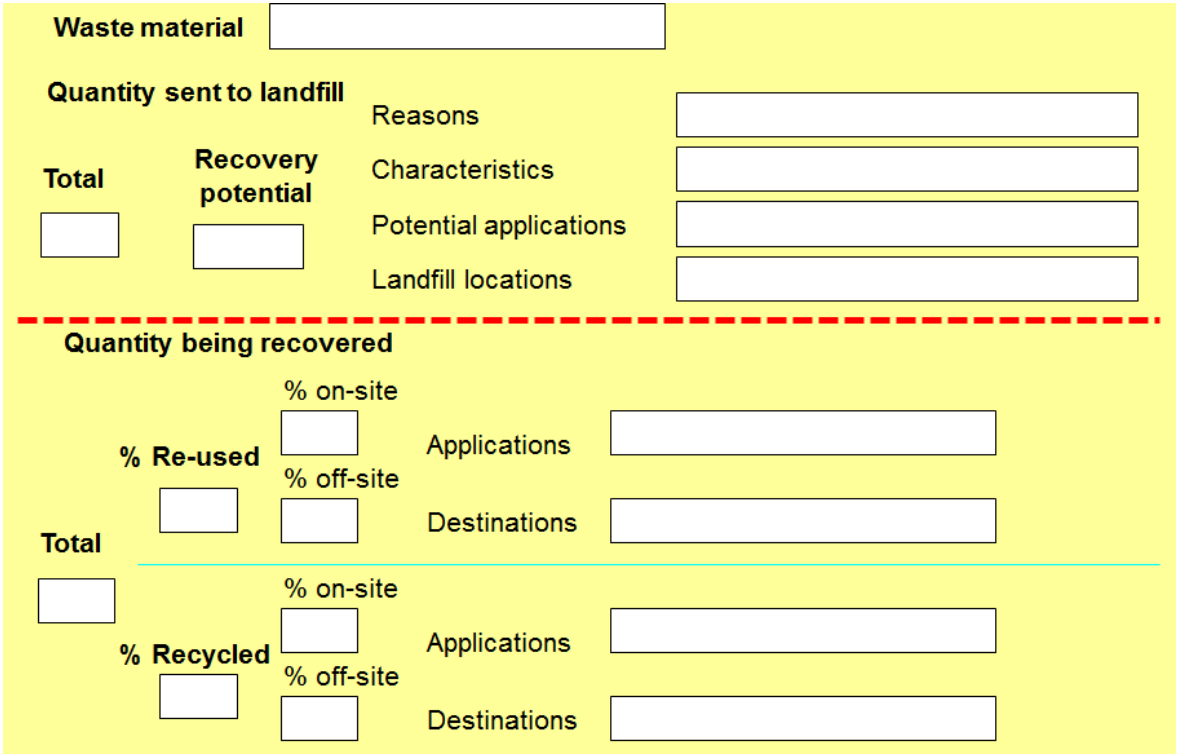
Total cost	Collection/handling	Transport	Landfill tax
	Rating*	Rating*	Rating*
	%	%	%
	Euro/Ton	Euro/Ton	Euro/Ton

Recovery cost

Total cost	Collection/handling	Transport	Recovery/Reprocessing
	Rating *	Rating *	Rating *
	%	%	%
	Euro/Ton	Euro/Ton	Euro/Ton

* High; medium; low

CDW-PEERA Methodology Stage 5b: Current waste recovery status



CDW-PEERA Methodology Stage 6: Waste recovery limiting factors

Waste material _____

	Description	Severity Rating *
Limiting factor		○ Low ○ Medium ○ Critical
Limiting factor		○ Low ○ Medium ○ Critical
Limiting factor		○ Low ○ Medium ○ Critical
Limiting factor		○ Low ○ Medium ○ Critical
Limiting factor		○ Low ○ Medium ○ Critical
Limiting factor		○ Low ○ Medium ○ Critical

* Low: tolerable; Medium: restricts recovery; Critical: prevents recovery

CDW-PEERA Methodology Stage 7: Addressing limiting factors

Waste material _____

Limiting factor	Recommendation	Category E	Category T	Category O	Timeframe ST	Timeframe MT	Timeframe LT
		○	○	○	○	○	○
		○	○	○	○	○	○
		○	○	○	○	○	○
		○	○	○	○	○	○
		○	○	○	○	○	○

(E) = economic; (T) = technical; (O) = other

(ST) = short-term (<1 year); (MT) = medium-term (2 – 5 years); (LT) = long-term (over 5 years)

CDW-PEERA Methodology Stage 8: Recovery options

Re-use/recycling opportunities

Waste material

Re-use	Details	Sector OS	Sector SS	Sector CS	Environmental impact Increase	Environmental impact Neutral	Environmental impact Decrease
Current route		○	○	○	○	○	○
Alternative route 1		○	○	○	○	○	○
Alternative route 2		○	○	○	○	○	○

Recycling	Details	Sector OP	Sector SS	Sector CS	Environmental impact Increase	Environmental impact Neutral	Environmental impact Decrease
Current route		○	○	○	○	○	○
Alternative route 1		○	○	○	○	○	○
Alternative route 2		○	○	○	○	○	○

(OS) = material recovered on-site; (SS) = material recovered within same sector;
(CS) = material recovered in different sector (cross-sector)

CDW-PEERA Methodology Stage 9: Recovery Requirements

Waste material | **Recovery route**

Description of recovery processes

Essential material properties — **Attainable**

		Yes	No
Physical		○	○
Chemical		○	○
Other		○	○

CDW-PEERA Methodology Stage 10a: Capital cost

Capital cost

Waste material | Re-use/ recycling route

Type	Ranking				Value (Euro)	Details
	N/A	Low	Medium	High		
Land/Plant	○	○	○	○		
Equipment	○	○	○	○		
Labour	○	○	○	○		
Logistics	○	○	○	○		
Other	○	○	○	○		

CDW-PEERA Methodology Stage 10b:Operational cost

Operational costs

Waste materials ☐ **Re-use/ recycling root** ☐

Type	Ranking				Value (Euro)	Details
	N/A	Low	Medium	High		
Collection	○	○	○	○	☐	☐
Transportation	○	○	○	○	☐	☐
Sorting	○	○	○	○	☐	☐
Treatment	○	○	○	○	☐	☐
Overheads	○	○	○	○	☐	☐
Other	○	○	○	○	☐	☐

CDW-PEERA Methodology Stage 10c:
Payback period & future legislation

Payback period

Waste materials _____ **Recovery option** _____

Payback on capital investment

Short-term (<3 years) ○ Medium-term (3-5 years) ○ Long-term (over 5 years) ○

Payback on operational cost

Short-term (<3 years) ○ Medium-term (3-5 years) ○ Long-term (over 5 years) ○

Impact of future legislation on financial viability

_____

CDW-PEERA Methodology Stage 10d: Market value

Market value

Waste material | **Recovery option**

Primary (virgin) materials

Current value (Euro/ Ton)

Price changes during past 5 years

Price changes in the next 5 years

Recycled waste material

Current value (Euro/ Ton)

Price changes during past 5 years

Price changes in the next 5 years

CDW-PEERA Validation: Waste Targeting & Prioritising

Recycling Potential Ranking	Cluster 1 PLASTICS	Cluster 2 WOOD / TIMBER	Cluster 3 BRICKS & BLOCKS	Cluster 4 CEMENT & CONCRTE	Cluster 5 'catch all' MANUFACTURING	Cluster 6 – A 'catch all' CONSULTANTS	Cluster 6 – B 'catch all' CONSULTANTS
1	GRP (Glass-reinforced plastic)	Saw dust chips	Spoilt products on site	Unsaleable product	Timber (packaging)	Packaging	packaging (pallets, shrink wrap, bubble wrap, boxes, polystyrene, plastic containers (contaminated), aerosols, plastic/metal wrapping bands, skids, cordex sheets.
2	PVC (Polyvinyl Chloride)	Wood panel off cuts	Demolition wastes	Packaging waste	Glass	Subsoil extraction Spoil (1)	Composites (materials mixed together, materials joined –laminated, product composed of > 1 material) Polymer composites (cladding, door, decking, rooflights & rooftiles, strengthening plates) Laminated composites (worksurfaces, furniture, doors, SIPS, mmc)
3	PE (Polyethylene)	Metal (packaging, incl containers/tins)	Scrubber / exhaust wastes	Factory waste (PPE, kitchen waste, oily waste, fabric waste etc)	Stone washing fines	Timber (Treated)	Plasterboard
4	PU (polyurethane)	WESP Sludge	Packaging	Expired cement	Plastic (packaging)	Plasterboard	Plastics (plastic pipes: Window frames, doors, soffits & fascias, ducting – conduit, rooflights, flooring, temporary materials: plastic covering for floors)
5	PES (Polyether sulphone) / XPS	Plastic waste	Unusable products (factory)	Bypass dust	Plasterboard	Subsoil extraction Spoil (2)	Glass (windows)
6	EPDM (Ethylene Propylene Diene Monomer)	Treated wood			Insulation	Timber (untreated)	
7	PET (Polyethylene Terephthalate)				Air filter fines	Hard Core	
8	PP (Polypropylene)				MDF		
9	Rubber				Steel		

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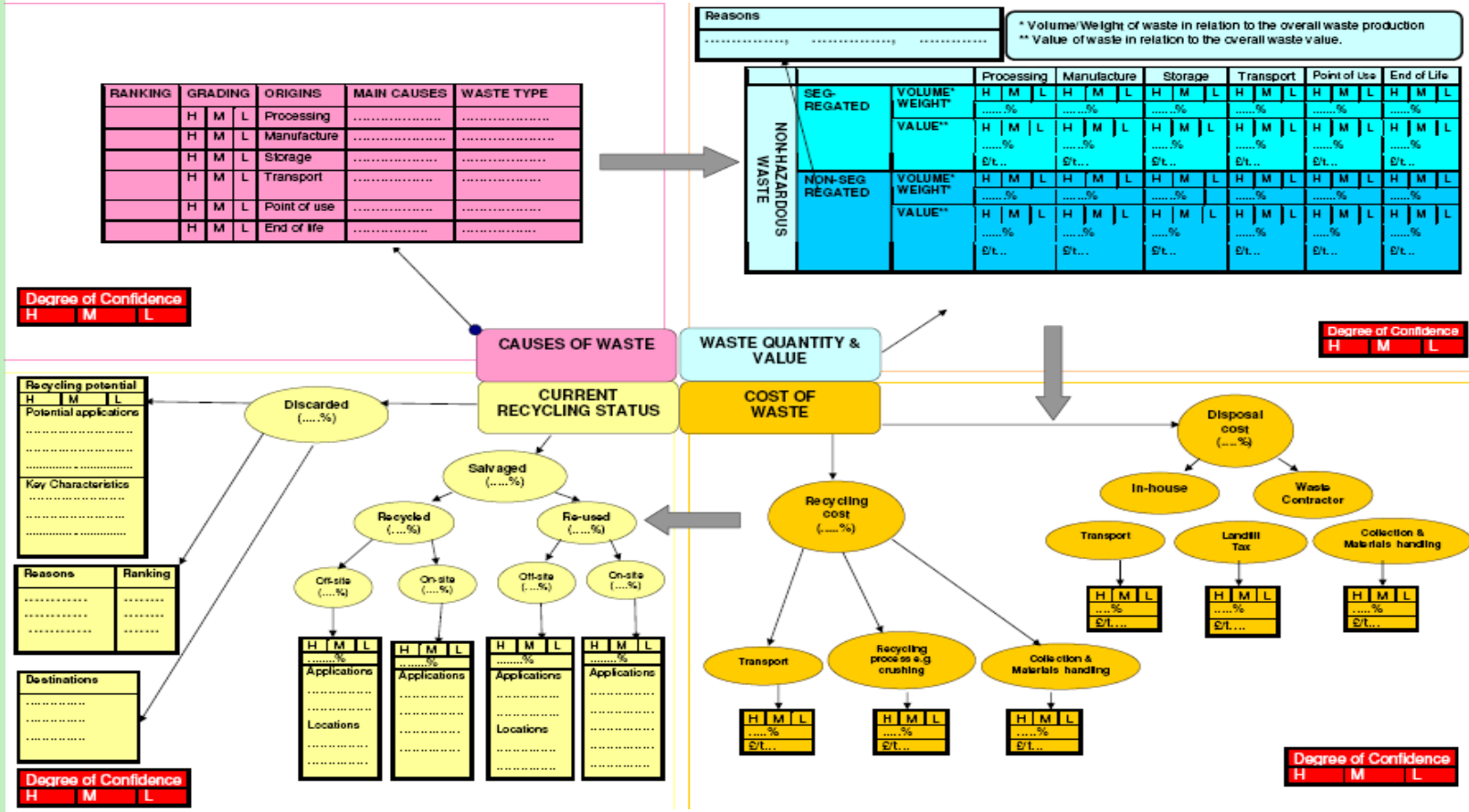
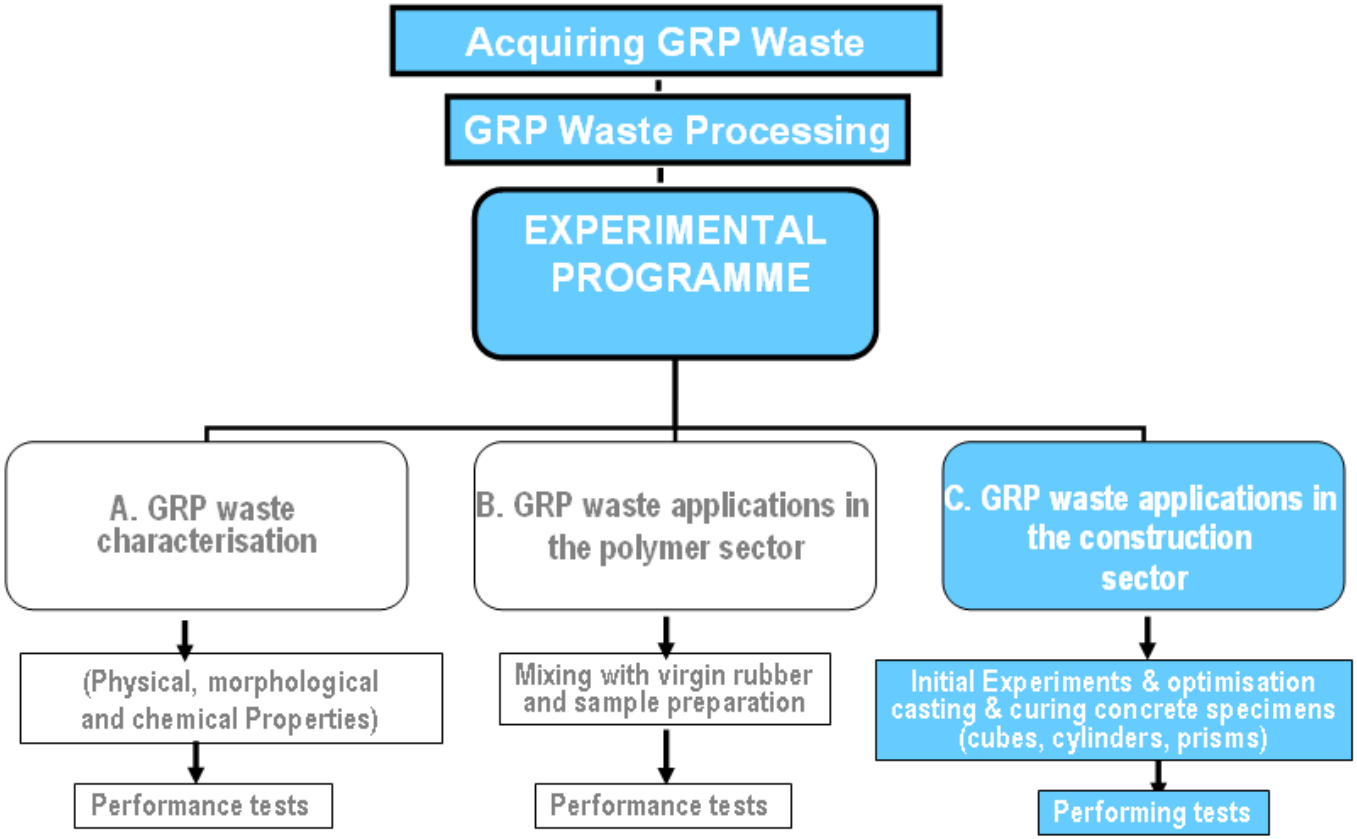
CDW-PEERA Validation:Waste Mapping (data collection)



CDW-PEERA Validation (material performance & economic assessment results)

PLASTICS	WOOD / TIMBER	BRICKS & BLOCKS	CEMENT & CONCRTE	INSULATION
GRP (Glass-reinforced plastic)	Wood panel off-cuts	Concrete blocks from demolition	Damaged concrete flooring	Trimmings from insulation
PVC profile		Clay bricks from demolition	Reject pre-cast concrete units	Plasterboard off-cuts
		Damaged clay bricks (factory)		

CDW-PEERA Validation: GRP Recycling Testing Programme



CDW-PEERA Validation: GRP Recycling Testing Programme

GRP waste processing

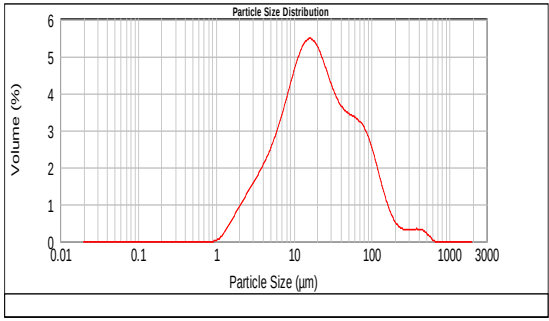
Sieving GRP waste

Fibre content < 5%

Powder content about 95%

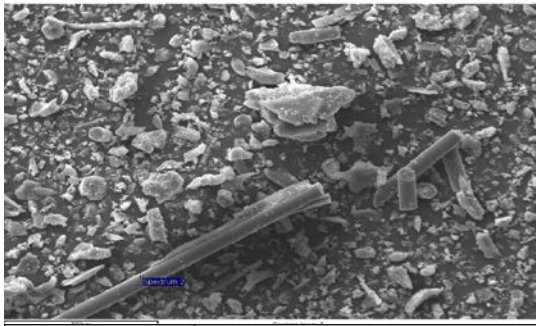
CDW-PEERA Validation: GRP Recycling Testing Programme

GRP waste characterisation



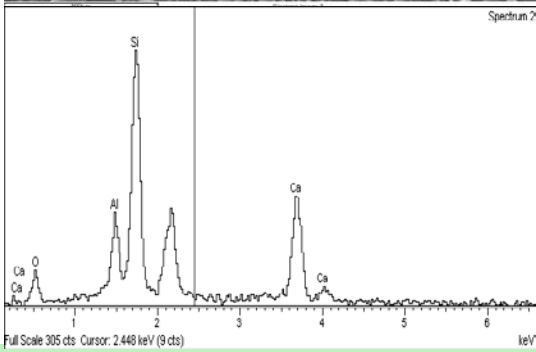
Physical Characterisation

1. Particle size analysis and particle distribution profile
2. Morphological studies



Chemical Characterisation

1. Glass transition temperature
2. Thermal properties
3. Elemental composition
4. Chemical composition and polymer types



CDW-PEERA Validation: GRP Recycling Testing Programme

GRP-waste filled rubber composites

Prototype: Anti-vibration pad using 50 % GRP waste powder

Other application:

- Carpet underlay
- Bearing pads
- Paving drainage pads
- Bridge & concrete expansion joints
- Rubber water stops

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CDW-PEERA Validation: GRP Recycling Testing Programme

GRP waste filled concrete & cement composites

190 GRP waste powder filled concrete composite specimens

GRP waste fibre filled cement composites
Produced panels: (30x30 cm) 8 &12 mm thick

CDW-PEERA Validation: GRP Recycling Testing Programme

Applications: GRP waste filled concrete & cement composites

- Architectural cladding panels
- Precast paving slabs
- Roof tiles
- Precast wall elements
- Light weight concrete
- Concrete blocks

Full compliance tests such as durability and fire properties for specific applications are recommended.

Thank you

Any Questions?

Email: m.osmani@lboro.ac.uk
Tel: +44 1509 228155