RETHINKING THE CONSTRUCTION SUPPLY CHAIN WITHIN A CIRCULAR ECONOMY

Dr Mark Kelly, Department of Building and Civil Engineering, GMIT
• Research background.

• Definition and background to the Circular Economy (CE).

• Building on resource efficiency good practice.

• Moving from resource efficiency to circular resource/materials flows.

• Preliminary conclusions and ongoing work.
Background

2000-2002
Co-funded Enterprise Ireland and Barna Waste Recycling to examine the development of a construction and demolition waste recycling facility.

2003-2007
EPA ERDTI-funded project, which investigated the development of an audit methodology to generate C&DW factors for the Irish construction sector, worked in close collaboration with several building contractors over a two-year auditing period.

2008-2013
EPA STRIVE-funded project, which examined waste prevention and minimization opportunities in the design and construction phases in collaboration with Scott Tallon Walker Architects and John Sisk and Son Building Contractors.

BACKGROUND

2013-2016
EPA Cleaner Greener Production Programme (CGPP)-funded project entitled ‘The Development of a Resource Efficient Toolkit for Construction-SMEs’, which involved close collaboration with Carey Building Contractors and BAM Ireland.

2017-Current
EPA Green Enterprise Scheme funded project entitled ‘The Exploration of Cradle-to-Cradle Opportunities in the Irish Construction Sector’, working in collaboration with Carey Building Contractors.

Current
DEFINITION

The circular economy is one that is restorative by design, and which aims to keep products, components and materials at their highest value at all times.

(Ellen McArthur Foundation, 2015)

‘A lifecycle approach that optimises the buildings’ useful lifetime, integrating the end-of-life phase in the design and uses new ownership models where materials are only temporarily stored in the building that acts as a material bank.’

(Leising et al., 2018)
Ideas That Influence the CE Concept

The Waste Hierarchy

1. Maximum conservation of resources
2. Reusing materials
3. Recycling & reprocessing materials
4. Energy recovery prior to disposal
5. Zero conservation of resources
BUILDING ON GOOD PRACTICE...

Moving from Resource Efficiency to Circularity


Rediscovery Centre Circular Conversations, 11th July 2019
BENCHMARKING RESOURCE EFFICIENCY DURING THE CONSTRUCTION PHASE

FINDINGS
Demolition of ‘Block M’ – NUI, Galway

This project consisted of the demolition of an existing single storey timber clad ‘Block M’ building on the grounds of NUIG with a total floor area of 199.5m². The works included demolition, diversion of services, removal of asbestos materials, waste management and all remedial landscaping and associated site works.

Project Details

<table>
<thead>
<tr>
<th>Project location:</th>
<th>NUI, Galway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value Range:</td>
<td>€50,000 – 100,000</td>
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<tr>
<td>Floor area:</td>
<td>199.5m²</td>
</tr>
<tr>
<td>Start date:</td>
<td>12th July 2013</td>
</tr>
<tr>
<td>Completion date:</td>
<td>16th August 2013</td>
</tr>
</tbody>
</table>

Research Activities on Site

<table>
<thead>
<tr>
<th>6</th>
<th>3 RE initiatives</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site visits</td>
<td>Implemented on site</td>
<td>RE Audits</td>
</tr>
</tbody>
</table>

The Resource Efficiency (RE) Savings

- **€680.36** Cost Savings
- 48% of Profit Margin

Waste Quantities Identified

- 99.7% waste Diverted from landfill
- 12.07 tonnes Diverted from landfill

Implementation costs: **€0**

‘Standard Practice’ Waste/100m² floor area

‘Exemplary’ Waste diversion from landfill

Transport Emissions: 0.618 tonnes CO₂

Asbestos: 1.18 tonnes

3 Waste Skips: 12.444 tonnes (75.347m³)

Resource use CO₂ emissions: 11.526 tonnes

Resource Use

Asbestos

CO₂
Cystic Fibrosis Unit – UCH, Galway

The cystic fibrosis (CF) unit project in UCH consisted of the construction of a new outpatient children’s unit. The new unit included 4 examination rooms, a treatment room for procedures, 2 offices and a gym for assessment and physiotherapy. The works comprised of the shell, core and fit-out of a new single storey building with a structure of raft foundations, concrete block walls, metal and plasterboard stud partitions and a timber flat roof.

Project Details

- **Project location:** UCH, Galway
- **Value:** €0.5 – 1 million
- **Floor area:** 223.8m²
- **Start date:** 12th December 2013
- **Completion date:** 24th July 2014

The Resource Efficiency (RE) Savings

- **€1,961**
  - Cost Savings
- **1.22 tonnes**
  - Energy CO₂
- **4.7 tonnes**
  - Waste Prevented
- **11.3 tonnes**
  - Diverted from landfill
- **22%**
  - of Profit Margin
- **1,908 kWhrs**
  - Energy Saved
- **€0**
  - Implementation costs

Research Activities on Site

- 31 Site visits
- 12 RE initiatives implemented on site
- 25 RE Audits

Resource Use

- 5 Waste Skips
  - 7 tonnes (47.298m³)
- 7.324 tonnes
  - Resource use CO₂ emissions
- **17,429**
  - CO₂ equivalent

‘Good Practice’ Waste/100m² floor area

‘Exemplary’ Waste diversion from landfill
Podiatry Unit – Merlin Park Hospital, Galway

The project consisted of the construction of an extension to the existing Podiatry Suite in Merlin Park Hospital. The building was a 2-storey building with a link formed between the existing building and the new building. The works comprised of the shell, core and fit-out and the structure of the building was raft foundations, concrete block walls, metal and plasterboard stud partitions and a timber flat roof.

Project Details

<table>
<thead>
<tr>
<th>Project location:</th>
<th>Merlin Park, Galway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value:</td>
<td>€1.5 – 2 million</td>
</tr>
<tr>
<td>Floor area:</td>
<td>401.33m²</td>
</tr>
<tr>
<td>Start date:</td>
<td>9th June 2014</td>
</tr>
<tr>
<td>Completion date:</td>
<td>13th February 2015</td>
</tr>
</tbody>
</table>

Research Activities on Site

- 31 Site visits
- 23 RE initiatives implemented on site
- 29 RE Audits

The Resource Efficiency (RE) Savings

- **€8,835** Cost Savings
- **37%** of Profit Margin
- **3.84 tonnes** Energy CO₂
- **6,028 kWhrs** Energy Saved
- **164 tonnes** Waste Prevented
- **26.52 tonnes** Diverted from landfill
- **€0** Implementation costs
- ‘Good Practice’ Waste/100m² floor area
- ‘Exemplary’ Waste diversion from landfill

**Resource Use**

- 18 Waste Skips
  - 27.5 tonnes (149.6m³)
- 13.396 tonnes Resource use CO₂ emissions
- 32,106 CO₂ equivalent

**Research Activities on Site**

- 31 Site visits
- 23 RE initiatives implemented on site
- 29 RE Audits

**The Resource Efficiency (RE) Savings**

- **€8,835** Cost Savings
- **37%** of Profit Margin
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- **6,028 kWhrs** Energy Saved
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- **€0** Implementation costs
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- 23 RE initiatives implemented on site
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- **3.84 tonnes** Energy CO₂
- **6,028 kWhrs** Energy Saved
- **164 tonnes** Waste Prevented
- **26.52 tonnes** Diverted from landfill
- **€0** Implementation costs
- ‘Good Practice’ Waste/100m² floor area
- ‘Exemplary’ Waste diversion from landfill
**High Dependency Unit – Bon Secours Hospital, Galway**

The High Dependency Unit project consisted of the demolition and strip out and fit-out of several existing rooms in the Bon Secours Hospital in Galway. The works included the merging of 4 single bedrooms into a 6-bed high dependency ward. All works were completed within a live hospital environment with external access available via a scaffolding system.

**Project Details**

- **Project location:** Dublin Road, Galway
- **Value:** €0.5 to 1 million
- **Floor area:** 212m²
- **Start date:** 9th February 2015
- **Completion date:** 29th May 2015

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**Research Activities on Site**

- **16 Site visits**
- **17 RE initiatives Implemented on site**
- **15 RE Audits**

**The Resource Efficiency (RE) Savings**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost Savings</td>
<td>€3,092</td>
</tr>
<tr>
<td>Energy CO₂</td>
<td>1.19 tonnes</td>
</tr>
<tr>
<td>Energy Saved</td>
<td>3,436 kWhrs</td>
</tr>
<tr>
<td>Waste Prevented</td>
<td>8.03 tonnes</td>
</tr>
<tr>
<td>Diverted from landfill</td>
<td>36.9 tonnes</td>
</tr>
</tbody>
</table>

**Implementation costs**

- €37.76

---

**Resource Use**

- **Diesel 6,059 kWhrs**
  - 1.66 tonnes CO₂
- **14 Waste Skips**
  - 30.22 tonnes (128.8m³)
- **19.632 tonnes**
  - Resource use CO₂ emissions

**CO₂ CO₂ equivalent**

- 47,051 Miles driven by an average passenger vehicle
Merlin College Schools – Doughiska, Galway

The project was part of the Irish Governments Schools Bundle 3 Project and consisted of a Post Primary Community College and Primary School constructed on a shared site with a total floor area of 8,300 m². The structure of the buildings was generally masonry walls and precast concrete floor slabs and stairs with a structural steel frame roof. The schools were built to accommodate a total of 1,100 students.

<table>
<thead>
<tr>
<th>Project Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project location: Doughiska, Galway</td>
</tr>
<tr>
<td>Value Range: €10 - 15 million</td>
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<tr>
<td>Floor area: 8,300 m²</td>
</tr>
<tr>
<td>Start date: 12th November 2012</td>
</tr>
<tr>
<td>Completion date: 14th February 2014</td>
</tr>
</tbody>
</table>

**The Resource Efficiency (RE) Savings**

| **Cost Savings** | €16,697 |
| **Reduced energy** | 13 tonnes CO₂ |
| **Energy Saved** | 21,410 kWhrs |
| **Waste Prevented** | 28 tonnes |
| **Diverted from landfill** | 316.5 tonnes |
| **Implementation costs** | €85.93 |

**Research Activities on Site**

| Site visits | 59 |
| Implemented on site | 25 RE initiatives |
| RE Audits | 54 |

**Research Use**

- Diesel 708,247 kWhrs 194.06 tonnes CO₂
- Electricity 215,991 kWhrs 137.59 tonnes CO₂
- 98 Waste Skips 316.5 tonnes (1,516 m³)
- Gas 286,978 kWhrs 56.82 tonnes CO₂
- 505.487 tonnes Resource use CO₂ emissions

**‘Good Practice’**
- Waste/100 m² floor area

**‘Exemplary’**
- Waste diversion from landfill
Merlin Schools SNU Extensions – Doughiska, Galway

The project involved the construction of 2 single-storey extensions to the recently completed primary and secondary level schools to house two new SNU’s with a total floor area of 547 m². The extensions were constructed on the campus of 2 fully functioning primary and secondary schools. The structure of the buildings was generally masonry walls and precast concrete floor slabs with a structural steel frame roof.

**Project Details**

<table>
<thead>
<tr>
<th>Project location:</th>
<th>Doughiska, Galway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value Range:</td>
<td>€0.5 – 1 million</td>
</tr>
<tr>
<td>Floor area:</td>
<td>547 m²</td>
</tr>
<tr>
<td>Start date:</td>
<td>24th March 2014</td>
</tr>
<tr>
<td>Completion date:</td>
<td>7th August 2014</td>
</tr>
</tbody>
</table>

**Research Activities on Site**

- 23 Site visits
- 28 RE initiatives Implemented on site
- 21 RE Audits

**The Resource Efficiency (RE) Savings**

- €16,174 Cost Savings
- 4.8 tonnes Energy CO₂
- 7,513 kWhrs Energy Saved
- 19.4 tonnes Waste Prevented
- 107.5 tonnes Diverted from landfill

**Implementation costs**

- €9.89

**Resource Use**

- Diesel 49,991 kWhrs 13.697 tonnes CO₂
- Electricity 2,461 kWhrs 1.567 tonnes CO₂
- 21 Waste Skips 107.483 tonnes (380.6m³)
- 52.532 tonnes Resource use CO₂ emissions

**‘Standard Practice’**

Waste/100m² floor area

**‘Exemplary’**

Waste diversion from landfill
Lambe Institute for Translational Research – UCH, Galway

The combined facility of the CRF TRF project covered an area of 5,125m² and is a new 4-storey building with direct linkages into the existing hospital building. The works comprised of the shell, core and fit-out of the new building. The building was constructed from precast concrete, manufactured off site, with pad foundations with the building fabric made up of external insulation and a pre-coloured polyciliate render.

Project Details
- **Project location:** UCH, Galway
- **Value Range:** €15 – 20 million
- **Floor area:** 5,125m²
- **Start date:** 16th September 2013
- **Completion date:** 19th March 2015

### The Resource Efficiency (RE) Savings

<table>
<thead>
<tr>
<th>Resource Use</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Diesel</td>
<td>382,283 kWhrs, 104.746 tonnes CO₂</td>
</tr>
<tr>
<td>Electricity</td>
<td>127,886 kWhrs, 81.493 tonnes CO₂</td>
</tr>
<tr>
<td>Waste Skips</td>
<td>183, 409.83 tonnes (1,683m³)</td>
</tr>
<tr>
<td>Water</td>
<td>1,028m³, 0.388 tonnes CO₂</td>
</tr>
<tr>
<td>CO₂</td>
<td>307.464 tonnes</td>
</tr>
</tbody>
</table>

### Resource Use CO₂ emissions

- **Diesel:** 382,283 kWhrs, 104.746 tonnes CO₂
- **Electricity:** 127,886 kWhrs, 81.493 tonnes CO₂
- **183 Waste Skips:** 409.83 tonnes (1,683m³)
- **Water:** 1,028m³, 0.388 tonnes CO₂
- **307.464 tonnes**

### Research Activities on Site

- **122 Site visits**
- **31 RE initiatives** Implemented on site
- **114 RE Audits**

### ‘Good Practice’ Waste/100m² floor area
- **€22,568 Cost Savings** 9% of Profit Margin
- **42 tonnes Energy CO₂**
- **35 tonnes Waste Prevented**
- **66,021 kWhrs Energy Saved**
- **410 tonnes Diverted from landfill**

### ‘Exemplary’ Waste diversion from landfill
- **€104.32 Implementation costs**
- **307.464 tonnes Resource use CO₂ emissions**

Multi Storey Car Park – UCH, Galway

The project consisted of the construction of a 2-storey car park consisting of 238 number spaces together with associated site works. This car park was constructed on the site of an existing car park to the north east of an existing helipad and comprised of four phases of work which included; a temporary ambulance bay, road widening, the car park structure, which was comprised of a precast concrete frame, and the resurfacing of an existing car park.

<table>
<thead>
<tr>
<th>Project Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project location:</td>
</tr>
<tr>
<td>Value Range:</td>
</tr>
<tr>
<td>Floor area:</td>
</tr>
<tr>
<td>Start date:</td>
</tr>
<tr>
<td>Completion date:</td>
</tr>
</tbody>
</table>

**Research Activities on Site**
- 61 Site visits
- 34 RE initiatives implemented on site
- 57 RE Audits

**The Resource Efficiency (RE) Savings**
- €9,275 Cost Savings
- 26% of Profit Margin
- 4.36 tonnes Energy CO₂
- 9,469 kWhrs Energy Saved
- 33.5 tonnes Waste Prevented
- 23.4 tonnes Diverted from landfill
- €223.31 Implementation costs

- ‘Best Practice’ Waste/100m² floor area
- ‘Exemplary’ Waste diversion from landfill

**Resource Use**
- Diesel 139,668 kWhrs 38.269 tonnes CO₂
- 15 Waste Skips 23.36 tonnes (138.62m³)
- Water 873.25m³ 0.262 tonnes CO₂
- 55.82 tonnes Resource use CO₂ emissions
**Human Biology Building (HBB) – NUI, Galway**

The HBB was a new research and teaching facility for the three NUIG departments of Anatomy, Physiology and Pharmacology and Therapeutics. The development was a five-storey building with a rooftop level plant enclosure and an exterior envelope of aluminium, limestone and glass. The HBB has a floor area of 8,200m² with a precast concrete structure and significant mechanical and electrical services installations.

### Project Details

<table>
<thead>
<tr>
<th>Detail</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Project location:</td>
<td>NUI, Galway</td>
</tr>
<tr>
<td>Value Range:</td>
<td>€20 – 25 million</td>
</tr>
<tr>
<td>Floor area:</td>
<td>8,200m²</td>
</tr>
<tr>
<td>Start date:</td>
<td>5th January 2015</td>
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<tr>
<td>Completion date:</td>
<td>1st September 2016</td>
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### Resource Use

- **Diesel**: 197,605 kWhrs, 54.144 tonnes CO₂
- **Electricity**: 178,006 kWhrs, 113.39 tonnes CO₂
- **Waste**: 219.17 tonnes (934.27m³)
- **Water**: 2,131m³, 0.639 tonnes CO₂
- **CO₂**: 274.037 tonnes

### Research Activities on Site

<table>
<thead>
<tr>
<th>Activity</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>Site visits</td>
<td>154</td>
</tr>
<tr>
<td>33 RE initiatives</td>
<td>Implemented on site</td>
</tr>
<tr>
<td>124 RE Audits</td>
<td></td>
</tr>
</tbody>
</table>

### The Resource Efficiency (RE) Savings

- **Cost Savings**: €43,910, 13% of Profit Margin
- **Energy CO₂ Saved**: 93 tonnes
- **Energy Saved**: 146,134 kWhrs
- **Waste Prevented**: 52 tonnes
- **Waste Diverted from landfill**: 219 tonnes
- **Site visits**: 124
- **RE Audits**: 33
- **RE initiatives**: 33

### ‘Best Practice’ Waste

- Waste/100m² floor area: €293.09

### ‘Exemplary’ Waste

- Waste diversion from landfill: 103 Waste Skips, 103 Waste Skips

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**Note:** The above information is a summary of the document content. For detailed analysis, refer to the original document.
INDUSTRY GUIDELINES

WRAP (UK) principles of:
- Design for Reuse and Recycling
- Design for Waste Efficient Procurement
- Design for Materials Optimisation
- Design for Off-Site Construction
- Design for Deconstruction and Flexibility

Reports and factsheets are available on the EPA [website](www.epa.ie)

Rediscovery Centre Circular Conversations, 11th July 2019
EU GUIDELINES AND OTHERS

Guidelines for the waste audits before demolition and renovation works of buildings
EU Construction and Demolition Waste Management
May 2018

EU Construction & D Management Protocol
September 2016

CE100
CIRCULARITY IN THE BUILT ENVIRONMENT CASE STUDIES
A COMPILATION OF CASE STUDIES IN THE UK
APRIL 2015

Rediscovery Centre Circular Conversations, 11th July 2019
CIRCULARITY OPPORTUNITIES DURING THE CONSTRUCTION PHASE

A SME PERSPECTIVE
New second-level school
1,640 m² floor area
Value €2.8m

Circularity?

Rediscovery Centre Circular Conversations, 11th July 2019
Must consider the SME-context.

Traditional competitive bid process.

Timelines and turnarounds.

Cost…cost…cost!

Planning requirements?

Client requirements?

Design team requirements?

Contractor’s tendering and procurement strategies.

On-site management.

Tracking to final end-use.

Figure 1: Mapping the new Plan of Work, and alignment with the current proposed CIC stages
What are the cradle-to-cradle (C2C) or circular economy (CE) opportunities during the construction phase?

Design out waste
Design for resource efficiency
Design for deconstruction and disassembly
Use renewable energy
Reduced embodied carbon over a whole building lifecycle
Materials selection, management and logistics
Responsible sourcing of materials
Reduced toxicity
Reuse of buildings and components
Recycling
Cradle-to-Cradle? Circular Economy?

Design out Waste?
Design for Resource Efficiency?
Design for Deconstruction and Disassembly?
Reduce Embodied Carbon?
Reduce Toxicity?

Use Renewable Energy?
Materials Selection, Management and Logistics?
Reuse Buildings and Components?
Recycling?
WORK TO DATE

Case Study Example

New second-level school,
1,640m² floor area, Value €2.8m

Timber, metals, mixed recyclables (cardboard/packaging, general and food waste) segregated = diverted from landfill.

Over €1,500 saving in waste skip costs.

Waste generation factor = 0.026 tonnes/m²
WORK TO DATE

Case Study Example

Diversion from landfill for segregated = 100%

Diversion from landfill for mixed = approx. 70%

Waste costs = €11,243

Waste cost factor = €11,243/1,640m² = €6.86/m²

% of project cost = 0.004%

But % of project margin (1.5%) = 27% !!!
Rediscovery Centre Circular Conversations, 11th July 2019

Opportunities during the tendering and pre-construction planning phases?
**Work to Date**

**Design and Testing of C2C Strategies on Case Studies**

New Fire Station
557m² floor area
Value €1.5m

Timber, metals, plasterboard, mixed recyclables (cardboard/packaging, general and food waste segregated = diverted from landfill.

Over €1,878 saving in waste skip costs.

Waste generation factor = 0.048 tonnes/m²

Rediscovery Centre Circular Conversations, 11th July 2019
Diversion from landfill for segregated = 100%

Diversion from landfill for mixed = approx. 70%

Waste costs = €3,652

Waste cost factor = €3,652/557m² = €6.56/m²

% of project cost = 0.002%

But % of project margin (1.5%) = 16% !!!
Case Study

Circularity Interventions

✓ Provide a project-specific plan

✓ Site Induction

✓ Site Set-Up

Contractor Buy-In

Resource Management Plan

Tuam Fire Station, Galway

Revision prepared by:
Print Name
Signature

Print Name
Signature

Initial RMP approved by:
Print Name
Signature

Distribution List

Name | Date | Sections Issued | Checked
--- | --- | --- | ---

This plan must be displayed on the Site Environmental Notice Board. Site waste management plan requirements have been included in this document.

Rediscovery Centre Circular Conversations, 11th July 2019
Supply Chain

Circularity Interventions

✓ Resource Management Plans

✓ Policy Statement

✓ Project Targets

All suppliers and sub-contractors

Rediscovery Centre Circular Conversations, 11th July 2019
## Case Study

### Circularity Interventions

✓ **Resource Management Plans**

Supply chain engagement at different scales...

### Rediscovery Centre Circular Conversations

**11th July 2019**

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you discussed materials sizes and pre-cut options with your supplier?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Provide detail:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will you purchase materials with recycled content [check specification for requirements]?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Provide detail:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will you purchase materials with less packaging, where appropriate and feasible?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Provide detail:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will your suppliers take back packaging and pallets?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Provide detail:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will your material deliveries be coordinated to match work stages and with other sub-contractors on site?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Provide detail:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Will you ensure that your material deliveries are</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Case Study  Resource Management Plans

21 sub-contractors – 9 recorded responses with 6 others listed but no record!

✓ Optimisation of orders, deliveries and material sizing.
✓ Specifying materials with recycled content (??) and minimal packaging.
✓ Employing take-back schemes with themselves or their suppliers.
✓ Appropriate materials management on site.
✓ Compliance with on-site waste segregation policies, reuse of offcuts.
Case Study  Resource Management Plans

15 suppliers — all replied.

✓ Optimisation of orders and deliveries.
✓ Supplying materials with recycled content (??) and minimal packaging where appropriate.
✓ Employing take-back schemes.
✓ Appropriate materials management on site.
Preliminary Conclusions

Resource Management Plans provide a framework even if not asked for.

Supply chain engagement can be difficult.
Tracking and quality assurance important but seen as an extra task.

Recommendations

Resource Management Plan template developed.
Supply chain RMPs completed annually, not for every project.
Supply chain engagement strategy.
A HOLISTIC AND COLLABORATIVE SUPPLY CHAIN APPROACH...

Clients interested in facilities and asset management.

Design for function and longevity versus flexibility and deconstruction.

Material ‘biographies’ from extraction to end-of-life.

(brand, 1994)
ONGOING…

Regulation and Planning Requirements
The client…the client…the client…

Role of Design Teams

Contractual Arrangements

Role of the whole Supply Chain

Tendering and Procurement phases

External Drivers

Most Preferable

AVOID
REDUCE
REUSE
RECYCLE
RECOVER
TREAT
DISPOSE

Least Preferable

Rediscovery Centre Circular Conversations, 11th July 2019
CHALLENGE...

Possible Construction CE Model

Current Model (Linear)

[Diagram showing the circular economy model for the built environment]


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CONSIDER...

Retrofit 500,000 homes.
- Planning requirement?
- C&DW management plan requirements?
- Pre-retrofit resource surveys?
- Hazardous material identification and management?
- Retrofit ‘waste’ circularity?
- New retrofit materials – benign, durability, maintenance, deconstruction, end-of-function/life circularity?

Replace 500,000 to 600,000 oil boilers.
- Contamination, reuse, recycling, energy recovery, disposal?

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RECOMMENDATIONS...

Regulation and Policy
- Roadmap
- Building Control
- Building Regs

Planning
- Design-Phase RMP
- Pre-Comm. RMP
- RMP Implement

Client
- Public Sector
- Procurement
- Tendering Process
- Contracts
THANK YOU FOR LISTENING.

Dr Mark Kelly, Department of Building and Civil Engineering on behalf of the core team members.