London 2012 Sustainability Lessons Learned
Masterclass 6: Materials

Speakers:
• Peter Bonfield, Chief Executive, BRE
• Shamir Ghumra, Head of Sustainability, Aggregate Industries
• Kirsten Henson, Director, KLH Sustainability
• Noah Bold, Sustainability Manager, CLM
• Dr. Dorte Rich Jørgensen, Sustainability Manager, Atkins

Agenda
10:30 Event Begins & Introduction
10:45 SESSION 1: Delivering responsibly sourced materials
11:00 SESSION 2: Delivering sustainable concrete
11:15 SESSION 3: Delivering 100% sustainable timber on a construction project
11:30 Coffee break
11:40 SESSION 4: Temporary venues, infrastructure design and their materials
11:55 Q&A
12:25 Roundtable Discussions & Group Feedback
13:00 Event Closes

Introduction to the project approach to the materials during design, procurement and construction
Dr. Peter Bonfield
BRE Group Chief Executive and Sustainability and Leader, Construction Products, Olympic Delivery Authority
Six Phases of the Project:
- Planning (up to Spring 2007)
- Demolish, Dig, Design (up to Beijing Games)
- Big Build (up to summer 2011)
- Test Events (to Games 2012)
- London 2012 Olympic and Paralympic Games
- Games Legacy (post 2012)

Sustainable Development
- Carbon
- Water
- Waste
- Materials
- Biodiversity and ecology
- Land, water, noise and air
- Supporting Communities
- Transport and mobility
- Access
- Employment and business
- Health and well-being
- Inclusion

BREEAM Categories
- Health & Wellbeing
- Transport
- Energy
- Materials
- Water
- Waste
- Pollution
- Land Use & Ecology

Sustainability
- ODA Sustainable Development Strategy (SDS) targets and commitments with regard to materials are principally based on:
  - responsible sourcing;
  - minimising embodied impacts;
  - use of secondary materials; and
  - ‘healthy’ materials.

Critical Success Factors/Priority Themes

KPIs
There will be a standard set of measures. Measures will be designed for each contract based upon these and the overall Policy values. Fast Construction Projects like 2012 Construction Industry KPIs will be used with additional sub-measures beneath as required.

Mission
To deliver venues, facilities, infrastructure and transport on time for the London 2012 Olympic and Paralympic Games that are fit for purpose and in a way that maximises the delivery of a sustainable legacy within the available budget.

Inclusive Design
Promoting excellence and innovation in architecture and engineering.

Sustainable Development
- Ownership & Management
- Structure
- Community Utilisation & Benefits
- Sustainable
- Physical Infrastructure
- Financial Viability & WLC
- On Time Sub-programme
- Cost Sub-programme
- Programmes Cost
- Programme
- On Time
- Cost
- Value for Money
- Fit for Purpose

There will be a standard set of measures. Measures will be designed for each contract based upon these and the overall Policy values. Fast Construction Projects like 2012 Construction Industry KPIs will be used with additional sub-measures beneath as required.
– Performance measures – critical for success
– Balanced approach – systems approach
– Drive and unlock innovation – performance based, consistent standards and measures, strong science base
– Procurement, design and engineering – all powerful
– Ask the right questions, rather than prescribe solutions
– Unlock the potential in our people
– Save money, reduce risk, add value and........
.................... lower impact on the environment.

Shamir Ghumra
Head of Sustainability, Aggregate Industries
Supplier of Ready mixed Concrete & Aggregates
Responsibly Sourced Materials

www.ukgbc.org
Overview

What is Responsible Sourcing?

Traditional

Sustainable

Market

Time

The Successes

The Olympic development really kick started the Responsible Sourcing Agenda

Two standards were born; BS 8902 and BES 6001

Responsible Sourcing criteria became embedded in BREEAM

Manufacturers had to rise and meet the challenge

The Challenges

Understanding the provenance of our products

Acknowledging the governance of our products

Supply chain considerations

Communicating this new standard

Lessons Learned

Aggregate Industries has continuously improved ratings under BES 6001 and is now rated ‘Excellent’ for most products

Engaging with our operational sites is key

Training our sales people is essential

Communication the benefit is an ongoing process

Most contractors are already procuring Responsibly Sourced products - they just don’t know it

Agenda

• Is Concrete Sustainable?
• Improving Concrete’s Credentials
• Challenges in using Sustainable Concrete
• Achievements
• Repeating Successes
• Further Information
Is Concrete Sustainable?
Cement production accounts for 4% of global CO\textsubscript{2} emissions. Concrete is approximately 15% cement, by mass but cement accounts for over 90% of the carbon footprint of concrete.

So Why Use Concrete?
• Very durable
• Fair faced concrete as a sustainable building material
• Reduced material import and reduced waste
• No finishing trades
• Easier, end-of-life deconstruction
• Thermal mass
• Naturally fire retardant

Sustainability is always about using the right material for the job.
There is no magic bullet!

Improving Concrete’s Credentials
• Increasing recycled content, by mass (aggregate substitution)
• Reducing its carbon footprint (cement replacement)
• Sustainable transport (aggregate transportation)
• Responsible sourcing

Improving Concrete’s Credentials - Balanced Scorecard Approach to Procurement

The Successes
Ready Mix Concrete
- Approx 450,000m\textsuperscript{3} poured
- 22% secondary aggregates (170,000 tonnes)
- 24% reduction in embodied energy (30,000 tonnes CO\textsubscript{2}, equivalent to almost 4 years of Park operation.)
- 70,000 HGV movements eliminated from London’s roads

The Successes
Pre Cast Concrete
- 21,000m\textsuperscript{3} used
- 7% secondary aggregates (2,485 tonnes)
- 23% reduction in embodied energy (2485 tonnes CO\textsubscript{2})

Challenging the supply chain sometimes delivers great results... ...but if you don’t ask, you won’t get
Isn’t Everyone Doing It?
Concrete Industry Sustainability Performance Report 2011 indicates:

- 94.2 kg CO₂/tonne concrete carbon footprint, including transport, similar to the Olympic Park average
  (98.3 kg/tonne if considering 2010 ‘rolling mix’ industry average composition).
- 27.8% cement substitution, compared to 32% on the Olympic Park
- 5.8% recycled aggregate use, compared to 22% on the Olympic Park
- 91% of materials transported by road, compared to less than 6% on the Olympic Park

Isn’t Everyone Doing It?
AND

Contaminated ground conditions and almost 70% of concrete in the ground
50 kg/m³ more cement in DC3 and DC4 mixes than DC2

High proportion of high strength concrete (almost double market average)
75 kg/m³ more cement in C50 mixes than C35

Preference given for PFA substitute over GGBS in non-visible concrete
maximum possible OPC substitution of 40% compared to 70%

Sustainable materials used in fair-face and other visible concrete, not just hidden in the substructure or clad frame.

The Challenges

- Preconceptions of sustainable materials
- Use of standard concrete specifications
- Understanding finish quality, workability
- Understanding strike times and strength requirements
- Interpretation and application of standards
- Risk adverse nature

The Challenges

Asking for cement substitution or recycled aggregates, sometimes resulted in suppliers increasing total cementitious content
Is offsite manufacture always more sustainable?
What about wastage rates?

<table>
<thead>
<tr>
<th>Concrete Grade</th>
<th>C35</th>
<th>C40</th>
<th>C45</th>
<th>C50</th>
<th>C55</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength (MPa)</td>
<td>35</td>
<td>40</td>
<td>45</td>
<td>50</td>
<td>55</td>
</tr>
<tr>
<td>Water/Cement</td>
<td>0.5</td>
<td>0.45</td>
<td>0.4</td>
<td>0.35</td>
<td>0.3</td>
</tr>
<tr>
<td>Workability</td>
<td>15</td>
<td>14</td>
<td>12</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Strike Time</td>
<td>4</td>
<td>3.5</td>
<td>3</td>
<td>2.5</td>
<td>2</td>
</tr>
<tr>
<td>Cost Savings</td>
<td>20%</td>
<td>30%</td>
<td>40%</td>
<td>50%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Embedded Energy (kWh/m³)

<table>
<thead>
<tr>
<th>DC2</th>
<th>DC3</th>
<th>DC4</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.216</td>
<td>0.298</td>
<td>0.326</td>
</tr>
<tr>
<td>0.274</td>
<td>0.238</td>
<td>0.215</td>
</tr>
</tbody>
</table>

Lessons Learned

Pouring concrete is like baking a cake…. you can follow a recipe but it turns out a little different each time

- Early identification of opportunity
- Setting targets is a useful tool for pushing innovation
- Collaboration - get the supply chain involved
- Understanding trade-offs and balance beyond carbon footprint
- Knowledge share
- Trials and learning
- Communication
- Always check and double check mix designs
- There is no right answer to suit all occasions!

If you don’t ask you are unlikely to get.

Further Information

Detailed case study:
Procurement and Use of Sustainable Concrete on the Olympic Park

Available under the Sustainability Case Studies section of the ODA Learning Legacy website
http://learninglegacy.london2012.com/
Noah Bold
ODA Delivery Partner (CLM)
Sustainability Manager

Delivering 100% sustainable timber on a construction project

Overview
- Maximise timber from sustainable sources
- FSC and PEFC schemes accepted
- Park wide certification

Overview
This had never been done on a construction project of this scale before

Overview
- FSC and PEFC are independent schemes
- Timber used extensively, in many forms

Overview
Any failure to procure timber from sustainable sources had the potential to pose a significant reputational risk

The Challenges
- Engagement with industry
- Working with FSC and PEFC
- Timber Supplier Panel
- Justification Reports
- Delivery Management System
- Embedded the core objective
- Monthly Delivery Reports
- Engagement with contractors
- Timber champions
- Inspection
The Challenges
- Site audits
- Training of key personnel
- Record of timber purchases
- Contracts
- Engage with suppliers
- Ensure Chain of Custody
- Athletes Village FSC only

<table>
<thead>
<tr>
<th>Scheme</th>
<th>%</th>
<th>%</th>
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<tbody>
<tr>
<td>FSC</td>
<td>71.8</td>
<td>9085.6</td>
</tr>
<tr>
<td>PEFC</td>
<td>28.2</td>
<td>3564.9</td>
</tr>
<tr>
<td>Total</td>
<td>12650.5</td>
<td></td>
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The Successes
- 100% certified timber achieved
- Timber Supplier Panel was hugely innovative
- Raised the importance of unbroken chain of custody
- Increased knowledge and understanding of certified timber
- Open Forums enabled the timber industry to meet and discuss issues
- Brought certification bodies together
- Catalyst for change

Lessons Learned
- Have a clear and focused strategy
- Embed methods and processes
- Provide continuous training
- Monitor the supply chain
- Key takeaway - We are all in this together!

Overview - How temporary venues fit in

The Successes - Embedding the Sustainability Strategy

<table>
<thead>
<tr>
<th>Phase</th>
<th>Infrastructure Design Teams</th>
<th>Infrastructure Design Teams</th>
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</thead>
<tbody>
<tr>
<td>Early Design</td>
<td>- Sustainability Plan - CEEQUAL assessment - Coordination meetings - Information CEEQUAL - Product reviews - Embedding ‘green matrix’ - Meetings/workshops - High level studies - Ad hoc requests - Supply chain engagement</td>
<td></td>
</tr>
<tr>
<td>Main Design</td>
<td>- Commission for Sustainable London 2012 - Coordination meetings - Engagement with CEEQUAL - Design support - Planning support - Coordination meetings - CEEQUAL assessment - Adjusting designs/specifications - Document/drawing/specification sharing - CEEQUAL assessment</td>
<td></td>
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<tr>
<td>Tender/Construction</td>
<td>- Commission for Sustainable London 2012 - Coordination meetings - Engagement with CEEQUAL - Design support - Planning support - Coordination meetings - CEEQUAL assessment - Adjusting designs/specifications - Document/drawing/specification sharing - CEEQUAL assessment</td>
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Dr Dorte Rich Jørgensen
Atkins
Sustainability Manager – Infrastructure Team

CAMPAIGN FOR A SUSTAINABLE BUILT ENVIRONMENT
www.ukgbc.org

Temporary Venues, Infrastructure Design and their materials

We are all in this together!
The Successes - Infrastructure

Client targets:
- 20% recycled content (by value)
- 25% recycled aggregates (by weight)
- 50% (by weight) sustainable transportation of materials
- 90% reuse of demolition materials

Design for Legacy
- Where scope permits and Games Design is temporary e.g. loop road and lighting columns

Design optimisation:
- Bridges, retaining walls and abutments
- Reuse of demolitions materials in design 90% reused
- Responsible sourcing: aggregates, timber and concrete

The Successes - Wetland Bridges - Achieving Materials Targets

Client targets:
- 20% recycled content (by value)
- 25% recycled aggregate (by weight)
- 50% (by weight) sustainable transportation of materials

Designer:
- Statements in specifications
- Embodied energy statements for key materials
- Minimising waste in design with compliance reporting
- Training of design team

Contractors achieved:
- 45% recycled content by value,
- 56% recycled aggregate by weight
- 65% of materials delivered by sustainable transport

CEEQUAL WPA materials score = 95.4%

The Successes - Wetland Bridges - Highest CEEQUAL to date (98.3%)

Majority of treatment/coatings are VOC free

Gabions with reclaimed materials from site supporting 96% site-wide target

Reuse of utility pipes as bird boxes

Optimisation of abutment and wing wall design

Low Carbon Concrete using secondary aggregates as steel and cement replacement is pulverised fly ash

The Successes - Innovative habitat creation: Bat and bird boxes on bridges

Clear guidance: bat and bird box guidance documentation
- Location to ensure highest possible usage by birds
- Reuse of cut off from utility pipes as boxes
- Consensus amongst multiple stakeholders
- Procurement of reused utility pipe cut offs

The Successes - Temporary and permanent kerbs

Temporary
- Kerbs made from waste plastic (bottles etc.)
- Plastic kerbs weigh 5.4 kg vs 69 kg concrete
- Faster laying time, H&S and less equipment
- BBA HAPAS certified

Permanent
- Conservation kerbs look like granite
- 47% recycled materials

General
- Adaptable of kerbs
- 90% reduction in comparison to granite/concrete
- Carbon footprinting

What lies beneath

0.97 km of drainage pipes = 453 T CO2 reduction

- 11kV voltage ducts
- 132kV electrical Ducts
- Communications and non-portable water ducts

Total of 286 km of 453 T CO2 reduction

Comparison of Embodied Carbon of Kerbs

Embodied Carbon (kg CO2e)

Concrete Kerbs

Kerbs

Steel Kerbs

Concrete Kerbs

Embodied Carbon (kg CO2e)

Concrete Kerbs

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Embodied Carbon (kg CO2e)
The Successes - Temporary venues

The Challenges

- Finding our way...in the beginning, scope, timing and right resource match
- Size of the project, sequencing of works, breadth of stakeholders and profile
- Influencing 150 people+ to design beyond habits/codes within short time scale
- Balancing effort of input on what to challenge to achieve biggest possible wins

Lessons Learned

- Engage stakeholders to buy recycled over buying new.
- Cross fertilisation from other industries e.g. Temporary venues to the Army.
- Change is possible – designers have expanded the design pallet.
- When...
  - High level client buy-in and objectives asks to challenge convention, right environment is provided so helps transform industry practice.
  - Projects need to be auditable against sustainability target, as part of contracts.
  - The team is open and adaptable

Key Takeaway for Industry

A process of strategic drivers to embed sustainability onto a project from the outset which is monitored throughout influences peoples behaviour, practices and processes. This is key to achieve international carbon reduction and sustainability objectives.

Further Reading: Learning Legacy Papers

- Sustainable material use in paving and seating
- Innovation in timber supply for London 2012
- The procurement and use of sustainable concrete
- Implementation of the PVC policy
- Responsible sourcing of the Handball Arena cladding
- Role of construction supply chain in delivering sustainable solutions
- Habitats for birds and bats on the Olympic Park
- Transport of construction materials by sustainable means
- Timber Management
- Innovation in Timber supply
- Reducing embodied carbon through efficient design
- Reuse and recycling on the London 2012 Olympic Park

All papers available at LearningLegacy.London2012.com
Upcoming Events

MASTERCLASS 7: LAWN
Tues 3rd July
8am to 10am

MASTERCLASS 8: Biodiversity
Tues 10th July
8am to 10am

Series Finale Event

Tues 3rd July
4-6pm Panel Discussion
6-8pm Outdoor Reception
Register at ukgbc.org

Thank you for attending!