

CONCRETE USAGE IN THE LONDON 2012 OLYMPIC PARK AND THE OLYMPIC AND PARALYMPIC VILLAGE AND ITS EMBODIED CARBON CONTENT

Stuart Matthews



bretrust

CONCRETE USAGE IN THE LONDON 2012 OLYMPIC PARK AND THE OLYMPIC AND PARALYMPIC VILLAGE AND ITS EMBODIED CARBON CONTENT

Stuart Matthews



bre

This work has been funded by BRE Trust. Any views expressed are not necessarily those of BRE Trust. While every effort is made to ensure the accuracy and quality of information and guidance when it is first published, BRE Trust can take no responsibility for the subsequent use of this information, nor for any errors or omissions it may contain.

The mission of BRE Trust is 'Through education and research to promote and support excellence and innovation in the built environment for the benefit of all'. Through its research programmes the Trust aims to achieve:

- a higher quality built environment
- built facilities that offer improved functionality and value for money
- a more efficient and sustainable construction sector, with
- a higher level of innovative practice.

A further aim of BRE Trust is to stimulate debate on challenges and opportunities in the built environment.

BRE Trust is a company limited by guarantee, registered in England and Wales (no. 3282856) and registered as a charity in England (no. 1092193) and in Scotland (no. SC039320).

Registered Office: Bucknalls Lane, Garston, Watford, Herts WD25 9XX

BRE Trust
Garston, Watford WD25 9XX
Tel: 01923 664743
Email: secretary@bretrust.co.uk
www.bretrust.org.uk

BRE Trust and BRE publications are available from www.brebookshop.com

or
IHS BRE Press
Willoughby Road
Bracknell RG12 8FB
Tel: 01344 328038
Fax: 01344 328005
Email: brepres@ihs.com

Requests to copy any part of this publication should be made to the publisher:

IHS BRE Press
Garston, Watford WD25 9XX
Tel: 01923 664761
Email: brepres@ihs.com

Printed on paper sourced from responsibly managed forests

PUBLISHER'S NOTE

All URLs accessed August 2012. The publisher accepts no responsibility for the persistence or accuracy of URLs referred to in this publication, and does not guarantee that any content on such websites is, or will remain, accurate or appropriate.

ACKNOWLEDGEMENTS

This publication was written in co-operation with the Olympic Delivery Authority (ODA). Images are provided courtesy of the ODA and Arup.

The author would like to thank the following people for their contributions:

Tim Beeson – Senior Materials Engineer, Balfour Beatty
Jo Carris – Sustainability Research Coordinator, ODA
Arash Fatemi – Operations Director Russia, Lend Lease
William Holloway – Senior Design Manager Olympic and Paralympic Village, Lend Lease
Andrew Kinsey – Sustainability Manager Olympic and Paralympic Village, Lend Lease
Alistair Legg – District Technical Manager, London, Tarmac Ltd
Dr Bryan Marsh – Associate with Arup Materials Consulting, Arup Group
Gordon Mungall – Associate Director and Project Engineer for the Aquatics Centre, Arup Group
Shaun Roche – Technical Manager, London Concrete
Jo Smit – Principal Editor, BRE

The preparation and publication of this report was funded by BRE Trust.

Cover images:

Main: ???

Top right: Aerial view of the 2012 Olympic Park and Olympic and Paralympic Village during construction

Middle right: Side view of the diving boards in the Aquatics Centre

Bottom right: Detail of one of the residential blocks in the Olympic and Paralympic Village

FB 49

© Copyright BRE 2012
First published 2012
ISBN 978-1-84806-289-4

CONTENTS

Executive summary	iv
1 INTRODUCTION TO THE PRIORITY SUSTAINABILITY THEMES OF THE LONDON 2012 OLYMPIC AND PARALYMPIC GAMES	1
2 STUDY METHODOLOGY	2
3 ODA CONCRETE SUPPLY STRATEGY FOR THE LONDON 2012 GAMES	3
3.1 Introduction	3
3.2 Main components of the ODA's concrete supply strategy for the London 2012 Games	3
3.3 Indicative volumes of concrete used in the Olympic Park and the Olympic and Paralympic Village facilities	4
4 SUSTAINABLE CONCRETE CONSTRUCTION: INFLUENCING FACTORS, EMBODIED CARBON AND SOME PREVIOUS EXPERIENCES	5
5 EMBODIED CARBON BENCHMARKS FOR AGGREGATES FOR CONCRETE AND CONCRETE MIXES	8
5.1 Introduction	8
5.2 Embodied carbon benchmarks for aggregates for concrete	8
5.3 Embodied carbon benchmarks for concrete mixes	9
6 CONCRETE SUPPLY TO THE OLYMPIC PARK	13
7 CASE STUDY: THE AQUATICS CENTRE	16
7.1 Introduction	16
7.2 Experiences with sustainable concrete use at the Aquatics Centre	19
8 CASE STUDY: THE OLYMPIC AND PARALYMPIC VILLAGE	21
8.1 Introduction	21
8.2 Concrete supply arrangements for the Olympic and Paralympic Village	21
8.3 Observations on the concrete mixes used in the Olympic and Paralympic Village	24
8.4 Design and construction considerations	24
8.5 Carbon footprints of concrete mixes supplied to the Olympic and Paralympic Village	25
9 CONCLUSIONS AND OBSERVATIONS FOR THE FUTURE	28
10 REFERENCES	30

EXECUTIVE SUMMARY

Concrete is widely used in the Olympic Park and Olympic and Paralympic Village. Its specification and use provided an important opportunity to reduce embodied carbon emissions involved in the creation of facilities and infrastructure, as well as to influence the overall carbon footprint of the London 2012 Games.

The Olympic Delivery Authority initiated a concrete supply strategy that included requirements to: achieve sustainability targets; appoint single concrete suppliers for the Olympic Park and Olympic and Paralympic Village; source via two on-site batching plants; work with the supply chain to minimise transport impacts; use secondary/recycled aggregates; and incorporate fly ash and ground granulated blastfurnace slag as Portland cement replacements in the concretes used.

Across the Olympic Park as a whole, it is estimated that the embodied carbon footprint of the concrete mixes supplied has been reduced by 33% relative to the UK construction industry average. This BRE Trust Report sets out the evidence on concrete supply to the Olympic Park and the Olympic and Paralympic Village, lessons learned from the experience of using sustainable concretes and examines the estimated carbon footprints. Case studies of the Aquatics Centre and the Olympic and Paralympic Village are included.

IHS BRE Press has published two other publications relating to sustainable construction of the London 2012 Games. These are:

- *BREEAM and the Code for Sustainable Homes on the London 2012 Olympic Park* (FB 47)
- *Innovation in timber supply at the London 2012 Olympic and Paralympic Games* (IP 17/12)

Summaries of these reports have been published on the Learning Legacy website together with many other reports and case studies (<http://learninglegacy.london2012.com>).

1 INTRODUCTION TO THE PRIORITY SUSTAINABILITY THEMES OF THE LONDON 2012 OLYMPIC AND PARALYMPIC GAMES

When London won the right in 2005 to host the London 2012 Olympic and Paralympic Games, the bid team pledged to set the highest possible standards in sustainability. This will be the first summer Games to map its complete carbon footprint over the entire project.

The London Games' mission statement is: 'To minimise the carbon footprint of the Games and provide a platform for demonstrating long-term solutions for energy and water resource management, infrastructure development, transport, local and seasonal food production and carbon impact mitigation and adaptation.'

To help it deliver on its pledge, the Olympic Delivery Authority (ODA) adopted the principles of 'One Planet Living' as the basis for its London 2012 Sustainability Plan ('Towards a One Planet 2012'). The 'One Planet Living' approach was developed by green campaign groups BioRegional and WWF and is based on the efficient use of natural resources.

Construction activity for the 2012 Games (Figure 1) is guided by six core priority sustainability themes: reducing carbon emissions; minimising water use; minimising waste; sourcing sustainable materials; retaining biodiversity and enhancing it where possible; and minimising overall environmental impact. These principles were applied across the Games' landmark venues and all other development, including the Olympic and Paralympic Village that will house athletes and officials, the 30 bridges and other infrastructure provided, and the landscaping.

For the Olympic Park site in Stratford, east London, the ODA made specific commitments to:

- achieve a 50% reduction in carbon emissions from permanent buildings on the Olympic Park (compared with notional buildings built to the Building Regulations 2000 (as amended^[1]) by 2013
- supply 20% of the energy used on the Olympic Park after the Games from on-site renewable sources
- achieve Code for Sustainable Homes Level 4^[2] for the Olympic and Paralympic Village dwellings, resulting in a 44% reduction in carbon dioxide emissions relative to the requirements of the 2006 version of Approved Document L of the Building Regulations^[3]
- freight 50%, by weight, of construction materials for the Olympic Park by rail or river
- reduce the amount of potable water used in new permanent venues by 40% (against 2006 standards) by using water-efficient appliances and non-potable water for irrigation.

The ODA also made a commitment that permanent buildings would achieve a Building Research Establishment Environmental Assessment Method (BREEAM; see www.breeam.org) 'Excellent' rating, after the Games^[4, 5]. To take this forward it was necessary for the ODA and BRE to work together to develop a bespoke version of BREEAM that could be applied to both the sport venues and the Park itself.

The ODA's delivery against its objectives has been monitored by an independent body, The Commission for a Sustainable London 2012, which reports on a regular basis (see <http://www.cslondon.org>).



Figure 1: Aerial view of the 2012 Olympic Park and Olympic and Paralympic Village during construction