

learning legacy

lessons learned from the London 2012
Games construction project



The role of the construction supply chain in delivering sustainable solutions on the Olympic Park

Abstract

In winning the 2012 Olympic and Paralympic Games London pledged to host the 'Greenest Games' ever and to leave a lasting legacy of physical assets and learning to be shared with future Games and other major projects. This therefore provided a huge opportunity for the UK construction industry to meet the many challenges of delivering a sustainable development project and to address the radical changes needed in current construction practices.

This Learning Legacy paper outlines the key processes implemented to delivery sustainability objectives on the Olympic Park and explains the activities undertaken by different parts of the supply chain to help deliver these goals.

Although manufacturers and suppliers have been making significant investment in products and proceses that will enhance the sustainability performance of the built environment, there are many barriers to the wider take up of innovative products and practice on construction projects.

As the client on the Olympic Park, the Olympic Delivery Authority (ODA) put in place processes to overcome the traditional barriers against using innovative solutions by creating the culture and conditions to embrace creativity and innovation from the supply chain. These processes included: Setting a strong vision and developing challenging sustainability targets; engaging early with the supply chain; embedding sustainability into procurement processes; communicating contract opportunities; managing risk, rather than avoiding it; employing sustainability managers; and implementing a strong auditing procedure to track delivery of sustainability targets.

As a result, the ODA is on track to achieve its sustainability targets and more products with improved environmental performance have been introduced to the market.

Challenges still remain which will need to be actively addressed by clients, designers, contractors, suppliers and government. The real legacy of the Games will depend on the extent to which the industry learns from, adopts and develops the processes used on the Games.

Introduction

London's bid for the 2012 Olympic and Paralympic Games made the commitment to set new standards of sustainability for the Games and the process of regenerating and constructing the Olympic Park. London pledged to host the 'Greenest Games' ever and to leave a lasting legacy of physical assets and learning, to be shared with future Games and other major projects.

Following the award of the Games in 2005, the Olympic Delivery Authority (ODA) translated these commitments into a Sustainable Development Strategy¹ that had 26 environmental targets under the themes of energy, water, materials, waste, biodiversity and environmental impacts. The ODA worked with its Delivery Partner (CLM²), designers and contractors to procure innovative products and solutions from the rest of the supply chain to meet these targets.

This Learning Legacy paper investigates:

- Innovation in the construction industry, to set the context for the Park project
- The processes (framework) that were put in place by the ODA to foster innovation
- How the supply chain responded, illustrated through ten case studies
- The overall achievements and remaining challenges

The output of the paper is a set of recommendations for clients, product manufacturers, designers, contractors and government.

Challenges and lessons learnt are highlighted throughout the paper as part of a commitment to promote best practice in sustainable design and construction.

This paper was commissioned by the Construction Products Association and the Building Research Establishment (BRE) and was written by a team comprising consultants from MustRD as well as from the Construction Products Association and the BRE. The content was informed by semi-structured interviews with key members of the ODA, construction product manufacturers, contractors and designers on the Games.

Recommendation 4: 'That the industry and government should work together to use the occasion of the London Olympics as a showcase of how to implement plans for a low carbon built environment, embracing design and engineering; works execution right through the supply chain; materials, product and component manufacture; and all other construction-related services.'

Low Carbon Construction Innovation and Growth Team Report³

Context: innovation in the construction industry

The research and development is there and products are being tested in the market place, but there needs to be a step change in demand both to stimulate further innovation and to bring down prices through economies of scale.

Low Carbon Construction Innovation and Growth Team Report³

The need for improved efficiency, higher levels of performance and greater innovation in the construction industry has been the subject of successive government reports, most notably those led by Sir Michael Latham⁴ and Sir John Egan⁵.

After London won the bid to host the 2012 Games, the ODA, the construction industry and government collectively agreed to use the Games to showcase construction and exceed current best practice. This intention was captured in the 2012 Construction Commitments⁶ which identified a range of topics in which best practice would be pursued, this included sustainability as one of the key areas.

The joint industry and UK government's Strategy for Sustainable Construction⁷ (2008) highlighted the need to deliver a radical change in the construction industry's engagement with the sustainability agenda. The Low Carbon Innovation and Growth Team (IGT) led by government Chief Construction Adviser Paul Morrell, picked up this theme in 2010/11 when it conducted a review into how the industry can deliver a low carbon built environment. The IGT Steering Committee included ODA Chairman John Armitt. The IGT's Low Carbon Construction Report³ (the IGT Report) was published in June 2011 and recognised that 'the research and development is there and products are being tested in the market place, but there needs to be a step change in demand both to stimulate further innovation and to bring down prices through economies of scale.'

The IGT report identified many barriers to innovation in the construction industry and called for active engagement with the process of overcoming them. The need to capture and exchange lessons learnt from major projects, in particular the Games, is one of the key recommendations from the report. By analysing the processes established to deliver innovative and sustainable solutions (specifically from the construction product supply chain), this learning legacy paper is a direct response to that call.

Manufacturers and suppliers from the Construction Products Association's Olympic Liaison Group that contributed to this learning legacy paper identified a range of drivers and barriers for utilising innovative products and solutions as set out in the table below. These reinforce the influences on innovation identified in previous research and in the IGT report.

Drivers	Barriers
<ul style="list-style-type: none">• Reputation• Competitive advantage• Client requirements• Regulation/legislation• Corporate sustainability objectives• Market pull (end-user requirements)• Technological developments• Aesthetics/design trends• Efficiency in construction• Commercial gain	<ul style="list-style-type: none">• Lack of client demand for sustainable solutions• Lack of client engagement with the supply chain• Client, designer and contractor concerns about the risks associated with using new products• Lack of clarity from government about future changes to policy, standards and building codes• Poor communication and knowledge sharing up and down the supply chain leading to a lack of awareness amongst designers and contractors about new materials/products• Procurement rules• Poor returns on investment due to low or slow adoption of innovative products• Unwillingness of industry to change• Cost of research and development• Not enough time to innovate for specific projects and one-off clients

The processes implemented by the ODA to overcome these barriers and to bring forward innovations from the supply chain are set out in the following section, followed by an analysis of their effectiveness.

Setting a framework for innovation

As the client for the construction of the Park, the ODA had a significant role to play in creating the right environment and culture to enable innovation from the supply chain to flourish. Leadership, culture, communication, design, procurement and auditing processes were critical to ensure the ODA's aspirations for a sustainable Park were achieved. Below is a brief description of the processes that were adopted to overcome the barriers to innovation and to embed sustainability into the programme. This approach is echoed in the Government 2011 Construction Strategy⁸. The next sections of this paper analyse the effectiveness of these processes.

Client demand and leadership for sustainability

- The ODA sent a clear message to industry that as a client it was serious about delivering high levels of sustainability and was committed to working proactively with the supply chain to implement best practice
- The ODA's Sustainable Development Strategy¹ was developed early (in consultation with stakeholders) and communicated widely to industry. It was embedded into governance structures, and design, procurement and construction processes
- The ODA created an environment and culture that supported innovation. Challenging performance specifications were set, which required delivery teams to be creative and innovative when finding design solutions
- The ODA encouraged collaboration between designers, project managers, contractors and product suppliers

Early engagement with the supply chain

- The Construction Products Association was appointed the representative body for manufacturers and acted as a conduit for information between industry and the Games
- The ODA engaged very early and extensively with manufacturers and distributors to identify innovation across a wide range of products and services. By becoming a knowledgeable client the ODA was in a better position to unlock innovation that was already in the materials supply chain
- The key methods of engagement were Industry Sector Days and Olympic Liaison Group meetings (see page 7). These supported communication, knowledge transfer and understanding between the supply chain and the ODA

Embedding sustainability into procurement

- The ODA integrated sustainability into its Procurement Policy⁹. The policy stated that 'The ODA will seek to use its purchasing power to support sustainable development in London and the UK and the implementation of the ODA's Sustainable Development Strategy... the ODA will aim to ensure that sustainability is integrated into business cases, procurement plans and related contracts'
- A balanced scorecard¹⁰ was used at each stage of procurement to evaluate how a company would perform against the ODA's suite of objectives. The evaluation criteria were set typically at 70:30 (Technical: Price). Sustainability formed part of the technical question

Communicating contract opportunities and providing support to companies to win work

- The ODA's Supplier Guide¹¹ provided information to suppliers and contractors interested in opportunities on the Park. Sustainability was listed as one of the ODA's procurement values in the Supplier Guide
- 'Meet the Buyer' events were held around the country to inform industry about contract opportunities and the client's requirements, including sustainability
- The online CompeteFor¹² service and website was set up to enable businesses to compete for contract opportunities linked to the Games. Companies were required to have an Environmental Policy in order to register for CompeteFor. Representatives worked with companies that did not have these to help them develop appropriate policies

Managing risks

- The ODA recognised that innovation can be risky particularly where products had not been tested before or were new to the delivery team. Risk management was therefore an active part of the programme management process
- The ODA typically adopted best practice and solutions that were tried and proven rather than procuring completely new products
- The ODA set up trials for innovative products that designers were reluctant to specify due to concerns over performance
- The ODA established a number of site-wide supply frameworks (for concrete, timber, waste and fuel) to manage risk and encourage innovation in a consistent way across projects

Employing sustainability managers

- The ODA programme managers put in place well-resourced sustainability and supply chain management teams to deliver the project's sustainability targets across the multiple construction projects and to manage the interface with the supply chain
- Within the ODA Sustainability Team there were specialists in materials and products who played an important role in researching innovative products and bringing these to the attention of designers and contractors, through meetings and by setting up tests and demonstration projects
- Each contractor had a Sustainability Manager who worked full time on the Games. They researched innovative sustainability solutions, wrote business cases and promoted delivery of the ODA's sustainability targets through the supply chain

Strong auditing procedure to track delivery of sustainability targets

- The ODA and its Delivery Partner put in place a robust sustainability auditing procedure to ensure that sustainability targets were filtered down the supply chain and were being achieved. The auditing procedure and risk of non-compliance was a big driver for the Tier 1 contractors to do this

Achievements

Interviews with key members of the ODA, construction product manufacturers, contractors and designers on the Games produced positive feedback about the approach taken on the Park. The overall successes and achievements of the approach are outlined below. There were, however, many challenges and lessons learnt and these are set out in a later section.

Client vision

The ODA's publicly communicated vision to set stringent standards for sustainability sent a clear message to the industry that it was serious about implementing best practice. There was consensus among suppliers, designers and contractors interviewed that the ODA's demand for high levels of sustainability set the premise for the project.

“The ODA has been successful in sending signals about their sustainability requirements to the marketplace, as companies have been ready to respond when procurement started”

Commission for a Sustainable London 2012

The ODA successfully used the high profile of the project to stimulate innovation in sustainability. Suppliers were very keen to work on the Games and understood that in order to win business they would have to demonstrate the sustainability benefits of their products, as well as the sustainability credentials of their company. Several suppliers interviewed for this learning legacy paper said that the Games encouraged them to bring to market and promote innovations they were already developing, and to improve their products or processes to gain competitive advantage and win work on the Park. One supplier said: 'The Olympics Park provided us with the perfect opportunity to commercially justify some step changing process innovations.' Another said: 'We already had very stretching targets with regards to sustainability... the Olympics allowed us to reap the benefits of this approach as we were able to work with a like-minded organisation with the same goals.'

Culture

The ODA has demonstrated that the industry is capable of delivering sustainable projects if the right culture and project conditions are created. Creating a culture that supported and actively promoted innovation was not easy; it required behaviour change, and an openness and willingness to actively challenge the status quo in an industry that tends to be conservative and risk averse. Furthermore, it needed a collaborative approach that started with leadership from the client and worked its way throughout the supply chain.

Many interviewees emphasised that the client Sustainability Team, which actively advocated sustainable solutions across the programme, played an important role in developing a culture in support of sustainability. Designers' and contractors' sustainability advisors/managers were very successful in raising the importance of sustainability within their project teams and the construction workforce, which we hope will be transferred to future projects.

Contractor Sustainability Managers found that procuring innovative and sustainable products worked best when they had support from the senior team, especially the Project Director and Procurement Manager – demonstrating the importance of senior-level leadership for sustainability.

'We created a culture where people were encouraged and motivated to do better in the supply of everything from paints to seats to light fittings to taps. We got everybody looking out for innovation and we achieved things you would never have dreamed of.'

Peter Bonfield, ODA Head of Construction Products

Engagement

The ODA's early and extensive engagement with the supply chain opened up opportunities for suppliers to provide best practice products and services to the Park. Contractors reported that innovative solutions were best identified when contractors engaged with manufacturers prior to tender – this is a key learning point.

Best practice: early engagement with the supply chain

In the first three years of the ODA programme (2005-2008), the ODA engaged extensively with manufacturers and distributors to identify innovation across a wide range of products and services and to unlock innovation inherent in the materials supply chain but which often doesn't have a clear route to implementation. The ODA Sustainability Team worked with the Procurement Team to meet suppliers to understand the market opportunities and constraints.

The Construction Products Association¹³ and BRE played a key role in linking the ODA and the supply chain and supporting communication. Early engagement took two forms: Industry Sector Days and Olympic Liaison Group meetings.

Industry Sector Days: At the beginning of the planning phase for the construction of the Park, the principal construction materials and products were identified including concrete, steel, plastics, drainage piping and timber and a series of industry days were held for each of these different construction product sectors. In advance of these industry days, the ODA provided suppliers with a brief which outlined the sustainability opportunities and challenges and suppliers were invited to give a presentation to the ODA and contractors on how they would meet the challenges.

This process was very instructive to the ODA, as by engaging with the product manufacturers, the client became better-informed and more knowledgeable about current and forthcoming innovative solutions. The suppliers likewise were able to innovate and deliver, as they were better informed about the ODA's requirements. Product suppliers have recommended that meetings would have been even more effective if more contractors had been present to participate in discussions about innovation. Crossrail has taken measures to address this: each contractor is contractually required to hold an industry day every year of their five year contract.

Olympic Liaison Group: An Olympic Liaison Group was established by the Construction Products Association, for suppliers who registered to receive regular updates about Olympic projects. Olympic Liaison Group meetings started almost immediately and three meetings were held a year; each one was half a day and included several speakers from the ODA and contractors. The aim of the meetings was to inform industry of current progress on the Park, the ODA's priorities (such as sustainability, health and safety and design quality), processes (including procurement, CompeteFor and logistics) and most importantly forthcoming contract opportunities. This enabled industry to prepare accordingly.

There was very positive feedback from industry about these events. As the client, the ODA found the meetings useful: it was a very good way to share knowledge and information and it informed the ODA of innovations and best practice. The Construction Products Association is now arranging similar Liaison Group meetings with Crossrail.

Sustainable Development Strategy Extract

'The ODA aims to work proactively and collaboratively with its supply chain to deliver against its sustainability requirements through its supply chain management programme. This will also allow for continuous improvement and for shared learning across the supply chain.'

Procurement

As a non-departmental public body, the ODA was required to comply with the UK's public sector procurement regulations. To encourage sustainable solutions from the supply chain within the boundaries of these regulations, the ODA actively integrated sustainability into its Procurement Policy and procurement processes. For the ODA, this was a vital tool for communicating sustainability requirements to the supply chain early and it rewarded those companies that had invested in sustainable products and processes.

An extract of the ODA's Procurement Policy is provided below.

Sustainable development

Sustainable development encompasses quality and functionality, environment and legacy.

The ODA is committed to seeking continuous improvement in its own and its contractors, performance on sustainability that is consistent with the need to provide Value for Money by:

- Developing a sustainable development strategy
- Setting and monitoring relevant, measurable sustainability objectives and reporting progress regularly
- Establishing sustainable development as a clear feature of ODA decision-making
- Maintaining management systems to manage and monitor sustainability performance
- Early consultation with the supplier market
- Setting output-based specifications, inviting bidders to submit proposals for meeting sustainability objectives, rather than itself be prescriptive, so as to encourage innovation
- Setting minimum standards to which contractors and designers will be required to work
- Requiring major contractors to have expertise and management systems in place to manage and monitor sustainability performance
- Educating, training and motivating staff and contractors to work in a socially and environmentally responsible manner
- Working collaboratively and proactively with contractors, whilst providing robust contract management
- Actively managing its supply chain to achieve sustainability objectives

The inclusion of sustainability performance requirements in tender documentation required contractors to address sustainability and in many cases the ODA saw an improvement over a period of time, i.e. if a bidder was unsuccessful on a particular project, they were given feedback on how they could improve and often did so, scoring more favourably when bidding again in the future.

Many Tier 1 contractors replicated elements of the ODA's procurement approach (e.g. balanced scorecard) within their own processes, demonstrating that best practice can be client led.

Performance-based specifications

Setting performance-based specifications, rather than being prescriptive about technological solutions, encouraged creativity and innovation from the supply chain and resulted in the most technologically appropriate and sustainable solutions. The ODA, designers, contractors and suppliers concur that this approach should be replicated on future projects.

Sustainable outcomes

The ODA's framework for innovation resulted in '...some excellent examples of its sustainability targets being delivered by the supply chain.'¹⁴ A number of new, more sustainable products and processes were developed by the supply chain and implemented on the Park. A selection of case studies in the Appendix of this paper demonstrates this.

The most notable sustainability achievements include:

- More than 50% of materials were delivered by rail or water
- A blackwater treatment plant was installed on site (Old Ford Water Recycling Treatment Works), which is the first large scale wastewater recycling scheme in the UK. This was procured as part of a seven year R&D project with Thames Water
- Waterless urinals, water efficient fittings, rainwater harvesting and Aquatics backwash recycling have significantly reduced water consumption on the Park
- High levels of energy efficiency have been achieved – most notably on the Velodrome, which was 31% better than Part L Building Regulations
- Materials and products with low embodied carbon were used. For example there was a 42% reduction in carbon emissions for ready-mixed concrete compared with the UK industry average
- More than £1m of waste was avoided through sustainable design, procurement and construction processes and more than 90% of construction waste was diverted from landfill
- A Timber Supplier Panel was implemented to deliver the ODA's target for 100% legal and sustainable timber

The UK construction industry has gained valuable experience and confidence in delivering sustainable projects. The majority of suppliers that contributed to this learning legacy paper thought that the ODA's approach to innovation and sustainable development has influenced long term change in the industry and left a lasting legacy.

The following comments come from the interviews conducted to inform this legacy paper:

'By making companies more aware of the impact on the environment'

'It has set a benchmark, that sustainability is a top priority and can be done cost effectively'

'We believe that the ODA's approach to sustainable development has showcased the capabilities of the construction materials sector'

'We developed products for the Olympics that are rapidly becoming the norm elsewhere'

'The experiences we have had supplying materials for the Olympics park have given us evidence that there is a commercial gain to operating the way we do and providing the products and services that really drive the sustainability agenda. Our experiences on the Olympic park have led us to delve even deeper and invest more in sustainability'

'We have learnt a significant amount from our involvement with the Olympic Project, and we are keen to use this knowledge on future major contracts that we hope to be involved with'

Remaining challenges

The ODA put in place many successful processes to address the barriers to innovation but many still remain. Challenges include:

Integrating the supply chain

The ODA developed a culture of collaboration and put in place processes and systems to address the fragmented nature of construction. However, more can be done to integrate the supply chain on future projects. Other clients are building on the ODA's processes. For example, on the Park suppliers were not given contractors' contact details, so they could not approach them directly with their product innovations. Crossrail, however has published the contact details of contractors so that suppliers can make direct contact with them. Crossrail has also included a clause for contractors to hold a 'meet the contractor' event for suppliers every year of their five year contract, to ensure they engage with the supply chain. This will help clients, designers and contractors become more aware of the products that are available on the market. The next step is to use these events to work with the whole supply chain (designers, contractors, manufacturers and suppliers) to focus on addressing the sustainability agenda – especially carbon as identified by the IGT Report.

Sharing risk

Risk was highlighted as a major barrier to the uptake of innovative solutions by clients, designers, contractors and project managers. New and untested products presented concerns over deliverability and performance and therefore professional indemnity, liability and reputation. On the Park, it was especially challenging to convince project managers to agree to the use of innovative solutions, as they were incentivised by programme and delivery. The high profile nature of the Games and the immovable deadline meant that risk was actively managed and often shared. Some of the most significant sustainability achievements derived from the site-wide framework agreements, where the ODA took an active role in encouraging industry practice and managing risks on a park-wide basis (see case studies on timber and concrete for examples).

Feedback from designers and contractors on the Park is that more sharing risk between clients, designers and contractors will go a long way to overcoming this barrier to innovation on future projects. Much can be learnt from other major projects, for example, BAA, the client for Heathrow Terminal 5, took the highly unusual step of taking on all of the risk for the project and BAA developed the 'T5 Agreement' with its 60 main suppliers. The risk-free environment ensured that suppliers could focus on working together effectively and were able to share more information than they would be willing to, under traditional arrangements¹⁵

Certification schemes

Many of the environmental claims made about products lacked third party independent review and certification. This made it difficult for the client to verify supplier's claims, or test them against alternative products. The ODA also found it challenging to compare products that were certified, due to the many methodologies used (e.g. carbon footprinting, life cycle assessment, environmental product declarations and Green Guide ratings). There is a lack of transparency about some of the parameters that are used to assess environmental performance in some certification schemes. It is also difficult to compare elemental and systematic performance. The European CEN350 Sustainability of Construction Works standards due for completion in 2012 may provide clients with much needed consistency and transparency and reduce pressure on suppliers to hold multiple certifications.

Costing sustainable solutions

More sustainable solutions might have a higher capital cost, but provide better whole life value. The traditional focus on capital cost is often a barrier to the use of products that deliver more sustainable solutions. However, products that are slightly more expensive to purchase might reap financial savings from transportation, equipment, amount of labour required, installation time, amount of waste produced. The health and safety risks might be lower during construction and operation. They also might present lower operating costs and less maintenance. Many contractors on the Park started to think more holistically about costing sustainable solutions and were flexible with budget allocations, but this approach needs to be replicated and developed on future projects, to avoid more sustainable solutions being disregarded for cost reasons.

Clients need to be prepared to accept some additional capital cost particularly where it can drive down operating costs. Business cases for sustainable solutions should therefore assess capital costs and whole life value. More sophisticated assessment criteria are needed to assess value.

Stimulating innovation – long term clients

Even though the ODA had the limitations of being a one-off client with a very tight deadline it was still committed to finding and encouraging innovative solutions and achieved much. Large clients with multiple projects and long term relationships with their supply chain are in a much better position to stimulate research and development, trial innovative products, share risk and share learning with industry. This will only happen if the sustainability agenda is prioritised.

Recommendations

The sustainability challenges of climate change, resource depletion and environmental and social impacts of the built environment pose very significant challenges to the construction industry and will only be addressed if there is a shared vision, collaborative approach and concerted effort by the whole industry to raise standards. The London 2012 Olympic and Paralympic Games has helped to identify some of the ways that the industry can adapt and improve.

Legacy recommendations for different parts of the supply chain are set out below.

Recommendations for clients and client advisors

Clients can act as a catalyst for, or a barrier to, innovation. If clients are going to demand sustainable standards they need to:

- Set a strong vision and sustainability strategy with clear and measurable performance targets and communicate this to the construction industry early
- Create the right culture and project conditions to support creativity and innovation
- Be willing to manage rather than avoid risk
- Carry out full and early engagement with the supply chain so as to become a knowledgeable client about what is achievable and to open up opportunities for the use of innovative solutions and learn from the supply chain
Engagement in small groups around specific themes would be most effective, with greater involvement of specifiers and Tier 1 contractors
- Implement a procurement strategy that supports sustainability (e.g through a balanced scorecard and business cases for innovative/sustainable solutions that assess both capital costs and whole life value) and put in place robust supply chain management processes and auditing procedures
- Put in place resources (i.e. a Sustainability Team) to maximise the uptake of sustainability objectives throughout the supply chain
- Work with and listen to, the supply chain via industry representative bodies and trade associations that have networks and experience to support client engagement with the construction product suppliers
- Focus on whole life value not just cost

Recommendations for designers

Designers play a key role in specifying sustainable solutions. Designers should:

- View low environmental impact as a fundamental design objective, integrated with form and function and use tools to help evaluate the optimum solution in whole life terms
- Be willing to try new ideas
- Establish a learning environment within their practices
- Be more proactive in working with suppliers and sustainability consultants to help research the latest solutions
- Ensure sustainability specifications are performance focused. When the correct solution has been identified and designed, this needs to be specified to ensure it is cascaded through the construction team. Test specifications with contractors
- Assess how they can become less risk averse

Recommendations for contractors

Contractors and subcontractors directly procure products and hence are close to the manufacturers. This means they are well placed to harness innovation and recommend alternative solutions. However, they also want to minimise costs and risk. Contractors should:

- Engage with the supply chain early (before tender if possible). Attending industry days that are organised by clients is an efficient way to do this. Engagement with trade bodies such as the Construction Products Association can help raise knowledge and awareness about suppliers and products
- Work with designers and specifiers and support designers in trials and demonstration of products; perpetuate best practice rather than block it
- Engage more deliberately in promoting and adopting innovation and addressing the inherent risks
- Consider the 'price' and not just the 'cost' of more sustainable alternatives; strive for the best value solution

Recommendations for manufactureres and suppliers

The role of manufacturers and suppliers in driving innovation is crucial. Suppliers need to:

- Continue to invest in R&D to identify and manufacture more sustainable products and processes
- Be proactive in engaging with clients, designers and contractors to inform them about the latest sustainable solutions and work with them to develop solutions
- Ensure that innovative products are tested and independently certified to support claims about the environmental performance of their products. Case studies are also helpful to demonstrate application
- Set up public demonstration projects and trials to build confidence
- Promote the value added to new and improved products particularly where they cost more

Recommendations for government

Construction activity –including innovation – is strongly influenced by government spending programmes, government procurement policy and standards and regulations. Government needs to:

- Implement a consistent, unified vision and strategy and improve clarity about future sustainability policy, legislation and standards so that industry is aware of where the market is heading and are confident about investing in R&D
- Set consistent and measurable targets
- Learn from the ODA experience on the procurement of public sector projects – for example, be bolder in developing policy and regulation, require adoption of best practice across public sector projects and lead by example

Conclusion

Every member of a construction project supply chain has a part to play in investing in and supporting innovation, starting with the client. The ODA built on the successes and lessons learnt from previous construction projects, and demonstrated that efficient, high performing, innovative and sustainable buildings and infrastructure can be delivered, if the right conditions are created.

The Park project has shown that the changes in practice and behaviour that are required to deliver a low carbon, sustainable built environment are starting to occur. There is real and significant innovation happening in the construction supply chain, particularly innovation by manufacturers and suppliers. The Games has provided an opportunity for those manufacturers that are investing in research and development to improve the sustainability impact of their products, to gain a competitive advantage in the marketplace and to be rewarded by increased sales.

This legacy paper demonstrates the important role played by the client in supporting the uptake of innovations from the construction product supply chain. The ODA put in place many successful processes to overcome the traditional barriers to the uptake of new and more sustainable products and services. This has contributed to the ODA being on track to achieve its best practice sustainability targets and raising the benchmark for future projects. All of this has been achieved while delivering the programme on time and to budget.

The legacy of the Games will depend on the extent to which the industry learns from, adopts and develops the processes used on the project. It is now up to future projects to take the baton from the ODA.

Appendix A

Case studies: the role of construction product suppliers in delivering innovative solutions

Timber – compliance process to ensure responsible sourcing

Product:	Timber
Use on the Park:	All projects
Suppliers:	Arbour Forest Products Limited, Arnold Laver & Company Limited, Brooks Bros. (UK) Limited, Christina Meyer Sustainable Wood Products and International Forest Products (UK), Finnforest UK Limited, Hoppings Softwood Products Plc, James Latham Plc, Jewson Ltd, John Brash & Company Limited, Kronospan Limited, MLM Distribution Limited, Premier Forest Products Limited, Ridgeons Limited, Timbmet Limited, Vincent Timber Limited and Wolseley UK Limited



The ODA set a sustainability objective to use only timber from known legal sources and to maximise the use of timber from sustainable sources. For the latter they required evidence from respected timber certification schemes which had full chain of custody from forest to end user. To fulfil this requirement the ODA adopted the guidelines of the UK government's Central Point of Expertise on Timber Procurement¹⁶ (CPET).

Procuring timber from illegal or uncertified sources presented a very high reputational risk to the ODA, so they put in place a rigorous process to ensure that contractors and sub-contractors could only use certified timber. Central to this process was the Timber Supply Panel¹⁷, which the ODA established as one of its site-wide supply frameworks. The Panel comprised 16 suppliers all of which could guarantee that the timber they supplied would be 100% legal and be certified as coming from sustainably managed forests. The ODA made it very clear that if any non-certified timber was supplied by a member of the Panel they would immediately be asked to leave the Panel. Non-compliance with the policy therefore carried with it a stringent commercial penalty.

All Games projects were required to order their timber from the Panel and a computer ordering system was set up to facilitate this. Each project had a designated person who could access the computer system and this helped decrease the chance of timber being brought to site that might not have been ordered through the Panel. When timber arrived on site it was further checked for appropriate certification by a rigorous auditing procedure.

In addition, the ODA arranged training sessions to communicate their timber sourcing policy and chain of custody procedures to designers, contractors and sub-contractors and hoped its rigorous auditing approach could be a catalyst for change and shift best practice into normal practice thus leaving a lasting legacy. **There is already evidence that** the ODA's timber policy has shifted contractor practices. Balfour Beatty, for example, has changed its timber policy to align with the ODA. Significant improvement in knowledge and understanding of certified timber and Chain of Custody is also becoming apparent amongst other designers and contractors and discussions have been held to assess the potential of the ODA model of a Timber Supply Panel being rolled out for other projects.

'The key lesson from the Olympic build programme is the clarity of the message on sustainable procurement from the ODA. It was made clear from the outset what would and would not be allowed. The contractors knew that their supply chain would be rigorously audited and so they took extra care to ensure that the CPET procurement rules were adhered to not only by their own staff but also with their subcontractors. This was unique and the success proved that a proactive client can make a significant impact on the type of materials used within the construction process.'

Andrew Laver, Arnold Laver.

As well as responsible sourcing, timber suppliers also had to be proactive and innovative in their approach so as to differentiate themselves from the other suppliers on the Panel, to win contracts. For example by implementing minimum packaging policies, implementing low carbon transport logistic plans such as delivery by barge and establishing supply analysis tools.

For more detailed information about innovation in timber supply to the Park, please refer to the ODA learning legacy paper¹⁸, and the BRE's detailed publication.

PVC membranes - non-phthalate plasticisers and high recycling

Product:	PVC membranes
Use on the Park:	Aquatics, Stadium, Basketball, Water Polo, Eton Manor
Suppliers:	Ferrari and Verseidag



This case study neatly demonstrates how a specific innovative solution delivered a specific Games sustainability objective.

London 2012 will have more temporary venues than any previous Olympic Games or global event and these structures required a covering material ('wrap'). The criteria for wraps were stringent. They had to be lightweight, flexible; have a high reuse and recycling potential; have the capability to be printed on, backlit and have lighting projected on them; and have a low carbon footprint. A detailed study was undertaken to assess different potential cladding systems and PVC proved to be the best option. However, the environmental and social impacts

associated with its manufacture, use and disposal have often caused concern amongst environmental groups and the ODA was therefore cautious about choosing this material.

The Sydney 2000 organisers had banned PVC wherever possible because of environmental and social concerns and pressure from stakeholders. The Athens and Beijing organisers did not adopt the same stance and London 2012 decided to take a different approach. The ODA worked with stakeholders to develop a PVC Policy¹⁹ with a stringent specification for the manufacture, use and reuse or recycling of PVC, that required the supply chain to develop innovative and sustainable PVC solutions that has left a positive legacy for the industry. The ODA PVC Policy aimed to accelerate achievement of the existing industry Vinyl 2010 commitments²⁰. A number of PVC suppliers for the wraps around the venues attempted to develop products that could comply with the specification whilst also meeting the engineering and architectural specifications. Ferrari was particularly successful in developing a phthalate free PVC. There was a very small increase in the cost of the PVC due to the higher cost for the phthalate free plasticiser.

Some extracts from the PVC specification that incentivised the supply chain to innovate are outlined below, plus the outcome.

Policy specification	Outcome
Reasonable endeavours to procure PVC produced with non-phthalate plasticisers	Building wraps on the Park contain no phthalate plasticisers which was a significant achievement (with the exception of the Basketball Arena which was procured prior to the non-phthalate material entering the market)
All PVC procured for structural membranes must have 30% recycled content unless this is specifically precluded by performance requirements	Getting a certificate of performance for wraps with recycled content was difficult because it wasn't virgin feedstock - there were concerns about weathering and discolouration. This policy specification was hard to achieve and more research into how a certification system might be established is required
PVC procured for use in temporary buildings must include a take back and re-use clause or a take back and recycle clause	PVC used for temporary membranes will be taken back by the supplier and reused directly or recycled (e.g. into gymnastics mats). It was not possible to find a legacy end use for all wraps within the constraints of the procurement strategy. The procurement strategy did not allow for the option of relocation – as this was not part of the process, it could be categorised as an opportunity lost

Concrete - low environmental impact

Product:	Concrete
Use on the Park:	All projects
Suppliers:	London Concrete (part of Aggregate Industries)



The ODA sustainability targets included requirements for products with lower environmental impacts, at least 20% (by value) of secondary materials used in the permanent venues and the Athletes Village and 25% recycled aggregates (by weight) for the permanent venues and infrastructure. In addition, 50% of materials were to be delivered to site by rail or water. These targets were far higher than had previously been set for any other major construction project.

London Concrete, the winner of the framework contract to supply ready-mix concrete to the Park²¹ invested significant time and resources to develop the innovative solutions to align the supply of concrete with the ODA's sustainability targets:

- The ready-mixed concrete products were designed to have lower embodied impact, especially lower embodied carbon, through cement replacements (pulverised fly ash or ground granulated blast furnace slag). As a result, there was a 42% reduction in carbon emissions compared with the UK industry average for ready-mixed concrete
- It offered a range of secondary and recycled aggregates, including recycled construction and demolition waste and the use of stent (a by-product from the china clay industry in Cornwall)
- The logistics and internal sourcing strategy was developed to ensure that the majority of raw materials could be transported to the site by rail
- Aggregate Industries (London Concrete's parent company) sought certification for responsible sourcing and was the first company in the world to achieve the BES6001 Responsible Sourcing Standard, in March 2009

Many designers and contractors on Games projects initially specified a standard mix from London Concrete using virgin aggregates and Portland cement and were reluctant to specify cement substitutes or secondary aggregate replacement due to concerns such as strength, strike time and finish quality. The ODA as client and its Delivery Partner (CLM) played a key role in pushing for improvements in sustainable specifications for concrete with designers and contractors. Balfour Beatty (the Aquatics Centre contractor) was prepared to test more sustainable concrete mixes including the use of stent in high profile visible concrete, successfully pouring the internal walls of the Aquatics Centre with 76% stent to an exceptional high quality finish. Once one contractor had successfully used the new concrete mix other contractors were willing to follow suit and the aversion to risk was overcome.

The concrete products that have been brought to market as a result of the ODA's sustainability targets, the projects' sustainable concrete specifications and the investment in research and development by London Concrete, have set new sustainability standards for concrete across the industry. Specifications used on the Park are already being used in other projects, delivering significant benefits across a wide range of sustainability indicators.

Please refer to the ODA Sustainability Learning Legacy paper on 'Procurement and use of sustainable concrete'²² for more detailed information about achievements and lessons learnt.

LED lighting – carbon savings

Product:	LED Lighting
Use on the Park:	Athletes Village
Suppliers:	Philips



The Athletes Village planning commitments and the target to achieve Code for Sustainable Homes²³ Level 4 inspired Lend Lease (the Athletes Village developer) to explore innovative solutions for energy efficient lighting.

In 2006, when concept designs for the Athletes Village were first being developed, consultants would have tended to specify 50w halogen light bulbs. However Lend Lease engaged with the manufacturer Philips to assess technological developments in energy efficient lighting that were likely to be coming to market for domestic properties by 2012. Philips predicted that wattages of 7w rather than 50w could be achieved around 2012. The energy saving benefits of using such low voltage lighting would be significant across the development of 2,818 dwellings and this was very appealing to Lend Lease. Given the scale and profile of the project, Philips brought forward its development of 7w LED lighting which has been installed. Independent calculations show that across the Athletes Village, the energy efficient lighting is predicted to save 5,317 tonnes of CO₂ annually, representing an 85% reduction on standard 60w lighting. Dwelling occupants in the future will also benefit from reduced energy bills.

This energy efficient product is available on the market earlier than Philips originally planned because of the demand by such a major client as the Games. The developer's (Lend Lease) early engagement with the product manufacturer to discuss technological innovation and availability enabled the supplier to accelerate its research and development programme.

Plastic piping systems

Product:	Ground soil and waste drainage pipes
Use on the Park:	Throughout the Olympic Park
Suppliers:	Polypipe



The supplier Polypipe was engaged with the ODA and Bovis Lend Lease (the main contractor for the Athletes Village) early on, was proactive in promoting itself and was willing to develop its products as needed. This ensured the PVC piping systems supplied to the Park met all of the ODA's requirements. From this early engagement, Polypipe developed other sustainability elements for its products so as to be in a stronger position to compete for the Games work. As a business, Polypipe has invested heavily in expanding its UK manufacturing facilities which enabled the company to introduce innovative new product ranges.

For the Games, Polypipe:

- **Supplied products that were already in their portfolio** - Polypipe supplied the plastic above-ground soil and waste drainage on all of the major projects on the Park including the Olympic Stadium, Velodrome and Athletes Village, bidding for each individually
- **Brought product from its European partner to the UK market** - Polypress is a high performance multi layer pipework system for water supply and distribution and this type of system, whilst relatively new to the UK, is widely used across Europe. Polypipe partnered with a major European manufacturer to bring a range to market suitable for UK applications. This product has been widely used across the Athletes Village, providing a number of advantages to the project not least because of its lightweight nature and requiring no hot works to install. This product was also widely used for the many bathroom pods manufactured off site for the Athletes Village
- **Developed new products as a result of client demand** –The 'Firetrap' fire protection system for above ground drainage systems and Terrain Fuze HDPE pipework – which is a substitute for cast iron drainage, has been widely used across the Park and particularly on the Athletes Village

David Higgins, Chief Executive of the Olympic Delivery Authority presented Polypipe with the 'Manufacturer of the Year' award at the 2010 Building Awards in recognition of their many major successes²⁴ The company's commitment to sustainability, early engagement with the ODA and contractors, proactive attitude and communication of sustainability objectives down the supply chain were all key elements to deliver more sustainable outcomes for the Park.

However, Polypipe was unsuccessful in convincing contractors to purchase its new and innovative water supply system called Terrain HPPE (High Pressure Polyethylene) for use on the Olympic Stadium, though it was used later for the Boosted Cold Water System ring mains on the Athletes Village. Terrain HPPE can be prefabricated in a factory to pre-set radius bends (reducing waste). This product was particularly suited for use on the Olympic Stadium because of the venue's round shape. The system utilised an innovative, flame free jointing mechanism and was much lighter than traditional materials (bringing health and safety benefits). The M&E subcontractor on the project, already appointed for this package, put the product forward, but the design consultants would not accept it because it had not been used before. Although Polypipe had done some small trials and had warranties in place, the product had not been officially launched (so there was no official literature or information on Polypipe's website). It was therefore deemed too risky for the project.

This is an example of designers being reluctant to use new and innovative products and shows the need for suppliers to put forward products that have been launched and proven for risk averse projects like the Games.

Logistics - use of rail to transport materials

Product:	Rail Transport
Use on the Park:	Throughout the Olympic Park
Suppliers:	DB Schenker



As DB Schenker (the largest rail logistics company in Britain) already owned the rail head in Stratford, near the Park construction site, it proactively approached the consortia tendering for the Olympic Delivery Partner role with a proposal for rail transport to deliver materials to the Games site. This was of great interest to CLM which was bidding to be the ODA Delivery Partner and had as one of its stated targets to deliver 50% of materials by non road methods. Subsequently, CLM was chosen as the delivery partner and DB Schenker with its proposed sustainable transport solution became a Tier 1 contractor to CLM.

As a result, the ODA set the sustainability target for 50% of materials (by weight) to be delivered by rail or water. The early feasibility work carried out by DB Schenker gave the ODA the confidence to set a very challenging target for sustainable transport of goods and materials.

Supplying such a large percentage of materials and goods to a major regeneration project was very challenging. An agreement was set up between the rail head provider and the ODA, whereby DB Schenker leased the rail head and operated a logistics service to rail providers. They also competed to provide rail services to contractors. The terminal supplied all of the contractors on the Park as well as Westfield and the Olympic Village. This made the logistics complex and required process innovation in inventory and order management.

DB Schenker discussed its sustainable transport solution with contractors and the supply chain early on via the Olympic Liaison Group Meetings and had them thinking about rail deliveries as an early option. The biggest challenge was to convince contractors and the supply chain to use rail services rather than road transport with which they were familiar. Whilst there was reluctance initially, contractors came to rely more and more on rail as they began to realise that it was easy to use, flexible and had logistical advantages over other forms of transport. The biggest issue however was programming. The more notice the contractor could provide the easier it was to supply a full logistics service. Marketing and selling the service and providing good communications was the most important issue in winning over the contractors.

DB Schenker's investment was largely recovered through aggregates, but there was a number of other examples of rail deliveries, such as for tiles for the Aquatics Centre which were delivered from Italy and bathroom pods for the Media Centre which were delivered from Scunthorpe.

The ODA is on track to meet its target for 50% sustainable transport, with the current percentage at 67%.²⁵ DB Schenker's solution resulted in less traffic on local roads, lower emissions of CO₂ and other pollutants and a reduction in the social impacts of deliveries by road (congestion and accidents). It also contributed to security of supply and just in time deliveries.

This case study demonstrates that if by providing the right site and the right people with the right attitude, outstanding levels of sustainability can be achieved.

Asphalt - low embodied carbon

Product:	Bardon Foamix
Use on the Park:	Temporary road construction
Suppliers:	Aggregate Industries



Foamix is a cold foamed bitumen asphalt that is suitable for use on lightly trafficked roads. The material is supplied and laid cold – so it has a lower embodied carbon and is also safe to the touch.

On the Park Foamix was used as a replacement sub base for temporary roads and was manufactured using 5000m³ of material from demolition of the Park, saving 25 tonnes of CO₂. 100% of the product can be recycled.

This product, which had been used on many projects, was presented as a solution to the ODA and its contractors by Aggregate Industries and supported by the Delivery Partner Materials Manager.

Carpet - high recycled content

Product:	Carpet
Use on the Park:	IBC, Athletes Village
Suppliers:	Interface



Interface is a carpet supplier with strong sustainability commitments that are implemented in practice. This focus on sustainability is derived from an internal drive to minimise the environmental impact of its products and demand for sustainable products from clients. The industry carpeting best practice performance standards (which are much more stringent than legislation) have also been a driver for improvement.

A Life Cycle Assessment (LCA) of Interface's carpet revealed that the biggest environmental impact was the yarn and in response Interface developed a carpet with 100% recycled yarn. It also focused on incorporating other recycled materials into its products which now have about 50% recycled content, primarily because of the backing, which is made from limestone and a sophisticated recycled bitumen. The carpet was chosen because of its low life cycle impact compared to other products, plus it has better recyclability. Interface has removed VOCs from its products by using a sticker solution, rather than using glue and this helps recyclability and at end of life. Interface has invested in equipment to separate the yarn from the backing, to facilitate recycling of yarn-to-yarn and backing-to-backing and has sought Environmental Product Declarations for its products; once the European standard CEN 350 is introduced Interface will align its LCA to this. Interface was very proactive in engaging with the ODA and contractors on the Park.

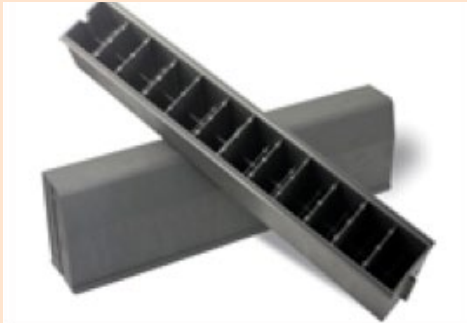
The ODA's sustainability targets did not require Interface to design anything new; all the products supplied already existed and already met the ODA's requirements, but the ODA's sustainability targets confirmed the trajectory of a the business plan that Interface had already started. Interface did however implement a take-back initiative on the Games which they had not done previously.

On the International Broadcast Centre (IBC), the Sustainability Manager (who was previously aware of Interface's sustainable solutions) persuaded the project team to move from the original architect's specification of using 'cut pile carpet', to Interface's specification for 'loop yarn carpet'. Loop yarn uses 50% less yarn than the original product, has 70% recycled content and also works aesthetically.

The importance of LCAs and client demand for sustainable products and practices has been reinforced by Interface.

Plastic kerbstones – high recycled content

Product:	Charcon Durakerb
Use on the Park:	Temporary roads
Suppliers:	Charcon (part of Aggregate Industries Group)



Durakerb plastic kerbstones have been used for civil engineering and highways trades in the UK since 2006. The product is manufactured using 88% recycled material – a polymer blend based on waste plastic bottles that would otherwise be destined for landfill.

The product represents a 20% carbon saving compared with a concrete kerb. It is very light (6kg compared to 67kg) making it easy to handle with associated safety advantages. In addition, it has a very fast laying time compared to other materials and when cut does not produce crystalline silica dust. The Delivery Partner Materials Manager informed designers and contractors for the temporary roads

about the product, but they were initially reluctant to use it. The Materials Manager pursued use of the product with the assistance of the Delivery Partner Project Management team, due to its low environmental impact and wider benefits. The product has a PAS 2050 accredited carbon footprint and is BBA-HAPAS accredited, both certifications improving its uptake by contractors.

Gas generators - improved energy efficiency

Product:	Gas generators
Use on the Park:	Athletes Village
Suppliers:	Aggreko



Bovis Lend Lease needed 9MW of temporary power during construction of the Athletes Village for a period of two years. Bovis had a choice regarding the type of power, either diesel powered generators that are commonly used, or gas powered generators, which although common in other industrial sectors, had previously not been used for temporary power generation in construction in the UK. Bovis carried out an assessment of the two options. Simple economics dictated the use of diesel equipment, as the hire costs were roughly half that of the gas. However, fuel costs for diesel were significantly higher than for the gas. In addition, Bovis analysed the wider implications of the two options including the relative social and environmental implications.

Bovis chose gas generators and rented Aggreko's lean-burn reciprocating gas engine technology. This had the following benefits:

- Reduction in nuisance, congestion and impact on air quality on the local community
- Reduced CO₂ emissions by 10,552 tonnes (22.2%)
- Economic cost saving of around £13 million
- Provided UK employment

The technology operates on pipeline natural gas and uses a heavy duty, spark ignited, turbocharged engine. The patented fuel system and advanced engine design ensure emission regulations are met.

The willingness of Bovis Lend Lease to explore the use of innovative sustainable alternatives and to actively choose to rent the product (even though the technology had not been used in this way before), set new standards for the industry.

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Survey respondents

J&P Building Systems Ltd, Leaderflush Shapland, Saint-Gobain Ltd, BASF, Twyford Bathrooms, Construction Products Solutions International Ltd, PEIKKO UK LTD, Hird Rail Services Ltd, Forticrete, Brett Landscaping, ICI Paints Akzo Nobel, JELD-WEN, London Concrete, Saint Gobain, Knauf Drywall, Butyl Products Limited, BASF plc Construction Chemicals, Marshalls plc, Thorp Precast Limited, Eaton Electric Ltd, A-Plant.

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