HSE

Health and Safety Executive

Pre-conditioning for success

Characteristics and factors ensuring a safe build for the Olympic Park

Prepared by **Loughborough University**
for the Health and Safety Executive

RR955
Research Report

HSE

Health and Safety Executive

Pre-conditioning for success

Characteristics and factors ensuring a safe build for the Olympic Park

Dr Helen M Bolt CEng, MICE
Professor Roger A Haslam FErgS, CMIOSH
Professor Alistair G Gibb CEng, MICE, MCIOB
Dr Patrick Waterson CPsychol, AFPBPsS

Loughborough University
Loughborough
Leicestershire
LE11 3TU

This research has looked to identify factors which have contributed to the London 2012 Olympic Park being delivered on time, on budget and with an exemplary health and safety record. Where other research has captured 'how' things were done, this research has explored 'why' and focused on the underpinning human and organisational interactions.

The research has tapped in to the close-out and lessons learnt activities for six of the venue and infrastructure projects. In addition interviews were conducted with executives from the Olympic Delivery Authority as client, their Delivery Partner and contractors. Emerging findings were triangulated with observations from other health and safety research teams and evidence from diverse aspects of the build programme contained in the London 2012 learning legacy publications.

Findings centre on the underpinning role of human characteristics like respect, trust, clarity, pre-emption, challenge, consistency, collaboration, motivation, empowerment, communication, open-ness, fairness and assurance. Their practical influence on approaches to, and effectiveness of, leadership, worker involvement, cultural change, communication systems, risk management, monitoring and assurance are brought out.

It is concluded that many of the principles offer potential benefits across a wide range of construction projects, with implementation scalable to suit the simplicity or complexity of the work. Corresponding recommendations are presented for different parties in the construction supply chain.

This report and the work it describes were funded by the Health and Safety Executive (HSE). Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.

HSE Books

First published 2012

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the firms and individuals involved in building the London 2012 Olympic Park who participated in interviews and provided the research team with access to the venue and infrastructure close-out meetings. We would also like to acknowledge the contribution of fellow researchers in the London 2012 Learning Legacy programme in sharing their emerging findings so that cross-cutting themes could be identified. The support and facilitation from the Olympic Delivery Authority's learning legacy team is also acknowledged.

This research is part of a suite of research projects and independent evaluations undertaken on health and safety on the London 2012 construction programme comprising:

- Leadership and worker involvement on the Olympic Park
- Occupational health provision on the Olympic Park and Athletes' Village
- London 2012: The Construction (Design and Management) Regulations 2007 – duty holder roles and impact
- Safety culture on the Olympic Park
- Pre-conditioning for success
- Communication and action for a safer London 2012 Olympic and Paralympic Games
- Supply chain management for health and safety
- Food safety and sustainability (Case study).

Research summaries are accessible on the London 2012 Learning Legacy website (http://learninglegacy.london2012.com/themes/health-and-safety/index.php) and should be read in conjunction with the summary for the project below which provides an overview of health and safety on the London 2012 construction programme:

- Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village.

Full research reports for all projects are/will be published on the HSE or IOSH websites.

CONTENTS

CONTENTS iii

GLOSSARY iv

KEY MESSAGES vii

EXECUTIVE SUMMARY ix

1 INTRODUCTION 1

1.1 CONTEXT 1

1.2 IMPLICATIONS 1

1.3 APPROACH 2

2 RESEARCH FINDINGS 9

2.1 PREAMBLE 9

2.2 SUMMARY OF KEY 'PRE-CONDITIONING' CHARACTERISTICS 9

2.3 KEY CHARACTERISTICS IN PRACTICE 12

2.4 SUMMARY OF THE LINK BETWEEN CHARACTERISTICS AND PRACTICES 25

2.5 VALIDATION 27

2.6 TRANSLATING PRE-CONDITIONING FACTORS INTO PRACTICE 28

2.7 MODELLING OF INFLUENCES 29

2.8 THE REGULATORY ROLE 30

2.9 BUSINESS BENEFITS 34

APPENDIX A – INTERVIEW STRUCTURE – FOR CLIENT, DELIVERY PARTNER AND REGULATOR 37

APPENDIX B - SIGNIFICANCE OF HUMAN FACTORS REVEALED BY THE LEARNING LEGACY DOCUMENTS 39

THE LONDON 2012 LEARNING LEGACY RESOURCE 39

REVIEW IMPLICATIONS 40

REVIEW APPROACH 41

ANALYSIS OF PRE-CONDITIONING CHARACERISTICS AND RELATED FACTORS 51

APPENDIX C - A CONSTRUCTION INDUSTRY FOR THE 21ST CENTURY 115

REFERENCES 125

GLOSSARY

CDM	Construction (Design & Management) Regulations 2007, which cover health and safety requirements, including roles and responsibilities, for construction work (also abbreviated CDM Regulations).
CLM	The consortium of CH2M Hill, Laing O'Rourke and Mace awarded the DP role for the London 2012 build.
CEO	Chief Executive Officer.
COO	Chief Operating Officer.
CompeteFor	Web based procurement scheme implemented by ODA to give smaller companies opportunities to bid for work in the London 2012 build supply chain.
CV	Curriculum vitae.
DP	Delivery Partner – the role to enact the requirements of ODA as client for the London 2012 build. CLM were appointed to the DP role.
Games	Olympic and Paralympic Games.
GOE	Government Olympic Executive.
H&S	Health and safety.
HSE	Health and Safety Executive, national regulator for health and safety in Great Britain.
IN	Influence network used to represent the hierarchy of interacting influences affecting performance.
IOSH	The Institution of Occupational Safety and Health.
IOC	International Olympic Committee.
KIT	Keep in touch (meetings).
KPI	Key performance indicator.
LOCOG	London Organising Committee of the Olympic and Paralympic Games, responsible for preparing and staging the London 2012 Games.
London 2012 build	Primary construction of the venues and infrastructure at the Olympic Park for the London 2012 Olympic Games and Paralympic Games. Work on this main build concluded in the summer of 2011 (some 12 months ahead of the Games) ahead of work to fit out the facilities for the sporting events. Also referred to as the construction for 'London 2012' or the 'main build'.
LUEL	Loughborough University Enterprises Limited.

MPA	Major Projects Association.
MEWP	Mobile elevated work platform.
NEC	New Engineering Contract, the form of contract currently recommended for public sector construction. Version NEC3, issued in 2005, was adopted for the London 2012 build.
OB	Olympic Board.
ODA	Olympic Delivery Authority – the body established with responsibilities including the construction client role for the London 2012 build. The Interim ODA was established to initiate the planning and preparations ahead of the formal constitution of ODA by Act of Parliament in 2006.
O&M	Operations and maintenance.
Park (the)	The Stratford, East London site for the London 2012 Olympic and Paralympic Games (also the Olympic Park or London 2012 Olympic Park)
PI	Principal Inspector role within the Health and Safety Executive.
RAG	Red, amber, green, traffic light grading to indicate status of activities.
Section 106	Under the Town and Country Planning Act 1990 local planning authorities can enter into a legally-binding agreement or planning obligation with a landowner in association with the granting of planning permission. The obligation is termed a Section 106 Agreement. These agreements are a way of delivering or addressing matters that are necessary to make a development acceptable in planning terms.
SHELT	Safety, health and environment leadership team which brought together project or main board directors from the Tier 1 contractors across the Olympic Park.
Supervisor	A Supervisor under NEC3 is appointed as the client's representative with responsibility for maintaining quality control under the contract - not to be confused with the workforce supervisors on site.
Tier 1 contractors	Main contractors for each project within the London 2012 build with principal contractor responsibilities under CDM and Tier 1 responsibilities under NEC3.

KEY MESSAGES

- *London 2012 was an immensely challenging construction programme*. Nevertheless it has delivered on the aspirations not only to complete ahead of time and within budget but also to showcase UK construction at its very best to the world. Achievements in health and safety, sustainability, and equality and inclusion are better than anything achieved previously and set new standards for the future. **A common thread through all aspects of the build success is the people and their focussed and collaborative interactions.**

- *This was a real construction project and not everything went right* – some things nearly went very wrong. Key attributes for achieving success included the willingness and ability to tackle problems early and openly, find new solutions, share and transfer the learning, and still sustain focus on delivering the objectives. **Learning from the experience of the London 2012 build is therefore relevant to construction more widely and demonstrates practical steps that different parties can adopt to secure benefits for themselves and other stakeholders.**

- *Successful construction outcomes in the build were inextricably linked to the human behaviours through the supply chain.* This was identified through the independent observations by researchers and found to be mirrored in the reflections of experienced construction practitioners through the London 2012 supply chain. While contracts, processes, systems and equipment provided the framework, the effectiveness of their implementation came through the relationships and style of working forged at company and individual levels. **The two aspects, systems and people, work in tandem; neither is sufficient on its own but the full potential of each relies on the other.**

- *Successful relationships in the context of construction projects are not just a matter of chance.* It is the clear and consistent focus on the commitment, collaboration, transparency and communications needed for success, and relentless efforts to equip and support the construction teams to work in this way that yield positive results. **Clarity of purpose, leadership through all levels, respect for each other's roles, and sharing of expertise and learning are not of themselves costly or esoteric but they have been shown to be invaluable for forging effective relationships.**

- *Construction health and safety guidance has long required client leadership, a conducive culture, communication and cooperation, worker involvement, risk management, and supply chain integration.* It is significant that this wider research brief has linked the same characteristics to a full range of construction outcomes (including schedule, budget and quality alongside good health and safety performance and delivery on other sustainability or employment targets). **The evidence is that active focus on the human relationships and ways of working has the potential to deliver benefits across a wide range of construction metrics, including health and safety.**

- *Many of the steps taken are scalable and paying attention to people and their interactions is as applicable to small building projects as it is to multi billion pound programmes.* It is desirable for a project at any level to have, for example, a client who: is clear on their requirements from the outset; encourages supply chain partners to work collaboratively - including sharing problems at an early stage so solutions can be found before costs escalate or re-work becomes necessary; has an engaged and responsible workforce; and instils mutual confidence in a successful outcome. **The learning from the London 2012 build puts new attention on the underpinnng human and organisational interactions.**

EXECUTIVE SUMMARY

Summary

This research reveals factors which appear to have helped secure success in the main build of venues and infrastructure on the Olympic Park for the London 2012 Olympic Games and Paralympic Games (the London 2012 build). These factors generally relate to the style of approach adopted by the people involved and, where appropriate, the way they embedded these characteristics in various management processes and systems. Contributors to the research indicated this attention to people and their interactions is not costly, brings tangible benefits and has some applicability to future construction projects, irrespective of scale.

It is striking that the emerging recommendations can be seen to align with calls from the construction industry itself as well as the Health and Safety Executive (HSE) over the past two decades to secure improved performance in overall business terms and on health and safety, in particular. Straplines like 'Respect for People', 'Constructing the team', 'Commitment to people: our biggest asset', 'Ownership, leadership, partnership' etc all resonate with the approach at London 2012. It is hoped that the broad recognition by industry, now coupled with the evidence of how performance can be markedly enhanced in practice, will provide the impetus for the principles to be adopted more widely.

It is also demonstrated that some of the key characteristics identified like clarity, openness, early engagement, and assurance are equally evident in successful aspects of HSE's approach to regulating the London 2012 build.

Background and context

Even before the main build of the London 2012 Games site was complete, it was evident that there were considerable successes both in terms of delivery ahead of time and with budgetary savings, and much lower levels of injury and ill-health than might be predicted for a project of this size and complexity. More than this, there was a positive sense within the senior management and construction teams that something distinctive had been achieved.

Capturing '**how**' things had been done, the processes and procedures, already formed an important part of the London 2012 learning legacy project to secure insight and develop understanding of good practice to inform future actions. By contrast, the remit for this research was to understand '**why**' things were done, the underpinning thought processes and their interactions, with a view to determining enabling factors that had helped secure success. The ultimate objective was to suggest approaches that could be deliberately implemented up-front to 'pre-condition' future projects for success. The 'pre-conditioning for success' phrase was coined by those commissioning this research; however, it was equally clear that learning should also be drawn from things that had not worked well and could have undermined success.

The findings are based on interviews with people involved in the London 2012 build from the chief executive of the Olympic Delivery Authority (ODA) through to some of the operatives from site. The research team observed a number of project close out and lessons learnt meetings across the Park. Initial findings were shared with other researchers, particularly in relation to health and safety themes, to broaden the reference base. In addition, an extensive review and analysis of nearly 200 documents from ODA's learning legacy project provided supporting evidence for the success factors proposed. A model of the factors which influence performance is used to explain the interaction of the factors that lead to positive construction outcomes including a safe and healthy working environment.

Findings

Common factors characterising the human activity around the London 2012 build have been crystallised under 13 headings. They reflect recurrent themes identified by the authors within the research material with evidence provided in the body of the report and summarised here. The characteristics, although distinct, interact and the research does not support a quantitative weighting of their relative importance. The ordering therefore reflects a qualitative interpretation. Rather than provide grammatical consistency in the terms, the characteristics have been captured in the form of speech used most frequently by interviewees. The characteristics identified are:

- **Respect** – fundamentally respecting individual and corporate roles, and recognising mutual reliance and the right to respect in terms of conditions and personal interactions
- **Trust** – putting faith in other parties to achieve shared objectives based on a cycle of *commitment* and *delivery*, fuelling the ability to collaborate effectively
- **Clarity** – providing the foundation for planning, risk management and delivery, as well as a basis for transparency, communication and a shared commitment to the objectives
- **Pre-emptive** – securing information and action as early as possible to ensure there is time for careful consideration of alternatives and proper planning
- **Challenge** – maintaining focus on whether there could be a better route to the objectives and encouraging an openness to ideas and innovation from counterparts in the supply chain
- **Consistency** – being relentless in focussing on priority objectives, ensuring there is alignment through the supply chain and persisting even as the build phases change
- **Collaborative** – leveraging resources by securing alignment, working constructively, and sharing expertise and understanding, to achieve a common purpose
- **Motivation** – inspiring people and organisations to collaborate in achieving more than they think they can against the London 2012 objectives, industry legacy aspirations and personal goals
- **Empowerment** – enabling parties to work to best effect based on their knowledge and skills, providing motivation and encouraging innovation
- **Communicative** – engaging up, down and across the supply chain to develop understanding, to listen and pass on messages to support clarity, openness and collaboration
- **Open** – sharing information to avoid unwarranted suspicions and to encourage trust, and particularly to be transparent where there are opportunities for wider learning
- **Fair** – being equitable by recognising good performance and providing motivation through reward but using sanctions where rules are flouted and in so doing underlining their importance
- **Assured** – having a rigorous basis for knowing facts around the objectives, to provide confidence in delivery or the means to prioritise actions to maintain and improve performance.

These characteristics are inter-dependent but are evident in a range of overarching mechanisms influencing performance on site, including:

- **Leadership**
- **Worker involvement**
- **Culture change**
- **Communication systems**

- **Contracts and procurement**
- **Risk management, monitoring and assurance**

With leadership, for example, the characteristics were cascaded in the values advocated and behaviours demonstrated, whereas in procurement, they were bound into contract terms or evaluation score-cards. Specific processes also delivered the mechanisms. Examples include daily activity briefings (Communications), Trends analysis (Monitoring and assurance), behavioural safety (Culture), supervisor up-skilling (Worker involvement), director/Chief operating officer cross-park leadership teams (Leadership) etc. Further details are in the report.

Recommendations

Recommendations are made to enable those engaged in construction businesses to benefit by learning about the success factors that influenced the London 2012 build. Significantly it is concluded that the characteristics identified will help ensure project objectives are delivered, whether those objectives are time and budget or, for example, sustainability or health and safety outcomes. The alignment is because the characteristics feed through into the quality of management controls which affect all aspects of performance. Although health & safety is a central focus of the recommendations here, implemented effectively, the same factors should provide much wider benefits as evidenced in the research findings. Many forms of recommendation can be drawn from the London 2012 experience. The presentation here focuses on recommendations particularly relevant to different parties to the construction process from clients, who procure construction projects and services, through the supply chain to workers out on site. They include those with specific roles as defined under the Construction (Design & Management) Regulations 2007[30] (CDM). The recommendations are not exclusive and some apply similarly to other parties. For example, ensuring health and safety is a line management responsibility not just a separate function, applies not only to project or programme managers but also to those with corporate responsibilities through the supply chain.

For clients – whether clients directly or those advising and supporting clients

- Recognise the supply chain will take its lead from you in terms of the matters to prioritise, the spirit in which work is carried out, the ways parties interact and people will behave – deliberately use that influence to positive effect and be a visible champion of important values for the supply chain and workforce.
- Be clear on requirements and objectives from the outset as well as roles and responsibilities. If necessary take time to provide that clarity. Be equally clear on any gaps or matters that remain to be confirmed.
- Work with leaders through the supply chain to achieve a common understanding and shared commitment to the project objectives so that you are consistent and persistent in the messages you pass through the supply chain.
- Use procurement processes and contract documentation to instil fairness and to reinforce objectives and help you deliver on the full range of target outcomes including health and safety, cost, and schedule.
- Recognise the pivotal role of human interactions and ensure there is an ongoing mechanism to address the suitability of personnel and effectiveness of relationships within and between teams as projects progress and demands change.
- Acknowledge the mutual reliance between the supply chain (needing work) and the client (needing skills) and take a respectful approach and establish a good working environment that will inspire commitment and collaboration.

For CDM coordinators

- Deploy inter-personal alongside technical skills to establish and develop effective relationships and collaborative working methods. Use these as a productive basis for problem solving and innovation to reduce risks and meet client objectives going beyond the basic requirement for co-ordination and exchange of information.

For designers

- Work to embrace and contribute to the full breadth of client objectives for the build process.
- Engage early with contractors and suppliers, respect the value they can bring in achieving project objectives and be open to collaboration, new ideas and innovation.

For programme and project managers – whether as a delivery partner to the client or within the main contractor

- Be consistent in driving client objectives.
- Work with contractors to prepare early for critical tasks and milestones, encouraging the necessary collaboration and sharing of information between parties involved. This might include explaining the benefits and supporting contractors with delivery processes.
- Ensure there is a process to confirm the true state of progress and to reveal potential issues on the horizon that may affect delivery, including threats from external sources.
- Take steps not just to manage the immediate but also to manage uncertainty by controlling emerging risks and putting in place mitigation measures to minimise future impact.
- Use monitoring and assurance processes to see whether required standards are being achieved, not as a tick box exercise but by encouraging interaction between parties to resolve problems and work collaboratively to achieve better outcomes.
- Make sure health and safety is made a line management responsibility through the supply chain, not just a separately discharged function.

For contractors

- Take time before mobilising to site, to plan, identify future risks and decide how to manage them.
- Ensure that the necessary infrastructure, boundaries and facilities are on site early to set the tone for the respect afforded to the workforce and the standards of health and safety expected.
- Through direct contact and communications, ensure subcontractors and material suppliers are fully aligned with project objectives and ways of working.
- Understand the benefits of implementing behavioural safety programmes from the experience of others and work to implement these through all levels of representation on site.
- Recognise the significant role of construction supervisors and develop and harness the skills of effective supervisors to engage the workforce and represent their views, to provide leadership, build trust and empower action, particularly on matters of health and safety.

For workers

- Respond to opportunities to use your knowledge, experience and ideas to improve standards and ensure practices damaging to health or safety are tackled.

The allocation of roles and responsibilities might vary with the nature or scale of project but the elements could all usefully feature, whether a moment of reflection on a small job or a documented analysis for a major build. It is clear that the activities map onto the steps required under CDM and recognised industry good practice. The recommendations have, however, been built up independently, based on the evidence of factors that drove success on London 2012.

For the regulator

For the Health and Safety Executive this research endorses its approach to regulating major projects where a tailored intervention may be appropriate. Significantly that approach reflects the same characteristics of clarity, openness, empowerment, communication, consistency and fairness evident in the wider recommendations:

- Provide a clear, open statement of approach and priorities at the outset, empowering the client and supply chain.
- Engage early with the client and design team to assess the level of engagement on health and safety and the adequacy of processes to manage risks, and challenge when appropriate.
- Use a sampling inspection approach to target risk and seek assurance that the processes are being delivered and are effective.

1 INTRODUCTION

1.1 CONTEXT

Even before the main build for the London 2012 Olympic Games and Paralympic Games was complete, it was evident that there were considerable successes both in terms of delivery ahead of time and with budgetary savings, and exceptionally low levels of injury and ill-health. More than this there was a positive sense within the senior management and construction teams that something distinctive had been achieved.

In early 2010 the then Director of Construction at the Olympic Delivery Authority (ODA) Howard Shiplee, composed a short document reflecting on the interaction between people and the organisational, structural and operational mechanisms which it seemed held the key to success. It was therefore of practical interest to determine whether there were philosophical and personal traits which would be significant for creating similar successful teams in the future.

Capturing '**how**' things had been done, the processes and procedures, already formed an important part of the London 2012 learning legacy project to secure insight and develop understanding of good practice to inform future actions. However, understanding '**why**' things were done, the underpinning thought processes and the way the factors interacted would additionally determine any enabling or 'pre-conditioning' factors.

The aim for this over-arching research was therefore established:

- to identify, understand and document the human and organisational aspects that have underpinned the success of the ODA construction programme.

It was agreed with the ODA and Health and Safety Executive (HSE) who facilitated and funded the research, that the work should take a broad view of success. Although health & safety was the principal outcome from the regulatory perspective, insight into how success could be achieved whether in terms of sustainability, schedule, cost and quality was of equal interest so that the influencing mechanisms affecting construction practices could be understood. It was also recognised that learning should come not just from success but also from those things that had not worked well or had been subject to improvement through the build.

1.2 IMPLICATIONS

The findings from the research provide evidence-based recommendations for different parties to inform their approach and help secure success on future construction projects.

The most important observation is that, far from being a 'soft' peripheral issue, the way individuals and organisations have interacted has had a significant influence on construction project outcomes. It is therefore recommended that parties should implement aspects of the approaches seen in the London 2012 build in line with the specific recommendations modified as appropriate, to their own role and scale of project.

In some respects the approaches may require a change in mindset and warrant some investment in time to think and engage with others to find ways of working that best fit individual circumstances. However, the message conveyed to the researchers was that none requires capital investment or significant expenditure and the potential benefits and savings experienced rewarded the attention invested.

Endorsement for the approach also comes from the pre-existing analyses of ways to improve construction industry performance (see reference to Appendix C later). Many of the mechanisms prioritised like leadership, worker involvement and so on are again underlined as important here. However, additionally, the London 2012 experience has demonstrated the attitudes and behaviour that can make the mechanisms really effective in practice.

1.3 APPROACH

1.3.1 Research Outline

The research was contracted to a Loughborough University Enterprises Ltd (LUEL) team combining expertise in ergonomics and human factors from the Design School and construction engineering management from the School of Civil and Building Engineering. The fieldwork and analysis was conducted by a consultant to the team who is a chartered civil engineer with a specialism in construction health and safety and in human and organisational influences on performance.

The primary research in mid to late 2011 had three principal aspects:

- **Tracking the 'close-out' and lessons learnt processes** for six different venue and infrastructure projects, obtaining evidence for the major influences on health, safety and sustainability out-turns as well as other aspects of the build. Further insight was developed where necessary through follow up interviews with project (including contractor) and central close-out teams. [*]
- **Interviews with senior executives** and lead operational personnel from the client ODA, the regulator HSE, and the delivery partner (DP) CLM[†], exploring early expectations and reflections on performance for the build overall and in specific objective areas.[‡]
- **A systems modelling** of the influences through the supply chain from Government and wider societal interests through to the execution of construction work on site to examine the interactions and dominant factors.

As the findings were assimilated and critical factors emerged, secondary research was included:

- Preparatory interviews one to one, followed by a collaborative workshop with **health and safety research teams** to explore common factors affecting performance identified in their studies.[§]

---

[*] Each of the close-out meetings for the 6 projects involved up to 16 personnel from the client, DP and contractors with selected follow up interviews and supporting lessons learnt documentation.

[†] References are made both to the DP and CLM through this report. In general DP is used where the generic role and function of a delivery partner is in focus and CLM where it is particular aspects of CLM's approach to the DP role that is being discussed.

[‡] 17 executive interviews provided 23 hours of structured evidence and were supplemented with attendance at Park-wide fora such as meetings of the senior executives' safety, health and environment leadership team (SHELT).

[§] 13 researchers from 6 complementary projects collaborated in 8 hours of preparatory interviews and a day-long workshop.

- Reviewing and analysing all micro-report, case study and research summary documents on the **London 2012 learning legacy** website[1] to identify any supplementary evidence for the relevance and significance of the factors to those authors as they identified learning in relation to disparate legacy themes. [**]

Finally a **validation exercise** presented and debated the conclusions, first in the forum of the Major Projects Association (MPA)[2] and then with ODA executives (and former executives who had moved on as the build completed). This report summarises the findings and recommendations.

1.3.2 Research rationale

The rationale for the elements of the research is set out below.

The focus on close-out and lessons learnt activities was suggested by ODA and CLM, firstly because of the frank insights they recognised the process was revealing but also because it complemented the site based interviews which were a focus for most other research teams. In practice the process itself also presented a microcosm of the organisational approach for many aspects of the build programme.

A formal procedure for close out was driven by CLM to ensure works, documentation, approvals and so on were all in place at the point of handover. At its core was the Health and Safety File requirement under the CDM Regulations[15] but the coverage was comprehensive, streamlining a range of close-out activities alongside health and safety. The scope for the 'Case' was consistent, covering:

- Deliverables schedule
- Testing and commissioning
- Completion of the works
- Record drawings
- Operation and maintenance manuals
- Asset schedule
- Building energy log book
- Health and Safety File
- Consents and licences (town planning, building control, sporting body accreditation, remediation validation, statutory regulators approvals / other stakeholders)
- Security
- Other priority themes (Environment and sustainability; Inclusive design; Equality and inclusion / Employment and skills).

Milestone meetings with a structured agenda ran to a consistent timetable through the close-out process and were initiated from 6-8 months ahead of planned completion. They were attended by many project and central specialisms and reached a RAG (red, amber, green) rating on the status of items and defined actions. The concept was that the process drove behaviours with the focus on sooner being better. The early start and delivery partner (DP) drive was unfamiliar for

[**] 110 micro-reports, 39 case studies and 13 research summaries were covered in the review of London 2012 learning legacy documents.

many and expectations around the quality of documentation were hard for some to fulfil. At the working level instances of resistance were visible, particularly initially, because of what were perceived to be both onerous and additional demands when they were still in the throes of construction. The DP therefore had to implement a range of measures to facilitate progress. This included reference to the contracts as the origin (with the process being the consistent means to delivery on the Works requirement), briefing material to explain the rationale, regular meetings to nurture the process, template documents to clarify the expectations, constructive commentary on drafts and guidance on employing technical authors where necessary to provide meaningful system documents not just compilation of data sheets. Once complete lessons learnt workshops were held.

Witnessing the processes gave insight to day to day operations affecting the full range of contract deliverables. It provided links with central and site based teams and personnel at different levels and the opportunity to hear candid reflections in lessons learnt.

Involvement with the close-out process revealed the significant influence from ODA as the client in setting the expectations and CLM's drive as the DP with Principal Contractors (Tier 1 contractors) to ensure the goals were achieved. Significantly, early and structured activity was specifically tackling the unsatisfactory scramble to assemble documents more usually seen as (and after) site work concludes. Interviews with senior personnel in the client and delivery partner organisations therefore took on particular significance to explore the underlying basis for the direction being set and approach taken, not just for close-out but more widely. The experience and motivations to explain the 'why' were the principal focus. Appendix A contains the interview brief used to structure these discussions.

The interviews also provided the opportunity to review the Influence Network (IN) structuring of the interaction between human, hardware and external influences on performance through different levels of the supply chain. The model (see Figure 1) has been used extensively with the construction industry and in a range of research projects for HSE[(e.g. 3).] The diagram illustrates the factors but supporting modelling not only considers the **quality** of the individual factors but also their relative **weight** of influence. This means that an individual factor could be rated quite highly (e.g. training) but when assessing the influences on compliance at the next level, it could be judged that supervision, for example, carries much more weight with the workforce. In order to improve compliance this could suggest that effort would be better invested in supervision than training. Applied to the London 2012 build, the model provides a framework to help explain why attention to particular aspects of human behaviour has translated into successful construction outcomes.

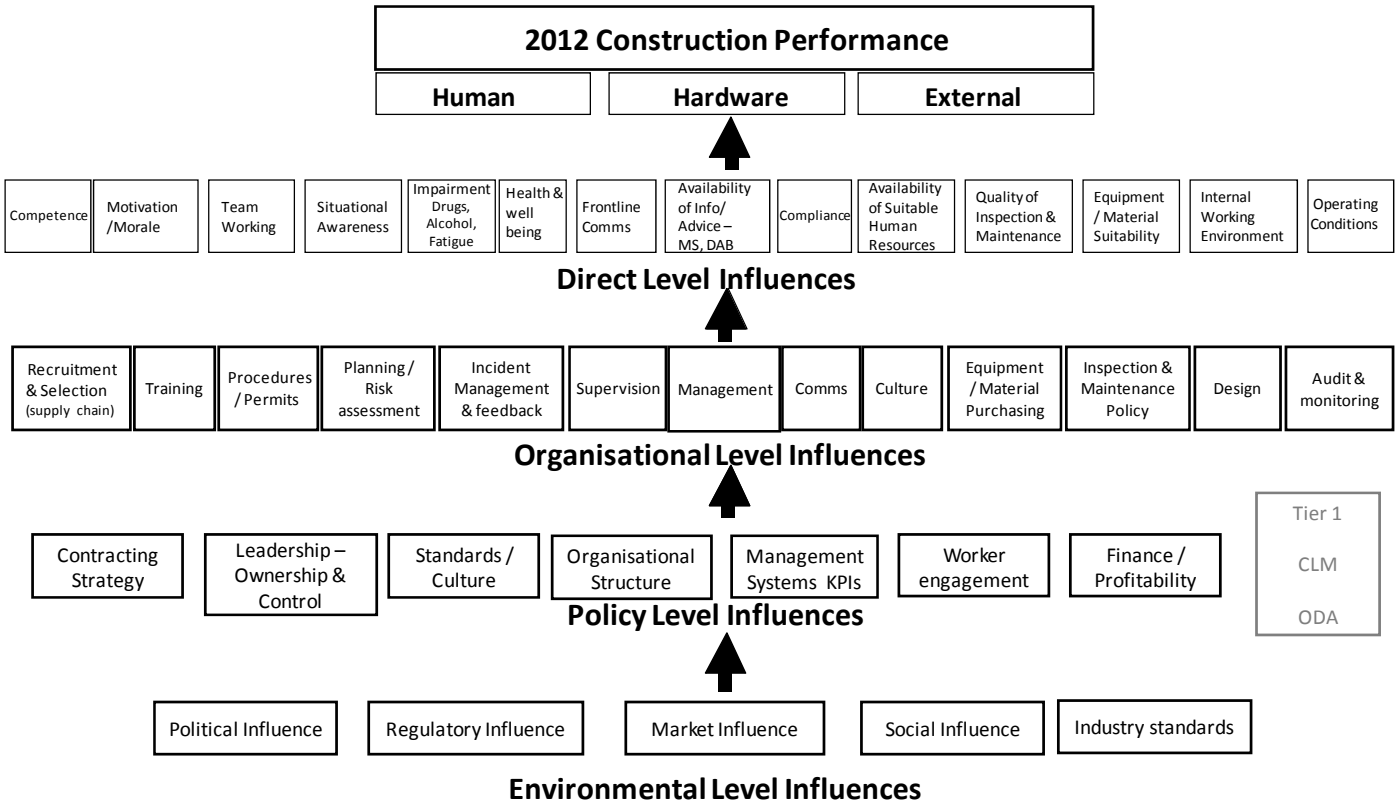

Figure 1 An influence network of human, hardware and external factors affecting (health and safety) performance

In parallel with this legacy research, ODA was working with HSE and the Institution of Occupational Safety and Health (IOSH) to enable other research teams to examine specific aspects of the health and safety management (i.e. communications, leadership and worker involvement, CDM regulatory impact, supply chain management, occupational health service provision, and safety culture). Table 3, research summaries R1 to R7 give further details – see also HSE's website[4]. The researchers themselves identified underlying influences that were not the primary focus of their research reports but which they felt were unusual or potentially significant to the overall approach and should be captured in the legacy output. An additional activity therefore brought research teams together in a workshop to identify factors that might tie in to this work with over-arching significance. It both drew added value from the work of others and also gave the valuable opportunity for them to debate and test their own findings with informed and knowledgeable peers.

The launch of the learning legacy web resource[1,5] in October 2011 opened up a new range of perspectives on the London 2012 build. The documents (over 250 in number) were prepared by the ODA, delivery partner and a range of contractors, designers, industry professionals and academics in the form of brief **micro-reports** or more detailed **case studies** about learning and innovation. **Research summaries** cover the studies undertaken by third parties (as above), often co-funded with ODA by other industry stakeholders, providing a commentary on detailed aspects of performance and using the experience to try and advance the underpinning theories. There are also **champion products** (although not reviewed here) which disseminate some of the tools and templates that have been adopted with success on the programme. Although ostensibly tackling specific themes (related to Archaeology, Design and engineering innovation, Equality and inclusion, Health and safety, Masterplanning and town planning, Procurement, Project and programme management, Sustainability, Systems and technology, and Transport)

the legacy document authors - who had been at the heart of the construction operations - have reflected independently on success and the learning to pass to future projects as well as the factors that helped bring this about. Reviewing all these documents provided the opportunity to test whether any of the emerging themes were reflected in these independent accounts.

The final test was to meet again with the principal architects of the project and to ensure that the influences identified chimed with their experiences and remained valid as the latter stages of the build had progressed. In addition, the MPA Forum[2] (which included preparatory sessions and exchanges of presentation material during development as well as follow up analysis reports) brought together senior parties from throughout the London 2012 construction programme who compared and presented their findings to the scrutiny of major project practitioners from different fields.

1.3.3 Research methods

ODA, CLM and contractors generously afforded researchers access to the close out processes. Six projects were nominated by the ODA and CLM close out co-ordinators covering both venue and infrastructure projects as well as different stages toward completion: Handball Arena, Main Press Centre, Eton Manor, Royal Artillery Barracks, Wetlands and soft landscaping, and Roads (including the Northern Retail Lifeline). The timing of the research dictated the eligible projects in terms of close out schedules but the selection was made to cover a range of factors such as: types / sizes of Tier 1 contractors; on and off Park construction; more or less prestigious projects; and degrees of technical and programme changes and challenges faced during the build. It was not appropriate or practicable to take audio recordings of the pre meetings, multi party close out meetings or some individual follow up meetings on site or with central team members but contemporaneous notes made by the researchers and formal records of the status in each area and learning points provided reference material. In addition, the researchers' own observations of the behaviours and interactions between the parties were an important evidence source.

Executive interviews were recorded with formal permission, transcribed and subjected to content analysis. The process was iterative and required some rationalisation of alternative terminologies. It was also necessary to identify human traits which better characterised the organisational factors in the influence network – for example team working (in the IN) is expressed in terms of the collaborative ethos that in turn facilitated effective team working. Some attention was given to separating the characteristics that one party identified in another from the approach that an individual themselves felt had been taken. This provided a basis for not just capturing what people thought they had done well (their approach) but also understanding why it had been felt to impact on others (key characteristics).

The IN then helped place the human characteristics in context and examine other success factors that had helped drive the characteristics to the fore or provided additional leverage (or impediment), particularly in relation to business impact and transferability.

The researcher interviews individually and in plenary were recorded with permission, transcribed and subjected to further analysis.

Having identified characteristics and other factors as central themes, the legacy documents (over 160) were subject to a thorough review and template analysis which provides a bank of extracts and quotes (see Appendix B) that act as pointers to more detailed explanations in the source documents.

1.3.4 Report structure

In the next section, Section 2, the consolidated findings from the research are presented linked to the key characteristics emerging from the analyses. Their role and significance is illustrated through an account of aspects of the London 2012 build. Concluding sub-sections put the findings in the context of industry-wide developments, highlighting the transferability and business benefits and considering the regulator's role specifically. Further analysis of the primary research material will be covered in future academic papers. The analysis of the legacy documents is, however, covered in detail in Appendix B to this report as it cross-references public domain documents which readers can follow up on directly.

2 RESEARCH FINDINGS

2.1 PREAMBLE

This section presents a synthesis of the findings from the strands of research outlined above. Having concluded the fieldwork it was evident that strong themes characterised the approaches and emerged repeatedly in different aspects of the work. Reporting separately on each research strand would provide a clumsy and unnecessary demarcation for the reader more interested in the factors that contributed to success, their benefits and transferability. Where appropriate specific details are expanded on in the appendices and/or will form the basis of academic papers in due course.

2.2 SUMMARY OF KEY 'PRE-CONDITIONING' CHARACTERISTICS

Right across the breadth of London 2012 construction activity (whether focused on health and safety, cost and schedule, or other target outcomes) certain characteristics were evident in the aspirations and attitudes and were manifest in aspects of behaviours. The factors listed below have been identified by the authors as recurrent characteristics across a broad spectrum of performance referred to by interviewees or witnessed in the working methods observed in the course of the research. Some are terms used explicitly and repeatedly by those involved in the London 2012 build (e.g. clarity, collaborative). Others are suggested as being characteristic of the approaches and practices described (e.g. pre-emptive, assured). It is acknowledged that other researchers might identify additional characteristics or propose different terms. However, the following are all recognisable features evident in the raw research material and were endorsed in follow up interviews as part of the validation activity once the main research was complete.

- Respect
- Trust
- Clarity
- Pre-emptive
- Challenge
- Consistency
- Collaborative
- Empowerment
- Communicative
- Open
- Fair
- Assured
- Motivation.

It can be seen that there is considerable inter-relation between the characteristics (e.g. openness / transparency and collaboration). Certain characteristics serve to enhance or predispose success in others, however the characteristics are distinct and one does not necessarily lead to another. The order of presentation is therefore not definitive but reflects a qualitative sequencing from the authors' interpretation. A quantitative weighting of occurrence would be inappropriate given the limitations from the size of the study and the correlation of perspectives inherent in

sample groups. Instead the flow runs from fundamental characteristics (like respect) which it can be argued are a pre-requisite for many of the others, through ones which affect the course of projects from the earliest stages (e.g. clarity), to ways of working (e.g. collaborative), and ultimately to those which follow as a consequence of other activity (e.g. assured). The presentation is simply intended to give a logical flow for readers but alternative interpretations of the sequencing could be equally valid.

Table 1outlines a definition and rationale for the significance of each characteristic, again built up from the observations in the primary research.

For each characteristic to have influence there needs to be a mechanism or mechanisms for them to have practical impact. Examples emerging through the research are listed below and importantly mirror the principal subjects examined in the health and safety legacy research (e.g. reference R2, in Table 3).

- Leadership
- Worker involvement
- Culture change
- Communication systems
- Contracts and procurement
- Risk management, monitoring and assurance

The mechanisms are also evident in the IN representation in Figure 1. Furthermore, as the review of legacy documents in Appendix B shows, the self-same mechanisms are important factors for a wide range of the construction outputs and objectives for the London 2012 build. Pervading all of these are the necessary interactions and inter-party relationships.

Table 1 Characteristics identified through the research to have pre-conditioned success

Characteristic	**Description / Rationale**
Respect for people	- Acknowledges and values complementary roles - Recognises managing people to get the best from individuals and teams is key - Values relationships - Builds trust and underpins transparency, communications, collaboration etc
Trust	- Engendered by delivering on promises - Unlocks a willingness to be open - Reflects respect
Clarity of purpose	- Prevents lack of clarity and uncontrolled change leading to conflict, confusion, cost, delay and failure - Provides alignment, common focus and effective contractor work - Defines build deliverables and captures wider commitments and performance standards
Pre-emptive / Early	- Ensures a planned and measured approach based on choices and options - Avoids the disruption of late surprises
Challenged to do better	- Motivated by trust and respect for capability - Fuelled to deliver and raise the bar
Consistent / persistent / relentless	- Unites teams and demonstrates fairness - Reinforces purpose and buy-in (through supply chain and over time)
Collaborative	- Route to recognising and achieving common purpose - Basis for constructive, effective solutions
Motivation	- Provides determination and ownership - Fuels delivery and drive to raise the bar
Empowering / goal setting	- Teams (supported) rise to challenges, innovate and take ownership
Communicative	- Reinforces clarity and engages commitment at all levels - Relationships secure insight, understanding and solutions providing meaning to formal information systems
Transparency / Openness	- Reflects honesty - Shared understanding and basis for problem solving - Enables uncertainty and future risk to be managed with timely mitigation
Just / Fair	- Demonstrates fairness - Reinforces standards, values and priorities (reward and punishment) - Engenders respect, support and motivation
Assured	- Communicates objective information - Secures confident leadership

2.3 KEY CHARACTERISTICS IN PRACTICE

To give some substance to the characteristics listed In Table 1, this section provides an account of the way construction operations were established and conducted, based on the primary research material (see Section 1.3.1). Reference is made to some of the systems but the focus is on 'why', the motivations and characteristics embraced by those involved.

The ODA Executive Board

In the beginning there was no ODA. The body was established to deliver the venues and infrastructure for the Games but beyond that it would cease to exist. The scale was massive, the time was finite, the contaminated site was challenging, and the eyes of the country and the world would be watching. It had to embrace bid-winning commitments, aspirations and funding. The construction industry had been stung by recent high profile failures with over-runs in cost and time, ending in the collapse of businesses and expensive litigation. Public sector clients, particularly, had a reputation with contractors for interference, incompetence and indecision. The organisation would be accountable to some 30 Government bodies. Meanwhile the construction industry was booming.

Appointments to the Executive team brought together individuals motivated by the challenge and unique opportunity both personally and professionally. *"This was the opportunity to showcase the best of British industry to the world"*. The recruitment of course secured appointments of recognised individuals at the top of their profession. Three had worked in the same public sector organisation previously but generally their backgrounds were diverse and they had not worked together as a team. There was therefore little baggage of history but nor were there established alliances.

Appointments were made in quick succession and an early activity was residential workshops where the executive board designed itself. It looked for lessons from previous Games and major builds (and secured advisors from whom they continued to seek guidance throughout the build). In this regard they learned the norm was for the executive to be fired, en masse, about a year out, becoming scapegoats as completion looked to be in jeopardy and a fresh team would be brought in. Repeatedly interviewees identified 'survival' as a key driver and efforts focussed on defining the measures to ensure there was confidence in completion to time and budget, thus securing their tenure.

The team also worked on defining their objectives for the build in line with bid commitments over and above schedule and cost. From this the six priority themes were established and expectations defined. The output was wholly owned by the executive and whilst each might have had stronger alignment with one aspect or another, the subsequent supply chain saw no sign of this. Once agreed, the board was consistent between each other and over time and remained clear these were essential deliverables.

From a health and safety perspective, particularly, they showed a commitment that the considerations would be paramount. Construction for previous Games had been blighted by fatal accidents and individual executives also drew on personal experience of deaths 'on their watch'. To them all this was unacceptable and safety and health measures were morally essential aside from legal drivers to protect the workforce.

Appointing a Delivery Partner

Building a transient client and programme / project management organisation in isolation was never a possibility. However the scale of ODA and nature of support had to be determined. David Higgins as CEO (Chief Executive Officer) signalled the need for partnering but equally it was deemed necessary for ODA to have sufficient resource to discharge its responsibilities and remain confident of delivery (not a thin client as sometimes stated but one with sufficient resource).

The process for identifying an appropriate delivery partner (DP) was based on competitive dialogue, with scenarios played out to examine both capabilities and compatibility between ODA and prospective DPs. Repeated reference to the 'right fit' indicates the early emphasis on relationships and the ability to work collaboratively as a team.

With the DP role awarded to CLM (a consortium and so also a transient and adaptable entity rather than an established body), the parties had to work to define the respective roles and how they would be discharged. The principal demarcation between client and DP was for ODA to focus on ensuring stakeholders were satisfied, particularly Government, and for CLM to drive delivery. The roles were complementary and provided a 'double headed' client, ODA setting expectations and CLM charged to implement them. They were also reinforcing so the respective leads on health and safety, for example, did not overlap and broadly ODA set the direction and CLM as DP ensured action.

Although ODA and CLM were conscious to respect the separation, it is notable that for many contractors, particularly lower tiers through the supply chain, ODA and CLM were synonymous as the client. At the core of CLM was a common purpose with ODA to deliver the facilities to time and budget and safeguard professional reputation. This was enhanced by the parties agreeing a basis for incentivisation where the DP's rewards matched ODA's objectives and further provided a basis for back to back incentives through the supply chain. These inherently ensured consistency, alignment, a mutual dependence on success and thus collaboration. The terms also placed responsibility on CLM to be dynamic in its allocation of resources – sufficient to provide the necessary drive and controls to meet the targets but not so heavily resourced that potential rewards would be eroded.

This in itself also required a collaborative view within the consortium of CLM. The distinct skills of each party meant that deployment would be by need in the best interests of the programme at whatever stage, not quota. Some of the tensions with the first Director were seen to stem from the affiliation to one of the three companies. The external appointment of his successor and his engagement as the sole CLM employee successfully overcame any perception of bias. A testament to the success in integrating the team was that comments were often made that there was really no visibility of an individual's heritage. Others commented on the value of complementary backgrounds ensuring that within the DP there were individuals able to understand the perspective of contractors as well as the client and thus help resolve 'issues'. For those engaged in deploying resource, the combination also gave great flexibility. Overall it is judged some 3,000 people passed through the CLM organisation on London 2012 with around 600 at the peak.

Form of contract

The chosen form of contract was the NEC3[6] which opens with a commitment between the parties to collaboration[††]. It serves to drive problems into the open early, avoid dispute with the potential for adjudication, and different options provide a fair basis for reward depending on the degree of (un)certainty at the point of contract award. For the DP, reward was linked to the management securing construction on time and budget with savings shared. It rewarded the execution of designated management systems (e.g. health and safety monitoring) but not to standards of performance outwith the DP control. The contract here and throughout the supply chain secured the priority themes as core deliverables alongside the structures or services removing any possibility for them to be viewed as 'lip service'. Not only were the expectations made clear to contractors, so too was the requirement for the expectations to cascade through the supply chain.

Significantly, although use of the standard form of contract and consistency between contracts was reached ultimately, some early contracts did not include the priority themes explicitly. Nevertheless, the shared values and one project ethos developed across the park meant that contractors voluntarily agreed to deliver on the themes. As one interviewee commented: "*the values of 2012 are intrinsically good and people want fairness and to be seen to be taking part*".

A similar commitment was the necessity to meet the planning commitments and any Section 106 agreements. Any subsequent debate over demands was essentially eliminated because of the legal formality. The importance of the planning decisions is underlined in a number of the legacy documents, indicating that it was the absolute clarity that actually helped ensure work focused on solutions without procrastination or vacillation. It was also suggested that the clarity of the time frame for the build and the immovable deadline was, although challenging, actually a benefit in that it removed the variable when options were being considered. These were not targets, they were givens and demonstrate the ability to deal with certainty, no matter how challenging, whereas uncertainty or lack of clarity make for indecision, inefficiency and delay.

Constructing the team

As the executive board worked together it became evident that the DP was not wholly trusted, apparently with no other cause than it comprised private sector entities with profit motives not wholly understood by public sector professionals. This was challenged by the Director of Construction whose experience was principally private sector and so felt he himself would be regarded similarly with suspicion. This dialogue brought the issues into the open to provide a basis for building understanding, trust, alignment and effective working relationships which characterised the approach.

Different backgrounds and an assembled rather than evolved team inevitably brought different personality traits, styles and tensions. Far from a cosy fit and an effective decision making body initially, coaching was utilised by several parties within the executive to work on the listening and temperate behaviours that team cohesion and survival would depend on. Furthermore, these were not one off considerations but needed to be sustained through the finite life of the build

[††] NEC3 builds on experience of NEC and NEC2 from the 1990s and is the form of contract recommended for public sector procurement by the Construction Clients' Board (formerly the Public Sector Clients Forum). At the time London 2012 commenced NEC3 was relatively new having been issued in 2005

and some, having recognised tangible benefits in their effectiveness as a result, chose to continue with coaching throughout albeit with reducing frequency. In considering the role of leadership and the respect for different roles, it is notable that at the operational level, one interviewee commented unprompted on the behaviours at site meetings where even there it was rare for voices to be raised, in comparison with more familiar construction environments.

The inclusion of deep construction expertise within the client ranks, despite the differences, was also widely recognised to be crucial to the eventual success of the build. It brought respect from the contractor fraternity and a ready basis both for debate and mutual understanding. The ability to work with the construction industry, to bring them in as contractors or work to fix solutions as difficulties arose, inevitably stems from experience.

Indeed an early role was to engage with the industry and work to make the ODA a client of choice. The difficulties and risks perceived to go with the London 2012 build meant there was little appetite even to tender. Solutions required identifying features that would attract contractors and demonstrate how the client valued their role. The focus on the provision of site services, including occupational health and a focus on respect and well-being, were amongst the guarantees made. Further steps were taken through the design to ensure the packages would be met with effective competition when they were put out.

The work was focused on building trust at the industry and corporate levels. It built particularly on the conviction not just that this was the opportunity to showcase the construction industry to the world and could deliver significant improvements in construction practice as a legacy for the future, but that such achievements were possible. This reflected understanding of the design and construction supply chain and a true respect for the skills.

Having progressively brought in designers and contractors, the client recognised the imperative to deliver on its commitments. ODA's chairman was reported in this research to say even he had underestimated the power of the client role and recognised through the programme the strong influence it wields. He also recognised the importance of the infrastructure, of tidy, clearly delineated work areas, with good transport and welfare facilities and in hindsight had reflected that had these been in place sooner the very evident demonstrations of expected standards and respect would have been communicated even more powerfully – a lesson for future projects.

In the relationship with contractors it was clear that trust would only build once commitments on both sides were delivered. As trust was established and subsequent challenges emerged expectations could be raised in a way that was fair and further commitments could be secured.

Alongside the governance structures and formal collaborations, a very important level of contact was maintained throughout the programme based on relationships founded on trust and openness. The Director of Construction maintained direct contact with Directors and Chief Operating Officers (COOs) of the Tier 1 contractors, meeting informally to share perspectives on the build, issues and levels of satisfaction with performance all round. In a sense this triangulated the information coming through monitoring and assurance processes. Maintaining alternative communication channels and mutual respect and understanding also provided a basis for early warning and strategic action to broker solutions and secure alignment and expedite constructive formal interactions. Where significant problems arose the relationships provided a basis for unlocking issues.

Contrasting examples were given of significant difficulties encountered in the build and how they were resolved on the basis of openness and respect. It is notable that there has been no

litigation from the build and the adjudication process was only needed to achieve resolutions in a few cases. In one instance where problems loomed with the potential for catastrophic cost and delay, matters escalated to the firm's board. Once facts were firmly established, the situation was turned to find solutions, establish commitments and, with delivery, reaffirm trust to the extent that the same firm made significant contributions to solving other problems the client encountered at a later stage.

Delivery Partner operations

With the contracts being established, emphasis turned increasingly to the DP role. The CLM parties brought with them a bank of processes and procedures for monitoring and control but with contractors ranging in scale and experience even at the Tier 1 level there would be significant challenges to embedding them. A number of features characterise the DP's response.

Paramount importance was placed on planning, on anticipating and ensuring measures were in place in an orderly and managed way. Significantly there was a period of months before the necessary statutory mechanisms and planning authorisations would be in place for work to start on site. This gave time both for CLM to hone its own approach and to engage with designers and contractors to think about options. For many this enforced period of planning was crucial and should be preserved on future projects. Some others suggested the extent of proceduralisation might otherwise have been less onerous.

There was a clear understanding of the contractors' position and, for example, the need for over-arching targets against the priority themes to be broken down into tangible and measurable elements which each project could take responsibility for delivering. Ensuring delivery at project and programme levels then needed a monitoring and assurance process applied consistently to provide for aggregation across the Park. It was recognised that some of the expectations on priority themes were in the experience of some contractors linked more to clients' aspirations than firm requirements and so they were not necessarily equipped to understand how best to deliver the expectations or ensure they were equally embedded through their supply chains. The role therefore also involved mentoring and support whilst also reinforcing that the elements were non-negotiable. To this end the clarity of planning commitments and the contractual obligations were important.

An important function for the DP was to provide project based support and drive local delivery while also providing links to the wider programme. Explicit co-ordination on cross-cutting themes like health and safety, quality or sustainability or on universal processes such as close-out activities (examined particularly in this research) enabled best practices to be shared and weaknesses to be addressed progressively as projects reach different stages in turn.

Interviews with the close-out team illustrated how this was adapted project by project to suit the style of operation and needs of individual project managers. Whilst all projects had to deliver the required outputs in consistent formats, there was local empowerment to drive production. The sheer number of communications emailed to project managers to cascade further was also recognised centrally. The close-out team (and they assumed equally other central teams) saw one of their functions to be to provide supplementary support in testing which messages had got through and where necessary providing direct information to ensure key instructions did not "fall through a gap. There was no sense of blame if things were trapped in an inbox but instead a clear, collaborative ethos of helping ensure priorities were delivered.

A consistent feature of the controls was earlier than normal engagement, for example driving a three month forward look on activities to ensure health and safety risks were mitigated or a completion minus eight month initiation of close-out activities. The bewilderment and irritation of project teams in the throes of construction was evident as initial close-out meetings were convened. However, presentations which helped explain the purpose, close tracking of the status in individual areas (incentivising a move from red through amber to green), and final reflections contrasting the more measured handover with the normal scramble for missing documents, served to confirm the value. Furthermore, contractors' own observations that they just 'didn't get it' to begin with but then saw the focus as really helpful and now intend to implement it on future jobs, pays testament to the clarity and consistency achieved.

However, this ultimate success should not diminish the initial difficulties where at the local level requirements were seen to be onerous requiring "*three to four times more effort than normal*" and particularly challenging for contractors to secure cooperation from the supporting supply chain who were even less familiar with such demands. The immediacy of the LOCOG activity and take over by Park Operations, the near-term overlay to transform Olympic to Paralympic facilities and so on, no doubt underscored the imperative for comprehensive and timely close-out packages. Reflecting on successes and challenges, the central teams acknowledged the success of contractors who, although challenging were willing to listen and adapt. Contractors themselves emphasised their reliance on mentoring support from CLM. They identified how dependent the processes were on collaborations and how expectations in the contract needed to be interpreted clearly for delivery teams.

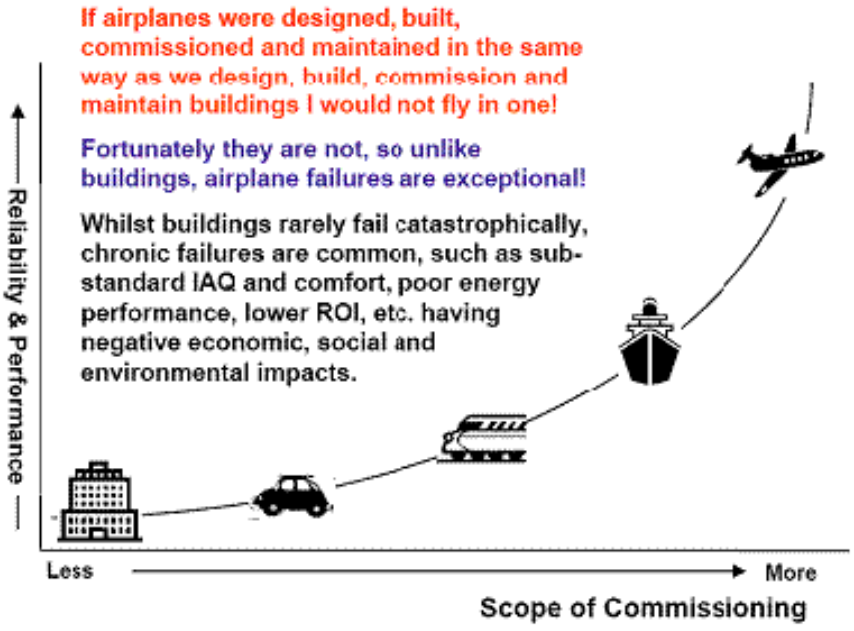

Figure 2 A slide extracted from the CLM presentation explaining testing and commissioning expectations of close out (IAQ - Indoor Air Quality; ROI - Return on Investment)

It was evident that attention was paid to ensuring communications were meaningful to the audience and helped people understand not just **what** had to be done but got their buy-in to **why**. In the close-out process the supporting presentation was mentioned in lessons learned to have been particularly helpful and the graphic Figure 2 used to present the challenge to do better on testing and commissioning was clearly recalled by individuals as the light bulb moment and secured a real commitment to do better.

A particular motivator in this instance was the immediate takeover by LOCOG and inextricable linkage between the build and satisfactory operation of the buildings and systems which would remain in the public eye. Nevertheless through the close collaboration the quality of O&M (Operations and maintenance) manuals, for example, surpassed the industry norm – in place of component by component data sheets, well-written, technically authored manuals assembled instruction for systems, aligned to the way asset based inspection and maintenance activities are carried out as opposed to the sequence of build.

Working so closely on the ground provided important insights from project and programme perspectives over and above monitoring and reporting systems. Each week, in addition to formal governance arrangements, senior CLM and ODA personnel met un-minuted to review performance providing for 360° feedback considering their own respective performances. These meetings were founded on the strong relationships and the trust, respect and shared commitment that had developed through the programme and were considered to be valuable to resolving issues, providing early warning and maintaining alignment.

Assurance and scrutiny

From the outset, ODA was accountable to the Olympic Board (OB) and Government Olympic Executive (GOE) along with some 30 or so other Government Departments on specific matters. In addition a plethora of other stakeholders including the media, the local community and regulators all had continual interest in performance. An early ODA decision was to be entirely open and meet the scrutiny head on; the philosophy of clarity and no surprises being instilled through the contract chain would apply equally in its other interactions. The baseline 'yellow' document[7] published the cost and schedule plans supported by annual plans and gave a clear basis for its own and third parties' measurement of performance. The approach was to seek to communicate and engage, to develop experience and delivery in certain areas, then commit to more. Similarly strategies in priority theme areas, such as health and safety or sustainability, were enshrined in transparent policies and, where appropriate, supporting standards set out unequivocally the performance expectations. Monthly updates to the OB and GOE and annual reports published on the web ensured ODA was accountable.

However, the directors also required significant levels of assurance not just that what had gone was accurately reported but that they could be sufficiently confident that the overall goals would be achieved. Issues and challenges could be tackled and managed – things that were unknown or uncertainties potentially undermined confidence and trust and could derail the programme. To that end reporting included key performance indicators (KPIs) and metrics, including earned value to be more accurate than spend. It also required 'Trend' analysis of possible issues and degrees of uncertainty so that quantitative risk analysis could be used by the DP to give an indication of overall confidence and enable attention to be focussed on areas of high risk or uncertainty. Although these approaches are 'how' the work was carried out, the underlying motivation was for clarity, and openness for the parties to be (re)assured.

Beyond the processes, it was again necessary to get the buy-in from contractors for processes that were seemingly onerous and required prompt and regular completion. CLM provided both support in the execution and encouraged understanding of the programme-wide perspective. Where many of the KPI metrics were self-monitored, the assurance functions sought to verify the assessments. DP project managers embedded in contractor teams also played a part in monitoring and it seems in some cases took responsibility themselves to translate the data into the streamlined metrics required for the programme-wide picture. Whether alternative solutions could have been found with firmer direction of the contractors could be debated, but it does

demonstrate the buy-in and accountability felt by key personnel in the DP that no way would they let their project fail.

Layers of assurance were also imposed on ODA as a public body from the National Audit Office, together with regulatory inspections on particular aspects. It was considered by ODA that this level of intrusion would not have been tolerated without the trust established with contractors at the outset.

Openness also extended to affording access to groups seeking to review and learn from the way business was conducted on the park. Although in some senses the degree of interest was motivating, interviewees at team level in ODA, CLM and Tier 1 contractors did also identify the burden and demand it created. The Tier 1 contractor's responsibilities for safety during visits required resource to be focused on visitors rather than (or in addition to) operational priorities. At the stage of the legacy research, the scrutiny then came from researchers seeking to attend, participate, arrange focus groups and/or interview personnel at all levels from subtly different perspectives. In the event over 600 interviews were conducted and the cooperation is in itself testament to the effective leadership and communication through the supply chain of the pledge to provide a legacy.

Continual improvement

Raising the bar was just one of the sporting metaphors utilised through the build. Significantly this ran through all levels. A pivotal ODA/CLM board meeting in late 2009 reflected on health and safety performance and CLM's programme director looked at the site outside and declared standards were falling woefully short. Initially this was not recognised within the room but he walked their eyes through the hazards and evident risks. This challenge to do better was taken up at managerial level and, through a process of mentoring, expectations were raised and progressively communicated. Similarly as evidence of near misses accumulated, underlying causes were examined and action was taken on common themes. Incidents pointing at inadequacies in supervision led not to blame, but recognition that the role should be valued more highly. It was concluded that supervisors needed to be equipped with training to enable them to communicate more effectively with the workforce. Supervision needs to be resourced in sufficient numbers and through all contracting tiers to perform their essential function. Effective supervision was deemed to be so crucial that action was mandated across the Park and benefits were identified not just in health and safety outcomes but also in improved levels of worker involvement, satisfaction and motivation and not least more productive working. As the build moved from the relatively stable peak period of activity into the completion and fit-out phase with teams on the Park for shorter periods, deliberate actions were also taken to increase the supervisor/workforce ratios because of the safety contribution they made.

In parallel with the DP to project interactions, the client retained a persistent focus on leadership and direction. The actions and dialogue of individuals reinforced priorities. By establishing Boards to oversee delivery against specific priority themes, each chaired by an ODA director, the work of central and project based teams was endorsed. Far from window dressing, these were active mechanisms to engage, listen, provide feedback, share learning and improve. Senior project personnel, in rotation, were invited to present to the respective Boards on progress. The dialogue was seen by the ODA to be very important for the direct contact and measure of the mood that this gave, over and above the reporting of metrics. There is clear evidence that they were also prepared to alter the methods as a result of feedback. It was important that priority themes were clear and practical to implement, 'blended' with the construction processes, not add-ons. In the case of equality & inclusion and employment &

skills, for example, contractors found some overlaps and confusion. Understanding the issues from their perspectives, the bold move was taken to reconfigure the theme and combine the team. The legacy documents confirm how this streamlined the ODA and DP activities and created a meaningful framework for contractors. The result brought together respect, new work opportunities for young people and groups traditionally under-represented in construction with contractors convinced of the skilled pool of resource available to them.

Motivations

Just as motivation was a key in securing and focusing the senior executives, so the same principles applied through the supply chain. Some ODA employees took specific appointments, others came as secondees whether from legal firms or engineering and project management consultants, all attracted by the opportunity and challenge. Similarly within CLM, people were brought in from component companies, in every case interviewed for this research, relishing the opportunity the experience would provide and recognising the value of a successful stint in the London 2012 teams on their CVs (and indeed as one said, "*how cool is it to have a london2012.com email address?"*!). The fluidity and flexibility both ensured that the very best people could be attracted but that people and roles could be matched and refreshed as the stages of the build progressed. The focus on human resource management looked beyond individuals to interactions and effective teams and swift action was taken to relocate or reconfigure teams as necessary. Having established acceptable behaviours and values, contractors were encouraged to impress these in their workers and supply chain.

At the workforce level, the prestige, on-site facilities and the recognition of competence all had some bearing, but so too did the recession when the inconvenience of travel to East London and the complexity of security arrangements became more tolerable as construction jobs became scarce. However, interviewees reported recognition of genuine concern from the top that they should return home unharmed by their work. A union representative reportedly said he considered it the safest site he had ever worked on. Others indicated they felt their supervisor took account of their views or that they were authorised to stop work if they felt things weren't right. There was also evident pride in individual and collective achievements – asked what an appropriate prize for good safety performance might be, feedback from one venue was interest in the opportunity to look round other venues – something the management team readily implemented. The same concepts of pride and respect were used by the quality team as motivators in a communications campaign.

Considerable emphasis was placed on motivation by ODA in the form of reward and recognition. This was not just for the exceptional but, acknowledging the challenge of the task, delivery on core aspects of the build was also celebrated. Whether this related to milestones in completion, millions of hours worked without reportable accidents, innovation in equality and inclusion or achieving accreditation to sustainability schemes, each was recognised or rewarded. The structured awards processes were specifically designed to be as inclusive as possible and were successful in promoting innovation, pride and respect. Investment in Park-wide communications demonstrated the value perceived by ODA as did the care with which imagery was chosen to engage and be meaningful to the workforce (depicting real site workers rather than celebrities). Pin badges were valued by the workforce and the symbolism of the recognition of their role as an individual was appreciated. It became evident that the way people were treated affected how they worked and responded. In the case of what might be deemed unfamiliar goals for construction projects like diversity and inclusion, reward and recognition was seen to be significant in sharing ideas and 'raising the game'.

Just as the good was celebrated so the poor was not ignored. Red line items like failing drug or alcohol screening saw people removed from site. Unsafe behaviours or flouting of rules despite warnings were also addressed within the contracting chain but the feedback was of a just culture or fair blame. These were not penalties for innocent misdemeanours, they were consequences that could have been expected within the rules and the actions were seen to be consistent and reinforce the priorities.

Motivation was also important at all levels. When the then Government Minister with the health and safety portfolio instigated a visit to site to congratulate the project directors' leadership team on a milestone achievement of manhours without a reportable accidents, the impact was considerable. This was cascaded across site and recalled in interviews for this research. It underlined the values and provided a basis for redoubling efforts.

Breadth of programme (beyond project) commitment and gearing

Alongside the formal processes to contract companies into the construction supply chain for each project, there was clear recognition that it was also important to harness the human commitment. The vision for the Games and legacy gave something clear for all parties to unite around but the conviction for programme-wide delivery needed something more. Importantly ODA (particularly in the form of the Director of Construction whose own construction achievements were recognised and respected by the contracting fraternity) communicated a belief in the industry's ability not only to deliver but to do so to new, higher standards. This presentation of confidence and trust encouraged the industry leaders in turn to respond to reward that faith. Indeed where the positive was emphasised, interviewees also indicated that no one wanted to be at the forefront explaining to the same Director of Construction why they had failed to reach the mark. The whole framework was one of just reward – succeed and share in the reward, but fail and the penalties would be harsh.

Steps were also taken to engender clear recognition of a collective responsibility to the programme despite project based contractual responsibilities. The chief operating officers (COO) met with ODA quarterly. With time the explicit feedback from one COO was reportedly along the lines that they were 'in this together now and the industry will pull together to deliver. You told us about the value and how we would be treated and although we have heard this before the difference is you are doing it and you meant what you said'. This demonstrates the trust and collaboration engendered with the direct impact on ODA's ability to perform and deliver.

The same peer effect was used to lever improvements at many different levels and on many different issues through the build. A very significant forum was the leadership team established with project or main board directors from the Tier 1 contractors who were brought together to tackle safety, health and later environment (SHELT). Instigated by ODA, with time its benefits and effectiveness meant it was sustained by the contractors themselves with ODA/DP support. As the profile on the Park changed and new contractors came in, the ODA/CLM team remained attuned and were able to step in to reinvigorate the activity as required. The required composition and attendance sent the clear message that health and safety were of paramount importance to ODA and was expected to be so within the supply chain. Preventing incidents, controlling risks and learning from each other was of mutual benefit with no basis for secrecy or competition. As trust developed, so the meetings became increasingly frank and open with companies sharing problems and learning from within the Park as well as external projects and, significantly, taking decisive action to implement more stringent controls across all London 2012 sites. The exclusion of semi-automatic quick hitches and additional common standards on

the use of mobile elevated work platforms (MEWPS) are amongst the very significant changes affecting workforce safety on the Park.

The openness and collective agreements reached were enabled by the influence between peers, all wanting to demonstrate their commitment to high standards before the client and none wanting to be seen to fall short. The same factors played into the success of cross-Park fora at other levels whether on health and safety, sustainability, quality or other themes. Another factor was the significant opportunity presented by interactions with counterparts in other companies on subjects where there was common interest. Audit exchanges between sites gave a fresh perspective, new ideas and improved standards. Quite clearly this was stimulating professionally, brought exposure to new ideas, respect for the skills of others, and resulted in many examples of innovation as catalogued in the legacy documents (see Appendix B).

The explicit challenge to continually look for improved ways of doing things ('is there a better way?') played into the skills to engineer solutions inherent in the construction industry. The Director of Construction in talks to project personnel was recalled to have highlighted the network of contacts they would surely develop during their time on site – it was recounted as part of the positive experience being described. It should also be noted that the interaction was not just within disciplines. The legacy documents identify cases where, unusually, design and engineering teams were brought together early as integrated teams focusing on matters like biodiversity and the collaboration not only fostered efficiency but the complementary skills stimulated genuine innovation that neither would have achieved alone.

Having appointed Tier One contractors, their autonomy as Principal Contractors was respected. To manage programme risks however, a view across lower tier suppliers was needed both to avoid overload and protect against insolvency, particularly as the credit crunch hit. However, whereas other projects in the recent past had developed a command and control stance (e.g. on Heathrow Terminal 5 where BAA as the client mandated the behavioural safety scheme to be applied) on London 2012 there was a greater focus on empowerment. Where it was deemed appropriate, Tier One contractors were set a standard or goal (e.g. to address behavioural safety) but the choice and approach was left to their selection, to meld with any existing measures or the nature and style of their operations. Empowerment to find the best fit but equally an imperative to secure behaviours conducive to safety and ill-health prevention, resulted not only in high levels of ownership within projects (for example behavioural safety on the Olympic Stadium, education & skills on the Aquatics Centre and Sustainability on the Velodrome) but a subsequent drive to promote the achievements and benefits within their wider company activities and across the industry more generally.

Depth of supply chain engagement

Contracts were established to provide for consistency through the supply chain but, as with many other areas, it was recognised by ODA that the reality would need more direct communication. The priority themes, such as equality, skills and inclusion, were deliberately manifested in all aspects of the delivery and there was a particular commitment to ensure the build opportunities were open to a wide network of potential contractors and suppliers. 'CompeteFor' provided the mechanism but even within that efforts were made to help prepare smaller contractors, perhaps less familiar with priority theme areas, so they were not disadvantaged at the tender stage. Criteria were held fairly and consistently but efforts helped contractors 'raise their game' affecting their eligibility not just for London 2012 work but for wider contracts in the future.

In addition, supply chain briefings were arranged to give contractors early and clear insight to the expectations so they could plan and prepare their workforce. One of the HSE interviewees remarked on the significant influence he saw these having and indeed ODA had involved HSE to underscore the core health and safety principles to the assembled company. As with many other areas, the focus on preparatory work was seen to ensure things progressed as intended on site and were not subject to avoidable correction or rework.

Once engaged, there was emphasis and encouragement for integrated teams and supply chain involvement from specialist subcontractors or suppliers to input to solve problems and identify solutions. The time constraints meant a strategy to sit back and let others fail and then step in was not an option – if one failed then all would fail but equally success would be shared. As the legacy documents reveal (Appendix B), instances of innovation, not just for the project but for future wider industry benefit, resulted from the new collaborations.

The requirement for supply chain partners to work seamlessly and 'do it once, do it right', as in one of the quality campaign straplines was recognised to rely on understanding between the parties and good communication from the outset. Experience also meant that ODA recognised the value of established relationships, particularly when specialist skills were involved. Without undermining procurement laws, value was nevertheless placed on effective supply chain relationships in contract award. At all levels a balanced scorecard was used in tender assessments, complementing a necessary focus on cost but valuing capabilities, track record and commitments for delivering on the wider themes linked to programme success. Not only did this ensure suitable contractors could be appointed but it also sent very clear signals as to the priority and expectations of the ODA.

As a consequence of the supply chain empowerment, Tier 1 contractors were responsible for their subcontractors and material suppliers, ensuring they complied with working practices that met Tier 1 expectations and programme standards. This was a significant challenge, particularly, for example, in close out, to meet exacting requirements of documentation. Lessons learnt highlight Tier 1 contractors' own recognition of the benefits if they could improve collaboration and ensure earlier engagement with the supply chain. Mechanisms for bringing subcontractor directors to site to remind them of pre-contract briefings and secure their leadership in resolving issues on site were said to be particularly effective and techniques they would take to future jobs. Again, as the build moved to fit-out with an increase in minor incidents familiar on general sites but unacceptable on London 2012, just such action was taken calling Tier 2 and 3 directors in for a further briefing to communicate directly and re-engage their commitment and leadership.

Health and safety performance

Monitoring and audit is often synonymous with information gathering. On the Olympic Park, particular skill had been used by CLM to develop key performance indicators (KPIs) which provided leading indicators of future performance as well as measures of intermediate out-turns. This was important both for the overall assurance process as described but also for the clarity it gave to contractors about what successful performance in a range of areas actually meant. However, collation of KPI data was a significant task and success relied on contractors' commitment to gathering and supplying information. Near-miss reporting similarly needed buy-in but was seen by ODA to be a crucial mechanism to improve on general construction practices on matters particularly relevant to the site and stage of activity. There is always a natural scepticism and reluctance to provide near-miss information and the London 2012 site was no different, but efforts were made through communication campaigns, particularly early

on, to explain and incentivise participation. Once data began to flow, feedback on the lessons drawn and, crucially, communications confirmed the steps taken to respond to the information the workforce had provided and improve the situation. In the 'you said, we did' philosophy, there was openness around the activity with no blame on individuals but instead objective measures, including where appropriate behavioural recommendations, to avoid similar issues in the future. Contributions were rewarded and trust ramped up, increasing the flow of reporting, enabling ODA, DP and contractors to implement necessary controls, increasing the benefit to workers.

Allied initiatives were the empowerment of the workers to stop work if they considered aspects to be unsafe or harmful or outwith planned approaches. With time, confidence grew and occasions when work was stopped, for example despite an imminent concrete pour, were well known across the Park and applauded with full support all the way up to ODA.

These successes were inextricably linked to the communications with the workforce, the values demonstrated and reinforced by the leadership and reflected in communications from poster campaigns through to daily activity briefings. The involvement of the workers, whether on health and safety or production matters, was set as an important principle from the leadership and manifested in the accounts to researchers on the ground. The principles were for respect, to value their knowledge and ideas, and to recognise that, at all levels, actions follow trust. A key component here was also the role of supervisors, the significance of whom was particularly highlighted by the safety team's review of a spate of near accidents where more effective supervision was revealed as a common theme as described above. The constant challenge to do better, the review of incidents and subsequent measures were reported to give a step change in performance. Special training for supervisors was set up and mandated across the Park such was the significance. This focused on the communication skills and ways to engage effectively with the workforce and was judged by both supervisors and their workforce colleagues to have been successful and valued for the respect the investment conveyed. The level of supervision and necessity for Tier 3 contractors to supply supervised teams were also emphasised - one of the measures an HSE interviewee observed was a particularly valuable step for safety. He indicated that valuing supervisors had reinforced their role and made a big difference compared with other sites.

A challenge with many of the mechanisms like cross-park fora, near-miss reporting and up-skilled supervision is the transient nature of construction. Collaboration, trust, and empowerment are rarely instant and take time to build as true intentions are understood and relationships become established. To ensure confidence did not fade, deliberate and constant reinforcement was pursued and the challenge to do better was seen in targeted campaigns, for example after holiday periods, or with specially themed weeks, to re-confirm the priorities. It was recognised that crises can be an effective juncture to focus attention and gain renewed commitment so opportunities were taken deliberately to build success from significant events. However, as the main build concluded and gradually fit-out activities came to the fore, the turnover in personnel increased and the duration of their tenure on site reduced. During this research, the transition was evident but so too was the active response of ODA, DP and Tier 1 teams, gearing up the messaging and focusing on activity briefings and supervisory needs to ensure safety. Indeed whereas other programmes such as Heathrow Terminal 5 were reported to have relaxed the focus on reporting as the main build concluded with a perceived deterioration in performance, the conviction in ODA and CLM was in the necessity to be consistent and maintain the focus and systems right through to the final handover.

Human resources management

Attention was also paid to the characteristic strengths of individuals. The legacy documents even describe how the different strengths of professional groups (e.g. in terms quantified (data) versus graphical (spatial) forms of presentation) were accounted for in the design of integration information systems for use on the Park. In terms of project managers and even CDM coordinators, strengths can be in relation to the mechanistic aspects of processes and systems so deliberate steps were taken by the CLM human resources function to overlay and ensure effective engagement at personal levels with an effective mix of traits and skills. In some instances the skills of CDM coordinators were judged to be well suited to coordinating information and systems but less well honed for building relationships and facilitating collaboration between people.

CLM took steps to ensure people skills were adequately balanced, reflecting different demands at different stages of the build and swiftly addressing interpersonal issues. It had been anticipated the human resources management function would have a finite role at the start of the build to help build the teams and relationships. However the value of the activity to secure effective working and the inevitable churn of personnel as the phases of the build changed meant it remained a central function throughout.

A further challenge was ensuring adequate consistency between individuals, despite different backgrounds, styles and situations, as corporate representatives on different projects across the Park. Again there was a role for central oversight but not all project-based personnel felt this was done to the extent it might have been with hindsight. This apparent criticism does however underline the value and importance of attending to the human dimension.

Sensitivity was also needed to contractual roles, authorities and accountability were respected and preserved, particularly given the back-to-back functions and complementary expertise in different organisations (client, delivery partner, Tier One contractors). It was important not to over-step boundaries and to preserve corporate as well as individual positions. Project based personnel were particularly affected as were client Supervisors (designated under NEC3) and Tier One management who faced potentially competing demands from project and parent company perspectives. Equally, central ODA personnel were cognisant of the issues when seeding ideas with contractors, not directing them but, for example for health and safety communications, trusting the benefits would be recognised and suggestions adopted.

2.4 SUMMARY OF THE LINK BETWEEN CHARACTERISTICS AND PRACTICES

The above account has provided an overview of aspects of the evolution and delivery of the London 2012 build. It has necessarily described some of the processes involved but particularly has sought to highlight the motivations and ways in which people have worked to secure success.

It confirms the characteristics underpinning the approach documented in Section 2.2 which, it is proposed, have pre-conditioned success. Those characteristics alone have not, of course, secured success; various tools and processes have provided the mechanisms. Table 2 illustrates this, identifying various systems, processes or activities which relate particularly to each characteristic. The factors of course interact and the links are not unique. Importantly it is concluded that the characteristics pervade all aspects of the leadership approach from ODA through the supply chain. In particular the leadership and management drive through the tiers provided a seamless exposition of the same values. The form of contract, its coverage and

linked strategies and standards are also judged to have been an effective mechanism to deliver the approach and secure success. Importantly most projects will recognise the mechanisms deployed. The quality of their implementation or the degree to which the characteristics are manifested may however vary. Nevertheless it does mean that the positive impact from increasing attention to the human and organisational aspects is a question of adjustment or re-balancing rather than costly or revolutionary new processes.

Table 2 Summary of the systems which support and reflect key success characteristics

Characteristic	**Supporting system examples**	
Respect for people	- Employment, training, equality & diversity provision - Health, safety and well-being - Relationship / human resources management overlay - Workforce involvement	Culture Leadership Delivery partner composition, role and structure Form of contract / procurement ↑ ↓
Trust	- Annual plans and reports - Pre-contract supply chain briefings and delivery - Informal relationships / 'keep in touch' meetings	
Clarity of purpose	- Priority theme strategies and standards - Baseline yellow book - Contract schedules - Daily activity briefings	
Pre-emptive / Early	- Pre-planning and gateways before work proceeds to site - 8 month scheduled preparation of close-out - 3 month H&S forward look on construction activity risks	
Challenged to do better	- Priority themes - InspireMark - Construction commitments	
Consistent/persistent/relentless	- Executive Board alignment and leadership - Supply chain briefings - Refreshed campaigns	
Collaborative	- NEC3, white space management, central/specialist services, peer to peer audits, integrated teams	
Motivation	- Reward and recognition - Contract incentivisation - The Olympic and Paralympic opportunity and ideals	
Empowering / goal setting	- behavioural safety, leadership teams, STOP cards	
Communicative	- Supervisor training - Informal KIT meetings / open door	
Transparency / Openness	- KPIs, early warning, leadership teams, external accountability , near-miss reporting	
Just / Fair	- Tackling failure, learning lessons	
Assured	- Auditing, change control, Trends, Priority theme boards	

2.5 VALIDATION

Appendix B provides a thorough assessment of each of the characteristics and supporting mechanisms with reference to evidence from the body of London 2012 learning legacy documents. Detailed tables present examples of where the characteristics have been deemed to be significant and introductory text in each case explains the significance and inter-relation between characteristics revealed. The over-riding conclusion is the remarkable consistency with which important characteristics for pre-conditioning success revealed in the primary research (such as early engagement, culture, trust etc) come through in the diverse documents, often almost as asides and despite very technical titles or focus. Despite different research methods, evidence sources, timing, foci etc, the findings are consistent and broadly interchangeable.

It is also important to acknowledge that not everything always went well on the build and many of the legacy documents provide examples in addition to those indicated in Section 2.3. A marked feature of the build has been the ability to recognise and respond to issues whether alerted through contractual warnings or based on a sense that performance could have been better. There is also an openness in legacy documents about things that had not worked well (such as disappointments around the level of re-use; obstacles, delays and rework because of incompatible drafting systems; etc) and frequently the link is made to the need for expectations or systems to have been established sooner, yet again underlining the importance of pre-conditioning characteristics like early planning.

Further validation can be found in the litany of construction reports and reviews from the past 20 years focusing variously on a more competitive, efficient, healthy and safe, and/or sustainable industry. A separate review is presented in Appendix C which summarises the calls for change and the direct overlap with all the characteristics set out above and further draws parallels with the success factors utilised in other industrial disciplines. Even the titles of pivotal documents referenced in the appendix like *Ownership, leadership, partnership, Respect for people*, and *Constructing the team* demonstrate alignment. The recent Wolstenholme report (also referenced in Appendix C), once again entreats the whole supply chain to embrace the principles of collaboration. These earlier references should be recognised as influences on the industry practitioners who joined the ODA and London 2012 supply chain and formed part of the inspiration to show that the British Construction industry really could do better.

As the legacy work was commissioned, the Director of Construction spoke of a former life characterised by being "*ruthless, remorseless and relentless*" and a London 2012 experience better described in terms of "*leading, listening, liaising*" – three Ls replacing the three Rs. The research has certainly confirmed the prevalence and power of leadership and reinforcing information and communications throughout the supply chain from client to workforce. However, it has also suggested that elements of the three Rs remain important, so long as they too are reinforced by communications and not pursued irrespective of the circumstances. For example, the relentless attention to the build objectives including the priority themes and the human values they enshrined has been a significant contributor to success. This suggests a valuable blend of past and emerging best practices.

The significant step now is that the London 2012 build provides a clear demonstration that tangible benefits can be achieved and so should provide impetus and a practical example for others to follow.

2.6 TRANSLATING PRE-CONDITIONING FACTORS INTO PRACTICE

Having suggested change could readily be achieved with reference to the London 2012 experience and a focus on pre-conditioning characteristics, it is also important to reflect on the significant challenges. In an industry known for its macho culture, a harsh environment, and a heritage once characterised by heavy manual labour, attention to human behaviours has not been the norm.

With multiple parties and transient involvement it is clear, both in principle and from the London 2012 evidence, that expectations need to be consistent, visible and constantly reinforced. Without that, credibility and trust are undermined and practices readily deteriorate. Indeed, it is not that the approaches are radical but the significant change is the degree of rigour and persistence with which they have been implemented, an observation echoed in interviews with other researchers about their independent findings. Change is therefore significantly dependent on commitment.

To consider the future application it is necessary to strip away any perception of the uniqueness of London 2012 and the links to programme scale. It can be argued that these gave no significant advantage. The budget was a big number and there were a number of years for construction but there was a lot to build on a very challenging and uncertain contaminated site. The prestige provided strong motivation but it put performance in a goldfish bowl. The parallel activities enabled a common resource and shared learning but the industry at large or projects within a company similarly provide a basis for comparison. The duration and phasing gave the opportunity for project to project improvement so the practices described are the best practice results of iteration and improvement; however, the legacy provides a springboard for future projects to utilise.

Significantly many parties have acknowledged benefits from the practices adopted. Crucially, for many, harnessing the human capital, far from being ‘fluffy’, has had a positive impact on the bottom line. Some argued the focus on relationships would be their approach anyway but having proved success at this scale it warrants adoption more widely.

Translating the characteristics into tangible actions throws up clear priorities based on the London 2012 experience. Particular priorities emerging are for clients to appreciate their strong influence, to be clear on what they want to achieve and for this clarity to be shared with all parties. Documents need to be consistent and communicated effectively. Contracts should reinforce the required principles. It is important to plan for early engagement, to make judgements and prioritise ahead of time when options are many and to prevent costly re-work. Leadership is key at all levels and leaders should be seen to do what they say. Emphasis on early actions and ensuring ‘no surprises’ has been shown to pay dividends. Taking time to plan before embarking on site is similarly time well invested.

An important step is to work with the supply chain to establish common purpose and unambiguous values, and encourage collaboration with terms of engagement reflecting collective achievement not competition. Time is needed to establish relationships based on trust, understanding mutual needs and respecting contributions. Honest and open systems need to be in place to give accurate status information and warning of potential issues so mitigations can be planned in (and avoiding late surprises). Contractors and suppliers may need to be nurtured and encouraged down the line to foster buy-in and harness innovation and new approaches. Calls for openness need to have reciprocal actions. Shared learning and improvement in a just or fair blame environment can take many forms but are crucial to identify areas for improvement and good practices on projects and across the wider industry.

The Executive Summary sets out specific recommendations along these lines for parties in the construction supply chain, building on the findings in this research.

2.7 MODELLING OF INFLUENCES

This section returns to the influence network model introduced in Section 1.3.2 to examine the interaction of the influences and the rationale for their impact on health and safety performance. The categorisation of influences is derived from established research into human and organisational factors affecting the performance on health and safety (see Reference 3 for sources). This research has looked beneath many of these at some of the characteristics such as clarity, trust and respect which enable the factors to work effectively. It can be seen by looking across each factor in turn that most feature in the description of practices in Section 2.3. Further it demonstrates, for example, how the interface between policy level expectations (e.g. worker engagement, leadership and standards) has linked to incident feedback (near miss reporting systems) at the operational level and has explained the role of trust that was established in a just or 'fair blame' environment in ensuring these systems worked effectively and delivered significant improvements for health and safety.

The model includes equipment and hardware factors as well as human and organisational systems. Little has been said in the body of this report about hardware, as observations were generally that the necessary equipment would be in place and these elements were more straightforward. There were, however, clear links between the leadership priorities, collaborative actions through the open forum of SHELT to eliminate equipment from site (e.g. semi-automatic quick hitches) which confirms the interface.

Reviewing the diagram in Figure 1 it is possible to look across each factor from environmental through to direct influence levels and recognise how the role has been identified in this research and, as in the example above, the inter-relation with other factors. Tracing each influence pathway in turn is not feasible in this report, instead the following narrative provides an overview.

- Success is a controlled timely build utilising the best practices from the best contractors and specifically good health and safety outcomes. The principle is that systems provide information and mechanisms to effect this control but people have made it happen.
- The programme was shaped by political expectations, engagement by regulators on specific matters, the need to respond to market conditions, public scrutiny in many forms and the standards and expectations of and for the construction industry with the unique opportunity provided by the London 2012 build.
- These factors variously affected the policies and practices adopted and shared between the client, delivery partner and Tier 1 contractors, in terms of the form of contract, the leadership style and role, the standards to be adopted and cultural expectations, the defined roles and responsibilities, the design of supporting management systems, respect for and commitment to engage with the workforce, and a basis for budget control and fair remuneration.
- The organisational factors for delivery in turn reflected these elements with a commitment to training, careful recruitment and human resource management to reflect priorities, procedures to ensure consistency and clear and concise method statements, a focus on early planning and managing risks and uncertainties in a way that was transparent, sharing learning from incidents and implementing improvements, investment in effective supervision with management support systems, imaginative uses of communication to

inform, reinforce and motivate, a consistent and pervasive culture embodying leadership values, systems to provide equipment and materials consistent with the project aims, design challenges for collaboration and innovation and a through running system to monitor, provide assurance and demonstrate opportunities to do better.

- The translation of these into the build practices on the Park was in a competence at all levels, strong motivation reinforced by team working and respect, recognition of risks expectation and controls, fair action to prevent impairment and support systems to provide for health and wellbeing. Open dialogue at the workface was supported by the provision of information, daily activity briefings and posters for example. Together the organisational systems encouraged compliance and ensured suitable resources whether workers or equipment were on site and covered the control of the site working environment and to the extent possible wider operating conditions during poor weather and so on.

The influence model captures the impact of the factors on performance. Equally as an established model it demonstrates the comprehensive coverage of the elements within the London 2012 approach in securing good performance.

2.8 THE REGULATORY ROLE

The factors underpinning successful health and safety performance are of particular interest in this research. With an accident frequency rate below 0.17 for the main build (i.e. fewer than 1.7 reportable accidents per million hours worked), the safety standards were significantly better than the construction industry at large and, despite the inherent hazards of a construction site, represented conditions as safe as the average British workplace. Section 2.3 has described the motivators and commitments and actions in the ODA and CLM teams. However, the HSE's actions also warrant scrutiny to consider the approach and its effectiveness and any lessons to precondition a successful role regulating future projects.

The analysis is particularly interesting for the best practice parallels that can be drawn between the characteristics of the duty holder and regulator approaches.

The CDM Regulations provide the backdrop and place explicit emphasis on the role of the client, the need for early engagement between design and construction teams, the benefits of co-ordination and cooperation through the supply chain, the role of competence and workforce engagement. In addition, a more strategic approach to intervention had been being developed by HSE, with early engagement with clients and designers before work begins on site making it "*easier to deal with issues if* [regulator / duty holder] *parties are talking early*".

HSE engaged with the London 2012 build even at the bid stage and through the early formation of the Interim ODA. HSE met with the Government Olympic Executive (GOE) to encourage them to use their influencing powers over ODA and the Olympic Board (OB) as the principal funders. The stated aspiration for London 2012 was to be 'an exemplar' so meetings convened by HSE after the bid sought clarification as to what this would mean, and picked up on CDM arrangements which, it was revealed, had not so far been addressed. HSE made clear its expectations of the client to lead in setting out its health and safety strategy and standards, and drive these through the supply chain. As referenced in Section 2.3, the ODA policy statement and common standards were soon established and were widely recognised to be powerful in setting the tone and material expectations of health and safety performance throughout the build. Reporting requirements through the OB and GOE made health and safety performance visible and the scrutiny increased the driver for ODA and construction teams.

This early engagement also provided HSE insight to the whole ethos of the bid and the UK's commitments to the International Olympic Committee (IOC). At an early stage, HSE made a director level appointment to provide its own lead on the regulator's London 2012 involvement, not just for the construction but Games, overlay and legacy as well, and a sequence of papers have kept the HSE Board informed of developments. They have also visited the site as a Board to look at the achievements and gain insight to the practices being adopted. Ministerial attention from HSE's parent department, the Department for Work and Pensions, was a particularly strong and positive influence, for example instigating a meeting with the Tier 1 Directors on a milestone interval without reportable injuries. If not reward, recognition was an important motivator even at the highest levels. Just as the Games were a showcase for the construction industry, so did they also draw international focus on the regulatory framework (and indeed parallels in terms of the international profile for sustainability are made equally in legacy papers).

HSE's Construction Division strategy[25] has for a number of years focussed on Ownership, Leadership, Partnership, particularly with public sector clients and major projects. The mantra was fitting for the ODA and early on HSE's Chief Inspector of Construction (later appointed as HSE's London 2012 Director) was invited to the Olympic Board Steering Group. He is reported to have said[8]

"We (HSE) see London 2012 as a way of leveraging improvements across UK construction. Delivery is crucial, this is a flagship project that can stimulate a step-change for the whole industry. The key components are a clear policy statement, a transparent organisation with mechanisms to deliver excellence, a process to change cultures so that health and safety really matters and through this to become a beacon of excellence."

The call was not just to do it safely but to rise to the Olympic and Paralympic ideals, and reflects the same motivation driving the ODA directors, to showcase what could be done and drive up standards by empowering those with direct control.

Once the ODA Director of Construction was appointed, HSE's Chief Inspector of Construction arranged the first of a number of direct meetings. This was built on with occasional phone calls in both directions to maintain the relationship without being a burden, but providing the opportunity for any health and safety or regulatory issues to be raised and ensuring the profile and emphasis was maintained. This account, drawn from HSE interviews for this research, directly parallels the ODA Director of Construction's own account of maintaining relationships with senior contractor executives.

HSE's operational approach reflected the Construction Division's strategy on major projects, with direct engagement with the client and delivery partner to secure leadership and a commitment to build an effective health and safety culture through the supply chain, competence and worker involvement. Central interventions were matched by early engagement with designers and contractors to review policies with senior project personnel and examine risk management strategies. The intervention approach was founded on Hampton principles[9] to make effective use of resource, be targeted and proportionate, and consistent. The focus was on tactical inspections on each site, at critical points for influencing health and safety, to test, by engaging with mangers and workforce representatives, that the plans are being implemented in practice and proving to be effective in controlling risks.

HSE provided clarity in its approach from the outset, publishing its intervention strategy (the current edition being a third revision)[10]. This not only made the expectations clear to the construction programme, it also provided the reference for HSE's critics – evidencing the

options for greater or lesser involvement, dependent on the programme's performance. The framework of legislation is goal-setting, making clear the standards to be achieved but leaving the selection of control measures to duty holders. The inspections were intended to audit the implementation of the contractors' own plans more than check for legal compliance, however where matters of evident concern were encountered necessary steps were taken, including enforcement action. This ensured the regulator was consistent, transparent and fair, as with the ODA philosophy, it did as it said.

As health and safety systems matured, constructive relationships were established and, as part of efforts to impress health and safety through the supply chain for remediation works, HSE was asked to present its approach and expectations. An incident at one stage showed that despite initial plans, management arrangements turned out not to be sufficiently robust to deal with the inherent uncertainties with this challenging work. The learning taken on board by HSE was for more follow up inspection to test that plans worked in practice – this learning and improvement, and its own challenge to do better, informed HSE's approach through the big build.

Having listened to the client and delivery partner arguments that developing the Olympic Park as separate projects significantly de-risked the build, HSE worked at length to ensure interfaces were clear[⌗⌗]:

"I recall very early on, the regulator was very keen to make sure the boundaries were managed appropriately, that there was absolute clarity on who was responsible for which areas and … looking back, I think that was fundamental to concentrating people's minds. It certainly was a big issue and very important that we had to get that right." (ODA Health and Safety Team member)

On one particular occasion during the build significant issues were identified by inspectors, pointing at system failings. The matter was escalated and the Chief Inspector sought an immediate meeting with ODA, CLM and contractor directors. He reported "*a straightforward honesty about that meeting"*. The openness in acknowledging the failings, responding to the imperative to do better with a commitment to reinforce Park-wide monitoring resources and improve site wide co-ordination and communication, served in turn to maintain the respect and trust between the regulator and duty holders. It also influenced the role of the Safety, Health and Environment Leadership Team (SHELT), with Director level representation, authority and then commitment to agree site-wide improvements. The cycle gives an example of HSE executing its proper challenge function and securing the duty holder's response. One interviewee confirmed that HSE tried to set the tone and reinforce what ODA and CLM were doing while also confirming that HSE too meant what it had said at the outset.

At the operational level HSE's Principal Inspector (PI) with the London 2012 construction portfolio actively engaged with central and project teams, including for example SHELT and health and safety fora, early on directly communicating HSE's plans and expectations and later sharing HSE's perspective of lessons learned enabling contractors to benefit from that expert insight. Similar site based talks were also given to IOSH member groups for whom travel to

[⌗⌗] Interviews with the central co-ordination team confirmed that at its peak over 600 handovers of land areas were live at one time. Controls became increasingly important in relation to buried services but also helped ensure access routes were confirmed before all bridge structures were in place. Despite practical frustrations, contractors universally acknowledged the need for a system to ensure safety and none identified a practical improvement.

local branch meetings was impractical. As a safety culture survey was instigated by ODA, the HSE PI was "*interested and supportive"* particularly encouraging a focus beyond measurement on improvement and progression. Involvement in supply chain briefings was felt to be particularly beneficial, helping ODA instil expectations before work began on site and practices need correction. Explicitly HSE saw itself "*lending regulatory support to ODA messages",* reflecting a common purpose. Although the London 2012 experience demonstrated the leverage when HSE supported client initiatives geared at performance improvement, it was the exceptional scale of the project that justified the resource.

On a project basis, HSE assigned individual Inspectors to specific venues or infrastructure sites and each worked with the relevant duty holders developing an intervention plan, in line with the overall strategy, with inspections principally at critical points in the build to maximise the value to all parties.

Internally HSE had its own systems and meetings to share insights between inspectors and help ensure consistency. Again this parallels centrally provided coordination of devolved CLM teams for the purposes of communication, coordination, continual improvement and consistency.

Each of the individual projects was a significant size, with experienced Tier 1 (principal) contractors and sophisticated management systems, making sampling challenging for inspectors coming to a changing site on an infrequent basis. HSE's own critique in this research recognised a tendency for hazard spotting on immediate issues to divert attention from delving into the efficacy of underpinning systems and this is a learning point for future projects. Similarly the effectiveness of aligning inspectors to the strategy and the ongoing sharing of lessons learned could have been stronger but this would have involved drawing in more line management resource and more interaction between teams to improve communications. However, with inspectors based in different offices with a wide range of other responsibilities in their areas a considerable amount was nevertheless achieved.

The HSE website[11] now includes case studies identifying good practice lessons for industry observed by inspectors as well as learning legacy research outputs. HSE's London 2012 team played an instrumental role in developing the learning legacy and funding projects. In addition a video dialogue between HSE's Chair, Judith Hackitt, and ODA's Head of Health and Safety, Lawrence Waterman, prepared as the big build concluded, describes HSE's role as one of 'critical friend' working with ODA to achieve its build objectives but ensuring health and safety standards were not compromised. The internet profile matches the ODA priority on communication and commitment to the wider learning legacy.

Whereas for major construction projects in the past, like the Channel Tunnel, HSE deployed a team of resident Inspectors, regulation of the London 2012 build has taken less resource but involved strategic engagement. The characteristics directly echo those the industry teams link to success, namely clarity of purpose and expectation, effective relationships, respect, collaboration, communication, a challenge to do better, transparency, fairness and consistency, trust and empowerment, and a framework of monitoring and assurance. There was alignment between HSE and ODA on the role of leadership and demonstrable success where timely HSE engagement at a high level led to project decisions and effective action cascaded through the supply chain. The whole approach therefore suggests itself for the regulation of other construction projects, not necessarily large in scale but where there is a client able to provide the essential leadership. One HSE interviewee described the effectiveness of the combined efforts of the ODA Head of H&S with a small team and the ODA Director of Construction in providing

the mechanisms and inspiration through the contract chain. Discussing health and safety, he described the Director as "*the most committed of all clients I've ever seen*".

It is notable that without the client lead HSE's involvement may need to have been more intrusive and demanding. However, by taking the lead the client was able to utilise the regulator to reinforce and provide import to its messages and requirements to advantage.

2.9 BUSINESS BENEFITS

A particular challenge for researchers across all disciplines has been the absence of a definitive comparator to assess the impact of the London 2012 approach. Such assessments are also confounded by the multiplicity of factors that were new, better, more or just different than normal practice would involve. When exploring the relative impact of even subsidiary areas (such as alternative communications on health and safety), the response tended to be that it was the cumulative effect that secured success and no one would venture what to drop or pursue in isolation.

One argument could be to look at the programme in aggregate and conclude that the successful outcomes flow from the combination of different measures put in place.

However, it is remarkable that success has been achieved in disparate areas (whether time, budget, safety, diversity etc.) across many different types of site with very different Tier 1 contractors and supply chains within which a degree of autonomy was given. This therefore points at success factors being all pervading in the way the programme was approached.

Turning the issues the other way, construction failures typically mean cost increase; schedule over-run; defective quality; injury/death; a fractious environment; project aspirations not being met; and/or reputational damage with the fundamental cause being a failure to control and manage. Those failures in turn are often attributed to poor project definition, problems not tackled, obstructive relationships, breakdown in communications, incompetence, late changes etc. As the research has shown, the London 2012 approach specifically sought to eliminate these potential failings by ensuring clarity, requiring openness and communication, remaining consistent and fair and so on. In that sense the mechanisms are subsidiary to these principles and it is these that can be deemed to have pre-conditioned success.

The resulting controls have led to business benefits as revealed from public domain information about the build, insight through this research and third party accounts in the legacy documents in terms of:

- Overall delivery on time and within budget – arguably the acid test
- Minimal re-work
- Complete handover documents to facilitate Park Operations, LOCOG and other facility users
- Clean and swift project completion and settlement of final accounts
- Minimal waste (to the extent the disposal contract had to be re-negotiated because of the low throughput)
- A safety record with an accident frequency rate below 0.17 (significantly below any construction norm and more akin to an all industry average)
- A productive workforce / a committed workforce / reduction in industrial relations issues
- High level of apprentices with a low drop-out rate

- Reduced programme risk
- Parties advocating some of the London 2012 processes and practices like early planning of close-out, better integration of material and product suppliers, and behavioural safety programmes in the ongoing business of their parent companies
- Innovations which have delivered cost savings and/or more sustainable solutions and with benefits cascading into future project and industry practices
- The build has been achieved with a workforce some 15-30% smaller than the range of initial estimates judged
- Consequent savings in just site logistics from fewer personnel movements of some £80million.

The last two points are particularly significant.

The successes and benefits in the delivery of London 2012, for the reputation of the individuals, companies and British industry, are evident. The characteristics of Respect, Trust, Clarity, Early engagement, Challenge, Consistency, Collaboration, Empowerment, Communication, Openness, Fairness, Assurance, and Motivation, are judged to be a rare combination, underpinning the effectiveness of key control processes and are therefore deemed to have pre-conditioned success.

APPENDIX A – INTERVIEW STRUCTURE – FOR CLIENT, DELIVERY PARTNER AND REGULATOR

Learning Legacy Research

Preconditioning for Success – Interview briefing document

Research Aim: To identify, understand and document the human and organisational aspects that have underpinned the success of the ODA construction programme

Research background – some key points:

- Complements other legacy work on what has been done by focusing on why in terms of underpinning human and organisational drivers and evidence of how these have 'preconditioned' success
- Examines the influence of individual and combined human factors, their origins and how they can be acquired or nurtured to secure and sustain good performance (examples relate to the attitudes, behaviour and interaction between people and the impact on the effectiveness of leadership, workforce involvement etc and ultimately construction success)
- The work takes a broad view of success – particularly health and safety and sustainability but also in terms of schedule, cost and quality
- The research team has gathered evidence by following venue and infrastructure close-out processes including lessons learnt sessions and collaboration with other legacy research teams to identify over-arching issues
- The research is populating a system model, looking at the interaction of human and organisational factors and the cascade through the client and contractor chain and different delivery processes
- Insight to things that have not worked well strengthens understanding of why others have so should not be avoided
- Recommendations will identify key influences on success and how they can be instilled or 'pre-conditioned' for future projects based on core principles

Research interview (1 hour)
Introductions – Interviewee - role, stage of involvement; Researcher – aim, model concept and scope of processes and human and organisational factors

Specific questions will be adapted to reflect the role and area of responsibility of each interviewee but broadly cover:

- How did you define success when you took up post – *may be a combination of contractual and individual goals*?
- What skills, processes and structures did you anticipate being needed? What formed those expectations?
- Which of these and what additions have driven or enabled successful delivery? What, in your view, influenced their implementation - *this may relate to human or organisational factors and the extent of take-up or degree to which impact was sustained*? What would you cite as evidence of their effect?

- Thinking about the principal challenges you/the build have faced, what were the key things you drew on to overcome them *(e.g. individual approach, mechanisms, systems)*? Which were more or less successful?
- How would you characterise the attitudes, behaviour and interaction between people at different levels associated with the London 2012 build in comparison with previous construction experience? If there are differences, can you identify specific underpinning influences – *may be a consequence of specific measures or related to London 2012 features specifically*?
- What features developed through the London 2012 build would you advocate transferring to future construction programmes? How would you argue the value and benefits?
- Thinking about the London 2012 performance on health and safety or sustainability specifically, are there any human and organisational factors in addition to those you have mentioned already that you see have had a bearing on success *(+ve/-ve)*?

Closing review and critique of the developing system model (including reference to interview responses) – which factors would you rate highly compared with other projects and where has their weight of influence been strongest – on you/your function and from you/your function?

Although responses should focus on the interviewee's experience this may include observations of parallel processes.

APPENDIX B - SIGNIFICANCE OF HUMAN FACTORS REVEALED BY THE LEARNING LEGACY DOCUMENTS

THE LONDON 2012 LEARNING LEGACY RESOURCE

Addressing one of the perennial failings of the UK construction industry (notably the inability to learn and transfer lessons from one project to another), the learning legacy commitment by ODA reflected principles within the London 2012 build of delivering best practice and providing a continual challenge to find ways to do things better. It also responded to a mandate from the Government's Public Accounts Committee. The web resource was launched in October 2011 setting out the ODA's commitment, by sharing the knowledge and the lessons learned from the construction of the Olympic Park, to help raise the bar across the industry and act as a showcase for UK plc. It comprises over 250 documents grouped into 10 themes:

- Archaeology
- Design and engineering innovation
- Equality and inclusion
- Health and safety
- Masterplanning and town planning
- Procurement
- Project and programme management
- Sustainability
- Systems and technology
- Transport.

The documents were prepared by the ODA, delivery partner and project teams in the form of brief **micro-reports** or more detailed **case studies** about learning and innovation[§§]. There are also **champion products** (although not reviewed here) which disseminate some of the tools and templates that have been adopted with success on the programme. **Research summaries** cover the studies undertaken by third parties, often co-funded with ODA by other industry stakeholders, provide a commentary on detailed aspects of performance and use the experience to try and advance the underpinning theories. (A companion research summary to this report is included under the health and safety theme.)

Although the production was necessarily centrally coordinated, the contents of the various outputs were authored independently from each other with central editorial functions limited to consistency in official terminology (e.g. in relation to the venues and Games). This research therefore included a task to read across the documents and look for evidence of the role of human and organisational factors on the different outcomes. The findings are summarised in this appendix.

[§§] **Micro reports**: Short examples of lessons learned, best practice and innovations from the construction programme by the ODA, Delivery Partner, contractors and industry partners.
Case studies: Peer reviewed papers on lessons learned, best practice and innovations from across the Programme by ODA and the Delivery Partner, contractors and industry

REVIEW IMPLICATIONS

The over-riding conclusion is the remarkable consistency with which important characteristics for pre-conditioning success revealed in the primary research (such as early engagement, culture, trust etc) come through in the diverse documents, often almost as asides and despite very technical titles or focus. Despite different research methods, evidence sources, timing, foci etc, the findings are consistent and broadly interchangeable.

Of course, links between successful outcomes and a collaborative culture (as an example) are not proved categorically in the confines of short papers and more reflect the belief and observations of the authors. They in turn were often working in environments where, in this example, the importance of collaboration and culture were continually reinforced perhaps suggesting the significance. However, the authors should be recognised as the subject matter experts in their areas having generally worked with the issues they describe for the London 2012 build over a period of months and years. They are experienced professionals whose learning legacy contributions should be seen in the context of wider experience in other contexts through their careers. The authors, from the evidence in other parts of their papers, were also willing to be critical, either directly or indirectly, to ensure lessons learned included the avoidance of pitfalls not just adopting the successes. Were authors ambivalent, remaining silent would have been an option, particularly with tight constraints on space (i.e. two pages including headers and illustrations in the case of micro-reports). These points, taken together with the fact that the documents were produced quite separately, mean that the explicit and repeated references to many of the pre-conditioning for success characteristics is considered to carry some weight in supporting our research findings.

The maturity of the industry's approach in the different areas varied. Health and safety as a priority was already well established with the call for early engagement, strong (client) leadership, communication and cooperation, worker involvement and so on being familiar and reflected in the statutory CDM regulations and the entreaties of the regulator. In contrast, although the virtues of equality and inclusion, links to art and culture, aspects of sustainability such as biodiversity and sustainable sourcing, and so on, were recognised they were not universally understood in terms of practical delivery. It is therefore striking that across these newer areas success is similarly linked to the lead from ODA, the steps to bring clarity to the expectations, the communication through the supply chain, collaborative working, rigorous assurance processes etc, etc. The observations come from both getting it right on the London 2012 build and identifying improvements for future projects. They are the conclusions of different teams focused on distinct parts of the construction agenda. Their brief was not to comment on these specific issues; instead they have spontaneously identified the features they believe underpin success in delivering their assigned priorities.

The consistency with which these characteristics have been identified as being crucial gives a very powerful demonstration of their role in delivering successful construction outcomes (whether time, cost, quality, health and safety, sustainability, diversity etc). Furthermore, far from being piecemeal measures to tackle aspects of performance, it is evident that ensuring clear leadership, effective communications, worker involvement and so on, supported by appropriate management systems can deliver a multiplicity of inter-related benefits.

A finding from this review is the universality of the human and organisational factors leading to success across a wide range of construction objectives. An important conclusion is that many of the characteristics being promulgated in the health and safety arena are self-evidently not specific H&S devices. Those being advocated in relation to health and safety (e.g. legacy

document R2 on safety culture or R5 on leadership and worker involvement) are reported equally powerfully in relation to quality (M10) or sustainability (C31). Research summarised in R9 relates to the construction management and focuses on similar success factors echoing the themes identified by the ODA and delivery partner themselves (for example, C23). Where these authors have chosen to identify underlying enabling factors which they consistently show links to the human and organisational factors. Reading the documents, the construction objectives health and safety, quality, sustainability etc could be interchanged between the papers.

Finally, there is a striking reference in C39 (a transport legacy document) to six values "*London 2012 defined [which acted] as guiding principles and a frame of reference for the way in which the two primary delivery bodies (ODA and LOCOG) operated and how their employees behaved*":

- Inspirational
- Open
- Respectful
- Team
- Deliver
- Distinctive

Somewhat surprisingly these were not mentioned directly during the primary research but they clearly reflect the characteristics identified on the ground in terms of leadership, transparency, respect, collaboration, challenge to do better, innovation and so on. The legacy review has therefore brought a neat closure and conclusion to the characteristics observed.

REVIEW APPROACH

The approach taken in this part of the study was to review the micro-reports, case studies and research summaries in turn and identify extracts where the authors had independently linked their findings to the characteristics that had emerged as being important in our primary research.

The purpose of the presentation in this appendix is to demonstrate the number and variety of cases where the characteristics appear and to demonstrate the way the characteristics were manifested. It is also important to provide a route to the source documents so the full context can be understood. This is complicated because of the large number of outputs and their applicability often to more than one of the 10 learning legacy themes. Two tables therefore provide the links and source documents are referenced M1, M2 etc for micro reports, 'C' for case studies and 'R' for research summaries. Table 3 provides a cross-reference to the document title and authorship, type (e.g. micro-report) and the London 2012 learning legacy theme(s) to which each is related and where it can therefore be located on the website. Table 4 uses just the abbreviated reference but identifies which of the human and organisational factors drawn out in the main report are evidenced within the document. The main body of the appendix then goes on to examine each characteristic in turn. Table 4 is also useful as a basis for further research. Looking down the columns it enables documents reflecting given characteristics to be located. Looking across the rows, papers with strong coverage of multiple themes (and thus their interaction) can be seen.

It should be noted that although the present authors have endeavoured to be thorough, the omission of a legacy output (as summarised in Table 4) does not necessarily mean it did not imply some link to one of the characteristics linked to success. Furthermore, even where a

document is included it could be that links to some of the characteristics have been missed. However, where quotes are included they do reveal a clear and specific link and so the table presents a minimum evidence base from the learning legacy outputs supporting the human and organisational factors suggested here to have pre-conditioned success.

In the sections which follow, short extracts and quotes (italicised) from the legacy documents are presented against some of the key characteristics and organisational mechanisms to illustrate this. The sections relate to the column heading in Table 4 and are presented in the same order. A short introductory text summarises how the characteristic appeared in the reference documents and the tables provide the supporting evidence. These summary paragraphs could be read in isolation to get an overview of the coverage – the tables provide supporting insight and illuminate the issues raised. Where only a subset of the relevant quotes identified is given, those chosen reflect the breadth of activities. Any quote is only used once, but a further feature is how often the links between the factors are revealed by the phrases used (e.g. relationships to collaboration to culture etc). The title of the source document is given to provide an indication of the context, together with the shorthand reference adopted in Table 3 so the source can be located on the London 2012 Learning Legacy website. Given the volume of material the extracts are limited and simply provide a pointer to the issues raised. Readers should consult the source documents for the full and accurate context.

Table 3 Legacy documents reviewed in this study with reference scheme and source

Ref	Title of selected learning legacy outputs	Theme http://learninglegacy.london2012.com/themes/									
		Archaeology	Design and engineering innovation	Equality and inclusion	Health and safety	Masterplanning and town planning	Procurement	Project and programme management	Sustainability	Systems and technology	Transport
Micro reports											
M1	The archaeological challenge	X									
M2	Built heritage recording	X									
M3	Archaeological community work	X									
M4	The Roman Road	X									
M5	The evolving landscape of the Olympic Park	X									
M6	Industry in the post-medieval to modern period – Excavations at Temple Mills	X									
M7	Geoarchaeology	X									
M8	The discovery of a 19th century boat	X									
M9	Crossing Stratford High Street		X								X
M10	Promoting quality during the Build		X					X			
M11	Working together to prevent cable damage		X		X						
M12	Assessing the sustainability of pavement design solutions		X						X		
M13	Improvement in occupational health: a Velodrome case study		X								
M14	Olympic Infrastructure Technical Approval Authority		X								X
M15	Sustainable material use in paving and seating		X						X		
M16	Implementation of the PVC policy		X						X		
M17	Primary Foul Sewer value engineering		X								
M18	Complementary engineering and architecture of the Primary Foul Water Pumping Station		X								
M19	Ensuring quality construction for the Olympic Park		X								
M20	Restoring the Olympic Park waterways		X						X		
M21	Managing the demolition of Angel Lane bridge		X								X
M22	Developing a family of bridge designs		X								
M23	Olympic Park site ground investigation – innovative approach to drilling		X								
M24	The Olympic Park bridge abutments and retaining wall facings		X						X		
M25	Utilities resilience and capacity on the Olympic Park		X								
M26	Treating Japanese Knotweed on the Olympic Park		X						X		
M27	Renovation of The Greenway Pedestrian Cycle Track		X								
M28	Habitats for birds and bats on the Olympic Park		X						X		
M29	Designing river edges in the Olympic Park		X								
M30	Biodiversity Action Plan: Securing ecology objectives for the Olympic Park		X						X		
M31	Olympic Park lighting design		X								
M32	Integrating trees and utilities within the Olympic Park		X								
M33	Lighting the Olympic Park main arenas		X								
M34	Eradicating invasive weeds during the construction of the Olympic Park		X						X		
M35	Olympic Park training and apprenticeships strategy		X								
M36	Outfall design optimisation to meet multi-stakeholder objectives		X								
M37	Irrigation system for the Olympic Park		X								
M38	Sustainable procurement			X			X				
M39	Impacting change – a fresh approach to the successful delivery of employment and skills			X							

Ref	Title of selected learning legacy outputs	Theme http://learninglegacy.london2012.com/themes/									
		Archaeology	Design and engineering innovation	Equality and inclusion	Health and safety	Masterplanning and town planning	Procurement	Project and programme management	Sustainability	Systems and technology	Transport
M40	Using an awards process to change behaviour and performance			X	X						
M41	Leadership, governance and engagement			X							
M42	The Community and Trade Union Learning Centre			X							
M43	Negotiating the Citizens Agenda for Wages, Training and Employment			X							
M44	Building for success – Apprentice Plus programme			X							
M45	Diversity training contributed to a culture of inclusion on the Aquatics Centre Project			X							
M46	Attracting historically underrepresented talent			X							
M47	Positioning Equality, Diversity and Inclusion alongside Health and Safety			X	X						
M48	Training in partnership:			X							
M49	Embedding diversity in the supply chain			X							
M50	Priority themes captured in planning conditions and obligations				X	X			X		
M51	Temporary bridges				X						
M52	Using free-standing pins to reduce the health and safety risk to buried services				X						
M53	Suction excavation reduced risk of cable strikes				X						
M54	Quick hitch – management and safe use				X						
M55	Benefits of using Visual Standards				X						
M56	Health and Safety risk profiling				X						
M57	Reducing trip hazard during construction of steel reinforcement concrete slabs				X						
M58	Riser platforms and protection floor penetrations				X						
M59	International Broadcast Centre/Main Press Centre – selecting the safest materials				X						
M60	Monitoring risk of hand arm vibration injury				X						
M61	Occupational health – The combined approach of both clinical and prevention teams				X						
M62	Impact of design change on occupational health risk				X						
M63	Asbestos in soil – keeping the work going				X						
M64	Reducing hazards of installing gabion walls				X						
M65	The lowering of mobile elevated working platforms in an emergency				X						
M66	Manual handling – reducing muscular-skeletal injuries				X						
M67	Welding – identifying the right level of control				X						
M68	Effective delivery of transport mitigation measures: the Olympic Park Transport and Environmental Management Scheme					X					X
M69	The town planning client role					X					
M70	Developing wider community engagement for arts projects by working with a series of partners					X					
M71	Design solution for enhancing a functional security fence					X					
M72	Artistic development and exploration					X					
M73	Integrating art into the Olympic Park					X					
M74	The View Tube community facility					X					
M75	Using art to tell the story of the Olympic Park					X					
M76	Effective management of masterplan changes					X					
M77	Managing remediation planning conditions					X					
M78	e-Evaluation tool – Award						X				

Ref	Title of selected learning legacy outputs	Theme http://learninglegacy.london2012.com/themes/									
		Archaeology	Design and engineering innovation	Equality and inclusion	Health and safety	Masterplanning and town planning	Procurement	Project and programme management	Sustainability	Systems and technology	Transport
M79	Using CompeteFor to drive competition in the supply chain						X				
M80	Driving best practice procurement processes with eSourcing tools						X				
M81	ODA/CLM approach to Baseline Control and Contingency Management							X			
M82	Approach to Anticipated Final Cost							X			
M83	Integrated planning for the London 2012 Programme							X			
M84	Monitoring and control of delivery at the ODA							X			
M85	Using Earned Value/stable baselines with NEC Contract projects							X			
M86	Managing risk across the Olympic programme							X			
M87	Assuring the sustainability of the 2012 Programme – a world first								X		
M88	Project FSC certification – assuring legal and well managed timber								X		
M89	NoWaste Lean Construction training programme								X		
M90	Non-potable water supply for construction								X		
M91	Permit to Proceed Assurance, protection of remediation works								X		
M92	Transport of construction materials by sustainable means								X		
M93	The control of noise during construction								X		
M94	Minimising potential nuisance dust from around a construction site								X		
M95	Responsible sourcing of the copper cladding on the Handball Arena								X		
M96	Rainwater harvesting at the Velodrome								X		
M97	Manifold system for construction waste water discharges to sewer								X		
M98	Flood Risk Compliance Procedure								X		
M99	Reducing the Aquatics Centre's water consumption								X		
M100	Silt prevention for road surface water drainage								X		
M101	Lagoon system for waste water deposition and reuse for road sweeping								X		
M102	Waste Recovery Licences								X		
M103	Achieving the Part L target at the Aquatics Centre								X		
M104	The Velodrome, the most energy efficient venue on the Olympic Park								X		
M105	Coordinating installation of superfast broadband at the Athletes' Village									X	
M106	Using an integrated CAD model for design coordination									X	
M107	Site investigation data management for earthworks and remediation design									X	
M108	3D model creation and its use on the Olympic Park									X	
M109	Web-based spatial data viewer									X	
M110	Web-based photograph viewer									X	
Case studies											
C1	Environmental analysis	X									
C2	Artefactual evidence	X									
C3	Promoting biodiversity in the Olympic Parklands		X						X		
C4	Olympic Parklands Green Infrastructure		X						X		
C5	Olympic Park soil strategy		X								

Ref	Title of selected learning legacy outputs	Theme http://learninglegacy.london2012.com/themes/									
		Archaeology	Design and engineering innovation	Equality and inclusion	Health and safety	Masterplanning and town planning	Procurement	Project and programme management	Sustainability	Systems and technology	Transport
C6	Translocation of habitats and species within the Olympic Park		X						X		
C7	The planting strategy for the Olympic Parklands		X								
C8	Demand-led skills provision, including National Skills Academy for Construction status			X							
C9	Targeted approaches to equality and inclusion			X							
C10	London 2012 Apprenticeship Programme			X							
C11	Workforce monitoring and reporting			X				X			
C12	Equality, Inclusion, Employment and Skills – process and systems case study			X							
C13	Equality, Inclusion, Employment and Skills – leadership and strategy			X							
C14	Jobs Skills Future Brokerage			X							
C15	Food and sustainable sourcing: Feeding the construction workforce				X						
C16	Innovation in creative community engagement					X					
C17	Striking the balance: commissioning artworks in public spaces					X					
C18	The value of external experts for guiding choice on arts commissions					X					
C19	Stratford City Consultative Access Group: Inclusive access and design					X					
C20	The role of the Olympic Delivery Authority as promoter and planning authority					X					
C21	The procurement and use of sustainable concrete on the Olympic Park						X		X		
C22	Supply Chain Management – Insolvency Management						X				
C23	The ODA's Delivery Partner approach – Creating an integrated framework for mutual success						X	X			
C24	Programme assurance on the Olympic Delivery Authority construction programme							X			
C25	Carbon reduction in transport management								X		X
C26	The Olympic Park water strategy								X		
C27	The Olympic Park Waste Strategy: Development and Implementation								X		
C28	Demolition Waste Management on the Olympic Park								X		
C29	Designing out waste on the Olympic Park								X		
C30	Construction waste management on the Olympic Park								X		
C31	The role of the construction supply chain in delivering sustainable solutions on the Olympic Park								X		
C32	Collaboration with environmental regulators and statutory stakeholders								X		
C33	Delivering the Olympic Park Biodiversity Action Plan								X		
C34	The Olympic Park Energy Strategy								X		
C35	Reducing embodied carbon through efficient design								X		
C36	Transport Knowledge Management									X	X
C37	Systems Integration: A programme-wide approach to systems delivery									X	
C38	Engineering content management and collaboration system deployed by ODA Delivery Partner									X	
C39	Implementation of BS8901 sustainability management systems for events										X

Ref	Title of selected learning legacy outputs	Theme http://learninglegacy.london2012.com/themes/									
		Archaeology	Design and engineering innovation	Equality and inclusion	Health and safety	Masterplanning and town planning	Procurement	Project and programme management	Sustainability	Systems and technology	Transport
Research summaries											
R1	Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village				X						
R2	Safety culture on the Olympic Park				X						
R3	Supply chain management for health and safety				X						
R4	Occupational health provision on the Olympic Park and Athletes' Village				X						
R5	Leadership and worker involvement on the Olympic Park				X						
R6	Communication and action for a safer London 2012 Olympic and Paralympic Games				X						
R7	The Construction (Design and Management) Regulations 2007: duty holder roles and impact				X						
R8	The arts and cultural strategy for the Olympic Park					X					
R9	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme							X			
R10	Working to the Code on the Athletes' Village								X		
R11	Development and use of BREEAM for Olympic Park venues								X		
R12	Innovation in timber supply for London 2012								X		
R13	Data handover from project delivery into operations									X	

Table 4 Themes identified in legacy documents (refer to Table **3** for details)

Ref	Characteristic or feature raised within legacy documents																		
	Respect	**Relationships**	**Trust**	**Clarity**	**Collaborative**	**Communicative**	**Challenged to do better**	**Transparency/Openness**	**Innovation**	**Just**	**Consistency**	**Assured**	**Early / Pre-emptive**	**Leadership**	**Culture**	**Empowering/Goal setting**	**Worker engagement**	**Business benefits**	**Reward & recognition**
Micro reports																			
M3		X				X													
M7							X												
M9						X			X				X						
M10	X			X	X	X			X				X	X	X	X	X	X	X
M11				X	X	X					X	X	X					X	
M12				X		X							X					X	
M13		X			X	X					X				X	X		X	X
M14			X	X	X				X		X	X						X	
M15					X		X		X				X					X	
M16				X	X		X		X			X							
M17				X	X		X					X	X					X	
M18					X				X									X	
M19				X	X	X	X	X			X	X	X	X	X	X	X	X	X
M20				X	X		X		X				X						
M21					X	X						X	X			X		X	
M22				X	X	X				X			X						
M23									X										
M24				X	X		X	X	X		X								
M25																		X	
M26				X	X	X													
M27						X							X						
M28					X	X			X				X	X					
M29				X	X	X						X							
M30				X	X			X	X			X	X						
M31											X		X					X	
M32					X		X												
M33					X								X					X	
M34				X	X	X					X	X	X						
M35		X			X	X							X	X				X	
M36					X													X	
M38				X					X	X	X	X	X						
M39	X	X	X	X	X	X	X			X		X		X	X	X			
M40				X	X	X	X		X	X		X		X	X				X
M41	X					X	X				X		X	X	X		X	X	
M42	X				X													X	X
M43		X		X	X			X			X	X		X				X	
M44					X	X	X		X		X							X	
M45	X					X	X				X			X	X		X	X	
M46		X		X	X	X													
M47	X			X		X	X				X	X	X		X			X	
M48				X	X		X		X									X	
M49				X	X	X	X	X				X	X	X	X	X		X	
M50				X				X				X	X						
M51							X						X					X	
M52							X											X	
M53							X											X	

Ref	Characteristic or feature raised within legacy documents																		
	Respect	Relationships	Trust	Clarity	Collaborative	Communicative	Challenged to do better	Transparency/Openness	Innovation	Just	Consistency	Assured	Early / Pre-emptive	Leadership	Culture	Empowering/Goal setting	Worker engagement	Business benefits	Reward & recognition
M54				X		X	X	X			X			X				X	
M55				X	X	X	X			X	X	X			X		X	X	X
M56				X	X	X	X	X				X	X		X				
M57									X									X	
M58				X			X											X	
M59					X		X		X	X	X		X					X	
M60							X		X								X		
M61					X	X	X		X								X	X	
M62					X		X		X									X	
M63						X					X	X						X	
M64							X		X									X	
M65							X												
M66					X	X	X	X	X					X	X		X	X	
M67					X		X											X	
M68				X	X						X	X						X	
M69		X									X							X	
M70					X										X				
M71					X			X										X	
M72				X		X											X		X
M73													X						
M74					X														
M76				X									X						
M77				X	X				X		X		X						
M78																		X	
M79												X							
M80											X							X	
M81				X				X				X			X				
M82												X	X						
M83					X	X	X				X	X			X			X	
M84	X										X	X		X	X				
M85							X	X					X		X				
M86								X				X	X		X				
M87		X	X			X		X			X	X	X						
M88						X	X					X						X	X
M89					X	X	X				X					X	X	X	X
M90							X						X					X	
M91				X		X					X		X						
M92				X															
M93	X			X				X				X						X	
M95					X									X					
M98								X			X		X						
M102				X	X														
M103												X							
M104					X		X	X	X			X		X				X	X
M105				X	X						X		X						
M106				X	X	X					X	X	X						
M107						X					X	X		X					
M108											X		X					X	
M109			X	X		X		X					X					X	
M110									X									X	

Ref	Characteristic or feature raised within legacy documents																		
	Respect	Relationships	Trust	Clarity	Collaborative	Communicative	Challenged to do better	Transparency/Openness	Innovation	Just	Consistency	Assured	Early / Pre-emptive	Leadership	Culture	Empowering/Goal setting	Worker engagement	Business benefits	Reward & recognition
Case studies																			
C3				X	X		X				X	X	X						
C4					X	X	X	X			X			X				X	
C5					X							X	X		X				
C6													X						
C7		X			X							X	X						
C8		X			X		X			X		X		X		X		X	
C9	X			X	X	X	X	X						X	X	X	X	X	
C10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	
C11				X		X		X		X	X	X							
C12	X	X		X	X	X	X				X	X	X	X	X	X	X	X	
C13	X	X		X	X	X	X	X			X	X		X			X	X	
C14		X		X	X	X	X	X	X		X	X		X		X			
C15				X	X	X	X							X		X	X		
C16		X		X															X
C17		X																	
C18	X	X											X						
C19					X	X	X		X				X	X				X	
C20				X	X			X					X	X	X				
C21				X	X	X	X		X	X	X		X	X					
C22		X			X						X	X	X					X	
C23		X	X	X			X		X			X	X	X	X	X			
C24					X		X	X		X		X	X		X				
C25									X										
C27				X			X												
C28				X	X		X		X				X						
C29				X	X	X	X						X						
C30				X	X	X	X		X		X		X			X		X	X
C31				X	X	X	X		X			X	X	X	X	X		X	
C32	X	X		X	X	X			X				X					X	
C33					X						X	X		X		X			X
C35													X						
C36	X					X			X		X		X	X	X	X		X	
C37							X	X			X	X	X	X		X		X	
C38					X				X		X		X		X				
C39											X	X			X				
Research summaries																			
R1				X		X	X		X		X	X		X	X	X	X		X
R2	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X
R3		X		X	X	X	X	X				X		X		X	X	X	X
R4					X	X					X	X	X	X	X		X		X
R5	X	X		X	X	X	X			X	X	X		X	X	X	X	X	X
R6		X		X	X	X						X	X	X	X	X	X		X
R7					X		X				X	X	X	X	X	X	X	X	
R8					X		X						X	X					
R9		X	X	X	X	X	X	X	X				X	X	X	X	X		
R10					X	X	X						X						
R11					X														
R12				X	X		X		X			X		X					
R13				X		X	X				X	X	X						

ANALYSIS OF PRE-CONDITIONING CHARACERISTICS AND RELATED FACTORS

Respect

Respect is a term used explicitly in relation to the equality and inclusion priority theme. It is similarly associated with health and safety, particularly flowing from the industry initiative with the 'Respect for People' strap-line[20]. On the London 2012 build it was also used to promote quality. As in the primary research interviews, the documents also imply the respect between parties based on mutual recognition of their competences and experience. Furthermore the evident consideration of the local community on whom the construction work impacted and the approaches to engage and listen reveal a further dimension of respect. Understanding and respecting the differences between professions was critical to providing meaningful and effective technical systems.

Quote / Extract - Respect	Legacy document title and reference	
Categories of ED&I include[ed]: - ***fairness and respect***	Positioning Equality, Diversity and Inclusion alongside Health and Safety	M47
...their skills, enthusiasm and commitment have ***helped change some deep-seated attitudes*** *towards women in the construction workplace and helped generate even more opportunities for women on the Park and Athletes' Village.*	London 2012 Apprenticeship Programme	C10
it was important in terms of overall safety that all individuals felt valued, so the ***messages about respect*** *and well-being of others was also important* *Supervisors and managers needed to understand what was required to manage difference, and importantly,* ***how to create an environment of respect*** *and team-work.*	Equality, Inclusion, Employment and Skills – process and systems case study	C12
Managers and supervisors had ***fostered an attitude of respect***	Safety culture on the Olympic Park	R2
…..running ***campaigns promoting respect*** *for everyone across the Park;*	Targeted approaches to equality and inclusion	C9
….respecting the work of others *A* ***'Be Respectful' initiative****: It's your work… protect it; It's their work…. respect it.*	Promoting quality during the Build	M10
Encouraging and promoting a positive and inclusive work environment is crucial to developing a more diverse workforce and ***creating a culture of integrity and respect****.* *'****Respect for People'*** *was an innovative training programme…..*	Diversity training contributed to a culture of inclusion on the Aquatics Centre Project	M45
57 per cent [overall 72 per cent of operatives] saw ***changes*** *to the way in which people worked with and related to each other since the respect for people sessions/toolbox talks.*	Leadership, governance and engagement	M41
Companies on the Park consistently recognised the value and importance of workers.....Management consistently recognised that the ***workforce was their biggest asset*** *and conveyed this message to workers.* *To help* ***gain the respect of the workforce****, as well as their interest, the campaign initiative was then launched by someone workers felt they could relate to* *The ODA was a supporter of the strategic forum,* ***Respect for People – Code of Good Working Health and Safety Practices****.*	Safety culture on the Olympic Park	R2
ODA and DP ...recognised that their ***appointed contractors were amongst the best in the field*** *and it was vital to tap into their expertise and initiative*	Leadership and worker involvement on the Olympic Park	R5
All staff interviewed highlighted that the ***experience and knowledge*** *of colleagues on both sides [project and regulators] helped to create good working relationships.*	Collaboration with environmental regulators and statutory stakeholders	C32
*Contractors were also required to register with the Considerate Constructors Scheme …...****being a good neighbour*** *to both businesses and residents was an integral part of that commitment*	The control of noise during construction	M93

Quote / Extract - Respect	Legacy document title and reference	
*..research pointed to the **low esteem in which construction was held** by some communities. A targeted promotion reflecting the positive case studies of people working on the Park to those communities may have had a significant impact.*	Targeted approaches to equality and inclusion	C9
*....during the London 2012 Olympic and Paralympic Games and after...These two areas **needed to work together and be respected**. Each side therefore needed to justify their views in an accessible way that considered all the needs without ever compromising the core values for the art commissions*	The value of external experts for guiding choice on arts commissions	C18
*When bringing together the disciplines of CAD and GIS, one of the major challenges faced was the **difference in characters** of each field. CAD users tend to be engineers, highly technical, with a focus on accuracy. CAD users are not usually well versed in dealing with large geographical areas, instead focusing on small areas. The field of GIS, on the other hand, is predominantly populated by geographers, excellent at spotting patterns and dealing with large areas, but not as well versed in version control and design.*	Transport Knowledge Management	C36

Relationships

Relationships are a pre-requisite of collaboration and inextricably linked with communications on different levels. Legacy documents refer repeatedly to the importance of the relationships with stakeholders on a whole range of issues either explicitly or implicitly somtimes expressed in terms of engagement or contact. The importance of relationships both formally and informally, corporately and between individuals, through the supply chain and at different levels is also identified as a key enabler for making progress or unlocking challenging situations.

Quote / Extract - Relationships	Legacy document title and reference	
*An important lesson in establishing the JSF Brokerage, which is a consistent theme throughout the London 2012 construction programme, is the **inestimable value of building and sustaining effective working relationships with a broad range of partners, stakeholders and funders**. This includes local, regional and national organisations and local political representatives and government departments.*	Jobs Skills Future (JSF) Brokerage	C14
*Including the key stakeholders from the ODA, the London Organising Committee of the Olympic Games and Paralympic Games (LOCOG) and the Olympic Park Legacy Company (OPLC) also meant that those involved in delivering the project **felt a buy-in from the start**.*	The value of external experts for guiding choice on arts commissions	C18
*...**build relationships with, and provide a central interface for**, key stakeholders*	The town planning client role	M69
*It was essential that SCM **engaged with industry and key stakeholders formally and informally** at the earliest opportunity.*	Supply Chain Management – Insolvency Management	C22
*Engagement with wider stakeholders: **Good engagement** with wider stakeholders such as local and regional non-governmental organisations ensures that specific stakeholder issues are considered as part of the assurance process.*	Assuring the sustainability of the 2012 Programme – a world first	M87
*The team **established positive relationships** with contractors Robust and effective working relationships were fostered with a number of colleges and training providers....**success** of the ODA's 'Skills Show Case' events....**bears testimony to these productive relationships**.* *The **relationship** between NSAfC, the ODA and Athletes' Village has proved to be a **highlight of the programme**.*	London 2012 Apprenticeship Programme	C10
….challenge was as much about delivering people as it was about delivering venues and infrastructure *…while the **informal relationships** between the two teams were*	Equality, Inclusion, Employment and Skills – leadership and strategy	C13

Quote / Extract - Relationships	Legacy document title and reference	
happening, it was at the behest of individuals to make the alignments		
*It was **critical** to the success of the project for the ODA and its contractors to have **good working relationships with the key environmental regulators** such as the Environment Agency (EA). Relationships also developed **between regulatory stakeholders and site teams**, rather than simply via a top-down approach. Co-location of different regulators also helped to facilitate an understanding of each others' expectations of the project, avoiding conflicting regulatory requirements.* ***Developed strong working relationships and a collaborative approach**, leading to:–more effective use of time and meetings;* *–effective arrangements for managing the environment, …;* *–detailed technical input from regulatory and planning representatives, who helped develop strategies, plans and designs..*	Collaboration with environmental regulators and statutory stakeholders	C32
*London Citizens **developed a positive working relationship** with the ODA*	Negotiating the Citizens Agenda for Wages, Training and Employment	M43
***Building good relationships** with a wide variety of work placement groups and support organisations also helped to increase diversity.*	Attracting historically underrepresented talent	M46
*The successful outcome of the project is **in no small part driven by the success of the client and Delivery Partner relationship**.* ***Culture and relationships have been a defining point for the success on this project.*** *[DP tendering via competitive dialogue]....this exercise networked the proposed executive teams from the bidders with the ODA executive and enabled an early assessment of **the relational compatibility and behavioural alignment** of the teams.* *NEC3 form of contract which helped define behaviours from the outset. Leadership and organisational structure also helped to establish the right cultures and behaviours and foster an **open, honest and communicative relationship** with an appropriate level of commercial tension.*	The ODA's Delivery Partner approach – Creating an integrated framework for mutual success	C23
*…the DP sought to define its role, establish a modus operandi and **build personal relationships**.* *Proactively getting 'the right person in the right position' was cited on many occasions as critical to **fostering the right working relationships** and embedding the open, collaborative culture.* *.....the rationale[for facilitating working with familiar partners] being **that the value of established personal relationships** in resolving problems and issues outweighed any loss of competitiveness in bidding*	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme	R9
*Regular site visits by the meadow designers, **good working relationships** and communication between client, design teams, specialist advisers and contractors was vital.*	The planting strategy for the Olympic Parklands	C7
*The ESMs were integrated into the Venue Project team and able to **build relationships throughout the supply chain**, a key learning point which has since been adopted by the NSAfC National team.*	Demand-led skills provision, including National Skills Academy for Construction status (NSAfC)	C8
*As this meeting was attended by all contractors on site, it allowed a **direct relationship with Tier Two and Three contractors** who may have only been on the Park for a few weeks to be established*	Improvement in occupational health: a Velodrome case study	M13
*A strong communication strategy, both in terms of contractual requirements and **nurturing relationships**, made this happen*	Impacting change – a fresh approach to the successful delivery of employment and skills	M39
*Venue leaders across the Park developed **good working relationships** (providing opportunities to discuss standard expectations on site, and sharing good practice) through the SHELT forum.* *Companies worked hard to dispel the 'them and us' culture and build **good working relationships**.* *.....allowing workers to work together over an extended period of time, to develop **good working relationships*** *Strong, **positive working relationships** had developed*	Safety culture on the Olympic Park	R2

Quote / Extract - Relationships	Legacy document title and reference	
*At an organisational level, there was an emerging feeling from the Tier One contractor, for example, of **a two-way relationship with the ODA** in terms of the development of health and safety procedures and systems.*	Supply chain management for health and safety	R3
*ODA and DP also maintained close contacts with the most senior leaders in contractor organisations…. and would **use these relationships if they felt those on site were not sufficiently responsive.***	Leadership and worker involvement on the Olympic Park	R5
*Health and safety managers achieved **credibility through the relationships they established with the workforce***	Communication and action for a safer London 2012 Olympic and Paralympic Games	R6

Trust

The expressions of trust in the legacy documents have many facets whether between the project and external stakeholders or within and between teams and across diverse aspects of delivery. Some documents draw it out in terms of overall performance; some link it to specific issues like integrating 'new' technologies. Its significance from the outset and capacity to develop are highlighted and interaction with communications, trust, fairness, openness, collaboration and confidence are all suggested.

Quote / Extract - Trust	Legacy document title and reference	
*Those involved had knowledge and experience …...Without the **resultant credibility and trust** established among the main stakeholders, it is unlikely that the outcomes would have been so positive.*	London 2012 Apprenticeship Programme	C10
*NEC3 ... was chosen as it reflected the ambition of the organisation to operate an **environment of mutual trust** and cooperation which was a key principle of the contract*	The ODA's Delivery Partner approach – Creating an integrated framework for mutual success	C23
*..**a large degree of trust** was built up between the OITAA and the Host Boroughs.* *This **trust was further enhanced** as the OITAA was available to respond to site queries from both contractor and supervising staff.*	Olympic Infrastructure Technical Approval Authority (OITAA)	M14
*Successful delivery – three Ts: Team, Targets, **Trust***	Impacting change – a fresh approach to the successful delivery of employment and skills	M39
***Developing trust early between bodies being assured and the assurance body is crucial**, ensuring the process produces better outcomes*	Assuring the sustainability of the 2012 Programme – a world first	M87
*….. buy-in to new technologies and methods of working. This **required mutual trust and transparency**, achieved through good ongoing communication between all team members.*	Web-based spatial data viewer	M109
*reward and recognition…. methods **helped instil trust and respect** and demonstrated fairness to all.*	Safety culture on the Olympic Park	R2
*Informal weekly ODA-DP management meetings were set up to foster openness and collaboration. As a result, **trust and confidence built up between key individuals** from each organisation.* *....process learning, …..**as familiarity and trust developed**.*	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme	R9

Clarity

The benefits of clarity (and particularly early clarity) come through repeatedly across the legacy areas. This can be clarity in terms of requirements and standards to be applied or the priority accorded by the client. Through running themes are the power of the planning obligations and

Section 106 agreements in defining delivery, the crucial role of contracts in formalising expectations, and the contribution of strategy documents and supporting standards particularly in priority theme areas to clarify potentially more nebulous or unfamiliar aspects of the London 2012 build. In addition, providing visibility and focus on issues clarified their importance and was sometimes achieved by establishing specific responsibilities or central support resources to help drive delivery. Beyond these the work by the Delivery Partner to translate the objectives into measurable and meaningful delivery requirements on a project basis with key performance indicators (KPIs) for tracking, provided the essential definition for contractors' work. Emphasis on clarity also involves appropriate forms of communication through the supply chain to define what working practices are or are not acceptable and to secure the buy-in and commitment of contractors and the workforce. It can be seen from other aspects of this review that this clarity provided the foundation for trust, transparency, assurance, collaboration and so forth which in turn provided the mechanisms for success to be achieved.

Quote / Extract - Clarity	**Legacy document title and reference**	
*detailed **planning and forecasting*** *programme ... included a **strict definition** of what an apprentice constituted* *The implementation of a **contractual requirement** that three per cent of a new contractor's workforce be apprentices has been a positive driver for engagement between the programme and employers* *Bringing the clause to the attention of project leads at the beginning **negated any misunderstanding or confusion** about what the ODA expected.*	London 2012 Apprenticeship Programme	C10
***clarity surrounding measures** applied to the workforce data*	Workforce monitoring and reporting	C11
Applicants were asked to describe their arrangements to ensure equality of opportunity in their supply chain, *The link between PQQ, ITT and the NEC3 contract requirements provided the potential contractor with a **clear picture of what would be expected** at contract award.*	Equality, Inclusion, Employment and Skills – process and systems case study	C12
*A feature of the ODA has been its capacity to develop deliverable **strategies and plans**...set itself ambitious objectives designed to stretch everyone involved while remaining achievable. EiES strategies were based on consultation Strategies for real delivery: the ODA produced strategies which were easily understood, challenging and realistic. Translating the strategies into project plans that were regularly monitored and reported on was essential. The plans drove progress, created the capacity to deploy and redeploy resources, anticipated problems and developed relevant solutions within time, budget and quality.*	Equality, Inclusion, Employment and Skills – leadership and strategy	C13
*At the beginning of 2009, the ODA brought together the Equality and Inclusion, and Employment and Skills functions and this synergy created a more cohesive function that was able to **integrate the ODA's commitments** to local employment with its aspirations to deliver the most accessible and inclusive Games ever.* ***used benchmarks and targets** to drive performance both targets and benchmarks offered a sense of '**what good would look like'**.*	Jobs Skills Future Brokerage	C14
*The ODA set out its **expectations and minimum standards** for suppliers of catering services across the Park and off-Park venues during the construction phase of the project in a*	Food and sustainable sourcing: Feeding the construction workforce	C15

Quote / Extract - Clarity	Legacy document title and reference	
Catering Requirement Brief.		
*This model of project planning and production demonstrates that when the original concept for an artwork is **strong and clear**, and the artist engages directly with participants, it is easy to get the public to understand and buy-in to the process.*	Innovation in creative community engagement	C16
*A **protocol was established and agreed***	The role of the Olympic Delivery Authority as promoter and planning authority	C20
***Early clarity** on material demands and requirements allowed designers and contractors to take a proactive approach to delivering given sustainability targets*	The procurement and use of sustainable concrete on the Olympic Park	C21
*The governance regime and boards which were implemented have been very successful in providing….**clear and efficient route** to seek approval / ratify change…*	The ODA's Delivery Partner approach – Creating an integrated framework for mutual success	C23
*Fundamental to the success of this strategy was intelligent strategy development including **detailed** water demand **modelling** both for the Park and each venue, **clear technical guidance** to project teams and **inclusion of targets** in supply chain contracts.* *establish a **challenging yet achievable target*** *Many clients are target-driven, but they should bear in mind that **clear objectives and processes** for reducing water consumption, for example, through clear and appropriate specifications for water efficiency, could be more effective than a quantitative target; contractors can control specifications (unlike patterns of demand and occupant behaviour*	The Olympic Park Waste Strategy: Development and Implementation	C27
*Key factors in the success of the demolition waste strategy included the ODA's vision for demolishing the Olympic Park site in a sustainable manner which was implemented by communicating **clear sustainability objectives** from the outset, establishing plans for applying the waste hierarchy, carrying out pre-demolition audits, embedding the 90 per cent diversion from landfill through reuse or recycling target in contracts, establishing a data management system, allocating a dedicated resource within the delivery partner to drive sustainable materials outcomes, and acquiring the support of specialist consultants*	Demolition Waste Management on the Olympic Park	C28
*ODA changed this into a systematic and effective process integrated at an early stage into **design briefs and procurement contracts**, and this was key to the success of the designing out waste strategy.* *The Sustainable Development Strategy sent a **clear message** to potential design teams and contractors.* ***No target** was set for waste minimisation due to a lack of robust evidence at the time on which to base a stretch target. As a consequence, this aspect of DoW received **less focus**.* *Early client action in setting **simple and clear policy requirements** for waste, particularly where specified as quantitative targets in the project brief, is instrumental in focusing the attention of design and construction teams*	Designing out waste on the Olympic Park	C29
***Code of Construction Practice and the Biodiversity Implementation Guidance** for Project Teams (see Biodiversity IGPT Learning Legacy champion report) provide advice on implementation*	Promoting biodiversity in the Olympic Parklands	C3

Quote / Extract - Clarity	Legacy document title and reference	
*The ODA's Sustainable Development Strategy then established a set of **specific integrated targets** to meet these commitments. This had direct impact on integrating biodiversity within the planning, design and construction of the entire Parklands*		
*..a **dedicated team** for managing the waste generated from the construction activities to maximise the on-site segregation and improve the reuse of materials*	Construction waste management on the Olympic Park	C30
*setting a **strong vision and developing challenging sustainability targets**; embedding sustainability into procurement processes* *set a strong vision and sustainability strategy with **clear and measurable performance target**s, and communicate this to the construction industry early;*	The role of the construction supply chain in delivering sustainable solutions on the Olympic Park	C31
*The production and distribution of **guidance documents to help to clarify** project responsibilities, consents required, and consenting timescales were key to ensuring a good working relationship with the regulatory a*	Collaboration with environmental regulators and statutory stakeholders	C32
*Quality **Benchmarks** initiative* *Quality tool box talks…**required standard of work***	Promoting quality during the Build	M10
*aimed to avoid unnecessary delays and inconsistencies associated with regulatory uncertainty and duplication, by using **standardised regulatory measures** and documentation that would satisfy both development control and waste regulatory requirements*	Waste Recovery Licences	M102
*produce a **detailed asset list and simple schematics** of superfast broadband components, to guide space designers and contractors*	Coordinating installation of superfast broadband at the Athletes' Village	M105
*Provide **clarity on the ownership** of the integration model and the roles/responsibilities of designers submitting information and creating the model.*	Using an integrated CAD model for design coordination	M106
*be **clear on the purpose** ……. and* *—be clear on the functionality required*	Web-based spatial data viewer	M109
***Common Standard** 14 – Protection of Utility Services*	Working together to prevent cable damage	M11
***Assessment criteria** were chosen*	Assessing the sustainability of pavement design solutions	M12
*two Comprehensive **Design Guides***	Olympic Infrastructure Technical Approval Authority	M14
*[Where PVC was necessary] ODA challenged its contractors to show that the product met certain **mitigation requirements***	Implementation of the PVC policy	M16
*Based on .... alternative design, Thames Water wrote to the ODA **stating that** the design as presented met all their design criteria, and would be adopted ... if offered ... This was a crucial success factor at this stage in the project*	Primary Foul Sewer value engineering	M17
*Establishing an appropriate and achievable **benchmark for quality** is essential* *..quality, test and inspection plans that **included benchmark and samples** at the outset of all construction projects*	Ensuring quality construction for the Olympic Park	M19
*value of preparing a strategic flood risk assessment early to **define** the design parameters*	Restoring the Olympic Park waterways	M20
*A set of '**value criteria'** for the designers enabled flexible design within a coordinated framework*	Developing a family of bridge designs	M22

Quote / Extract - Clarity	Legacy document title and reference	
*A full scale **mock-up** was erected …..…..sub-contractor then went on to construct a **benchmark** in the works on site*	The Olympic Park bridge abutments and retaining wall facings	M24
*Areas of invasives were **highlighted** in Environmental Constraints Maps and posted in site compounds, as well as within Environmental Management Plans.*	Treating Japanese Knotweed on the Olympic Park	M26
*The use of the flood-risk assessment data to determine the **detailed flow characteristics** enabled…..*	Designing river edges in the Olympic Park	M29
*planning permissions placed an **obligation** not only to provide a new 45 hectare area, but also to improve the quality of habitat being delivered*	Biodiversity Action Plan: Securing ecology objectives for the Olympic Park	M30
*Holding **toolbox talks** to help site operatives understand the environmental and legal implications of poor management of invasive species. They also help contractors with identification of invasive species and measures needed when working in these areas.*	Eradicating invasive weeds during the construction of the Olympic Park	M34
***balanced scorecard** against which all bidders were tested throughout the procurement process, and policy objectives and reporting regimes were built into the resulting contracts Following a consultation process, including a series of board-level workshops, the set of key objectives set out in Figure 1 were adopted.*	Sustainable procurement	M38
***Clarity and communication** of the delivery model is key once aligned to the vision and partnered with defined deliverables clearly communicated across all levels. **project obligations and Key Performance Indicators** (KPIs) were communicated pre-tender*	Impacting change – a fresh approach to the successful delivery of employment and skills	M39
***marking guide** for use by the panel of judges*	Using an awards process to change behaviour and performance	M40
*ODA's procurement policy required that the LLW be **built into all contract tender submissions***	Negotiating the Citizens Agenda for Wages, Training and Employment	M43
*Increasing the number of underrepresented talented people in the workforce is a key part of any Corporate Social Responsibility (CSR) agenda and was an ODA Integrated Equality Scheme **objective***	Attracting historically underrepresented talent	M46
*The London 2012 programme **contract** required a more proactive approach*	Positioning Equality, Diversity and Inclusion alongside Health and Safety	M47
*The ODA made an early **pledge** to ensure training associated with the London 2012 build was used as a catalyst for employment opportunities*	Training in partnership:	M48
*ODA ...set **challenging targets** for all its main contractors*	Embedding diversity in the supply chain	M49
*The 2007 Olympic and Legacy Facilities (OLF) planning application put all of the priority theme elements together in a single, comprehensive and public submission. The subsequent **planning permission and related Section 106 legal agreement captured these commitments**. the planning obligations provided an important 'back-stop' **to ensure that the priority themes were delivered**.*	Priority themes captured in planning conditions and obligations	M50
*This **common standard** set out new requirements*	Quick hitch – management and safe use	M54

Quote / Extract - Clarity	Legacy document title and reference	
*A manual was produced '**what good looks like**' and '**what bad looks like**'.*	Benefits of using Visual Standards	M55
*risk themes were **identified***	Health and Safety risk profiling	M56
*the contractor adopted the **policy** that all temporary floor penetrations on the Athletes' Village would be covered by Dura Tread or Firecrete.*	Riser platforms and protection floor penetrations	M58
*Key elements to the achievements….focusing on the formation of an **annual strategy***	Effective delivery of transport mitigation measures: the Olympic Park Transport and Environmental Management Scheme	M68
***Clear explanations** needed to be given that the artist in residence's brief was open*	Artistic development and exploration	M72
*an agreed **process for evaluating** the nature of the changes and their likely impact.*	Effective management of masterplan changes	M76
*purpose was to give **clarity to the expectations***	Managing remediation planning conditions	M77
*status, progress and forecasting to be **reported accurately** and effectively*	ODA/CLM approach to Baseline Control and Contingency Management	M81
*benefits included...the establishment of **clearer communication** and integration between site remediation designs and subsequent civil works designs – this was not the case in the early stages of the project*	Permit to Proceed Assurance, protection of remediation works	M91
*The ODA committed to using reasonable endeavours to meet the **challenging target** of transporting at least 50 per cent of construction materials, by weight, to the Olympic Park Construction Site (OPCS) by rail and/or water.*	Transport of construction materials by sustainable means	M92
*A **Code of Construction Practice** (CoCP) was a contractual requirement*	The control of noise during construction	M93
visual standards	Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village	R1
***Embedding the core objective in all policy, procurement, designs and procedures**. This was a critical success factor in ensuring the objectives would be met.*	Innovation in timber supply for London 2012	R12
*a **dedicated Delivery Closeout team** was set up* *[late spec meant] **lack of clarity** over the contractual requirements of some suppliers to deliver data in particular standards and formats - unclear submission and approval processes for receiving data from early projects* ***Clear contractual obligations** and commercial incentives for contractors to provide information to the required formats and standards.... On the programme, where these obligations were clear, they drove quality, where they were not clear, significant additional work was required to obtain data in the required formats.* *A detailed **plan of data requirements and standards**, which is established at the outset. This is crucial*	Data handover from project delivery into operations	R13
***clarity throughout the supply chain** of the organisational standards and requirements, including the desire for cultural alignment (ie consistent commitment to the same HS&E Standard) **clearly communicated their expectations** for all*	Safety culture on the Olympic Park	R2

Quote / Extract - Clarity	Legacy document title and reference	
contractors on the Park from the outset ***'blue packs' provided concise information*** *that was accessible to workers*		
Health, Safety and Environment (HS&E) ***Standard*** *8. The strong emphasis on incorporating health and safety from the inception and planning stages of all the work* *was also clear from the* ***Standard's opening policy statements and throughout the other documentation and systems****.* *proviso that those working within them could* ***see both why they were in place and that they would benefit*** *some part of the work* *Factors that were key to this achievement were:* *—****clarity and transparency*** *of roles, responsibilities and expectations from the outset;*	Supply chain management for health and safety	R3
a ***clear vision, priorities and a strategy*** *for health and safety;* *—a* ***clear statement of expectations*** *which incorporated a set of standards concerning health and safety;* *ODA and the DP collectively established a strong and* ***clear statement of vision and purpose*** *regarding health and safety*	Leadership and worker involvement on the Olympic Park	R5
The major achievement at the Park was that ***standards*** *were not developed simply as a guide, they were actually acted upon.*	Communication and action for a safer London 2012 Olympic and Paralympic Games	R6
What was crucial was that ODA ***senior management made it clear*** *that these additional targets were not just window dressing.*	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme	R9

Collaborative

More than half of the 162 documents reviewed have been found to include some reference to collaboration. The review did not include a word search and the instances identified are based on perceived alignment with the points around collaboration revealed by the primary research. If anything, this will therefore be an underestimate. Of the characteristics being looked for, it is the most frequently occurring and is described positively in almost all cases. The nature of the subject matter for some documents means they are far more likely to address collaboration than others. In some ways it is the incidental references to the value and benefits of collaboration that are therefore most revealing. Furthermore in several cases 'collaboration' is explicitly described as the key to success: *the cornerstone of successful operation*, *central to success*, *key ingredient*, and benefits are linked to cost and other programme savings, risk reduction, raising the bar for individuals and the industry, high quality and effective structures, sharing and learning, innovative thinking, and so on. The observations on collaboration are linked to technical and engineering matters as well as to achieving success in less familiar or developed areas like equality and inclusion or aspects of sustainability and biodiversity, for example.

The extracts demonstrate that the collaboration was at all levels whether with the community or regulators, between the ODA and delivery partner and with them to contractors, within contractor supply chains, among contactors across the Park, between different professionals and specialists, or engaging individual workers. The degree of collaboration and integration is noted in some documents to be unusual and cannot be attributed to chance or common practice. 'Fragmented' is the more usual description seen to blight the construction industry[17] whether between designers and contractors or equally through the entire supply chain. Here, instead, the

collaboration can be seen a function of the lead from the client, the clarity of purpose and culture engendered. It relied on mutual respect and developing relationships and trust through communication in an open and transparent way.

Collaboration implies communication, coordination and co-operation. From a health and safety perspective, the CDM Regulations have these behaviours at their core and stress the benefits of integrated teams to overcome the obstacles of fragmentation[12]. The collected evidence from the legacy documents establishes the practical importance of these, not just for ensuring health and safety but equally for effective delivery of construction projects to meet a range of objectives and targets including time, budget and quality.

Quote / Extract - Collaborative	**Legacy document title and reference**	
*The ODA has been particularly **adept at working with its contractors**, all of which were at varying stages of development, capacity and experience in delivering an equality, inclusion, employment and skills programme. By adopting **a collaborative approach**, the ODA has managed to raise the bar for individuals, along with that of the industry, and the impact has been positive.*	Targeted approaches to equality and inclusion	C9
*The process was **collaborative and facilitative** as it sought to improve contractor performance in the context of the construction industry's relatively underdeveloped approach to equality and inclusion.* *Creating a network of contractors **harnessed both competitiveness and collaboration, and led to sharing and learning** among the different organisations.* *While business assurance was a formal mechanism, it also created informal ways of facilitating best practice and **collaboration** among contractors and encouraged networking and shared learning through the Equality@2012 network*	Equality, Inclusion, Employment and Skills – process and systems case study	C12
*The ODA exhibited a **commitment to working with its contractors**, all of whom were at varying stages of development, capacity and experience in delivering the EIES programme. By adopting a **collaborative approach**, the ODA managed to **raise the bar** for individuals, along with that of the industry and the impact has proved to be positive* ***Collaboration, collaboration, collaboration**. The LDA has played an active role in brokering formal relationships between the ODA and key stakeholders. The ODA also put effort into supporting its contractors to assist in the delivery of all of its aspirations. From the outset of the programme, there was much goodwill associated with the delivery of the Games infrastructure. People and organisations have been keen to support the ODA, some have participated for short periods, others, such as the Host Borough Unit, Jobcentre Plus and the LDA have remained constant companions. On occasions, these partnerships have involved constructive criticism, leading to better analysis and improved approaches. **These interactions have at their core, collaboration**.*	Jobs Skills Future Brokerage	C14
*as a result of the **collaborative approach** to working...* *The collaborative and proactive working between promoter and planning authority was **central to this success**,*	The role of the Olympic Delivery Authority as promoter and planning authority	C20
*Assurance was seen to be data driven, **collaborative**, and proactive, focused on process improvement and problem solving rather than simply highlighting deficiencies* ***Collaborative working** between the ODA and the DP…*	Programme assurance on the Olympic Delivery Authority construction programme	C24
*As a result of the **collaborative arrangements** with these organisations, a number of project benefits were realised.* ***Collaboration resulted in programme savings**.* *An important part of this was fostering mutual endorsement of the project aims.* *The arrangements put in place enabled a high level of **collaboration**. This provided significant time savings, a strong level*	Collaboration with environmental regulators and statutory stakeholders	C32

Quote / Extract - Collaborative	Legacy document title and reference	
of programme certainty and risk reduction, along with associated cost savings.		
*Ecological and horticultural objectives for the planting can be successfully combined though **collaborative and considered design** On urban post-industrial sites it is fundamental to landscape and planting design that the landscape architect's team includes and integrates specialist horticultural, ecological, soil science, river and drainage engineering, garden and irrigation design expertise from the start.*	The planting strategy for the Olympic Parklands	C7
*a **collaborative, interdisciplinary approach** to working resulted in the most important contributor was the early decision to instil a culture of interdisciplinary working within the Design team*	The Velodrome, the most energy efficient venue on the Olympic Park	M104
*demonstrates the **significant value of collaboration** between contractors and architects on complex utilities' structures to deliver high quality and effective structures* **unusual** *for a design team to include an architect and for the building to be so closely aligned to the engineering design.*	Complementary engineering and architecture of the Primary Foul Water Pumping Station	M18
*This project is evidence of **inventive thinking generated through a collaborative design approach***	The Olympic Park bridge abutments and retaining wall facings	M24
*Other benefits of the adopted approach included **relevant stakeholder input**. The ODA held a number of workshops with relevant organisations such as Natural England and the London Wildlife Trust*	Biodiversity Action Plan: Securing ecology objectives for the Olympic Park	M30
*The stakeholders' objectives and constraints would not have been achieved without **continuous coordination and involvement** from the early stages of the design.*	Outfall design optimisation to meet multi-stakeholder objectives	M36
*key to the success of the model was the alignment of the training offer to the ODA's own labour market intelligence, intelligence provided through the Construction Skills Network and, importantly, through **regular employer meetings** to ensure the training best addressed their individual needs during all phases of the London 2012 build.*	Training in partnership:	M48
*stakeholders **worked together** to agree the mitigation delivered coordination with other developments* *The **collaborative approach was a key success***	Effective delivery of transport mitigation measures: the Olympic Park Transport and Environmental Management Scheme	M68
*has relied on **extensive partnership working***	Developing wider community engagement for arts projects by working with a series of partners	M70
*project leaders engaging with the supply chain and developing a **collaborative, mutually responsible, challenging and learning culture*** *support provided to contractors in helping them understand what was required* *At project level there is evidence of a **collaborative approach** to health and safety mirroring that at the level of SHELT.* *At project level, contractors spoke of a **team approach**, rather than a loose collection of contractors* *a perceived benefit of the approach taken was **improved collaboration and communication** between the people involved on the project, whether between operatives and supervisors, or between Tier One contractors and their suppliers. A further perceived benefit was in smaller contractors seeing and experiencing the benefits of doing things differently and therefore, potentially shifting their future approach.*	Leadership and worker involvement on the Olympic Park	R5
principal contractors shared ideas and lessons learned; *There has been **significant coordination and cooperation*** *the best solutions (in terms of buildability, cost and programme as well as health and safety) often came from organisations working together;*	The Construction (Design and Management) Regulations 2007: duty holder roles and impact	R7

Quote / Extract - Collaborative	Legacy document title and reference	
*Full stakeholder engagement that included relevant industry bodies **a collective and completely joined-up approach**.* *By working together, managers employed at the London 2012 construction programme have driven activity and **overcome any barriers to success**. This was true for all levels* *contractual agreements ought to be supplemented by high levels of collaboration between all the parties involved*	London 2012 Apprenticeship Programme	C10
*EiES strategies were **based on consultation*** *Listening and acting on feedback: that the leadership acknowledged the comments of its contractors and implemented change was a positive marker all round, **reinforcing collaboration**, illustrating appropriate responsiveness and yielding improved working all round.*	Equality, Inclusion, Employment and Skills – leadership and strategy	C13
*The **membership profile** of the group is an indication of the partnership across professions, agencies and organisations which characterises the Consultative Access Group model.* *the **collaborative nature of its membership**, has been the **cornerstone of its successful operation**.*	Stratford City Consultative Access Group: Inclusive access and design	C19
*a **key ingredient of success** was the appointment of a **collaborative and inter-disciplinary team of experts**. This meant there was an integrated approach to the design of this contemporary urban park from the outset, ensuring that practical and technically achievable solutions could be developed to strike a balance between the needs of people and wildlife.*	Promoting biodiversity in the Olympic Parklands	C3
*To enable this, a waste **Memorandum of Understanding** (MoU) was developed with the Environment Agency to allow the Park to be considered as one site for the purposes of waste management licensing and regulatory controls* *the result of significant **joint effort** by ODA/DP, contractors and the waste management contractor.* *Subcontractors were invited to present waste minimisation initiatives that would benefit the project.* *Contractors also **engaged with their supply chains** to reduce packaging and implement take-back arrangements for packaging where possible.* *Contractors have **shared best practice and collaborated** on initiatives, for example, the Main Stadium and the Aquatics Centre have worked together to implement a take-back arrangement for timber pallets.*	Construction waste management on the Olympic Park	C30
*The BAP was developed through **regular consultations** and workshops with key stakeholders* *To deliver such a large construction project to a fixed deadline in a short timescale required **close, collaborative working** between the ODA's Planning, Design, Delivery, Construction and Management teams for enabling works, utilities, venues, structures, bridges, highways, systems integration, Parklands and Public Realm, logistics and Park operations.*	Delivering the Olympic Park Biodiversity Action Plan	C33
*It was therefore essential that all parties **worked together** to ensure that the installation of the landscape scheme was correct*	Olympic Park soil strategy	C5
*a '**Memorandum of Understanding** (MoU) for Waste Management Licensing Applied to the Olympic Park' was signed by the ODA, the ODA's Delivery Partner CLM, the Tier One Enabling Works Contractors and the EA* *approach was **facilitated by close collaboration** between the Project and the EA, not only at an early stage of project planning, but also throughout the duration of the Project*	Waste Recovery Licences	M102
***include** ICT **specialists** throughout the design process;*	Coordinating installation of superfast broadband at the Athletes' Village	M105
*Utilities and the electrical distribution network operator **worked extensively with** the ODA and their delivery partners, to improve the level of understanding in order to minimise incidents*	Working together to prevent cable damage	M11

Quote / Extract - Collaborative	Legacy document title and reference	
"3rd Party Dig" process was developed to provide guidance to third party contractors		
*OITAA was set up in 2008 to act as an independent **single point of contact** for the design review process*	Olympic Infrastructure Technical Approval Authority	M14
*The designer **engaged closely** with Thames Water, ultimately obtaining their acceptance of the alternative design* *working closely with the Construction Design and Management (CDM) coordinator for the project, the supplier considered…* *The supplier **consulted** some of Thames Water's contractors*	Primary Foul Sewer value engineering	M17
*Internal **workshops** were used to review the ODA value criteria and fix the design brief.*	Developing a family of bridge designs	M22
*treatments were developed in **close liaison** with the Environment Agency, the London Development Agency (LDA) and the Olympic Delivery Authority (ODA).* *One of the key lessons learned, is that **liaison with third parties** surrounding the Park is critical for the control of Japanese Knotweed as well as other invasive species.....Local Boroughs have invasive species in many areas adjacent to the site and the ODA have been able to assist and implement treatments as well as providing advice and support.*	Treating Japanese Knotweed on the Olympic Park	M26
*A comprehensive eradication strategy was **developed with** the Environment Agency*	Eradicating invasive weeds during the construction of the Olympic Park	M34
*factor in the success of the programme was a **partnership between** the ODA, the National Horticultural Skills Council and local training colleges to deliver well-structured training*	Olympic Park training and apprenticeships strategy	M35
*The award categories were chosen **following correspondence with stakeholders***	Using an awards process to change behaviour and performance	M40
*The CTU was established by unionlearn in **partnership** with the Olympic Delivery Authority (ODA).* *The centre is all about trades unions, the employers and the government **coming together***	The Community and Trade Union Learning Centre	M42
*By **working with** London Citizens [an alliance of 230 member institutions] from the outset, the ODA could ensure that the programme delivered real benefits to the local area.* *Throughout the process, the ODA **engaged** with schools and other members.*	Negotiating the Citizens Agenda for Wages, Training and Employment	M43
*Community careers events, and **working in partnership** with work placement groups, offered an effective opportunity to consult with, and gain feedback from, potential applicants*	Attracting historically underrepresented talent	M46
*Before the site embarked on training, the safety adviser **sought advice** from the Park Health physiotherapist*	Manual handling – reducing muscular-skeletal injuries	M66
*The **key partnership working** between ODA, Leaside Regeneration and LTGDC continued to be joined-up and collaborative throughout, due to the drive and dedication of the team working on the project*	The View Tube community facility	M74
*the Protocol was drafted **collaboratively*** ***continued collaborative working** needed to deal with issues arising (secure supporting mechanisms such as a Remediation Forum with relevant partners)*	Managing remediation planning conditions	M77
*A **partnership was established** between the main contractor, training providers and funding partners*	NoWaste Lean Construction training programme	M89
***Industry engagement** is crucial to successful application of the Code. Successful implementation of the Code relies on able and willing contractors – contractors will be fighting a losing battle if their sub-contractors do not 'buy-in' to the philosophy they are working to.*	Working to the Code on the Athletes' Village	R10
*Timber Supplier Panel members and contractors have **grown and developed their networks**.*	Innovation in timber supply for London 2012	R12
*Engender a sense of ownership of the commissions amongst staff (and later on, residents and visitors) by **involving them** at crucial points in the commissioning process.*	The arts and cultural strategy for the Olympic Park	R8

Quote / Extract - Collaborative	Legacy document title and reference	
*Art commissioning and health and safety teams need to establish a **dialogue that empowers** the art commissioning team members to discuss options with artists and agree on a level of risk.*		
*A process of **education throughout the supply chain** is required before improvements are realistically seen.*	Food and sustainable sourcing: Feeding the construction workforce	C15
*The ODA worked with the concrete supplier and **engaged with the supply chain** to develop sustainable concrete mixes*	The procurement and use of sustainable concrete on the Olympic Park	C21
*The approach ensured that both horizontal and vertical supply chain dimensions were managed to improve efficiencies and facilitate an **integrated and collaborative approach** to delivery. SCM worked with all Tier One main contractors to identify critical material and commodities whose risk of supply can be reduced from advanced buying ahead of the current schedule requirements possible as a result of a joint initiative by the ODA, Delivery Partner and Tier One main contractors to identify and register critical packages and components*	Supply Chain Management – Insolvency Management	C22
*Without organisations like Hyder Consulting, MASCo and BioRegional **working with** the ODA and demolition contractors to encourage reclamation and salvage, it is likely that the levels of re-use would have been even lower.*	Demolition Waste Management on the Olympic Park	C28
*On later projects (for example, Eton Manor, Basketball Arena), the ODA requirement was established in time to be implemented from the design stage. The designers then passed the WMA lists onto the contractor to **implement and develop further**.*	Designing out waste on the Olympic Park	C29
***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*	The role of the construction supply chain in delivering sustainable solutions on the Olympic Park	C31
*The ODA **worked in conjunction with** the DP by ensuring that any issues highlighted, were resolved*	Engineering content management and collaboration system deployed by ODA Delivery Partner	C38
*Design team meetings were held **with key stakeholders** a design-led approach from the outset with **integrated teams** having the correct skills available at key times and driven by an agreed vision and fixed programme. Clear project management was essential from the outset to ensure complex and regular **partnership working** between the design teams was achieved*	Olympic Parklands Green Infrastructure	C4
*A strong **buy-in** from the project management team to deliver on the EIES key performance indicators (KPIs) existed, which resulted in the ESP targets being rapidly incorporated into the overall deliverables. The ESMs **worked throughout the supply chains of contractors**....It was quickly established that contractors had the best knowledge of the workforce requirements, opportunities for new entrants and the up-skilling of their existing workforce. **Collaborating with contractors** to improve their own organisational standards and awareness of different sources of recruitment, has led to improved representation of groups of people not traditionally seen as part of the construction industry.*	Demand-led skills provision, including National Skills Academy for Construction status	C8
*The management teams from the client, Delivery Partner, contractor and supply chain organisations were **gathered together** at a Performance Excellence Conference*	Promoting quality during the Build	M10
*This was a **collaborative approach** by the Delivery Partner and the Tier 1 Infrastructure Designers*	Using an integrated CAD model for design coordination	M106
***interaction between** Principal Contractor, sub-contractor and advisory service was effective in ensuring that any additional controls measures necessary were implemented and the associated information was passed to all concerned.*	Improvement in occupational health: a Velodrome case study	M13

Quote / Extract - Collaborative	Legacy document title and reference	
*best solutions were achieved through early engagement and **collaboration** with the supply chain* *Early in the design process, manufacturers and contractors were invited to demonstrate innovative surfacing solutions*	Sustainable material use in paving and seating	M15
*ODA contractors **approached the supply chain** to procure a solution*	Implementation of the PVC policy	M16
***lessons were shared** between contractors* *The ODA **worked with the manufacturer** to change the production method to produce a smooth face on the kerbs and hence, a higher quality finish.*	Ensuring quality construction for the Olympic Park	M19
***an integrated, creative and collaborative approach to** strategic and detailed design*	Restoring the Olympic Park waterways	M20
*Essential to the success ….a **holistic approach** to both the design and construction* *Approval of critical path items was prioritised to obtain **stakeholder buy-in** of the scheme*	Managing the demolition of Angel Lane bridge	M21
*Architects, engineers and ecologists **worked together** to identify **new and innovative approaches to** creating habitats for bats and birds.*	Habitats for birds and bats on the Olympic Park	M28
***Working in collaboration** with the landscape architect's team…. the River Engineer*	Designing river edges in the Olympic Park	M29
*it was necessary to **work with** the utility companies to agree a mix of **innovative solutions** to achieve the tree planting and ensure the protection of both trees and utilities in the long-term.*	Integrating trees and utilities within the Olympic Park	M32
*At all stages in the design process there was **close liaison** with the structural designers. This enabled easy access for commissioning and maintenance, and made sure the structure would give flexibility in final design adjustment.*	Lighting the Olympic Park main arenas	M33
*a core deliverable of the project and ensuring it was **embraced by the supply chain*** *BeOnsite was set up to respond to community needs and **build local partnerships**, providing those with barriers to employment..... with industry relevant training and sustained jobs*	Impacting change – a fresh approach to the successful delivery of employment and skills	M39
***cooperation** from the building contractors and **close liaison** with the ODA* ***effective collaboration** between the ODA and partners apprenticeship team*	Building for success – Apprentice Plus programme	M44
*shows how a Tier One contractor... successfully embedded equality and inclusion throughout the project by engaging and **working collaboratively** with their supply chain.* *the contractor **communicated the importance of collaborative working** – a whole project approach – from an early stage.* *supplier's in the supply chain were given the opportunity to make use of the expertise and experience of the Tier One contractor's equality and inclusion advisors.*	Embedding diversity in the supply chain	M49
***Through dialogue** with the specialist Tier 1 contractors*	Benefits of using Visual Standards	M55
*To fully understand the future H&S risks, **information was gathered from the project teams** on the work planned in the next three months, including when the planned tasks were going to take place*	Health and Safety risk profiling	M56
*An information sheet was created about the health effects of isocyanates and distributed to all principal **contractors on the Park** to highlight how this hazardous substance could often be substituted for a safer alternative.*	International Broadcast Centre/Main Press Centre – selecting the safest materials	M59
*This information was gathered by the attending nurse and immediately **passed onto** an on-site hygienist, who investigated the work area*	Occupational health – The combined approach of both clinical and prevention teams	M61
***request help** from an expert*	Impact of design change on occupational health risk	M62
*Contractors **liaised with** the on-site Occupational Health team to organise and undertake these measures on a regular basis.*	Welding – identifying the right level of control	M67

Quote / Extract - Collaborative	Legacy document title and reference	
a joint team	Design solution for enhancing a functional security fence	M71
*handovers of areas of land were to be key **interface factors***	Integrated planning for the London 2012 Programme	M83
*The client, Delivery Partner, Principal Contractor, their sub-contractor and copper manufacturer, **worked collaboratively with the supply chain** to ensure the responsible sourcing requirement was clearly understood by all parties, and that processes were put in place to ensure (and be able to demonstrate) that the copper was responsibly sourced.*	Responsible sourcing of the copper cladding on the Handball Arena	M95
*Novation of the design team to the contractor could have caused some conflict over this issue, however, contractor, design team and client **worked successfully together** to ensure Excellent is the expected outcome after the Games.* ***Good communication and collaborative working** between teams were required to ensure an Excellent rating was attainable.*	Development and use of BREEAM for Olympic Park venues	R11
*These benefits had extended **across company boundaries**, with workers also comfortable challenging sub-contractors regarding safe behaviours.*	Safety culture on the Olympic Park	R2
*Tier One contractors were responsible for **cascading the approach** down the supply chain and ensuring that their sub-contractors also met both the Standard and the KPIs* *it was clear that contractors at all levels had had the opportunity to **learn from each other**; that is from contractors at their own and at both higher and lower tiers.*	Supply chain management for health and safety	R3
***Engagement**: making contact with the contractors, understanding the main issues on site and producing simple and easy solutions* *Enabling: helping contractors implement a 'health like safety' approach, integrating good OH management practice into daily working practice.*	Occupational health provision on the Olympic Park and Athletes' Village	R4
*The DP was not a bureaucratic management layer, they actively **facilitated** completion of the project.*	Communication and action for a safer London 2012 Olympic and Paralympic Games	R6
*the London 2012 programme has been a **testament to collaboration** with a remarkably low level of disputes* *a supportive culture, is crucial for driving the **'open and collaborative' behaviours that underpin success**.*	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme	R9

Communicative

Primary research summarised in R6 (see Table 3) examines the essential role of communication for delivering health and safety and assesses the impact and inter-relation of different aspects of the London 2012 build strategy. Further supporting evidence is found here looking across the range of legacy documents and identifying where communication has played a part in delivering different agendas. Evidence relates to the managed nature of programme and project communications, external stakeholder engagement and market dialogue with the supply chain and potential contractors pre-tender. The underpinning influence is the emphasis on communication as part of the leadership style, to raise consistent awareness and reinforce programme objectives, develop workforce engagement, and provide the openness and transparency. Attributes evident from the extracts below are the inclusive style and two-way nature of communications vertically through project supply chains and programme wide, attention to timing (whether early, timely, regular or repeating) and communication skills, seeking 'no surprises', a focus on the audience being clear and concise, looking to nurture relationships and convey benefits as well as requirements. Various mechanisms facilitate communication such as co-location and integrated teams; systems and software; document protocols and standards for ease and consistency; creation of liaison posts; provision of training;

open days, briefings or public events; explicit contract clauses; parkwide fora such as leadership or topic based teams; publication of standards, targets and annual progress reports; and so on. In addition specific communication tools are used on site such as newsletters, bulletins or alerts; toolbox talks; signage; videos/DVDs; visual standards; use of personal testimonies or re-enactments; posters sometimes in conjunction with themed 'week' campaigns. Together these demonstrate the important role of communications and the repeated use of effective techniques (such as posters) to promote action on diverse themes.

Quote / Extract - Communicative	**Legacy document title and reference**	
*The ODA ensured that the statistics were presented in a **clear and concise** manner*	Workforce monitoring and reporting	C11
***locate** the teams in the same physical space so that they could at the very least communicate*	Equality, Inclusion, Employment and Skills – leadership and strategy	C13
***regular, open, structured** meetings allowing decisions to be made in a timely manner* *guidance documents produced* ***co-locating** regulatory and statutory stakeholders with the ODA and contractor teams to ensure early identification of key risks and regular liaison*	Collaboration with environmental regulators and statutory stakeholders	C32
*One of the major problems with such large projects is that through the lack of **cross-communication** and knowledge transfer, silos of knowledge arise, causing repetition of data sourcing or modelling.*	Transport Knowledge Management	C36
*The establishment of a protocol for presentations to the review panel ensured a **clarity and consistency of response** and comments on detailed designs.*	Stratford City Consultative Access Group: Inclusive access and design	C19
*Regulatory engagement should commence as soon as possible in order that a **dialogue is opened** and decisions can be made quickly with the regulator*	Site investigation data management for earthworks and remediation design	M107
*A dialogue was opened to promote a **clear and common understanding** of the works, and ensure both compatible design and construction techniques, and the smooth implementation of the demolition works.*	Managing the demolition of Angel Lane bridge	M21
*time was spent **engaging with stakeholders***	Developing a family of bridge designs	M22
*design ideas and concepts were presented to key stakeholders and **consultees** including the Environment Agency, Natural England and the London Wildlife Trust to make sure….*	Designing river edges in the Olympic Park	M29
*A further objective achieved by the ODA was **raising the profile** of the horticultural and green skills apprenticeship, and training opportunities*	Olympic Park training and apprenticeships strategy	M35
*A strong **communication strategy**, both in terms of contractual requirements and nurturing relationships, made this happen*	Impacting change – a fresh approach to the successful delivery of employment and skills	M39
*Early marketing, clearly **explaining the benefits** to the key stakeholders at a senior level, achieved greater participation and outcomes*	Building for success – Apprentice Plus programme	M44
*gave guidance on what H&S **campaigns** would be developed for the next quarter*	Health and Safety risk profiling	M56
*To achieve an understanding of the artist in residence's role, Neville and Sam made numerous **presentations** to different teams and specialist interest groups* *A key lesson learned through this process was to **constantly communicate***	Artistic development and exploration	M72
*principles were:...**continuous two-way communication*** ***No surprises**: Communication needs to be excellent from all parties, thereby avoiding unexpected and unplanned for announcements, programme outcomes or commentary.*	Assuring the sustainability of the 2012 Programme – a world first	M87
*...any design solution must include stakeholders at an early stage to get their **views** on design requirements …*	Crossing Stratford High Street	M9
***promotion of knowledge** and awareness of the need to protect previously installed brownfield remediation works*	Permit to Proceed Assurance, protection of remediation works	M91

Quote / Extract - Communicative	Legacy document title and reference	
Clear and effective communication *is vital on any development to ensure that, for example, tasks get assigned to the correct team and that they are carried out to the required standard and at the appropriate time.* *The need for* ***effective communication*** *on this project was heightened by the multinational nature of the workforce.*	Working to the Code on the Athletes' Village	R10
Completion Planning meetings were set up to go over the requirements with project teams and to give the supply chain opportunities to give feedback and obtain clarifications *The requirement for complete information at construction completion was* ***communicated through meetings*** *between the Delivery Partner and the Tier One contractor, sub-contractors and design consultants.* *This communication on procedures and standards needed to be* ***constantly reiterated****. The data handover process required a change in working practice and took longer than expected, so clear communication of requirements enabled contractors to prepare information.*	Data handover from project delivery into operations	R13
the importance of approachable leaders on site, and invested resources into supervisor training to help develop ***communication skills*** *the relevance of the various* ***campaigns and training courses*** *to workers, not only at work…* *'health and safety weeks' aimed at making safety* ***personal to workers*** *It was considered vital to ensure* ***two-way communication*** *so that issues were raised and shared, allowing for appropriate solutions to be identified*	Safety culture on the Olympic Park	R2
This was all underpinned by the generally very ***effective communication*** *across the site, which was apparent up as well as down the supply chain, and enhanced by the significant opportunities provided for, and encouragement of, shared learning both within and between tiers.* ***Communication*** *within the supply chain, both vertically and laterally, was also a key feature on the Park.*	Supply chain management for health and safety	R3
effective communication *both up and down the chain of command achieved through the use of a variety of methods ….. and* ***constant reinforcement*** *recognised that* ***communicating the importance*** *of health and safety through the supply chain would be an important part of ensuring that contractors and workers were fully engaged* *Much, if not all, of the face-to-face communication .... also offered the opportunity for* ***feedback and challenge*** *Both operatives and supervisors mentioned personal testimonies as having an impact* *The high level of communication on the Park, and the* ***effectiveness of the information cascade****, was supported by evidence from the survey of workers.*	Leadership and worker involvement on the Olympic Park	R5
Well planned activities will be ***easier to communicate effectively****.* ***Supervisors*** *are important individuals in the communication process .... need technical, interpersonal and communication skills. ..... the effectiveness and impact of health and safety messages is likely to increase.*	Communication and action for a safer London 2012 Olympic and Paralympic Games	R6
a strong emphasis on ***internal communication to aid awareness*** *of how the programme was going, to reinforce key messages and to foster pride*	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme	R9
The ODA ensured that the statistics were presented in a ***clear and concise*** *manner*	Workforce monitoring and reporting	C11
A quarterly ***newsletter*** *Jobs Skills and Futures, published by the ODA, contained progress data about the London 2012 Apprenticeship Programme, ensuring that all stakeholders were kept up-to-date*	London 2012 Apprenticeship Programme	C10

Quote / Extract - Communicative	Legacy document title and reference	
*further equality and inclusion input through the '**toolbox talks**'….and provided an opportunity to reinforce equality and inclusion messaging and assist the workforce in understanding the role they played* *ODA also developed an **e-learning package*** ***Using systems familiar with the construction industry** was helpful, for example tool box talk.*	Equality, Inclusion, Employment and Skills – process and systems case study	C12
*To offer context and transparency about its employment and skills work, the ODA developed the Jobs Skills Futures **newsletter***	Jobs Skills Future Brokerage	C14
*The campaigns aimed to raise **awareness** of the importance of breakfast ...a big breakfast week which ran in March 2010 ('push on the porridge') and March 2011 ('the builder's breakfast').*	Food and sustainable sourcing: Feeding the construction workforce	C15
*The DP Sustainability team led numerous **workshops** at different project stages*	The procurement and use of sustainable concrete on the Olympic Park	C21
*Engaging with the supply chain and clearly explaining the client's requirements to suppliers and subcontractors through documentation and face-to-face briefings, particularly for Tier Two and Three contractors, ensured that waste and resource efficiency messages were **communicated and acted upon**.* *Key tactics include package-specific requirements on waste at the **tender stage**, and explicit discussion of the savings from specific DoW actions at tender interviews and pre-start meetings.*	Designing out waste (DoW) on the Olympic Park	C29
*Contractors were required to provide all site operatives with an **induction** which covered environmental issues. They frequently delivered toolbox talks and other training on waste to improve performance.*	Construction waste management on the Olympic Park	C30
communicating contract opportunities *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*	The role of the construction supply chain in delivering sustainable solutions on the Olympic Park	C31
*From the outset, the word '**special**' was used to explain the aspiration for the place that was to be created.*	Olympic Parklands Green Infrastructure	C4
*[review] indicated that there was a gap in the information provided, and access to a named contact within the ODA JSF Brokerage. This was acknowledged by the ODA and a named Employment and Skills Manager (ESM) became the **liaison** between the JSF brokerage, the local labour schemes, Jobcentre Plus and the support agencies. This led to **better coordination** of information and **increased communication** between all the agencies.*	Targeted approaches to equality and inclusion	C9
*'Zero defects at completion' **campaign*** *Poster campaigns…. Subliminal messages…Be proud / Be respectful* *Quality **videos** /Quality **tool box talks***	Promoting quality during the Build	M10
*The integration model was accessible by all projects via ProjectWise and was regularly used as an effective tool in **integration workshops**.*	Using an integrated CAD model for design coordination	M106
*a buy-in to new technologies and methods of working. This required **mutual trust and transparency, achieved through good ongoing communication** between all team members.* ***Regular briefing sessions** were held with all contractors*	Web-based spatial data viewer	M109
*Going Live **presentations***	Working together to prevent cable damage	M11
*The options assessment was a very useful **tool to communicate** the various possibilities to the client and construction teams, and allowed an informed decision about the best option.*	Assessing the sustainability of pavement design solutions	M12
*Regular **training sessions** were held on a variety of topics for both supervisors and operatives*	Improvement in occupational health: a Velodrome case study	M13

Quote / Extract - Communicative	Legacy document title and reference	
*do it once, do it right …..**workshops** were convened for key work packages so that each individual knew their role and responsibilities, good communication was established, and better ways of delivery promoted*	Ensuring quality construction for the Olympic Park	M19
*Follow-on projects were **apprised of the issues** associated with these species to ensure that contaminated areas were demarcated with appropriate signage to prevent spread to non-contaminated zones* ***Toolbox talks** were carried out to make staff aware of what invasive species looked like and what they should do to prevent spread.*	Treating Japanese Knotweed on the Olympic Park	M26
*regular **stakeholder workshops** at strategic points during the design programme….encourage[d] decision making and achieve[d] design sign-off*	Renovation of The Greenway Pedestrian Cycle Track	M27
*To deliver innovative solution, ... **clear communication and guidance** needed to be available for all stakeholders. This was achieved by providing guidance documents, drawings and hands-on support*	Habitats for birds and bats on the Olympic Park	M28
***Public events** have helped to tell the archaeological story*	Archaeological community work	M3
*uniform **signage** affixed to all orange fenced areas, clearly stating the invasive species type and warning operatives not to enter the area or disturb the ground* *Involving interested third parties, ... from an early stage so they fully understand the remediation strategy. .... and to avoid misunderstandings.* *regular invasive species **bulletins** to the project managers*	Eradicating invasive weeds during the construction of the Olympic Park	M34
*annual **diversity week***	Using an awards process to change behaviour and performance	M40
*a more accessible **feedback mechanism**, particularly for site based staff, would have been beneficial to interrogate the impact of the projects approach*	Leadership, governance and engagement	M41
***workshops and toolbox talks** titled 'Respect for People' was created to reach all employees including senior managers, the project team, site supervisors, operatives and members of the supply chain.*	Diversity training contributed to a culture of inclusion on the Aquatics Centre Project	M45
*Tier One contractor used **outreach activity*** ***Job fairs** and 'Get Ready for 2012'* ***Interview days*** ***Work placement groups**...were valuable [forums] in communicating vacancies and commitment to attract a diverse pool of applicants*	Attracting historically underrepresented talent	M46
*The use of an Equality, Diversity and Inclusion (ED&I) **booklet** disseminated at induction alongside similar H&S and Environment publications ... Position[ed] ED&I messages at the same level of importance as the more traditional cross cutting topics*	Positioning Equality, Diversity and Inclusion alongside Health and Safety	M47
*From the outset, the commitment to equality and diversity was communicated to all suppliers through **contract requirements** reflecting the obligations the ODA placed on all its Tier One contractors* *A series of regular **supplier briefing events** was implemented covering a range of issues, but always including an element around equality and diversity.*	Embedding diversity in the supply chain	M49
*The Visual Standards provided easy to understand **tools** for communication of standards*	Benefits of using Visual Standards	M55
***toolbox talks** were undertaken for all the operatives and the supervisors and foreman briefed on the potential hazards.* *By producing a strategic approach to potential health issues and informing operatives of the risks, contractors can pre-empt possible events which would otherwise cause delays in the programme of works, and can continue to provide control measures that ensures the safety of their workforce.*	Occupational health – The combined approach of both clinical and prevention teams	M61

Quote / Extract - Communicative	Legacy document title and reference	
*minimum requirement for the site to reopen would be to provide asbestos awareness **training** for all site staff. This involved training more than 200 site staff to the necessary level and giving appropriate information on any health risks*	Asbestos in soil – keeping the work going	M63
*Stretch and flex was a central theme to a **health week** organised on site, and was launched by Danny Crates, a Paralympic Gold medal-winning athlete.* *Through **effective communication**, the aims of stretch and flex were fully understood by everyone on site.*	Manual handling – reducing muscular-skeletal injuries	M66
*All teams were involved in monitoring and managing interfaces through regular **coordination meetings and reporting**.*	Integrated planning for the London 2012 Programme	M83
*To ensure proper communication of the requirements, a number of **toolbox talks** were developed. Signed registers gave evidence of the briefings*	Project FSC certification – assuring legal and well managed timber	M88
*NoWaste Lean Construction training programme on the Athletes' Village - Specifically developed '**espresso toolbox talks**' were developed to engage with operatives and supervisors aimed at reducing waste production on site. To overcome any language difficulties, **cartoon-style** waste problems overlaid on the real construction site were used to engage operatives and supervisors working on site.*	NoWaste Lean Construction training programme	M89
Opportunities existed for communication across projects through a number of fora: *—**Project Leadership teams** (PLTs)* *—**Safety, Health and Environment Leadership teams** (SHELTs)* *—**HS&E fora*** ***bulletins*** ***Specialist software** facilitated the exchange of HS&E information between the ODA, the DP and the Tier One contractors.* ***alerts***	Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village	R1
***briefings** delivered to both workers and managers on a range of general and occupational health issues* *The **regular meetings** that occurred on site offered a vehicle for Park/Village Health to promote OH messages and encourage contractors to take the issues seriously.*	Occupational health provision on the Olympic Park and Athletes' Village	R4

Challenged to do better

As discussed in the primary research, a strong driver for the ODA directors was for the London 2012 build to be a beacon of best practice, delivering far-reaching commitments and showcasing the British Construction industry to the world. This was backed by a conviction that the industry was capable and would rise to the challenge. The following extracts illustrate the diverse areas in which improved performance was sought. Many of the documents outline the usual problems afflicting construction practices and the industry's reputation, some identify challenges in response to failings in the early stages of the build (both incidents and unsatisfactory processes), and others demonstrate the willingness to pass learning from venue to venue and seek continual improvement. A further dimension was research undertaken within the programme to provide a clear understanding of issues and possibilities; examples relate to the construction for previous Games or the state of the art in sustainability practices. The constant role of challenge '*is there a better way*' is evident and reflected in the role of the delivery partner and in the inter-contractor competitiveness that developed. The role of the planning commitments and formalisation of priority themes within contracts which confirmed the unequivocal drive are highlighted and the consequences in terms of research, innovation and engagement with the skills and expertise of the supply chain are evident. The importance of incentivisation in improvement is also revealed by cases where in hindsight more could have been achieved if the if the drive were stronger (e.g. re-use aspects of waste management).

Quote / Extract – Challenged to do better	Legacy document title and reference	
*The 'right partner' will offer support, advice and guidance as needed, but will also provide the right **level of challenge** when needed.*	The ODA's Delivery Partner approach – Creating an integrated framework for mutual success	C23
Delays and cost overruns on projects in the recent past...a sobering frame *Programme Assurance Office —provided '**challenge and support**' to delivery teams*	Programme assurance on the Olympic Delivery Authority construction programme	C24
*The inclusion of apprenticeship-related **objectives in these targets** has boosted opportunities and **acted as a lever on performance***	London 2012 Apprenticeship Programme	C10
*core of London's bid ….was a **pledge** to achieve an outstanding example of sustainable development and a legacy of regeneration for east London*	The Olympic Park Waste Strategy: Development and Implementation	C27
*Delivering **a project of the highest quality has been one of the overriding themes** of the entire Olympic project. For the Park, the core intention from the outset was to bring together, through competitive selection, some of the best talent in masterplanning, urban design and landscape architecture to design a landscape of international stature, befitting the profile and prestige of the Games*	Ensuring quality construction for the Olympic Park	M19
*The implementation of a recognised benchmark, that is higher than regulation project certification, acts as a **demand signal** to the supply chain and encourages improved best practice across the industry.*	Project FSC certification – assuring legal and well managed timber	M88
striving for excellence in all activities	Safety culture on the Olympic Park	R2
*the collection, reviewing and analysis of data, enabling the identification of trends, problem spotting, and the discussion of **how health and safety could be improved*** *previous experience of having worked on projects where fatalities had occurred and the desire not to experience the same thing again was a particularly **strong motivation*** *desire for excellence .... the ODA and DP saw the project as an **opportunity to raise standards in the construction industry**, and to operate at a level the industry was capable of but seldom achieved* *Reputational risk and the fact they were under intense scrutiny* *....helped in securing the support and engagement of contractors to the approach taken.*	Leadership and worker involvement on the Olympic Park	R5
*organisations were constantly asking questions such as '**Is this the best way to do it**?' and '**Can we do it a better way**?' This was found to be an effective form of risk management*	The Construction (Design and Management) Regulations 2007: duty holder roles and impact	R7
'this programme has to be a success' and 'we'll do what it takes to get it done'. *supply chain were challenged to '**do the best they could every day**'.*	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme	R9
ODA recognised that to achieve its ambitions for EIES, the in its approach and application. This meant that the ODA needed an appropriate mechanism to work with contractors who traditionally were more accustomed to and adept at building rather than delivering social and economic regeneration. *It was agreed to review the EqIA process to reduce the number of potential assessments requiring completion. This created a **streamlined process** that was meaningful and outcome focused* *The ODA was keen **not only to deliver its obligations but also improve upon best practice***	Equality, Inclusion, Employment and Skills – process and systems case study	C12
*The group's aspirations for **higher standards** for access and inclusive design and the scrutiny imposed upon detailed proposals have resulted in a higher standard of inclusive design **at minimal additional cost.***	Stratford City Consultative Access Group: Inclusive access and design	C19
*site visits encouraged **friendly competition** between contractors to **push the boundaries** of sustainable concrete even further*	The procurement and use of sustainable concrete on the Olympic Park	C21

Quote / Extract – Challenged to do better	Legacy document title and reference	
*awards process…to create a **competitive spirit** across the supply chain* *Most improved organisation – awarded to a company that demonstrated outstanding efforts to **drive change and improve performance***	Using an awards process to change behaviour and performance	M40
*the cost to provide sufficient water through the mains supply for 2010 was likely to be in the region of £1.18 million, of which approximately £230,000 was for road maintenance.[**financial drive** to find better methods]*	Non-potable water supply for construction	M90
*meetings allowed key personnel from the Tier One contractors and their suppliers to **share HS&E information*** *contractors to input information regarding accidents, incidents and to complete HS&E scorecards.*	Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village	R1
***Competition** between contractors has, in this case, proved to be a useful tool in driving an improvement in standards. If the performance of contractors/departments is tracked and made public then there is an onus on them to work harder/better in order not to 'lose face' by being shown to be a poor performer.*	Working to the Code on the Athletes' Village	R10
***Normal design standards can be challenged**…….....Engagement ….. is vital in agreeing any departures from standard design criteria*	Primary Foul Sewer value engineering	M17
*Specialists with experience from **previous major sporting events** were involved from an early stage to ensure lessons learned were used effectively* *Relevant experience and **lessons learned** on one venue were **transferred b**y the SI team to **other venues**.*	Systems Integration: A programme-wide approach to systems delivery	C37
*Regular inspections and references to benchmarks during construction allowed the knowledge gained through continuous refinement **to be shared** between different contractors.*	The Olympic Park bridge abutments and retaining wall facings	M24
*a **review** of accident and near miss statistics for the Park that showed the majority of accidents and near misses happened before lunchtime [prompting a breakfast campaign]*	Food and sustainable sourcing: Feeding the construction workforce	C15
***programme changes** based on ODA, contractor and apprentice feedback*	Building for success – Apprentice Plus programme	M44
*All suppliers were invited to the events, which also provided an opportunity for suppliers to **feedback** on the contractor's approach, allowing the project to refocus on specific areas*	Embedding diversity in the supply chain	M49
*Following this issue the CDM Coordinator gave a presentation at the quarterly CDM Coordinator's meeting which **included lessons learned** from this experience which included the ability to understand and identify health risks during the design and build phases and understanding the cumulative nature of health risks.*	Temporary bridges	M51
*[following] the series of **near misses and serious accidents** and fatalities across the construction industry, the Safety Health and Leadership Team (SHELT) directed that a common standard be developed on the safe use of QHs on the Olympic Park.*	Quick hitch – management and safe use	M54
*review of the **best available techniques** in the industry,*	Benefits of using Visual Standards	M55
***Historically**, risers have posed significant health and safety risks during both the construction and operation of a building* ***Following an incident** in which a riser platform fell to the level below injuring an operative…..…*	Riser platforms and protection floor penetrations	M58
*.. control measure [wearing air-fed breathing apparatus] is very **impractical** given the nature of the cladding works …..… could pose an even **more significant safety risk**, not to mention the additional risk to health [hence focus on material selection]*	International Broadcast Centre/Main Press Centre – selecting the safest materials	M59
***Lessons learned** following a fatality on a non-London 2012 project involving a mobile elevated working platform (MEWP) resulted in an emergency drill being carried out on the Olympic Park. It was found that not enough of the workforce knew how to lower a MEWP*	The lowering of mobile elevated working platforms in an emergency	M65

Quote / Extract – Challenged to do better	Legacy document title and reference	
in an emergency		
*Contractor's site (area CZ3a) an operative **became contaminated** with spoil and leachate resulting in skin irritation*	Occupational health – The combined approach of both clinical and prevention teams	M61
*Initially, the Integration team was set up as a centrally-based group within the programme. However, it was soon recognised that these individuals had to work in Project Delivery teams to effectively identify the required interfaces and **implement the required programme changes.***	Integrated planning for the London 2012 Programme	M83
***drove simplification** of the PMB with high-level milestones to trace the critical path and key interfaces*	Using Earned Value/stable baselines with NEC Contract projects	M85
*Lean manufacturing ... **lessons learned and best practice** from [the automotive sector] were **reviewed***	NoWaste Lean Construction training programme	M89
*The contractor **subsequently installed** an air extraction system in the workshop to remove the fumes. This was done within two days, and minimised the disruption that would have been caused if the work had been suspended indefinitely.*	Welding – identifying the right level of control	M67
***across the industry**, data handover from project delivery to operations ….. poor* *the provision of high quality data became a key target* *Lessons learned provided guidance for data handover on **later venues**, and were used to audit progress on these projects.* *Central teams must also be ready to act quickly and **improve the procedures** to deal with specific issues arising on local projects*	Data handover from project delivery into operations	R13
*indicated that such **chains frequently generate adverse consequences** among suppliers and relatively rarely encompass attempts by buyers to positively influence how health and safety is managed within them when external economic, social and regulatory pressures serve to engender 'reputational risks' …unprecedented **opportunities for shared learning** and the development of careers, teams and health and safety systems. It also ensured that the reputations of all those involved were at stake*	Supply chain management for health and safety	R3
*public bodies were historically **adept at producing good strategies but light on recognisable deliver**y.* *It was often stated that equality and inclusion was where health and safety was a **decade earlier**.*	Equality, Inclusion, Employment and Skills – leadership and strategy	C13
*The ODA was regularly challenged on the extent of its ambition and capability to deliver a change which was sustainable in an industry **not traditionally renowned for fair and open recruitment practices**, or for targeted approaches to redress disadvantage or exclusion*	Jobs Skills Future Brokerage	C14
*Although diversity training for site and project based staff in construction is not new, the **effectiveness of the training has often been questioned**.* *Traditionally, training ….. **not aligned** to company or project culture*	Diversity training contributed to a culture of inclusion on the Aquatics Centre Project	M45
*In the construction sector ED&I is **rarely positioned** at the same level as other cross-cutting themes such as Health, Safety and Environment.*	Positioning Equality, Diversity and Inclusion alongside Health and Safety	M47
*Historically, training has been carried out with **little thought** for the final employment outcome.*	Training in partnership:	M48
*Designing out waste (DoW) is **often an informal and piecemeal process***	Designing out waste on the Olympic Park	C29
*what was **missing** was a real dedication to looking at inner-city worklessness and tackling issues around social inclusion*	Impacting change – a fresh approach to the successful delivery of employment and skills	M39

Quote / Extract – Challenged to do better	Legacy document title and reference	
*The prioritisation …. of operational issues …. meant that, **often, resource was not allocated** to driving the equality and diversity in the same way*	Leadership, governance and engagement	M41
*Manual handling injuries are **one of the most common causes** of accidents in the construction industry*	Manual handling – reducing muscular-skeletal injuries	M66
***directly learned** from the lessons of past Olympic cities ..Sydney, which regretted not developing a stronger cultural programme for the Park from the start.*	The arts and cultural strategy for the Olympic Park	R8
*provided...impetus in a number of areas for **further research** to be undertaken by suppliers to enable them to deliver truly sustainable solutions in the future*	Sustainable material use in paving and seating	M15
*The policy **stimulated the supply chain to innovate** a non-phthalate PVC*	Implementation of the PVC policy	M16
***Continue to seek better solutions** as detailed design progresses*	Restoring the Olympic Park waterways	M20
*Through workshops with the client, design teams and utility companies, a **research-led solution** was developed to eliminate the impact of trees on services*	Integrating trees and utilities within the Olympic Park	M32
*The contractor on the Olympic Park's Primary Foul Sewer Project **trialled** a hand arm vibration monitoring system to assist the Site Management team in reducing the risks to employees from hand held vibration tools*	Monitoring risk of hand arm vibration injury	M60
*It presents an important **step forward** in creating sustainable environments to help communities to live within environmental limits*	Promoting biodiversity in the Olympic Parklands	C3
*a significant opportunity for the ODA to **raise the bar for standards of construction waste management** on this scale and contribute to waste industry benchmarks for sporting venues and regeneration projects.* *The overall target **did not incentivise** the waste management contractor to put processes in place to enable reuse.[so this specific aspect did not perform so well]*	Construction waste management on the Olympic Park	C30
***managing risk rather than avoiding it**;* *[many lessons learned to improve]*	The role of the construction supply chain in delivering sustainable solutions on the Olympic Park	C31
*For many years, national urban green space policy has been driven by a 'Cleaner, Safer, Greener' programme. …..… The landscape planning and design challenge presented by the London 2012 Games has provided the opportunity to **take this agenda one highly significant step forward**.*	Olympic Parklands Green Infrastructure	C4
*ODA was keen to use the London 2012 construction programme as a **catalyst for a breakthrough in the methods of recruitment and training** in the construction industry. Hence, Employment and Skills was one of the ODA's six **priority themes**.*	Demand-led skills provision, including National Skills Academy for Construction status	C8
*The ODA sought to **exceed its statutory obligations** and apply its commitment to being '**best in class**' in relation to its expectations of the contractors on the London 2012 construction programme.*	Targeted approaches to equality and inclusion	C9
*has a designed energy efficiency improvement of **31 per cent over building regulations***	The Velodrome, the most energy efficient venue on the Olympic Park	M104
*It is unparalleled in its field, both in its size and detail, and **will act as a benchmark** when investigating, assessing and analysing complex depositional environments elsewhere.*	Geoarchaeology	M7
*Both the Environment Agency and the Department for Environment, Food and Rural Affairs (Defra) confirmed that the practice and achievement of 98.5 per cent re-use and recycling represents the **forefront of industry practice**. This advanced previous industry best practice experience from Heathrow Terminal 5*	Demolition Waste Management on the Olympic Park	C28

Quote / Extract – Challenged to do better	Legacy document title and reference	
*A significant **legacy** for Tier One contractors is their full understanding of the supply chain and delivery routes for the project and of how to ensure design changes are logged and monitored as the supply chain changes.* *The contractors faced **tough questions** on this project, and that in turn led them to ask tough questions about their own company practices. The project has caused businesses to review, renew and rewrite their sustainable timber procurement policies*	Innovation in timber supply for London 2012	R12
*The preferred solution is to **avoid digging into the ground at all**, as this removes this hazard completely.*	Using free-standing pins to reduce the health and safety risk to buried services	M52
*In order **to avoid damaging these services** and injuring the workers, a specialist suction excavator was used*	Suction excavation reduced risk of cable strikes	M53
*project teams were able to anticipate the risks in the coming months, allowing them to plan for various activities and **minimise risk***	Health and Safety risk profiling	M56
*use of extraction systems and respiratory protective equipment …..**originally being suggested***	Impact of design change on occupational health risk	M62

Transparency / Openness

An over-riding characteristic emerging from the primary research was for openness and transparency to engender trust whether the news was good or bad so that knowledge could be used to focus priorities and secure solutions. As a public sector project the demand for outward transparency was inevitable but the extent and the degree to which the philosophy was embedded in the supply chain is remarkable. The extracts below confirm the transparency and openness with external stakeholders whether Government funders, the local community, regulators or the public at large and notes efforts to ensure the communications were presented in meaningful terms. Published strategies across all aspects of the build including priority themes not only provided clarity but also set out measurable targets against which performance would be judged. This required information and ongoing assurance from contractors facilitated by the NEC3 form of contract and early warning mechanisms was matched in turn by transparency from ODA, with communications through the supply chain to site. Benefits in terms of credibility and the ability to manage risk are highlighted. In addition the openness, sometimes referred to as the goldfish bowl, is recognised in turn to drive good performance rather than be seen to fall short. The principles of transparency are also part of the challenge to do better, to collaborate and learn from each other and the degree of openness must in part stem from the just / no blame / fair blame ethos which turned the focus on collective improvement.

Quote / Extract – Transparency / Openness	Legacy document title and reference	
*As with the overall approach to projects overseen, by the ODA, it was keen to maintain its **accountability and transparency** in the reporting of progress against **publicly stated commitments** and targets.* *Accurate, timely and triangulated data is a **real driver for activity**, as it can be used to highlight performance issues*	London 2012 Apprenticeship Programme	C10
*Reporting in public: The **credibility** of the assurance being provided is assessed by wider stakeholders based on the value brought by the assurance process. A significant part of this value is brought through the capacity to report in public and to make appropriate commentary in the press.*	Assuring the sustainability of the 2012 Programme – a world first	M87

Quote / Extract – Transparency / Openness	Legacy document title and reference	
*To have a **clear and transparent process** that was acceptable to the EA and delivered evidence that the infrastructure was compliant*	Flood Risk Compliance Procedure	M98
All data was published in line with government guidelines on the release of information, and was subject to review by the GOE prior to publication. *Great care was taken to ensure **transparency** with regard to the communication of business rules applied to the workforce statistics.*	Workforce monitoring and reporting	C11
*The new scheme was based on the growing experience of the ODA, **describing in a more accessible way what would be different as a consequence of its equality and inclusion interventions*** *The leadership did not disregard any fear and cynicism, but **worked with its contractors in a bold and forthright way** to get its objectives met.*	Equality, Inclusion, Employment and Skills – leadership and strategy	C13
*Working actively in partnership with its contractors to facilitate the development of their approach to recruitment rather than rigid contract compliance, led to more **openness** on the part of the contractors about what works and what barriers exist.* *ODA has consistently **published data and information** on the delivery of the EIES strategy planned and agreed outcomes*	Jobs Skills Future Brokerage	C14
*Ensuring that the planning process was managed **transparently** and with appropriate autonomy from the rest of the ODA was essential to demonstrate clear separation between the ODA's dual role as promoter and decider.* *Planning Decisions Team (PDT) took the step of publishing its manual on its website to show that it was **committed to transparency** of working and clear separation of function.*	The role of the Olympic Delivery Authority as promoter and planning authority	C20
*The **transparency** of data also enabled the audit programme to be 'tuned' to **align with key programme risks*** *[Assurance approach] found to promote **a transparent, 'no blame' culture** where issues were more likely to be raised early.* *a feature of the assurance process was its open nature*	Programme assurance on the Olympic Delivery Authority construction programme	C24
*The vital role played by the SI function was such that its performance became effectively regarded as a '**priority reporting theme**', alongside others such as Security and Health and Safety, and therefore monitored closely by the ODA's EMB.*	Systems Integration: A programme-wide approach to systems delivery	C37
*Two key documents, the ODA's design strategy, Designing for Legacy 20, and the Sustainable Development **Strategy**, set out how the masterplan would meet the environmental commitments*	Olympic Parklands Green Infrastructure	C4
*The ODA **published data and information** on the delivery of the targeted interventions*	Targeted approaches to equality and inclusion	C9
*This type of working not only requires strong leadership, **openness** and flexibility…*	The Velodrome, the most energy efficient venue on the Olympic Park	M104
*a buy-in to new technologies and methods of working. This required mutual trust and **transparency**, achieved through good ongoing communication between all team members.*	Web-based spatial data viewer	M109
*samples could be **shared with other contractors** and viewed by other interested parties*	Ensuring quality construction for the Olympic Park	M19
*ODA) suggested that individual site operators should visit and **learn from other teams** during the construction period*	The Olympic Park bridge abutments and retaining wall facings	M24
*this incident was **shared with other Tier 1 contractors** on the Olympic Park via the Health, Safety and Environment (HS&E) forum,*	Quick hitch – management and safe use	M54
*The information was **communicated at the monthly HSE forums**, allowing all project teams to further brief their own workforce on key future risks*	Health and Safety risk profiling	M56
*Biodiversity **Action Plan** (BAP)...set out clearly how new habitats would be created in the Park at both Games and post-Games phases, and the means by which these were to be maintained*	Biodiversity Action Plan: Securing ecology objectives for the Olympic Park	M30
*[ODA] regularly attended **Accountability Assemblies** of 1,000 and more people to provide a brief report on progress made to the London Citizen membership.*	Negotiating the Citizens Agenda for Wages, Training and Employment	M43

Quote / Extract – Transparency / Openness	Legacy document title and reference	
*The supply chain was encouraged to complete a **baseline assessment and monitor their progress** against any gaps in their equalities performance.*	Embedding diversity in the supply chain	M49
*provided **clarity of expectation** for all parties, so minimising risk to delivery*	Priority themes captured in planning conditions and obligations	M50
*Publishing a Programme Baseline and implementing rigorous and disciplined change control **enabled a strong framework of control to be built up and maintained***	ODA/CLM approach to Baseline Control and Contingency Management	M81
made performance highly visible	Using Earned Value/stable baselines with NEC Contract projects	M85
*encouraged project managers to be **open about the risks they faced** and the contingency they required to manage them*	Managing risk across the Olympic programme	M86
*information from which was provided to the contractors and the local authorities within a weekly RAG (Red Amber Green) **report** and incorporated within a monthly interpreted report. A monthly summary of both dust and noise levels was also posted on the London 2012 website*	The control of noise during construction	M93
*Communication was considered central to ensuring good health and safety practice, with **transparency in health and safety activities and decision-making believed to be vital***	Safety culture on the Olympic Park	R2
*Among the most significant features of the approach adopted on the Park were the **transparency of governance** and the emphasis on the inclusion and consideration of health and safety…*	Supply chain management for health and safety	R3
*The most important aspect of these contracts was the requirement **to provide transparency of progress**, to bring problems or issues to light as soon as possible and to work in collaboration with DP and others to find solutions to problems.* *the level of **openness (and hence, collaboration) increased still further***	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme	R9

Innovation

Innovation in a sense flows from the 'challenge to do better' and there are therefore overlaps. The extracts below illustrate just a few of the specific innovations not just in products or construction methods (which could be considered an inherent aspect of engineering endeavours) but also in the associated programmes and organisational processes. Authors speak of innovation, of unusual, unique or progressive aspects or of lateral thinking or solution delivered for the first time. Particularly significant are the linkages made to the collaboration (in some cases in itself seen as innovative) and the environment encouraging innovation fostered persistently across the programme. Early engagement through the supply chain and integration of traditionally separate functions (architecture and engineering teams) are cited as having been key to success.

Quote / Extract - Innovation	Legacy document title and reference	
***innovative approaches to collaboration** which helped to increase diversity in the Park workforce and raise standards within the construction industry*	Jobs Skills Future Brokerage	C14
*The group fostered **an environment where innovative techniques** and best practice outcomes were developed to increase accessibly to the planning process for all*	Stratford City Consultative Access Group: Inclusive access and design	C19
*competitive dialogue approach to procure a Delivery Partner …..The process adds value by **encouraging innovation** while maintaining competitive pressure*	The ODA's Delivery Partner approach – Creating an integrated framework for mutual success	C23
*Contractors reported that **innovative solutions** were best identified when contractors engaged with manufacturers prior to tender* *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***	The role of the construction supply chain in delivering sustainable solutions on the Olympic Park	C31

Quote / Extract - Innovation	Legacy document title and reference	
encouraging innovative solutions *and achieved much*		
*The **collaborative approach** has also facilitated the development of **improved** sustainability solutions*	Collaboration with environmental regulators and statutory stakeholders	C32
*value of preparing a strategic flood risk assessment early to ...**push for innovation** throughout the design process*	Restoring the Olympic Park waterways	M20
*The apprenticeship programme was **successful because it was innovative** and adaptable and through the support provided by the ODA and Delivery Partner senior management, able to adjust to changing economic and political environments.*	London 2012 Apprenticeship Programme	C10
*The **innovation** of the Park planners, engineers, contractors and their supply chain has eliminated the quarrying of over 289,000 tonnes of primary material and saved more than 46,500 tonnes of carbon, equivalent to almost six years of the Park's operation.*	The procurement and use of sustainable concrete on the Olympic Park	C21
*London 2012 is **the first** Summer Games host city – or host of any event of this magnitude – to attempt to map a complete carbon footprint (including embodied carbon) of the Games over the entire project term.*	Carbon reduction in transport management	C25
*looking for the best …celebrate… **innovative ideas**…*	Promoting quality during the Build	M10
*thereby **supporting and encouraging genuine innovation** within the design process*	Olympic Infrastructure Technical Approval Authority	M14
*need to **push for innovation** in sustainable design*	Sustainable material use in paving and seating	M15
***model was unique** in that it provided training both in collaboration with contractors and their client, and used intelligence among those partners to ensure the training equated to a real job.*	Training in partnership:	M48
*Following consultation with industry, the ODA put in place **innovative methods** and processes to ensure delivery of its objective.*	Innovation in timber supply for London 2012	R12
*[Management processes]..Taken individually, these approaches were **not particularly innovative**. What was striking, however, was the level of **effort and rigour** with which they were pursued and executed*	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme	R9
*Contractors have engaged with their supply chains to implement **reverse logistics agreements** during construction where possible. This included take-back of surplus materials and packaging.*	Construction waste management on the Olympic Park	C30
*Key to the success of delivery of transport on the London 2012 Olympic and Paralympic Games was the promotion of **knowledge management techniques in the use of spatial data** while ensuring governance through integration with the quality management system*	Transport Knowledge Management	C36
*innovation was the **interoperability among disparate engineering technology platforms***	Engineering content management and collaboration system deployed by ODA Delivery Partner	C38
*it is the **successful integration of these solutions** that creates the biggest win*	The Velodrome, the most energy efficient venue on the Olympic Park	M104
*key innovation, was the **integration of Global Positioning System (GPS) technology** as part of this process*	Web-based photograph viewer	M110
*The **whole life cycle of the products** needs to be considered. the supply chain actively sought to develop new products that attempted to meet all of the requirements*	Implementation of the PVC policy	M16
*a number of **innovative features** Although **unusual** for a building of this nature, the [sustainability] features sit happily alongside the engineering*	Complementary engineering and architecture of the Primary Foul Water Pumping Station	M18
*The **innovative use of a 'sonic' drill** proved successful*	Olympic Park site ground investigation – innovative approach to drilling	M23

Quote / Extract - Innovation	Legacy document title and reference	
*Traditionally, bridges are seldom used to mount bat and bird boxes, so this represented an **innovative approach** to habitat creation*	Habitats for birds and bats on the Olympic Park	M28
*The approach to biodiversity in major redevelopment sites has **generally involved** like for like replacement of particular habitats [not done here]*	Biodiversity Action Plan: Securing ecology objectives for the Olympic Park	M30
*Prior to the ODA Diversity Awards, **no construction-specific diversity awards existed** within the industry*	Using an awards process to change behaviour and performance	M40
*EiA used **coaches** as an alternative style to teaching to unlock the potential of each participant.*	Building for success – Apprentice Plus programme	M44
***innovative approach** to the cladding of the concrete bridge abutments* ***lateral thinking** through the **introduction of architectural teams into civil engineering projects**, which generated new solutions for site waste management and use*	The Olympic Park bridge abutments and retaining wall facings	M24
*scorecard...applying both traditional ...and **progressive** …… criteria*	Sustainable procurement	M38
*This **innovative approach** was developed to reduce the number of slips, trips and falls which is still one of the industry's biggest cause of three-day reportable accidents*	Reducing trip hazard during construction of steel reinforcement concrete slabs	M57
*small **meters about the size of a pager which magnetically attached to** vibrating hand tools (which was previously been fitted with a 'tool-tag', a small colour coded device fitted to the tool to monitor vibration magnitude) to monitor a person's exposure to vibration.*	Monitoring risk of hand arm vibration injury	M60
***For the first time** in a construction project of this size, both clinical and preventative teams have been able to work side by side to protect worker health.*	Occupational health – The combined approach of both clinical and prevention teams	M61
*temporarily **capped** with modified small diameter ductwork which reduced risk of injury and also improved installation efficiency for infilling.*	Reducing hazards of installing gabion walls	M64
Stretch and flex	Manual handling – reducing muscular-skeletal injuries	M66
***model was unique** in that it provided training both in collaboration with contractors and their client, and used intelligence among those partners to ensure the training equated to a real job.*	Training in partnership:	M48
*An **improved best practice approach** was developed to integrate the assessment of highway and pedestrian conditions.*	Crossing Stratford High Street	M9
***innovations** such as agreeing visual standards and establishing a mandatory supervisor course on leadership and behaviour*	Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village	R1

Just

'Just' brings with it an implication of fairness and parity and this was highlighted in a number of areas. As might be expected workforce and employment practices were explicitly linked to 'fairness and opportunity for all' with practices to avoid discrimination but equally to enforce policies if rules were flouted. The same principles applied in procurement processes to provide access to opportunities via CompeteFor and with measures to help prepare smaller contractors in some policy areas so they were not disadvantaged at the tender stage. This link between improvement and fairness rather than automatic blame was particularly evident in the health and safety arena and the balanced approach, including just consequences where warranted, was respected by the workforce and seen to reinforce expectations of safe behaviour. Fairness and opportunity were seen equally in ensuring wide eligibility for awards and in core business processes involving design selections and decisions.

Quote / Extract - Just	Legacy document title and reference	
*Key to this was **a culture of fairness** and opportunity for all*	Impacting change – a fresh approach to the successful delivery of employment and skills	M39
*One area where non-completion was a direct result of site operations was the ODA's implementation of strict health and safety site rules including a **zero tolerance policy** on drugs and alcohol usage. For a small number of young people on site this proved difficult to adhere to, including a handful of apprentices who had been directly provided with job opportunities through the programme.…..…*	London 2012 Apprenticeship Programme	C10
*The WRS has enabled contractors to have access to information about the composition of their workforces, and the workforce of the whole project…..The figures have been used in discussion with contractors, **to influence and inspire** contractors to improve their performance.*	Workforce monitoring and reporting	C11
*'who you know approach' ... **potentially discriminatory** recruitment practice is one that the ODA wanted to reduce and by introducing a sustainable employment database, the ESMs were able to give the contractors access to a pool of job-ready candidates,*	Demand-led skills provision, including National Skills Academy for Construction status	C8
*The majority of contractors initially raised issue over having to use a specified supplier, often on cost grounds….**direct agreement was reached** between the ODA and the railhead operator to reduce the handling fees passed on through the supply chain.*	The procurement and use of sustainable concrete on the Olympic Park	C21
*Real time reviews allowed a more forward looking approach that helped gear the programme towards a focus of performance improvement **instead of** retrospective thinking that encouraged **a 'blame culture'.***	Programme assurance on the Olympic Delivery Authority construction programme	C24
CompeteFor system	Sustainable procurement	M38
***fair and clearly documented** judging process*	Developing a family of bridge designs	M22
*ensured that as many of ODA's contractors as possible were **eligible***	Using an awards process to change behaviour and performance	M40
*If the standards fell below what was expected, then the Visual Standards were **used to coach the project teams to improve**.*	Benefits of using Visual Standards	M55
reporting observations, and reassured workers that they did not intend to use these to apportion blame *Companies across the Park also addressed any unwanted or unsafe behaviours that occurred, by applying **'just' consequences**.* *Workers considered that these **consequences were fair** and helped to embed expectations of safe behaviour.* ***A 'fair' culture was developed***	Safety culture on the Olympic Park	R2
*…look much more deeply into the potential underlying causes where accidents or incidents occurred and identify how similar incidents might be avoided in future. This approach … helped establish what the site termed a **'fair blame' culture*** ***Commitment to learning and a 'fair blame' culture***	Leadership and worker involvement on the Olympic Park	R5

Consistency

The programme has exercised a balance between empowerment and encouraging innovation and consistency. A key step to 'de-risk' the programme was to designate separate projects and this required considerable work by the delivery partner to disaggregate overall objectives into achievable targets project by project. Consistency (and with it fairness, and a basis for comparison and continual improvement) was achieved with a universal requirement for monitoring, consistent metrics and benchmarking, and park-wide standards and priority themes. The project separation presented particular challenges for IT integration, for example, and required centrally supplied information systems as the '*single source of truth*'. Even where

site/project based delivery of support proved to be more effective than a centralised team, communication and cross-park collaboration was used to ensure consistency in approach, shared learning and improvement. The potential to exploit consistencies and avoid inefficiencies and confusion saw the employment & skills and equality & inclusion work areas brought together with positive effect. Similarly as alignment between health and safety, environment and sustainability, and quality agendas emerged through the programme, steps were taken to integrate activities, share process learning and exploit the synergies. Consistency was also important in the leadership and communications whether between different parties, between words and actions, and, over time. Benefits from the constancy, persistence and relentless attention to priorities underlined their real importance, engendered trust and thus openness and transparency.

Quote / Extract - Consistency	**Legacy document title and reference**	
*…… helpful outcome of combining EIES was a **single lead taking responsibility and ensuring a more consistent approach** and direction of the contractors' efforts*	London 2012 Apprenticeship Programme	C10
*it was not until the two themes were **brought together** under a single leadership that the broader team became more effective and impactful. The Employment and Skills team were able to deliver the equality and inclusion objectives in a more tangible and understandable way for contractors and the industry.* ***Consistency of message** from all leaders was vital: contractors and workforce alike commented on the high level and consistent messaging about equality and inclusion and employment and skills.*	Equality, Inclusion, Employment and Skills – leadership and strategy	C13
*Working with contractors to move them away from their traditional routes of recruitment, for example, word of mouth or through agencies, to working in a more open and transparent way set up by the JSF Brokerage, required a **consistent and coordinated approach.*** *the messages to the contractors were **consistent and unambiguous***	Jobs Skills Future Brokerage	C14
***Centralised procurement**, early supply chain integration and extensive trials and testing of various sustainable concrete mixes, were key*	The procurement and use of sustainable concrete on the Olympic Park	C21
*a **centralised approach** to waste management with significant emphasis placed on individual contractors segregating waste at source.* *The centralised approach of procuring one waste management contractor and establishing a WCC was effective during the construction of Heathrow Terminal 5 (T5) and is considered an effective model for major construction projects.*	Construction waste management on the Olympic Park	C30
*Lessons learned included the need to involve ecologists within an **integrated approach***	Delivering the Olympic Park Biodiversity Action Plan	C33
*The ODA procurement strategy of appointing separate design and build contracts for each venue and major infrastructure works on the Olympic Park posed significant **challenges to the integration** of Information Technology (IT), communications, power and security systems.* *By adopting a **consistent approach** to capturing and defining operational requirements across the entire construction programme and by disseminating system requirements to the construction projects (numbering around 80), the ODA was able to influence the scope of each construction project early*	Systems Integration: A programme-wide approach to systems delivery	C37
*SCM integrated their resource within the major contractor's project teams to assist their respective procurement processes with a unique, **Park-wide visibility** of the collective supply chain (both vertical and horizontal) to **identify potential opportunity and risk mitigation.*** *Areas of concern were identified, together with areas of good practice with all parties to ensure a consistent approach was adopted which in turn promoted learning and good practice across*	Supply Chain Management – Insolvency Management	C22

Quote / Extract - Consistency	Legacy document title and reference	
the vertical project and horizontal programme supply chain.		
*The figures have been used in discussion with contractors, to **influence and inspire contractors** to improve their performance*	Workforce monitoring and reporting	C11
*Equality@2012 **network**...opportunity for the contractors ...to meet and facilitate their learning as a **group and to share experiences and good practice**....monthly workshops* ***a consistent approach** to contract requirement and management helped to drive this agenda forward* *the [tender] evaluation process was brought in-house...balanced scorecard.....higher level of **consistency** in assessments*	Equality, Inclusion, Employment and Skills – process and systems case study	C12
*To enable **all users to access** the highly useful information contained within the single source of truth, the ODA commissioned*	Transport Knowledge Management	C36
*the demand for **quality was never neglected** in the drive to deliver the Park on budget and on time* *an **overall Parklands Quality team** to ensure good communication across the entire Park*	Ensuring quality construction for the Olympic Park	M19
*The BAP for the Park had teeth. It included specific targets and was incorporated into planning conditions though the Section 106 legal agreement. Giving the BAP this status ensured confidence with stakeholders that biodiversity would **remain a key consideration throughout the project***	Promoting biodiversity in the Olympic Parklands	C3
Biodiversity Implementation Plans set out requirements for each venue and project, and on-site environment managers were assigned to all construction projects to provide technical advice to each project team *Environment **Managers Forum** to exchange best practice and troubleshoot problems* *It has needed **tenacious conviction***	Olympic Parklands Green Infrastructure	C4
key tool for integrating *maintain as far as possible **throughout the course of the project***	Using an integrated CAD model for design coordination	M106
*The challenge then was to collect the information from each designer and collate them all into a **single Park-wide model** without disrupting the programme or incurring additional cost*	3D model creation and its use on the Olympic Park	M108
***Throughout the duration**…*	Working together to prevent cable damage	M11
***Persistent commitment from senior management** ensured the importance placed on the agenda remained high*	Leadership, governance and engagement	M41
*to maintain the positive momentum that initial sessions created, a **programme of keeping it alive** [was actively] employed.*	Diversity training contributed to a culture of inclusion on the Aquatics Centre Project	M45
*ODA and the DP coordinated activities across the Park using SHELT to identify **common practices and ensure site-wide adoption of good practice*** *workers believed in the genuine commitment within organisations, as **the message was constant and reiterated across the Park over time*** *consistent messages that managers would do as they say* *The key was to **relentlessly** work with the DP and every Tier One contractor to ensure that this was how it operated throughout the supply chain* *leaders were aware of the risks of removing attention from health and safety, and **constantly reiterated its importance** and relevance to the workforce and put effort into it 'feeling fresh'.*	Safety culture on the Olympic Park	R2
*The engineering content management and collaboration system provided **centralised access** to Architecture, Engineering and Construction (AEC) information, including CAD data, and a 'single source of truth' for its users. Giving contractors the opportunity to use a common set of design tools provided a platform for integrated design, enabling* *the DP to create a **coordinated information model** for construction.*	Engineering content management and collaboration system deployed by ODA Delivery Partner	C38

Quote / Extract - Consistency	Legacy document title and reference	
*The development of a management system that applied **consistent standards and approaches** across all aspects of transport planning was considered **essential** to facilitating the transport sustainability objectives.* *The project-specific sustainability issues were evaluated during the planning and implementation of all projects. The ODA **integrated this process with the Transport Health and Safety project risk** assessment and HazOps*	Implementation of BS8901 sustainability management systems for events	C39
*identify a single point of contact across a programme for **coordination of separate projects' delivery** of new technology*	Coordinating installation of superfast broadband at the Athletes' Village	M105
*A further challenge was ensuring all contractors adopted and submitted in the **same format***	Site investigation data management for earthworks and remediation design	M107
*the **supply chain** were encouraged to use the services available*	Improvement in occupational health: a Velodrome case study	M13
*In order to bring consistency to the designs and promote best practice, the OITAA brought together the often conflicting design requirements of the five Host Boroughs (and Transport for London for structural designs) into a **single set of agreed design guides**.*	Olympic Infrastructure Technical Approval Authority	M14
***To ensure consistency**, lessons learned were shared between Project Supervisors and contractors at site quality meetings, which included site visits.*	The Olympic Park bridge abutments and retaining wall facings	M24
*Key factors in the success of the lighting scheme include a clear lighting strategy [and policy of common procurement]that ensured a **unified look and feel** of materials and fixtures across the Park*	Olympic Park lighting design	M31
*dedicated invasive species **coordinator** was key to ensuring that the treatment programme remained effective*	Eradicating invasive weeds during the construction of the Olympic Park	M34
*This testing and support process c**onditioned SMEs to the ODA's wider objectives***	Sustainable procurement	M38
*a **level playing field** for all potential bidders*	Negotiating the Citizens Agenda for Wages, Training and Employment	M43
*The programmes also gave them an opportunity to develop their **networking** and team working skills.*	Building for success – Apprentice Plus programme	M44
*This approach was particularly innovative because the booklet was not only issued to the Contractor's employees, it was **also provided to all sub-contractors.** This ensured a **consistent message** was communicated to the whole workforce, including the supply chain and promoting **a one team approach**.*	Positioning Equality, Diversity and Inclusion alongside Health and Safety	M47
*a **common standard** was developed for the safe use of QHs which was adopted by all contractors*	Quick hitch – management and safe use	M54
*one of the main challenges was to agree a **common set of standards** for everyone to follow.* *Each contractor was able to apply the standards required because they had contributed to agreeing a solution.*	Benefits of using Visual Standards	M55
*Throughout the course of their project, training on COSHH and hazardous substances was **provided to both operatives and management** by the on-site Occupational Health team* *On many occasions the contractor contacted the Occupational Health team for advice on the health effects of various solvent-based materials, such as paints.*	International Broadcast Centre/Main Press Centre – selecting the safest materials	M59
*This case identified a need for asbestos awareness **training for all** construction workers and to date this training has been delivered to more than 500 workers across the Park site.*	Asbestos in soil – keeping the work going	M63
*The Review Panel streamlined the assessment process and ensured a **consistent approach** across the variety of schemes.*	Effective delivery of transport mitigation measures: the Olympic Park Transport and Environmental Management Scheme	M68
A coordinated approach was essential *ensured **quality and consistency** across all submissions and ensured that, collectively, over-arching obligations (eg sustainability targets) were met*	The town planning client role	M69

Quote / Extract - Consistency	Legacy document title and reference	
*By **setting out the expected contents** of documents, the Protocol could be used by contractors and consultants acting for the applicant in preparing reports.*	Managing remediation planning conditions	M77
*a unique and innovative approach to cascading the benefits of the tendering tool down the supply chain. The ODA did this by creating project microsites and **subsidising licenses and training** for the Tier One supplier community to **manage their own** major project procurements via the ODA eTendering portal*	Driving best practice procurement processes with eSourcing tools	M80
***integrated planning** approach was essential*	Integrated planning for the London 2012 Programme	M83
*a structure was needed which would ensure not only the delivery of individual projects, but would **also be effective for programme control**.*	Monitoring and control of delivery at the ODA	M84
***involved multiple** organisations, many individual projects and initiatives, over many locations.*	Assuring the sustainability of the 2012 Programme – a world first	M87
*'The Hidden Construction Site' focused on eight hidden wastes and **the environmental, health and safety issues***	NoWaste Lean Construction training programme	M89
*enabled remediation measures to be **integrated across the Park***	Permit to Proceed Assurance, protection of remediation works	M91
***cumulative impacts** modelled*	Flood Risk Compliance Procedure	M98
*used to produce **coordinated responses to HS&E issues** in the form of common standard documents.*	Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village	R1
[late spec meant] local standards being used, for example continuation of original naming standards as opposed of the new programme-wide ones; *Whilst the programme was able to recover somewhat from this, it did mean that some **inconsistency** continued*	Data handover from project delivery into operations	R13
*A **joined-up approach to monitoring** was also in place, allowing the clinical team to instigate investigation where possible exposures occurred*	Occupational health provision on the Olympic Park and Athletes' Village	R4
*the **additive effect** of a wide range of approaches which helped achieve the standards sought* *a range of activities that were carefully followed through* *sharing the results of data analysis encouraged a degree of **competition** amongst contractors to drive up standards* *This would involve pairing with another supervisor and inspecting an area they did not work in, looking for issues and good practice. This practice was felt by the supervisors involved to 'keep them on their toes'.* ***constant refreshing of posters on the Park was useful in reinforcing important messages***	Leadership and worker involvement on the Olympic Park	R5
*ODA's actions tied in with its words and gave **credibility to the health and safety messages*** *the CDM Integrator's aim being to produce a uniformly high standard of CDM coordination with a **common approach*** ***Continuity of CDM coordinators** by transferring CDM coordinators from the designers to the contractors* *Plan remained **a 'live' document during the life of the project.***	The Construction (Design and Management) Regulations 2007: duty holder roles and impact	R7

Assured

The concept of being assured emerged in the primary research in relation to the clients' need to be confident that the build objectives would be achieved. 'Confidence' was a term that it became evident could be misconstrued as arrogance or blind confidence as the findings were disseminated and therefore the focus has turned to the state of being assured rather than 'confident'. It is evident from the extracts below that establishing the current, true position from the assurance processes was crucial. This related to the efficacy of systems and processes

as well as core outcomes, and explicitly addressed uncertainties and risk. It was concerned not only with the status of what had been achieved but importantly ensuring the possible forward trajectories were recognised and could be managed without fear of latent surprises. Although valuable for assuring external bodies and equipping ODA for honest interactions with stakeholders, the assurance also informed the executive teams enabling them to plan and prioritise future actions, drive improvements or effect changes to minimise risk. Assurance was secured in many ways and case study C24 provides detailed insight to the workings of the ODA's Programme Assurance Office. The extracts demonstrate the additional roles of third party auditing, internal project QA controls, review teams, supervisor checks, trials to test and validate solutions, external certification from established schemes, and so on each providing different levels of assurance to different parties from the point of work up through the supply chain. It is clear that assurance throughout the build was wide ranging, thorough and relentless however added benefits are also highlighted in terms of reinforcing the importance of the audit topic, sustaining attention through the programme, and protecting parties from unforeseen events, giving them control to provide managed solutions. The extent of the assurance activity and the 'intrusive approach' adopted by ODA demonstrates how crucial it was to them to have an assurance system which provided knowledge and information on which to act.

Quote / Extract - Assured	**Legacy document title and reference**	
*For the ODA senior executives and board members to be **confident that the organisation would achieve its critical objectives on time, within budget and to the required quality*** *it needed to assure itself on an ongoing basis of its performance…* *..the provision of independent and objective oversight, both **of performance and of the control systems** used to manage delivery, providing confidence that critical outcomes are likely to be achieved* *Senior executive management and non-executive directors were seen as being **very supportive** of the assurance process, both for the intelligence it provided to them, and also for the confidence it helped instil in outside agencies*	Programme assurance on the Olympic Delivery Authority construction programme	C24
[success linked to] -Implementing a follow-up monitoring process *The reporting of progress and the analysis ...was a helpful driving element ... enabling internal stakeholders, including those senior staff charged with the oversight, **to understand the performance** against the apprenticeship target*	London 2012 Apprenticeship Programme	C10
*To date, each month the **ODA was confident** that the KPI figures were within ± one per cent of the true figure.* *To validate the Park statistics …...an **independent survey** was conducted in autumn 2009.* *FOI...**high levels of robustness and confidence due to fully assured figures***	Workforce monitoring and reporting	C11
The ODA regularly monitored and audited the equality action plans and overall performance *Similarly, the **ODA was confident** that it had not only fulfilled its public sector requirements, but was also developing venues and facilities based on a rigorous application of equality and inclusion*	Equality, Inclusion, Employment and Skills – process and systems case study	C12
*working with **external assurance** also provided confidence to stakeholders* *The Commission for a Sustainable London 2012 is an independent organisation providing assurance to the Olympic Board and the public on how the bodies delivering the Games and Legacy are meeting their sustainability commitments.*	Delivering the Olympic Park Biodiversity Action Plan	C33
*This approach effectively derisked the transport programme and provided **confidence to stakeholders** that the programme was being effectively managed.*	Implementation of BS8901 sustainability management systems for events	C39
ODA was awarded National Skills Academy for Construction (NSAfC) status	Demand-led skills provision, including National Skills Academy	C8

Quote / Extract - Assured	Legacy document title and reference	
*NSAfC status **provided reassurance to contractors** about the standard and quality of the training provided*	for Construction status	
*The policy recognised the **industry's voluntary code**,*	Implementation of the PVC policy	M16
*Considerate Constructors Scheme was an **external verification organisation*** *To monitor the effectiveness of these controls, **Environmental Assurance** was undertaken*	The control of noise during construction	M93
*ODA describing itself as '**incredibly intrusive** into the supply chain for all sorts of reasons'*	Supply chain management for health and safety	R3
*During the on-site monitoring – both personal and environmental – of asbestos fibres in the air, no results were produced which caused concern. This **reassured contractors** and gave them the confidence that the control measures they put in place were suitable and sufficient.*	Asbestos in soil – keeping the work going	M63
*Active management of AFC, with monthly analysis against the CBB [baseline], was **pivotal in allowing ODA to manage scope, cost and budget holistically, and ultimately delivering the programme within budget***	Approach to Anticipated Final Cost (AFC)	M82
*Trying to define and solve all the integration and interface issues in the early stages of the programme was impossible. Dealing with known issues and using the risk process **to deal with the unknowns** was a far more efficient method for forecasting outcomes*	Integrated planning for the London 2012 Programme	M83
*a '**single truth**' was established for Programme performance*	Monitoring and control of delivery at the ODA	M84
*The setting of corporate policy and processes, **adequate assurance and audit** to confirm compliance, and an independent Core Risk team within the delivery organisation, gave great **clarity to the risks being faced*** ***gave the funders and government confidence** that the risks were being consistently and effectively managed*	Managing risk across the Olympic programme	M86
*Commission for a Sustainable London 2012 was established to provide independent, credible, commentary and **assurance over the sustainability*** *commensurate level of **assurance focus** [for the materiality of the issue at hand].*	Assuring the sustainability of the 2012 Programme – a world first	M87
*ODA's internal auditors, who provided robust and rigorous oversight and **made recommendations for improvement***	Equality, Inclusion, Employment and Skills – leadership and strategy	C13
*The rigor of workforce **monitoring has been pivotal in the success** of this initiative*	Jobs Skills Future Brokerage	C14
*ODA required further **assurance and mitigation measures** to both understand these emerging risks [credit crunch] and their potential impact* *strategy of...**lessening the chance of any surprises*** *process went beyond Tier Two supplier selection and approval, and formed the basis of regular reviews to identify, agree and monitor **critical packages*** *NAO "the ODA's monitoring and active intervention in its supply chains has **protected its delivery programme from delays** through contractor financial distress and insolvency"*	Supply Chain Management – Insolvency Management	C22
*transparent relationships to ensure the accurate reporting of risks and issues – this is also **aided by the integrated risk and audit**.*	The ODA's Delivery Partner approach – Creating an integrated framework for mutual success	C23
*will only be achieved over the **long term through regular monitoring and review***	Promoting biodiversity in the Olympic Parklands	C3
*implementing a strong auditing procedure to **track delivery*** *role of manufacturers and suppliers in driving innovation is crucial…. Need to 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*	The role of the construction supply chain in delivering sustainable solutions on the Olympic Park	C31

Quote / Extract - Assured	Legacy document title and reference	
*trials to **build confidence***		
*The SI team deliberately avoided introducing a policing approach or an 'audit culture' in conducting **technical assurance**. Instead, the SI team acted as an 'intelligent client' across the programme*	Systems Integration: A programme-wide approach to systems delivery	C37
***closely monitored**…*	Olympic Park soil strategy	C5
*The planting **trials** for both the wetlands and meadows ensured confidence for both the client and the design teams*	The planting strategy for the Olympic Parklands	C7
*it was important that **checks were made** throughout the procurement and construction phase to ensure the as-built elements met the Design team specifications*	Achieving the Part L target at the Aquatics Centre	M103
*also needs to have systems and tools in place, such as 3D modelling which allow the team to optimise the design and **check their assumptions***	The Velodrome, the most energy efficient venue on the Olympic Park	M104
*Set up **Quality Assurance checking processes***	Using an integrated CAD model for design coordination	M106
*All the data was collated, **checked and reviewed** by the Tier Two site investigation contractor, before being passed to the Tier One contractors' environmental consultants for review*	Site investigation data management for earthworks and remediation design	M107
the team often attended site to check progress *the opportunity to have an **additional assurance check***	Working together to prevent cable damage	M11
*ability to **independently challenge** the designs was invaluable* *devised to enable a clear audit trail* *remit could have gone further to extend to operational and maintenance functions*	Olympic Infrastructure Technical Approval Authority	M14
***audits ensured that the Regulations had been met** during the design process.*	The Construction (Design and Management) Regulations 2007: duty holder roles and impact	R7
*gave the **ODA confidence** in the reference design for tender*	Primary Foul Sewer value engineering	M17
*Delivery Partner's **quality assurance team actively promoted** construction quality across the Park* *ODA's Site **Supervisors provided an additional level of assurance** by ensuring that quality control systems were in place and that all works complied with the drawings and specification*	Ensuring quality construction for the Olympic Park	M19
***careful monitoring** of programme and site progress*	Managing the demolition of Angel Lane bridge	M21
*a **12-month on-site trial** along a 50 metre length of the river was undertaken*	Designing river edges in the Olympic Park	M29
*required accompanying details of a **mechanism to ensure monitoring** of its implementation and the measurement of successes and their reporting to the Local Planning Authority.*	Biodiversity Action Plan: Securing ecology objectives for the Olympic Park	M30
*adequate supervision and **monitoring*** ***regular audits*** ***reviews** of Risk Assessments and Method Statements*	Eradicating invasive weeds during the construction of the Olympic Park	M34
*ODA established **specialist assurance teams** consisting of at least five members for each policy area, such as health and safety, equality and inclusion, and sustainability*	Sustainable procurement	M38
***monitored** regularly.*	Impacting change – a fresh approach to the successful delivery of employment and skills	M39
*The ODA's diversity **assurance processes** (to which the awards process was complementary) helped to make sure related contractual requirements were met*	Using an awards process to change behaviour and performance	M40
*ODA also developed **a robust monitoring process** to verify whether contractors on site were implementing the LLW*	Negotiating the Citizens Agenda for Wages, Training and Employment	M43
*Equality and Inclusion **audits** conducted by the ODA showed a considerable level of awareness of ED&I among the Contractor's employees and their supply chain*	Positioning Equality, Diversity and Inclusion alongside Health and Safety	M47

Quote / Extract - Assured	Legacy document title and reference	
*Suppliers were asked to complete a **health check** looking at the progress made to date on the policies and the action plans requested of them* *It would have been beneficial to have a **monitoring and feedback mechanism** for suppliers from the beginning of the project.*	Embedding diversity in the supply chain	M49
*The project instigated a client-side design team and **robust review processes** to ensure success.*	Priority themes captured in planning conditions and obligations	M50
***HS&E Assurance team** were able to use the Visual Standards manual as a reference document when carrying out their regular compliance reviews*	Benefits of using Visual Standards	M55
*focus attention on the high risk elements of work, and **prioritise assurance monitoring*** *This process of reviewing works three months in advance and providing focus to the H&S Assurance teams was termed H&S risk profiling* *The H&S Assurance team undertook their compliance reviews with a **specific focus**, avoiding a 'scattergun' approach.*	Health and Safety risk profiling	M56
*Key elements to the achievements…**tracking their progress** through to implementation*	Effective delivery of transport mitigation measures: the Olympic Park Transport and Environmental Management Scheme	M68
*Buyer Engagement team (BET) ….**follow u**p the contractual obligations set for Tier One contractors to ensure their sub-contracting opportunities were advertised*	Using CompeteFor to drive competition in the supply chain	M79
informed management decisions	ODA/CLM approach to Baseline Control and Contingency Management	M81
*Additional **audits** … to ensure compliance*	Project FSC certification – assuring legal and well managed timber	M88
*In order to do their inspections effectively, the **assurance team** identified HS&E priorities **three months ahead** of the work.*	Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village	R1
*To support implementation, a number of **tools and processes** were put in place to gather data and monitor the performance of contractors against the objective.* *Monitor the supply chain to **provide assurance** that the objective is being met*	Innovation in timber supply for London 2012	R12
To address this issue there was a strong focus on compliance *Despite the checks and guidance, these are sometimes still not submitted as per the guidance, but are accepted due to time pressures.*	Data handover from project delivery into operations	R13
***audits of systems** and procedures to ensure both the work task and the procedure remained appropriate and relevant.*	Safety culture on the Olympic Park	R2
*Evidence and legacy: collecting evidence on progress made by contractors and information which could be used to **inform the future development** of OH management in construction.*	Occupational health provision on the Olympic Park and Athletes' Village	R4
*The requirement for self-reporting health and safety performance, and the **auditing** of this by the DP, provided a clear message that performance was monitored and **taken seriously**. It also enabled the ODA and DP to highlight any performance issues and **drive up standards***	Leadership and worker involvement on the Olympic Park	R5
*The difference at the Park was the apparent ability to implement these initiatives and **continually monitor them**.*	Communication and action for a safer London 2012 Olympic and Paralympic Games	R6

Early / Pre-emptive

A common characteristic of activities, identified by different people involved in different aspects of a project, which brought the following benefits would recommend itself for attention by clients and others in the construction supply chain:

- Influenced outcomes
- Led to better integration
- Increased collaboration and efficiency in decision making
- Helped cement staff commitment
- Improved quality of design
- Ensured required principles embedded into [design] scheme
- Gave time for technical solutions to be identified and integrated into design
- Enabled solutions to be developed and problems mitigated
- Optimised market responses
- Opened up opportunities for suppliers to provide best practice products and services
- Was linked to clarity and certainty
- Gave consistency of message and development of an inclusive culture
- Meant action and effort were prioritised
- Enabled well informed decisions to be made and reduced the risk of later rework
- Avoided last minute additions or potential delays
- Gave more efficient and ultimately cost-effective solutions
- Eliminated risks to health and reduced time required in evolving the issue
- Drove successful programme delivery [by getting issues and risks surfaced earlier than might otherwise have been]
- Ensured rapid deployment of mitigation actions [key enabling factor of programme's ultimate success].

These phrases are all derived from descriptions in the legacy documents of measures taken 'early'. From a health and safety perspective, the CDM Regulations already place emphasis on the importance of early engagement between clients, designers and the contracting supply chain. The extracts here demonstrate the universal call, almost irrespective of the particular business goal, for measures to be put in place as early as possible in the programme. This links in part to the need for clarity and consistency which later additions or changes can appear to undermine. Where the legacy documents reflect on how things could be improved in future, a repeated observation is that it would have been easier or the results better had the measures been implemented earlier. Equally, many link success to the early stage at which approaches were implemented or teams came together with knock-on benefits in the degree of collaboration, innovation, etc. While the circumstances of the London 2012 build programme precluded construction teams starting on site immediately enforcing a period of planning, the strength and breadth of the efficiencies, savings and successes attributed to preparation provide a strong incentive for gateway processes linked to readiness.

This needs to be seen in conjunction with the approach to being assured. It is very clear that action was not constrained until everything was known, instead uncertainties were identified, risks assessed with management controls prioritised accordingly. The approach to anticipation

and planning ahead continued through the programme and is exemplified by the unusually early stage at which close-out processes were initiated (six to eight months out) and the three month forward look over construction activity to review health and safety risks. The early warning of potential difficulties enshrined in the NEC3 contract and openness and transparency sought through the regular reporting processes were fundamental.

Quote / Extract – Early / Pre-emptive	Legacy document title and reference	
Early engagement *employing contractors is a real necessity*	London 2012 Apprenticeship Programme	C10
Timely consideration of equality and inclusion issues at the ***beginning of the design process*** *led to better integration of a range of equality approaches*	Equality, Inclusion, Employment and Skills – process and systems case study	C12
The benefits of using an experienced panel, who had a wide variety of arts' experience as well as public art commissioning experience, meant that a great deal of potential risks could be ***considered in advance****, such as the viability and longevity of the artists' proposals.*	The value of external experts for guiding choice on arts commissions	C18
The SCCAG was established as a result of negotiations between the Local Planning Authority, the developer and local consultative access groups at the Outline Planning Application stage in 2004–05, ... *This encouraged* ***early engagement*** *and ensured that inclusive design principles were embedded into the scheme. .... also promoted increased collaboration and efficiency in the consideration and determination of schemes.* *Early engagement between the developers, their design team and the review panel has made a significant difference to the quality of the agreed detailed designs. It has also helped to enable a collaborative approach to design development.*	Stratford City Consultative Access Group: Inclusive access and design	C19
the benefits of ***early*** *communication and risk identification* *Risk identification meant that early warnings for issues of planning concern to both promoter and planning authority were given and this, in turn, enabled solutions to be developed and problems mitigated.*	The role of the Olympic Delivery Authority as promoter and planning authority	C20
Security of concrete supply was ***identified early on as a major risk*** *to the London 2012 construction programme* *This early engagement with the supply chain allowed questions of quality, strike time and opportunity to be discussed prior to any concrete being poured on the project site.*	The procurement and use of sustainable concrete on the Olympic Park	C21
Through ***early market engagement****, SCM was able to optimise market responses from the most capable contractors (based on experience and financial strength) to forthcoming procurement notices*	Supply Chain Management – Insolvency Management	C22
ODA ensured that project objectives were clearly defined from the ***outse****t….to procure delivery partner who would be accountable for managing the delivery of the planning, design, construction, commissioning, maintenance and conversion to legacy mode, and for cost management (monitoring, reporting and control) up to the conclusion of final account in accordance with the ODA's time-certain, quality and budget objectives and priority themes*	The ODA's Delivery Partner approach – Creating an integrated framework for mutual success	C23
assurance process had helped drive successful programme delivery by getting ***issues and risks surfaced earlier*** *than they might otherwise have been*	Programme assurance on the Olympic Delivery Authority construction programme	C24
Pre-demolition audits *-[per ICE demolition protocol]*	Demolition Waste Management on the Olympic Park	C28
Early contractor involvement *plays a major role in DoW. This process allows time for technical solutions to be identified and incorporated into the design prior to detailed specification and costing (Stage E). It also gives access to the specialist insight of Tier Two and Three subcontractors*	Designing out waste (DoW) on the Olympic Park	C29

Quote / Extract – Early / Pre-emptive	Legacy document title and reference	
*..value if, instead, the waste minimisation actions are planned systematically upfront. Project teams also saw that early quantification would help to **prioritise actions and effort***		
*For a regeneration programme of such scale, including biodiversity as one of the core strategic policies at the **outset** of planning was a significant achievement and **key** to ensuring its early consideration*	Promoting biodiversity in the Olympic Parklands	C3
*Opportunities to maximise the reuse of surplus materials from construction should be optimised. A strategy for achieving this should be developed and implemented **at an early stage** of the project*	Construction waste management on the Olympic Park	C30
*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* *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*	The role of the construction supply chain in delivering sustainable solutions on the Olympic Park	C31
*Engaging stakeholders **early on** made a great deal of difference to the level of collaboration achieved*	Collaboration with environmental regulators and statutory stakeholders	C32
*This approach is most effective when targets are **set early** in the concept and design processes, and included in the design brief.*	Reducing embodied carbon through efficient design	C35
*The management of knowledge was identified **early** on as critical to the success of the transport operation.*	Transport Knowledge Management	C36
***Early** investigative and modelling works ….. enabled well-informed decisions to be made and reduced the risk of later rework*	Systems Integration: A programme-wide approach to systems delivery	C37
*requirements should be determined **early** in the programme and included in contracts from the beginning.*	Engineering content management and collaboration system deployed by ODA Delivery Partner	C38
*part of the overall '**design'** process*	Olympic Park soil strategy	C5
*timing is key – it is **vital to plan works well in advance***	Translocation of habitats and species within the Olympic Park	C6
*This was achieved by ...**an early procurement strategy***	The planting strategy for the Olympic Parklands	C7
*the promotional campaign for quality should be ready to implement on the **commencement** of the build* *---greater benefit… if sooner*	Promoting quality during the Build	M10
*define and select superfast broadband infrastructure services **early** in the design process (preferably at the concept stage)*	Coordinating installation of superfast broadband at the Athletes' Village	M105
*Establish the process **as early as possible** in the project*	Using an integrated CAD model for design coordination	M106
*It is advisable to identify all possible modelling uses for the project **at an early stage** of the project*	3D model creation and its use on the Olympic Park	M108
*greater benefits could have been achieved by providing the tool **earlier in the project***	Web-based spatial data viewer	M109
***early** contact and discussion with distribution network operators or other utilities concerned [to] identify..any systems .. in place ..*	Working together to prevent cable damage	M11
*Using the tool **early** in the optioneering process made it highly effective in driving a sustainable design*	Assessing the sustainability of pavement design solutions	M12
*There was a continual need **to engage early** with the supply chain, clearly communicate requirements and undertake trials to demonstrate effectiveness.*	Sustainable material use in paving and seating	M15
*Recognising the need for, and the benefits of, **early engagement** during the design development process*	Primary Foul Sewer value engineering	M17
***Early procurement** allowed the trees to be monitored for some time before planting.* *Challenge….. To ensure that adequate time was committed to the landscape project, not, as in most large projects, squeezed into the time available at the end*	Ensuring quality construction for the Olympic Park	M19
*value of preparing a strategic flood risk assessment **early**…*	Restoring the Olympic Park waterways	M20

Quote / Extract – Early / Pre-emptive	Legacy document title and reference	
*The proposed demolition….required **early** and clear consultation between the designer, contractor, client, and asset owners*	Managing the demolition of Angel Lane bridge	M21
*It is essential that **early** on in the design process criteria are established to judge different design options.*	Developing a family of bridge designs	M22
***Early** [stakeholder] contact avoided last minute additions or potential delays* *A more detailed approach to the topographical survey at an early stage may have avoided minor delays during the construction*	Renovation of The Greenway Pedestrian Cycle Track	M27
*They integrated the boxes **early** on in the design and construction of the Park's structures and bridges*	Habitats for birds and bats on the Olympic Park	M28
*The **early** implementation of two hectares of off-site habitat….was also a unique element*	Biodiversity Action Plan: Securing ecology objectives for the Olympic Park	M30
*Utility routes were established in **advance** [without due cognisance of lighting column needs]* *Contractors reported that **innovative solutions** were best identified when contractors engaged with manufacturers prior to tender – this is a key learning point.*	Olympic Park lighting design	M31
*lesson learned is that the involvement of all stakeholders, from architect to supplier, at the early conceptual stage of a project will result in a more **efficient and ultimately cost-effective solution***	Lighting the Olympic Park main arenas	M33
***Prior** to any clearance and construction work, a detailed strategy was established.*	Eradicating invasive weeds during the construction of the Olympic Park	M34
*To meet specific training targets, clients need to identify and commit to training opportunities **early** and establish robust strategies for delivery*	Olympic Park training and apprenticeships strategy	M35
*CompeteFor required bidders to demonstrate that they were '**Business Ready**', ….. before they could access the system*	Sustainable procurement	M38
*Communicating the dedication of senior management from the **beginning** of the project helped to **cement staff commitment**.* *Developing the OLG from the inception of the project would have provided a greater focus for delivery of the equality action plan*	Leadership, governance and engagement	M41
*All parties must be engaged as **early** as possible on a project to ensure consistency of message and the development of an **inclusive and positive culture***	Positioning Equality, Diversity and Inclusion alongside Health and Safety	M47
*It would have been beneficial to have a monitoring and feedback mechanism for suppliers from the **beginning** of the project.* *Introducing it at a later date implied to suppliers that more work was being required of them.*	Embedding diversity in the supply chain	M49
*it is essential that both developer and planning authority establish their priority principles at the **outset** and capture these 'non-negotiables' within conditions and obligations*	Priority themes captured in planning conditions and obligations	M50
*All the occupational health risks could have been **designed out at a much earlier** point in this process, thereby eliminating risks to health and reducing the amount of time required in resolving the issue.*	Temporary bridges	M51
*To promote a more proactive style of H&S management, a **future work plan** was devised to identify when high risk activities would take place.*	Health and Safety risk profiling	M56
*This was avoided because the principal contractor made sure staff responsible for selecting hazardous substances had received the necessary training and recognised the potential problems **before** they arose.*	International Broadcast Centre/Main Press Centre – selecting the safest materials	M59
Being introduced to the project two years after activity had commenced on the design of the Park was a challenge *Arts and culture need to be an integral part of masterplanning and design intent from the **start**.*	Integrating art into the Olympic Park	M73
*Having an agreed, robust process from the **outset** would also ensure clarity and certainty..*	Effective management of masterplan changes	M76
*set out expectations at the **beginning**;*	Managing remediation planning conditions	M77

Quote / Extract – Early / Pre-emptive	Legacy document title and reference	
Early identification of potential cost pressures and opportunities formed part of an early warning process ***early warning of emerging issues***	Approach to Anticipated Final Cost	M82
Early warning *allowed rapid deployment of mitigation actions…..became one of the key enabling factors for the programme's ultimate success*	Using Earned Value/stable baselines with NEC Contract projects	M85
risk process has been one of the key elements of ***forecasting***	Managing risk across the Olympic programme	M86
the process needed to be ***forward-looking****, so that assurance could influence outcomes rather than simply confirm or challenge outcomes after the event*	Assuring the sustainability of the 2012 Programme – a world first	M87
...any design solution must include stakeholders at an ***early stage*** *to get their views on design requirements …*	Crossing Stratford High Street	M9
Future projects should calculate their construction water demand requirements at the ***outset*** *and discuss options for installing a groundwater abstraction borehole with the EA during the planning phase.* *investment at the* ***beginning*** *... can pay dividends throughout the construction phase, and potentially thereafter*	Non-potable water supply for construction	M90
early identification of potential risks *to completed site remediation works and/or related planning permissions*	Permit to Proceed Assurance, protection of remediation works	M91
project teams to identify ***in advance****, any construction activities that would impact on flood risk*	Flood Risk Compliance Procedure	M98
The Code was considered and incorporated into the design of the Athletes' Village ***from the earliest stages of development***	Working to the Code on the Athletes' Village	R10
structured processes were developed and completion preparation meetings were held with Tier One ***contractors at least six months before*** *the delivery programme began to ensure documentation was progressively developed and completed in parallel with construction works* *[challenge where] some information management processes, systems and data standards were not established or standardised across all projects* ***at the outset*** *of the programme (DP appointed Aug 2006 after initial contracts)*	Data handover from project delivery into operations	R13
Park and Village Health team provided health and safety training to construction teams on the Olympic Park during the ***early stage*** *of a project so that they can assist with planning and early decision making, particularly around the design of infrastructure.*	Occupational health provision on the Olympic Park and Athletes' Village	R4
early planning, coordination and contractor involvement were crucial *early appointment of CDM coordinators…..was part of the ODA's* ***strategy*** *to ensure health and safety was central to all aspects of construction*	The Construction (Design and Management) Regulations 2007: duty holder roles and impact	R7
importance of learning from these challenges by including arts and culture in development schemes ***from the start****, both in terms of design and budget*	The arts and cultural strategy for the Olympic Park	R8
the need to recast the forward programme each month ***a commitment to bringing problems to light at an early stage and striving collaboratively to find solutions****;*	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme	R9

Leadership

Leadership, and in particular the influential role of the client, is well recognised in construction as being linked to high standards of performance, including health and safety. The research summarised in R5 provides extensive details so brief extracts from that document, together with comments on leadership from across the legacy themes are covered in this table. These emphasise the recognition of the need for leadership qualities from the outset and at all organisational levels. A number of the sources attribute success to the quality of the leadership.

They describe specific devices to mobilise leadership such as leadership teams in relation to quality; safety, health and environment; and equality and inclusion opportunities at executive director levels and mirrored at operational levels through the delivery chain. Boards to provide strategic oversight of particular themes, regular meetings requiring attendance and accountability and direct engagement through effective relationships are also highlighted. Together the documents catalogue some of the attributes and role of the leadership in terms of:

- Being visible
- Championing priorities
- Setting targets, driving and inspiring ever better performance
- Exercising influence
- Facilitating engagement and collaboration
- Securing expertise
- Guiding
- Being relentless yet responsive
- Being consultative
- (Strategic) Decision making
- Balancing competing priorities
- Holding people and organisations to account
- Shifting blockages
- Securing change
- Mobilising resources

Quote / Extract - Leadership	**Legacy document title and reference**	
*Delivery Partner characteristics which were important to the ODA from the outset...**able to lead and manage** the design and construction industry output*	The ODA's Delivery Partner approach – Creating an integrated framework for mutual success	C23
*The town planning profession was at the heart of this success. It **provided leadership at an executive level** within the ODA both on the promoter and planning authority side, guiding design, managing determinations efficiently and responding innovatively to change.*	The role of the Olympic Delivery Authority as promoter and planning authority	C20
***Dedicated, active, open and visible leadership** was crucial to delivering the seemingly 'softer' priorities of a regeneration initiative. As with all of the ODA's Build Programme, it was open to engagement, dedicated to the task, energised in its intent and clear to all involved. This **inspired the team**, the contractors and the workforce to do their best.* *The leadership were **relentless yet responsive** drivers of the themes By establishing the respective equality and inclusion and employment and skills boards, clear signals about the importance of these two priority themes were:* *—given by the leadership of the ODA; and* *—received throughout the leadership of the Tier One contractors. Being invited to attend [Boards] and being held to account is a **leadership function** that the ODA has enacted adeptly.* *Giving the ODA's executive directors responsibility for elements of the strategies for equality and inclusion in particular helped to develop the directors' ownership as they monitored the delivery of their specific objectives, as well as assisting the delivery or shifting the blockages that could impede success* *Moving equality and inclusion into the Construction Directorate*	Equality, Inclusion, Employment and Skills – leadership and strategy	C13

Quote / Extract - Leadership	Legacy document title and reference	
*was a **shrewd leadership move** in terms of positioning the theme away from a traditional human resources component to a genuinely cross-cutting approach impacting on all aspects of the build programme, from design to sustainability to Tier One contractors.*		
***robust** senior level management and **leadership**;* *The tangible ownership and driving influence of senior project leads **resulted in a clear drive** to achieve high performance and exceed targets.* *Strong, effective leadership at all levels is **crucial to the success** of London 2012 Apprentice Programme*	London 2012 Apprenticeship Programme	C10
*areas [driving success]:–Leadership: How equality and inclusion was **promoted throughout the company**.* *Senior leaders need to understand and buy into equality and inclusion objectives in order to promote their relevance to the construction sector*	Equality, Inclusion, Employment and Skills – process and systems case study	C12
*where the ODA was expected to play its leadership part, it **did so effectively.*** ***Key was robust coordination and leadership***	Jobs Skills Future Brokerage	C14
*a developer-funded inclusive access design review panel has encouraged a **more meaningful consultation process and dialogue**. This is due not only to the monetary contribution made by the development partners, but also as a result of the investment of time and the developer's own expertise in preparing for and attending meetings.*	Stratford City Consultative Access Group: Inclusive access and design	C19
*ODA **took the lead** on providing guidance, support, checking and reviewing welfare facilities by working with stakeholders and regulators*	Food and sustainable sourcing: Feeding the construction workforce	C15
*A dedicated Materials Manager within the DP's sustainability team .. This **level of ownership and technical support was critical*** *Delivering sustainable concrete requires a client with strong sustainability ambitions, an informed client representative, ….*	The procurement and use of sustainable concrete on the Olympic Park	C21
*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* ***put in place resources**, such as a sustainability team, to maximise the uptake of sustainability objectives throughout the supply chain* *Every member of a construction project supply chain has a part to play in investing in and supporting innovation, **starting with the client***	The role of the construction supply chain in delivering sustainable solutions on the Olympic Park	C31
*A **strong commitment** to delivering the biodiversity objectives by the client team, the Delivery Partner and all contractors was vital to meeting the challenges of such a large and complex project*	Delivering the Olympic Park Biodiversity Action Plan	C33
*As a newly created organisation, brought together for the sole purpose of creating the Park, the ODA had little prior organisational experience of how systems across the Park would support operational activities and processes during or after the Games. Substantial effort was applied in **identifying and bringing together relevant experience, knowledge and skill** to apply to the task of forecasting the technical requirements for the Park's operational systems.*	Systems Integration: A programme-wide approach to systems delivery	C37
*Effective green infrastructure delivery cannot be fully realised without a **clear strategic framework and high-level political commitment*** ***strong leadership and swift decision making** was essential to negotiate agreed solutions*	Olympic Parklands Green Infrastructure	C4
*To achieve success, the ODA's approach was to **encourage contractor commitment** to training from the outset and to gain their immediate buy-in to ensure that contractors took ownership of their targets.* *Essential to the success of the demand-led training provision was a **commitment from leadership at all levels**, which demonstrated a*	Demand-led skills provision, including National Skills Academy for Construction status	C8

Quote / Extract - Leadership	Legacy document title and reference	
genuine interest in performance and progress through regular progress meetings.		
*The **targets** were used as a tool to combat complacency and demonstrated that the ODA was committed, as stated in the Equality and Diversity Strategy*	Targeted approaches to equality and inclusion	C9
*….impress the need for quality on the Programme presented by **programme leaders*** *Quality walks - **Senior management** regularly walked the site, engaged with the workforce*	Promoting quality during the Build	M10
*This type of working not only requires **strong leadership**, openness and flexibility…*	The Velodrome, the most energy efficient venue on the Olympic Park	M104
*Olympic Delivery Authority's (ODA's) **commitment to quality set the overall tone** for the project* *To ensure there was a full commitment to quality across all teams and tiers of construction, both the North and South Park construction teams set up **Quality Leadership teams***	Ensuring quality construction for the Olympic Park	M19
***strong leadership skills**, combined with the ability to drive change into the design process, were needed to finalise input from the various groups*	Habitats for birds and bats on the Olympic Park	M28
key commitment of the ODA was to encourage the training and employment of apprentices during the construction of the Park *ODA's Director of Construction helped **drive the process and unlock specific issues**, including securing agreement on the structure of the training programme and the reluctance of contractors to take on apprentices.*	Olympic Park training and apprenticeships strategy	M35
*achieved with senior management **cascading high profile support** mirrored by all levels of the project team, delivering these messages to the supply chain, mobilising relevant contractual obligations and facilitating engagement in the right forums*	Impacting change – a fresh approach to the successful delivery of employment and skills	M39
*ODA **engaged with its contractors** to gain their support in meeting programme objectives and targets around representation and opportunities*	Using an awards process to change behaviour and performance	M40
***leadership, governance and engagement were central** to [approach to embedding equality and diversity]* ***Opportunities Leadership Group** (OLG) to coordinate and promote its equality and diversity objectives* *active support of senior management for the equalities agenda was **highly visible** and encouraged positive behavioural change within the organisation.* *'train the trainer' approach.....**reinforcing the role played by senior management** in instilling the agenda throughout the project* *The **commitment of senior management** to the agenda was one of the main reasons [for impact]*	Leadership, governance and engagement	M41
*The ODA has been recognised as a 'Living Wage **Champion'** by London Citizens for the example it has set to other employers.*	Negotiating the Citizens Agenda for Wages, Training and Employment	M43
*it allowed staff to see the **commitment** of senior managers to the agenda.*	Diversity training contributed to a culture of inclusion on the Aquatics Centre Project	M45
Suppliers were invited to attend regular Opportunities Leadership Group meetings to discuss the Aquatics Centre project's progress against the equality and inclusion targets and the ways in which suppliers could better contribute to their achievement. *These meetings also gave suppliers direct contact with members of the ODA, so that **key messages could be directly communicated**.*	Embedding diversity in the supply chain	M49
*the Safety Health and Leadership Team (**SHELT**) **directed** that a common standard be developed*	Quick hitch – management and safe use	M54
***Leadership** on the Stretch and Flex programme has been **key** in both a successful launch and maintaining the enthusiasm of the workforce.*	Manual handling – reducing muscular-skeletal injuries	M66

Quote / Extract - Leadership	Legacy document title and reference	
Fundamental to the effectiveness of the reviews was having people in the room that could ***make a difference*** *Clear lines of accountability allowed the executive team to implement* ***effective leadership***	Monitoring and control of delivery at the ODA	M84
it is key that the ***client engages with the supply chain*** *early in the design process to obtain assurance and evidence of responsible sourcing of any materials with the potential to cause social and environmental impacts.*	Responsible sourcing of the copper cladding on the Handball Arena	M95
*Director level executive management teams from the ODA, DP and the Tier One contractors formed the HS&E leadership team (****SHELT****).*	Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village	R1
number of suppliers have said that their engagement with the ODA was the first time they had come together to openly discuss the issues of legal and sustainable timber and the supply chain. This ***open forum*** *needs to continue beyond the Games and should be adopted by a timber industry organisation.*	Innovation in timber supply for London 2012	R12
The ODA and the DP demonstrated their commitment to health and safety by commissioning and then mandating the use of a modified version of the Safety Climate Tool (SCT) across companies working on the Park. ***strategic role*** *of the ODA across the Park, in setting safety as a priority and integrating it into the business through standards and requirements*	Safety culture on the Olympic Park	R2
*c****ommitment to involvement in the supply chain*** *was immediately apparent, with the ODA acknowledging from the start of the work the significant potential influence it was trying to use as the client to achieve its aims in relation to health and safety. A clear distinction was drawn by some interviewees between their client on the Park (the ODA or a Tier One or Tier Two organisation) and previous clients, particularly smaller ones. In the current situation, health and safety was much more frequently seen as an overriding factor, whereas for other clients money was very often far more significant, with health and safety regarded as a bonus but not their number one priority. recognition and* ***strategic use of its huge potential influence*** *over its suppliers, which is, at least in part, the result of the unique setting of the build and its consequent reputational might*	Supply chain management for health and safety	R3
strong and influential champions at senior levels were viewed as necessary to ***ensure real changes*** *are made within organisations.*	Occupational health provision on the Olympic Park and Athletes' Village	R4
need to tackle ***all layers in the leadership*** *and management structure The leadership structure established for health and safety ensured that health and safety was* ***fully embedded and facilitated collaborative working at all levels***	Leadership and worker involvement on the Olympic Park	R5
*It was evident that communication was not a system in isolation and that without the support of a proactive client, DP and contractors, communication alone would have been ineffective facilitating and enabling factors…..****visible leaders who engaged with the workforce*** *The ODA was driven by safety, they knew exactly what they wanted to achieve in terms of health and safety before construction began. Their initial planning and organisation meant they could* ***provide direction and a key leadership role*** *to contractors and employees.*	Communication and action for a safer London 2012 Olympic and Paralympic Games	R6
the Client (ODA/DP) had a ***significant impact*** *on health and safety;*	The Construction (Design and Management) Regulations 2007: duty holder roles and impact	R7
Recruit a team of employees who have complementary skills as well as ***leadership qualities****, who are able to bridge the gap between the two worlds of construction and contemporary art.*	The arts and cultural strategy for the Olympic Park	R8

Quote / Extract - Leadership	Legacy document title and reference	
*delivery partner' ... implies a more dynamic, more **pro-active leadership** of the overall programme.the DP had high ownership of the resulting work packages*	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme	R9

Culture

Considering safety culture, one of the most recognised definitions comes from the Advisory Committee on the Safety of Nuclear Installations (ACSNI)[13]. It is reproduced below and can readily be used to consider culture more generally by removing the safety specific references.

"*The [safety] culture of an organization is the product of individual and group values, attitudes, perceptions, competencies and patterns of behavior that determine the commitment to, and the style and proficiency of, an organization[']s health and safety management]. Organizations with a positive [safety] culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of [safety] and by confidence in the efficacy of preventive measures."*

In essence it concerns the attitudes and consequent behaviours developed through the managed interaction of individuals. 'Culture' is referred to explicitly by several authors; related terms like cadence are used by others. The associated descriptive terms used in the legacy documents across the different themes include:

- *creating the culture and conditions to embrace creativity and innovation*
- *a culture of change*
- *a culture of fairness and opportunity for all*
- *a healthy culture of competition*
- *a diverse and inclusive culture*
- *a culture of integrity and respect*
- *a positive culture in line with Olympic values*
- *a good culture of inclusion*
- *a positive health and safety culture.*
- *a culture of logical forward planning to manage H&S risks*
- *a culture with excellent communication and cooperation*
- *a focus on taking positive action set the cadence*
- *a 'control culture' and trust in the accuracy of reporting*
- *an 'honest' culture of risk awareness*
- *a culture where workers felt comfortable raising health and safety issues*
- *a culture, systems and processes which also influenced communication efficacy*
- *a supportive programme-wide culture*
- *the highly collaborative culture which extended across the entire programme.*

The extracts tabulated below not only provide the source for these quotes but also include other references to the underpinning values and the steps taken to promote certain attitudes and develop and reinforce behaviours (see the definition of culture above). Significantly many

demonstrate the links with other characteristics prominent in this study such as communication, consistency, clarity and collaboration. In addition, far from being an accident of fortune, the early and explicit consideration of culture from the outset whether in setting the London 2012 values, in selecting contractual partners or putting in place conducive systems is evident.

Often 'culture' is deemed too nebulous to tackle but the demonstration here is of practical systems and processes that with clear and consistent leadership from the outset, and communication and support to take all parties along, were able to sustain a strong understanding of 'this is the way things are done around here', a more colloquial definition of culture. Reflecting on their experiences many of the authors are describing the culture as inextricably linked to success. The first quote is particularly significant suggesting the cultural compatibility of different priority themes and the consequent benefits from openly aligning them. In addition the research summary R2 presents results of a repeated survey with specific metrics to assess different aspects of safety culture in relation to: Organisational commitment; Health and safety-oriented behaviours; Health and safety trust; Usability of procedures; Engagement in health and safety; Peer group attitude; Resources for health and safety; and Accident and near miss reporting. The finding that the scores for every factor from the construction firms on the Park were higher than the highest scores in the Health and Safety Laboratory's all-industry dataset is a significant and objective indicator of the positive culture achieved.

Quote / Extract - Culture	**Legacy document title and reference**	
*These informal mechanisms influenced the contractors' appreciation of equality and inclusion, and **helped create an environment of good practice**.* *DVD site induction....ODA ensured that the DVD included **messages about behaviour and culture** which the training manager would reinforce.* *Aligning messages with other priority themes meant that the workforce received **continual reinforcement about values and behaviours**, enabling them to see the positive links between all aspects of the programme and collaborate with their colleagues.*	Equality, Inclusion, Employment and Skills – process and systems case study	C12
promoting behavioural change *teams worked cooperatively, responsively and creatively …..., while ensuring transparency and robustness in decision making*	The role of the Olympic Delivery Authority as promoter and planning authority	C20
What behaviours will be promoted? - Q in Partner framework *Key considerations: Is there **cultural alignment**?* *–Are there any behavioural aspects to be considered? **'right fit'*** *.....imperative that....bought into the objectives. This was done through contractual mechanisms and the establishment of strong, open and honest relationships from the top of the organisation.* *Successful incentivisation in the contract was a key mechanism for achieving the mutual success of both organisations and **aligning success and objectives**.* ***contract promoted right behaviours**...integrated team*	The ODA's Delivery Partner approach – Creating an integrated framework for mutual success	C23
*As the ODA was set up from scratch, it had the opportunity to **embed the assurance functions into the culture at the inception of the organisation**, aligning programme assurance with the needs of the programme and the life cycle of the organisation* ***Behaviours** ... were identified by interviewees as having been key to ensuring that integrated assurance was effective and added value.....*	Programme assurance on the Olympic Delivery Authority construction programme	C24
*As the client on the 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**.* *The ODA developed **a culture of collaboration**,*	The role of the construction supply chain in delivering sustainable solutions on the Olympic Park	C31

Quote / Extract - Culture	Legacy document title and reference	
Knowledge management is dominated by soft measures such as the development of knowledge sharing environments (encouraging inquisitive behaviours and not being afraid of asking 'obvious' questions), however, the quality management system can be used to help supply ***a framework*** *within which to exploit knowledge sharing.*	Transport Knowledge Management	C36
London 2012 defined ***six values*** *that acted as guiding principles and a frame of reference for the way in which the two primary delivery bodies (ODA and LOCOG)* ***operated and how their employees behaved****. ....Inspirational, Open, Respectful, Team, Deliver, Distinctive*	Implementation of BS8901 sustainability management systems for events	C39
The philosophy that was applied to all soiling works was to ***get it right first time.***	Olympic Park soil strategy	C5
The number of disabled people working on the Park and Athletes' Village was consistently below the three per cent benchmark. The figures suggested that ***there was a need for behavioural and cultural change****, ...* *The overriding consistent response from all the interviewees was that they felt that any form of race discrimination or harassment* ***would not have been tolerated*** *and would have been dealt with at the highest level*	Targeted approaches to equality and inclusion	C9
Performance Excellence Conference to …….. ***drive a culture of change***	Promoting quality during the Build	M10
supply chain that is committed *to improving their own health and safety performance as well as the overall project's performance*	Improvement in occupational health: a Velodrome case study	M13
an established attitude *throughout the project team that the quality of materials and workmanship was as important as value for money, fitness for purpose and programme*	Ensuring quality construction for the Olympic Park	M19
Key to this was ***a culture of fairness and opportunity for all*** *focus was turned to employers' requirements and the* ***behaviours linked to success***	Impacting change – a fresh approach to the successful delivery of employment and skills	M39
awards...created ***a healthy culture of competition****, furthering diversity* *Together [ODA and contractors] created* ***a working environment conducive*** *to people who traditionally had not worked in construction*	Using an awards process to change behaviour and performance	M40
significant resource was allocated to develop ***a diverse and inclusive culture*** *80 per cent of operatives and 75 per cent of supervisors thought that these activities* ***made a difference to the culture of the workplace***	Leadership, governance and engagement	M41
Encouraging and promoting ***a positive and inclusive work environment i****s crucial to developing a more diverse workforce and creating* ***a culture of integrity and respect****.*	Diversity training contributed to a culture of inclusion on the Aquatics Centre Project	M45
This resulted in ***a positive culture in line with Olympic values*** *not typically found on other construction sites.* *development of an inclusive and positive culture*	Positioning Equality, Diversity and Inclusion alongside Health and Safety	M47
a good culture of inclusion *as evidenced by the independently judged ODA Diversity Awards for contractors* *Central to this session was* ***sharing the project's ethos,***	Embedding diversity in the supply chain	M49
helped establish ***a positive health and safety culture****.*	Benefits of using Visual Standards	M55
The principle of Health and Safety (H&S) risk profiling has contributed to ***the positive safety culture*** ***A culture of logical forward planning to manage H&S risks*** *was established.*	Health and Safety risk profiling	M56
The ***strong control culture*** *– created through a published baseline and rigorous change control – was one of the fundamental parts of managing the delivery of the London 2012 construction programme.*	ODA/CLM approach to Baseline Control and Contingency Management	M81

Quote / Extract - Culture	Legacy document title and reference	
*Effective integration requires **a culture with excellent communication and cooperation*** *teams were …. proactive on interfaces or potential issues that led to interfaces; this eventually **became the culture***	Integrated planning for the London 2012 Programme	M83
*a focus on taking **positive action set the cadence***	Monitoring and control of delivery at the ODA	M84
*a '**control culture**' and trust in the accuracy of reporting were built up through training, coaching, support and, when appropriate, intervention;*	Using Earned Value/stable baselines with NEC Contract projects	M85
*healthy balance of review, assurance and audit promoting **an 'honest' culture of risk awareness***	Managing risk across the Olympic programme	M86
*Implicit in the ODA's HS&E Standard was that Tier One contractors have **a behavioural safety management system** in place* *establishing a mandatory supervisor course on **leadership and behaviour.***	Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village	R1
*the mean [safety climate tool] SCT scores from the Park were greater than the **highest scores in HSL's all-industry dataset for every factor*** *SHELT:–**set the benchmark for the culture** and expectations on the Park* *induction training focused on securing worker engagement and **instilling the correct, safe behaviours** in workers.* *Examples were given from across the Park to highlight how **a supportive working environment** had been created.The aim was to create a 'feel' across the Park that the sites were above average, by creating an environment where workers felt cared for and that allowed workers to perform at the optimum level.* *the key difference is the persistent effort devoted to leadership and engagement of staff, so that the **desired behaviours and attitudes have become embedded on site**.*	Safety culture on the Olympic Park	R2
*OH team was required to ensure that their services were well utilised and that they **influenced attitudes and behaviours** across site* *An encouraging 73 per cent of managers stated that they would definitely or probably **behave differently in the future** as a result of working on the Park/Village.*	Occupational health provision on the Olympic Park and Athletes' Village	R4
***cultural effect** of these initiatives [kpis etc] too, with contractors, the ODA and the DP acknowledging that attitudes shifted from believing that existing practice was good enough to acknowledging that this was not always the case.* *The ODA and the DP emphasised the importance of adopting a wider concern for employee well-being rather than a narrow focus on safety to provide the conditions for positive worker involvement.....These broad approaches **helped engender a culture** where workers felt comfortable raising health and safety issues.*	Leadership and worker involvement on the Olympic Park	R5
communication at the Park was not a process in isolation…. *It was **supported by a culture**, systems and processes which also influenced communication efficacy* *the client ... a very significant influence on **the overall 'culture'** of any project* *important that efforts are taken to address and **change beliefs if behaviour change is to occur***	Communication and action for a safer London 2012 Olympic and Paralympic Games	R6
*ODA **set the tone** for health and safety from day one* *Behavioural health and safety initiatives (for example, running forums where people learn about what behaviour causes accidents and how to avoid it) were **aimed at changing culture** by changing the way that people (at all levels and disciplines) viewed health and safety and their responsibilities to themselves and others.* *Organisations considered behavioural health and safety initiatives to have had **significant impact** on managing risks on site.* ***noticeable change in the culture***	The Construction (Design and Management) Regulations 2007: duty holder roles and impact	R7

Quote / Extract - Culture	Legacy document title and reference	
*Near-miss reporting also **helped in changing the culture*** ***Behavioural health and safety initiatives** – to make people responsible for their own health and safety, and the health and safety of others.*		
a supportive programme-wide culture *Tightly controlled aspects included ……...and the kind of behaviours required to underpin **the programme culture**. The culture on the programme can be traced back to the leadership of the ODA and other senior managers at the DP or Tier One level.ODA ran a selection process which emphasised (amongst other things)* *'**compatibility of working style**'* *invest in human resources and organisational development – to build skills, relationships and **a supportive culture**.* *Perhaps the main feature to highlight is the **highly collaborative culture** which extended across the entire programme*	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme	R9

Empowering / Goal setting

Ownership and commitment are a recognised response to empowerment. However, on the scale of a project of the Park there is an inevitable tension between consistency and empowerment. The extracts provide illustrations from areas as diverse as food catering, health and safety management, and biodiversity showing that although the objectives and targets were rigid decisions were to be made locally by contractors on how best these were to be achieved in their context. The flexibility that the approach gave was also extended in a different way to core aspects of the fit-out specification. Several of the examples elucidate the benefits of the approach in terms of incentivisation and healthy competition, creativity and innovation, and the overall level of engagement and accountability and thus ownership for delivery assumed on the ground. The extracts include evidence of learning and moving from centralised to local approaches and the improvement in buy-in that resulted. Rather than command and control, the approach is further evidence of the effective use of a proficient supply chain, backed by monitoring and assurance processes to provide confidence in the outcomes being achieved.

Quote / Extract – Empowering / Goal setting	Legacy document title and reference	
*Different approaches to catering could be adopted by caterers as each principal contractor **made their own catering arrangements**.*	*Food and sustainable sourcing: Feeding the construction workforce*	*C15*
*To create a mutually successful partnership, success needs to flow both ways. …. success of the ODA …. **align directly to the financial and reputational success** of the Delivery Partner.*	*The ODA's Delivery Partner approach – Creating an integrated framework for mutual success*	*C23*
*whilst some of the specific practices were based on the ODA's HS&E Standard, there was **a range of ways** in which this standard was implemented* *Workers and supervisors who **felt empowered to take responsibility** for their own and others' health and safety, ensuring local, site-level issues were accounted for*	*Safety culture on the Olympic Park*	*R2*
*For the ESP targets, the first year of operation saw the numbers identified through a central forecasting approach. Subsequent **targets were set and agreed with individual contractors**. This was more successful because the approach was based on the training being demand-led and an improved buy-in from contractors.*	*Demand-led skills provision, including National Skills Academy for Construction status*	*C8*
*Where practical and affordable, adopt a '**fitted for, but not with**' approach to system requirements to ensure that foreseeable requests for change would cause the minimum of disruption or need for rework.* *Mandatory requirements and constraints were specified **only where essential.***	*Systems Integration: A programme-wide approach to systems delivery*	*C37*

Quote / Extract – Empowering / Goal setting	Legacy document title and reference	
*keeping design and **construction techniques flexible throughout***	*Managing the demolition of Angel Lane bridge*	*M21*
*The BAP allowed **a degree of flexibility** in the relative quantity of each habitat type to be delivered*	*Delivering the Olympic Park Biodiversity Action Plan (BAP)*	*C33*
Everyone was responsible for quality. *Quality circles: **empowering the workforce to take ownership***	*Promoting quality during the Build*	*M10*
*contractors can **pro-actively identify any potential issues** and access the relevant assistance whenever necessary*	*Improvement in occupational health: a Velodrome case study*	*M13*
'invest once, invest wisely' *'**do it once, do it right**'*	*Ensuring quality construction for the Olympic Park*	*M19*
*Contractors also saw the benefits of an employer-led model **demonstrating different delivery interpretations** of use for their own recruitment and upskilling requirements*	*Impacting change – a fresh approach to the successful delivery of employment and skills*	*M39*
*the choice and design of the system remained the **responsibility of the Tier One** organisation*	*Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village*	*R1*
*The ODA allowed **contractor autonomy** where standards were introduced so that what was implemented would suit each individual organisation.*	*Communication and action for a safer London 2012 Olympic and Paralympic Games*	*R6*
*Each of the Tier One contractors **had their own initiatives and targets** for reducing injury and ill health – while they all had different terminology, they were aimed at a common purpose.*	*The Construction (Design and Management) Regulations 2007: duty holder roles and impact*	*R7*
*Fundamental to this approach was the requirement that Tier One and lower level contractors must **use their own health and safety management systems** to meet the ODA's HS&E Standard and its corresponding key performance indicators (KPIs)*	*Supply chain management for health and safety*	*R3*
*Tier One directors referred to **having the flexibility to see what worked well and adjust that as necessary*** *Underpinning this desire to engage and empower contractors was a strong and unwavering commitment of the senior team to safety*	*Leadership and worker involvement on the Olympic Park*	*R5*
*It is possible that this **sense of pride and commitment** that apprentices reported to programme staff in evaluation sessions was a significant factor in the low attrition levels.*	*London 2012 Apprenticeship Programme*	*C10*
*There was also **healthy competition** between contractors to achieve the highest [waste segregation] levels.*	*Construction waste management on the Olympic Park*	*C30*
*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 agree that this approach should be replicated on future projects.*	*The role of the construction supply chain in delivering sustainable solutions on the Olympic Park*	*C31*
*the key to allowing these two disciplines to work well together is through **an open approach to the choice of tools**, recognising the faults of each and determining which is most relevant to a specific task. The appointment of a dedicated spatial data manager, who was fluent in both CAD and GIS data formats, was critical to the successful bridging of the gap between the two fields.*	*Transport Knowledge Management*	*C36*
*NoWaste encouraged trade contractors to think about a problem and **identify solutions*** *programme **empowered participants and ensured engagement in problem solving and elimination***	*NoWaste Lean Construction training programme*	*M89*
Loosely controlled aspects included how contractors would implement the principles (for example, health and safety) or achieve the targets… *Better to provide an objective and challenge **the contractor to find their own route** to achieving it.* *(KPIs). This provided the DP with a huge incentive to meet various milestones and targets and served to align objectives between the DP and the ODA. The KPI approach also provided **flexibility so that incentives could be aligned** between the DP and Tier One contractors.*	*Lessons learned from the London 2012 Olympic and Paralympic Games construction programme*	*R9*

Quote / Extract – Empowering / Goal setting	Legacy document title and reference	
*The ODA devised tools that allowed contractors **to assess their own equality and inclusion performance**. This self-assessment helped to increase transparency and accountability, as each contractor developed individual Equality Action Plans (EAPs) which specified how the contractor would develop their equality and inclusion capacity.* *the modules were bespoke to the needs of each contractor. This allowed for **targeted messaging** which could easily be included in other areas of the contractor's business, helping to introduce good equality and inclusion approaches to the industry.*	*Equality, Inclusion, Employment and Skills – process and systems case study*	*C12*
*Contractors who have made presentations to the EIES Board regularly indicated that they have been supported as well as, where necessary, challenged in a constructive way. This helped to bring about **behavioural changes** in their approach to making EIES part of their regular business rather than an add-on or supplement to the day job.*	*Jobs Skills Future Brokerage*	*C14*

Worker engagement

Workforce consultation is a legal health and safety requirement so it is to be expected that a number of the health and safety studies mention or focus on worker engagement. However, comparable references to the significance of worker engagement, the role of senior management taking the lead, and the essential element of two-way dialogue and respectful interactions are found in relation to equality and inclusion, employment and skills, quality, sustainability, food safety and overall construction management practices. In a sense a number of the extracts are repetitive in the points they make but this serves to demonstrate the significance of this engagement to independent authors. The examples demonstrate different styles of engagement from senior staff walking the site to meetings, surveys and toolbox-style interactive briefings. There are clear expressions of the benefits gained in terms of process improvements, motivation, empowerment and productivity. There are also examples of interactions at different levels with evidence of listening and change resulting. It is also evident that engagement is not compliance driven but stems from a genuine recognition and respect for the knowledge and experience through the supply chain right to the point of work.

Quote / Extract – Worker engagement	Legacy document title and reference	
*the ODA and the DP who **promoted workforce engagement** and the development of informal networks across the Park*	Communication and action for a safer London 2012 Olympic and Paralympic Games	R6
opportunities for employees to feedback	Leadership, governance and engagement	M41
*It made individual workers on site feel that **management did, in fact, care** about them. This generated **commitment** which, in turn, inspired greater **effort and productivity**.*	Lessons learned from the London 2012 Olympic and Paralympic Games construction programme	R9
*it was important to create a space where **feedback is heard and analysed**, so that a positive outcome results from everyone's endeavours, rather than blockages and barriers to getting things done*	Equality, Inclusion, Employment and Skills – process and systems case study	C12
*Tier One contractors' **regular feedback** to the Equality and Inclusion Board made it clear that the two themes ought to be brought together…..duplication and confusion,…..better coordination on the part of the ODA was necessary* ***Be the change that you want to see**: a leadership style that mirrored the approaches that were being promoted was key to the workforce believing the intent of the objectives.*	Equality, Inclusion, Employment and Skills – leadership and strategy	C13

Quote / Extract – Worker engagement	Legacy document title and reference	
*In addition, a selection of each contractor's BAME workforce was also interviewed. Each contractor received a report following the review with recommendations for areas of targeted interventions and **feedback from the staff interviews**.*	Targeted approaches to equality and inclusion	C9
*The involvement of the project's people in development and delivery **ensured relevant content** and messages communicated from familiar faces were **better received**. It also allowed for attendees to follow up thoughts and discussions with those present*	Diversity training contributed to a culture of inclusion on the Aquatics Centre Project	M45
*what came out strongly from all the interviews is that there is a complex balance to be struck between authoritative nanny state controls and **allowing people to make informed choices**.*	Food and sustainable sourcing: Feeding the construction workforce	C15
...initiatives involved all levels through the Programme from senior management to the individuals of the workforce. *Quality circles: .... workforce ... encouraging them to discuss problems or issues with installation techniques, involving them in decisions linked to the final product, **management taking on board the ideas of the experts**.*	Promoting quality during the Build	M10
*Quality Circles ... weekly ... very popular and successful way to involve the workforce and get them to **contribute ways to improve quality**.*	Ensuring quality construction for the Olympic Park	M19
*the artist in residence had to be free to ….. **meet a range of workforce***	Artistic development and exploration	M72
*aimed at supervisors and operatives, but **made available to all interested parties on sit**e*	NoWaste Lean Construction training programme	M89
*worker engagement aspects to be adopted included:–an open 'no blame' culture;–leadership;–robust safe systems of work;–**communications up and down***	Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village	R1
*operatives were working in areas that did not match the Visual Standards, they were **openly encouraged to speak to their supervisor** and arrange for improvements to be made.*	Benefits of using Visual Standards	M55
*The operatives not only have to be trained but must **'buy in'** to the system*	Monitoring risk of hand arm vibration injury	M60
*A review of work activities, **conversations with operatives**, inspection of control measures in use was carried out during a walkthrough of the site*	Occupational health – The combined approach of both clinical and prevention teams	M61
*At the outset, a **questionnaire** was introduced for the workforce to provide their opinions and perceptions of stretch and flex.* *help[s] the **workforce engage** during the morning briefings before starting work;*	Manual handling – reducing muscular-skeletal injuries	M66
Workers believed** health and safety was a high priority for managers* *Workers on one site praised a specific, highly experienced project director as being **very approachable	Safety culture on the Olympic Park	R2
*Factors that were key to this achievement were:.....**the involvement** and particularly, the empowerment, of workers at all levels in relation to health and safety.* ***evidence of worker involvement** in health and safety and of the empowerment of workers by giving them the 'authority' to report near misses, to stop unsafe work and to discuss and contribute to the development of ways of working*	Supply chain management for health and safety	R3
***the more engaged the workforce** was with the OH messages and services provided on the site, the more likely they were to change their behaviour* *[briefings]… were seen as informative, engaging and interesting, and workers commented that the **sessions allowed them to fully engage with the issues**.*	Occupational health provision on the Olympic Park and Athletes' Village	R4
*behavioural safety initiatives which sought to engage workers with health and safety and **make safety personal to them*** *interviewees mentioned the attendance of Tier One project directors at meetings of worker representatives, **conveying the message that health and safety was taken seriously**.*	Leadership and worker involvement on the Olympic Park	R5

Quote / Extract – Worker engagement	Legacy document title and reference	
*Managers talked about operative meetings as an opportunity for issues to be raised, and as **a mechanism for finding solutions and ways to improve health and safety** on the Park.*		
*worker engagement helped to **motivate the workforce** and get key messages across* *Senior management engaged with the workforce, and this helped to get the message across and demonstrate how seriously health and safety were taken 'Do you feel safe on site?' was a key driver.*	The Construction (Design and Management) Regulations 2007: duty holder roles and impact	R7

Business benefits

Many of the legacy documents identify specific benefits delivered for the London 2012 build and offer the potential for improved practices to carry forward into future projects as illustrated below. Some benefits are expressed in core schedule and cost terms or the reduction of risk, others in safer or more sustainable solutions or a more dependable and competent resource base. In some areas such as planning or sustainability step changes in approach have been delivered potentially transforming industry approaches. Most of the reports however deal with a specific priority theme area or a novel technical solution and there is therefore merit in looking at the combined achievement even from just these examples. As revealed by the matrix (**Table 4**) many of these business benefits are documented in the individual papers alongside descriptions of the leadership, clarity, collaboration and so on which was part and parcel of the approach taken. It is these common underpinning characteristics, cascaded through the supply chain, that have enabled business benefits to be crystallised. To this end the culture of challenge, to innovate and find better ways, has paid dividends. It is the potential of the whole approach to enable business benefits to be realised as much as the individual achievements that is the focus of this report. Importantly it is also recorded that many solutions were not seen to be costly but related principally to the way of working and relied on a willingness to adopt them rather than financial investment.

Quote / Extract – Business benefits	Legacy document title and reference	
*the ODA and the DP held a clear view that **a safe site would also be an efficient one*** *Managers expressed the view that the **approach taken had improved productivity and efficiency*** *a number of case study participants also recognised that a number of the practices and methods adopted **were not complex and did not necessarily involve a high cost**. Rather, they required a belief in their value and a willingness to carry them out.*	Leadership and worker involvement on the Olympic Park	R5
*'**Can we do it a better way**? these discussions were also relevant for achieving construction on time and within budget* ***Business benefits could be linked directly to good health and safety performance and CDM*** *many of these lessons relate to the **way of working as opposed to spending extra money** to get results*	The Construction (Design and Management) Regulations 2007: duty holder roles and impact	R7
*it not only has the benefit of ensuring the wellbeing of the workforce, it can negate the need for works to be halted while remedial actions are taken, often at **great expense in time and resources**.*	Temporary bridges	M51
***reduced the risk of procurement slippage** but significantly reduced the procurement programme*	e-Evaluation tool – Award	M78
estimated to have led to: *–**productivity savings** more than £5m;* *–postage and print savings more than £350k;* *–significant **environmental benefits**;* *–**massive reduction in project cycle time** leading to objectives*	Driving best practice procurement processes with eSourcing tools	M80

Quote / Extract – Business benefits	Legacy document title and reference	
delivered faster.		
Without good collaboration, the project would have been exposed to potential risks: *–to the **programme**, for example, if consent approvals took longer than anticipated to be granted; and* *–to the project **costs** (as a result of delays and the subsequent costs of remobilising project teams).*	Collaboration with environmental regulators and statutory stakeholders	C32
*Through early detection, intervention and collaborative working between the Delivery Partner and main contractor, 73 per cent of **supplier risks were removed** pre-tender*	Supply Chain Management – Insolvency Management	C22
*benefits can **reduce uncertainty and risk** for a developer and help to enable a Local Planning Authority to manage planning applications in an efficient and timely way.*	Stratford City Consultative Access Group: Inclusive access and design	C19
*contributed significantly to keeping the **consequential costs of integration to a minimum***	Integrated planning for the London 2012 Programme	M83
significantly reduced programme risk	The town planning client role	M69
*enabled them to make **timely planning approval decisions***	3D model creation and its use on the Olympic Park	M108
*Clarity and continual focus on the end-game meant that the Equality and Inclusion team was less bogged down in the minutiae and worked to capture headline issues of **relevance to delivering both to time, quality and budget** alongside improving approaches to equality and inclusion, and employment and skills*	Equality, Inclusion, Employment and Skills – process and systems case study	C12
*the leadership approach was to **integrate the ambitions of the themes into the business of building** the Olympic Park.*	Equality, Inclusion, Employment and Skills – leadership and strategy	C13
*exceeded its objectives with 430 apprentices engaged at April 2011 Something very positive and supportive was in place within the environment that the ODA created on the build programme and the **markedly low drop-out** helped to promote apprenticeships among those employers who were reluctant to take on young people, some of whom feared a high turnover and a wasted investment.*	London 2012 Apprenticeship Programme	C10
*[Addressed] lack of **candidates** in the sector*	Olympic Park training and apprenticeships strategy	M35
*a better trained/skilled workforce, enhanced **community cohesion**, and partnership collaboration*	The Community and Trade Union Learning Centre	M42
*The business case demonstrated that **staff retention** increases dramatically following the introduction of the Living Wage, which in turn results in savings on recruitment, induction and training Skills Academy was….a major benefit to people from the local area achieved over 20 per cent of residents of the host boroughs working on the Park [cf 10-15 per cent target]*	Negotiating the Citizens Agenda for Wages, Training and Employment	M43
*The beneficiaries of additional learning are not only the apprentices themselves, but also the building contractors, through the renewed **enthusiasm and commitment the apprentices** have towards their own personal development and a better understanding of their role in the business.*	Building for success – Apprentice Plus programme	M44
*The workshop has been delivered within several of the Tier One contractors' operating companies, has been adopted by a number of supply chain companies and is being **rolled out on other of the Tier One contractors' group projects***	Diversity training contributed to a culture of inclusion on the Aquatics Centre Project	M45
*The booklet is also being considered for **distribution across the company** beyond London 2012.*	Positioning Equality, Diversity and Inclusion alongside Health and Safety	M47
*almost 500 unemployed local people have found meaningful work. In addition, another 1,000 people have **developed new skills** to prepare them for employment as well as set them up to progress to a full qualification.*	Training in partnership:	M48
*feedback following the events suggests that they were well received and gave **value for the time invested***	Embedding diversity in the supply chain	M49

Quote / Extract – Business benefits	Legacy document title and reference	
recognition that a diverse and inclusive culture provides more opportunities than challenges, such as a more committed workforce, a wider pool of talent and a ***reduction in industrial relations issues****.* *80 per cent of operatives and 100 per cent of supervisors thought that they would* ***take learnings*** *around equality and diversity with them to their next project*	Leadership, governance and engagement	M41
... economic downturn, as a result, there was a greater focus on ***sustainable employment and on up-skilling the existing workforce****. This is a good example of both the ODA and the NSAfC being able to respond quickly to employer-led demands and focus on supporting the workforce where possible, and such flexibility has been a positive aspect of this approach.* *The NSAfC along with collaborative management employed by the ODA were* ***key to the overall [build] success****.*	Demand-led skills provision, including National Skills Academy for Construction status	C8
The ODA worked directly with its contractors to raise awareness of the potential employees who could be missed through traditional employment practice and to improve their understanding of disability in the workplace. This resulted in a number of the contractors working directly with specialist providers to increase their awareness and saw an ***increase in the number of disabled people employed*** *both on and off the Park.*	Targeted approaches to equality and inclusion	C9
improved efficiency, assurance and reliability of data	Web-based spatial data viewer	M109
provide the flexibility needed to ***mitigate the risk*** *inherent in operational requirements that had not matured at the time*	Systems Integration: A programme-wide approach to systems delivery	C37
*[****Savings on time, rework, abortive work*** *etc]*	Transport Knowledge Management	C36
A key achievement has been the role of green infrastructure in supporting the delivery of over three-quarters of the ODA's ***sustainability commitments***	Olympic Parklands Green Infrastructure	C4
The Games has provided an opportunity for those manufacturers that are investing in R&D to improve the sustainability impact of their products, ***gain a competitive advantage in the marketplace and be rewarded by increased sales****.*	The role of the construction supply chain in delivering sustainable solutions on the Olympic Park	C31
a low carbon footprint and ***reduced energy bills for the Legacy owner***	The Velodrome, the most energy efficient venue on the Olympic Park	M104
lasting benefit in the supply chain by ***increasing the number of certified suppliers***	Project FSC certification – assuring legal and well managed timber	M88
13 per cent ***decrease in waste production*** *over a six-month period and an estimated £94,000 saving in waste disposal costs*	NoWaste Lean Construction training programme	M89
Align the campaign with the Health and Safety initiatives that are taking place where possible, after all they ***impact each other****, use similar techniques such as behavioural training for supervisors*	Promoting quality during the Build	M10
The investment in a new groundwater supply does not only result in ***financial savings****; the reduction in potable mains water also helps meet sustainability objectives*	Non-potable water supply for construction	M90
high standards *on the Park and Public Realm could be attributed to careful design, leadership and checking and reviewing*	Ensuring quality construction for the Olympic Park	M19
phased approach to ***reduce disruption*** *to rail movements [and costly possession] This allowed the contractor significant flexibility in delivering the scheme, with non-critical path works able to be rearranged to best utilise plant, sub-contractors, site conditions, and progress. Unforeseen site conditions were able to be accommodated into the works without delay to the delivery of the scheme.* *method resulted in an* ***acceleration of the remaining works, and significantly reduced the risks of working at height***	Managing the demolition of Angel Lane bridge	M21
central resource enabled remote monitoring and off-site review, which ***minimised the requirement for multi-discipline, resource heavy site visits****.*	Web-based photograph viewer	M110

Quote / Extract – Business benefits	Legacy document title and reference	
*enabling stakeholders to debate issues and agree a solution that **maximised the sustainability of the whole design**, and not just one element*	Assessing the sustainability of pavement design solutions	M12
*hoped that the contractors will go on to **use this knowledge and experience in other projects** beyond the Park*	Improvement in occupational health: a Velodrome case study	M13
*review period was constrained to a 10-day turnaround…..OITAA was **able to draw upon a large pool of specialists** who were independent of the design process to achieve these targets*	Olympic Infrastructure Technical Approval Authority	M14
significant contribution to meeting the ODA's ambitious sustainability targets	Sustainable material use in paving and seating	M15
*delivered £2 million **cost saving** and a 42 per cent reduction in waste*	Primary Foul Sewer value engineering	M17
*delivered an architecturally enjoyable building that relates well to its environment, creating **improved site amenity**, sense of place and in turn better site value for future developments*	Complementary engineering and architecture of the Primary Foul Water Pumping Station	M18
*The principle of considering the Park as a separate license area [for network operators] was used in the development of the utilities to **maximise competitiveness** in the procurement process.*	Utilities resilience and capacity on the Olympic Park	M25
*The ODA's decision in 2009 to use advanced lighting and energy-savings technologies such as LEDs has reduced waste and provided **improved quality and distribution of light**.* *generated some **cost savings** though combined procurement.* *clear benefits in aligning the lighting strategy with the biodiversity objectives for the project.*	Olympic Park lighting design	M31
*a more **efficient and ultimately cost-effective solution***	Lighting the Olympic Park main arenas	M33
***eight outfalls were eliminated** through sustainable design*	Outfall design optimisation to meet multi-stakeholder objectives	M36
***saved £200,000** by removing the requirement for a separate art panel*	Design solution for enhancing a functional security fence	M71
reduced instances of damage**, and impacts in terms of injuries to individuals, delays to programme, expensive reworks and repairs Cable Inspectors were able to offer advice and propose solutions in order to **minimise delays	Working together to prevent cable damage	M11
*This solution offered the following **benefits**:–It eliminated any possible cable strikes;–It made use of recycled waste material;–It was quick and easy to install;–It was a cost-effective solution.*	Using free-standing pins to reduce the health and safety risk to buried services	M52
*The **advantages** of the suction excavator were that it:* *—did not damage underground cables and was a single operation;* *—took up less space than a normal excavator and tipper truck;* *—required only two operators and was a neater and cleaner process.*	Suction excavation reduced risk of cable strikes	M53
***elimination of accidents** involving QHs on the Park.*	Quick hitch – management and safe use	M54
*when personnel moved to a different site on the Olympic Park, or a new site was set up, everyone knew the standards to be achieved, making the **start up phase of a contract much more effective and efficient.*** *aspiration is that all personnel who have worked with these Visual Standards will be able to use the standards of excellence on their **next project**. This will help share good practice across the whole of the UK construction industry.*	Benefits of using Visual Standards	M55
*all trades were free to move around the slab using the D49 as a stable platform **greatly reducing the risk of lower limb injurie**s*	Reducing trip hazard during construction of steel reinforcement concrete slabs	M57
*[**benefits**] were:–elimination of the risk of falls from height; –reduction in manual handling; –elimination of hot works; –protection of the riser for follow-on trades and building operation and maintenance*	Riser platforms and protection floor penetrations	M58

Quote / Extract – Business benefits	Legacy document title and reference	
reduced risk from exposure to hazardous substances, and ***reduced the likelihood of works being halted*** *if concerns were raised*	International Broadcast Centre/Main Press Centre – selecting the safest materials	M59
This allowed contractors to ***significantly reduce delays*** *in work incurred with time lost through off-site treatment and investigation of the incident and resolution of the problem*	Occupational health – The combined approach of both clinical and prevention teams	M61
allowed the ***works to continue with minimal delay*** *while ensuring the continued safety of the welders*	Impact of design change on occupational health risk	M62
approach allowed the contractors to continue working with ***minimal delays*** *or risk to the health of operatives.*	Asbestos in soil – keeping the work going	M63
An added benefit of using the plastic protection is that it ***speeds up filling*** *and results in less 'spillage' over the top of the basket.*	Reducing hazards of installing gabion walls	M64
Stretch and flex continues every morning and has been given the 'green light' to be ***taken forward in the rest of the Tier One contractor's business*** *– a great step forward for the construction industry*	Manual handling – reducing muscular-skeletal injuries	M66
reduce the likelihood of significant delays *being encountered if work is halted to improve the controls.*	Welding – identifying the right level of control	M67
cost saving *through the use of the latest technology and infrastructure* ***prevented works being done more than once*** *at one location wherever possible*	Effective delivery of transport mitigation measures: the Olympic Park Transport and Environmental Management Scheme	M68
The success of this approach is evident through the ***small number of complaints*** *received by the construction hotline* *possible to carry out construction in a considerate manner, without significant impact on the programme or cost*	The control of noise during construction	M93
A workforce that was respectful, felt listened to, and therefore, adhered to the organisation's policy and procedures.	Safety culture on the Olympic Park	R2
On the other, however, there were ***elements of the system that suppliers reported intending to adapt*** *and continue to use on future projects.* *their companies'* ***health and safety systems had been improved*** *by the experience of working on the Park*	Supply chain management for health and safety	R3
The reuse market needs to become more established ***to incentivise construction projects*** *to expend resources on developing and implementing such a strategy*	Construction waste management on the Olympic Park	C30

Reward and recognition

As the extracts reveal, reward and recognition were a key feature of the build approach. Reward and recognition took many forms and began in the tendering processes where a balanced scorecard was used to value good previous performance in a range of areas such as health and safety. Recognition was sought from established schemes at corporate (e.g. BREEAM) and individual (e.g. NVQ) levels. Prestigious awards from peers in the industry were particularly valued (e.g. for engineering design or the occupational health service). There were awards within the London 2012 arena like the Inspire Mark for the Learning Centre as well as for performance against priority themes where not just performance levels but also relative improvements were rewarded. Themes like diversity were given a dedicated set of awards for the first time, not just embedded within a clutch of industry awards. Performance towards the build objectives was also celebrated at key milestones with Park-wide and external fanfares whether linked to the completion of venues or significant manhours without reportable injuries. The examples demonstrate the simplicity of the awards but the motivation and engagement that flowed from the symbolism. Crucially the reward and recognition process tapped into the inherent pride of the teams in the collective achievements.

Quote / Extract – Reward and recognition	Legacy document title and reference	
*Reward and recognition was a **key feature** of the Olympic Delivery Authority's (ODA's) construction programme* *Contractors who were nominated, but did not win outright received an ODA certificate in **recognition***	Using an awards process to change behaviour and performance	M40
*clear that their health and safety reputation had been **influential in securing their work** on the Park and stood to be significantly enhanced by their continued success in such a high profile project*	Supply chain management for health and safety	R3
*The service received a number of **awards from external bodies**,*	Occupational health provision on the Olympic Park and Athletes' Village	R4
*shortlisted for the prestigious **RIBA Stirling Prize***	The Velodrome, the most energy efficient venue on the Olympic Park	M104
***Certification** is advantageous to CfSH and BREEAM…. providing market recognition for low environmental impact buildings*	Project FSC certification – assuring legal and well managed timber	M88
*gave individuals the opportunity to gain a **recognised qualification*** *82 people achieved an NVQ in waste management*	NoWaste Lean Construction training programme	M89
*awarded the **best improvement** in occupational health award*	Improvement in occupational health: a Velodrome case study	M13
*the centre was awarded the **Inspire Mark**, for stimulating and innovative projects inspired by the Games*	The Community and Trade Union Learning Centre	M42
*felt it was essential to hold this **'thank you'** event and to conclude the participant's engagement of the project, so that they felt their time had been well spent*	Innovation in creative community engagement	C16
*The real impact of the work has been in terms of the people who built the Park, **celebrating their roles** and raising the profile of the hidden stories.*	Artistic development and exploration	M72
*Tier One contractors were required to consider programmes which incentivise personnel and teams at all levels to make **a positive contribution to good health and safety performance**. Reward and recognition for workers on the Games construction projects included:-pin badges for worker contributions; –specially made t-shirts; -monthly SHELT awards;–ODA annual awards; –free BBQs; –breakfast vouchers.*	Delivering health and safety on the development of the London 2012 Olympic Park and Athletes' Village	R1
*In addition, the DP's Sustainability team established the Key Performance Indicator for zero rejected loads .... This strategy was very effective; the majority of contractors strove to achieve high levels of good quality segregation. They were incentivised by lower prices for segregated waste and the **recognition for implementing best practice waste management**.*	Construction waste management on the Olympic Park	C30
market, promote and celebrate achievements	Delivering the Olympic Park Biodiversity Action Plan	C33
*reward and recognition for good quality practices….Pin badges .. showed...that quality was **important to the client*** *Celebrating getting it right.*	Promoting quality during the Build	M10
*commitment to quality, awards ….were much appreciated and helped to ensure that the workforce felt that their commitment to quality was **recognised***	Ensuring quality construction for the Olympic Park	M19
*If the standards on site matched the 'good' pictures in the Visual Standards, the project teams were **congratulated on their achievements***	Benefits of using Visual Standards	M55
*implemented a one-month introductory reward and recognition scheme solely to reward those who had stopped work for safety reasons. This **helped to increase the take-up** of the initiative and gave workers the confidence to stop work for health and safety reasons;*	Safety culture on the Olympic Park	R2
*reward and recognition programmes to **encourage safe working*** *Reward systems form an important lever in **shaping both individual and organisational behaviours** and were an important factor in encouraging near miss reporting* *Celebrating good performance was also a way of **maintaining the high profile** of safety on the projects, and the Park more widely.*	Leadership and worker involvement on the Olympic Park	R5

Quote / Extract – Reward and recognition	Legacy document title and reference	
*The use of rewards also **positively reinforces the message** that safety is important*	Communication and action for a safer London 2012 Olympic and Paralympic Games	R6

APPENDIX C - A CONSTRUCTION INDUSTRY FOR THE 21ST CENTURY

One of the drivers of the approach adopted for the London 2012 build was a conviction from experienced practitioners that the British construction industry could and should be doing things better and London 2012 gave a unique opportunity to develop and demonstrate best practice. As many acknowledged in the course of interviews, the approach adopted was not unheard of but it was unusual to place such explicit and continual focus on a respect for people in all its different guises. In understanding the influences that finally came to bear on the success of the London 2012 build, some reflection on milestones in the construction industry's development is warranted.

Back in the **1990s**, with Government level concern about the extent of conflict and litigation, and the unsatisfactory productivity and competitiveness of the UK construction industry in the international market, Sir Michael Latham was asked to lead a review of procurement and contractual arrangements. Following wide industry consultation, his report 'Constructing the Team' was published in July **1994**[14] to address the problems of fragmentation. Key points within the Executive Summary relevant to the approach developed some 12 years later for the London 2012 build include:

- *Implementation* [of improvements] *begins with clients*
- *Clients, and especially Government, …have a role in promoting excellence in design*
- *Use of coordinated project information should be a contractual requirement*
- *..clients should begin to use the NEC and phase out 'bespoke' documents*
- *The role and duties of Project Managers need clear definition. Government project sponsors should have sufficient expertise to fulfil their roles effectively*
- *Tenders should be evaluated by clients on quality as well as price*
- *Adjudication should be the normal method of dispute resolution.*

In the health and safety arena, this coincided with the introduction of the **1994** Construction (Design and Management) Regulations[15] which placed new duties on clients, designers and contractors, and required similar coordination and cooperation between the parties in the supply chain.

Work got underway to implement Constructing the Team recommendations and the Reading Construction Forum published 'Trusting the Team' based on research into partnering in **1995**[16], to be followed by innumerable academic works and industry guides in later years. Sir Michael Latham's Foreword to that book welcomed its "*clear best practice guidance aimed at replacing the adversarial attitudes which proliferate with a new* [partnering] *approach based on mutual objectives, agreed problem resolving methods and continuous improvemen*t". The book summarised three stages of partnering all of which are recognisable in the ODA's approach:

- *mutually agreeing to use partnering;*
- *setting up an initial partnering workshop to agree objectives and the disputes resolution process; and*
- *carrying out the construction work using partnering workshops to ensure the team steadily gets better and better.*

The next Government came to power in **1997** and, impatient for change in practice, a Construction Task Force was set up to look at the scope for improving quality and efficiency in UK construction. Sir John Egan's report 'Rethinking Construction' was published in **1998**[17]

building on the earlier foundation[14]. It begins praising the excellence of the industry at its best but lamenting its propensity to under-achieve. To improve quality and efficiency and ensure the industry's survival into the 21st century, five key drivers for change were identified which, again, are relevant to the approach for the London 2012 build. The drivers are listed in Table 5 quoting the description and rationale from the report. Certain words are highlighted by this report's authors which it will be recognised mirror many features of the London 2012 approach being linked to performance success.

It would generally be frowned on to quote large sections from readily available references in research reports such as this. However, the rationale for the main themes identified in the Egan report is deliberately reproduced here. References to "*Egan*" and "*Latham*" are made liberally around the industry, but for many it will be some while since the detailed words have been reviewed. The words do however deserve fresh scrutiny. It is to be remembered that the report reflected extensive consultation so it was the industry which helped define the Egan priorities. The point is that the approach to the London 2012 build has embraced key elements of those recommendations. The 'you said, we did' mantra for engagement on the Park has some resonance here. To some it may be disappointing that no new silver bullet has been identified, but perhaps more importantly it demonstrates that solutions are already within the industry's ken, and the London 2012 experience has demonstrated how the elements can be implemented in practice to deliver successful construction outcomes. Furthermore, the London 2012 build has also demonstrated how the response to these drivers leads to improved construction performance across a range of metrics whether time, cost, health and safety, diversity and inclusion, and so on.

Back in **1998**, following on from the Egan report recommendations, the body Movement for Innovation (M4i) was established. The terms used in the Egan report were for a movement for change to involve all who were able to demonstrate commitment to:

- *carrying out demonstration projects to advance the knowledge and practice of* ***construction best practice****;*
- ***focusing on the needs of*** *their* ***clients*** *in everything that they do;*
- *developing within their own organisations and throughout their supply chains a* ***culture of trust and respect*** *that encourages the contributions of all participants in the project process;*
- ***training*** *all their staff fully and providing them with conditions of* ***employment and facilities that enable them to give of their best****;*
- ***measuring performance*** *against other member's projects and project processes, and* ***sharing the results*** *with the wider industry;*
- ***extending the benefits*** *of improved performance to all their clients.*

The phrases highlighted are again reflected in the London 2012 approach.

Table 5 Drivers for change quoted verbatim from the Egan Report, 1998[17]

Driver	***Description***	***Rationale***
Committed leadership	This is about management believing in and being totally **committed** to driving forward an agenda for **improvement** and **communicating** the required **cultural** and operational changes throughout the **whole** of the organisation.	*In construction, there is no part of the industry which can escape this requirement: it affects constructors, suppliers and designers alike. The Task Force has met many managers of companies in the construction industry over the last few months and, while many wish to improve company performance, we have yet to see widespread evidence of the **burning commitment to raise quality and efficiency which we believe is necessary**;*
A focus on the customer	In the best companies, the customer drives everything. These companies **provide precisely what the end customer needs**, **when** the customer needs it and at a **price** that reflects the product's value to the customer. Activities which do not add value from the customer's viewpoint are classified as waste and eliminated.	*In the Task Force's experience, the construction industry tends not to think about the customer (either the client or the consumer) but more about the next employer in the contractual chain. Companies do little systematic research on **what the end-user actually wants**, nor do they seek to raise customers' aspirations and educate them to become more discerning. The industry has no objective process for auditing client satisfaction comparable with the 'ID Power survey' of cars or the 'Which' report. We think **clients**, both public sector and private sector; should be much more **demanding of construction**;*
Integrate the process and the team around the product	The most successful enterprises do not fragment their operations - they work back from the **customer's needs** and focus on the product and the value it delivers to the customer. The process and the production team are then integrated to **deliver** value to the customer efficiently and eliminate waste in all its forms.	*The Task Force has looked for this concept in construction and sees the industry typically dealing with the project process as a series of sequential and largely separate operations undertaken by individual designers, constructors and suppliers who have no **stake in the long term success** of the product and no commitment to it. Changing this **culture** is fundamental to increasing **efficiency and quality** in construction.*
A quality driven agenda	Quality means not only zero defects but **right first time**, delivery on time and to budget, innovating for the benefit of the client and stripping out waste, whether it be in design, materials or construction on site. It also means after-sales care and reduced cost in use. Quality means the total package - exceeding customer expectations and providing real service.	*The industry rightly complains about the difficulty of providing quality when clients select designers and constructors on the basis of lowest cost and not **overall value for money**. We agree. But it must understand what clients mean by quality and break the vicious circle of poor service and low client expectations by delivering real quality.*
Commitment to people	This means not only **decent site conditions, fair wages and care for the health and safety** of the work force. It means a commitment to **training** and development of committed and highly capable managers and **supervisors**. It also means **respect** for all participants in the process, involving everyone in **sustained improvement and learning**, and a **no-blame culture** based on **mutual interdependence and trust**.	*In the Task Force's view much of construction does not yet recognise that its **people are its greatest asset** and treat them as such. Too much talent is simply wasted, particularly through failure to recognise the significant contribution that suppliers can make to innovation. We understand the difficulties posed by site conditions and the fragmented structure of the industry but construction cannot afford not to get the **best from the people** who create value for clients and profits for companies.*

Amongst the working groups set up by M4i, one examined the issues associated with people in the industry[18] and in November **2000** published 'A Commitment to People "Our Biggest Asset"'[19]. This report set out to demonstrate to industry and its clients that 'people' issues are fundamental to business success and identified seven priorities for action, bringing clear attention to factors which have featured in the London 2012 approach, namely:

- Workplace Diversity;
- Site Facilities and the site working environment;
- Health;
- Safety;
- Career development and lifelong learning;
- The off-site working environment;
- Behavioural issues.

A series of trials was taken by several hundred companies before a final report 'Respect for People - A Framework for Action'[20] was published in November 2004 (with M4i now consolidated with other bodies under the Constructing Excellence umbrella). The framework was accompanied by specific toolkits which have been advanced over subsequent years and used to benchmark performance, align with other key industry standards, and drive progress against quantified performance improvement targets in all areas.

Turning back to 2000, not long after the Egan report was published, the Government was maintaining its focus on the construction industry's performance and in particular the unacceptable toll of death and injury. In 2000/1, 105 construction workers were killed, a 30% increase on the previous year and a rate of 5.9 per 100,000 workers[***]. As the figures were emerging during the year, the Deputy Prime Minister with HSE convened a high level summit of industry leaders in February **2001** entitled 'Turning concern into action'. Within the action plans put forward by different industry groups, were commitments to inter alia:

- develop a culture of continuous improvement
- [construction clients] demonstrate a lead
- recognition of occupational health
- close cooperation between client and contractors
- involving the workforce.

The above are taken from summaries in an HSE research report[21] in which the authors also observed:

> *At the Summit the politicians laid out the challenge to redefine the modern construction industry. Importantly its productivity is being held back to a degree by a skills shortage, not as much to do with training as the inability to attract trainees and undergraduates to the construction sector. The modern world is one which cocoons individuals and develops*

[***] The severity of the situation can be understood against the latest (provisional) figures available from HSE for 2010/11 a decade on showing the number of worker deaths in construction is 50 equivalent to a rate of 2.3 per 100,000 workers. Major injury rates per 100,000 employees then and now were 380.9 compared with 173.2 in provisional figures for 2010/11 (see http://www.hse.gov.uk/statistics/industry/construction/construction.pdf).

expectations that the 'system' will care for the 'individual'. In that context a rugged, uncomfortable and hazardous occupation is not attractive or necessary. It may be that the recognition needed to drive health and safety improvements is the same 'respect for people' [needed] to secure the industry's economic prosperity.

2001 also saw the formation of the Strategic Forum for Construction (SF*f*C) which continued under the chairmanship of Sir John Egan to develop Rethinking Construction[17] actions. His second report 'Accelerating change' published as an SF*f*C document in September **2002**[22] set out more specific measures to be implemented to secure the improvements sought. In his opening statement now familiar points were re-emphasised linking improvements for health and safety with business benefits.

I also passionately believe in the importance of tackling the industry's health and safety problems. Pre-planned, well designed projects, where inherently safe processes have been chosen, which are carried out by companies known to be competent, with trained work forces, will be safe: they will also be good, predictable projects. If we are to succeed in creating a modern, world class industry, the culture of the industry must change. It must value and respect its people, learn to work in integrated teams and deliver value for clients' money.

Accelerating change also brought sustainability onto the agenda including in the SF*f*C recommendations:

- *The industry must take responsibility for the sustainability of its products (from components to the completed structure) as well as its processes*.

At that stage the SF*f*C was reconstituted as an industry rather than ministerial led group.

Progress on health and safety still remained high with annual reports from HSE to Government covering progress since the 2001 Summit. Releasing the second report in January **2003**, HSE's Chief Inspector of Construction was quoted[23]:

The work of the Strategic Forum for Construction has also placed decent working conditions centre stage and confirms the business case that good health and safety is not a burden or additional cost. A properly procured and managed project delivers best value to the client, industry profitability and a safe and healthy workforce.

The role of Chief Inspector of Construction was by this time a full-time post and, following the 2001 Summit, HSE had established a separate Construction Division with dedicated resources and construction specific inspectors. The intervention approach was also changing, mirroring the focus of the CDM regulations and industry recognition of the underlying influences on construction practices. While addressing activities on site which were unsafe or damaging to health remained a priority, early strategic interventions with clients, designers and contractors became an increasing focus to help secure improvements before options were limited by the constraints on site. Engagement with major projects early in their gestation, and involvement with groups with the power to effect change over swathes of the industry, became the norm. This is reflected in the HSE's intervention strategy for London 2012[10], in its ongoing work plans[24], papers for HSE Board sanction[25], and in specific support material such as the toolkit[26], developed with the construction industry's Leadership and Worker Engagement Forum, to help contractors and managers reduce harm by learning from the best in the construction industry.

In order to recognise the industry's early successes in improving health and safety performance since the 2001 Summit and maintain the momentum across the more challenging areas like client leadership, a follow up Summit was arranged by Ministers and HSE in February **2005** with the theme of 'Ownership, Leadership, Partnership'. The opportunity was taken to launch the SF*f*C's 'Respect for People Code of good working health and safety practices' setting out universal good practice principles which could stand alone or alongside the RfP toolkit[27]. Jointly badged with HSE's Ownership, Leadership, Partnership Summit strap-line, this made a powerful demonstration of the alignment of the industry modernisation and health and safety agendas.

February **2005** was also the time when the International Olympic Evaluation Committee visited London to inspect the bid plans which had been under development since the bid team was formed in 2003 and it was on July 6 2005 the announcement was made that "*the Games of the XXXth Olympiad in 2012 are awarded to the city of…London*".

This then was the background to the status of construction management practices and developments particularly in relation to respect of people and related issues and the regulatory framework for health and safety. Certainly at the mature end of the industry most of the issues emerging from this research and linked to the success of the London 2012 build were well recognised with demonstration projects confirming their value. Nevertheless effective implementation was not universal nor did it consistently cover all aspects. This serves to demonstrate the significant achievement in implementing so many elements of the modernising construction agenda in the London 2012 build.

However, the context changed further even as Government and the industry came together to design and build the London 2012 Games facilities from **2006** onward.

The first important step was linked to the build itself. Reflecting the driver identified at the start of this appendix, that the London 2012 Olympic Games and Paralympic Games offered a unique opportunity to showcase the very best of Britain, the SF*f*C recognised that the construction industry expected to make an outstanding contribution delivering sustainable, exemplary projects with long-term benefits for the local community and the nation. A Task Group was set up in 2005, announced by Ministers, as a focal point for liaison between the industry, the Government and London 2012 Olympic authorities (the ODA and LOCOG) to help ensure the successful delivery of the London Olympic facilities and infrastructure[28]. This put best practice firmly on the agenda and the terms of reference included explicit reference to "*effective leadership, supply chain management, industry improvement, respect for people, innovation*". Their Task Group conducted wide consultation, involving Government bodies and the industry at large, to ensure all subject areas were covered and a strong consensus achieved. A set of Construction Commitments[29] was launched in July 2006 with six to eight points for action to address each of the six key areas deemed vital to delivering the Games' vision in time, safely and to budget:

- Procurement & Integration
- Commitment to people
- Client leadership
- Sustainability
- Design quality
- Health and Safety

In launching the commitments and inviting companies to sign up (as of 2012 more than 400 have done so) the SF*f*C said:

> *They represent the principles by which we will endeavour to achieve a better industry and exceed current best practice. The Commitments will be developed by the client and the industry in a practical and realistic way to suit the needs of the Olympic delivery programme and projects and to provide for relevant targets.*

Another significant step, following a long period of consultation (including formal consultation through 2005), was the revision of the CDM regulations in April **2007**[30] (CDM 2007). The principles implement a European Directive so remained the same but the objectives[†††] in changing the details were to focus on:

- Simplification - making it easier for the dutyholders to know what is expected of them;
- Flexibility - the regs need to work across the vast range of contractual arrangements;
- Planning and Management- emphasise active management and effective risk control rather than endless paper chases and unread plans;
- Better integration - particularly between designers and contractors - sharing problems and finding solutions before they materialise on site;
- Improve Competence - both of companies and individuals to raise standards and reduce bureaucracy.

Key points for clients emphasised in HSE's presentations[31] around the launch included:

- The focus should be on establishing a competent project team early on which fosters a culture of co-operation and integration
- By choosing the right people for the job and appointing them early, your team can make sure that your project is safe to build, safe to use, safe to maintain and deliver you good value
- Invest in your team, not in paper. Give them enough time and resource and you will get the building you want, when you want it and on budget.

With CDM 2007, HSE presentations emphasised the importance of integration, particularly on large complex projects, and involving contractors when reviewing buildability and the client (or future building operators) when reviewing usability and maintainability. HSE also placed emphasis for Principal Contractors on worker engagement and communication linking this to positive safety culture with fewer accidents and better health, improved innovation and productivity.

In parallel work on industry's RfP agenda continued with 'Respect for people: The business benefits'[32] being published by Constructing Excellence in August **2007** presenting case studies and results of a survey exploring the impact of implementing the RfP tools. The headline

---

[†††] Parallel research (Frontline Consultants Ltd. '*The Construction (Design and Management) Regulations 2007: duty holder roles and impact*', http://learninglegacy.london2012.com/publications/the-construction-design-and-management-regulations-2007-.php, 2011) researched the extent to which CDM2007 helped or hindered the construction of the London 2012 Olympic and Paralympic Games by reviewing how those with duties under CDM put them into practice.

finding from the survey was that all sectors of the industry from suppliers, contractors, professionals to clients were agreeing or strongly agreeing that Respect for People contributed a positive business benefit. The business case for action[32] centres on '3 Rs': **r**espect for people enabling **r**ecruitment and **r**etention of the best talent of individuals and business partners. It argues that to improve performance, it is important to involve, engage and empower everyone in the process otherwise profitability will not improve and new contracts will not be secured. Success is illustrated by the graphic in Figure 3.

Figure 3 The business benefits flowing from a respect for people [32]

An over-arching recommendation of RfP is now also that construction firms of all kinds and sizes should commit to achieving the standard of Investors in People[33], something adopted by the ODA client and CLM delivery partner and into the supply chain for the London 2012 build.

Just as the profile of sustainability was raised in Accelerating Change[22], so the policy framework was expanded on in a Strategy for Sustainable Construction[34] published as a result of work by industry (via the SF*f*C) and Government in July **2008**. In parallel with the changing shape of health and safety legislation[30], the focus expanded beyond the immediate construction phase to include the longer term implications for sustainability in use. These legacy impacts already featured similarly in the London 2012 approach.

At the same time (July **2008**), Government was publishing its wider review 'Construction Matters'[35]. Again a Government report began noting that despite areas where the UK construction industry was a world beater, there were also significant problems. Factors were highlighted like the complexity and fragmentation, difficulties in ensuring that lessons from experience are shared, the perceived risks of innovation and so on. Recommendations were wide ranging but included, for example, early engagement with the supply chain, integrated team working, measuring performance workforce diversity etc. The timing meant that early work for the London 2012 build came under specific scrutiny. It was said "*the adoption of an integrated team-working approach will be key to the delivery of the Games on time and to budget. Early indications suggest the Olympic Delivery Authority (ODA) is adopting most of the best practice required to foster such integrated working.*" Acknowledging that construction work had only just begun, progress in relation to sustainability, workforce engagement, health and safety, training opportunities, and diversity was praised.

In **2009** a further report was published based on an industry review led by Andrew Wolstenholme, entitled 'Never Waste a Good Crisis: A review of progress since Rethinking Construction and thoughts for our future'[36]. With the backdrop of the economic down-turn it

considered and confirmed the ongoing relevance of Egan's Rethinking Construction themes[17] with the increasing emphasis on contributing to a low carbon economy and whole life values. Whilst recognising the role of clients, the report points at the significance of supply side solutions to shape the industry's long term future.

> *We believe that the era of client-led change is over, at least for the moment, and that it is now time for the supply side to demonstrate how it can create additional economic social and environmental value through innovation, collaboration and integrated working – in short, the principles outlined in Rethinking Construction. Clients should focus instead on professionalising their procurement practices to reward suppliers who deliver value-based solutions.*

Although the timing limited impact on the London 2012 approach, it underlines the relevance of the supply chain experiences and working practices for application to other projects in the future.

Looking at the wider context it was in 2001 that the philosophy of the Japanese Toyota motor manufacturing company was set down explicitly[37] with two main elements - continuous improvement and respect for people - covered by 14 key principles. The principles for continuous improvement include establishing a long-term vision, working on challenges, continual innovation, and going to the source of the issue or problem and those relating to respect for people include ways of building respect and teamwork. The more recent developments in the so-called India Way[38] style of management, suggest higher levels of trust and respect are engendered by a corporate focus more on worker and wider societal values than shareholder returns. Although somewhat removed, these references illustrate the extent to which respect for people and other values were gaining acceptance as the design and build phases for London 2012 took shape. In addition the wider motivating principles linked to corporate social responsibility in the India Way have some parallel in the Olympic ideals and particularly the societal contribution from the regeneration and legacy the build was set to bring to East London.

REFERENCES

1 ODA. *London 2012 Learning Legacy web resource,* http://learninglegacy.london2012.com/about/, launched October 2011. From mid-December 2012 the content, including a summary of this research report, will be available via: http://learninglegacy.independent.gov.uk./

2 Major Projects Association. '*London Games - From Construction to Commissioning*', Seminar, 2 November 2011, London, including Bolt, HM / Loughborough University Enterprises Limited, 'Leadership and the human dimension of the learning legacy', http://www.majorprojects.org.

3 BOMEL Ltd. '*Improving health and safety in construction Phase 2 – Depth and Breadth. Volume 6: Generic model for health and safety in construction*', HSE Research report RR235, 2004.

4 Health and Safety Executive. '*London 20120 Games – Research Reports*', http://www.hse.gov.uk/aboutus/london-2012-games/research-reports.htm

5 Olympic Delivery Authority. '*Learning Legacy*', http://learninglegacy.london2012.com/documents/pdfs/supporting-documents/learning-legacy.pdf, October 2011. From mid-December 2012 the content will be available via: http://learninglegacy.independent.gov.uk./

6 NEC. ' *What is the NEC?', http://www.neccontract.com/documents/WhatistheNEC.pdf*

7 ODA. '*Programme delivery baseline document*', http://www.london2012.com/about-us/publications/publication=programme-delivery-baseline-report/, Revision 28 May 2009.

8 Shiplee, H et al. '*Delivering London 2012: health and safety*', Proceedings of the Institution of Civil Engineers – Civil Engineering Volume 164, No. CE5, May 2011.

9 Hampton, P. '*Reducing administrative burdens: effective inspection and enforcement*', http://www.berr.gov.uk/files/file22988.pdf March 2005.

10 Health and Safety Executive, Construction Division. '*Intervention Strategy and delivery arrangements for regulating the Construction Phase of the London 2012 Venues and Infrastructure*', Revision 3, http://www.hse.gov.uk/aboutus/london-2012-games/resources/construction-intervention-strategy.pdf, February 2011

11 Health and Safety Executive. '*The London 2012 Olympic and Paralympic Games: HSE's role in making it happen*', http://www.hse.gov.uk/aboutus/london-2012-games/index.htm, current February 2012.

12 Health and Safety Commission. '*Managing health and safety in construction. Construction (Design and Management) Regulations 2007. Approved Code of Practice*'. HSE Books Publication L144, ISBN 978-0-7176-6223-4, 2007.

13 Advisory Committee on the Safety of Nuclear Installations (ACSNI). *Study group on human factors, Third report: Organising for safety*. HMSO, 1993.

14 Latham, Sir Michael. '*Constructing the Team*', HMSO, July 1994.

15 Health and Safety Executive. *Construction (Design and Management) Regulations*, HMSO, 2007.

16 Bennett, J. and Jayes, S. '*Trusting the Team*', Reading Construction Forum, ISBN 0-7049-0503-5, 1995.

17 Egan, Sir John. '*Rethinking Construction*', HMSO, 1998.

18 Constructing Excellence (incorporating the former Movement for Innovation). Respect for people website zone: http://www.constructingexcellence.org.uk/zones/peoplezone/respect.jsp

19 Movement for Innovation (now within Constructing Excellence) Working Group on Respect for People. '*Commitment to People "Our biggest asset"*', http://www.constructingexcellence.org.uk/pdf/rfp/rfp_report.pdf, November 2000.

20 Constructing Excellence. '*Respect for People – A framework for action*', http://www.constructingexcellence.org.uk/pdf/rfp/rfp_A_Framework_for_Action.pdf, October 2004.

21 BOMEL Ltd. '*Improving Health and Safety in Construction. Phase 1: Data collection, review and structuring*', HSE Contract research report 387/2001, HMSO, ISBN 0 7176 2140 5, 2001.

22 Strategic Forum for Construction chaired by Sir John Egan. '*Accelerating Change*', ISBN 1 898671 28 1, Rethinking Construction, September 2002.

23 Health and Safety Executive. '*HSE reports on construction industry's health and safety performance*', HSE press release, http://www.hse.gov.uk/press/2003/e03001.htm, 8 January 2003.

24 Construction Division, Health and Safety Executive. '*Construction Division Plan of Work 2010-11*'. http://www.hse.gov.uk/construction/work-plan-2010-11.pdf

25 White, P. '*An Update on Work of the Construction Division*', HSE Board Paper HSE/09/78, http://www.hse.gov.uk/aboutus/meetings/hseboard/2009/260809/p-aug-b09-78.pdf, August 2009.

26 Health and Safety Executive. '*Leadership and Worker Involvement Construction Toolkit*', Web resource: http://www.hse.gov.uk/construction/lwit/index.htm

27 Strategic Forum for Construction. '*Respect for People (RfP), Code of good working health and safety practices*', http://www.strategicforum.org.uk/pdf/codeofpractice.pdf, Launched at the HSE Construction Summit 'Ownership, Leadership, Partnership', London, February 2005.

28 Strategic Forum for Construction '*2012 Construction Commitments*', Web resource, http://www.strategicforum.org.uk/2012CC.shtml.

29 Strategic Forum for Construction. '*2012 Construction Commitments*', http://www.strategicforum.org.uk/pdf/2012ConCom.pdf, 3 July 2006.

30 Health and Safety Executive. 'The Construction (Design and Management) Regulations, SI 2007/320, April 2007.

31 Health and Safety Executive. '*CDM Training Presentations*', http://www.hse.gov.uk/construction/resources/cdm.htm, 2007.

32 Constructing Excellence. 'Respect for People – The business benefits', http://www.constructingexcellence.org.uk/pdf/document/ce_respect_for_people_report.pdf, August 2007.

33 Investors in People. Web resource accessed February 2012. http://www.investorsinpeople.co.uk/profit/iip_index1.html?&gclid=CPrjtqO-pa4CFaEntAodf3E6Qg

34 HM Government in association with the Strategic Forum for Construction. 'Strategy for Sustainable Construction', http://www.bis.gov.uk/files/file46535.pdf, July 2008.

35 House of Commons, Business and Enterprise Committee. 'Construction matters', Ninth report of Session 2007-8, Volumes I and II, HC 127 I & II, http://www.publications.parliament.uk/pa/cm200708/cmselect/cmberr/127/127i.pdf, July 2008.

36 Wolstenholme, A. '*Never Waste a Good Crisis: A review of progress since Rethinking Construction and thoughts for our future*', Constructing Excellence, October 2009.

37 Liker, J. K. '*The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer'*. McGraw-Hill. ISBN 9780071392310, 2004.

38 Capelli, P et al. '*The India Way - How India's Top Business Leaders Are Revolutionizing Management*', Harvard Business Press, 2010.

Published by the Health and Safety Executive 11/12

HSE

Health and Safety Executive

Pre-conditioning for success

Characteristics and factors ensuring a safe build for the Olympic Park

This research has looked to identify factors which have contributed to the London 2012 Olympic Park being delivered on time, on budget and with an exemplary health and safety record. Where other research has captured 'how' things were done, this research has explored 'why' and focused on the underpinning human and organisational interactions.

The research has tapped in to the close-out and lessons learnt activities for six of the venue and infrastructure projects. In addition interviews were conducted with executives from the Olympic Delivery Authority as client, their Delivery Partner and contractors. Emerging findings were triangulated with observations from other health and safety research teams and evidence from diverse aspects of the build programme contained in the London 2012 learning legacy publications.

Findings centre on the underpinning role of human characteristics like respect, trust, clarity, pre-emption, challenge, consistency, collaboration, motivation, empowerment, communication, open-ness, fairness and assurance. Their practical influence on approaches to, and effectiveness of, leadership, worker involvement, cultural change, communication systems, risk management, monitoring and assurance are brought out.

It is concluded that many of the principles offer potential benefits across a wide range of construction projects, with implementation scalable to suit the simplicity or complexity of the work. Corresponding recommendations are presented for different parties in the construction supply chain.

This report and the work it describes were funded by the Health and Safety Executive (HSE). Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.

RR955

www.hse.gov.uk