

A REPORT FROM THE HOUSING FORUM
JUNE 2018



INTERACT
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Stopping building failures

How a collaborative approach can improve
quality and workmanship

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About this report

The purpose of this report is to draw on the vast experience of our members in order to provide guidance and recommendations that could prevent poor quality and failure in new and refurbished homes.

While the majority of new homes and regeneration projects are delivered to the very highest quality, it has become evident there is a lack of consistency across the sector. Pervasive reports of building failures in both new build and refurbishment and maintenance of existing stock are undermining consumer confidence.

To this end The Housing Forum has brought together experts from across the supply chain to consider the key risks that the current method of developing and refurbishing residential property poses to truly successful outcomes, particularly for landlord clients and the well-being of their residents.

Working Group Co-chairs

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Acknowledgements

The Housing Forum would like to thank all those that contributed to this report, in particular those who have provided case studies, and to the sponsors who have provided financial support for the publication.

Join The Housing Forum

The Housing Forum is the only cross-sector, industry-wide organisation that represents the entire housing supply chain as the voice of the industry.

We have 150 member organisations, from both public and private sectors, and are uniquely placed to interpret the whole housing market and provide a timely examination of the issues that will encourage the recognition of quality homes.

The views in this report are the views of The Housing Forum and have been contributed from Working Group discussions.

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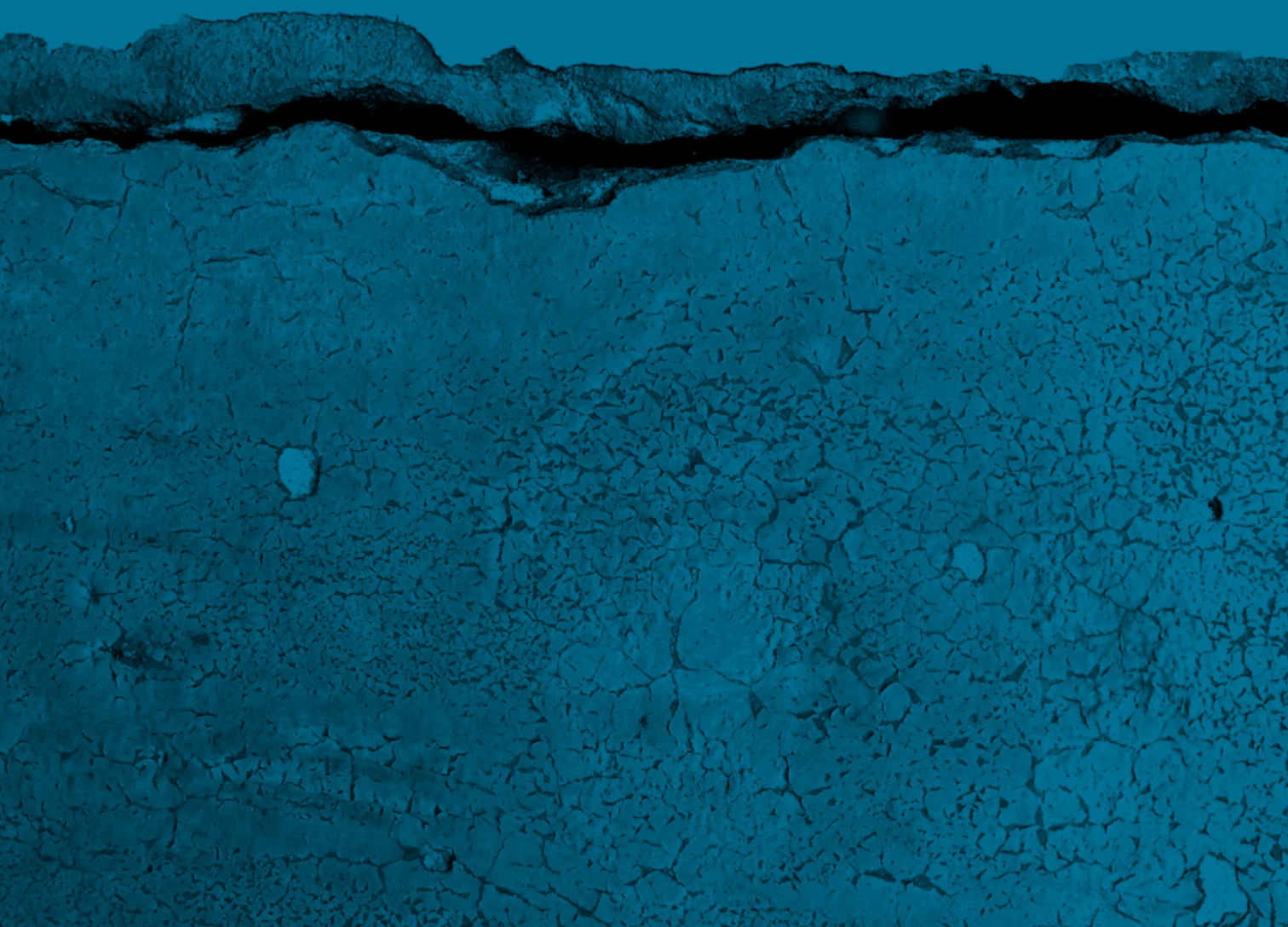
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Foreword



Andy Tookey and Nigel Ostime
Co-chairs of the Working Group

One of the great and unique benefits of being a member of The Housing Forum is the interaction across the whole project team with other specialists in the sector. It is a microcosm that represents much of what this report calls for: namely, that working together, collaboratively, we can achieve the step change in productivity needed to allow for inward investment to improve quality.

We are pleased to present this timely report, which is the result of a cross-section of Housing Forum members bringing their experience to bear on a matter that has gone from being important in improving consumer confidence to one where life safety issues have arisen.

In the last couple of years, housing has changed from a topic of relatively low interest to politicians to one that's become a core policy issue, both through the significant housing need and the tragedy of Grenfell Tower. An inability to deliver consistent quality is at the heart of all the building failures we have observed and is a matter that we must not lose sight of in the drive to provide the large number of homes society needs today.

Collaboration is a clear focus running through this report and it is an attitude that both our practices embrace. It is a core recommendation that the design team is established early on to reduce design risk; and that the constructor is also involved early on in the design process. This is true for both traditional and modern methods of construction. Either way, we need to address the difficulty of achieving that through single-stage design and build, and we recommend alternative means of procurement to unlock the potential benefits.

It is acknowledged, however, that planning risk can be a strong factor in delaying the appointment of a wider team. Where this is the case it is essential that the inherent risks are acknowledged and managed.

We also embrace value management – an exercise that must start at the briefing stage, not when it is too late and becomes merely cost-cutting. There is detailed advice on this activity in Part 1.

If the sector is to improve productivity we must also embrace digital technology and modern methods of construction. System building seems to have been on the cards for decades, but we feel the stars are at last aligning for real change. Part 2 outlines areas the industry needs to invest in if we are to achieve this.

Finally, we need to address the lack of quality control on site, the topic of Part 3. This is an issue that can be improved with immediate effect and we urge clients to adopt suitable mechanisms in their tender documents and contracts and to start to employ clerks of works.

We hope you will agree with the proposals we set out and look forward to your feedback.

Summary and Recommendations

In an era when large housing associations and councils will be embarking on major housing construction projects, it is essential the housing construction sector addresses and resolves the issue of quality.

The tragic events that unfolded at Grenfell Tower in June last year have brought failings across construction into sharper focus.

What has become clear is an urgent need to change culture and processes. As a unique cross-sector housing and construction body, The Housing Forum is in a position to demonstrate the value of open collaboration and upholding good practice, both of which can make a crucial difference.

To this end The Housing Forum has brought together experts from across the supply chain to consider the key risks that the current method of developing and refurbishing residential property poses to truly successful outcomes, particularly for landlord clients and their residents.

Our report reflects some of the themes in Dame Judith Hackitt's interim report following Grenfell. It focuses on the practicalities of bringing about this culture change through collaborative working, beginning with the way a project is set up through to its handover at completion, better quality assurance regimes and harnessing new technology.

Procuring for quality

Recommendations for the short and medium term

Recommendation 1: Set up the project correctly and this will drive quality and value. The brief should reflect clear value judgements linked to initial cost plans. One tool we recommended to achieve these is value management, applied at the concept stage.

Proving such a clear statement of intent – one might say 'vision' at Stages 0, 1 and 2 on the RIBA Plan of Work (see page 9), should also include aspirations for development, profit and contingency which must be agreed and protected by the entire project team throughout subsequent stages. The vision and 'needs' or values, to be satisfied should be a golden thread that ties in initial (and costed) quality aspirations right through to delivery.

To ensure the project is set up for the best outcome we envisage clients and their professional teams:

- Spending more time, some of it with their advisers, developing a brief and understanding risk.
- Being prepared to spend more time in the design phase to work properly to co-ordinate the design and consider buildability.
- Selecting design teams using criteria more heavily weighted for quality than price.
- Procuring for value – not necessarily by selecting the lowest price but by a thorough assessment of what reduces costs over the life cycle and increases performance and quality. Changing the procurement process to place more emphasis on quality would be an enabler for this (see Recommendation 2).

- Being more innovative in how quality is proved and evaluated – in other words, a move away from scripted responses to scenario questioning and site visits and references.
- Properly understanding risk, mitigating where possible, but ensuring that the best placed party is responsible for managing.

Recommendation 2: Clients should procure projects using contracts that support integrated teams, promote value and develop tight performance specifications. Careful consideration should be given to alternatives to single-stage design and build contracts.

We would urge clients to:

- Adopt procurement processes which are fair, simple and transparent and which enable early contractor involvement in design.
- Choose the contract to promote tender processes that assist in meeting project objectives. This will involve moving away from traditional single-stage competitive tendering, with consideration of two-stage design and build, cost-led procurement (bid as overheads plus profit) and alliancing contracts – so that emphasis is on quality and how it will be delivered – and, where appropriate, construction management.
- Incorporate tighter, more prescriptive specifications to avoid a drive down to minimum standards.

Recommendations for the longer term

Recommendation 3: Industry and clients should work together to develop new materials, techniques and training to help clients gain a better understanding of the appointment and briefing process.

Recommendation 4: For industry, government and the insurance sector to work together to further develop Integrated Project Insurance procurement as a means to drive integrated teams and project efficiencies in the sector and provide sustainable financial margins for firms operating in the sector.

Harnessing innovation

Recommendations for the short and medium term

Recommendation 5: We urge wider adoption of BIM to provide a continuous record of decisions, actions and transactions through the project, to enable improved coordination and provide the opportunity for better facilities management. BIM is also an enabler for collaboration.

Recommendation 6: We would urge all clients and their design teams to consider at early project stages (from RIBA Stage 2) how DfMA and modern methods of construction can be used to reduce workload and improve productivity and safety on site.

Building defect-free homes

Recommendations for the short and medium term

In the short term, the practical and critical changes we would advocate to improve quality assurance processes on site are as follows:

Recommendation 7: Greater emphasis and training for on-site inspection methods across the board – particularly for those managing construction projects.

Recommendation 8: Greater use of clerks of works employed by clients to provide impartiality and a quality safety net. We appreciate the current shortage of people trained to fulfil this role and we would support more funding being channelled to support greater training of people to take up this profession – including setting up a new training academy.

Recommendation 9: Industry needs to make greater use of technology to document construction quality.

We envisage an increase in harnessing tablets and appropriate software on site to allow site managers to document inspections easily.

Wherever possible, the use of digital technology including BIM and imaging and sensors should also be adopted to provide evidence that work has been completed to standard.

Recommendation 10: Clients should make development of skills, such as training of apprentices, part of the selection criteria to help drive more training to plug the skills gap.

The HACT toolkit on social value procurement can help with this.

Recommendation 11: Ensure greater clarity on project team roles including the role of clerk of works to maintain the golden thread of project quality.

Recommendation 12: Adopt greater use of pilots or benchmark samples/mock ups to assess quality of workmanship when selecting suppliers.

If a supplier's work is not up to the quality expected it is straightforward to assess their work against an agreed standard of quality.

Recommendations for the longer term

Over the longer term we are calling for tighter controls of the competencies of the workforce to raise the bar on quality

Recommendation 13: Introduce licensing for operatives in life-critical trades.

We would like to see a mandatory licencing system set up to regulate competencies of operatives initially in life-critical trades (such as passive and active fire systems and structural systems) to drive improvement in quality in the same way as health and safety. Over time, we envisage this being a requirement applied more broadly to construction trades.

Recommendation 14: We recommend the introduction of 'hold points' in the construction process, whereby critical stages would be checked and verified by independent quality checkers before further work can proceed.

This could be tied to the payment processes for the main contractor and sub-contractor.

Introduction

The purpose of this report is to draw on the vast experience of our members in order to provide guidance and recommendations that could prevent poor quality and failure in new and refurbished homes.

While the majority of new homes and regeneration projects are delivered to the very highest quality, it has become evident there is a lack of consistency across the sector. Pervasive reports of building failures in both new build and refurbishment and maintenance of existing stock are undermining consumer confidence.

In an era when large housing associations and councils will be embarking on major housing construction projects, deploying a variety of development deals, and private homebuilders are increasing output, it is essential the housing construction sector addresses and resolves the issue of quality.

The tragic events that unfolded at Grenfell Tower in June last year have brought failings across construction into even sharper focus.

What has become clear is an urgent need to change culture and processes. Grenfell will be the catalyst for changes that many in the sector would say are long overdue. But alongside the regulatory reforms that must ensue, how can we bring about a much-needed culture change so that all homes get built the way they are designed, to the highest quality standards?

As a unique cross-sector housing and construction body, The Housing Forum is in a position to demonstrate the value of open collaboration and upholding good practice, both of which can make a crucial difference.

To this end The Housing Forum has brought together experts from across the supply chain to consider the key risks that the current method of developing and refurbishing residential property poses to truly successful outcomes, particularly for landlord clients and the well-being of their residents.



Our work builds on the report we published in December 2017 (see image above), *Building Homes Better, The quality challenge*,¹ which was in preparation at the time of the Grenfell Tower fire. In it, we called for action to foster a quality culture which puts consumers at the centre.

This report does not cover areas such as regulation, standards, material performance and building control, which are likely to be covered by Dame Judith Hackitt's imminent review, or the Grenfell Tower Inquiry or addressed by expert bodies. In her interim report² published in December 2017 Dame Judith picked up on several key problems: regulations and guidance that is complex and unclear; lack of clarity around roles and responsibilities; lack of competence; and a culture of procurement where lowest price takes precedence over value and quality.

Our report reflects some of the themes Dame Judith touched upon and focuses on the practicalities of bringing about this culture change through collaborative working, beginning with the way a project is set up through to its handover at completion.

Our thrust for improvement is centred on three key areas:

Procuring for quality: (PART ONE, pages 8-23)

Time and money spent up front to establish the project pays dividends and in this section we explore how clients and their construction teams can better understand value and minimise costs over a lifetime, work with integrated teams to provide a golden thread of continuity and responsibility and ensure the tender and contract conditions can promote quality.

Harnessing innovation to prevent defects: (PART TWO, pages 24-29)

In this area, we look at how technologies like building information modelling (BIM) and the use of design for manufacture and assembly (DfMA) can help reduce defects on site, boost productivity and in the longer term improve productivity in the sector. Experience elsewhere in construction has demonstrated these practices improve accountability, drive collaboration, bring efficiencies and ultimately provide a digital asset, making operational management more effective.

Building defect-free homes: (PART THREE, pages 30-39)

Finding new and better ways to ensure site supervision, quality assurance and addressing skills shortages is essential for change and improvement. This includes a greater investment in quality inspection as well as the development of skills and pride in the job.

¹ *Building Homes Better, The quality challenge*, The Housing Forum, December 2017
<http://www.housingforum.org.uk/news/view?id=137>

² *Independent review of building regulations and fire safety: interim report*, Dame Judith Hackitt, Ministry of Housing, Communities & Local Government, December 2017.
<https://www.gov.uk/government/publications/independent-review-of-building-regulations-and-fire-safety-interim-report>

PART ONE:

PROCURING FOR QUALITY

The conditions for success

The difference between the success or failure of a building project is often cemented into place long before workers arrive on site. Many other factors are in play at the outset which will determine the quality of design, construction and value for money for the client.

Problems around quality are often the unwanted side effects of the systemic problem of short-termism in the construction industry – and particularly in the housing sector – coupled with fragmentation of the supply chain, lack of clear lines of responsibility and a ‘race to the bottom’ in pricing. Opting for contracts based purely on the lowest price means corners are more likely to be cut in design and construction, leading to dissatisfaction and waste and false economies as processes have to be redone.

In an ideal world, the project is designed and fully costed in an environment where risk is properly understood and managed with input from the contractor and specialists to ensure buildability – following which the project starts on site and is constructed as specified. Instead, what often happens is that designs are drawn up without input from the construction team.

Then, once work gets underway the designs are changed, to save money or speed up construction. Specified or suggested building products are substituted by team members and the supply chain, for cheaper alternatives, compromising the design and impacting negatively on whole-life performance. What is procured as an “equal and approved” component is rarely equal and on occasions not approved. This can also lead to a lack of documented provenance for all components in a building.

A lack of visibility and an interrupted workflow also impact on quality and retention of sub-contractors. This results in instability on site and all the disruption associated with an ever-revolving supply-chain door. Tendering at the bottom of market can also be a factor. Over the years, quality has suffered as a consequence of work which was tendered and awarded at the bottom of the market: subsequently the rates became unobtainable and proved undeliverable. The current level of risk transfer to contractors through design and build is unsustainable and mitigates against achieving quality.

Clients certainly need a better grounding in the briefing of designers for major projects; and architects and contractors need a better understanding of how clients will use and manage places as explained by Darren Nolan Associate Director, Operations, Silver (see page 19).

Everyone involved needs a better understanding of the financial and other drivers which influence decisions. Providers also need to develop practices which ensure project risk is understood and mitigated at an early stage. That means bringing in all members of the team, and especially designers, as early as possible.

Time and money spent up front to establish the project pays dividends. A sound understanding of the requirements of the product and the constraints of the project allows the design team to produce plans which take value into account from the start. Value engineering has gained a reputation as purely a cost cutting exercise to meet contract sums. However, carried out properly at early stages, ‘value management’ is an extremely useful approach for clients to establish ‘red lines’ for the project and build in priorities which deliver measurable benefits to resident and landlord over the lifetime of the building.

Value has to be seen as not just the tender cost but, instead, something that is viewed holistically over the whole life of the building (see right). Procuring by single-stage design and build where value is not a consideration can prove a false economy.

Stages in the RIBA Plan of Work.

View the plan in detail online:

<https://www.ribaplanofwork.com/PlanOfWork.aspx>

Understanding value and minimising costs over a lifetime

If costs are underestimated at the start, then pressure is on all the way throughout the project to claw money back.

Underestimation often occurs when developers sell on schemes after obtaining planning permission with outline design. Receiving planning permission does not require regulatory compliance, for example, so this will add to costs once detailed design works are commissioned. Those buying the site do not always take these extras into consideration when they pay for the land, so immediately the scheme is under pressure to recoup costs in order to make it viable.

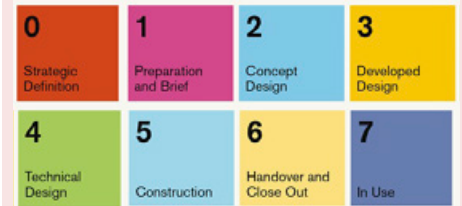
This is an issue the RIBA's emerging Quality Tracker will look to address. Set out as an overlay to the Plan of Work (see top right), it is due for publication later this year and will provide a 'chain of custody' as the project develops, identifying the degree of input – or lack of it – that has gone into the scheme at a given point in the process, as well as providing a means of establishing what needs further consideration in subsequent stages. For example, it will identify to what degree the design has been co-ordinated between the different disciplines and how far regulatory compliance has been considered in the planning application. Similarly, it will identify the extent of detail in the tender documents, which could be just the planning drawings; a fully co-ordinated RIBA Stage 3; or with some (or all) of the Stage 4 Technical Design completed.

A joint memorandum of understanding to develop, publish and promote this tracker has been signed by the presidents of RIBA, CIOB and RICS and as such it is hoped it will gain traction across the whole project team of clients, consultants and contractors.

Planning risk is also a factor in the quest to improve quality. Invariably, developers will not invest in design detail until a scheme receives planning permission. Apart from moving to a pre-determined 'spatial planning system' there is a little that can be done to easily remedy this issue, and we have not proposed answers in this in this report.

It is paramount there is shared understanding of value at the briefing stage. To this end, we advocate a full, or abbreviated (depending on size and complexity) value management exercise for every project. Workshops are recommended to scope the brief, and the involvement of the design team at this stage is crucial. Value has to be seen as not just as the tender cost but, instead, viewed holistically over the whole life of the building (see Andy Tookey page 13).

As previously mentioned, value engineering has become a euphemism for cost cutting and often takes place at Technical Design Stage (Stage 4 of RIBA) and worse still, as construction progresses. Value management needs to happen from the feasibility/concept design stage (RIBA Stages 1 and 2) and design teams need to be fully involved with cost discussions.



Stage 0 - Strategic definition

Stage 1 - Preparation and brief

Stage 2 - Concept design

Stage 3 - Developed design

Stage 4 - Technical design

Stage 5 - Construction

Stage 6 - Handover and close out

Stage 7 - In use

Cost has often been the major driver for the client in selecting their professional team and their contractor, and consequently for the contractor in the delivery of a project. Again, this can lead to a race to the bottom, almost guaranteeing building failure.

If consultants and contractors are selected on lowest price, there is a risk that lowest cost procurement drives the minimum standard of material and finish to meet the specification.

Quality needs to be given a greater weighting and there needs to be a connection between the tender cost and lifetime asset costs – as explained by Katie Saunders and Assad Maqbool from Trowers & Hamlin (on page 18).

The quality of the tender documentation and the tightness of the specification are also paramount.

Another clear failing, also highlighted in Dame Judith Hackitt's interim report, was the lack of continuity between the teams at various stages of the project, which invariably means that quality suffers.

Working with integrated teams and public procurement

In his influential sector review, Mark Farmer identifies the structural fragmentation of the construction model as being a cause of market failure.³ In particular, Farmer draws attention to the degree of separation between client and supply chain and the high proportion of self-employment at the operational level.

The Working Group found that this fragmentation is further amplified through the development cycle, with the lack of upfront involvement from the contractor in design and lack of input from architect into cost-reduction decisions.

As we have said already, we believe the solutions lie in bringing teams together early in the process, which means fostering legal contract structures and procurement routes that make this possible. This can be difficult to square legally because of the strict rules that restrict early contractor engagement.

However there have been available for some time a number of partnering contracts and alliance-style arrangements that make this possible. They are explained later by Katie Saunders and Assad Maqbool from Trowers & Hamlins (see page 15).

We strongly urge clients to move away from single-stage design and build, which has become the go-to procurement route, for the seemingly guaranteed price and one-stop shop it offers.

That said, it is not our view that design and build is an irredeemably flawed method of construction. It can work well if the right partners are selected – and if contractors can abstain from viewing it as an opportunity to cut costs through lowering quality, as Brendan Kilpatrick of PRP later explains (see page 16). Often with a project, the initial design and new business teams that envision the development hand over to delivery teams who are focused on costs and completion targets and then on to property management, but the whole client team needs to distinguish good from poor quality.

If design and build is used, we believe a number of steps need to be taken to ensure best value and quality. These include:

- Appointing the contractor on a two-stage process.
- Before going out to tender on design and build, the project should be designed to a minimum of Stage 3 on the RIBA Plan of Work (see page 9), and the Stage 3 design properly co-ordinated and risks properly understood.
- Performance specifications need to be tight to avoid a driving down to minimum standards.

Other models of working should, we believe, be more broadly considered. Options include, cost-led procurement, construction management and forms of alliancing or partnering contracts. Again, alliancing contracts are described in more detail later by Trowers & Hamlins (see page 15).

These type of contracts are often arranged on a cost-reimbursable, target-cost, open-book basis including both incentives and sharing of liabilities. Integrated project insurance (IPI) is one of the new models of alliancing procurement which we are watching with interest, particularly around the application for modern methods of construction (MMC) though its use to date has been limited.

The IPI model is underpinned by an innovative form of single-project insurance and a new alliance contract. For the purposes of the project, the alliance team are all part of one, temporary, project organisation and they are unable to sue one another. Members then work for a pain/gain share, which they are incentivised to protect.

The IPI model was included in the Government's 2011 Construction Strategy as one of a series of new, more effective procurement models designed to remove process and operational inefficiency, and thus drive down construction costs.⁴

³ *The Farmer Review of the UK Construction Labour Model, Modernise or Die*, Construction Leadership Council, October 2016

⁴ <https://www.gov.uk/government/publications/integrated-project-insurance>



Integrated project insurance (IPI) is to be trialled at the £16m revamp of Derby Silk Mill. Under the IPI approach all key packages will be appointed from the outset to work out the best way to achieve and develop the project's cost plan, which is insured by IPI.

It will be one of the trial projects supported and monitored by the Cabinet Office as part of a review of best practice project delivery.

With such a radically different approach to procurement and different requirements from the insurance industry, it is perhaps not surprising that adoption has been slow. It has only been used on one major project, Dudley College completed last year. Speller Metcalfe, the contractor on the Dudley College scheme, is now working with Derby Museums on the redevelopment of Derby Silk Mill using the IPI approach. ⁵

In the Dudley College project, the team operated on a 100% open-book basis, each group charging an agreed sum for the cost of actual resource used for their input to the project including an agreed allowance for corporate overheads and a normal level of profit. A gain/pain share agreement based around target cost provided further performance incentive.

If companies are to invest in research and development they need to make enough money to make this viable and not the wafer-thin margins that Farmer talks of in his review.

Our view is that IPI not only provides the basis for integrated team working, it potentially can provide the basis for a more sustainable financial model for construction companies, while reducing project costs.

⁵ <http://www.constructionmanagemagazine.com/news/speller-metcalfe-use-ipi-derby-silk-mill-project/>

Recommendations

Recommendations for the short and medium term

Recommendation 1: Set up the project correctly and this will drive quality and value. The brief should reflect clear value judgements linked to initial cost plans. One tool we recommended to achieve these is value management, applied at the concept stage.

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- Being prepared to spend more time in the design phase to work properly to co-ordinate the design and consider buildability.
- Selecting design teams using criteria more heavily weighted for quality than price.
- Procuring for value – not necessarily by selecting the lowest price but by a thorough assessment of what reduces costs over the life cycle and increases performance and quality. Changing the procurement process to place more emphasis on quality would be an enabler for this (see Recommendation 2).

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- Incorporate tighter, more prescriptive specifications to avoid a drive down to minimum standards.

Recommendations for the longer term

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Recommendation 4: For industry, government and the insurance sector to work together to further develop Integrated Project Insurance procurement as a means to drive integrated teams and project efficiencies in the sector and provide sustainable financial margins for firms operating in the sector.



PART ONE:

GOOD PRACTICE CASE STUDIES

CASE STUDY 1

The value in value management

Working Group Co-chair Andy Tookey, Managing Partner Baily Garner, explains why value management could prove an invaluable tool in the drive for quality.

We believe that true value management provides the cornerstone for ensuring the right projects get delivered to the right quality and the right price, and we consider it an essential exercise for all projects. Value management is a team-based approach used to define the client's objectives and ensure best value, based on selecting whole-life solutions to satisfy those objectives. Value management provides a framework to identify clients' overall vision for the project and 'needs' or 'values', and how these are prioritised.

As we've discussed in this report, so often projects get off on the wrong footing because:

- Quality is not defined in terms of what is perceived as of value to the project sponsor and, most importantly, to all the stakeholders who affect or are affected by the project.
- The process of developing the brief and commissioning projects is deficient, which has a knock-on effect on how and what are we measuring. It also makes it difficult to demonstrate that performance requirements have been missed, particularly when trying to determine the impact of any compromise on quality.
- The priorities are not known and, crucially, are not agreed by all stakeholders. When this is the case, it's unclear where resources should be focused, and it becomes all the harder, for example, to justify expenditure on superior products or services to achieve the desired quality set out in the project's vision.

To achieve maximum benefit, value management should be carried out from the very early design stages of a project. The later it is undertaken in a project's lifecycle, the narrower the opportunity for value enhancement becomes.

The process of value management includes value engineering, which has developed a reputation as simply a euphemism for cost cutting. But as part of an overall value management study in the early stages it's a more systematic approach to ensuring specific functions are satisfied to the required standard at the optimum cost.

To achieve a successful value management approach, it is crucial to apply it at RIBA Stage 0 or 1 and then at various iterations through the work stages (see page 9). In simple terms, the exercise involves an information-gathering stage – desktop research and one-to-one interviews, for example – before moving on to the creative evaluation and development phases. This involves bringing all stakeholders of a project together and taking team members through a series of questions and exercises (the process is illustrated in the examples below).

The value management process also promotes collaboration amongst all parties, as it creates an enhanced understanding of the project's objectives, needs and critical issues. Value management also has the ability to reconcile different stakeholders' objectives in the development and provides ownership by participants, thereby encouraging high motivation in the project.

Aerial from a feasibility study used in a Value Management workshop



In turn, improved communication between all parties provides an accountable basis for decisions, strategies and design, with the design proposals being made in accordance with sound value for money objectives.

The value management process also encourages creativity and stimulates innovation in both process and product, and also tests this against the 'value criteria'. Often this leads the design team to conduct further research and development into new, compliant products.

Crucially, the outputs are tested at key stages to confirm that project objectives are still valid.

This fully auditable process has a number of outputs including:

- **The value tree** – a diagram that describes a business driver (vision) for the project and sets out the criteria that need to be satisfied in order to achieve it. It is used as a touchstone and tested at key gateways to ensure that design development, budget allocation, product and performance all relate back to the vision and prioritised needs identified as part of the value management study. As design progresses, proposals are brought forward for consideration. Often that decision is made in isolation and the reason may not be transparent or auditable.

Clearly, innovation that could suggest alternatives should be encouraged. The value tree provides an auditable measure against which these can be evaluated, in the knowledge that all stakeholders have contributed.

- **Risk and constraint identification** – a major factor when deciding the best procurement route is understanding the project's inherent risk, and then identifying who is best placed to manage that risk and implementing mitigation strategies.

This directly impacts on the ability to control quality. In the normal course of events, a risk management strategy will be adopted, usually at strategic and delivery levels. Experienced individuals will identify frequently encountered or expected risks. The value management exercise supplements this by inviting the stakeholders to consider risks and constraints which could impact on delivery of the vision, when contemplating new or alternative approaches, or products which could potentially add value. In this way, the correct research and checks and balances are put in place to revisit a potential diminution in quality of performance.

- **Whole-life cost consideration** – full value management studies promote the use of a so-called 'decision analysis matrix', adjusted by net present value over an agreed period of time, to establish the whole life cost of products (or decision making) which should be fed into the overall design process.

The residential construction sector has not developed a mature approach to understanding lifecycle costs, yet it's a simple and cost-effective way of bringing longer-term performance to the fore.

Case study: How value management has provided measurable gains in quality

Estate regeneration

This study focuses on the refurbishment element of a large estate regeneration, following stock transfer from a local authority to a housing association.

The project ran into difficulties, and the early phases were seen to have failed in addressing the perceived issues which had prompted the stock transfer. Essentially, the works focused on the wrong priorities, meaning that the

quality issues identified, or perceived, by the stakeholders (primarily the residents) were not being addressed.

Before the next phase of the programme, a new consultancy team was appointed.

Following the appointment, a value management study was carried out. The first exercise, which is known as the information stage, was to study the background of the project and then gather together the lessons learnt to date.

The next step was a value management workshop, which distilled the highest level, or 'primary need', into a vision, from which the 'needs', or critical success factors, were identified and prioritised by the stakeholders. This then enabled a cost/value ratio exercise under Stage 2 of the workshop, value engineering. In turn, this dictated the correct level of resource to be made available to meet specific needs, or in other words, where to focus efforts.

The value management study achieved the following results:

- A full and thorough briefing document with clear expectations.
- A consultation tool for the residents on the estate.
- An auditable vehicle to demonstrate the needs/promises being met and tools to test outputs regularly.
- The correct amount of resource meant that the quality parameters were met.
- Solutions to meeting the needs were identified.
- It stimulated collaboration, innovation and evaluation of ideas by the project team to achieve best value solutions without compromising quality.



CASE STUDY 2

Contracts for collaboration

The law is not a barrier to early engagement of the supply chain as Katie Saunders, and Assad Maqbool, Partners at Trowers & Hamlins, explain.

Research and practice has demonstrated that using collaborative forms of contract on both small- and large-scale construction projects brings benefit to all members of the construction team.

Research by the UK National Association of Construction Frameworks found that “significant savings, benefits and other efficiencies in construction can be achieved by effective frameworks through the longer-term arrangements, non adversarial relationships, common incentives, integrated teams and objective assessment of performance associated with such frameworks.”

The Government policy paper Procurement Trial Projects Case Studies (2013) includes audited case studies of a number of projects, all created through collaborative contract structures with particular emphasis on supply chain engagement. For example, the Supply Chain Management Group (SCMG) social housing refurbishment project in the London boroughs of Hackney and Haringey demonstrated significant cost savings using collaborative forms of contract.

Yet, despite such tried and tested use of collaborative contracts, housing clients and

housing contractors do not always implement good practice on housing refurbishment, new build and responsive repairs and maintenance programmes.

Barriers to the use of collaborative working include the time and resource needed from all members of the construction team to engage early during the project planning process, attend communications meetings, ensure adequate flows of communication during the course of the project, and to measure performance against key performance indicator targets.

Ironically, the time and resource dedicated when there is a problem or a dispute arises on a housing programme far exceeds the resource needed to adequately project manage the programme in the first place.

Collaborative contracts are readily available in the housing market and indeed some forms are utilised most often on housing programmes. For example, early use of the Association of Consultant Architects standard form of Project Partnering Contract PPC2000 was most prevalent in the Government’s decent homes programme in 1999 and the form includes provisions perfectly suited for capital investment programmes of housing stock (for example, a two-stage ordering process and early contractor involvement, so that the team members can work collaboratively in undertaking surveys prior to undertaking works in occupied properties).

The Term Partnering Contract (TPC2005) has also developed similar themes on a two-stage order process, again to ensure that the service

provider and client can work collaboratively in deciding which works need to be undertaken to the client’s housing stock and then programme these effectively, taking into account residents’ needs.

Most recently, the Framework Alliance Contract FAC-1 can link together a series of housing capital investment programmes or can be used as an umbrella agreement between a number of clients and a number of service providers, in order to share improvements and efficiencies. TAC-1 (the development of TPC2005) ensures that all members of the team consider the importance of supply chain engagement. Transparency of the supply chain has been highlighted as a key issue for delivery of quality works in housing.

The NEC suite of contracts also includes open book and collaborative working processes and the NEC’s new Alliance Contract (NEC4 ALC) will take this a further step when it is published in 2018, as the first in the NEC multi-party contract, recognising the benefits of the multi-party approach taken by PPC2000, TPC2005, TAC-1, and FAC-1.

Housing clients certainly now have forms of contract which support their desire for collaborative and integrated team working. However, ultimately, the success or otherwise of a project will relate to the correct selection of partners under terms favourable to all parties, in return for the correct allocation of skills and resources and a joint vision and culture.



CASE STUDY 3

How design and build can deliver quality

Brendan Kilpatrick, Senior Partner, PRP, explains how the right management and conditions for design and build contracts can deliver high quality housing.

Design and build as a contractual procurement route has come in for much criticism in recent times. Discussion is ramping up on the demerits of this particular form of contract, which has transformed the UK construction industry since its first wide-scale deployment 30 years ago. But projects procured under this contract can deliver quality for the client if more rigorous balances and checks are built in.

Pros and cons

Design and build procurement came into existence as a foil to traditional forms of contract where clients' budgets were often exceeded. The traditional forms were often administered by architects and, rightly or wrongly, the profession attracted criticism for the lack of commercial acuity applied under this form of procurement.

The fixed-price nature of the design and build contract largely removed this failing. A key issue revolves around the basic premise of the contract which is that the contractor, having given a fixed price for the delivery of the construction, is largely at liberty to determine the method for doing so. The contract has little provision for governing standards of workmanship or inspection during the construction phase.

This apparent weakness has been exacerbated by the division of responsibility, particularly amongst housing associations, between those in the development team, whose role it is to secure planning consent, and those who see the project through RIBA Stages 4 to 6 and handover (see page 9). This dilution of responsibility means the quality aspirations of the project can be lost as the 'gatekeeper' of these aspirations is no longer involved with the job. There is evidence that this failing is now being addressed by the principal housing associations in London.

The primary advantage of the design and build contract is the concept of a fixed price for the construction contract. This tends to simplify administrative obligations on both sides of the contract. The disadvantage is that the contractor needs to price an element of risk to his tender, which can inflate tender prices. The risk element is fiercely protected by the contractor in order to ensure a profit margin. But it can have an impact on design quality where architects' drawings and specifications may be changed so that alternative materials are substituted, or ignored altogether, often without the client's (or his agent's) knowledge.

Alternatives under consideration for residential development are certain engineering forms of contract, construction management routes and even the reprise of traditional forms of contract.

Maiden Lane: Architect retained by client (LB Camden) for Part RIBA Stage 4 and subsequently novated



However, there are ways of ensuring that design and build delivers the measure of built quality aspired to at RIBA Stages 1 to 3 (see page 9). Some of these are as follows:

- Continuous monitoring of the emerging design during RIBA Stages 2 and 3, with close liaison between the architect and an experienced cost consultant. This avoids abortive work post-tender or a time-consuming value-engineering process which, by necessity if not by definition, seeks to diminish the quality of the project.
- Enhanced drawing and specification tender packages produced either to support the planning application, or more usually produced at the latter stage of RIBA Stage 3 or at the early part of RIBA Stage 4 (PRP's Maiden Lane project is an example of this and the quality of the completed building is testament to its efficacy). There is evidence that these enhanced tender packages have a tendency to de-risk the tender and procure more competitive results, particularly if the contractor is allowed to suggest alternative methods or materials which, by agreement, match the level of quality of the initial tender details.
- Novation, where the original architect at RIBA Stage 3 is retained through to RIBA Stage 4 and beyond, transferring contractual obligation from the initial developer client to the contractor. Novation remains unpopular with some clients as it seems to be against the spirit of the contract and many contractors claim that, depending on the identity of the architect, tender prices will be inflated by such an imposition.
- Novation of the wider design team, including engineering consultants and landscape architects (two areas of design which have tended to suffer most from poor quality installation in the recent past).
- Either with or without novation, the presence of a 'design guardian', usually the Stage 3 architect, will impact on the quality achieved during construction. However, the degree of impact is directly proportional to the scope envisaged within this appointment and the sanctions that such an appointment affords in relation to challenging poor workmanship or deviation from the prescribed materials in the contract.
- Employment of an experienced clerk of works. Over the last decade, the role of the clerk of works has diminished, with some of the inspections being carried out by the employer's agent whose qualifications and experience to conduct such a role are often dubious.

- More careful contractor selection which interrogates the contractor's track record of delivering high quality residential buildings.

Although the basic form of the design and build contract has changed little over the years, many of the processes around it have evolved. For instance, the architects on many current RIBA Stage 3 commissions, in advance of a design and build contract, are carrying out investigations into materials selection and specification to a degree which harks back to the days of traditional contracts.

This activity is carried out with the direct aspiration of securing the best possible materials whilst remaining within the client's budget. Many clients are beginning to recognise the need to incorporate some or all of the measures referred to above. This is a welcome evolution of the design quality culture in our sector, which was beginning to change even before the tragedy of Grenfell.



CASE STUDY 4

Evaluation strategies for balancing quality and price

Clients could be inadvertently selecting on lowest price say Trowers & Hamlins Partners Katie Saunders and Assad Maqbool. Here's their advice on giving quality more weight.

Under the Public Contracts Regulations 2015, contracting authorities (including all housing associations and local authorities) can select how they evaluate tenders for their public contracts. The most economically advantageous tender (MEAT) criteria are usually selected as the preferred option (rather than lowest price on the basis that quality is important). However, used in the wrong way (with the wrong price/quality split or with the wrong sub-criteria), price can still become an overriding factor in selecting the preferred bidder and, consequently, quality is compromised.

Therefore, when utilising MEAT, housing provider clients must ask themselves:

- Which financial element do they need to evaluate?
- What evaluation methodology should be adopted?
- What price/quality percentage should be used?

On housing programmes, the financial elements of the bid will include the construction costs, overheads and profits, costs of staff transferring as a result of TUPE (particularly on repairs and maintenance programmes), and the cost of any social value proposals including apprenticeship opportunities.

However, there are other financial elements that can be evaluated including discount cost savings over the lifetime of the contract and life-cycle costs. Once final prices have been submitted, the contracting authority will apply a standard differential model and award the highest marks to the lowest price. This model incentivises tenderers to bid as low as possible, sometimes resulting in tender prices that are unsustainably low, leading to problems at the contract delivery stage.

The financial race to the bottom also creates a high risk of abnormally low tenders that must be investigated by contracting authorities.

There are alternative pricing models that seek to protect the contracting authority and the bidders from an unrealistic pricing risk. One example is the optimum pricing model in which the contracting authority sets out the optimum price which it considers appropriate for the contract, based on market research. The tenderer is then incentivised to make the effort to reach the optimum price without undercutting it. The tenderer closest to the optimum price receives the highest mark. This should protect against abnormally low bids but arguably curbs the potential for truly innovative approaches.

Another option to consider is the fixed price model where the contracting authority fixes the price for the contract and then undertakes a value for money evaluation on the non price element of the contract's delivery, such as the quality and experience of the team, choice of materials, health and safety standards, liaison with residents, or environmental and social aspects of the project. By fixing the price and considering alternative value for money proposals, the contracting authority will again be neutralising the effect of any abnormally low bids on the overall evaluation.

It is important for housing providers to test out their evaluation methodology before the tender goes live. They should think about the price/quality split and how the price will be evaluated and provide detailed information to bidders to explain the financial evaluation methodology. Consideration should be given to alternative pricing models that might avoid compromising quality.



CASE STUDY 5

Getting what you want

Leaving enough time for the design before beginning construction will pay dividends says Darren Nolan, Associate Director, Operations, Silver.

Most construction companies are capable of delivering a quality result on any scheme as long as they are provided with the information they need to understand exactly what is required and given enough time to price and programme it accordingly.

So why do things go wrong and what can we do to improve matters?

Let's start at the very beginning.

Information, information, information

Design information is fundamental to the construction process and nothing – measuring, pricing, programming, purchasing – can happen without it. The problem is that preconstruction programmes are all too often squeezed, leaving insufficient time for the design stage to be completed correctly.

A correctly run design stage should involve all the relevant specialists and provide ample opportunity for the client to review and make comments. Only when everyone understands how a project works can the wider client team make a valuable contribution to the progress of the design. You should never end up with a situation where an asset manager is handed a building only to query the decisions that have been made or to comment, "Well, I wouldn't have done that!"

To go back to the planning stage, how many applications are made without structural and civil engineering support or without mechanical, electrical and plumbing (MEP) design involvement? Even the fire engineers or approved inspectors may be overlooked. The result is uncoordinated planning designs and the necessity to 'fix' the scheme as it progresses. This creates huge problems for anyone taking the design on, whether a tendering contractor who needs to understand the lack of co-ordination and the inherent risk, or a contractor managing negotiations.

Asking the right questions at the right time

Having a tested, fully thought through and co-ordinated design will ensure that a scheme is in a good place to progress once consent has been achieved. It's not the simplest solution and it takes time but asking the right questions now and dealing with them in detail pays dividends.

How do the services enter the building? How are they distributed vertically and horizontally? How does the ventilation work? Is there sufficient ceiling void? What about overheating? Or cleaning and maintenance? Asking valid questions like these too late in the process will lead to delays and possible design compromises. And it's not too early to think about construction. Can details be manufactured off site? What are the safety issues and can they be designed out?



When you take a robust approach to design with a full and frank presentation to the widest possible client team, projects progress with much better design information and much greater client buy-in.

Getting the tendering process right

When tendering, it's important to think about the scale and quality of the documentation provided. Appreciating how contractors go about pricing will help decide the essential information that will simplify the understanding of a project. They need access to everything that is useful and relevant and nothing should ever be buried in a set of employer's requirements. Getting it right will help them to take a more intelligent and realistic approach to build cost, build period and other aspects of their tender. Taking the contractor viewpoint when reviewing the risks inherent in any project will also help to decide on what should be investigated and mitigated.

It's not all about design information

Can the scheme be built in the sequence set out in the documents? Has the client team tested the phasing strategy? Questions like these need to be addressed as well as design details.

Third-party issues can also have a huge impact on the ability of a contractor to deliver quality, especially to programme. Should they really have to deal with licensing matters, party wall matters, or highways issues? What about making sure that the local authority agreements for road openings or closures are in place? By relieving them of the burden of third-party concerns such as these, client teams can help the contractor to concentrate on their main task.

Ensuring that quality improvements are delivered on site isn't about BIM or off-site manufacture, it's about reviewing and mitigating risk, dealing with design matters, being clear in what is required and ensuring that key decisions are made at the right time.

Experience shows that involving construction professionals at the earliest possible stage can really help.

Design information is fundamental to the construction process and nothing can happen without it.



CASE STUDY 6

An integrated team for the Packington Estate regeneration

The success and high quality of the Packington Estate regeneration in Islington, north-London owes a great deal to its integrated team approach, as Kaye Stout, Partner, PTE Architects, the scheme's architect explains.

We have created a genuine team environment for the regeneration of the Packington Estate which we have been working on now for over 11 years. The fact that the team has changed little in that time, both in terms of companies involved and personnel, has been massively helpful and the procurement approach has championed quality.

The project is being delivered in a 50:50 joint venture partnership between Rydon (which is also the contractor) and The Hyde Group, with residents in occupation across an eight-year, six-phase programme. Phase one started in 2007 and the Phase six, the final phase, is due for competition in early 2019.

A total of 538 structurally defective flats on the estate are being replaced with 790 mixed-tenure homes, together with community facilities.

These new homes are being funded through a combination of government funding secured by The Hyde Group and cross-subsidy from the development of 300 open-market-sale apartments and new infrastructure.

The overriding vision for Packington Estate was a balanced, tenure-blind neighbourhood, with no visible difference between social and private housing. The former Packington Estate was cut off from its surrounding neighbourhood: the aim was to integrate the estate with the adjacent community, to provide social-let homes on prime locations and family houses with their own private gardens on an estate that previously did not have any family homes.

The team was selected following success at competition stage where the vision was formed. Having the continuity of teams meant we were able to carry it through.

The scheme aims to reintegrate the old estate into the surrounding area by reinstating the pattern of Victorian streets and elegant squares typical to Islington, and to add a waterside park running the full length of the site alongside the Regent's Canal.



Rydon and Hyde had a partnering agreement for the six phases at Packington but had to price each phase individually and enter into a separate contract for each one. KPIs were scored on each phase including quality and the number of snags and defects. A minimum score had to be achieved on the previous phase to win the following phase. Also, at the end of each of each phase an all-party lessons-learnt workshop was held to identify any areas that didn't go so well and could be improved in the following phase.

The procurement of the sub-contractors included a number a key supply chain partners who are companies that we have worked with for a number of years and understand our way of working and expectations. They offer early design input and follow our QA system to minimise snags and defects and increase the final quality.

A collaborative approach to residential projects with a high-functioning integrated red team

While there has been movement of various individuals within the organisation, the main client members for both Hyde and Rydon have stayed with the project from inception through to construction. Equally the project team within PTE has remained involved throughout the various phases. The importance of retaining the design team throughout the regeneration project can't be emphasised strongly enough. An integrated project team from Hyde, Rydon and PTE and calfordseaden, based on site, also provides the opportunity for continuous learning, review and targets actions for improvement.



The project team was able to consult residents early on in the build. Residents are able to take advantage of Rydon's buying power/trade prices to upgrade the fit-out of their flats and a free handyman service is provided once residents move in.

Innovative approaches to procurement which encourage collaboration

Having set up workshops with local people during the masterplanning process, the team continued to work with a group of residents on materials choices and flat layouts. Their influence has been felt in, for example, the use of open-plan kitchens for smaller units, separate kitchens in large family homes, and in the residents' preference for glass balconies, which surprised some members of the team.

The on-site project team has established a reliable and quality-led supply chain phase on phase. This has encouraged ownership and speedy resolution of defects and improved design.



The involvement of the contractor from the outset was key; their contribution not only to cost plans but buildability issues and also innovative ways to procure and construct was invaluable. This created a truly collaborative team from the start, which is clearly impossible with the usual process of going out to tender at the end of planning.

Post-completion reviews leading to improvements in subsequent projects

Packington is a six-phase regeneration scheme, and as each of the first four phases have completed, the client and design team have been eager to improve the delivery and quality of the project. At the end of each phase (as well as during the construction of phases) we have held lessons-learnt workshops where there was no finger pointing but rather a genuine desire by all to develop and improve the process and outcomes.

The scheme is also notable for its meaningful resident involvement from day one and for the fact that our team partnership also includes a formally constituted Resident Board, which oversees the delivery and was integral to the development of the employer's requirements and feedback of the lessons learnt phase on phase.



CASE STUDY 7

Professor David Mosey, Director, Centre of Construction Law, King's College London gives two recent examples of alliancing.



Using alliancing contracts to deliver successful collaboration

A housing case study of a two-stage, collaborative approach combined with a design and build warranty was provided by Hackney Homes and Homes for Haringey, which created a two client, multi-contractor alliance for a housing refurbishment programme. This two-stage open-book procurement and contracting model achieved 16% procurement savings, 14% additional agreed savings, extensive tier 2 and tier 3 supply chain collaboration, engagement of local businesses, faster mobilisation, joint risk management, extended warranties, collaboration among competing tier 1 contractors and a joint local apprenticeships and training programme.

Details of this case study (shown left) are published by the Cabinet Office and Constructing Excellence at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/325951/SCMG_Trial_Projects_Case_Study__CE_format__130614.pdf

In a recent housing case study Futures Housing Group used FAC-1 to agree joint objectives and success measures among the members of a multi-party housing alliance comprising 5 clients and 23 SME contractors. Together they achieved 9% agreed savings compared to previous equivalent prices, plus a range of local business opportunities, local training initiatives and support for improved cashflow. Details of this case study are published by the Association of Consultant Architects at www.allianceforms.co.uk (Research and Consultation section). Other housing clients and their teams have used FAC-1 on procurements totalling over £3 billion, and FAC-1 has been adopted by the CLC Innovations in Buildings Workstream as the basis for strategic engagement using 'Smart Construction.'

 HM Government			
Trial project: Supply Chain Management Group (SCMG)		New delivery model / procurement route: Two Stage Open Book under PPC2000	
Cost savings achieved: 14% (in addition to 16.5% achieved through procurement)			
Other key benefits achieved: Time and cost control, end user satisfaction, reduced defects, reduced waste to landfill and carbon emissions, improved employment and skills outputs			
Trial report sequence:	Kick off meeting	Brief / Team Engagement	Decision to Build
Cost saving basis:	Outline savings aspiration	Challenging cost target	Award Cost
			Build and Occupy
			Outturn Cost
Trial project details:			
Project title:	Supply Chain Management Group (SCMG)		
Clients:	Hackney Homes and Homes for Haringey		
Project value:	Hackney Homes £110.8m and Homes for Haringey £91.5m		
Form of project:	Capital housing refurbishment programmes		
Main contractors:	Marsley, Keepmoat, Marisell, Lashhouse, Lovell, Watte		
Lead designer:	Main contractors as above		
Key suppliers:	Mace Vela Bauer Sovereign Grotargetup Bricout		
Executive summary: Hackney Homes and Homes for Haringey as members of the Supply Chain Management Group (SCMG) have used Two Stage Open Book to demonstrate a breakthrough that will enable public sector clients to deal directly with Tier 2 subcontractors and manufacturers, working with Tier 1 contractors, to build up fully integrated working relationships. SCMG has created a multi-client, multi-contractor team engaged on housing refurbishment that has worked with a wide range of SME subcontractors and manufacturers under a standardised system of costing and long-term engagement that has created major savings and significant qualitative benefits. The SCMG relationships and structures are sustained by training and support to embed a collaborative culture. Both Hackney Homes and Homes for Haringey re-procured their Tier 1 contractors during the Trial Project Case Study period, and demonstrated significant savings in the procurement process itself and in the outturn costs / rates.			

PART TWO: HARNESSING INNOVATION TO PREVENT DEFECTS

Profit margins in the supply chain are low and this, combined with procurement methods that favour cheapest price over long-term value, means there has been too little feedback and learning from one project to the next. This is a major impediment to improvement and innovation. To effect change, we need to generate higher margins and change the industry's attitude to R&D and investment in skills and training.

This will only be achieved through changing current procurement methods, increasing the use of off-site fabrication and assembly and more widespread use of building information modelling (BIM) and design for manufacture and assembly (DfMA), which will also significantly boost quality.

Housing is lagging behind in harnessing digital technologies. While public sector projects in sectors like health, education and prisons are mandated to ensure that Level 2 BIM processes are used, the same is not true of housing that has any public funding.

BIM builds computerised 3D models of buildings. Rather than relying on 2D drawings and printouts, a single digital model is used by team members for design and construction. The models are not just representations of a building's spatial form; they are also shared, centralised repositories of data on every aspect of its fabric and features. So, by sharing this information, changes are more easily made, and design clashes are detected.

Crucially, the information can form the basis of a manufacturing template for component fabrication in the factory, again providing a route to quality. Evidence suggests homes produced in factory conditions have fewer defects than traditionally constructed homes and there is certainly more take up among housing developers as skills shortages begin to bite.

Certainly, the move to increase off-site construction is gathering pace in housebuilding, with more than two-thirds of housebuilders investing in modular construction as the sector aims to improve standards and energy efficiency, according to new research by Lloyds Bank drawn from interviewing more than 100 homebuilders.

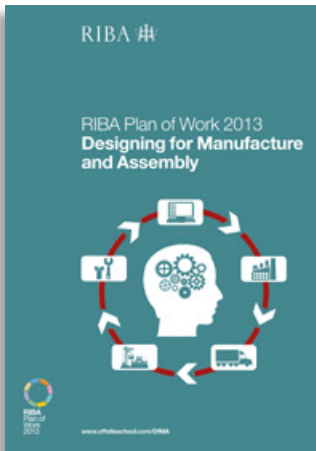
To satisfy insurers and warranty providers, off-site manufacturers have to quality assure all elements of their process. This involves consolidating the supply chain and limiting suppliers to a preferred list.

BIM could also potentially provide customisation in housing, allowing individualism while ensuring a high degree of quality, performance and cost. Another benefit is the digital asset created, which can help improve maintenance and management for the building owners.

However, we also strongly believe that the disciplines required to design, construct and manage assets and BIM can improve the quality of homes built using traditional methods too. Experience elsewhere in construction has demonstrated these improve accountability, drive collaboration, bring efficiencies and ultimately provide a digital asset making operational management more effective.

One of the few social housing schemes to be designed using BIM is The Meadows – a £5.5m, 54-home regeneration scheme in Nottingham. The developer Nottingham City Homes (NCH) claimed that it helped reduce costs compared to a similar scheme built without BIM at the same time.

RIBA
Plan of Work
2013



Design for manufacture and assembly (DfMA)

BIM is facilitating a culture of innovation and collaboration that assists the adoption of DfMA. To reap the maximum benefits of factory fabrication requires the design team to shift their thinking from traditional means of construction, to scenarios where buildings are assembled rather than constructed.

By developing solutions that are 'assembled' rather than 'constructed', DfMA offers the prospect of using fewer people, thus easing the pressure created by the skills shortage. Reducing on site work also reduces opportunities for installer error.

Other benefits include reduction in construction programme time and greater programme certainty. And because manufacturing and assembly need to be thought about upfront and the design agreed early, it facilitates more integrated working and early involvement of contractors and specialists.

Although there is a tendency to think of volumetric construction in the context of DfMA, the spectrum of factory fabrication is wide ranging.

As the RIBA notes in its guide *RIBA Plan of Work 2013, Designing for Manufacture and Assembly*:⁶

"DfMA does not impede design thinking or require any compromise in the quality of finishes or materials.

"With more sophisticated DfMA approaches, all or a substantial proportion of the project can be designed and delivered using standardised prefabricated components (e.g. volumetric room-sized modules, prefabricated bathrooms, flat-packed wall, floor or ceiling panels), procured from the contractor's supply chain in large quantities and efficiently assembled on site.

"At lower levels of sophistication, a project can be delivered traditionally but with consideration given to the logistics and management of the construction process, with the aim of creating 'factory like' conditions on site to counter traditional on site productivity rates and reduce or eliminate waste material. Some prefabricated elements can be incorporated into a project that is primarily traditionally delivered, such as prefabricated M&E elements or prefabricated doorsets or windows.

"A key part of any project is to define the DfMA strategy early in the design process. This will include a consideration of components manufactured off site, to determine which will add value without constraining creativity."

One concern that clients have is potentially limiting themselves to a single-source of supply at an early stage in the project process. This is understandable as things stand, and the industry needs to develop better inter-operability between systems to meet commercial drivers.

A starting point for this in the residential sector is the development of a set of standardised flat types, in a BIM environment, that have DfMA principles built in from the outset and have built-in 'tolerance' to accommodate diverse off-site forms of assembly such as cross-laminated timber, lightweight steel framing and volumetrics. Hawkins\Brown is developing such a system for a large housing provider in collaboration with HTA and PTE and believes this approach can be followed by other large-scale housing providers and deliver significant benefits. There are published examples already developed of standardised flat types, which are a good starting point to understand this approach such as *A residential guide for Greater London 2017* by Collado Collins.

⁶ <https://www.architecture.com/-/media/gathercontent/riba-plan-of-work/additional-documents/ribaplanofworkdfmaoverlaypdf.pdf>

Recommendations

Recommendations for the short and medium term

Recommendation 5: We urge wider adoption of BIM to provide a continuous record of decisions, actions and transactions through the project, to enable improved coordination and provide the opportunity for better facilities management. BIM is also an enabler for collaboration.

Recommendation 6: We would urge all clients and their design teams to consider at early project stages (from RIBA Stage 2) how DfMA and modern methods of construction can be used to reduce workload and improve productivity and safety on site.



PART TWO: GOOD PRACTICE CASE STUDIES

CASE STUDY 8

DfMA at Tottenham Court Road

Working Group Co-chair Nigel Ostime discusses Tottenham Court Road Oversight Development by Hawkins\Brown Architects, where he is Project Delivery Director. On this project, DfMA and off-site manufacture will minimise defects and BIM has been an enabler for this.

A DfMA approach on our mixed-use scheme above the new Tottenham Court Road Crossrail Station in London has ensured continuity between the design and assembly processes, significantly reducing risk and improving quality. Continuity and transfer of knowledge has been particularly valuable as all interfaces between the station and the development are highly complex, including multi-faceted acoustic isolation details through the structure, façade and MEP elements.

The over-site development (OSD) above the new Western Ticket Hall at the station will provide retail space at ground level and high-end residential units across two blocks. Block C is larger in scale and the materiality reflects 'retail-centric' Oxford Street onto which it fronts, whilst Block D responds to the Soho aesthetic, with traditional brick and concrete cladding split into three distinctive blocks to reflect Soho's Georgian townhouses.

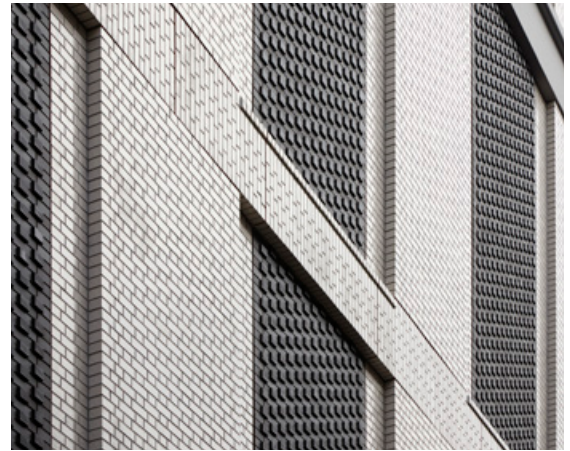
Developing above and around transport infrastructure is not easy. The interfaces and technical constraints are complex, and the construction of the OSD must not compromise the operation of the railway. Using BIM has been key within the detailed design of the project to understand the complex interfaces with the ticket hall and to co-ordinate the design with the station team and specialist sub-contractors appointed by Laing O'Rourke, the main contractor for the works. DfMA techniques and considered construction programming are being utilised to ensure that the building can be built with no disruption to the operations of the Western Ticket Hall below.

The design required the consideration of interlocking programmes of the over-site development and station, which were designed to maximise active frontages for the station and the proposed commercial developments. The proposals also considered

CGIs of the final development



Top Left: A factory mock up.
 Top Right: A close up of the façade
 Bottom: CGI of the final development



the reconfiguration and redesign of the public realm that served the station and the wider environs.

One of the key achievements for the project was to secure planning consent for a residential-led over-station development in this high-profile location. This required engendering a sense of trust with all the relevant stakeholders through an open design dialogue. Proposals were developed in close consultation with Westminster City Council, GLA, Historic England, CABE and TfL, to respond sensitively to the historic context of Soho and the eclectic commercial context of Oxford Street. As a result, Westminster City Council demanded an appropriate level of quality within the design and delivery of the project.

Building on top of any station carries its own challenges, but in this case building an OSD without disruption to the station has compounded these challenges and constraints on design and delivery.

The constraints imposed upon the design and delivery of Tottenham Court Road OSD meant that the building had to be built 'scaffold-free'. As a result, wherever possible off-site manufacture (OSM) techniques are being utilised.

Vertical, modular, service risers are being manufactured in two-storey independent framed sections and craned onto site; plant rooms are being manufactured off site and craned into place.

The reinforced concrete superstructure - slabs, columns and core walls - designed by Ramboll UK utilised Explore Manufacturing's BIM design elements which allowed the 3D information to be plugged straight into its factory machines, casting structural slabs and columns straight from the BIM model.

This was made possible by the early engagement of the main contractor Laing O'Rourke, which was brought on board because of its experience in this area. As part of the design development Hawkins\Brown engaged with Laing O'Rourke's in-house Engineering Excellence Group which focuses upon innovation within the development and delivery of its projects. These discussions primarily focused on construction sequencing and methodology with Laing O'Rourke's in-house team of BIM experts analysing the co-ordinated 3D models to assist with logistics, DfMA elements and construction sequencing.

Scope definition

Early co-ordination of elements manufactured off-site meant that it was important to define the extent of the scope in 2D and 3D to reduce scope gaps. BIM aided this by helping visually identify co-ordination requirements for the different specialist designers, ie, who is co-ordinating with whom, which minimises defects on site.

Design quality through early contractor engagement

One example whereby OSM and BIM have benefitted the quality and delivery of the design is within the external façade cladding package. Off-site manufactured large precast concrete cladding panels are being brought to site and erected, however, due to the arrangement of the station below, only two crane locations are available. Crane locations were defined which placed limits on the crane radius and corresponding loads available. The architecture and engineering teams worked closely with Laing O'Rourke's specialist cladding contractor, Vetter's, to develop the panelisation of the cladding and jointing to ensure the visual quality of the building aligned with the detailed scheme approved by Westminster. Careful consideration within joint locations and 'dummy' joint locations, joint widths and details were only made possible through the BIM model and construction tolerances available through OSM/DfMA.





CASE STUDY 9

How BIM generates savings and more for the Ministry of Justice




Professor David Mosey, Director,
Centre of Construction Law,
King's College London

Trial project case studies of BIM being used in conjunction with early contractor involvement and collaborative working include work by Ministry of Justice on two new build custodial projects, using a multi-party alliance that achieved 20% and 26% agreed savings with innovative and sustainable designs generated and tested through BIM. They also achieved successful joint risk management, engagement with local businesses and exceptional levels of local employment and training.

Details of these case studies are published by the Cabinet Office and Constructing Excellence at:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/325950/Cookham_Wood_case_study__CE_format__130614.pdf

http://constructingexcellence.org.uk/wp-content/uploads/2015/12/Trial-Projects-North-Wales-Prison-Case-Study_Final.pdf

 HM Government		 CONSTRUCTING EXCELLENCE	
Trial project: Cookham Wood		New delivery model / procurement route: Two Stage Open Book under PPC2000	
Cost savings achieved: 20%			
Other key benefits achieved: Increased cost and programme certainty, innovation and reduced prospective operating costs			
Trial report sequence:	Kick off meeting	Brief / Team Engagement	Decision to Build
			Build and Occupy
Cost saving basis:	Outline saving aspiration	Challenging cost target	Award Cost
			Outturn Costs
Trial project details			
Project title	Cookham Wood Youth Justice Board New Build Young Offenders Institution		
Client department	Ministry of Justice		
Project value	£20 million (including construction cost, fees and escorts)		
Form of project	New Build Young Offenders Institution		
Main contractor	Interserve		
Lead designer	Interserve supported by Arup		
Key suppliers	SSC – Pre-Cast Volumetric Cell Provider SMECON – Mechanical and Electrical Specialist Pentair & Gould – Client Representative H.N. Client architect/technical assessor F&B Design Tier Consult Arup MJ Patch ICI		
			
Executive summary: Ministry of Justice have created a collaborative culture so as to bring together the consultants, Tier 1 and Tier 2 contractors at the earliest stage and to develop cost savings innovations and improved efficiency prior to start on site. The Cookham Wood Trial Project combines collaborative working under Two Stage Open Book with the adoption of BIM, Project Bank Accounts and informal implementation of Government Soft Landings. A fully integrated team have worked to a tight timescale to commence delivery on site of a new build Young Offenders Institution that to date has exceeded cost saving targets. Despite problems on site with severe weather, the originally contracted project works were completed within both the agreed timescale and the agreed Maximum Price.			

CONSTRUCTING EXCELLENCE	
Trial project: New Prison North Wales	New delivery model / procurement route: Two Stage Open Book
Cost savings achieved to date: 26%	
Other key benefits achieved to date: Collaborative design/ costing/ programming/ joint risk management, leading to innovative joint designs and operational efficiencies, cost and time controls, cost savings in a rising market, opportunities for local and regional businesses, apprenticeships and other employment/training opportunities, effective use of BIM Level 2, benefits of Government Soft Landings and Project Bank Accounts	
Trial report sequence:	Kick off meeting
Cost saving basis:	Outline saving aspiration
	Challenging cost target
	Award Cost
	Outturn Costs
Trial project details	
Project title:	New Prison North Wales
Client department:	Ministry of Justice
Project value:	£108,223,000 (original cost estimate £112,200,000)
Form of project:	New Build Prison
Main contractor:	Land Lease
Lead designer:	Land Lease
Key suppliers:	ASCOM (Client Representative) Smeeth Group (Civil Consultant and CDMC / WYS Technical Assessor) Capita Symonds (Architect) TPC Consulting (Civil and Structural Engineers) Horse Lau (Mechanical and Electrical Engineers) Crown House (Mechanical and Electrical Specialist)
Executive summary: Ministry of Justice have created a collaborative basis under the PPC2000 contract for the design, construction and maintenance of a 100 place prison on a site in the Wrexham Industrial Estate. They selected a team from their National Alliance and undertook a 30 week period of programmed early contractor contributions to design, risk management and finalisation of agreed costs. Ministry of Justice are applying lessons learned from their Cookham Wood Trial Project. (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/325950/Cookham_Wood_case_study__CE_format__130614.pdf) These lessons have enabled the North Wales Prison team to obtain additional benefits from the use of BIM Level 2 and greater contributions from Tier 2's subcontractors and suppliers, including a specific focus on local/regional SMEs. The team are also using the CTCIS Client-Based Approach to maximise employment and skills benefits from the project. The North Wales Prison project is making Two Stage Open Book, BIM Level 2, Project Bank Accounts and Government Soft Landings. The savings are drawn from the combination of Two Stage Open Book with BIM, including market engagement and tender meetings to help de-risk the early selection of an integrated Team. Additional savings are drawn from joint design development and risk management during the limited pre-construction phase of the project.	

PART THREE: BUILDING DEFECT-FREE HOMES

The need for more rigour on site

The combination of a shortage of skilled people on site, a lack of adequate quality assurance and inadequate site supervision are at the root of some of the sector's failings.

Our Working Group identified, for example, that site management focuses on completing tasks quickly, rather than taking pride in the job, an approach that is exacerbated by reduced numbers of qualified clerks of works and a tick box approach to compliance. Combined, these shortcomings increase the risk that work will not be to standard and could compromise the safety of the building. Evidence from warranty provider BLP suggests 90% of defects are attributed to poor workmanship, though professions must also shoulder some of the blame. Design that is unbuildable and drawings which operatives find difficult to interpret have also been cited as the cause of things going wrong on site, not least by clients featured in this report. (see Case studies 13 and 14 on pages 36 and 38).

Either way, significant change is required. New research by the Chartered Institute of Building (CIOB)⁷ shows more than three-quarters of construction professionals believe the industry's current management of quality is inadequate. The professional body carried out the survey following a series of high-profile quality failings.

All key parties involved in home construction, whether they're contractor, developer or client (or any combination of the three roles), are under financially-driven time constraints for individual projects. These can relate to end of year performance, agreed dates for government grant, the cost and risk of maintaining a site presence and/or the threat of liquidated and ascertained damages (LADs). The reality of building projects is that those time constraints are often tested to the limit, which means the pressing need for all parties to effect handover could potentially cause oversight.

To eradicate these problems requires an acceptance of the generic failings and a relentless drive for higher standards. If the industry can better share data about relative success and failure we can all raise the bar.

One way to deliver this is through investing more in quality inspections. We would like to see all the different areas of construction incorporate this into the way they deliver their element of projects.

Until recently, clerks of works have not been considered with the same importance as in the past, but there are reports of an increase in their use by clients, and we would certainly concur with the Cole Review into the collapse of the Scottish schools that they have a bigger role on site.

That said, their role needs to be clearly defined and they need to have the correct competencies in terms of knowledge and record keeping.

There is a reliance on the quality control inspectors to have the relevant experience of the build type or use of certain products, for example, cladding, or other areas where there is a particular element of specialism. But with the continuing emergence of precision manufacturing solutions, do the industry's inspectors have the experience and knowledge of how such systems are constructed to perform their role fully? From first-hand experience and general reports, poor adherence to and implementation of quality assurance systems appears to be endemic in UK construction.

There remains a strong requirement for the main contractors to be working far more closely alongside sub-contractors rather than simply leaving them to it. This is particularly important where certain procedural requirements exist regarding surveys, marking up, production of records and photographic logs (for example, concrete and general façade repairs).

Ultimately, the industry may need the threat of tougher regulatory measures if it is to improve in the same way as health and safety has, where the last 20 years have seen a dramatic improvement on all fronts.

Gas Safe, formerly CORGI, now falls under the Health and Safety Executive for enforcement and control, with non-compliance leading to fines and/or imprisonment, and loss of registration.

⁷ <http://www.constructionmanagermagazine.com/news/three-quarters-construction-professionals-say-qual/>



This may be a step too far in the short term in terms of policing quality, but in our view a shift towards mandatory licensing for individuals in trades in life-critical areas, such as structures and passive and active fire systems, would be a step change towards enhanced quality control. In Germany certain trades have to obtain specific qualifications to be licenced to operate and we would like to see a similar scheme operating in the UK.

Aligned to this we are also suggesting the introduction of 'hold points' in the construction process, which could be written into contracts. **At these points, the critical stages would be checked and verified by independent appointed quality checkers, such as a clerk of works, appointed by the client. Work could not progress, or payment be made, until the quality of the work has been verified.**

Tackling skills shortages

As we mentioned above, site supervision – both in terms of site management from the contractor and oversight from the client in the form of the clerk of works – is suffering from a shortage of skills and personnel. There is also pressure on Building Control departments driven by fee competition and the squeeze on spending in local authorities, resulting in a tick box approach to assurance.

This is a pattern repeated across the built environment sector. The Farmer Review published in October 2016 pulls no punches in its analysis of the capacity issues facing the UK house building sector. The shortage of skilled labour means that relatively unskilled tradespeople are still in high demand and have no incentive to update their skills. This is expected to get worse after Brexit, as a number of recent reports have suggested.

There is also the issue that, crucially, skills and knowledge lost through an ageing generation of highly skilled trades people departing the industry has resulted in the failure to cascade those qualities to the upcoming construction industry workforce. An example is dry-liners who now often do not understand fixing requirements and therefore do not comply with the manufacturers' requirements for set systems.

Off-site manufacture offers better prospects for quality assurance and should become part of the toolkit for delivering new homes – as indeed it appears to be becoming. More than two-thirds of housebuilders are investing in modular construction, as the sector aims to improve standards and energy efficiency, new research has revealed.

A recent survey by Lloyds Bank of more than 100 homebuilders found that they plan to increase spending on "innovative building techniques" from 20% of turnover to 24% during the next five years.

Modular construction leads the way, with 68% of housebuilding firms saying they are investing in the methodology, followed by site-based modern methods of construction (61%), where components are brought together for assembly on site, and panelised systems (56%).

That said, there will still be a reliance on traditional site construction for the foreseeable future and there is certainly no one panacea for the challenge of capacity. This is a factor influencing quality that it is beyond the scope of this report to solve.

Recommendations

Recommendations for the short and medium term

In the short term, the practical and critical changes we would advocate to improve quality assurance processes on site are as follows:

Recommendation 7: Greater emphasis and training for on-site inspection methods across the board – particularly for those managing construction projects.

Recommendation 8: Greater use of clerks of works employed by clients to provide impartiality and a quality safety net. We appreciate the current shortage of people trained to fulfil this role and we would support more funding being channelled to support greater training of people to take up this profession – including setting up a new training academy.

Recommendation 9: Industry needs to make greater use of technology to document construction quality.

We envisage an increase in harnessing tablets and appropriate software on site to allow site managers to document inspections easily. Wherever possible, the use of digital technology including BIM and imaging and sensors should also be adopted to provide evidence that work has been completed to standard.

Recommendation 10: Clients should make development of skills, such as training of apprentices, part of the selection criteria to help drive more training to plug the skills gap.

The HACT toolkit on social value procurement can help with this.⁸

Recommendation 11: Ensure greater clarity on project team roles including the role of clerk of works to maintain the golden thread of project quality.

Recommendation 12: Adopt greater use of pilots or benchmark samples/mock ups to assess quality of workmanship when selecting suppliers.

If a supplier's work is not up to the quality expected it is straightforward to assess their work against an agreed standard of quality.

Recommendations for the longer term

Over the longer term we are calling for tighter controls of the competencies of the workforce to raise the bar on quality

Recommendation 13: Introduce licensing for operatives in life-critical trades.

We would like to see a mandatory licencing system set up to regulate competencies of operatives initially in life-critical trades (such as passive and active fire systems and structural systems) to drive improvement in quality in the same way as health and safety. Over time, we envisage this being a requirement applied more broadly to construction trades.

Recommendation 14: We recommend the introduction of 'hold points' in the construction process, whereby critical stages would be checked and verified by independent quality checkers before further work can proceed.

This could be tied to the payment processes for the main contractor and sub-contractor.



PART THREE: GOOD PRACTICE CASE STUDIES

CASE STUDY 10

A strategy for excellence

Clarion Housing Group, which includes the country's biggest Housing Association, is adopting a holistic approach to eliminating defects in its housebuilding programme. Joyce Ferguson, Director – Development New Projects, and Nigel Tenwick, Commercial and Technical Director, explain.

Clarion Housing Group includes the country's largest housing association with 125,000 properties nationwide. As a leading developer, Clarion also has a major role to play in tackling the country's housing shortage. Our target is to build 50,000 new homes in 10 years across the full range of tenures.

We are committed to ensuring excellent quality for all our new homes and have been taking a holistic approach to achieving this by instigating a number of new initiative across all stages of the development. As this report makes clear, building to the very best starts from the vision and ends with the handover. The changes we have made include the following:

- Reviewing our briefs to make sure they are clearer in our objectives and requirements. Our view is that failing take root at the outset it is important to work with partners and taking time to ensure we get what we want.
- Bolstered our in-house expertise by bringing in people with technical and commercial skills to allow us to take on more of the risk and explore different procurement routes – including a more collaborative approach to design and build type contracts and modular construction.
- Reviewing our frameworks to ensure our tender processes put more emphasis on design quality.

- Introduced independent clerks of works to raise standards on site; traditionally, at Clarion clerk of work roles have been part of the employer's agent role.
- Introducing staff training on technical issues like fire stopping and fire safety, alongside general snagging issues.
- Bolstered our aftercare department to respond to any defect issues quickly and produced a handbook for new occupants on how to manage their home. More face to face instruction is also planned to assist new residents to manage their homes.

Our ambitious housebuilding programme demands efficiency, value for money and homes that are sustainable and that our residents are comfortable happy to live in, whatever the tenure. Through the actions we have implemented defect rates are low.



CASE STUDY 11

A model of rigour

Kieran Larkin, Deputy Chief Executive, Hill describes the company's rigorous approach to ensuring defect-free homes.

We've always prided ourselves on the quality of our work at Hill but continually strive to do even better. We have been implementing a number of changes to our processes, including inspection and fire safety. We are taking the quality agenda very seriously.

After the Grenfell fire tragedy, we instigated changes in the design of all new build projects where we act as a developer. These changes relate to the installation of sprinklers in all new build flats that we construct, irrespective of height. We did not consider the risk to be as great in most of the houses that we construct so we have not insisted on installing sprinklers in new build houses. We have encouraged our partners to follow suit on joint venture developments, but unfortunately some have declined because of the cost.

We have reviewed the products we use on our schemes and only use non-combustible materials so that we minimise the risk on projects. We have also instigated processes where photographs are taken during construction that show we have installed the fire breaks around every door, window and aperture together with evidence that all horizontal and vertical fire breaks are in place between individual flats and houses.

It is our intention to retain a panel of three fire consultants who will be involved in our projects from the design stages, through the construction phase and at the final handover and commissioning.

With regards to inspection more generally we are building on the system we have in place whereby our managers build to the quality assurance/quality control procedures that have been established over a period of years. We also retain the services of an independent building inspector who visits our sites on a regular basis to inspect the quality.

This inspection is thorough and comprises a written report with photographs that illustrates any work where standards have not been met.

The report is left with the site manager for action and copied in to senior management so that we can be sure all defects are remedied.

We also have a process called the Final Inspection and Commissioning Checklist which is a rigorous process of checking the stages of the building and ultimately prior to handover. This process has resulted in substantial improvement in our ratings feedback from the NHBC and we anticipate returning to the grade of being a 5 Star housebuilder.





CASE STUDY 12

Introducing quality hold points

Paul Belfield, Director, Rund Partnership explains how enacting quality hold points in the construction programme can improve quality control.

Construction quality only improves through a right-first-time culture. Without this attention to detail, quality standards are seriously compromised and design standards unrealised. Without regular inspections, agreed quality and workmanship standards more often than not fall short. Looking beyond the role of a traditional clerk of works, a permanent quality inspector can achieve greater control over site quality to maintain appropriate standards of workmanship, ensuring quality is firmly embedded within the workforce on site, be that through a contractor or their subcontractors.

On a residential development in Hampshire with more than 1,000 units, over 300 new affordable homes were delivered under a Section 106 agreement on behalf of a regional housing provider. Rund Partnership, a surveying and construction consultancy, was appointed as employer's agent and clerk of works. By introducing the clerk of works into the project earlier than the norm, the opportunity was taken to review the proposed specification and drawings at the pre-construction stage. This process identified various improvements in the design and specification proposed by the volume housebuilder to comply with the housing association's requirements. This early intervention identified and eliminated issues before they escalated on site, which was crucial on a project where quality during the construction stage at times seemed elusive.

Working with an ever-changing technical and construction team proved challenging. As a result, Rund Partnership's clerk of works team undertook close site monitoring owing to the contractor's lack of supervision of their workforce and sub-contractors.

One such example where this close monitoring proved vital was for the installation of internal gas pipes. The clerk of works noted that gas pipe work did not meet the gas regulations for timber frame construction. The gas pipe was fitted in a timber stud that formed the external wall, but the pipe was not housed in a small void and also was not vented. The pipe was also not protected with mechanical measures to allow protection from screws or nails.

This quality and safety breach was escalated to Rund Partnership's employer's agent who, along with the gas pipe manufacturer's technical department, obtained confirmation of correct installation requirements in timber frame construction. Despite the contractor disagreeing and proceeding to cover up the works, Rund insisted on further investigation and that the work should be opened up.

When the work was opened up it was formally recognised by the contractor that it was incorrect. It was agreed that all pipes were re-opened for inspection and where necessary redone. On completion of the works, Rund requested that a gas installer inspected each installation for compliance.

By benchmarking work on site and enacting quality hold points in the construction programme, construction quality can be assessed, rectified if necessary, and higher standards instilled to improve quality control. Robust project monitoring and checking process ensure actions are recorded and proactively managed.

When it comes to maintaining quality, there is no substitute for regular site inspections. This is a role ideally suited to a quality inspector whose presence at every stage of the build process ensures a development complies with relevant standards and the agreed quality programme.

When it comes to maintaining quality, there is no substitute for regular site inspections



CASE STUDY 13

Learning lessons from major defects

Having to rebuild defective properties has led to one housing association to take a more hands-on approach, including setting up an in-house design team.

Poor design and workmanship has led to one housing association in London having to pull down homes on a new mixed-tenure estate. The lessons learnt has prompted it to employ in-house professionals to check and sign off construction quality and work more closely with the contractor to ensure the agreed design and quality will be delivered.

The development was completed more than five years ago, but it took some time before the full extent of the problems became apparent. The rising numbers of complaints from residents about damp, mould and drainage issues lead to a forensic examination of the properties.

Surveyors found major problems in the way the blocks had been designed and built. The timber frame was standing directly on the ground without protection rather than on a concrete plinth, allowing water to seep through the structure.

Other problems included missing compartmentalisation, defective gas piping and drainage and insulation missing in the roofs. The defects were so extensive that they exceeded the cap on the cover provided by the warranty and the association is having to bare the financial costs itself until full liability is agreed. Some of the properties are having to be demolished and rebuilt, while other blocks will either undergo extensive refurbishment or will be demolished and rebuilt. The contractor had subsequently gone into liquidation, so there was no redress there.

Like other organisations, the housing association says it is frustrated that the problems were not picked up by the consultants it employed at the time, or warranty providers and says it understood both to be inspecting every property – which is not the case. The housing association says that some of the problems were down to poor or complex design which were challenging for the contractor to build.



Going forward it has now changed its approach to the way it carries out projects. It has its own in-house quality and inspection team and designs to RIBA stage 4 (see page 9) on land led schemes, before tendering for the work. The housing association has a greater involvement and control over design and seeks to appoint contractors at an earlier stage to allow them to contribute to the design discussions. Furthermore, a design review panel, made up of people drawn from different parts of the business, review designs to bring perspectives on maintenance and housing management.

Once a contractor is appointed, usually under a design and build contract, the design team is novated to the contractor. The approach is then to review designs to ensure they are workable and takes on board contractor suggestions for improvements – though not ‘value engineering and cost cutting’, which could compromise quality outcomes.

Another important lesson the housing association says it has learnt is the need to ensure quality checks are continuously carried out during the whole construction process.

The organisation acknowledges that its new approach adds to capital costs but will save money in the longer term and provide a positive outcome for residents. As the team emphasise, the defective development has required a huge resource to put right and its detrimental impact on relationships could have been enormous. However, the positive learning outcome for this project has been the responsible and proactive approach adopted by the housing association which has allowed resident and stakeholder relationships to develop in a constructive and positive manner.

CASE STUDY 14

How thorough inspections can prevent problems

Lessons learnt from site.**Example 1 – Pipe fitted wrongly**

In this example, drain runs that pass through sub-structures had been encased by a lean mix concrete, ignoring the NHBC requirement for 50mm clearance around the pipe.

Additionally, the ground worker stated that he always built this way to prevent vermin entering around the pipe. The NHBC has provided a free App with a 3D detail which clearly shows the requirement for the clearance round the pipe in its technical standards.

The quality control inspector showed the contractors the NHBC App and they acknowledged the detail and changed their site processes.

The lesson here is that the inspector picked up on the error because of prior research, experience and knowledge. And importantly, that knowledge and learning was shared and the developer was able to provide a quality product in accordance with NHBC requirements.

Example 2 – Poor detailing

On a new build development in Kent, the drawings were approved and released for construction with the internal separating walls incorrectly showing lightweight blocks passing through the denser blocks. This provided a sound path for flanking sound transfer. As detailed within Approved Document E, the dense block should pass through to prevent the weakness at the junction with the lightweight blocks of the inner leaf of the superstructure. The contractor accepted that the works undertaken and the design as approved were not correct and remedial measures were undertaken.



Example 3 – Unsafe blocks

On the same development, two-storey houses and flats were constructed with the wrong strength blocks.

The design for these units specified for a 7 kN block. Those used were 3.5 kN, despite manufacturers making best efforts to ensure easy recognition of the different block types and strengths. This was later identified and four of the units had to be taken down.

The reason for the error was a lack of understanding by the site management and sub-contractors, together with design drawings not being checked as part of quality control process of site checking.

Example 4 – Faulty fire barriers

This example concerns horizontal fire barrier installation in rain screen cladding. The number and location of fixings was reviewed as the superstructure reached first floor level. Having checked the product website, the latest edition for the product had increased the fixing requirements. This had not been picked up by either contractor or sub-contractor. It should be noted that searching for information on the internet runs the risk of discovering out-of-date guidance.

The quality control inspector informed the manufacturer of this potential risk and further steps were taken on site to ensure correct compliance with the latest technical release. Further installation training sessions from the supplier were arranged by the contractor to ensure all operatives fully understood the requirements to be undertaken.

Acknowledgements

The Housing Forum is indebted to the many people who contributed to the content, writing and production of this publication.

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Special thanks

To all case study contributors and to our report sponsors:

Baily Garner

Fusion Building Systems

Hawkins\Brown

Hill

PRP

Trowers & Hamblins

Working Group support

Shelagh Grant, Chief Executive, The Housing Forum

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