# Building Product Performance
# Part 1– Discussion Paper

INTERNATIONAL
**BUILDING**
**QUALITY CENTRE**

April 2022

ICC INTERNATIONAL CODE COUNCIL®

UNIVERSITY OF CANBERRA

UCL

UNIVERSITY OF NAIROBI
A world class university committed to scholarly excellence

Produced with support from the International Code Council,
the University of Canberra, University College London, and the University of Nairobi

INTERNATIONAL
BUILDING
QUALITY CENTRE

## 1.PURPOSE

1.1 This paper is the first of two parts looking at the subject of building product performance. In Part 1 we examine the known problems and challenges associated with ensuring that building products both conform to the standards against which they have been tested and, once selected for use by the designer, perform in the manner required in order for the building to be compliant with regulations. The primary purpose of this paper is to identify and briefly discuss known problems. In exploring these issues, we reflect on the experiences of a range of countries to highlight both successful and negative regulatory outcomes.

1.2 As this Part 1 paper is a problem statement, we raise potential issues rather than conducting a detailed analysis. We welcome the views of those with experience and an interest in the subject. An opportunity to submit comments is made available on the IBQC website, and participation in an online workshop to be held in May 2022 is open to all (registration also available on the IBQC website). In Part 2 we will postulate a good practice framework based on regulatory approaches that have been or can be employed in order to support building product performance.

## 2.PREFACE

2.1 The application of products (which for the purpose of this paper includes product systems) that do not conform to regulations and standards or are incorrectly used is not a new phenomenon, nor is it restricted to the building industry. It is, however, a key issue for the construction sector where a building is the sum of its parts, comprising potentially thousands of components, making up products and systems that are in many cases complex and inter-dependent. These products therefore have a huge bearing on the safety and compliance of a building.

2.2 Unlike many other sectors in the economy, the performance or risk associated with a building product is determined not just by its characteristics, but also its application. This combination of factors make it critical for products to perform to the necessary standards (i.e., be fit for purpose), be specified, approved and installed by competent practitioners[1], reliably supplied and correctly maintained.

2.3 It is to be hoped that all building products on the market conform to the tests/standards against which they have been tested, but experience has shown that some do not. Further problems arise however (particularly in outcomes-based jurisdictions) when products for use in buildings are selected by the designer or contractor without a full understanding of what performance criteria the regulations governing compliance of the building require. If products are not fit for their intended use and where they compromise the integrity of the building, the consequences can be substantial, including property damage, injury and, at the extreme, death.[2] It is important to understand the extent to which building product performance is a problem or challenge for jurisdictions, in order to develop guidelines to assist regulators, inform practitioners and prevent harm to consumers.

1 Peter Johnson et al, 'Fire Safety Engineering – Final Report' (2020) Report 8 in Series of 8, Warren Centre for Advanced Engineering University of Sydney

2 Ann Marucheck et al, 'Product safety and security in the global supply chain: Issues, challenges and research opportunities,' (2011) 29 (7-8) Journal of Operations Management 707, accessed at <https://www.sciencedirect.com/science/article/abs/pii/S0272696311000945>.

## 3.INTRODUCTION

3.1 The International Building Quality Centre (IBQC) is a collaboration of international public and private sector professionals with expertise relating to the regulation of the building and construction industry. In 2020, the IBQC published Principles of Good Practice Building Regulation. The IBQC intends to embark on examination of the Principles of Good Practice Building Regulation through more detailed research and analysis of various aspects over coming years.

3.2 Principles for building product regulation were set out in Principle IV of the Principles of Good Practice Regulation.[3] The nature of this subject will vary for different countries and often manifests itself differently even within a country, particularly one that is based on a federated model, where regulatory practices may differ considerably.

3.3 Building product performance and selection is an area of building regulation that has been identified in some countries as representing a significant problem and risk over recent years. In the United Kingdom and Australia, it has been the subject of formal parliamentary inquiries and examination by governments. Other countries, such as the USA, have not experienced recent catastrophic events tied to building product regulation, but still regard the regulation of these products as a challenge that – if not addressed properly – could present considerable risk. Learning from regulatory success or regulatory failure can have equal value in informing the development of good practice regulatory principles for building product performance and selection.

3.4 It will be important, in contrasting different regulatory regimes, to distinguish between those which adopt a prescriptive approach, and those which instead require given outcomes or levels of performance, leaving the designer greater latitude. A different approach to both testing and compliance is required in jurisdictions where outcomes are to be achieved, rather than those in which legislation is prescriptive. In the latter, products are typically tested simply to show they conform to the prescribed requirements and therefore are compliant. Where outcomes are required rather than prescription, the manufacturer and the designer must consider what performance criteria the product must meet in order to be compliant with those outcomes, once used in a building of a given type. In the case of fire safety, the fire engineer must ensure that the performance criteria necessary to achieve the outcomes required for compliance with regulations are encapsulated in a Fire Safety Strategy for the building.

3.5 The environment in which building products are manufactured, distributed and assembled has changed considerably over the past few decades. This stems from a number of factors, including innovation in the types of products and materials used in buildings; global supply chains for building products becoming longer, more complex and less transparent; changes to regulatory practice, including, in some cases, deregulation; the drive to reduce costs; and the level of knowledge and demonstrated competence required of practitioners. It is for this reason the IBQC has prioritised building product performance as an area worthy of further thought leadership through research and collaboration of ideas and knowledge.

3.6 This paper has been prepared by a working group of the IBQC chaired by Dame Judith Hackitt, with contributions from Bronwyn Weir, Stephanie Barwise QC, Professor Charles Lemckert, Adjunct Professor Kim Lovegrove, Judy Zakreski, Professor José Torero Cullen and Adjunct Professor Neil Savery, all of whom have some degree of involvement with this subject.

3 International Building Quality Centre, IBQC Principles for Good Practice Building Regulation (Report No 1, September 2020), available at <http://www.ibqc.org.au/wp-content/uploads/2020/09/IBQC-Principles-for-Good-Practice-Building-Regulation.pdf>.

## 4.WHAT IS THE REGULATION OF BUILDING PRODUCT PERFORMANCE?

4.1 The aim of this paper is to examine how regulation can be used to ensure all products used in the construction or refurbishment of buildings conform to valid and relevant tests and standards which enable building officials[4] to be satisfied that buildings are safe and compliant. The scope of this paper extends to the specification of products for use through standards, codes and laws; the requirement for marks of conformity, labelling or product technical information; the processes by which products are tested to determine compliance and certified for use in a specified manner; and the checks and controls that may be imposed as part of the design, approval and installation of products. It also covers product consumer laws that prohibit misleading and deceptive conduct, requirements that products be fit for the range of purpose(s) for which ordinarily used and the various participants in the schemes that oversee and regulate compliance.

4.2 To simplify matters, we focus on two main categories, namely, those products that do not conform to specified testing or building standards and those that have been used incorrectly. For the purpose of this paper, we define these categories as follows:

(1) A **non-conforming building product** or material is one that claims to be something it is not, and/or does not in fact conform to the test/standards against which it purports to have been tested.

(2) A **non-compliant building product** is one that has been specified or applied in such a manner that its use does not comply with the requirements of a code or standard and/or regulation governing compliance of the building/structure in question. In the case of outcomes-based regimes, compliance means that a given outcome is demonstrated (by the designer and/or fire engineer) as having been established. For example, if a fire engineer determines that, in order to satisfy the outcomes required by applicable regulations, the use of cladding components which have been tested to achieve a classification of "non-combustible" is required, and yet products which have not been so tested are used, then the façade would be non-compliant. In a prescriptive system expressly requiring "non-combustible" products, then failure to use them would be non-compliance.

4.3 Whilst the focus of this paper is on the performance of individual products, it is acknowledged that each contributes to the whole, where the failure of one has the potential to compromise others, critical systems and in turn the safety of the building itself.

4.4 The extent to which non-conforming and non-compliant building products are representative of systemic failures and how they are experienced in different countries is subject to debate, but where failure occurs it is critical to fully understand the nature of the problem in order to propose solutions. It is also useful for jurisdictions that have not experienced a recent failure to regularly consider and explore these issues and use the study of better practices elsewhere to ensure their regulatory systems continue to provide the necessary protections to prevent catastrophic events caused by building products/systems used in construction, and/or by inappropriate specification of such products.

4.5 Below we explore the issues addressed in and lessons derived from, formal inquiries in the United Kingdom and Australia, which if taken on board can help ensure building product performance.

4 Depending on the jurisdiction, building officials may be known as building inspectors, building surveyors, plan reviewers, approving authorities or the like.

## 5.COMMON CONTROLS

5.1 Before exploring and defining the issues impacting building product performance, it is important to note this area is currently regulated, in many cases, by quite sophisticated schemes and laws. Many developed countries have one or more of the following features in place to regulate building product performance:

1. Consumer protection laws that prohibit false or misleading claims about products;
2. Codes and laws that require products must meet certain standards and/or have evidence of suitability to be used for their intended purpose;
3. A scheme for the creation of standards that a product must meet, which might include identifying properties of the product, tests it must pass, the limitations on its use and/or labelling requirements;
4. A means of accrediting laboratories under ISO/IEC 17025 to independently test products against applicable regulations and standards;
5. A means of accrediting inspection bodies under ISO/IEC 17020 to independently inspect processes and products against applicable regulations and standards;
6. Mandatory or voluntary conformity schemes under which products are independently certified to confirm they meet the specified standards. For example, under ISO/IEC 17065, product certification bodies are subject to oversight and must certify the products based on acceptable process and procedure including periodic inspection and/or testing of products to confirm continued quality and compliance; and
7. Obligations on qualified and experienced practitioners to establish that either evidence of suitability or product certification at the time of specifying and approving for use or installing products exists.

5.2 In defining the issues that have the potential to compromise building product performance, the current regulatory controls and their application need to be examined. Industry stakeholders and government also have an opportunity to learn from those countries where regulatory controls have been effective. It is not necessary to wholesale discard current regulation, but it is essential that there is a critical analysis of weaknesses in current regulatory features, including an understanding of whether the regulation is outcomes based or prescriptive. This will help to ensure the system in question is based on a testing regime apt to support the outcomes/prescription, that users understand what outcomes the regulations seek to achieve, and they have the means to achieve them.

## 6.REPORTS OF PROBLEMS

6.1 Despite detailed regulatory regimes being in place in many countries, there are instances across the globe of non-compliant and non-conforming building products being used.

6.2 One of the most prominent examples of the use of non-conforming and non-compliant building products, resulting in their performance contributing to the safety of a building being compromised, is the tragedy of the fire at Grenfell Tower in London. The event led to a public Inquiry into the fire, examining the circumstances leading up to and surrounding its propagation.[5]

6.3 Phase 1[6] of the Inquiry found "…there was compelling evidence that the external walls of the building failed to comply with Requirement B4(1) of Schedule 1 to the Building Regulations 2010, in that they did not adequately resist the spread of fire having regard to the height, use and position of the building. On the contrary, they actively promoted it."[7]

6.4 Phase 2[8] of the inquiry has included evidence about building products used in the refurbishment of the tower that was completed in the year prior to the fire. It has heard evidence from construction practitioners who specified and approved the cladding and insulation products installed, the manufacturers and suppliers of those products and the testing and certification bodies which examined the fire performance of those products.

6.5 The findings for Phase 2 are not expected to be published until well into 2022. However, there has been extensive evidence given and serious allegations made[9] during the public inquiry relating to the issue of building product safety. The inquiry has heard evidence and allegations that building product suppliers and manufacturers:

- misled industry about the fire performance of their products;
- manipulated test rigs to enable their products to pass tests;
- changed the composition of tested products and began selling the newer version of the product whilst still referring to the test results for the earlier version of the product;
- took advantage of the confusion and incompetency of building practitioners in their marketing of products;
- blamed building control authorities for approving their products based on their deliberately misleading material.[10]

5 A public Inquiry in the UK is an official process that is established by a Minister for the purposes of gathering information and examining facts to determine the events and circumstances which led to a specific matter of public concern and to make recommendations to prevent a similar matter from occurring in the future. By their nature, public Inquiries are fully funded by the government but must remain fully independent of the government, in case government activities are examined as factors in the matter being examined. Following the Grenfell Tower fire, the Prime Minister established a public Inquiry, appointed a Chair and set the Terms of Reference in accordance with the Inquiries Act 2005. The website www.grenfelltowerinquiry.org.uk is likewise financed by the government and curated by the independent commission conducting the Inquiry. More information about the public Inquiry process can be found at https://www.legislation.gov.uk/ukpga/2005/12.

6 https://www.grenfelltowerinquiry.org.uk/phase-1-report

7 The Right Honourable Sir Martin Moore-Bick, Grenfell Tower Inquiry: Phase 1 Report Overview, October 2019, APS Group of behalf of Her Majesty's Stationary Office, Open Government Licence

8 https://www.grenfelltowerinquiry.org.uk/evidence

9 Ibid

10 grenfelltowerinquiry.org.uk/ Stephanie Barwise QC, Marie Claire O'Kane, Dalton Hale, 'Module 2 Opening Submissions on behalf of Bindmans, Hickman & Rose and Hodges Jones Allen' BSR00000063/3 (2020); https://assets.grenfelltowerinquiry.org.uk/documents/transcript/GTI%20-%20Day%2067.pdf

6.6 For over three decades, Nigeria has experienced several multi-storey building collapses. Primary data collected from professional construction consultants, contractors and clients revealed that the frequency of building collapse is occurring at an alarming rate and that major causes are substandard reinforcement, structural steel and cement used for the production of foundations, columns, beams and slabs.[11]

6.7 In Australia, a Senate inquiry into non-conforming products heard written and oral submissions from dozens of stakeholders over three years and issued a series of reports with findings including:

- that there were weaknesses in the regulatory regime, including the certification process and the disjointed regulation of the use of building products, both manufactured in Australia and overseas;[12]
- that the deregulation and privatisation of building certification processes and the absence of proper regulatory controls, coupled with the increase in product importation, led to the proliferation and installation of non-compliant building products;[13]
- A lack of accountability has led to the risks of non-conforming and non-compliant products being left to building owners, particularly in cases where hidden faults emerge many years after any warranties have expired.[14]

6.8 In those countries that have not reported similar systemic problems, such as the United States, an equally important topic for consideration is what measures should be implemented to avoid experiencing such problems in the future? The IBQC intends to examine this in more detail in Part 2 on this topic.

11 Mansur Hamma-adama & Tahar Kouider, 'Causes of Building Failure And Collapse In Nigeria: Professionals' View', (2017) 6 American Journal of Engineering and Research 289, accessed at < https://www.researchgate.net/publication/322686191_Causes_of_Building_Failure_And_Collapse_In_Nigeria_Professionals' >.

12 Economics References Committee of the Senate of the Commonwealth of Australia, 'Non-conforming building products; the need for a coherent and robust regulatory regime' (December 2018).

13 Ibid

14 Ibid

## 7.ISSUES DEFINED BY CATEGORY

In this paper, the IBQC categorise the issues into ten groups, namely:

1. Volume and source of construction products
2. A culture of lax compliance by some in the manufacturing and supply industry
3. The development of standards and codes
4. Accreditation process, competent conformity assessment bodies and robust conformity assessment schemes
5. Product substitution
6. Product installation issues
7. The role and competency of specifier, designers and approval officers
8. Regulatory oversight
9. Inadequate quality assurance during construction
10. Lack of service and maintenance post construction

Key challenges associated with each of the above issues are set out below.

### 7.1 Volume and source of construction products

7.1.1 The building industry is estimated to generate 14% of global GDP.[15] This makes for a highly competitive and lucrative market for building product manufacturers and suppliers who can produce and sell high volumes of their product efficiently.

7.1.2 Problems associated with product safety may in part stem from the sheer volume of available building products and the often-complex supply chains bringing many of those products across jurisdictions and onto building sites.

7.1.3 The global supply chain has opened up markets to millions of potential products across the many and varied categories of building products. The capacity of countries and regulatory systems to monitor the expanse of these products for quality and legitimacy represents a substantial challenge.

7.1.4 In reality, the barriers to market entry for building products into some countries can be relatively low. Depending on legislative authority and economic resources, some import control processes may lack the capacity, capability, mandate, willingness or means to ensure an incoming shipment of building products conforms to the standards against which they have been tested, before allowing them into the country. This may also be true for products manufactured within country. It is for these reasons building control systems typically place responsibility on designers and builders to select appropriate products having regard to evidence that can assist them in determining its suitability, supported by a conformance and standards infrastructure and regulatory auditing.

7.1.5 Further, the use of the internet to buy products and receive their direct delivery from any manufacturer/supplier can make it difficult to identify non-conforming product, particularly if designers are not required to demonstrate product compliance during the approval process and if marks of conformity are not utilized as a method of compliance checking on site. Where conformity has been based on what is advertised or ordering a sample of the product (neither of which is a reliable or accurate method), it will be difficult for regulators to

15 https://www.mckinsey.com/industries/advanced-electronics/our-insights/construction-and-building-technology-poised-for-a-breakthrough

determine who is ultimately responsible for the sale of those products or to take enforcement action.

7.1.6 This challenge of transparency and traceability is a problem particularly inherent in building product markets, due in some part to a lack of global harmonization of codes and standards. It is essential that regulatory controls seek to mitigate this lack of transparency whilst somehow limiting regulatory burden and compliance costs.

### 7.2 A culture of misleading conformity testing and/or lax approach to compliance by some in the manufacturing and supply industry

7.2.1 Absent robust controls at the point of market entry and regulatory oversight by the authorities having jurisdiction, there is the risk that some participants will engage in unethical behaviour in order to secure market share for the sale of product.

7.2.2 The risk is highest in countries that lack transparent, accountable regimes and a quality compliance culture that demands adherence to safety standards. This has the potential to promote the sale of non-conforming products in countries that will either 'allow' or don't have the means to deny a product that other countries have already deemed as unacceptable based on safety or compliance concerns.

7.2.3 Whilst it would be wrong to say that all or even most building product manufacturers and suppliers are acting in this way, oral and contemporaneous documentary evidence given in the Grenfell Tower Inquiry has identified this type of violation in the UK. Testimony presented points to some setting out to mislead, deceive and game the system, which inevitably has the potential to undermine public confidence.[16]

### 7.3 The development of standards and codes

7.3.1 For many decades, standards have been developed governing the production, testing and performance of building products, to ensure prescribed levels of performance and transparency. Standards may include identifying properties of products, tests they must pass, inspections that may be required and limitations on their use and/or labelling requirements. There are standards that apply to a type of product alone as well as to complex systems that may set out requirements for products that make up the system.

7.3.2 The process for the development and adoption of new or current standards will vary across countries. Standards development invariably draws heavily from industry's knowledge and participation on committees, as well as stakeholder consultation. However, industry participation should be balanced with the participation of other stakeholders, including oversight bodies, to ensure the standards developed and adopted are aligned with broader societal goals. Absent that rigor, the development and review of standards could become exclusively driven by industry's priorities, which may be commercially motivated (due to implications for the production and sale of existing product) and which, to the manufacturers, may hold equal or greater importance than considerations of broader public interest and safety.

7.3.3 The existence of regulatory product conformity infrastructure does not guarantee tested products will be compliant, which is ultimately a question for the building official, especially in an outcomes-based jurisdiction. In any event, certification of compliance with a test standard does not guarantee conformity. This could either be as a result of the test method being misapplied or problems with the participants involved in the test and product certification supply chain process. The Grenfell Tower Inquiry has taken evidence in relation to this subject, but broader questions have been raised about the adequacy of some large-scale

16 The Right Honourable Sir Martin Moore-Bick, Grenfell Tower Inquiry: Phase 1 Report Overview, October 2019, APS Group of behalf of Her Majesty's Stationary Office, Open Government Licence Judith Schultz et al (2021) A Critical Appraisal of the UK's Regulatory Regime for Combustible Facades, Fire Technology, 57, 261–290.

test standards for external façade systems.[17] This issue has been explored by an eminent fire engineer, Dr Vyto Babrauskas, who suggests that no existing façade fire tests "can accurately quantify what they claim to be quantifying". Babrauskas concludes that this is because such tests are purely empirical and could only be validated by comparing the output of the test against an actual fire within the system tested.[18] His point is not that destruction of a fully constructed building should form part of compliance testing, but rather that whatever testing method is used, it must prove the product(s) in question has certain characteristics/ performance criteria, from which the fire engineer is able to satisfy themselves the regulatory requirements can be met.[19]

7.3.4 The UK large scale (BS8414) tests do not test for the specific performance criteria, which are needed to support the UK's two broad evacuation strategies, namely either "stay put" or controlled evacuation. The exercise which it is submitted must be carried out, is that a fire engineer must have identified (by way of a fire safety strategy) what performance criteria are required of the product(s) in order to achieve the outcomes required. In that way designers can ensure the relevant tests have been carried out so as to be satisfied, and can demonstrate, that compliance will be achieved. To assist law-makers, it would be preferable that manufacturers (subject to independent oversight bodies) use their research and development expertise to propose testing regimes which dovetail with the required outcomes and/or the prescriptive requirements of the jurisdictions in which they market their products.

7.3.5 On a broader scale, it is also widely recognised that testing products as assembled systems provides greater certainty about performance than testing their constituent parts, but nevertheless the testing of parts remains an acceptable approach in many jurisdictions.

7.3.6 Given the rate of building product innovation it is also difficult to maintain a suite of standards against which such products can be tested and/or certified. Regulatory systems have evolved in some performance-based jurisdictions where products that have no appropriate standard to be tested against can be adjudged by appropriately accredited product certification bodies to have met the requirement of regulatory performance through other means.

7.3.7 Whilst there are some rigorous processes and systems in place around the world that enable valuable innovation in the construction sector, they necessarily place an extraordinarily high competence burden on certification bodies, which are required to assess each aspect of the product's relevant performance. This is very much a topic for discussion, but it seems that unless the certification bodies have access to an appropriate level of expertise across all disciplines, this approach is likely to be inadequate in highly complex fields such as fire and structural engineering. It is known that in some instances, certification bodies are alleged not to have had the requisite degree of competence to adjudicate the suitability of the product.[20] If combined with an inadequate regulatory ecosystem, this has the potential to provide room to manoeuvre for those intent on finding loopholes in the system.

---

17 Judith Schultz et al (2021) A Critical Appraisal of the UK's Regulatory Regime for Combustible Facades, Fire Technology, 57, 261–290.

18 *"The Grenfell Tower Fire and Fire Safety Materials Testing"* Babrauskas 1.1.2018 https://www.fireengineering.com/leadership/the-grenfell-tower-fire-and-fire-safety-materials-testing/#gref

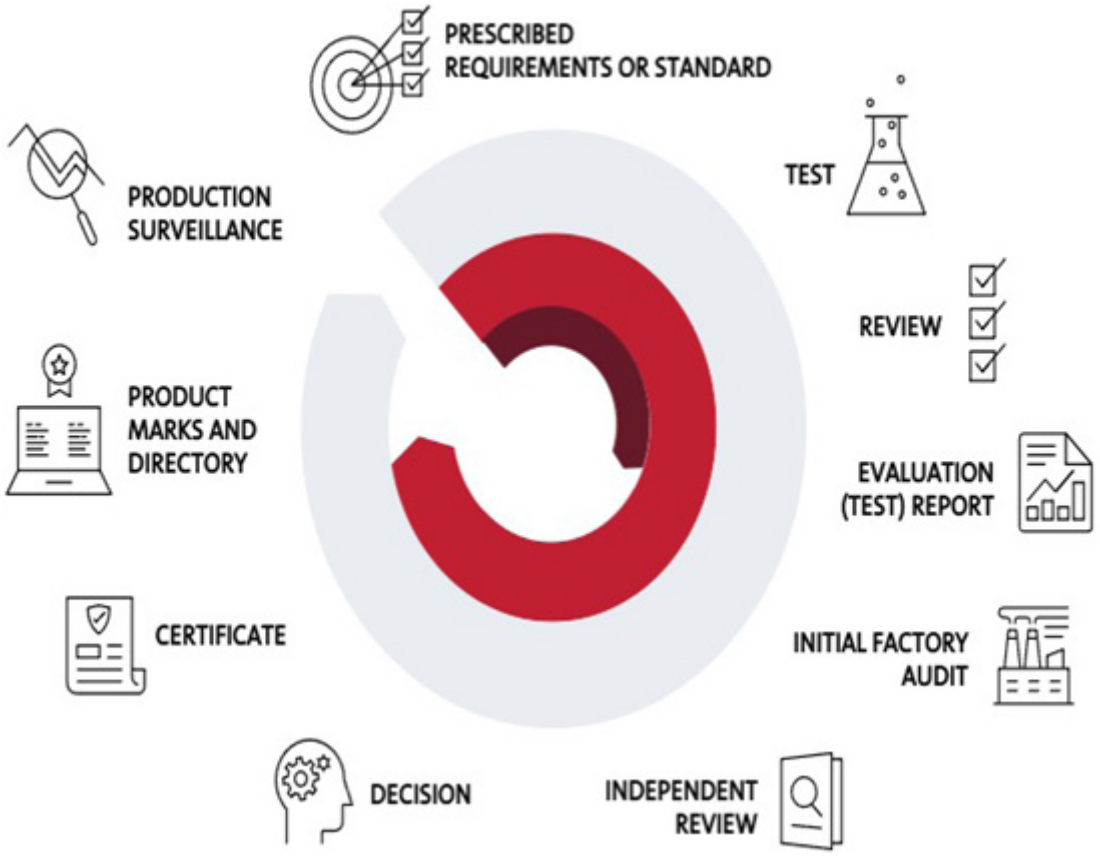
19 whilst this example focuses on fire engineering, it is also broadly applicable to other areas of building technical expertise who equally need to satisfy themselves of regulatory compliance where it applies to their respective fields of expertise.

20 See e.g., the training and competence of those members of BBA certifying Arconic's Reynobond cladding panels as deposed to by BBA's own witnesses in the Grenfell Tower Inquiry

## 7.4 Accreditation process, competent conformity assessment bodies and robust conformity assessment schemes

7.4.1 Conformity assessment schemes establish an independent process for the assessment of products to enable the issuing of a certificate of conformity. Such certificates can be relied on by designers, building control officers, authorities having jurisdiction and builders provided that the use of the product meets any conditions or limitations set out in the certificate.

7.4.2 The figure below illustrates the key features of conformity assessment schemes that are based on internationally recognised standards such as ISO/IEC 17065 and 17025.




Components of demonstrating product conformity[21]

7.4.3 In some jurisdictions that lack institutional capacity, competency and robust regulation, conformity assessment systems can be exposed to compromised outcomes through incomplete processes or less than rigorous practices on the part of participants in conformity assessment schemes, which can create the potential for the following types of risks:

- The adoption of certain test practices that increase the chance of passing, including by creating test conditions that are not reflective of how a product is commonly used or performs in practice;

21 Underwriters Laboratory, (March 2021) Product conformity – a matter of trust, e-book UL.com. Reprinted with permission.

- Creative advertising suggesting possible applications for a product in circumstances where they should not be used;
- Failure to consistently make available test reports and perhaps issuing only parts of test reports when requested to provide relevant information;
- Failure to disclose all information about all tests carried out on a product being offered for sale, including failed tests that might demonstrate more clearly how the product should not be used;
- Commencing or continuing to sell products that have not been tested or have failed tests; and
- The provision of selective information to under-resourced certification bodies to encourage them to issue certificates allowing the broadest possible use of the product.

7.4.4 Conformity infrastructure generally involves a variety of players and interactions designed to provide a level of reassurance that a product is what it claims to be. This includes:

- The accreditation of laboratories that test products against relevant standards and measure performance;
- The accreditation of entities that certify products that satisfy standards or where no such standards exist, meet a level of suitable performance for their intended purpose; and
- The issuing of certificates and/or labelling of products referencing certifications that are said to have been issued.

Both private and government conformity assessment schemes rely on the appropriate behaviour of all participants to achieve the intent and spirit of regulation and to avoid potential conflicts of interest or failure to observe a risk-based approach.

### 7.5 Product substitution or delayed selection of products

7.5.1 Product substitution has been reported as an identified practice in some jurisdictions.[22] This is where a developer or builder decides to use a product different to that specified by the designer and approved by the building control officer. This may occur because the original product is no longer available, or to save cost and/or because the developer or builder considers the new product to be equivalent to that specified. If the design is not updated and re-approved by the authorities that are responsible for plan review, if the products are not labeled in the design and in the installation, or if the building inspector does not have access to product specifications and certifications, it can be very difficult to identify instances of product substitution.

7.5.2 Furthermore, under some design and construct procurement models, the selection of products at the design and approval stage may be limited and at a high level. Detailed selection occurs whilst the project progresses and without reference back to the designer or building control officer, or identification by a qualified building inspector during the construction process. In these cases, any controls within the system triggered by obligations on a designer to check or on the building control officer to approve, are bypassed by the builder or developer wishing to avoid delays and/or failing to understand the requirement for there to be independent assessment of evidence of suitability of products, or by a lack of thorough inspection during the construction process.

22 Dame Judith Hackitt, (May 2018) Building a Safer Future Independent Review of Building Regulations and Fire safety: Final Report, UK Government Publications

## 7.6 Installation issues

7.6.1 Construction products are sometimes supplied as a system of components requiring assembly in a particular way and with specific skills and knowledge in order for the installed system to achieve compliance. Time pressures during construction or the use of inexperienced trades have the potential to lead to poor or improper installation.

7.6.2 Complex systems available for purchase through retailers or suppliers offering little or no after sales assistance have the potential to be poorly installed. These problems will be prevalent in the 'do it yourself' market.

7.6.3 Some manufacturers supply their products only through trained approved installers based on detailed guidance and after sales service, but many do not, and the quality of instruction manuals can vary.

7.6.4 There are many instances where a product or system needs to be modified to suit site conditions. An example would be when field conditions differ from the original design or when unanticipated construction hindrances are encountered and conditions on-site cannot be easily or cost effectively redesigned. In these circumstances, design recommendations are often made to propose alternative methods that ensure performance is not compromised. These are sometimes referred to as "Engineering Judgments" or "EJs", although other terms may apply dependent upon local practice. Since these recommendations are not based upon identical designs to those that have been tested, it is important that they be developed using sound engineering principles and good judgment.[23]

7.6.5 However, this is often a grey area because most codes and standards do not normally provide specific requirements on the applicability of an EJ and who is qualified to prepare this document.

## 7.7 The role and competency of specifier, designers and approval officers

7.7.1 Many schemes provide for the assessment of evidence of suitability of proposed products by building designers when specifying product and by the building control authority prior to issuing a building approval or variation to an approval. That evidence can come in the form of certificates of conformity issued by independent, accredited third party certification bodies, as discussed in paragraph 7.4 above, or through less formal (and therefore less credible) assessment reports or the manufacturers' own product technical information without any third-party assessment of the product's compliance with the applicable regulations.

7.7.2 These 'gates' within the building approvals process – to varying degrees – provide for the use of a product on a particular building project to be specifically assessed to ensure all conditions and limitations for use are considered carefully for that building.

7.7.3 However, the sheer volume of products, innovations for which there may be no obvious test standard, complexity of legislative requirements and the potential for those manufacturers and suppliers inclined to engage in illegal activity as discussed in paragraph 7.2 above, mean the task for designers and building control officers can be very difficult. Lack of role clarity can lead to designers expecting the building control officer to check for product compliance whilst they consider, for example, aesthetic outcomes or energy efficiency requirements, whereas the building control officer may sometimes assume (without confirming) that the designer has done the required due diligence. In both scenarios, this represents a breach of duty/ abdication of responsibility by the designer/ building control body.

---

23 International Firestop Council, *"Recommended IFC Guidelines for Evaluating Firestop System Engineering Judgments"*, Rev 2019-10.

7.7.4 Compounding this is a lack of education and understanding on the part of some practitioners as to what constitutes compliance (in outcomes-based regimes) and /or what constitutes suitable evidence that a product has been demonstrated to comply with regulations and /or has all of the necessary certification to justify its use.

7.7.5 Designers and building control officers report significant downward pressure on their costs, which has the potential to impact the time they give to compliance checking, if compliance is not made to be a priority. Competence, however, is the most critical driver of the correct behaviour, since absent competence, no amount of resources will ensure compliance. Also, as noted above, in some cases the builder or developer may defer the detailed selection of products, or make substitutions, without reverting to the designer or building control officer. In the legal proceedings following the fire at the Lacrosse building in Melbourne, Australia, the architect confirmed that the builder did seek its approval to substitute the external aluminium composite product, which later caught fire, however, the architect said it considered its role was only to check colour and other aesthetic considerations.[24]

7.7.6 Addressing this problem requires a strengthening of the gates through increased competence and role clarity and improvement in the quality and integrity of the product labelling and usage information.

## 7.8 Regulatory approach

7.8.1 Product safety laws commonly exist. They typically prohibit misleading and deceptive conduct in product information or sales practices and oblige those in the supply chain to provide products that conform to certain tests/standards. A consumer affairs or product safety regulator may administer and enforce these laws. This is likely to be a different body to the one implementing conformity assessment schemes and possibly auditing/inspecting building products on construction sites.

7.8.2 The body overseeing the building approval process and the conduct of designers, building officials and builders may serve as an additional layer of regulation. It is also common for countries to operate different laws across jurisdictions within their country resulting in multiple state, local or provincial government regulators. Product supply chains typically focus on national markets, such that these inter-jurisdictional differences can of themselves create the potential for non-compliance.

7.8.3 Fragmented regulatory oversight typically results in the opportunity to exploit accountability, confusion over responsibilities and role clarity, inconsistent enforcement resources and poor communication between regulators. The risk that follows is for non-conforming products to go undetected, regulated entities lacking clarity about jurisdiction and unethical actors to become more emboldened by a lack of enforcement to breach the laws.

7.8.4 When regulation, oversight and enforcement are ineffective, the onus to do the right thing falls on the participants within the system. This raises a question of governance, namely how to ensure accountability for the decisions made by many participants, some of whom are not easily accessible in a global supply and distribution network, and where assembly takes place on a construction site as part of what is referred to as an open system of production.[25]

---

24 Owners Corporation No.1 of PS613436T v LU Simon Builders Pty Ltd (Building and Property) [2019] VCAT 286 (28 February 2019)

25 Professor Russell Kenley and Dr Toby Harfield, (February 2019) Provision of Research to Improve the Evidence Base to Non-Conforming Building Products, Swinburne University of Technology

7.8.5 Such an arrangement suffers from difficulty in traceability, given materials and products emanate from many sources, and clarity of responsibilities is lacking. Furthermore, weaknesses in quality assurance are likely and consequentially it is difficult to allocate responsibility.

7.8.6 In some countries these arrangements create an environment more open to potential exploitation for non-conforming products or a culture lacking regulatory compliance leading to the incorrect use of products. The opportunity therefore is to learn from those jurisdictions where the regulations and their application have prevented or limited these circumstances from arising.

### 7.9 Inadequate quality assurance during construction

7.9.1 As noted above, building construction, particularly for large and complex buildings, is typified by an open system of production. These systems often include multiple participants with various responsibilities, creating difficulty in determining who is accountable for what. At the same time, there are a variety of inputs occurring, including the supply of products to site. Trades often work over the top of each other and project delivery is driven by time and costs.

7.9.2 Complex systems often require a complex regulatory ecosystem comprised of competent actors in order to deliver safe buildings. For example, a fire safety engineer is required to ensure the compliance of a building by means of a comprehensive fire safety strategy that encapsulates all the performance criteria necessary to ensure an outcomes-based compliance regime is satisfied. Such complex systems, without sufficient regulatory controls, create the potential for a number of risks to materialise, including lack of assurance that products being installed are those that have been specified and approved, and that they are being installed in accordance with the manufacturers' specifications as well as any limitations or conditions associated with their product certification.[26]

7.9.3 The volume of products involved in large scale construction can overwhelm regulators working without sufficient and reliable support infrastructure, making it difficult for them to comprehensively audit or verify their conformity. Some regulatory systems (especially outcomes-based jurisdictions) attempt to address this complexity by placing a high level of responsibility on those specifying the products as part of the design, those involved in the approval process and site supervisors to ensure that products are fit for purpose and what they claim they are.

7.9.4 Some companies invest significantly in their quality assurance processes to mitigate the risk of compromised product performance. However, quality assurance is not the same as product certification and quality assurance is only as strong as the weakest part of the supply chain. If products are not properly regulated and certified, the consequences for consumers of using non-conforming products or the poor installation of otherwise compliant products, can be experienced long after construction has been completed.

7.9.5 At a different scale, in the residential construction sector at least, consumers sometimes elect to purchase building products online and request that their builders use them in the construction of the consumers' homes. The potential for these products not to meet specified standards places the responsibility on practitioners to review their authenticity and seek approval to incorporate them into the design or face a failure upon inspection. This is particularly common for plumbing and electrical goods.

26 Consideration of this subject is linked to the increasing interest in and further opportunity for international building codes to evolve their approach to building classifications based on building complexity and risk

### 7.10 Lack of service and maintenance post construction

7.10.1 Whilst the scope of this paper is primarily focused on the conditions that can lead to the use of non-conforming products or the incorrect use of compliant products in building construction, it is important to observe that there have been circumstances where compliant products have failed causing damage to property, injury or loss of life through lack of appropriate servicing and maintenance following construction.

7.10.2 Problems related to improper service and maintenance can occur many years after completion, where buildings have been handed to new owners or buildings are subject to multiple ownership arrangements, particularly in the case of high rise residential and mixed-use buildings. In these cases, the owners are either not aware of the product maintenance regimes specified by the manufacturers to ensure the on-going serviceability of their products or systems, or there is no manual that documents the materials and products to provide suitable information for this purpose, or they make a conscious choice not to do so.

7.10.3 In the absence of proper maintenance, building products and systems can fail or simply under-perform. Examples include balustrades, smoke alarms, fire suppression systems, compartmentalisation (including fire doors) in the case of fire safety, or the very structure of the building.

7.10.4 This also raises another feature of product performance relating to durability or design service life. Building products should (subject to the requisite level of repair) remain fit for purpose throughout their design service life, which will typically be advised in manufacturer warranties and specifications. Poor installation and maintenance, however, can compromise a product's design life, voiding warranty and potentially impacting the safety of a building.

## 8. CLOSE

In presenting Part 1 on the subject of building product safety, the IBQC would welcome those who have an interest in the subject, from manufactures to consumers, through to certification bodies and practitioners, to provide us with their insights on the content of this paper and the subject more broadly. This input, including examples of what may represent good practice and practical solutions, will be used to help inform Part 2.

Parties interested in commenting on this draft or participating in the dialogue that will inform Part 2 should visit www.ibqc.org.au and follow the links to submit comments and/or join the online workshop that will be held in May 2022.

INTERNATIONAL BUILDING QUALITY CENTRE

**Bibliography**


Australian Building Codes Board (2021), Draft National Building Products Assurance Framework – *Discussion Paper*, ABCB

Australian Building Products Innovation Council (April 2018), *Building Rebuilding Confidence: An Action Plan for Building Regulatory Reform*

Australian Senior Officials Group (March 2016), Strategies to Address Risks Related to Non-Conforming Building Products

Babrauskas, Vyto, *The Grenfell Tower Fire and Fire Safety Materials Testing*, Fire Engineering 1.1.2018 https://www.fireengineering.com/leadership/the-grenfell-tower-fire-and-fire-safety-materials-testing/#gref

BBC, *Grenfell Tower inquiry: Cladding firm 'knew of fire risk'* (February 2021) https://www.bbc.com/news/uk-england-london-56014825

Building and Property, *Owners Corporation No.1 of PS613436T v LU Simon Builders Pty Ltd* ( [2019] VCAT 286 (28 February 2019)

Construction Dive, *Could a deadly fire like the one at UK's Grenfell Tower happen in the US?* (October 2019) https://www.constructiondive.com/news/could-a-deadly-fire-like-the-one-at-uks-grenfell-tower-happen-in-theus/564725/

The Fifth State, *Lessons for Australia from Grenfell Tower inquiry* (March 2021) https://thefifthestate.com.au/innovation/materials/lessons-for-australia-from-Grenfell-tower-inquiry/

Grenfell Tower Inquiry: Phase 1 Report (October 2019) - https://www.grenfelltowerinquiry.org.uk/

Grenfell Tower Inquiry: 'Module 2 Opening Submissions on behalf of Bindmans, Hickman & Rose and Hodges Jones Allen' BSR00000063/3 (2020): Stephanie Barwise QC, Marie Claire O'Kane, Dalton Hale https://www.grenfelltowerinquiry.org.uk/

Hackitt, Dame Judith, *Building a Safer Future: Independent Review of Building Regulations and Fire safety: Final Report* (May 2018), UK Government Publications

Hamma-adama, Mansur and Tahar Kouider, *Causes of Building Failure and Collapse in Nigeria: Professionals' View* (December 2017) - https://www.researchgate.net/publication/322686191_Causes_of_Building_Failure_And_Collapse_In_Nigeria_Professionals'_View

International Accreditation Service, AC291: *Accreditation Criteria for Special Inspection Agencies AC291* (September 2019).

International Building Quality Centre, *Principles for Good Practice Building Regulation* (September 2020) http://www.ibqc.org.au/wp-content/uploads/2020/09/IBQC-Principles-for-Good-Practice-Building-Regulation.pdf

International Code Council, *International Building Code*, 2021 Edition.

International Firestop Council, *Recommended IFC Guidelines for Evaluating Firestop System Engineering Judgments*, Rev 2019-10.

Johnson, Peter, et al, *Fire Safety Engineering – Final Report* (2020): Report 8 in Series of 8, Warren Centre for Advanced Engineering University of Sydney

Kenley, Professor Russell and Dr. Toby Harfield, *Provision of Research to Improve the Evidence Base to Non-Conforming Building Products*, Swinburne University of Technology (February 2019)

Marucheck, Ann et al, *Product safety and security in the global supply chain: Issues, challenges and research opportunities*, Journal of Operations (November 2011) https://www.sciencedirect.com/science/article/abs/pii/S0272696311000945

McKinsey & Company. *Construction and building technology: Poised for a breakthrough?* (April 2020) https://www.mckinsey.com/industries/advanced-electronics/our-insights/construction-and-building-technologypoised-for-a-breakthrough

Meacham, Brian, *Could a tragedy like the Grenfell Tower fire happen in the US?* The Conversation (June 2017) https://theconversation.com/could-a-tragedy-like-the-grenfell-tower-fire-happen-in-the-u-s-80035

Moore-Brick, The Right Honourable Sir, *Grenfell Tower Inquiry: Phase 1 Report Overview*, October 2019, APS Group of behalf of Her Majesty's Stationary Office, Open Government Licence

Parliament of Australia. *Non-conforming building products: the need for a coherent and robust regulatory regime* (December 2018) https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Economics/Non-conforming45th/Report

Schultz, Judith et al, *A Critical Appraisal of the UK's Regulatory Regime for Combustible Facades*, Fire Technology, 57, 261–290 (2021)

Shergold, Peter and Bronwyn Weir, *Building Confidence Report* (February 2018) building_ministers_forum_expert_assessment_-_building_confidence.pdf (industry.gov.au)

Underwriters Laboratory, *UL Warns of Counterfeit UL Mark on Fire Sprinklers* (Release 20PN-01) (March 2020) https://www.ul.com/news/ul-warns-of-counterfeit-ul-mark-on-fire-sprinklers-20pn-01

Underwriters Laboratory, (March 2021) *Product conformity – a matter of trust*, e-book (March 2021) UL_Product conformity e-book_202103_FINAL.pdf

Weir, Bronwyn, IBQC Principle 4 – *Building Product Safety*, Inaugural IBQC Conference (October 2020) - IBQC Forum – IBQC