The role of standards in enabling a data driven UK real estate market

Foreword

Dr. Amanda Clack MSc BSc PPRICS FRICS FICE FAPM FRSA FIC CCMI CMC

Executive Director and Head of Strategic Advisory, CBRE Ltd

Chair Designate and Trustee of UCEM

If data truly is "the new oil" as quoted by Clive Humby, nowhere is that data more prevalent than in the built environment sector. Many organisations have data going back decades but having it accessible and organised in such a way as it provides information from which to be meaningful for informed decision making is unquestionably the key. Particularly in a sector that is very much fragmented horizontally, but even vertically within organisations. When the focus of information becomes an asset, a building or infrastructure, whose lifespan is decades or even millennia, then designing, constructing, using, maintaining and valuing that asset to the best effect of the function and the people within it, relies on data.

According to Forbes "the amount of data we produce every day is truly mind-boggling' There are now 2.5 quintillion bytes of data created each day at our current pace, but that pace is only accelerating with the growth of the Internet of Things (IoT). Over the last two years alone 90 percent of the data in the world was created" and only 0.8% of it was analysed. If the data we produce in the built environment is accelerating at a similar pace, combined with the increasing need for collaboration and data sharing across teams and throughout the life of the building through the likes of Building Information Management (BIM), Modern Methods of Construction (MMC), IoT, the Code for Sustainable Buildings and the like, we need to get our data in order, and fast.

With the backdrop of build better : faster : greener being emphasised by the UK government. To achieve this, the sector will need to increase data creation and reliance to be able to achieve these aspirations as what gets measured gets done. That all points to data driven solutions with a strong backbone of a common standard.

2018 was a milestone when the General Data Protection Regulation (GDPR) became in force across much of Europe with 7 principles of: (i) lawfulness, fairness and transparency; (ii) purpose limitation; (iii) data minimalization; (iv) accuracy; (v) storage limitation; (vi) integrity and confidentiality (security); and (viii) accountability. Regulations need to be fundamentally underpinned by Standards, but what is clear through this incredibly timely research piece by Dan Hughes for the Red Foundation, is that role of standards in enabling a data driven real estate market is so complex and unclear it fails to protect and enable.

As a built environment sector, we need leadership and collaboration to come together to facilitate confidence in the data we utilise for decision making, through robust systems and process, underpinned by a sector collaboration to determine, agree and adhere to a unified data standard to give confidence in the quality of the advice and reliance of the basis of that advice. The time to do this is now, because at the rate in which we are all becoming increasing data generative and dependent the problem of complexity and reliability is only set to increase exponentially.

International precedents have been set for collaboration around Standards for the Built Environment with the adoption of International Property Measurement Standards (IPMS), International Construction Measurement Standard (ICMS) and International Land Measurement Standard (ILMS) set to provide trust, ethics and minimise risk.

This comprehensive and well written research is clear that as we see decisions increasingly based on data from the full lifecycle, and that whilst today have well established standards, as we see asset types increasingly blur, new factors such as productivity, sustainability and wellbeing will rise up the agenda and be even more data reliant. Only by truly connecting our Standards for data to a common data Standard.

The next steps are clear:

- Improve discoverability
- Increase connectivity
- Understand value
- Clarify the role of people

Our role now is to work together to put these next steps into action.

Executive Summary

We live in an ever more digital and data driven world and how the built environment adapts to this will be key for its success. The use of data is not in itself a new thing and there are many well established organisations, practices and standards in the market. However, we are seeing both an exponential growth in the data that is available and much more emphasis on output and a lifecycle view of decisions.

This paper explores the role of standards in ensuring an effective flow of data across the whole built environment, to set the scene for a sector wide discussion on what is available, what is needed and what is the role of people in all of this.

Current situation

In order to inform this paper, a review of some of the standards that are available within the UK was carried out. This was a high-level review and it interpreted standards in the broadest sense of the word; those that have an influence over creation, management or use of data. However, we can clearly see that the built environment has a well-established and comprehensive range of standards. Figure 1 below shows a visualisation of the standards identified as part of this study.

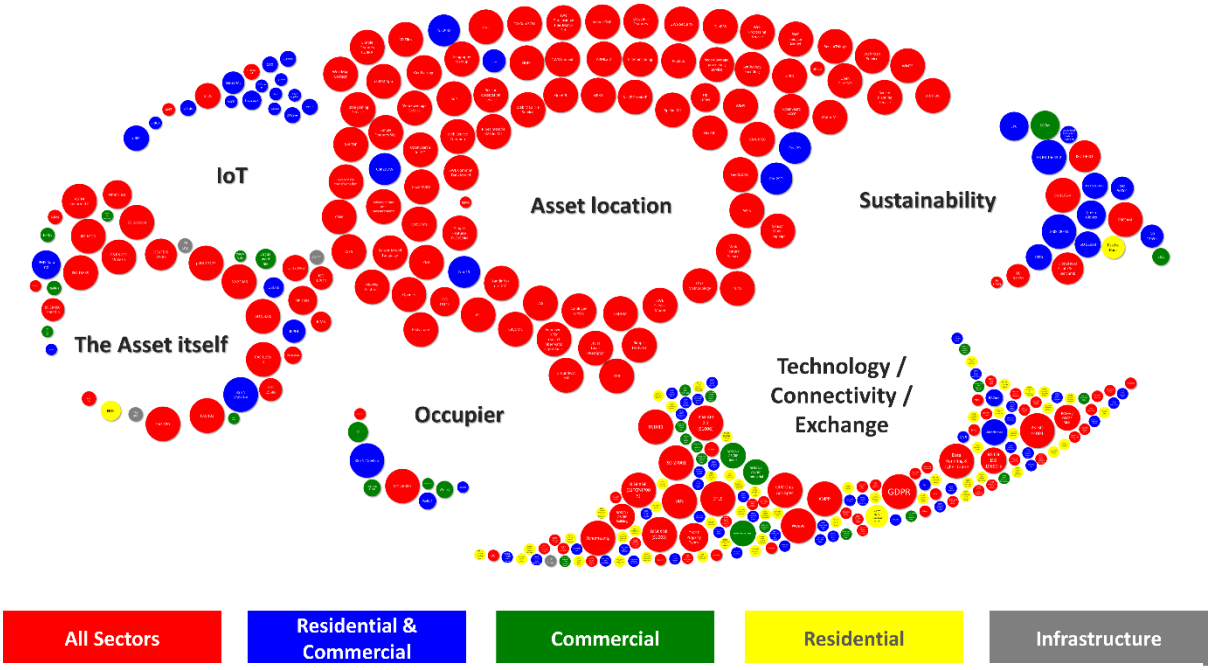


FIG. 1 – a visualisation of the standards available today in the UK real estate market that impact on the use of data.

However, standards tend to be focused on either a specific stage of the building lifecycle or job function. As data is increasingly needed to inform decisions beyond the building stage or job function within which it was created, standards will need to facilitate data increasingly being used by an ever-wider variety of people.

Anecdotally, awareness of all the standards available in the market is not high beyond the sector to which they were originally applied. This is perhaps not surprising but does means that the adoption and wider use of data is limited. It also leads to a range of overlapping or similar standards being created in isolation.

Beyond the flow of data, there are other challenges that the sector faces such as the discoverability of the standards available and clarity of who is responsible for what. If, for example, a professional is today required to be responsible for the data and therefore the standards that they use, how can this be practically achieved as we move into a world where more and more data sources are used to inform decision making? Furthermore, how do we make sure that the flow of data works when the application of standards for collecting, managing and using data is often by very different parties.

Key headlines about the role of standards in enabling a data driven property market

1. Real estate has a well-established and robust set of standards about the creation, management and use of data.
2. This often leads to an increased quality of data available in the sector.
3. To truly realise the benefits of data in the future, data must be able to flow freely across the whole sector beyond the existing silos; standards have a key role to play in this.
4. Existing standards need to be more valued and more easily discoverable to ensure wider adoption and to avoid reinventing wheels.
5. The value and cost of standards and data needs to be recognised fairly, especially when the value might be recognised by a different party other than the one incurring the cost.
6. It will become increasingly complex for a professional of the future to be able to have clarity or take responsibility for the data that they use and the standards that influence this data.

Next steps

The role of standards in enabling a more data driven real estate sector is important, but this report has identified challenges that the sector must address. Recommended next steps are:

Improve discoverability – industry and standard setting bodies should work together to improve the discoverability of standards relating to the creation, management and use of data. This should cover all aspects of the real estate sector.

Increase connectivity – standard setting bodies should explore ways of improving the connections between standards. For example, this might include a small number of agreed elements or items that are common to all standards moving forward.

Understand value – industry bodies and standard setting bodies should carry out a campaign to raise awareness of the value of standards across the real estate sector. This should include highlighting the cost of maintaining standards and governance.

The role of people – the whole real estate sector must come together to clarify the role of people in the use of standards. As the volume and variety of data used increases, who is responsible for ensuring that standards are applied correctly must be considered.

Report authored by Dan Hughes
of Alpha Property Insight for the use of the Real Estate Data Foundation.
This report was supported by the UCEM 'Harold Samuel Research Prize'

1. Introduction

The use of data across the built environment has been well established for many years, but we now find ourselves at a point of fundamental change where the sheer volume of data that is becoming available poses very significant opportunities and challenges for the sector.

Recently, there has been a greater focus on how data might be used, but as a sector it is necessary to have the appropriate infrastructure and processes in place to enable this both today and tomorrow. A key factor is ensuring well understood and consistent data, how it is created, managed and used, this is done largely through the use of standards.

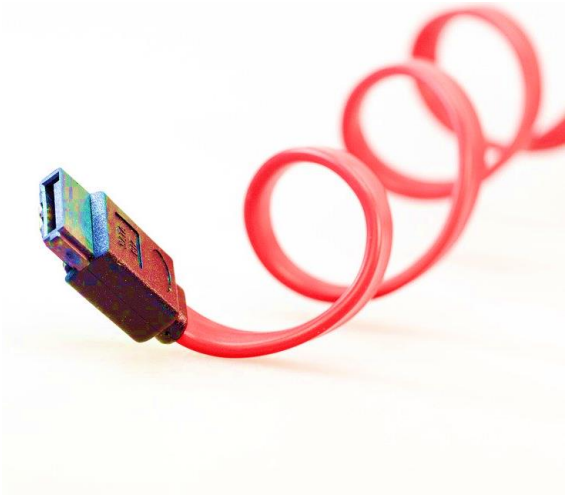
There is little doubt of the broad benefits of standards to an economy; an independent report by the Centre for Economics and Business Research (Cebr), commissioned by the BSI suggested 37.4% of UK productivity growth and 28.4% of annual UK GDP growth, equivalent to £8.2 billion, can be attributed to standards[1].

The purpose of this paper is to explore the role standards play and some of the challenges that we face in the real estate sector as we move into a more data driven world and to set the scene for a sector wide discussion on what is available, what is needed and the role of people in this.

The term 'standard' itself is used in many different forms by many different people and this report focuses on standards, in the broadest sense, that are applicable to the UK market.

Whilst this paper reviews what is available in different parts of the market as examples and to explore the likely direction of travel, it is by no means an exhaustive list of everything.

It should also be highlighted that this report considers the world from a data point of view, where it is created and where it will be used. It does not consider who is the direct user of the standards themselves. It is perfectly possible that an individual user will rely on a variety of data standards without knowing. For example, a valuer may rely on a variety of data sets in their roles such as air quality or customer satisfaction that are created through standards that they are not aware of.



"For real estate to meet the challenges of reducing the climate impact of buildings while improving user experience, we will have to work together to link systems and share data. The only way to do that efficiently is by agreeing on standard approaches to data, systems and processes."

- Jules Barker, British Land

[1] Cebr (2015) *The Economic Contribution of Standards to the UK Economy*, London: Centre for Economics and Business Research Ltd [online]. Available at: https://www.bsigroup.com/LocalFiles/en-GB/standards/BSI-The-Economic-Contribution-of-Standards-to-the-UK-Economy-UK-EN.pdf

2. How the use of data is changing

2.1 The growth of data

From Figure 2 below, we can see that there is an exponential growth in the amount of data available in the world, so for a sector that has traditionally relied heavily on a small number of slow changing data points to make the most of its decisions, this is a significant change. As the volume of available data grows and its use in all corners of the sector increases, our processes will have to build more and more data sets into them.

We have seen a significant growth in the amount of data collected in the world and much of this has been through digital platforms such as websites or apps. However, as buildings become increasingly connected with devices and sensors, they too will become platforms for data collection.

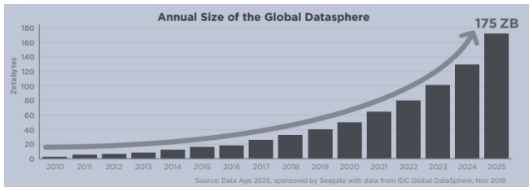


FIG. 2 – annual size of the global 'datasphere'[2]

2.2 Growing analytical power

The analysis of data has always been an integral part of the property sector. Historically, much of this has been carried out by people based on their knowledge and experience, but with the growing processing power of technology and the huge amount of data now available we are going to increasingly rely upon computer analysis to support or drive business decision making.

This means that we need to have a clear and manageable mechanism to allow huge amounts of data to reliably flow across and be used by all parts of the property sector.

For example, the graph below demonstrates that the expectation of valuation clients is for valuations to become far more data driven with more variety and volume of data being used.

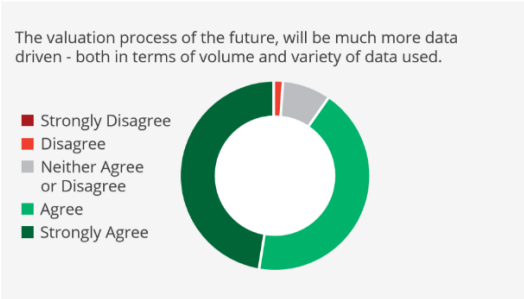


FIG. 3 – Valuation clients view on the growing influence of data in the valuation process[3]

2.3 From Component to System – the blur of silos

It is often noted that the real estate sector is 'siloed'. The sector has traditionally been structured around stages of the lifecycle and / or job discipline and there is often surprisingly little cross over between them. The structure of the sector is built around components. Each of these 'People Silos', to some degree or another, collects data, a 'data silo'. Historically the data created within a specific stage of the lifecycle, or silo, is rarely used by another. This principle is demonstrated by Figure 4 below.

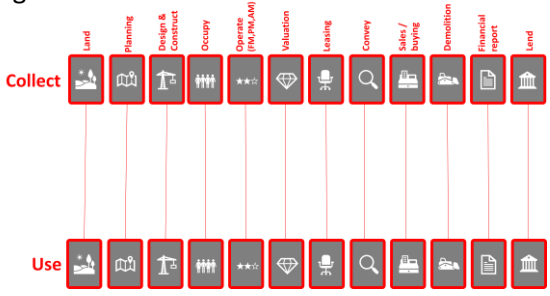


FIG 4 - A diagram demonstrating that historically, there has been little use of data beyond the silo within which it was collected

[2] IDC (2018) *Data Age 2025: The Digitization of the World – From Edge to Core*, Framingham MA USA: International Data Corporation [online]. Available at: https://www.seagate.com/files/www-content/our-story/trends/files/idc-seagate-dataage-whitepaper.pdf

[3] LIQUID Real Estate Innovation (2019) *Commercial Property Valuations – A Time of Change* [online]. Available at: https://www.liquidrei.com/

With an ever-increasing focus on whole asset life performance, the system, and the growth in data that is available to support this decision making, we will see a blurring of these silos as we turn our attention to a system wide focus. To a large degree, the job functions within the silos are unlikely to change dramatically, but they will need to be more aware of the whole system impact of what they do, and so the data silos that exist will blur significantly. This means that there will be a significant increase in the use of data for all parts of the property sector which will primarily be created by other stages, demonstrated below in Figure 5. This will increase the complexity of data and therefore it will become harder to understand, combine and compare with other data sets. Appropriate use of standards to enable this will be essential.

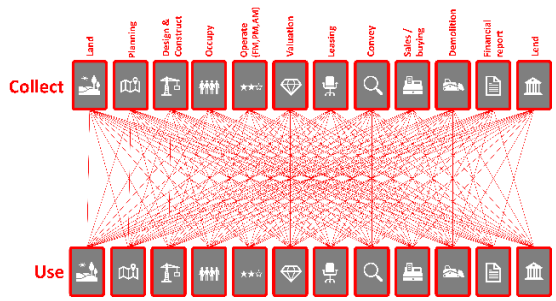


FIG 5 - A diagram demonstrating that in the future, much of the data used in a silo or stage of the lifecycle will be collected from multiple stages of a building lifecycle. This will lead to a significant amount more data transfer which leads to more complexity for professionals to understand

Despite the overall size of the real estate market, and unlike other sectors real estate is made up of a very high number of relatively small companies covering a highly complex process. This means that the real estate sector is highly fragmented. This fragmentation means more components and therefore interfaces and, unless carefully managed, every interface that data passes through can cause a reduction in the data quality. The fragmentation of real estate means that there are a lot of interfaces which in turn means an increased need for standards to maintain the effective flow of data.

If real estate were better equipped to manage this increase in data flow, not only would it be able to capitalise on a number of efficiency, value add or sustainability benefits, it would be better equipped to adopt initiatives, such as the 'Golden Thread' of information called for by Dame Judith Hackitt in her Independent Review of Building Regulations and Fire Safety 'Building a Safer Future'.[4]

2.4 The blur of sectors

Not only are the traditional silos that we work in blurring, but silos also tend to exist for different asset classes, which we are also seeing merge. Shortening leases and the growing popularity of co-working space means that, at times, some offices may behave more like a hotel than a traditional office; the move to online shopping is driving an increasing cross over between industrial and retail buildings; the rise of Build to Rent (BTR) is bringing traditionally commercial investors and developers into the residential sector.

2.5 The sector becomes more data driven

All decisions in the property sector are becoming more data driven. That is not to suggest that the human judgement is not, or will not continue to be needed, however, future judgements will be based on higher volumes of objective data. We can again look to the valuations process as an example of what is happening across the entire market.

[4] GOV.UK, Ministry of Housing Communities & Local Government (2018*) Independent Review of Building Regulations and Fire Safety: final report*, London: MHCLG [online]. Available at: https://www.gov.uk/government/publications/independent-review-of-building-regulations-and-fire-safety-final-report

The RICS Red Book[5] is the guiding standard for UK based valuations and within this it suggests that a valuer should consider the data that is typically used within the market. Investors are increasingly using a wide range of data sets collected from all sorts of different places and through many different methods, and so a valuer needs to consider how to build these into their calculations. Whilst this is a handful of data points, it is not too much of a problem, but when we eventually start considering millions of data points, then the ability of the valuer to effectively work with these is critical. More details about the types of data sets that the valuations report might use in the future can be seen in the LIQUID Real Estate Innovation (REI) report – 'Commercial Property Valuations – A Time of Change.'[6]

Many of these issues will not be solved by the valuer themselves, but by the technology solution providers, both in and out of house. However, if the valuation sector does not take the lead on driving the agenda and considering the flow of data that is to be used in the valuation process, then their value will become significantly reduced. This principle applies to most parts of the market.

"The Internet of Things has driven change, the rate of which is unprecedented within the real estate market, and yet owing to the systemically conservative and siloed nature of the industry, the true value this data has to offer, is to date, left largely untapped.

Now, at the behest of the current pandemic, is the perfect opportunity for this industry to take stock and address fully the issues surrounding the convergence and interlinking of standards, in order to realise this value."

- Claire Penny, Wia Technologies Ltd.

[5] Royal Institution of Chartered Surveyors (2020) *Red Book Global Standards*, London: RICS [online]. Available at: https://www.rics.org/uk/upholding-professional-standards/sector-standards/valuation/red-book/
[6] LIQUID Real Estate Innovation (2019) *Commercial Property Valuations – A Time of Change* [online]. Available at: https://www.liquidrei.com/
[7] https://fastedit.files.wordpress.com/2013/09/ipms-infographic.pdf

A Case Study - International Property Measurement Standards (IPMS)

Every building is different, and so in the property sector we naturally have to find a way of understanding and comparing data sets. To do this we often compare metrics based on building area; per square feet or square meter.

Data from different buildings, regions or markets are the basis of many of the decisions that we make. If, for example, we are comparing the cost of a commercial lease or the sustainability of a building, we need to make sure that we are comparing consistent data sets. But even if we are using data created in the same way, how do we make sure that the underlying data set, the building size, is consistent?

This sounds like an obvious statement that is taken for granted, but research by global property firm JLL shows that, depending on the method used, a property's floor area can deviate by as much as 24%.[7]

International Property Measurement Standards have been created by a global coalition of industry bodies and standard setters to address just this, a globally consistent way to measure buildings.

This is a good example of where knowing the data point, in this case the size of the building, is of limited use without knowing the standard that was used to capture the measurement.

3. Standards today

There are many different opinions across the market of what a standard is or should be. The term means very different things to different people. It is therefore perhaps worth starting with a dictionary definition[8]:

Standard /ˈstandəd/

Noun - *a level of quality or attainment.*

Adjective - *used or accepted as normal or average.*

An alternative and more detailed definition may be taken from the British Standards Institution (BSI) BS 0:2016 [9]:

Standard

Document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

An alternative approach might be to group approaches into the following categories:

- **Formalised standards –** those that fall within the British Standards Institute (BSI) / Comité Européen de Normalisation (CEN) / International Organization for Standardization (ISO) remit.
- **Standards –** formally agreed and documented methods of doing things.
- **Conventions –** generally accepted methods of doing things.

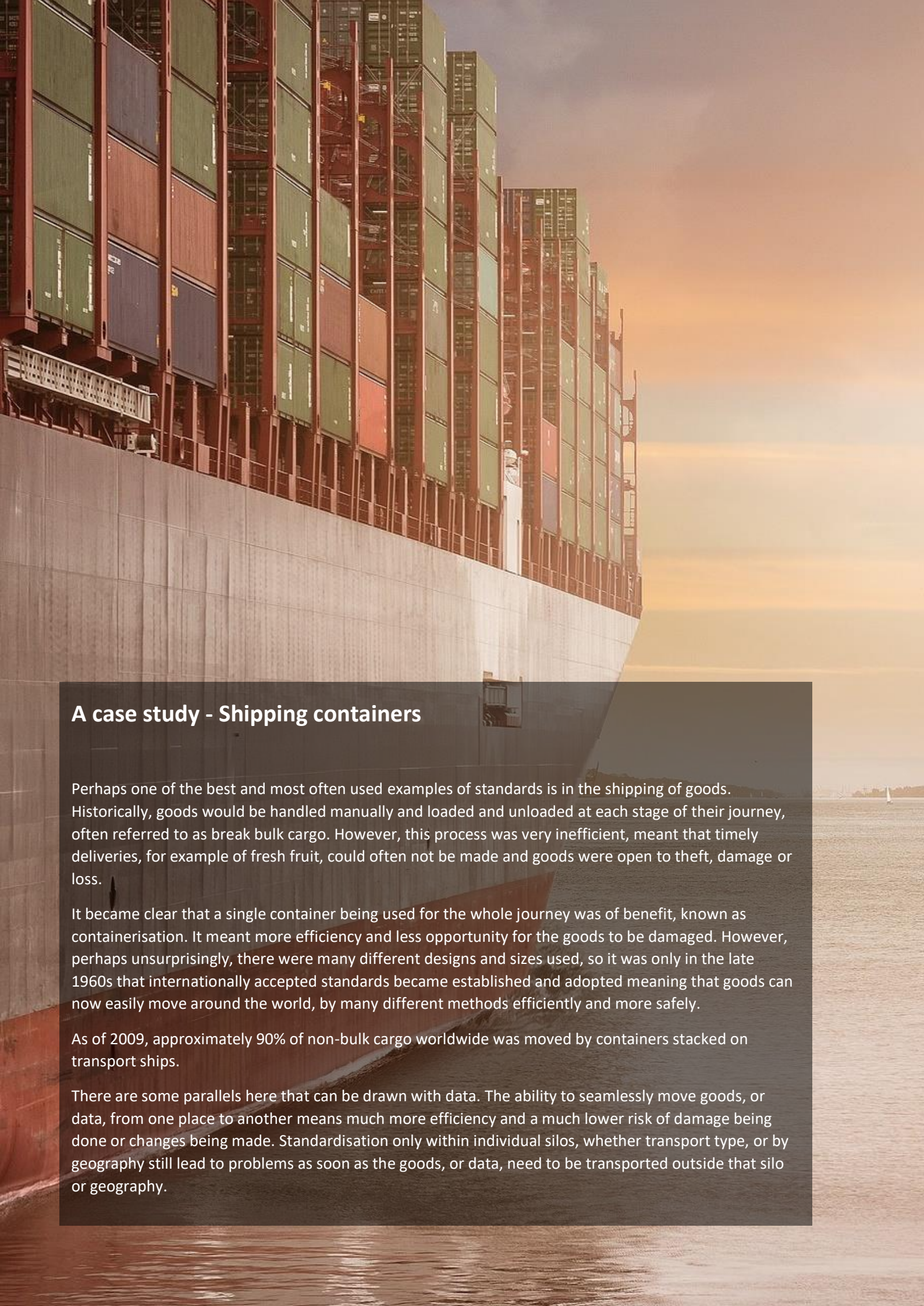
The purpose of this report is to consider the situation from a data perspective and where it will be used a point of view, and the role that standards may play in facilitating this, as opposed to the standards themselves. Therefore, in order to be inclusive, the definition that we will use for the purpose of this report is:

"Approaches to creating, managing or using data in a manner widely accepted as normal and of acceptable quality"

This is, of course, an extremely broad definition and there are very many well-established standards that fall within it. This report is not looking to produce an exhaustive list of these, but rather to explore the diverse range of standards that are already in use, and to consider the challenges that the sector faces as we see the need for data to increasingly flow across all sectors and stages of the lifecycle, irrespective of where, when and how it is created.

[8] https://www.lexico.com/en/definition/standard

[9] British Standards Institution (2016) *A standard for standards – Principles of standardization*, London: BSI Standards Limited [online]. Available at: https://www.bsigroup.com/Documents/standards/guide-to-standards/BSI-BS-0-2016.pdf



A case study - Shipping containers

Perhaps one of the best and most often used examples of standards is in the shipping of goods. Historically, goods would be handled manually and loaded and unloaded at each stage of their journey, often referred to as break bulk cargo. However, this process was very inefficient, meant that timely deliveries, for example of fresh fruit, could often not be made and goods were open to theft, damage or loss.

It became clear that a single container being used for the whole journey was of benefit, known as containerisation. It meant more efficiency and less opportunity for the goods to be damaged. However, perhaps unsurprisingly, there were many different designs and sizes used, so it was only in the late 1960s that internationally accepted standards became established and adopted meaning that goods can now easily move around the world, by many different methods efficiently and more safely.

As of 2009, approximately 90% of non-bulk cargo worldwide was moved by containers stacked on transport ships.

There are some parallels here that can be drawn with data. The ability to seamlessly move goods, or data, from one place to another means much more efficiency and a much lower risk of damage being done or changes being made. Standardisation only within individual silos, whether transport type, or by geography still lead to problems as soon as the goods, or data, need to be transported outside that silo or geography.

3.1 What standards cover

Standards relating to data in the real estate sector are widespread and are produced for the creation, management and use of data. They are also produced from both a built environment perspective and a technology perspective.

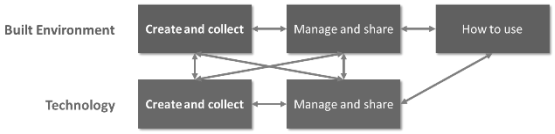


FIG 6 - A diagram demonstrating the sector within which standards are set and for what purpose.

As real estate relies on more and more data being collected by technology, from websites through to sensors and 'Internet of Things' (IoT) devices, we will need to become more aware of the data flowing across all parts of the decision making process. This, in turn, will rely on standards developed by numerous bodies from different parts of the sector.

3.2 Who creates them

Standards considered within this report are created by a wide range of different entities. A few examples of these are below, each of which brings its own strengths and weaknesses.

- **Professional bodies –** professional bodies are often responsible for standards about how data is created and used.
- **Standard setting bodies –** there are a number of organisations that have the primary purpose of producing and managing standards.
- **Industry groups –** a range of interested industry parties come together to agree a consistent way of doings things.
- **Market leaders –** many companies define a particular methodology for something and, if that company is in a dominant market position, then it becomes the 'standard' way of operating.

We can see from the types of organisations listed that, under the broad definition of standards used in this report, there are an equally broad range of standard setting bodies. Each of these has a different approach and rigour and it is worth noting that in the UK, the BSI has an agreement with the Government to act as the UK's national standards body.

BSI, the National Standards Body

BSI is appointed by the UK Government as the National Standards Body and represents UK interests at the International Organization for Standards (ISO), the International Electrotechnical Commission (IEC) and the European Standards Organizations (CEN, CENELEC and ETSI). Formed in 1901, BSI was the world's first National Standards Body. Its role is to help improve the quality and safety of products, services and systems by enabling the creation of standards and encouraging their use.

BSI publishes over 2,700 standards annually, underpinned by a collaborative approach, engaging with industry experts, government bodies, trade associations, businesses of all sizes and consumers to develop standards that reflect good business practice.

3.3 The standards landscape today

To support this paper, we carried out a market review of some of the standards that are available in the market today and noted which sector and stage of the lifecycle that they were available or most relevant to. A full list of these may be found in Appendix C along with a more in-depth methodology in Appendix B. However, the graphics below illustrate the range and depth of standards available (Figure 7 and 8).

A single person or job role is unlikely to ever need to know all of these and, whilst this covers all types of standard, it does highlight the number of different standards and interfaces that will play a part in the future flow of data across the sector.

3.3.1 By sector and focus

The diagram below demonstrates the standards identified as part of this study which are available in the sector and that influence the creation, management or use of data. They are sorted into their primary area of focus with colour coding based on the primary sectors that they apply to. The size of each circle is indicative of the number of stages of the building lifecycle to which the standards apply.

This does not demonstrate, or imply quality, importance or adoption levels of the standards.

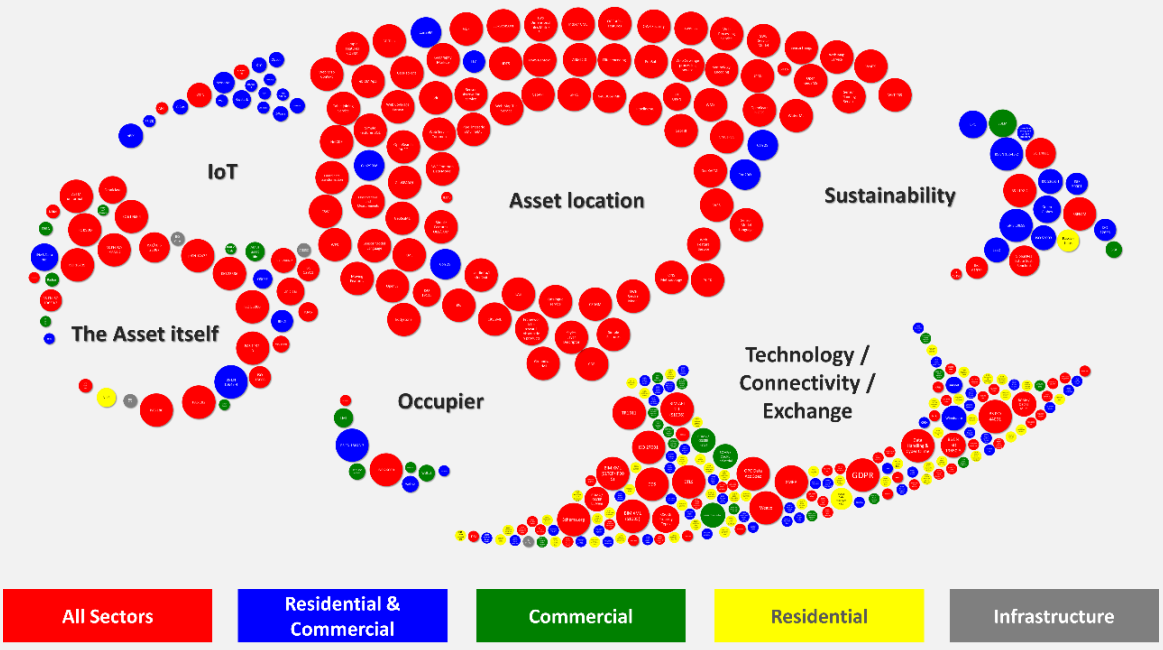


FIG. 7 – a visualisation of the standards available today in the UK real estate market that impact on the use of data.

3.3.2 By lifecycle

The diagram below demonstrates the standards explored for this paper and which stage of the lifecycle or job function they are most applicable to. One standard may be applicable to multiple stages or functions.

This demonstrates that, at each stage of the building lifecycle, there are, or will be, a wide number of standards that will influence the data used or created in that stage.

The categorisation of standards into the stage of the lifecycle is based on where they are likely to either have use today or in the future. More details about how this data was compiled may be found in Appendix B.

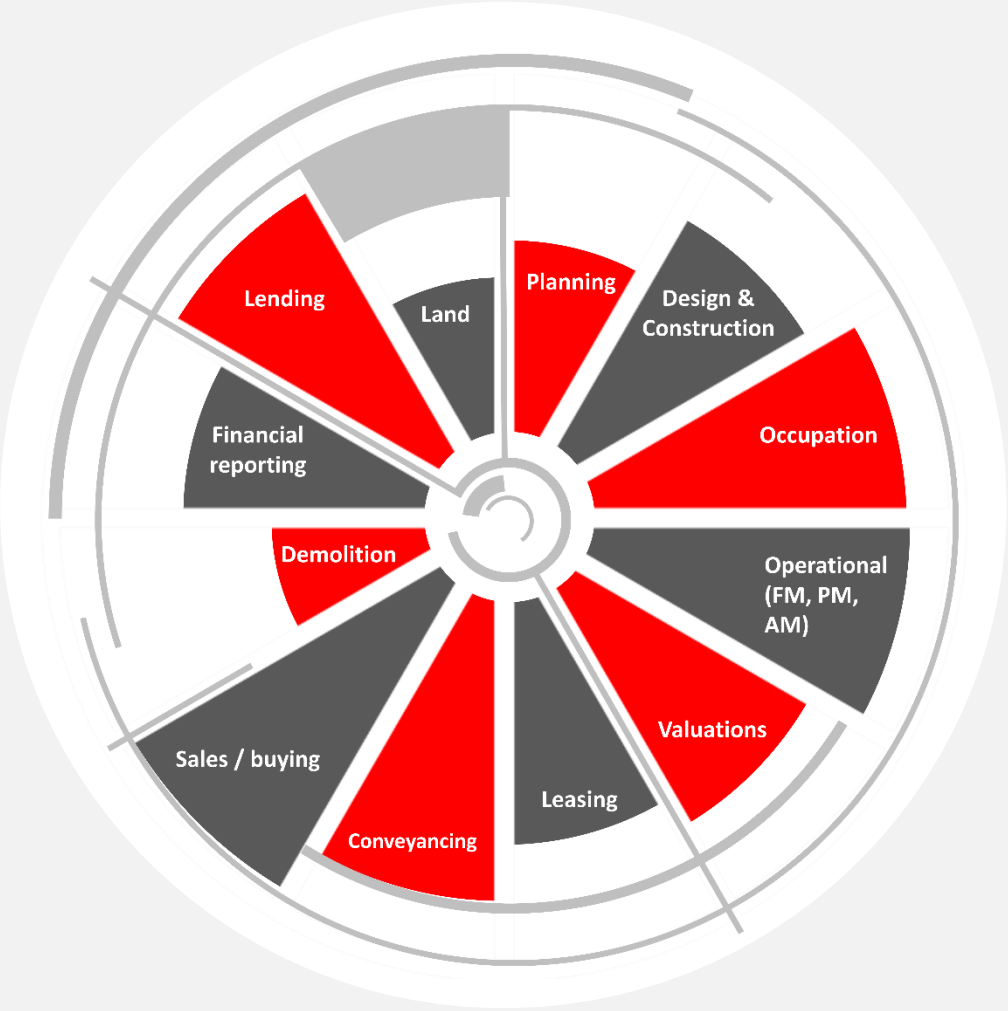


FIG. 8 – a visualisation of the standards available today in the UK real estate market by lifecycle stage

A Case Study - A standard identifier for property

Often, some of the most valuable insights that can be derived are from combining different data sets. One of the main ways to do this is by having a common point in each data set; the golden thread that ties the separate data sets together. In real estate, the majority of data sets that we collect, manage and use are about buildings. The most common factor here could be expected to be the building's address, but whilst on the face of it this feels intuitive, this is often not as straight forward as it sounds.

Every addressable location in Great Britain has a Unique Property Reference Number, often referred to as a UPRN, which is a unique identifier for that location. Geoplace, a joint venture between the Local Government Association and Ordnance Survey, is responsible for the UPRN.

Whilst the UPRN has been around for some time, recent changes have meant that it is now more easily identified and used. Whilst the UPRN only applies to Great Britain and is not a solution to all challenges, the adoption of a standard and unique property identifier could be a significant step forward for the management of data in the real estate sector.

4. Challenges for the sector to address

4.1 Speed of change

The ability to collect new data sets is growing quickly and, as data becomes more and more available, it is going to be increasingly important for standards to keep up with these changes. This presents the built environment with two key challenges:

- Real estate is, by its very nature, slow to change and relatively low risk. Therefore, many standards that have been created and are well established in the built environment are old and go through a robust, but slow review process. This is to ensure that the standards are kept up to date with the changing world we live in. However, technology moves very fast and so we need to have a clear understanding as to how these two different paced worlds will come together as data flows from one to another.

- The second issue is that because property moves so slowly as an asset, the time for which data is relevant and useful often tends to be longer than in other sectors. Therefore, data created a number of years ago is likely to have more value to real estate decisions than in faster moving markets such as FMCG (fast-moving consumer goods). Real estate therefore needs to establish how it gets the balance between regularly changing standards about the capture and management of data to make sure that they keep up with technologies but, on the other hand, not changing so quickly that historic data can no longer be consistently used and compared. Using a market index to understand long term performance is only useful if the basis of the index is constant.

It is worth noting that where standards cannot keep up with this pace of change, there is a risk that they do not facilitate new ways of doing things and therefore restrict innovation. However, there is also an argument that in certain situations, having standardised methodologies and practices can facilitate innovation by providing agreed processes and methodologies which therefore may speed up the process of innovation.

The Sector must establish ways to balance the speed of change and facilitating innovation with standard setting processes.

"To deliver benefits through technology, at a price point that is palatable, then alignment on data is critical. Standards for data in the built environment play a key role in aggregating demand for technology, supporting the services and experiences provided to become scalable platforms for change. So the built environment has to collaborate and create a common understanding to enable the transformative opportunities that technology presents to flourish."

- Alex Lubbock, BIM Object

4.2 Responsibility

In today's world, professionals offering a service, often take direct, or indirect responsibility for the accuracy of the data that they use. Very often this will mean understanding the standards by which the data was captured and shared. As more and more data is used and therefore more standards are available, how will the professional of the future take ownership of all of these as well as the advice that they provide on them?

"…[a valuer] must bring the required levels of independence and objectivity to bear on individual assignments, applying professional scepticism to information and data where it is to be relied on as evidence."[10] - RICS Red Book

As previously noted, the range of standards explored in this piece of work is incredibly broad and it is highly unlikely that one entity will need to understand or use all of the different standards that play a part in a specific decision. However, using the valuation process as an example, data created using a range of different IoT standards, will be combined with data from a range of sustainability measurement standards and compared based on building size, again all possibly measured under different standards. Who is responsible for making sure that the data is correct, and that appropriate standards are used in this process; and how would a valuer be expected to take responsibility for this?

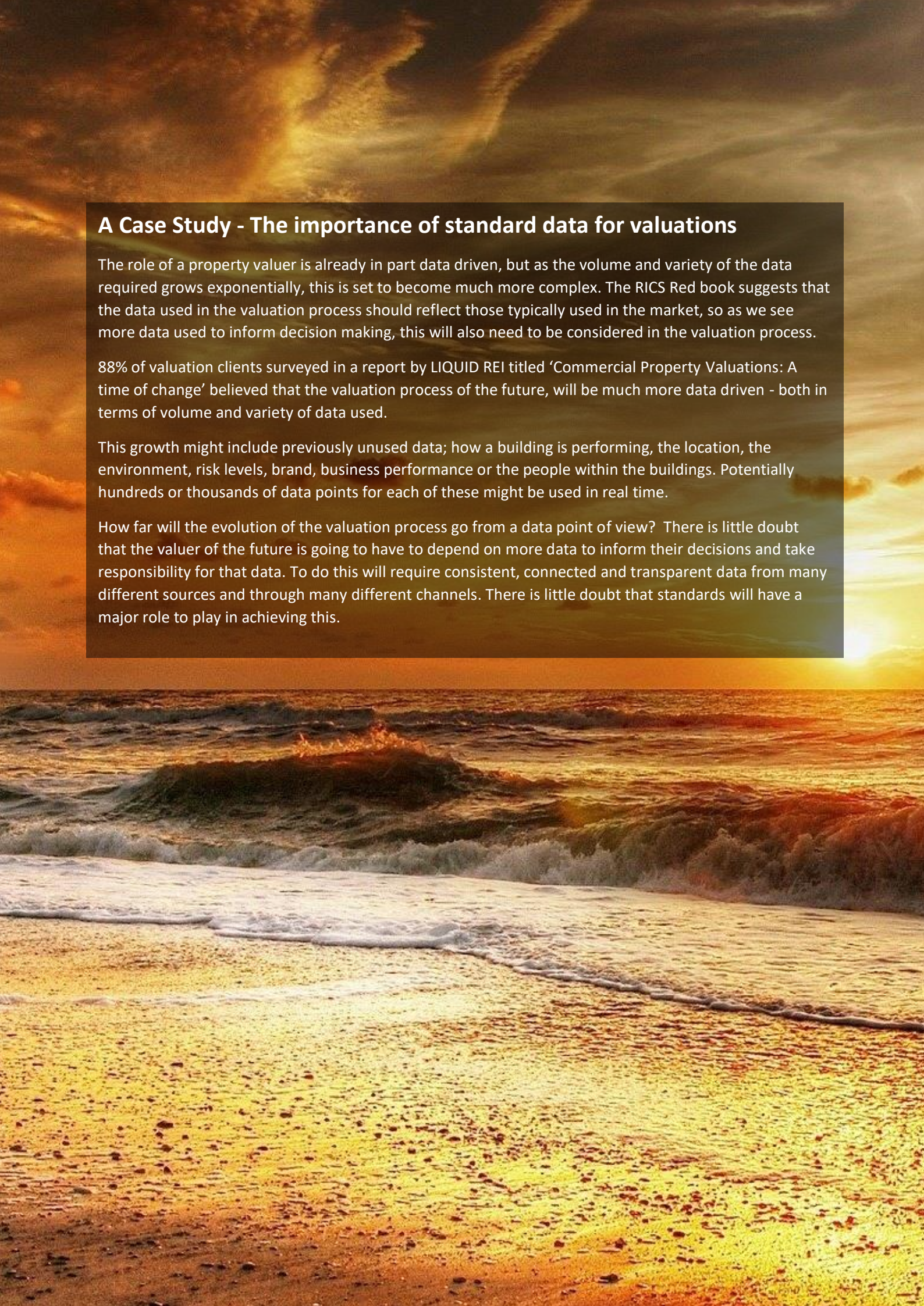
What a person can be responsible for in the future relating to data and the standards used must be considered.

4.3 Connecting standards

More than any other sector, real estate is huge, but it is also highly fragmented, and this is reflected in the range of different standards and standard setting bodies captured in this report. But, as we move into a world where we need data to seamlessly flow across all parts of the sector, between different asset classes and all stages of the lifecycle, how do we make sure that these are all appropriately joined up to allow the effective flow of data? At one extreme, a single standard for the capture and sharing of all data across the built environment would allow true consistency, but this is unlikely to be feasible or a sensible approach for such a large and diverse sector.

Data must be enabled to flow more easily across the sector and consideration should be given to if and how data sets created under different standards could be connected.

[10] Royal Institution of Chartered Surveyors (2020) *RICS Valuation – Global Standards*, London: RICS [online]. Available at: https://www.rics.org/globalassets/rics-website/media/upholding-professional-standards/sector-standards/valuation/rics-valuation--global-standards-jan.pdf



A Case Study - The importance of standard data for valuations

The role of a property valuer is already in part data driven, but as the volume and variety of the data required grows exponentially, this is set to become much more complex. The RICS Red book suggests that the data used in the valuation process should reflect those typically used in the market, so as we see more data used to inform decision making, this will also need to be considered in the valuation process.

88% of valuation clients surveyed in a report by LIQUID REI titled 'Commercial Property Valuations: A time of change' believed that the valuation process of the future, will be much more data driven - both in terms of volume and variety of data used.

This growth might include previously unused data; how a building is performing, the location, the environment, risk levels, brand, business performance or the people within the buildings. Potentially hundreds or thousands of data points for each of these might be used in real time.

How far will the evolution of the valuation process go from a data point of view? There is little doubt that the valuer of the future is going to have to depend on more data to inform their decisions and take responsibility for that data. To do this will require consistent, connected and transparent data from many different sources and through many different channels. There is little doubt that standards will have a major role to play in achieving this.

4.4 Discoverability

We can see from the market scan carried out for this paper, there are a wide range of different organisations and entities that create standards. Traditionally, the ones that have needed to be known about, sit within or alongside the specific part of the market that the person or company operates in. As we need to understand and identify standards from across the whole sector and beyond the silos that we currently work in, we are going to see this become increasingly challenging.

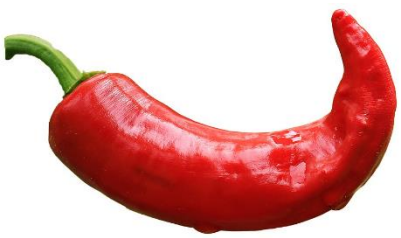
Very often, challenges that we face are not unique to one sector and so there is a 'reinventing of wheels' and multiple solutions to the same problem.

Real estate will need to become much better at understanding what data standards are already in existence and how to interact with them.

The real estate sector must explore how to make standards more easily discoverable.

"Currently, it is difficult to establish whether a specific standard exists unless you are made aware of it. Due to the complexity of our sector discoverability will remain an issue until we establish a formal taxonomy and attribute it to all types of standard."

- Dan Rossiter MCIAT, BSI



4.5 Market adoption

The use of standards has many perceived benefits, but two of the most significant are increased efficiency and market transparency. On the face of it, these are both obvious benefits, but there are elements of the market that may benefit from the inefficiency and lack of transparency that exists. For standards to be effective, they need to be widely adopted and this may mean a range of different approaches to make sure that this is the case.

Bodies representing the wider real estate industry must take a leading role in discussing and identifying sector level benefits of standard adoption.

4.6 International vs local

For the purpose of this paper, only UK relevant standards have been considered. However, it should be noted that as the world becomes ever more internationally connected and, with real estate often operating across international barriers, data is increasingly going to flow across them. Whilst this paper explores the need for data to flow across all stages of the building lifecycle, all job functions and all asset types, it should be noted that this is also likely to be true for international borders where countries often have their own standards.

However, real estate is inextricably linked to local markets and governments for example, through planning, land registration, or local addressing. Standards and processes must therefore consider the balance between data created through local standards and that created through international standards and the relation between these.

Consideration must be given to the benefit and practicality of global standards and how they operate with local standards.

4.7 Understanding value and funding

Some standards are available to use at no charge and some are paid for. This is often dictated by the organisation type creating the standards, but there is an interesting paradox that the whole sector must address; there is a cost to providing high quality, maintained and appropriately governed standards. However, charging for the use of standards and restricting the use of them are barriers that are likely to prevent their adoption.

With the right application, the use of standards can create many benefits such as transparency, efficiency or interoperability, but these are often only realised with wider market adoption; and the financial benefits, whilst often significant in real estate, are not easily measurable, especially as they are often realised by a different party from the one who has to bear the cost of implementation.

If we continue to use the example of property valuation, there will be much more data used to inform this process in the future, both volume and variety. However, that data will be drawn from a range of different and separate times and places. Without wide adoption of standards, this will become increasingly challenging to reliably build into automated calculations, yet the adoption of standards that benefit the valuation may have to be implemented elsewhere in the sector.

Bodies that represent the wider sector must take a lead on building a clear narrative around the benefits of standards for the whole sector consumption.

"The property sector is on a journey of embracing data and standards have a key role to play in this. Much progress has been made and many standards are available, however we can see the complexity of the current situation where even relatively simple tasks like measuring the overall sector's impact, size or worth are challenging"

- Patrick Brown, British Property Federation

4.8 Appropriate governance

Standards for the collection and sharing of data must be to the benefit of the market and have appropriate governance. Today, with so many standards that are relevant to the market, there are several models used. Where standards are not mandatory, and the value of using them is not directly to the people using them, we often find private companies defining processes that become 'standards'. There is nothing wrong with this, but how do we ensure appropriate governance so that these are written for the benefit of the sector, rather than an individual company? And furthermore, how do we balance this with asking a private company to fund the definition and management of standards that benefit the wider market and that could harm their commercial position?

The real estate sector must work together to ensure that standards serve the wider sector benefit without unfairly impacting any commercial models.

"Standards based on an integrated data model enable the industry to remove the Heath Robinson patchwork of translation and transformation to allow data to flow smoothly and speedily through processes and supply chains. This has never been more important, especially in the UK with the draft Building Safety Bill and Golden Thread proposals, where removing this friction can and will literally save lives"

- Chris Lees, OSCRE

5. Conclusion and next steps

Standards will play an important role in the successful transformation of real estate to a more data driven sector. In reflection of the highly fragmented and complex structure of the sector today, there are a huge range of different standards that impact the use of data, both the creation, management and use of it.

Many parts of the market today have well established standards, but as we see asset types increasingly blur, new factors such as productivity, sustainability and wellbeing rise up the agenda and we see decisions increasingly based on a full lifecycle basis. We need to make sure that, as a sector, we pay close attention to having the structures in place to allow the effective use of data.

There are many challenges that we face to achieve this, and there are not likely to be any easy solutions. The temptation is to focus on one small element at a time, but without a collective, market wide effort to at least be aware of the future flow of data, and therefore the different standards required, may grow the problem rather than solve it.

If the real estate sector is not able to move towards a more data driven world, it will suffer. Existing standards will become less valuable, the sector will be less efficient and real estate will not attract the levels of investment it has in the past as market transparency becomes an ever more important factor in investment decisions.

Next steps

The role of standards in enabling a more data driven real estate sector is important, but this report has identified challenges that the sector must address. Recommended next steps are:

Improve discoverability – industry and standard setting bodies should work together to improve the discoverability of standards relating to the creation, management and use of data. This should cover all aspects of the real estate sector.

Increase connectivity – standard setting bodies should explore ways of improving the connections between standards. For example, this might include a small number of agreed elements or items that are common to all standards moving forward.

Understand value – industry bodies and standard setting bodies should carry out a campaign to raise awareness of the value of standards across the real estate sector. This should include highlighting the cost of maintaining standards and governance.

The role of people – the whole real estate sector must come together to clarify the role of people in the use of standards. As the volume and variety of data used increases, who is responsible for ensuring that standards are applied correctly must be considered.

6. Appendix

Appendix A – Acknowledgements

This report was written by **Dan Hughes** of **Alpha Property Insight Ltd** on behalf of the **Real Estate Data Foundation.**

We would like to thank the **University College of Estate Management (UCEM)** for their support and awarding the 'Harold Samuel Research Prize'. UCEM is an independent University College with over 4,000 students studying worldwide. The institution is committed to excellence in teaching and to providing strong employability outcomes to increase professionalism and contribute to a better Built Environment.

We would also like to thank the following people for their support with the creation of this report, however, the content does not necessarily reflect their individual, or company views.

- Alex Lubbock – BIMObject UK
- Andrew Knight - RICS
- Anil Sawhney - RICS
- Chris Lees - OSCRE
- Claire Penny - Wia Technologies Ltd
- Dan Rossiter - BSI
- Jules Barker – British Land
- Naqash Tahir - PGIM
- Neil Thompson - Atkins
- Patrick Brown - BPF
- Stephen Spooner – Recept Consulting Ltd
- Stuart Chalmers – National Physical Laboratory

Note: All website references were reviewed on 14 August 2020.

Appendix B – Methodology

The purpose of this report was to explore the role of standards that have an influence over data across the whole built environment in the UK market. To do this, we needed to explore some examples of what was available in the market today. This was not intended to be a full audit of what is available, but a cross section of some of the different types of standard that are currently in use and it considered both international and local standards if they are used or applicable to the UK market.

To be clear, capture of the standard in this paper does not in any way endorse the standard.

By definition, the range of standards is very broad, therefore we identified a number of criteria that we would look at to allow us to explore the current situation further, this included:

Lifecycle / discipline relevant – the stage of a lifecycle or job discipline that the data covered by the standard is likely to be relevant to. This is relatively subjective and captures relevance, not use. We have used a relatively simplistic lifecycle model which means that the data captured is very general, however, it does demonstrate how widely used some of the data is likely to be.

Primary area of focus for the standard – we also wanted to broadly capture the standard by its primary area of focus and chose to classify each by 'The asset itself', 'Sustainability', 'The Occupier', 'IoT', 'Technology / connectivity / Exchange' or 'Asset location'. This has proven useful, however, it is worth noting that there are clear overlaps in this therefore, we have allocated to the most appropriate; for example, there is a reasonable cross over between 'IoT' and 'Technology / connectivity / Exchange'. It is also fair to say that whilst useful for categorisation and understanding the landscape, it also perpetuates the idea of silos.

Asset Type – we wanted to explore the primary focus of the standard on asset type that standards were available for, we did not want to overcomplicate this and so selected to only categorise by Commercial Property, Residential or Infrastructure (or combinations of the above).

Cost – based on the need to balance adoption and maintenance of the standard, we considered whether the standard was free or if there was a cost. The cost of the standard was considered as a direct cost at the point of supply. This does not take into account standards that are subsidised by alternative funding methods, or indeed where they may be paid for, but available to the end user for no charge.

Type of standard – recognising that there are many different types of definitions and formats of standards, we wanted to capture what type of format each standard came in. This was only captured where easily identifiable, however, this has not been used in analysis due to the incompleteness of the data set.

Data collection and report writing methodology – once the classification and structure for the data collection was established, the data was collected through a simple table (Appendix 3) in the following process: Stage 1 was desk-based research of what was available in the market. Stage 2 was to share with a small number of experts in the space for them to comment, amend, add. Stage 3 was to analyse the data and write the report. Stage 4 was to peer review this report with a number of experts in the market.

For avoidance of doubt, this report calls on the opinions of many experts in this space but does not necessarily represent the view or opinion of either the individual, their company, or anybody that they represent.

Caveats – there are a number of limitations to this methodology that should be noted:

- This was never meant to be a full audit of everything available and, along with the challenges of discoverability of standards, particularly outside the traditional silos that people work in, and the breadth included in the scope of this report, this is not an exhaustive list. There are inevitably standards that have been missed off the list which are as relevant as others that have been included.
- Each standard is captured by a single line in the table and part of the analysis includes counting standards. This provides a good overview of what is available and the problem from a user point of view, however, each line does not show the size, scope, depth or adoption rate of each standard. This report may therefore include a simple one-page best practice statement that applies to a very specific use case which is not widely used all the way through to a very extensive, highly technical and highly adopted standard. Both would be captured in a single line of the spreadsheet.
- A number of criteria used to classify the standards are subjective. We have mitigated this by consulting experts in the space, however, there is an inevitable judgement to make, particularly in the sectors that the standards are relevant to. There is an argument that all data could be relevant to all stages of the lifecycle. This has been further mitigated by assessing trends and general market size, rather than being definitive quantifications of the market.
- The lifecycle model used for the data capture is high level; this was to allow the best balance between speed of capture and depth of analysis. However, there are clearly areas where this is very general, for example; Design and Construction is captured as a single stage.

Appendix C – List of standards

Below is a summary of the standards identified for the purpose of this report that are relevant to the collection, management and use of data in real estate. The full set of results may be found at www.theREDFoundation.org and www.AlphaPropInsight.com.

Example standards	Lifecycle / discipline relevant?											Primary area of focus for the standard	What asset type is it most relevant for?	Authority / owner	Link
	Land	Planning	Design & Construction	Occupation	Operation (FM, PM, AM)	Valuation	Leasing	Conveyancing	Sales / buying	Demolition	Financial reporting	Lending				
1-Wire		■	■	■	■								Tech / connectivity / Exchang	All of the above		
3D Tiles	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
3dP	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
6LoWPAN		■	■	■	■								Tech / connectivity / Exchang	All of the above		
Alljoyn		■	■	■	■								Tech / connectivity / Exchang	All of the above		
ANSSC	■	■	■	■							■	■	The asset itself	Infrastructure		
ANT			■	■	■								IoT	All of the above		
ARGUS Enterprise Property Asset file				■	■	■	■		■		■	■	The asset itself	Commercial		
ARML2.0	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
ASTM Uniformat II	■	■	■	■	■	■	■	■	■	■	■	■	The asset itself	Resi & Comm		https://www.astm.org/Standards/E1557.htm
BACnet		■	■	■	■		■		■				Tech / connectivity / Exchang	Resi & Comm		http://www.bacnet.org/
BIM Collaboration Format API version 2.1 (S1006)	■	■	■	■	■	■	■	■	■	■	■	■	Tech / connectivity / Exchang	All of the above	Building Smart	https://github.com/BuildingSMART/BCF-API
BIM Collaboration Format XML (S1005)	■	■	■	■	■	■	■	■	■	■	■	■	Tech / connectivity / Exchang	All of the above		https://github.com/BuildingSMART/BCF-XML
Bluetooth		■	■	■	■								Tech / connectivity / Exchang	All of the above	Bluetooth Special Interest	https://www.bluetooth.com/
BOMA / OSCRE Industrial		■	■	■	■	■	■		■		■	■	Tech / connectivity / Exchang	Commercial	OSCRE / BOMA	https://www.oscre.org
BOMA / OSCRE Multi		■	■	■	■	■	■		■		■	■	Tech / connectivity / Exchang	All of the above	OSCRE / BOMA	https://www.oscre.org
BOMA / OSCRE Office		■	■	■	■	■	■		■		■	■	Tech / connectivity / Exchang	Commercial	OSCRE / BOMA	https://www.oscre.org
BOMA / OSCRE Retail		■	■	■	■	■	■		■		■	■	Tech / connectivity / Exchang	Commercial	OSCRE / BOMA	https://www.oscre.org
BOMA / OSCRE Building		■	■	■	■	■	■		■		■	■	Tech / connectivity / Exchang	All of the above	OSCRE / BOMA	https://www.oscre.org
BREEAM Technical Standards	■	■	■	■	■	■	■	■	■	■	■	■	Sustainability	All of the above	BRE	
BRICK				■	■								IoT	Resi & Comm	Open Source	https://brickschema.org
BS 1192-4:2014 (COBiE)	■	■	■	■	■	■	■	■	■	■	■	■	Tech / connectivity / Exchang	All of the above		
BS EN 15221-4 : 2011			■	■	■								Occupier	Commercial	BSI	
BS EN 15643 Part 2: 2011 Environmental performance	■	■	■	■	■	■	■	■	■	■	■	■	Sustainability	Resi & Comm		https://shop.bsigroup.com/ProductDetail/?pid=000000000030259777
BS EN 15643 Part 3: 2012 Social performance	■	■	■	■	■	■	■	■	■	■	■	■	Occupier	Resi & Comm	BSI	
BS EN 15643 Part 4:2012	■	■	■	■	■	■	■	■	■	■	■	■	The asset itself	Resi & Comm		
Building Device naming standards (BDNS)			■	■	■								The asset itself	Resi & Comm		https://www.w3.org/community/bdns/
C-Bus			■	■	■	■	■						IoT	Resi & Comm	Schneider Electric	https://www.clipsal.com/enabledprogram
Cat: ebRIM App Profile: Earth Observation Products	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Catalogue Service	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
CC-Link Industrial Networks				■	■	■	■		■				Tech / connectivity / Exchang	All of the above	Mitsubishi Electric	https://eu.cc-link.org/en/
CDB	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
CityGML	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Con 29	■	■	■	■	■		■	■	■	■	■	■	Asset location	Resi & Comm	Law Society	https://www.lawsociety.org.uk/support-services/advice/articles/con29-forms/
CON29DW	■	■	■	■	■		■	■	■	■	■	■	Asset location	Resi & Comm	Law Society	https://www.lawsociety.org.uk/support-services/advice/articles/con29-forms/
CON29M	■	■	■	■	■		■	■	■	■	■	■	Asset location	Resi & Comm	Law Society	https://www.lawsociety.org.uk/support-services/advice/articles/con29-forms/
Con29O	■	■	■	■	■		■	■	■	■	■	■	Asset location	Resi & Comm	Law Society	https://www.lawsociety.org.uk/support-services/advice/articles/con29-forms/
Coordinate Transformation	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
CSDGM	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	FGDC	https://www.fgdc.gov/metadata/csdgm-standard
CSW	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above		
DALI			■	■	■								Tech / connectivity / Exchang	Resi & Comm	DiiA	https://www.digitalilluminationinterface.org/dali/
Data Handling and Cyber Crime Professional Statement	■	■	■	■	■	■	■	■	■	■	■	■	Tech / connectivity / Exchang	All of the above	RICS	
DDS	■	■	■	■	■	■	■	■	■	■	■	■	Tech / connectivity / Exchang	All of the above		
DSI			■	■	■								Tech / connectivity / Exchang	All of the above	MIPI Alliance	https://www.mipi.org/
DTLS	■	■	■	■	■	■	■	■	■	■	■	■	Tech / connectivity / Exchang	All of the above		
Dynet			■	■	■								IoT	Resi & Comm	Philips Lighting	https://en.wikipedia.org/wiki/DyNet
EC-GSM-IoT			■	■	■		■		■				IoT	All of the above		https://www.gsma.com/iot/mobile-iot-technology-ec-gsm-iot/
Eddystone	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	Google	https://developers.google.com/beacons/eddystone
ENOcean			■	■	■								IoT	Resi & Comm	EnOcean	
EO-GeoJSON	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
EPC		■	■	■	■	■	■	■	■	■	■	■	Sustainability	Resi & Comm	MHCLG	https://www.epcregister.com/
EPRA Best Practice Recommendations						■	■		■		■	■	The asset itself	Commercial	EPRA	https://www.epra.com/application/files/7415/0306/4407/EPRA_BPR_Guidelines_2017.pdf
Filter Encoding	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
GDPR	■	■	■	■	■	■	■	■	■	■	■	■	Tech / connectivity / Exchang	All of the above	ICO (UK)	https://ico.org.uk/for-organisations/guide-to-data-protection/guide-to-the-general-data-protection-
GeoAPI	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Geography Markup Language	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
GeoPackage	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
GeoRSS	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
GeoSciML	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
GeoSPARQL	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Geospatial eXtensible Access Control Markup Language (GeoXACML)	■	■	■	■	■	■	■	■	■	■	■	■	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat

Geospatial User Feedback (GUF)	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
GeoTiff	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Global Real Estate Sustainability Benchmark	Sustainability	All of the above	GRESB	https://gresb.com/
GML in JPEG 2000	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
GPKG	Asset location	All of the above	OGC	
Green Globes	Sustainability	Resi & Comm	Green Building Initiative	https://thegbi.org/green-globes-certification/what-it-costs/
GRI CRESS	Sustainability	Resi & Comm	Global Reporting Initiative	Live
GroundwaterML	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
HACT / OSCRE Affordability Statement	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Aggregate Case Metrics	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Arrears Report	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Asset Inventory	Tech / connectivity / Exchang	All of the above	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Asset List	Tech / connectivity / Exchang	All of the above	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Available Appointments	Tech / connectivity / Exchang	Resi & Comm	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Care Case File	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Care Referral	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Care Referral Outcome Feedback	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Care Referral Response	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Care Services	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Component Certificates	Tech / connectivity / Exchang	All of the above	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Component Certification	Tech / connectivity / Exchang	Resi & Comm	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Create Rent Account	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Customer Data	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Customer Needs Assessment	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Customer Risk Assessment	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Development Benchmarking	Tech / connectivity / Exchang	Resi & Comm	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Development Handover File	Tech / connectivity / Exchang	Resi & Comm	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Job Status Update	Tech / connectivity / Exchang	Resi & Comm	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Lease Or Freehold Responsibilities	Tech / connectivity / Exchang	Resi & Comm	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Nominations	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Planned Maintenance Data Migration	Tech / connectivity / Exchang	All of the above	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Program Of Work	Tech / connectivity / Exchang	All of the above	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Program Of Work Instruction	Tech / connectivity / Exchang	All of the above	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Property Marketing Information	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Raise Repair	Tech / connectivity / Exchang	All of the above	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Rent Statement	Tech / connectivity / Exchang	Residential	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Request Additional Work Approval	Tech / connectivity / Exchang	All of the above	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Request Appointment	Tech / connectivity / Exchang	Resi & Comm	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Request Appointment Response	Tech / connectivity / Exchang	Resi & Comm	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Request Available Appointments	Tech / connectivity / Exchang	Resi & Comm	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Schedule Repair	Tech / connectivity / Exchang	Resi & Comm	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Service Charge Estimates	Tech / connectivity / Exchang	All of the above	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Update Component Accounting	Tech / connectivity / Exchang	All of the above	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Void Income Loss Statement	Tech / connectivity / Exchang	Resi & Comm	OSCRE / HACT	https://www.oscre.org
HACT / OSCRE Work Order Complete	Tech / connectivity / Exchang	All of the above	OSCRE / HACT	https://www.oscre.org
Haystack	IoT	All of the above	Open source	https://project-haystack.org
HDF5	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
HTTP/2				
HyperCat				
i3s	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
IBPDI (International Building Performance & Data Initiative)	The asset itself	Resi & Comm	IBPDI	https://ibpdi.org/about/
ICMS	The asset itself	All of the above	RICS	https://www.rics.org/globalassets/icms-data-standard_new.pdf
IEC 61850	Tech / connectivity / Exchang	Infrastructure	IEC	https://www.iec.ch/
IEC 61968-4	The asset itself	All of the above	IEC	https://www.iec.ch/
IEC 61968-6	The asset itself	All of the above	IEC	https://www.iec.ch/
IEC 61970	Sustainability	All of the above	IEC	https://www.iec.ch/
IEEE 802	Tech / connectivity / Exchang	All of the above	IEEE	https://en.wikipedia.org/wiki/IEEE_802
IES City	The asset itself	Infrastructure	IES / NIST	https://s3.amazonaws.com/nist-sgcps/smartcityframework/files/ies-city_framework/IES-
IFC bSDD	The asset itself	All of the above	BuildingSMART	http://bsdd.buildingsmart.org/
ILMS (International Land Measurement Standard)	Asset location	All of the above	ILMS Coalitiona	https://ilmsc.org/
IndoorGML	Asset location	All of the above	OGC	
Infra Asset Management (TR1010)	The asset itself	Infrastructure		https://www.buildingsmart.org/wp-content/uploads/2018/01/IR-0109-AM-TR1010.pdf
INREV Data Delivery	The asset itself	Commercial	INREV	https://www.inrev.org/library/inrev-standard-data-delivery-sheet-sdds
INREV Performance Measurement	The asset itself	Commercial	INREV	https://www.inrev.org/library/inrev-standard-data-delivery-sheet-sdds
INREV Property Valuation	The asset itself	Commercial	INREV	https://www.inrev.org/taxonomy/term/116
INREV Reporting Guidelines	The asset itself	Commercial	INREV	https://www.inrev.org/guidelines/module/ER/reporting#about
IOTDB	IoT	All of the above	Apache	https://iotdb.apache.org/#/
IoTivity	IoT	Resi & Comm	Open Connectivity	
IPMS Data Standard	The asset itself	Resi & Comm	RICS	https://www.rics.org/globalassets/ipms-data-standard_new.pdf
IPSO Application Framework	IoT	Resi & Comm	Open Mobile Alliance	https://www.omaspecworks.org/

IPv6	Tech / connectivity / Exchang	All of the above			
ISO 12006-2:2015	The asset itself	All of the above	ISO	https://www.iso.org/standard/61753.html	
ISO 12655	Sustainability	Resi & Comm	ISO	https://www.iso.org/standard/51634.html	
ISO 12911	The asset itself	All of the above	ISO	https://www.iso.org/standard/52155.html	
ISO 13153:2012	Sustainability		ISO	https://www.iso.org/standard/53401.html	
ISO 14001:2015	Sustainability	All of the above			
ISO 15686	The asset itself	All of the above	ISO	https://www.iso.org/standard/45798.html	
ISO 16739-1:2018	The asset itself	All of the above	ISO	https://www.iso.org/standard/70303.html	
ISO 19115-1:2014	Asset location	All of the above	ISO	https://www.iso.org/standard/53798.html	
ISO 19650-2	The asset itself	All of the above		https://shop.bsigroup.com/ProductDetail/?pid=000000000030333757	
ISO 19650-3	The asset itself	All of the above	BSI		
ISO 19650-5	The asset itself	All of the above			
ISO 22301:2019	Occupier	Resi & Comm	ISO	https://www.iso.org/standard/75106.html	
ISO 23386:2020	The asset itself	All of the above	ISO	https://www.iso.org/standard/75401.html	
ISO 26000:2010	Occupier	All of the above	ISO	https://www.iso.org/standard/42546.html	
ISO 27001:2013	Tech / connectivity / Exchang	All of the above	ISO	https://www.iso.org/standard/54534.html	
ISO 41001:2018	Occupier	Commercial	BSI	https://shop.bsigroup.com/ProductDetail?pid=000000000030378513	
ISO 44001:2017	Tech / connectivity / Exchang	All of the above	BSI	https://shop.bsigroup.com/ProductDetail?pid=000000000030353016	
ISO 50001	Sustainability	Resi & Comm	ISO	https://www.iso.org/iso-50001-energy-management.html	
ISO 52000-1:2017	Sustainability	Resi & Comm	ISO	https://www.iso.org/standard/65601.html	
ISO 52003	Sustainability	Resi & Comm	ISO	https://www.iso.org/standard/65662.html	
ISO 55000:2014	The asset itself	All of the above		https://www.iso.org/standard/55088.html	
ISO/FDIS 23387	The asset itself	All of the above	ISO	https://www.iso.org/standard/75403.html	
ISO/TS 37151:2015	Occupier	All of the above	ISO	https://www.iso.org/standard/61057.html	
KML	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
KNX	Tech / connectivity / Exchang	Resi & Comm	KNX		
LandInfra/InfraGML	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
LAS	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
LEED	Sustainability	Resi & Comm	LEED	https://www.buildinggreen.com/leed	
Leesman LMI Score	Occupier	Commercial	Leesman	https://www.leesmanindex.com/	
LLC (Local Land Charges)	Asset location	Resi & Comm	LA / HMLR	https://search-local-land-charges.service.gov.uk/	
Location Services (OpenLS)	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
LWM2M	IoT	Resi & Comm	Open Mobile Alliance	https://www.omaspecworks.org/	
Moving Features	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
MSCI (IPD) schema	The asset itself	All of the above	MSCI		
NetCDF	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
NFC	Tech / connectivity / Exchang	All of the above			
NLIS	The asset itself	Residential		https://www.nlis.org.uk/what-is-nlis	
NRM	The asset itself	All of the above			
oBIX	IoT	Resi & Comm	OASIS		
Observations and Measurements	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
OGC API - Features	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
Omniclass	The asset itself	All of the above	Omniclass.org	http://beta.omniclass.org/	
ONS Methodology	Asset location	All of the above	ONS	https://www.ons.gov.uk/methodology/methodologicalpublications/generalmethodology	
OPC Data Access Specification	Tech / connectivity / Exchang	All of the above	OPC	https://opcfoundation.org/	
Open GeoSMS	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
Open Standards for Regulation (TR1011)	Tech / connectivity / Exchang	All of the above	BuildingSmart	https://www.buildingsmart.org/wp-content/uploads/2017/11/17-11-08-Open-Standards-for-	
OpenMI	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
OpenSearch for EO	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
OpenSearch Geo	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
Ordering Services Framework for Earth Observation Products	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat	
OSCRE Action Request	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org	
OSCRE Action Request Response	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org	
OSCRE Additional Enquiry Answer	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Additional Enquiry Question	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Apportionment Calculation	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Buyer Aborted Deal Notify	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Buyers Initial Communication Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Buyers Memorandum Of Completion Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Buyers Memorandum Of Exchange Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Commercial Introduction Send	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org	
OSCRE Commonhold Information Form Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Completion Date Proposal Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Completion Information Request	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Completion Information Response	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Contract Bundle Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Contract Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Contractual Completion Notice Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	
OSCRE Cost Exchange	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org	
OSCRE Deeds Schedule Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org	

OSCRE Dispatch Work Order	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Evidence Of Title Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Exchange Parameters Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Failure Completion Notice Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Fixtures Fittings Contents Form Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Forward Action Request	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Forward Action Response	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Forward Order Query	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Forward Query Search Result	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Forward Response Query	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Forward Result Query Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Forward Search Order Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Forward Search Results Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Forward Status Request	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Forward Status Request Response	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Forward Status Update	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Housemark PLP	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Key Undertaking Request	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Leasehold Information Form Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Non Standard Deposit Request	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Portfolio Lease Summary	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Portfolio Update	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Proof Of Discharge Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Property Management Reporting Information	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Property Types	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Query Order Response	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Query Search Order Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Query Search Result Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Ready To Exchange Request	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Ready To Exchange Response	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Release Undertakings Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Request Land Charges Bankruptcy Search	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Request Land Charges Full Search	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Request O C With Summary	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Request Official Search Of Part	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Request Official Search Of Whole	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Request Search Of Index Map	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Request Title Known Official Copy	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Response OC With Summary	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Retail Turnover Certification	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Search Cost Request Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Search Cost Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Search Order Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Search Request Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Search Result Query Response	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Search Results Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Search Validation Request Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Seller Aborted Deal Notify	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Sellers Initial Communication Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Sellers Memorandum Of Completion Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Sellers Memorandum Of Exchange Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Sellers Property Information Form Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Send Agricultural Appraisal Report	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Send Assembly Meeting Place Appraisal	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Send Commercial Listing	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Send Healthcare Appraisal Report	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Send Industrial Appraisal Report	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Send Land Appraisal Report	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Send Lease	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Send Lease Abstract	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Send Lease Data	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Send Lodging Appraisal Report	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Send Multifamily Appraisal Report	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Send Office Appraisal Report	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Send Retail Appraisal Report	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Send Senior Housing Appraisal Report	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Send Shopping Center Appraisal Report	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Send Special Purpose Appraisal Report	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Send Sports Entertainment Appraisal Report	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Space Management Information Exchange	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org

OSCRE Standard Enquiries Request	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Standard Enquiries Response	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Status Request Response	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Status Request Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Status Update Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OSCRE Submit Investment Reporting Data	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Submit Portfolio Information Data	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Submit Property Valuation Data	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Submit Service Request	Tech / connectivity / Exchang	All of the above	OSCRE	https://www.oscre.org
OSCRE Transfer Send	Tech / connectivity / Exchang	Residential	OSCRE	https://www.oscre.org
OSCRE Unit Measurement History	Tech / connectivity / Exchang	Commercial	OSCRE	https://www.oscre.org
OSCRE Validation Response Send	Tech / connectivity / Exchang	Resi & Comm	OSCRE	https://www.oscre.org
OWS Context	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
OWS Security	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
PAS 1192-3:2014	The asset itself	All of the above		
PAS 180	The asset itself	Infrastructure	BSI	https://www.bsigroup.com/en-GB/smart-cities/Smart-Cities-Standards-and-Publication/PAS-180-smart-cities-
PAS 182	The asset itself	Infrastructure	BSI	https://shop.bsigroup.com/ProductDetail/?pid=00000000030290059&_ga=2.82650782.960558831.1584887833-
Passiv Haus	Sustainability	Residential	Passive Haus Trust	https://passivehouse.com/
PipelineML	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
prEN 17473	The asset itself	All of the above	European committee for standardization	https://standards.cen.eu/dyn/www/f?p=204:110:::::FSP_PROJECT,FSP_LANG_ID:64240,25&cs=154E73A578582D730F56EDA4D27F9C3D4
Project Haystack	IoT	Resi & Comm		https://project-haystack.org/
PubSub	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
PUCK	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Radius Data Exchange input model	The asset itself	Commercial		
ReimTech / OSCRE Lease data standards	Tech / connectivity / Exchang	Commercial		
SBEM	Sustainability	Commercial	BRE	https://www.bre.co.uk/page.jsp?id=706
Schema.org	Tech / connectivity / Exchang	All of the above		https://schema.org/docs/full.html
Sensor Model Language	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Sensor Observation Service	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Sensor Planning Service	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
SensorML	IoT	Resi & Comm	OGC	https://www.ogc.org/standards/sensorml
SensorThings	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Simple Features	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Simple Features CORBA	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Simple Features OLE/COM	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Simple Features SQL	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
SITES	Asset location	All of the above	MHCLG	https://www.gov.uk/government/publications/brownfield-land-registers-data-standard
SKA	Sustainability	Commercial	RICS	https://www.rics.org/uk/about-rics/responsible-business/ska-rating/
Streamlined Energy and Carbon Reporting	Sustainability	Resi & Comm	BEIS	https://www.gov.uk/government/consultations/streamlined-energy-and-carbon-reporting
Styled Layer Descriptor	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
SWE Common Data Model	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
SWE Service Model	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Symbology Encoding	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Table Joining Service	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
TCP/IP	Tech / connectivity / Exchang	All of the above		
TimeseriesML (tsml)	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Two Dimensional Tile Matrix Set	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
UK Unique Property Reference Number	Asset location	All of the above	Geoplace	
Uniclass	The asset itself	All of the above	NBS	https://www.thenbs.com/our-tools/uniclass-2015#classificationtables
UPRN (AddressBase)	Asset location	All of the above	Geoplace	
Very simple Control Proptocol (VSCP)	IoT	Resi & Comm	VSCP.org	https://www.vscp.org/
WaterML	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Weave	Tech / connectivity / Exchang	All of the above	OIC	http://oicweave.org/
Web Coverage Processing Service	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Web Coverage Service	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Web Feature Service	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Web Map Context	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Web Map Service	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Web Map Tile Service	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Web Processing Service	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
Web Service Common	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
WELL Standard (WELL v1)	Occupier	Commercial	International Well Building Institute	https://standard.wellcertified.com/well
WELL Standard (WELL v2)	Occupier	Resi & Comm	International Well Building Institute	https://standard.wellcertified.com/well
WFS	Asset location	All of the above	OGC	https://www.gistandards.eu/gis-standards/
WiredScore	Tech / connectivity / Exchang	Resi & Comm	Wiredscore	https://wiredscore.com/uk/
WKT CRS	Asset location	All of the above	OGC	https://www.opengeospatial.org/standards/cat
WMS (web map services)	Asset location	All of the above	OGC	https://www.ogc.org/standards/wms
WMTS (Web Map Tile Service)	Asset location	All of the above	OGC	https://www.ogc.org/standards/wmts
WPS	Asset location	All of the above	OGC	http://www.ogc.org/standards/wps
X10	IoT	Resi & Comm		http://kbase.x10.com/wiki/Main_Page
XBRL	Tech / connectivity / Exchang	All of the above	XBRL	http://www.xbrl.org.uk/
XMPP	Tech / connectivity / Exchang	All of the above	XMPP	https://xmpp.org/
XMPP-IoT	IoT	Resi & Comm	**XMPP-IoT**	https://xmpp.org/
Z-wave	IoT	Resi & Comm	Z wave Alliance	https://z-wavealliance.org/
Zigbee	IoT	Resi & Comm	Zigbee alliance	https://zigbeealliance.org/

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