Geospatial Commission

BUILDING BETTER DECISION MAKING

Location data in the property sector

Contents

A note on devolution

A number of policy areas covered in this paper are devolved to Scotland, Wales and Northern Ireland. The Geospatial Commission has a UK-wide role and the devolved administrations are represented at our Board of Commissioners. We have engaged with the devolved administrations in the development of this report and we have included insights and case studies from across the UK.

In this report when we refer to government policies we are usually referring to powers that reside with the UK Parliament, and some of the findings and recommendations relate to England or England and Wales only. We will continue to work with the devolved administrations to encourage UK-comparable data where appropriate.

Foreword

The property ecosystem provides the infrastructure of where we live, work and play. It is a cornerstone of the UK economy, employing 1.2 million people and contributing over £100 billion each year.

However, many of our interactions with the industry from planning to buying, renting and maintenance, remain stubbornly analogue. We can all see the transformative potential and multitude of opportunities for the property industry to embrace emerging technologies and digital tools empowered by location data; yet a truly systematic approach to innovation and technology across our diverse and siloed asset classes and property types has yet to emerge. Often this is blamed on the barriers, perceived or real, of how to securely hold, analyse, share and manage data that put off property companies from adopting change.

This report can be a catalyst for enabling that change. The UK is already home to a fast growing and innovative PropTech sector, transforming how developers find land and evaluate development potential, how local authorities and residents approach planning, how homes are bought, sold or rented, and how customers interact with their landlords and wider communities. Yet, there is further opportunity as geospatial underpins all aspects of a property lifecycle.

Every property exists in a place. The geographic context and surrounding area influences what is built where and how that property is used from underlying ground conditions to local amenities and transport infrastructure.

Digital tools embedded with geospatial capabilities enable organisations to manage their properties more effectively, operate buildings more efficiently and better oversee construction and renovation projects - this supports the creation of quality places where people and organisations can thrive.
For example, greater use of location data, services and applications can enable:

- Deployment of green technologies in properties - the energy crisis has demonstrated the urgent need to enable greater adoption of energy efficiency across all types of property: location-linked property attribute data, such as building material and height or roof size and orientation can support the effective deployment of solar panels, heat pumps, insulation and energy efficiency solutions

- New property development - location data on ground conditions (the suitability of the area for construction) and local amenities (bus routes, public services, parks, schools, electric vehicle charge points etc) can support the identification and more rapid approval of new developments that support their communities with the infrastructure they need

- More accurate insurance models - the insurance sector is already using location data to build up a comprehensive understanding of the nature of a property and its surroundings (including features like flood risk, local traffic and crime rates) to more accurately model the premiums it charges

Emergency services can more efficiently and safely navigate a building with prior knowledge of likely hazards. The Environment Agency can better prepare for flooding incidents by knowing in advance which buildings could be most affected such as those with below-ground rooms.

Today's publication sets out four cross-cutting themes to support the better use of location data, service and applications, including property as a complex interconnected system and the importance of a strategic approach to data access.

These themes arise from an understanding of the role of location data and services across different stages of the property lifecycle from land use and planning, design and construction, buying and selling, safety and operations to the broader themes of retrofit and regeneration.

Whilst not in any way intended to be comprehensive, the paper highlights some key initiatives already underway across the sector and identifies future opportunities to explore to unlock greater benefits. The genuinely collaborative conversations that contributed to this paper highlight that the property sector is perhaps at last ready to move on from its operational and data silos.

I would like to add my personal thanks, on behalf of the Geospatial Commission, to the many organisations, government institutions and businesses who have contributed to this work and will continue to drive it forward. The potential for positive impact is enormous and I am excited to share this initial paper with you all.

Alexandra Notay
Commissioner, Geospatial Commission

EXECUTIVE SUMMARY

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Executive Summary

The UK property sector is undergoing a technological revolution, rapidly adopting new technologies and becoming increasingly digital. Location data, services and applications are central to this technological revolution and essential for a well functioning property sector, from town planning and site identification to property management and retrofitting.

The UK property sector already contributes an estimated £100 billion to the UK economy each year (2019 data). The achievement of the sector's economic, environmental and social goals, from boosting productivity and innovation to improving our residential areas and achieving net zero ambitions, rely on findable, accessible, interoperable and reusable (FAIR) location data and innovative geospatial services.

This report considers the sector broadly, referring to both residential and commercial buildings and uses a property lifecycle, including design, build and operation to illustrate the crucial and varied roles of location data, services and applications across the sector.

Our research and engagement has identified four cross-cutting themes to support the better use of applications across the complex property ecosystem:

Four cross-cutting themes

1 PROPERTY DATA AS AN INTERCONNECTED SYSTEM

Considering the whole system can enable greater transparency, efficiency and productivity, but can be challenging to achieve due to the complexity and scale of data analysis required.

2 A STRATEGIC APPROACH TO DATA ACCESS

Looking at sustainable data access strategically, considering intellectual property, security and privacy, is crucial to driving innovation and economic growth across the property sector.

3 THE PROVISION OF AUTHORITATIVE DATA

Authoritative data is a complex and evolving concept that can include foundational data enabling others to develop value-add services and single-source or independently verified data which underpin legal liabilities.

4 COMPATIBLE DATA STANDARDS

Standards are wide ranging from best practice sector approaches to legally backed technical requirements. This creates a complex system that can limit full data interoperability across the whole property ecosystem.

Alongside these overarching themes, we identify a number of specific opportunity areas where location data, services and applications can drive innovation across the property life cycle.

Many of these opportunity areas leverage existing initiatives to support economic growth by ensuring relevant data can be found, accessed, connected with other datasets, and reused for a range of purposes.

Location data, services and technologies are vital to unlock benefits in a rapidly changing world. The private sector can further build upon the opportunities identified across the property sector in this report to drive innovation and deliver economic growth.

Action areas

A wide range of work is being undertaken to support unlocking greater value from location data in the public sector.

Advocating for a new data sharing gateway
The Geospatial Commission and the Valuation Office Agency will continue to advocate for a new data sharing gateway via primary legislation to allow wider public sector and private sector access to Valuation Office Agency property data.

Enhancing the Public Sector Geospatial Agreement (PSGA)
Building on the previous work that has seen an enhancement of the property level attributes available within Ordnance Survey data, the Geospatial Commission and Ordnance Survey will undertake further user engagement under the PSGA to establish new and emerging property data requirements.

Promoting Unique Property Reference Numbers (UPRNs) and data standards
The Geospatial Commission and the Department for Levelling Up, Housing and Communities will continue to promote the mandated adoption of UPRNs across the public sector. UPRNs are a crucial unique identifier supporting interoperability by providing every property with a consistent identifier throughout its lifecycle.

HM Land Registry, as set out in their Strategy 2022+, commit to improving their datasets in the coming years by making them more findable, accessible, interoperable and reusable (FAIR) and by releasing more data, supported by UPRNs where possible.

The Valuation Office Agency will seek to use data standards and unique identifiers such as UPRNs, where feasible, to improve the findability and interoperability of its data through its digital transformation programme.

Supporting the re-use of ground condition data
The British Geological Survey will continue to promote and support the better re-use of ground condition data used in the construction process. They will also explore the risks and benefits of storing and sharing additional location data related to construction projects across the public and private sectors.

Digitalising the property buying and selling process
HM Land Registry and the Department for Levelling Up, Housing and Communities with support from the Geospatial Commission, will continue to promote digitisation of the property buying and selling process, particularly ensuring data interoperability is built into the process.

The property policy landscape

The property sector is at the core of a number of key government priorities with responsibility across different departments and public sector bodies:

Housing and planning
The Department for Levelling Up, Housing and Communities (DLUHC) has responsibility for planning and residential housing in England. In Northern Ireland, the Department for Communities covers housing and the Department of Infrastructure covers planning. The Directorate for Local Government and Housing in the Scottish Government covers housing and planning.

Energy efficiency
The Department for Energy Security & Net Zero (DESNZ) are responsible for energy efficiency of properties. In Scotland, the Energy and Climate Change Directorate in the Scottish Government works on this area. The Department for the Economy has lead responsibility for the development of energy efficiency policy and legislation in Northern Ireland, working with other departments and public bodies.

Geology
The British Geological Survey are responsible for geological and ground condition data essential for construction and construction materials, property conveyancing reports and subsidence risk for informing insurance and mortgage decisions. In Northern Ireland, the Geological Survey of Northern Ireland, part of the Department for the Economy provides geoscience information and services to inform decision making.

Past coal mining
The Coal Authority manages the effects of past coal mining, including subsidence damage claims from properties and is one of a number of organisations who are statutory consultees for planning.

Property ownership
HM Land Registry keeps the Land Register which is the definitive and guaranteed record of property ownership in England and Wales, containing more than 26 million titles and covering around 88% of the land area. In Scotland, Registers of Scotland are responsible for keeping public registers of land, property and other legal documents. In Northern Ireland, the Land Registry, part of Land and Property Services maintains a record of map based land registrations in Northern Ireland.

Council tax and rates
The Valuation Office Agency values properties for the purpose of Council Tax and for Non-Domestic Rates in England and Wales. In Scotland, the Scottish Assessors Association has a similar role, with assessors based in local authorities.

Land and Property Service in the Department of Finance in Northern Ireland collect, process and manage land and property information, which underpins the collection of rates.

Other
Local authorities interact with properties and the property sector across housing, planning and other wide ranging functions, such as waste collection. Additionally many other central and local government organisations have a need for properties to deliver their objectives be that schools, hospitals, bus stations or research labs.

THE APPROACH

In the 2022/23 Annual Plan, the Geospatial Commission committed to identifying future opportunities for innovative use of location data related to property. Building on the landscape data review by Newgate Research in 2021, the Geospatial Commission has explored high potential areas where location data, services and applications could unlock greater value across the property ecosystem.

The report findings were primarily informed by:

TARGETED ENGAGEMENT

A series of three roundtables chaired by Geospatial Commission Independent Commissioner, Alexandra Notay.

In September and October 2022 involving 23 experts drawing on the breadth of experience of industry, academia and the public sector.

Additional targeted engagement with industry experts to gain insights on specific processes and technologies.

An evidence gathering and engagement exercise across the public sector in summer 2022

STRATEGIC PARTNERSHIPS

Geospatial Commission strategic partnerships and engagement with British Geological Survey, Coal Authority, HM Land Registry, Ordnance Survey and Valuation Office Agency informed this report. These are five of the six Geospatial Commission partner bodies and are some of the main public sector producers of location data supporting the property sector.

Geospatial Commission partner bodies:

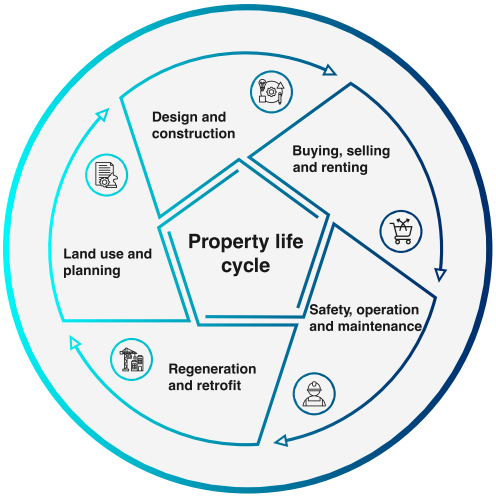
- British Geological Survey
- The Coal Authority
- HM Land Registry
- Ordnance Survey
- UK Hydrographic Office
- Valuation Office Agency

A workshop with 11 property industry representatives hosted by the Geospatial Commission, GeoPlace and Ordnance Survey in December 2022 to explore the high value use cases associated with adoption of Unique Property Reference Numbers (UPRNs) and Unique Street Reference Numbers (USRNs) in public sector datasets.

Scope

The Geospatial Commission uses a broad definition of location data to refer to data, services or applications with a geographic element (where people and objects are in relation to a particular geographic location) across the location data value chain. This data can relate to events, objects or people and can be static, such as a person's address or the location of a school, or dynamic, such as a bus travelling along its route.

For the purposes of this paper we will be taking a broad definition of property. We are referring to data about buildings (attributes such as height, age, size) - both residential and commercial, the immediate surrounding land (ownership, geology, topography) and the wider environment (access to local amenities, transport etc.) - the technologies that support the capture, processing and analysis of that data and the services and applications that utilise the data.
In terms of the 'property sector', our scope includes the whole ecosystem or organisations and businesses involved with properties through the entire property lifecycle from conception and land acquisition to potential demolition. Properties are seen through different lenses at different stages in their life cycle. Data requirements vary depending on the use case, such as schematics for construction compared to images and legal queries for selling a property.



Value chain for geospatial data

	Data capture and creation	Data transformation, processing, systems	Data analysis, visualisation	Application of data
Example value chain activties	• Physical and remote collection • Production of data collection equipment • Tracking systems • 3D mapping • Drone/ aerial photography	• Back-of-house system • developers • Data management/ hosting • Data linking / fusion • Data transformation support • Data interoperability • Data sharing	• Data analysis tools • Data dashboards • Geospatial models • Machine learning algorithms • Web maps	• Journey planning and navigation • Planning and exploration • Asset management • Environmental management • Service delivery • Decision making

Location data related to property

Whilst not intended to be a comprehensive list, the following graphic shows some types of location data that, when accessed, combined and analysed effectively can drive new insights and opportunities, such as options to put in sustainable drainage systems and ground source heat pumps.

Legal and documentary status

- Planning applications (historic, current, decline and consents)
- Freehold and leasehold information
- Energy Performance Certificate non domestic
- Occupancy
- Council tax band
- Non domestic rates
- Valuation for non domestic rates
- Geospatial identifiers e.g. address, UPRNs
- Listing and conservation status

Land data that affect property

- Geological and hydrological data – including in relation to climate change
- Geohazards e.g. ground, shrink-swell data (subsidence and landslide risk, including in relation to climate change)
- Pluvial, fluvial, groundwater data (for food risk)
- Coastal erosion
- Radon levels
- Groundsource heat potential
- Past, current and future underground coal workings
- Proximity to green space
- Services and utilities (proximity and accessibility)
- Connection to energy, water and telecommunications networks
- Land surface temperatures (heat risk)
- Sustainable drainage options
- Ground source heating feasibility
- Planning constraints
- Costs and risks associated with brownfield land regeneration
- Population density and social demographics

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CROSS - CUTTING THEMES

Following extensive engagement, our research has identified four cross-cutting themes to support the better use of location data, service and technologies across the property ecosystem.

Property data as an interconnected system

Considering the whole system can enable greater transparency, efficiency and productivity, but can be challenging to achieve due to the complexity and scale of data analysis required.

The property life-cycle illustrates how complex and interconnected the property ecosystem is while often being siloed in operation. Decisions about property construction will impact its value, the surrounding environment, local transportation systems, agricultural opportunities as well as affecting the value of its neighbours.

Taking a systems perspective is vital to enable more comprehensive decision making which can reduce unintended consequences. The collective assessment of linked impacts, hazards and risks can lead to better overall decision making, exposing where optimisation for one goal can have adverse effects on others.

The requirement for systems based thinking is well established in other technology driven industries where learnings can be transferred to the property sector. Networks, processes, patterns and the system as a whole can be focused on when taking a systems perspective. As an example, the full customer journey in the conveyancing process and the data required at each step could be mapped out to account for their interconnections and interdependencies.

The increasing availability of location data (and data more generally) can support a systems perspective, providing the context and rich detail to underpin analysis when multiple datasets are combined. Location reference data relating to properties, such as addresses and UPRNs are key to this.

The data analysis that informs systems based thinking is complex and there is a need for good data interoperability so that datasets can be combined to inform system decision-making. The Geospatial Commission's National Land Data Programme has explored key land use challenges and recently published a report Finding Common Ground demonstrating where innovative data analysis and evidence can support better land use decisions.

The National Digital Twin Programme is also exploring how spatial modelling can improve understanding of how land use can be optimised to manage competing demands and deliver government priorities.

Case study: Kadaster

In the Netherlands, the Cadastre, Land Registry and Mapping Agency ('Kadaster'), collects and registers administrative and spatial data on property and manages the rights involved. They are responsible for national mapping and maintenance of the national reference coordinate system and are an advisory body for land-use issues and national spatial data infrastructures. Kadaster provides information on national facilities, such as for addresses and buildings, cables and pipelines, and energy labels.

Information dating from 1985 onwards is available online, including information on energy labels of houses and underground cables and pipelines. The main customer groups are civil-law notaries, local authorities, businesses, financial institutions and private individuals.

There are good links between property data and land cover data, and models to show land registration, geology and utility data together. This presents many possibilities for research and innovation. The model also allows users to draw and visualise a 3D excavation before they start digging.

A 3D map of the Netherlands is available (3DBAG) in tiles, published at various levels of detail, which institutions from across the public and private sector can use for their purposes, such as to link data to and run analyses. It can, for example, be used to assess and calculate how wind turbines affect the local environment in terms of noise, flows of air, and the shadows they cast.

There is also now the ability to register property rights in 3D, which is particularly useful for buildings such as apartments and shopping malls. An example is the new combined structure of the city hall and underground railway station in Delft registered using a 3D pdf.

A strategic approach to data access

A strategic approach to sustainable data access, considering intellectual property, security and privacy, is crucial to driving innovation and economic growth across the property sector.

Only data that can be accessed can be analysed and used. Sharing and reuse of data is therefore vital for digital innovation in the property sector; it is not only the basis for data analytics but it determines the software, apps and tools that can be developed by the UK's flourishing proptech sector.

To enable economic growth and innovation across the property sector, it is essential to take a strategic approach to sustainable data access. This starts with considering data access and interoperability when transforming operating systems and addressing legacy technology. In the public sector there is an opportunity to ensure transformations consider the opportunities beyond the immediate benefits to the organisation, and also how the wider ecosystem could benefit from an aligned and interoperable approach to data.

A strategic approach to data access means taking a balanced approach to the risks and benefits of sharing data. Considerations include:

Intellectual property rights
Data owners may have legal rights over the onward use of their data, which enables them to reap commercial benefits.

In the private sector this supports a competitive and sustainable market for data collection, curation and maintenance, creating incentives to invest in improving data quality and innovation.

Charging for data
In the public sector, the government has made a vast amount of location data accessible and free to use under an Open Government Licence. For example, Ordnance Survey's Open ZoomStack provides a single customisable map of Great Britain and Energy Performance Certificate (EPC) data with UPRNs.

However, in other instances, especially where limited numbers of users benefit from access to the data, charging ensures sufficient investment is made in ongoing data stewardship (processing, maintenance and user support).

Data licences
The Geospatial Commission worked with its partner bodies to improve public sector location data licences; adding plain English summaries, better supporting guidance, and harmonised licences.

The Data Exploration Licence (and further Developer Licence 2.0) permits partner bodies' location data to be re-used under standardised licensing terms, providing harmonised and simplified access to and use of their data. This enables researchers and developers to use data to evaluate ideas, build prototypes and identify commercially viable opportunities.

Sensitivity of data and security considerations
This is an important consideration by all data owners. However, data sharing governance can be overly restrictive in certain circumstances, preventing non-sensitive data from being shared or simply causing confusion under which circumstances data sharing is permitted.

Data protection laws are sometimes cited as a reason for not sharing data, albeit there is wide acknowledgement that this is often driven by uncertainty or over-caution rather than legal restrictions. This finding was reinforced by the government consultation entitled Data: A new direction.

The Data Protection and Digital Information (No. 2) Bill aims to reform data protection regulations to reduce burdens on businesses and researchers, and enable innovations in science and technology that advance the health and prosperity of society. This includes simplifying the legislation, by consolidating the rules on when you can or cannot reuse data, which can help boost innovation.

Legislation

Within the public sector, some legislation has been identified as being overly restrictive for the nature of data it governs. For example, to fulfil its function of valuing properties for taxation purposes, the Valuation Office Agency collects property attributes (such as property function, type, age, and number of rooms) for every taxable unit in England and Wales.

The Commissioners for Revenue and Customs Act (CRCA) 2005 allows the Valuation Office Agency to disclose information only where there is a legal basis, such for the purposes of its functions, where there is a legislative gateway, or with customer consent. This causes public sector sharing of Valuation Office Agency data to be resource intensive and difficult to secure, impacting policy development, data improvements in the public sector and limiting its use in innovative applications in the private sector.

The Geospatial Commission has worked with the Valuation Office Agency to identify and pursue options to expand access to this property attribute data. As part of the announcement on regulatory reforms in September 2021, the government committed to expanding access to property attribute data held by the Valuation Office Agency. A new data sharing gateway via primary legislation will allow wider public and private sector access, supporting economic growth, delivery of better infrastructure and essential government functions.

Data held by the Valuation Office Agency could contribute to enhancing building safety initiatives by aiding emergency responders to identify below-ground properties, enabling them to prioritise flood response efforts reducing the risk to vulnerable households.

The data would also provide significant benefit to the private sector, fuelling innovation and driving economic growth through the creation of enhanced data services and technologies. For example, it will enable insurance companies to provide more competitive quotes and the energy sector to develop higher efficiency heating systems in support of net zero.

ACTION

The Geospatial Commission and the Valuation Office Agency will continue to advocate for a new data sharing gateway via primary legislation. This would allow wider public sector and private sector access to Valuation Office Agency property data.

ACTION

The National Geographic Database, managed by Ordnance Survey (OS), is regularly developed and improved to meet the needs of its customers and facilitate greater innovation in the private sector.

Building on our existing work to enhance the property level attributes that are available within OS data, the Geospatial Commission and OS will undertake further user engagement under the PSGA[1] to establish new and emerging property data requirements.

Spotlight: Energy data and privacy

Collecting energy performance data on a building can be very useful for landowners, developers and policy makers. More broadly, the strategy and action plan Digitalising our energy system for net zero: strategy and action plan 2021 set out that energy data sharing and digitalisation will be crucial to decarbonising the energy system and meeting net zero at least cost to consumers.

In addition to GDPR rules, the government has in place a strict Data Access and Privacy Framework for smart metering, that protects the privacy of domestic consumers and microbusinesses, and sets out the levels of access to energy consumption data from smart metres permitted for different parties.

This ensures that consumers have control over who can access their energy consumption data and for what purposes, except where this is required for regulated purposes (e.g. billing).

However, there is concern across the world that this data could provide information which is personal, or commercially sensitive in the case of businesses. A review of studies about privacy concerns with the installation of smart local energy systems found that people were commonly concerned that sharing detailed energy use data had the potential to reveal information about home life, and to intrude upon people's sense of autonomy, choice and control.

However, there is evidence from other sectors that "people are willing to accept new data sharing technologies if the benefits of doing so are clear, anticipated, and mutually beneficial"[2]. This aligns with the Geospatial Commission's location data ethics findings, that if individuals understand the personal and collective benefits of sharing data they will likely be supportive.

The principles developed in the work on the ethical use of location data could be applied:

- **Accountability -** Governing location data responsibly, with the appropriate oversight and security
- **Bias -** Considering and mitigating different types of bias, and highlighting the positive benefits of location data
- **Clarity -** Being clear about how location data will be used and the rights of individuals

This would help build trust in the data collection, enable people to make more informed choices around their location data and potentially allow greater data sharing.

The provision of authoritative data

Authoritative data is a complex and evolving concept. The government's role in the provision of authoritative data depends on how the concept is defined and the services that the data underpins.

Our research indicated a significant appetite from the private and public sector to have access to specific data that underpins a range of applications; often referred to as 'authoritative data'. There is not a single definition of authoritative data but it may include foundational data, single source data or independently verified data:

Foundational data
Certain datasets can be recognised as foundational, relevant in a range of circumstances, and therefore working as a 'spine' from which other data can be derived or linked with, such as basic features or boundaries on the earth's surface.

Depending on access conditions, organisations can build on these base layers to develop value-added products and services. Examples of this type of data include topographic data in the National Geographic Database held by Ordnance Survey, and forms of satellite imagery of the earth's surface.

Single source data
In some situations there needs to be a single, official dataset to underpin legal liabilities, such as the Land Register in England and Wales kept by HM Land Registry, the spatial element of which is derived from data provided by Ordnance Survey.

HM Land Registry safeguards land and property ownership valued at £8 trillion, enabling over £1 trillion worth of personal and commercial lending to be secured against property across England and Wales. The Land Register contains more than 26 million titles showing evidence of ownership for more than 88% of the landmass of England and Wales.

All registered titles are supported by a state-backed guarantee in the form of indemnity if a mistake or omission is made in the register which results in a loss. There is a similar arrangement in Scotland, where Registers of Scotland and its Land Registers underpin the property and land ownership market, and in Northern Ireland, where Land & Property Services keep the Land Registry.

Another example is data held by the Coal Authority, which is responsible for managing the environmental and safety-related liabilities from coal mining in the UK such as repairing subsidence damage and treating water pollution. Their data and information underpins CON29M[3] and coal mining reports for the conveyancing and property markets.

Independently verified data
In the property sector there can also be a requirement for data to be provided or assured by an independent and reliable source, such as identifying areas at risk of radon gas or flooding, given the risk to health and impact on property values. In these circumstances, there needs to be a high degree of veracity to the data.

The Geospatial Commission previously developed an authoritative data assessment tool, designed to help identify data publishing organisations and datasets which can be considered trustworthy so that users can have confidence in the data they find.

The concept of authoritative data is further complicated, as what constitutes authoritative data can change over time and depending on its application or use. The same data that is deemed accurate, valid and trusted for one specific use might not be for another.

It is not necessary that authoritative data is captured or managed solely within the public sector. Private sector provided data may be recognised by members of a community of interest to be authoritative because its provenance is considered highly reliable or accurate. However, when there needs to be general acceptance of the definitive single source or independent accuracy of the data, in many examples government involvement (through provision, legislation or regulation) can provide assurance to users that they can put trust in its veracity.

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Spotlight: Authoritative addressing data

Accurate addressing data is crucially important to make the most of property data. Across Great Britain, there are a number of sources of data that describe the location of property. The most widely used addressing datasets are the Royal Mail's Postcode Address File (PAF), and AddressBase produced by GeoPlace and made available by Ordnance Survey.

The PAF is the definitive source of all UK postal addresses for the purposes of delivering mail. Containing over 30 million UK postal addresses with postcodes, Royal Mail creates, manages and maintains the PAF with inputs from local authorities, as well as their approximately 90,000 postal workers who inform Royal Mail of any changes to addresses. It is estimated that this contributes to between 3,000-5,000 changes made to Royal Mail's database every day.

Royal Mail owns the intellectual property for the PAF and access to it is regulated by Ofcom. There are a range of ways to access PAF data:

Public sector
The Geospatial Commission has a contract with Royal Mail on behalf of the whole of the public sector in Great Britain, the PAF Public Sector Licence, which enables free at the point of use access to the PAF.

Charities
Small, UK-based registered charities registered with the Charity Commission or a Community

than £10 million, may qualify to receive PAF data free of charge.

Private sector
For the private sector use there are a range of options upwards from a single user licence at £80 a year; licences are scalable so the cost increases the bigger the business and the greater use that is made of the PAF.

To encourage innovation if you are an organisation with less than 9 employees and turnover below £2 million per annum, you may qualify for a free copy of PAF for the purposes of developing PAF- powered addressing solutions. At the point that you have completed your development and your solution is available (either for your own use or use by others) you will need to licence your use of the data and return the appropriate PAF licence and data fees to Royal Mail.

AddressBase
Ordnance Survey's AddressBase product brings together a range of data sources, including: the PAF, local authorities Local Land and Property Gazetteers, Valuation Office Agency data, property data, X and Y coordinates, Ordnance Survey's detailed property data, local authority data, Unique Delivery Point Reference Numbers (UDPRN) and also the PAF and links them through the use of the Unique Property Reference Number (UPRN).

This combination of data gives AddressBase users a view of postal addresses as well as "non-addressable" features such as churches and barns that do not receive post. Accurate and consistent location data about these non-addressable features are critically important in some sectors such as emergency services and insurance.

AddressBase is produced by GeoPlace and made available by Ordnance Survey to the private sector under licence, and free at the point of use for the public sector via the PSGA.

Northern Ireland
The Northern Ireland Civil Service is introducing the use of a minimum address format (Pointer) across government in specifications for new system procurements from 30 October 2023. Pointer contains unique address identifiers (UPRNs) and globally unique identifiers (known as Fusion IDs), which link property addresses to the mapped real world feature of the buildings that they are situated within.

Existing systems and databases will be changed to use the Pointer address format only where the change can be achieved without disrupting other priority work and represents value for money. The use of Pointer and its geospatial identifiers further enhances governments digital capacity and will derive maximum benefit from Northern Irish address-linked data. This will ultimately lead to better decision-making as well as a better service user experience for citizens using services in Northern Ireland.

New forms of addressing
Technological changes mean that new forms of addressing may become widely used in the future. There have been new disruptive business models, such as What3words, and other innovative solutions, such as Plus Codes by Google, which are based on latitude and longitude, and displayed as numbers and letters that can be used in areas without street addresses.

Credible 3D addressing might need to be developed to support drone deliveries and other emerging technologies, for example. There are several countries which have already created 3D cadastres which allow registration of property rights in 3D; particularly useful for multistory buildings such as apartments and shopping malls. An example is the new combined structure of the city hall and underground railway station in Delft in the Netherlands, registered using a 3D pdf.

Compatible data standards

The development and application of standards for data related to the property ecosystem is complex and inconsistent. Standards are wide ranging from best practice sector approaches to legally backed technical requirements.

Data standards describe how data should be collected, stored and exchanged to support interoperability across different systems, sources and users. The Royal Institute of Chartered Surveyors (RICS) have a global standards project aimed at increasing consistency and allowing benchmarking across building surveying, construction, real estate and valuation amongst other topics.

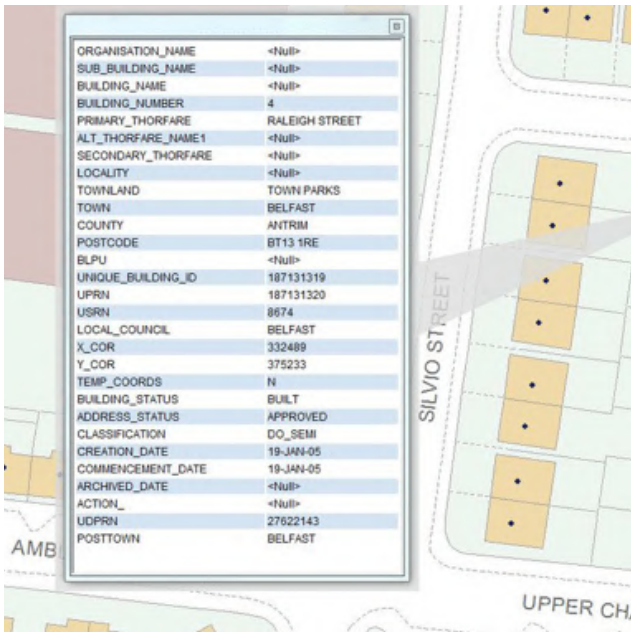
The Geospatial Commission has developed an overarching approach for public sector location data, based on the FAIR (Findable, Accessible, Interoperable and Reusable) principles. The 2022 report 'How FAIR are the UK's National geospatial data assets?' assesses whether the UK's geospatial assets on these principles.

Some standards, such as unique geographic identifiers, can be used across the whole property lifecycle. TOIDS (Topographic Identifier found in Ordnance Survey products), UPRNs and USRNs are key to efficient linking between datasets. Their use supports a wide range of projects from innovation around house sales information in the PropTech sector, to local councils being able to quickly identify vulnerable households for extra support.

The Newgate Planning and Housing Landscape Review found a lack of standards in planning data contributes to problems, such as difficulties with linking planning data with other spatial data related to transport, health and education. DLUHC is launching a series of initiatives to use digital to modernise England's planning system and strengthen the property sector in line with this review. This includes a power in section 78 of the Levelling Up and Regeneration Bill, to require planning authorities to comply with approved data standards for planning data, which will help ensure digitised consistent data.

Our research identified that in some parts of the ecosystem, particularly related to environmental building data, there were large numbers of data standards in use. There are standards that relate to records of the physical attributes of a property, construction of the property and the use of a property.

Standards often exist to ensure data is fit for purpose in a specific scenario, rather than for cross sector use. This can have a significant impact on the interoperability of data collected for different purposes when it is being used for alternative analysis. The large number of different standards can also cause confusion as to which the right approach is in a new scenario, and potentially lead to lack of trust in data that meets unfamiliar standards.



Spotlight: Unique Property Reference Numbers (UPRNs) and Unique Street Reference Numbers (USRNs)

UPRNs are a unique identifier which supports interoperability by providing every property (and some objects that might not have a 'normal' address, such as a bus shelter, pond or electricity substation) with a consistent identifier throughout its lifecycle, from planning through to demolition.

Authoritative address and street data with unique location identifiers provide a framework for linking all kinds of information efficiently – data that needs to be cleansed of personal details, perhaps, or datasets with few fields in common. UPRNs and USRNs enable certainty when identifying buildings and streets, and effective machine linking and matching of data, facilitating efficiencies.

The Geospatial Commission worked with GeoPlace, the Local Government Association, the Improvement Service and Ordnance Survey to provide access to UPRNs and USRNs data free of charge under an Open Government Licence, as part of the Public Sector Geospatial Agreement (PSGA) held between the Geospatial Commission and Ordnance Survey.

Following this in July 2020, the Open Standards Board, convened by the Central Digital and Data Office (CDDO), mandated the use of UPRN for gathering and storing address data in government systems. This open standard means that all datasets held by the government that include addresses must now incorporate UPRNs to support interoperability. The Data Standards Authority in the CDDO also published guidance on the use of UPRN.

The Geospatial Commission continues to work with DLUHC, GeoPlace, our partner bodies and others to demonstrate and promote the better use of location data identifiers. We encourage everyone across the property sector to make full use of open UPRNs. Energy Performance Certificates now include UPRNs. Additionally HM Land Registry includes UPRNs in their Registered Lease dataset and the National Polygon Service.

ACTION

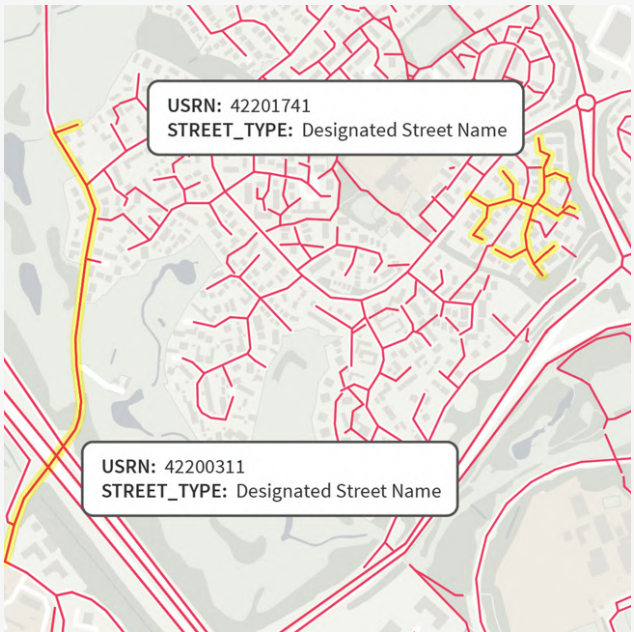
The Geospatial Commission and the Department for Levelling Up, Housing and Communities will continue to promote the mandated adoption of UPRNs across the public sector.

ACTION

HM Land Registry as set out in their Strategy 2022+ commit to improving their datasets in the coming years by making them more findable, accessible, interoperable and reusable (FAIR) and by releasing more data, supported by UPRNs where possible.

ACTION

The Valuation Office Agency will seek to use data standards and unique identifiers such as UPRN, where feasible, to improve the findability and interoperability of its data through its digital transformation programme.



Case study: The RED Foundation's action to improve data standards across the industry

The Real Estate Data (RED) Foundation is an initiative set up to ensure the real estate sector benefits from an increased use of data, avoids some of the risks that this presents and is better placed to serve society. They aim to connect people, projects and initiatives around the topic of data in the built environment, as well as raise the sector's engagement with the ethical challenges that the use of data can present.

The RED Foundation are working to promote collaboration, raise awareness of data standards activity and to identify overlaps (and opportunities for collaboration) across the sector with representation from all the major property industry associations.

They have recently produced a standards report which recommended that the property sector:

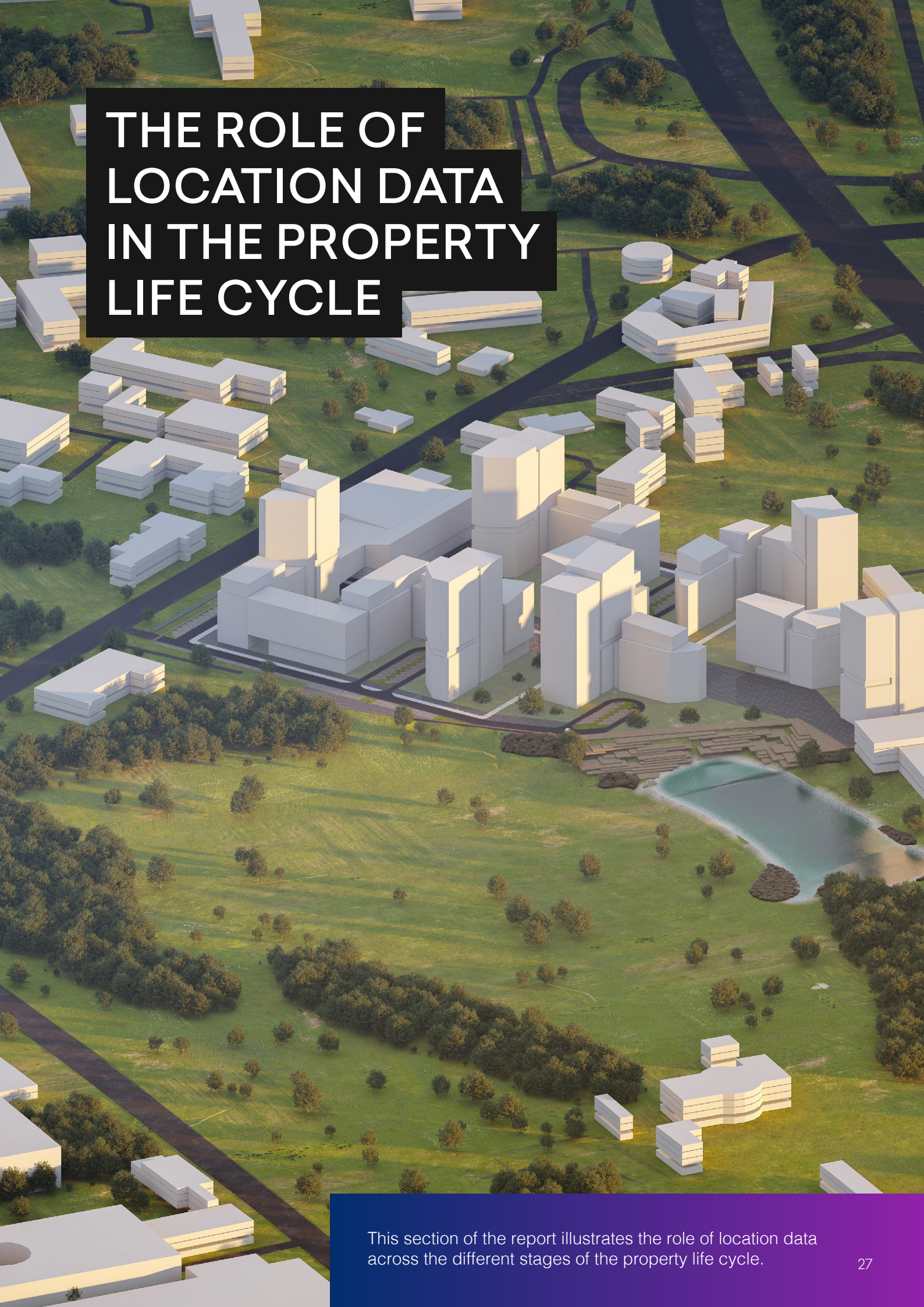
Improves discoverability
Industry and standard setting bodies should work together to improve the discoverability of standards relating to the creation, management and use of data. This should cover all aspects of the real estate sector.

Increases 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.

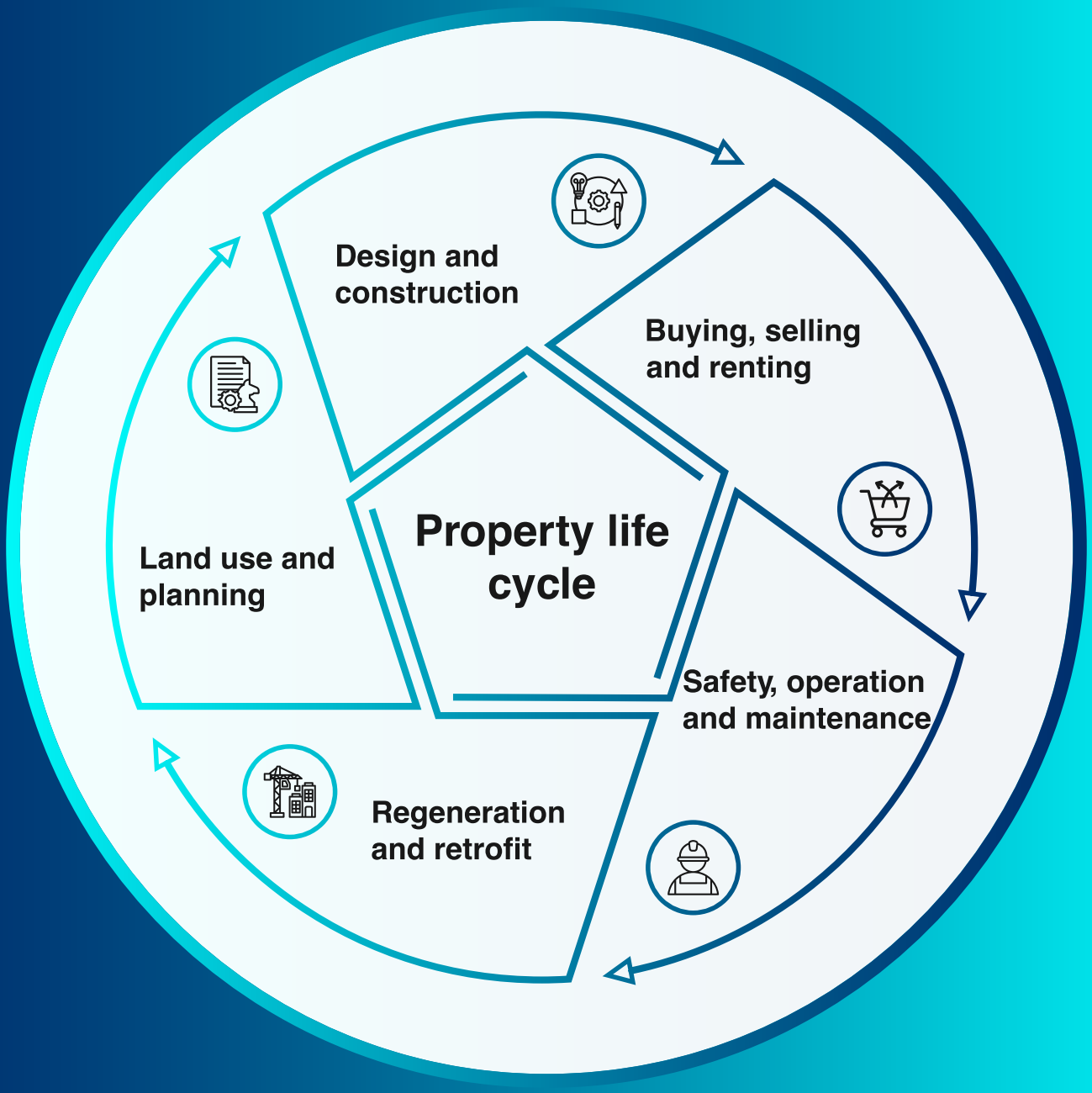
Understands value
Industry bodies and standard setting bodies should carry out a campaign to raise awareness of the value of standards across the real estate sector. This should include highlighting the cost of maintaining standards and governance.

Clarifies 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.

THE ROLE OF LOCATION DATA IN THE PROPERTY LIFE CYCLE



This section of the report illustrates the role of location data across the different stages of the property life cycle.


Property life cycle
Design and construction
Buying, selling and renting
Safety, operation and maintenance
Regeneration and retrofit
Land use and planning

Land use decisions and planning

Location data, services and applications enable land use decisions and planning at all spatial scales, from national and local areas down to individual properties. Strategic decisions about land use, including how it is used for property, are required at a national scale; the UK not only has a limited amount of land available, but we are seeing increasing and competing demands - from infrastructure development to farming and carbon sequestration.

Location modelling can identify the viability and impact of different land use choices, where land use trade-offs exist and help to avoid unintended consequences of land use change.

In May 2023, the Geospatial Commission published Finding Common Ground, a report which explores land use challenges and demonstrates where innovative data analysis and evidence can support better land use decisions. Whilst that takes a holistic view across the broad land use system, this report focuses on land for property development and opportunities for existing properties e.g. for ground source heat suitability.

Key location datasets that support the planning process include authoritative data such as title information held by HM Land Registry and coal mining data held by Coal Authority who are statutory planning consultees. Environmental data from independently verified sources is also crucial.

Opportunity areas

Standards

The Newgate Planning and Housing Landscape review highlighted that there is a lack of standardised format machine-readable

Spotlight: The PropTech industry is innovating to improve access to contextual site data

When considering a site, developers and planners consult a range of data to gain greater context about a site, such as legal constraints data, environmental data and utility asset data (energy, water and telecommunications) to assess the viability of housing development.

This data is often held by a range of agencies with different access policies. It can be difficult to find this data, work out access and it can also be challenging for non-experts to interpret the data.

There are a number of PropTech companies providing services to help users combine multiple datasets to get a richer view of a site and to identify potential locations for development. This can drive greater efficiencies and improve decision making.

There is support for PropTech startups using data in innovative ways from the Geovation Accelerator Programme, funded by HM Land Registry and Ordnance Survey. To date, more than 150 GeoTech and PropTech start-ups have been supported and more than 2000 jobs created.

In Scotland, Ordnance Survey works with Registers of Scotland to support Geovation Scotland to run an accelerator programme for innovative start ups.

planning data. This means data can be very hard to combine with other data sources or compare across areas.

Enhanced digitisation of planning data would greatly increase the interoperability of planning data with broader location datasets, allowing the wider context to be considered and better-evidenced decisions to be made.

DLUHC is working with local authorities to standardise local plans and is also running digital pathfinder projects with local authorities to make planning applications more user friendly and allow more consistent data on the status of applications. The Levelling Up and Regeneration Bill contains powers which would address standardisation of planning data.

The Welsh Government is also working with local authorities and National Parks to standardise Local Development Plans, and progress is being made to make the data available under an Open Government Licence where appropriate.

DLUHC has also launched a PropTech Innovation Fund to support the PropTech sector and local authorities to accelerate adoption of technology that will enhance community engagement and deliver a modern planning system.

Land use models

Local authorities, landowners and local communities often lack the sort of analytical applications that could provide them with a holistic view of land. In Finding Common Ground the Geospatial Commission highlighted the growing need for decision support tools which help local authorities, landowners, land managers and local communities understand and appraise the opportunities for multifunctional land use.

Such tools need to increasingly reflect the needs of more users, such as smaller landowners and land managers, and consider how to support local stakeholder engagement aligned to existing decision making forums.

Accessibility

The Welsh Government are pulling together data in one portal (Data Map Wales), that includes flood data, listed buildings, conservation areas, environment designations such as site of special scientific interest, airfields, coastal erosion. Much of this data is made available to the public and industry. Reporting and other online tools are made available to Planning and Environment Decisions Wales.

Quality and coverage

Data needs to be at the right resolution, sufficiently complete and up-to-date to have the greatest impact on decision making.

National level land data sets, such as soil data, are often not at the resolution required for local land use decision making (sometimes at the 1km grid scale) and local level land datasets are often hard to find and access due to commercial / organisational data sharing constraints. Data on water quality and quantity, species data and data for sustainability appraisals and habitats regulations assessments are often out of date.

Access

There is currently no easy way to check infrastructure data, such as national grid capacity, without speaking to numerous stakeholders. Our research identified that ground condition data can be hard to obtain and combine effectively (e.g. groundwater vulnerability, boreholes, mining records and brownfield contamination).

There is also a lack of data on the sites that can be used to meet housing demand. Often brownfield registers are not up to date, therefore knowing how viable sites are can be difficult. The Brownfield Ground Risk Calculator has been developed by the British Geological Survey to support decision making regarding rebuilding on and regeneration of brownfield sites. This is a spatial decision support tool for understanding ground conditions.

Spotlight: Land registration

Not all land in the UK is registered, however registration levels are increasing year by year. The total land mass in England and Wales registered is around 88%, in Scotland 51% of land mass is registered on the Land Register of Scotland, and in Northern Ireland 88% of the land mass is registered.

Land registration only became compulsory (under certain trigger events) relatively recently. It became compulsory in the event of a sale in England and Wales in December 1990 and on 1 April 1998 for all other transactions.

In Scotland, historically land registration was in the deeds based Register of Sasines (which dates back to 1617). The map-based Land Register of Scotland introduced in 1981 is now replacing this. The Land Registration etc. (Scotland) Act 2012 increased the number of events that will trigger the transfer of property from the General Register of Sasines to the Land Register and also created a power for the Keeper of the Registers of Scotland (who manages and controls the Land Register) to register a title without an application.

In Northern Ireland registration has been compulsory on sale of land since 2003. Titles are being transferred from the Registry of Deeds to the map-based Land Registry.
Land registration brings many benefits. Knowing who owns or occupies a piece of land or a building, what is there and what can or cannot be done with it is vital for many societal, environmental and economic goals by individuals, businesses and the public sector.

Registration makes it easier to ascertain who owns the property and what benefits and burdens are attached to the land. Being able to quickly identify ownership enables effective land use modelling and decision making, can identify opportunities, such as housing development on public sector land and also creates efficiencies on projects, such as siting new electric vehicle charge points.

Registration also provides greater security in land ownership. Registration of land provides proof of ownership, better protection against registered title fraud and makes it easier to buy and sell property in the future.

Case study: Nottingham City Council

Nottingham City Council is using a 3D city-scale digital platform to support planning decisions and increase participation and collaboration in the planning process. This platform brings together key spatial data sources, including commercially available data, in house data sources and additional planning data. The platform enables quicker, more informed decision making in relation to the pre-application assessment and approval of major planning proposals, including large scale property developments.

Models of proposed developments are 'dropped into' the city-owned 3D model and revisions can happen dynamically as part of the conversation, allowing developers to be more engaged in the process. Additionally, the 3D model allows early stage conversations about strategic site utilisation, through simple massing and site capacity conversations.

Additionally, Nottingham City Council has found that using a 3D interactive spatial solution as part of the planning consultation brings in much wider engagement. A recent consultation, including 3D elements and interactive maps on a major Broadmarsh Shopping Centre redevelopment, garnered over 7,000 responses.

Nottingham City Council recognises that the possibilities for the 3D model use are vast and have already started to consider its use to help assess how they will reach their carbon reduction targets e.g. mapping district heating systems and trees. Funding has recently been received from DLUHC's PropTech Innovation Fund to evaluate the benefits of rolling out this technology more widely to both increase participation locally, by further enhancing its 3D capabilities and engagement tools, and critically sharing its learning to enable other local authorities to benefit from the technology and approach.

Design and construction

Location data, services and applications are used across the different phases of design and construction. Firstly in the options phase location data can be used to identify the preferred solution to the problem.

Location data and intelligence are consumed by surveyors and engineers to provide insight around possible options for the construction. Planning, demographic, geology and environmental data is used at this stage.

Secondly in the development phase (when the design of the preferred solution goes through the necessary statutory processes up to the point where a decision to invest in the solution can be made) location data is both consumed and created. The chosen option is put into a real-world context and location data is collected or derived on aspects such as species biodiversity impact and carbon assessments.

Lastly in the construction phase when the solution is built, handed over for operation and the development project is closed down site specific location data is created at this stage.

This stage is where location data is finalised and built information is provided to the client.

Efficient and effective construction is needed to meet home building targets and wider economic goals. It is also important that we reduce the environmental impacts of construction to help meet biodiversity and net zero goals.

Currently the construction industry has lower productivity than the broader economy. Over the past ten years there have been strategies to address this and increase technological innovation in the sector, including through the better use of location data, services and applications, such as Construction 2025, the Government Construction Strategy and Transforming Infrastructure Performance: Roadmap to 2030.

Productivity levels have improved in recent years, with higher skilled workers, increased use of technology and increased spend on services and research.

Opportunity areas

Reuse

Keeping and re-using location data collected and created during design and construction would bring savings, and help with later stages of building maintenance and potential retrofit activities.

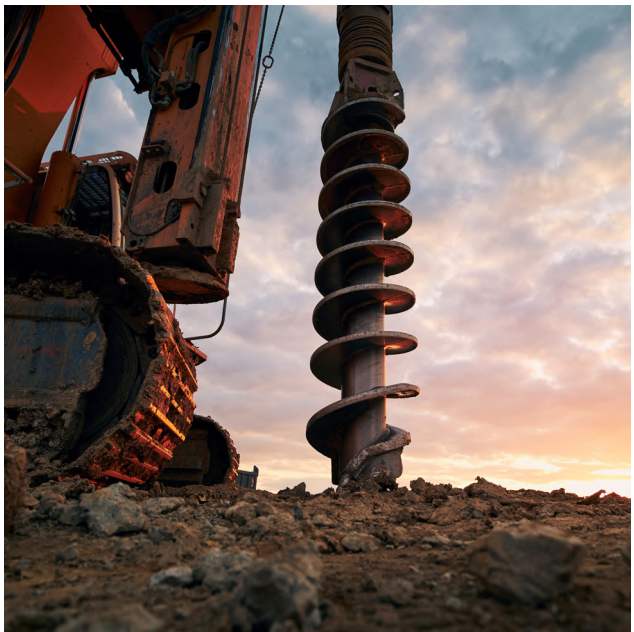
Currently, there is no requirement to maintain location data (e.g. ground condition, topographical data, environmental surveys, as built plans and data on the building itself) throughout the construction process resulting in data re-creation and duplication later in a property lifecycle.

Additionally, the designer or contractor often changes between the options and development phase causing some construction data to be lost. This can occur as Building Information Modelling (BIM) data is submitted as part of the design information to be passed onto the next phase of design, some location data is captured in this but most is lost unless it is specified in the information requirements that it be retained.

Collecting location data once and using it multiple times to help longer term decisions would bring huge efficiencies e.g. capturing the presence of basements in planning applications/as-built would enable better management of urban underground space and the creation of 3D urban models that also capture these basements.

ACTION

The British Geological Survey will continue to promote and support the better re-use of ground condition data used in the construction process and explore the risks and benefits of requesting, storing and sharing additional location data related to construction projects across the public and private sectors.



Case study:
Ground investigation data re-use

Around 500,000 boreholes are sunk in the UK every year. Data is collected from these boreholes by geotechnical specialists who interpret the findings to inform decisions about feasibility, design and construction stages of a construction or infrastructure project.

This data is highly valuable to others. It provides vital geological, geotechnical and geoenvironmental information that can create efficiencies and lower costs in other construction and infrastructure projects and is useful for academic research.

The British Geological Survey has a collection of over a million UK borehole records held in the National Geoscience Data Centre and thousands of new ground investigation records are added each year. However, the British Geological Survey estimates that 80% of borehole data is not reported to them, resulting in an estimated loss of data and knowledge to the UK economy valued in the region of £150-200 million per year[4].

Last year the Geospatial Commission collaborated with the Infrastructure and Projects Authority (IPA), the British Geological Survey and representatives from industry to explore what more could be done to tackle barriers to data sharing. The British Geological Survey and IPA developed standardised clauses which have now been added to the latest version of the Construction Playbook. These set out key policies and guidance for how public works projects and programmes are assessed, procured and delivered.

It is now a requirement for public sector projects to share any ground investigation data collected as soon as reasonably practical with the British Geological Survey.

Buying, selling and renting

The average length of time for a conveyancing process is 150 days. In England and Wales, the Conveyancing Association states that there are 163 different data sets required for review as part of residential transactions, most related to the property and any restrictions and risks.

In last year's Levelling Up White Paper the government committed to improve the home buying and selling process, working with industry to ensure the critical information buyers need to know is available digitally wherever possible from trusted and authenticated sources.

The conveyancing process could be significantly improved by FAIR location data resulting in greater transparency, quicker transaction and reduction in expensive late in process failures, as well as reducing local authority burdens.

Greater availability of high quality interoperable data earlier on would enable buying process decisions to be taken at an earlier point, for both professionals (e.g. conveyancers and lenders) and consumers (e.g. buyers and sellers). This could lead to fewer failed transactions at a late stage, saving money, time and stress.

In many other countries the sellers disclose a greater amount of information about a property at the marketing of that property. For example in Denmark, the Central Register of Buildings and Dwellings provides public sector information (up to 50 datasets) to the homeowner selling a property.

In addition, those seeking to rent a property often find out information too late - for example on a potential new landlord's regulatory compliance, or if the property they plan to rent is up to standard. This affects tenants' capability to make informed decisions before they take on a rental contract. Local authorities can struggle to identify landlords and gather information to take enforcement action.

Opportunity areas

Improving processes and digitisation
Conveyancing searches can take local authorities up to 40 working days. All local authorities have a process for making their data available for conveyancing purposes with many using the National Land Information Service (NLIS). However, some local authorities face delays in processing requests as their information is not fully digitised which increases the time it takes to complete a transaction.

HM Land Registry is working in partnership with local authorities in England and Wales to standardise and migrate the Local Land Charges Register information to one national register.

Local Land Charges are restrictions or prohibitions on the use of a property or land e.g. conditions imposed in a planning permission (these form the majority of charges), listed buildings, conservation areas, tree preservation orders, planning and enforcement notices, smoke control orders and light obstruction notices.

The new central register went live in 2018 and as of May 2023 covers 75 local authority areas. It offers instant online search results in a standard digital format for a fixed fee, helping the property sector and home buyers.

HM Land Registry has set out a programme of transformation in their Strategy 2022+ to provide secure and efficient land registration, enable property to be bought and sold digitally, provide near real-time property information, provide accessible digital register data and lead research and accelerate change with property market partners.

This work sits alongside that of DLUHC who committed in last year's Levelling Up White Paper to ensure home buyers have the critical information they need for a purchase, available digitally wherever possible.

The Geospatial Commission will support HM Land Registry and DLUHC in delivering their work on further digitisation of the property buying and selling process, particularly ensuring data interoperability is built into the process.

Data collection and accessibility

Through the Renters (Reform) Bill, the government is legislating for a new private rented sector database in England that will support the new Privately Rented Property Portal digital service. Private landlords letting property in England will be required to register details about the properties they let on the new service.

This service will support the government's aim to reduce the number of non-decent rented homes by 50% by 2030 and provide local authorities with the tools to drive out criminal landlords from the private rented sector.

The Privately Rented Property Portal will help landlords understand and demonstrate compliance with their legal requirements, alongside increasing the information available to a tenant before they decide to rent a property and throughout their renting journey.

Reuse

Often the same question of the data is asked multiple times by buyers, lenders and sellers, with multiple prospective buyers independently following the same process. Additionally in other areas, multiple organisations or companies are collecting the same information e.g. on building age due to it being hard to find in one location.

The Home Buying and Selling Group, which is made up of representatives from the property industry, have developed the 'Buying and Selling Property Information' (BASPI) dataset designed to be the 'one source of truth' when it comes to upfront information about a property. To support the BASPI, a technology sub group is developing a Property Data Trust Framework, building upon the methodology established by the Digital Identity Trust Framework.

This Property Data Trust Framework will be a framework, data and technology standards to enable people and organisations to reuse data relating to a property, and access and share authenticated property information or "property attributes" with other people and organisations more easily.

By adopting these standards, all services and organisations using the trust framework can describe property information they've created in a consistent way. This will make it easier for organisations and users to complete property transactions or share information with other trust framework participants.

ACTION

HM Land Registry and DLUHC with support from the Geospatial Commission will continue to promote digitisation of the property buying and selling process, particularly ensuring data interoperability is built into the process.

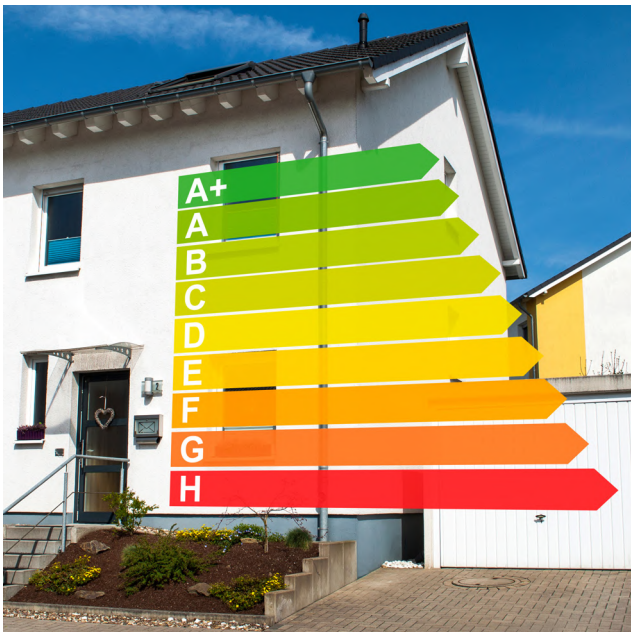
Case study:
Use of the Home Report in Scotland

The Scottish conveyancing system is different to that in England and Wales. Key differences related to location data are that the seller must provide potential buyers with a 'Home Report' on their property and searches can be completed within as little as 24 hours.

The Home Report has three parts – a single survey (visual inspection by a chartered surveyor) and valuation, a property questionnaire and an energy report (Energy Performance Certificate). The questionnaire covers:

- the home's council tax band
- any issues that may have affected the home in the past, like fire or storm damage or asbestos
- any alterations or extensions that have been made to the home
- details of any specialist works or guarantees
- details of any notices that might affect the home

A five year review of the Home Report found that this had reduced multiple surveys and valuations being carried out on the same property, although it was noted that lenders often wanted the data to be refreshed if the property had been on the market for more than 12 weeks.



Safety, maintenance, and operation

Location data, especially relating to the interior features of a building, is essential for effective operation, maintenance and safety. It also supports policy makers to make effective government policy, for example to spot patterns between energy efficiency of homes and health.

Building Information Modelling (BIM) information is increasingly integrated with location data for this purpose; location data can provide wider context to BIM information models, and BIM can be used with Geographic Information System (GIS) to provide accurate detailed models that can be used for building maintenance on a larger scale.

Common data includes local authority Households of Multiple Occupancy (HMO) data, drainage agreements and consents, building decisions, environmental notices, as well as Energy Performance Certificates, National Energy Efficiency Data-Framework (NEED) and electric vehicle charge point data.

There is an increasing number of companies innovating with location data in this space to provide services, such as tracking and repairing damage across a portfolio of properties.

In particular, for building safety and emergency response, as cross disciplinary teams are involved across multiple organisations, it is important to be able to use the same identifiers - so that they know they are referring to the same building (using a TOID - an identifier for each and every feature found in Ordnance Survey MasterMap products, or parent UPRN usually).
There is a huge amount of potentially useful data at this stage. Knowing what is out there, and then being able to quickly and easily access the appropriate data from different sources can be challenging for some stakeholders.

Opportunity areas

Improving access to, quality and completeness of data
Better location data to support the public sector to have better situational awareness of buildings would be useful for emergency response and identifying vulnerability, e.g. risk of fire and flooding.

The Geospatial Commission is investing £1 billion over 10 years in public sector access to enhanced location information for Great Britain, through the PSGA with Ordnance Survey. This includes the provision of new property attribute variables from 2023, including age, construction materials and presence of a green roof.

Additionally the Geospatial Commission manages the Postcode Address File contract mentioned earlier and the Aerial Photography Great Britain contract that provides public sector members with free at the point of use access to aerial imagery.

Local authority teams already draw on multiple sources of data, including location data to support enforcement of compliance and standards in the private rented sector, such as council tax data, voter registration data, energy performance certificate data and other local authority data, such as on waste collection.

However, a recent research report found that

"lack of comprehensive data and knowledge about the private rented sector is hampering efforts to identify poor conditions and rogue landlords, draining valuable capacity that could otherwise be spent enforcing, and leaves authorities unable to evaluate the effectiveness of their actions and approaches".

The previously mentioned Privately Rented Property Portal digital service, which DLUHC are taking forward, will aim to provide local authorities with a comprehensive intelligence source, allowing them to tackle rogue landlords.

The Levelling Up the UK white paper sets an ambition to halve the number of substandard homes in all rented sectors by 2030. The government has also committed to introducing a legally binding 'Decent Homes Standard' to the private rented sector for the first time, as is already in place in the social rented sector. Improved data collection will be needed to help ensure compliance.

Increasing the use of data from the Internet of Things (IoT)

There is an opportunity to harness data produced by sensors and robotics, as workplaces and homes become increasingly digital.

Occupancy sensors enable targeted heating and lighting processes that can reduce building energy consumption and carbon emissions, and detailed LiDAR (light detection and ranging) and optical maps generated by janitorial robots can potentially support emergency response and identify additional preventative building maintenance activities.

These activities leverage the advances in digital engineering which are expected to take advantage of the IoT, feeding real-time data to building managers enabling them to reduce wastage.

Case study:
National Digital Twin Programme

The National Digital Twin Programme was created by the UK government in 2018 in response to the National Infrastructure Commission's Report 'Data for the Public Good'.

The programme is run in collaboration with industry and academia, and serves as a focal point to grow national capability in digital twinning. This capability will allow the government, broader public sector and other organisations that provide services to test decisions before they are implemented – drawing on right-time data from multiple sectors, understanding the implications and unintended consequences, and allowing freedom to optimise decisions for public benefit.

There is a demonstration project on the Isle of Wight, which aims to test and showcase the work of the National Digital Twin Programme in various use cases including:

- infrastructure resilience
- emergency planning and responsiveness
- retrofit of domestic properties
- energy demand, use and supply

So far, the project has begun through the open source integration architecture, which is being created, to combine information sets from multiple sources to address specific use cases and related user requirements in a consistent, structured and interoperable format. Attribute-based security controls can be applied as required to that information where sensitive.

The project has explored the suitability of different digital modelling tools to interface with this information, tailored to meet different use requirements. Work is ongoing to begin layering selected tools on top of the integration architecture in a way that allows insights to be quickly shared between stakeholders, supporting user engagement between and across sectors. Some early work has also been done on data cleansing, ontology development, requirements around data quality and provenance, as well as trust and uncertainty.

Case study: National Buildings Database Project

The Department for Energy Security and Net Zero is developing a National Buildings Database which brings together existing data sources on buildings, including their geometry, and energy use, and supplements this with targeted sector-specific survey data. This spatial database features a one-to-one representation of every building in the country and will provide a step-change in the evidence available for analysis of decarbonisation across the building stock.

It will enable co-located buildings with similar or complementary demand profiles to be identified, which could support zoning of heat networks, analysing proximity of industrial energy end uses (which present opportunities for hydrogen clusters) and identification of buildings at risk from climate change impacts, through cross-referencing with local-scale climate model outputs.

The first phase of this project, the Non-Domestic Building Stock was commissioned in 2021, piloted the data modelling approach to combine existing data from sources including the Valuation Office Agency, Energy Performance Certificates, energy metres, Ordnance Survey AddressBase and MasterMap, with targeted sector specific surveys to produce a complete record of the building stock and its energy use.

The pilot study was carried out by University College London consultants using their 3DStock approach and focused on the hospitality sector, chosen for its highly varied activities and energy uses, and successfully created a national database of every hospitality building identified by the Valuation Office Agency.

The pilot study had to address several challenges ranging from data access arrangements to issues with identifiers and linking across datasets. The existing datasets used to build the database are owned by a multitude of different organisations all with different data governance arrangements.

A particular challenge was identifying where multiple premises existed within the same building and required cross referencing and analysis of spatial records to correctly link premises to the same building. While the database makes use of UPRNs to link across datasets there were low match rates with some datasets, such as the Inter-Departmental Business Register which limited the utility of such datasets.

The second phase of the project aims to roll the pilot method out to all non-domestic building sectors and incorporate data on homes to deliver a complete National Buildings Database.

The database will in the first instance only be accessible within the department although the aim is to extend access to other government departments, and through a workstream looking at generation of synthetic populations it will be possible to generate synthetic samples that can be shared more widely without sharing constraints (although obviously with some loss of detail and fidelity).

Process to create National Buildings Database Pilot

1. Classification

2. Data Linking

3. Analysis

4. Survey Validation

5. Complete Database

VOA Data

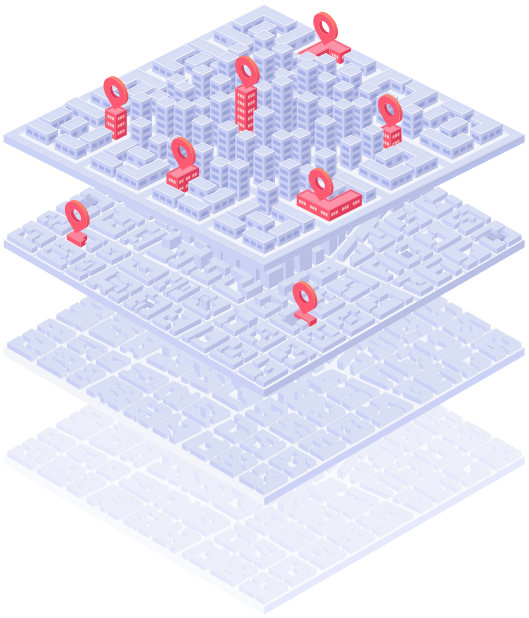
Classification based on activities on premises

UPRN				
###########	##		##	##
###########			##	##
###########	##		##	
###########	##		##	

EPC NEED OS Others...

Linking existing data using VOA as a 'spine"

3D Stock analysis and engineering to model key parameters



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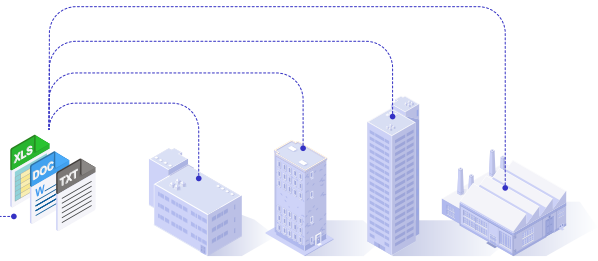

Sector specific surveys gathered to validate and fill gaps in database

Retrofit, demolition and regeneration

Location data will be a core component in achieving ambitious net zero targets by improving the energy efficiency of existing buildings. Buildings account for almost one third of the UK's total greenhouse gas emissions with homes alone responsible for 22%, mainly through heating.

An emissions reduction of potentially up to 98-100% is needed by 2050 compared to 2019. 80% of buildings in 2050 have already been built, so a major priority is decarbonising our existing stock.

For commercial properties change is also needed as approximately 70% of the UK's non-residential buildings were constructed before the year 2000, and non-domestic stock accounts for 23% of overall operational carbon emissions in the built environment.

There is increasing good practice around recycling non-hazardous construction and demolition waste with 92.3% recovered in 2018. However, demolition produces pollution and contamination, and the process of demolition and building again is energy intensive, with CO2 produced when making the new materials.

Compared to refurbishing a traditional Victorian terrace, a new building of the same size produces up to 13 times more embodied carbon. There is increased attention now paid to the carbon emissions of demolition and new build compared to the option of a retrofit. This is particularly the case around commercial buildings, especially retail which has been affected by changing shopping habits over the past few years and calls for whole life carbon assessments to be introduced.

Location data, services and applications can support decisions about what refurbishment and retrofitting changes are possible (e.g. roof orientation data for siting of solar panels), help target improvements and identify where they would be best located (e.g. heat networks).

Easy access to building attribute data mentioned in the previous section, such as age, construction material, tenure and value was emphasised in our engagement as crucial for making decisions on what retrofit is suitable.

Also sought after was data on where retrofitting has been done, energy efficiency measures such as insulation fitted and where solar panels are. Better data on the types of properties in an area would also allow better planning of retrofitting strategies and reduce the need to audit every building.

For regeneration, wider and contextual information is very important. This can include location data at a range of scales on:

- the location, local demographics, footfall to an area (such as British Retail Consortium data)
- amount of vacant properties and empty business space in the area (this is held on a local authority level, but cannot always be shared more widely)
- use classes (such as in a high street)
- how this has changed over time
- local greenspace
- transport links
- data used in the initial stage of the property lifecycle, such as on planning
- contaminated land and flood risk if more drastic regeneration of an area is planned
- options for sustainable drainage systems
- improving nature based solutions and greening

- commercial landlords
- the social value of housing and other properties (places with unique character)

Opportunity areas

Increasing access to location data

There is significant value in breaking building attribute data out of siloes to support multiple use cases including the delivery of new technology or features to support net zero goals. There are different approaches across the UK for access to data supporting housing and environmental strategies.

The Scottish Government pays for access for local authorities and their contractors to the Energy Saving Trust's home analytics dataset, which provides greater information on attributes of a building to support energy efficiency and retrofit decisions. This contains the Home Energy Efficiency Database (an address level repository of what retrofit has been done).

This dataset is updated every six months and is built off Energy Performance Certificates and Scottish housing data. This can be used as a tool to create strategies at a neighbourhood and street level.

The Welsh Government is currently developing a Housing Stock Analytical Resource (HSAR) for Wales. This will bring together a range of data on the characteristics, fabric, condition and energy efficiency of the housing stock to provide a robust evidence base for decision making.

HSAR will combine anonymised data, where possible at an individual property level and will be used to inform housing and environment policy direction, particularly housing conditions and fuel poverty. Data will also be made available for linking to wider datasets to enhance the broader evidence base for associated social policies such as health, education and the economy.
Our roundtables highlighted that in some areas full use is not being made of datasets and geospatial services due to lack of awareness of their existence, capability, skills and capacity issues, and in some instances poor metadata. The Geospatial Commission has previously published a list of housing and planning datasets to help the sector find relevant data.

There are also PropTech companies and industry associations innovating in this area, making it a better experience for those searching for data. More collaboration will be imperative to enable better use of these datasets.

Increasing quality and coverage

Coverage, currency, accuracy and completeness issues affect some building attribute data. Quality can be subjective, however, data may be sufficient for one use case (often the use case it was originally collected for), but is not sufficient for other uses.

An example of this is LiDAR (light detection and ranging) data originally developed for Environment Agency use is now being used to measure building height and determine suitability of properties for solar panels. As mentioned in the previous section the property portal being developed by DLUHC will help local authorities contact landlords if needed.

Case study: Mine water heat

The Coal Authority is working with partners to unlock the heat held within water in our disused underground coal mining infrastructure. Water within the mines is warmed by natural geothermal processes and can, if sustainably managed, provide a continuous supply of space heating and cooling distributed via heat networks.

Mine water temperatures are not affected by seasonal variations and, subject to the right support, mine water can provide renewable, secure, low carbon heating and cooling for buildings in coalfield areas.

The Coal Authority has a team which provides advisory services and helps support the development of mine water heat schemes. It is estimated that about one in four of UK properties are on a coalfield, meaning there is huge potential in this renewable heat source in ex-coal mining areas, helping us reach net zero. It can also help boost local economic growth; the North East Local Enterprise Partnership forecast that 4,500 direct and up to 11,000 indirect jobs will be created if 42 mine water heat schemes are developed in conjunction with the Coal Authority.

Location data has been critical to develop mine water heat schemes. The Coal Authority holds abandonment plans for former mines and location data which sets out the boundaries of mines, which when combined with environmental data such as depth to mine water and temperature of mine water can be used to locate optimal drilling locations for mine water heat schemes.

Other below ground location data used is about existing heat networks and their potential for extension. It is possible to combine mine heat networks with other heat networks and sources as recently demonstrated in Gateshead where a Combined Heat and Power network will be joined with a new mine water heat network making this the largest mine water heat network in the UK.

In order to fully realise the potential for this for the UK location data use needs to be optimised. The team faced some of the challenges discussed earlier in this paper in accessing building data.

The Ordnance Survey Cadre programme (which embeds Ordnance Survey geospatial expertise into public sector organisations to assist them with their use and analysis of location data available under the PSGA) has supported them to produce a closer analysis of the properties on top of the coalfield and assess the potential demand for heating and cooling in these areas.

This an area with huge possibilities, where maximising the use of location data is critical. Further data collection and analysis of the heat potential from the mines (precise mine locations, required depth of drilling and potential water yields) would help create mine water opportunity maps that could support local energy plans, along with further work producing a geothermal potential map for the UK to highlight where particular technologies are suitable would open up huge possibilities.

Through collaboration with other government departments, such as the British Geological Survey, Department for Science Innovation and Technology, and DLUHC this work will be hugely beneficial in upporting net zero and levelling up initiatives.

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Department for Energy Security and Net Zero

Department for Levelling Up, Housing and Communities

Department of Science, Innovation and Technology

Historic England

HM Land Registry

Homes England

Northern Ireland Executive

Ordnance Survey

Ordnance Survey Northern Ireland

Registers of Scotland

Scottish Government

Southwark Council

Valuation Office Agency

Welsh Government

Industry

Alpha Property Insight

Arup

Blackstock

British Property Federation

Building Research Establishment

Commonplace

JLL

Qualis Flow

RIBA

Stride Treglown

Targeting Zero

The Crown Estate

Acronyms

BASPI - Buying and Selling Property Information

BIM - Building Information Modelling

CDDO - Central Digital and Data Office

CRCA - Commissioners for Revenue and Customs Act

DESNZ - Department for Energy Security & Net Zero

DLUHC - Department for Levelling Up, Housing and Communities

DSIT - Department for Science, Innovation and Technology

EPC - Energy Performance Certificate

FAIR - Findable, Accessible, Interoperable and Reusable

GIS - Geographic Information System

HMO - Households of Multiple Occupancy

HSAR - Housing Stock Analytical Resource

IoT - Internet of Things

IPA - Infrastructure and Projects Authority

NEED - National Energy Efficiency Data

OS - Ordnance Survey

PAF - Postcode Address File

PSGA - Public Sector Geospatial Agreement

RED - Real Estate Data

TOIDS - Topographic Identifier

UDPRN - Unique Delivery Point Reference Numbers

UPRN - Unique Property Reference Number

USRN - Unique Street Reference Number

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Endnotes

1 The PSGA is a 10 year contract between the government and Ordnance Survey for the provision of key geospatial data to public sector members for use in everyday settings to support provision of critical services to the public.

2 Vigurs, C.; Maidment, C.; Fell, M.; Shipworth, D. Customer Privacy Concerns as a Barrier to Sharing Data about Energy Use in Smart Local Energy Systems: A Rapid Realist Review. Energies 2021, 14,1285.

3 The CON29M is an official legal search form used when buying and selling domestic properties within coal mining reporting zones.

4 BRICKER, S. TERRINGTON, R. DOBBS, M, KEARSEY, T. Burke, H. Anrhardt, R. Thorpe, S. 2021. Urban Geoscience Report - The value of geoscience data, information and knowledge for transport and linear infrastructure projects. British Geological Survey Open Report, OR/21/065. 67pp