

# FIRE AND RESCUE

*Increasing operational efficiency  
and effectiveness*

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# 01

“I want 2017 to be a big year for fire and rescue. If we get it right, we have the potential to transform the sector for the better, to create a fire service that is ready for the challenges of the future. I want this to be the year when real change happens.”

Brandon Lewis MP, 7 Feb 2017, then Minister for Policing and the Fire Service<sup>1</sup>

1. <https://www.gov.uk/government/speeches/fire-ministers-speech-to-reform>

## EMBARKING ON A JOURNEY OF CHANGE

The role of a modern Fire and Rescue Service (FRS) has become much broader than simply putting out fires. From prevention of road traffic collisions to neighbourhood renewal, the FRS has become deeply embedded in the community. Activities such as education of young people, working with older people to keep them safe in their homes, providing first aid and preventing crime are all part of this wider remit.

As a result, services have made a major contribution to ensuring safe and resilient communities, protecting people and places from harm and creating conditions for economic prosperity. They have driven a 50% reduction in the number of fires and a 20% drop in the number of fire fatalities since the 1980s<sup>1</sup>. However, in the current economic and political environment, even more is expected. The pressures to change include:

**Accountability** – Ensuring and demonstrating that a service delivers value for money means increased levels of measurement and monitoring. Desired metrics now extend beyond performance statistics to include cultural factors such as leadership, diversity and values.

**Transparency** – Government and citizens expect to assess performance and have visibility of information about pay, expenditure, accounts, plans and the composition of the workforce.

**Collaboration** – FRSs must now work with police and ambulance services on initiatives ranging from sharing of facilities (or services such as ICT, HR and procurement) to creation of tri-service teams of responders able to tackle a wide variety of situations.

# HOW CAN THE SERVICE IMPROVE PERFORMANCE WHILST REDUCING COSTS?

## 02

The mission is clear: to prevent incidents; protect people and property; and respond when needed. But fire chiefs are re-thinking the way they operate in an environment of cost reduction.

Between 2010 and 2015 funding for Fire and Rescue Services in England reduced by between 26% and 39%<sup>2</sup>. Services are now expected to improve overall performance whilst increasing accountability, transparency and collaboration, all within a growing funding gap. A new, more rigorous,

HMICFRS inspections programme<sup>3</sup> will be monitoring progress. In addressing the challenge, fire chiefs will need answers to a diverse range of fundamental questions about how they operate. The broader the knowledge base, the better the answers will be and digital technologies will inevitably play a central role. Location information is already a foundation of the activity of an FRS and this eBook introduces more opportunities for the use of location knowledge to deliver a more efficient, effective operation.

2. National Audit Office, 2015.  
3. <https://www.justiceinspectorates.gov.uk/hmicfrs/news/news-feed/hmic-to-extend-inspection-remit-to-fire-and-rescue-services/>

**“We will be reporting on each of the 45 FRSs over the next couple of years, culminating in a national summary of the overall performance of the FRS.”**

Zoë Billingham, HM Inspectorate of Constabulary and Fire & Rescue Services, 2017.



# 03

## Maximising the impact of scarce resources

A UK FRS implemented an initiative to reduce the number of Accidental Dwelling Fires (ADFs) in each of its station grounds. It profiled the ADF data, correlating with Mosaic demographics and identified that ADFs were concentrated in just 6 of the 66 Mosaic types. This knowledge enabled the FRS to focus scarce resources on the high-risk areas, putting in place carefully targeted awareness and prevention activities.

# GAIN GREATER INSIGHT INTO RISK

“We must adapt to the ever-changing risks in our communities and so, as we move to 2020 and beyond, your fire and rescue service will be changing.”

Chief Officer Dave Curry, Hampshire Fire and Rescue Service, Integrated Risk Management Plan, 2016.

The strategic and operational decisions of an FRS are based on a deep understanding of risk to life, the economy and society. The range of information sources needed to build a clear risk picture grows wider as the role of the FRS evolves. More and more data is available and increasingly the challenge is to make sense of it all, to answer questions such as:

- How many people could be affected by this hazard?
- What would be the wider societal impact of an incident here?
- How can these risks be managed?

With the latest geospatial tools, analysts can assess the probability of incidents and their likely severity, building risk profiles for areas, regions and buildings. Data from inspections can be combined with data on demand for services (fire and rescue incidents, road traffic collisions, hoax calls) and other sources (Ordnance Survey, demographics and hazard data) to create a complete picture.

By identifying patterns and correlations, analysts can build insight into the demand for services. Deeper knowledge informs intelligence-led activities

to reduce both risk and demand. For example, having identified an estate housing a concentration of people over 65 living below the poverty line, an FRS might focus extra awareness and inspection activity in this area. Insights such these enable an effective Integrated Risk Management Plan (IRMP), identifying clear service outcomes, to be built and maintained.



# BETTER SITE INSPECTIONS

## 04

### A more productive inspections programme

Transport Infrastructure Ireland (TII) regularly inspects around 1,000 locations on the national road network that have been identified as potential hazards due to risk of vehicles skidding.<sup>4</sup> Previously, a manual paper-based process led to inspectors wasting time in the field trying to find inspection sites, as well as grappling with paper in wet and windy weather. It took the office-based team many days of effort to plan inspections, print maps, report on progress, enter data into central systems and file the paper forms.

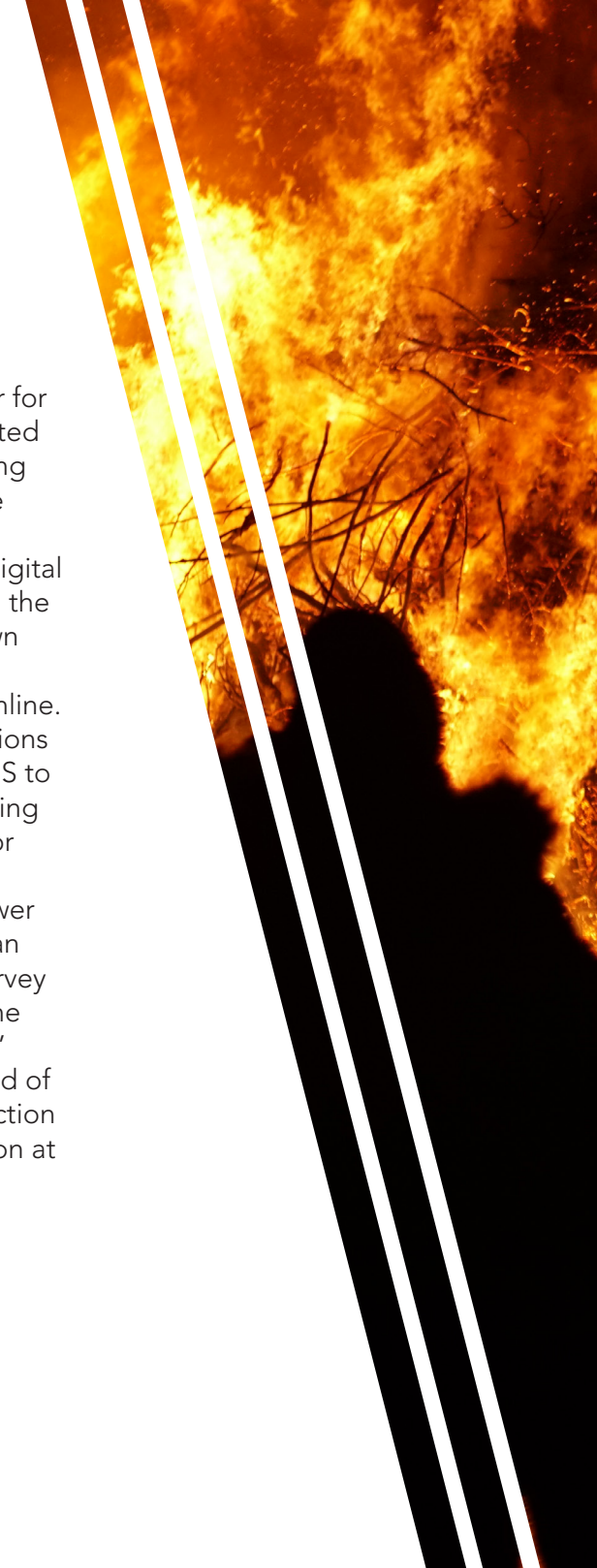
4. [https://resource.esriuk.com/transport\\_infrastructure\\_ireland/](https://resource.esriuk.com/transport_infrastructure_ireland/)

When inspecting buildings, firefighters identify and capture specific risks, from blocked exits and broken alarms to vulnerable people. This knowledge is used to create a site-specific risk index. Rigour is crucial and the pressure is on inspectors to provide more information in less time. But site inspections can be time-consuming and laborious. Many services still use paper-based systems that are error-prone, either because the person entering the data into a system is not the person who carried out the inspection, or because the systems and processes are not flexible enough.

Too often, operational information is out of date, due to delays in the process.

Automated field data capture systems can both improve data quality and reduce the administrative burden. Mobile devices running applications configured for this purpose can reduce double entry of data and validate data at time of capture, ensuring quality. Use of a structured, standardised, database facilitates information sharing across the FRS and enables collaboration with other agencies.

Using Esri's Collector for ArcGIS App, TII created a mobile app enabling inspectors to see the precise locations of inspection sites on digital maps, collect data in the field using drop-down boxes and upload it directly to ArcGIS Online. TII also used Operations Dashboard for ArcGIS to create a live monitoring and reporting tool for management. "We have around 20% fewer personnel and yet can still complete the survey programme within the required timeframe," said Tom Casey, Head of Pavements, Construction Materials & Innovation at TII.





# 05

## COMMUNITY SAFETY

'Safe and well' visits carried out by firefighters improve the health, wellbeing and safety of elderly and vulnerable people in their homes. To maximise the impact of these visits, FRSs need to identify and target the most vulnerable communities and the highest risk individuals. Analysis of residential demographics using geospatial tools can be used to find target homes and plan efficient routes. This minimises travel time, maximises time spent performing visits and creates

opportunities for further efficiency savings by combining visits with other activities. Information collected during safe and well visits is critical – it must be of the highest quality and properly managed, so that it is available to those who need it, when they need it. As already discussed, replacement of paper-based processes with configurable apps on mobile devices can increase the quality of information captured and enable more visits per hour of firefighter time.



# THE RIGHT INFORMATION TO DO THE JOB AND NOTHING MORE

As the volume and variety of data needed increases, so does the difficulty in managing data and drawing conclusions. Analysts need to effectively communicate to management, firefighters and partner organisations the implications and conclusions for the operation. Map-based visualisations are a powerful way to get the message across. Different internal audiences require different views of the same underlying data, presented to suit their individual needs. Flexible tools enable alternative views to easily be configured and irrelevant data excluded, creating a simple, easy to understand picture.

Much reporting is currently static in form, for example long pdf documents, which take time to produce and often serve only a single purpose. Greater flexibility is needed

across the organisation, from station manager to on-the-ground firefighter. Self-service interactive tools can replace static documents resulting in quicker, better informed decisions and increased flexibility. Managers can rapidly get up to speed with a current situation and staff can be temporarily re-assigned to an unfamiliar area in the knowledge that they have access to a current, complete operational view. Access can be on-premises via an internal network or in the field via a mobile device. The manager can rapidly access key figures (such as response times) by area across the station ground and present these to stakeholders in an understandable way. Such tools are easily accessible and are designed to be used without specialist training.

# 06

## Improved collaboration with partners and stakeholders

The £15 billion-pound Crossrail project is delivering a new railway for London and the South East of England. Using the ArcGIS platform, Crossrail can easily share data about its routes, assets, tunnels and stations with third parties, the public and the media. In the future,

the organisation plans to make it possible for partners, such as Transport for London, to consume its data as web services or gain secure access to Crossrail's central GIS portal. This approach will not only improve collaboration with partners; it is expected to also decrease the time that Crossrail spends managing content for third parties and reduce the risk of decisions being made based on out-of-date information.



# 07

## OPTIMISING STRATEGIC RESOURCING DECISIONS

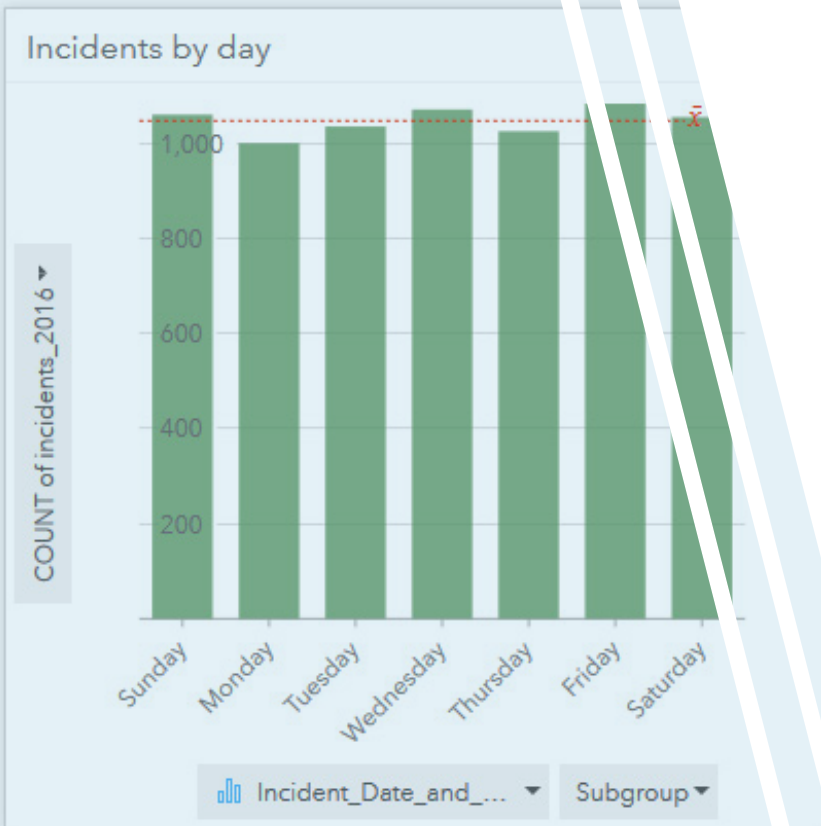
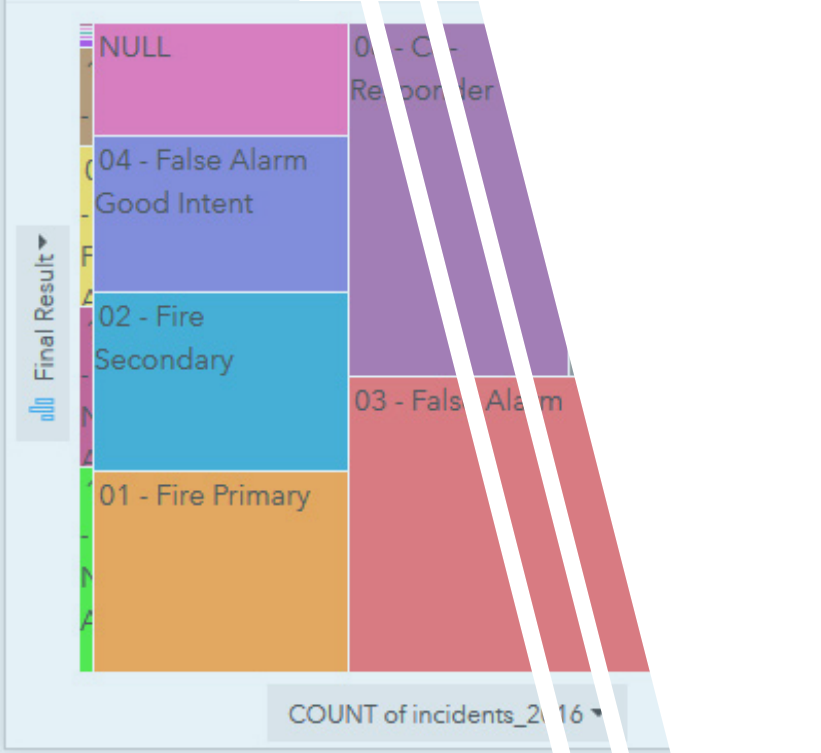
### Optimising resources to meet demand

An NHS trust was facing tough challenges in managing the demand for its services. As a result, it had difficulty efficiently managing patient flows and achieving its target of a four-hour waiting time. It deployed the Esri's ArcGIS Platform to identify the location and nature of demand within its catchment area. Using hotspot analysis, the trust could visualise geographic concentrations of demand by condition, admission method and treatment time. The resulting insights enabled the trust to identify interventions required to improve service. A key outcome was the re-allocation of staff, enabling the trust to meet increased demand at peak times.

Many stations were originally located when planners did not have access to geospatial analytics. Since that time, the geodemographics of both businesses and homes have changed, so current fire cover may no longer be optimal. The drive for efficiency puts the pressure on to optimise strategic decisions around:

- The location of fire stations
- Retained versus full time resources
- Positioning of mobile resources and specialist equipment
- Collaboration and information sharing with other emergency services

Geospatial tools can bring together the information needed to ensure that a fire cover review delivers optimal answers. Having built up a thorough picture of risk and demand, an analysis of travel times can be factored in to identify how incident response time might vary for a range of alternative station sites. By creating interactive reports that relate stations to incidents, it is possible to highlight areas and high-risk sites where response times may not meet targets. Any performance shortfalls can be addressed through further coverage planning, working with co-responders or by strategic positioning of mobile units.



# KEEPING EVERYONE INFORMED

## 08

### Faster incident response through improved operational intelligence

The Environment Agency (EA) uses the Esri ArcGIS platform to provide real-time operational intelligence for flooding incidents. By bringing together data from GPS-tagged equipment (such as temporary barriers and pumps), weather forecasts and field workers equipped with mobile devices, into operational dashboards the EA can now respond more proactively. For example,

Free flow of information is essential for an effective operation. Managers, the control room and firefighters all need the right information at the right time. Typically, a dedicated team of analysts produce bespoke maps and analysis to inform decision making and operational activities. But as information needs increase, analyst teams are becoming swamped with routine information requests, creating an information bottleneck and delaying delivery of information to people who need it. The alternative is to adopt a centralised, cloud-based geospatial information management platform. This enables staff and managers

to create the visualisations they need, whenever and wherever they are. Highly valuable information relevant to the task at hand is now made easily accessible, supporting both proactive fire prevention work and management of active incidents. For example, visualisation of a 6-month incident history of an entire area can be especially powerful when optimising resource allocation. More locally, after an incident an FRS may review local demographics to identify other, similar properties that should be visited. Planning for one-off events (such as festivals, sporting events) is also more easily facilitated.

the stock of mobile flood barriers can be optimised, getting them to the point of greatest need at the right time via a just-in-time logistics model. The results are twofold: floods can be avoided by dealing with issues before they become problems; and when problems do occur, the impact can be minimised by responding more effectively. "It's all about using real-time operational intelligence to know what's going on, where and when and feeding that back to different teams", Nick Jones, Senior Advisor, Environment Agency.





# 09

## Simplifying hydrant management

A UK Fire and Rescue Service found that its hydrant management database was inflexible and complex to use. Multiple instances of the system were replaced with a single Esri ArcGIS platform. The new system provided office-based and field-based tools that were easily configured to suit local data collection and storage needs. The impact of the change was a reduction in manpower operating and managing the system, faster access to hydrant information and a reduction in total costs of ownership.

## EFFECTIVE INSPECTION OF HYDRANTS

Fire hydrants stand unused for most of the time, but must burst into action the moment they are needed. Under the responsibility of the Water Officer, regular inspections are required to ensure that hydrants are accessible, in good condition and functioning correctly. Close liaison with water companies is needed to ensure damaged or non-functional hydrants are repaired or replaced.

Inspection work is labour intensive and can be inefficient - duplication of work is common. A map-based system for management of hydrant inspections linking the central office to mobile devices in the field can ensure the process is fit for

purpose. Inspection routes can be created based on the availability of parking and road traffic patterns, ensuring that inspections are completed in the shortest possible time. Duplication of effort can be avoided by scheduling tasks to individuals. Standard workflows for data capture can speed up cycle times and make it easy to include a photo as part of the documentation which is rapidly passed back to the central office. Activity can be monitored by the central office through a dashboard that tracks progress against plan. Up-to-date asset information can be made available to fire crews as they respond to incidents, via apps on mobile devices.

# INCREASE PUBLIC ENGAGEMENT

# 10

## Communicating a technical matter to a non-technical audience

The Office for National Statistics (ONS) created a new statistical geography called Towns and Cities. But defining the boundary of a town or a city is a complex task, with many areas are open to question. The ONS developed a definition based on two sources:

- 5. <https://data.gov.uk/>
- 6. Geographic Information System
- 7. <https://ons.maps.arcgis.com/apps/StorytellingSwipe/index.html?appid=33677f5284cc47caa94ce55fa95130b6>

Public engagement has risen to the top of the agenda. Services must keep fire safety in the minds of the public whilst also making government and other stakeholders aware of the breadth of activities undertaken and the results of firefighters' work.

However, the collection, aggregation and publication of data can place an additional overhead on an already resource constrained FRS. Open data is now expected and key information such as location of fire stations, fire risk assessments and statistics on incidents attended is already published by Government<sup>5</sup>.

But much of this is in a form only useable by GIS<sup>6</sup> technicians and expert users. Freedom of Information (Fol) requests are a statutory obligation but can take up large amounts of valuable analyst time.

Online map-based solutions are a powerful way to present information to the public and stakeholders in an easily digestible form. A public web mapping service can give the answers to common queries (such as the number of incidents attended, the number of safe and well visits carried out, average response times and the number of road traffic collisions attended) in a few clicks. Property owners, business and residents can search incidents by area and understand the most common causes of fire nearby, helping them put in place the right prevention measures. The result is improved transparency, compliance with government open data requirements, reduced reporting overhead and faster response times for information requests.

- Places with a population size of over 75,000 people at the 2011 Census
- Built-up area boundaries produced by the Ordnance Survey in 2011

To explain the differences and show how the new geography worked, the ONS created an online swipe map that visualised the differences between the sources and made it easy for non-technical people to understand<sup>7</sup>. This helped the ONS to engage with a wider audience.



# 11

**“Efficiency is doing things right; effectiveness is doing the right things.”**

The Effective Executive, Peter F. Drucker.



## BUILDING A SAFER FUTURE

As we create and implement more innovative firefighting applications, service delivery will be continuously improved. New technologies will allow an FRS to pinpoint a firefighter within a structure without the penetration issues suffered by GPS, enabling live monitoring of firefighter location. When used in conjunction with 3D building information this will highlight the firefighter's proximity to hazards and exit routes.

Augmented Reality (AR) headsets will provide vital information to firefighters in dangerous situations and conditions of poor visibility. This will increase firefighters' effectiveness and mitigate the risks they face. AuGeo, a Research Project from Esri Labs<sup>8</sup>, is a mobile AR app that illustrates the possibilities. It enables a person to view a real-time image of the immediate area on their mobile device with key data superimposed on the image. Tools such as this could guide rescue teams towards a fire hydrant that

otherwise would be missed, or provide vital information about the flammability of materials close to a fire.

Unmanned Aerial Vehicles (UAVs, or drones) are a powerful way to gain more information about a dangerous situation without risking lives. Drones equipped with thermal image sensors or conventional cameras can supply responders with a live video feed, map heat intensity and identify possible body heat through a building's walls. They can be used to examine damage and assess whether a structure is safe to enter or is too risky for firefighters to access. Drones can also support investigation work, examination of the burn pattern from the air could reveal where the fire started. Drones are increasingly used by fire services, with many innovative applications being trialled, all underpinned with location technology .

The costs of 3D laser scanning technology have fallen to the point where it is now feasible to capture large quantities of data on building internals. High risk buildings can be mapped and attributed in 3D with unprecedented levels of detail. With 3D visualisation of risk, emergency plans can be created in advance,

improving the likelihood that lives are saved should an incident occur.

Developments such as these are all built on knowledge of location, the critical glue that holds together all the information needed to build an even more effective and efficient Fire and Rescue Service.

8. <https://blogs.esri.com/esri/arcgis/2017/07/06/augeo-an-augmented-reality-mobile-app-for-your-gis-data-2/>



Esri is the global leader in spatial analytics technology and our geographic information system (GIS) software platform, ArcGIS, helps customers unlock the full potential of data, to improve operational and business results.

Esri UK has the UK's largest team of GIS professionals able to provide customers with fully integrated GIS solutions. We have been offering GIS solutions to leading organisations and a wide range of markets including Police, Fire, Ambulance, Government,

Defence and Utilities for over twenty years. Customers include Hampshire Fire & Rescue, Ministry of Defence, Birmingham City Council, Defra, the Environment Agency, Metropolitan Police Service, Ordnance Survey, RSA Group, Scottish Power and The Crown Estate.

Esri UK supports Fire and Rescue Services with skills, knowledge and resources in:

- Geodemographic analysis
- Location of assets and resources
- Field force management
- Web-based mapping
- Mobile survey and inspection applications
- 3D visualisation of buildings and places

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