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Digging Up Britain:

How Vulnerable is our Utility Infrastructure?


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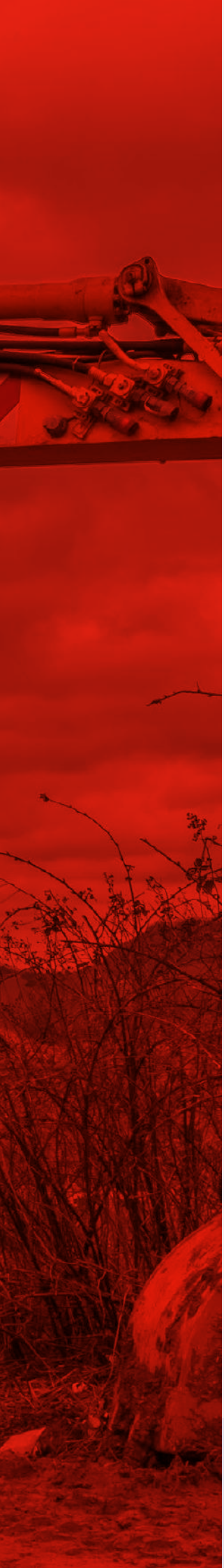


Foreword

When LSBUD was formed back in 2003 (as Linesearch.org), our founding principle was simple: to prevent underground utility assets from strikes. Why? Because asset strikes have serious consequences.

Inadvertently hitting an electrical cable or a gas pipeline can cause life-changing injuries to unfortunate site workers and we all have a duty of care to ensure we protect the safety of those working in our industry as well as the general public. For the asset owner, a strike can result in significant costs both in terms of repair and downtime but also to brand reputation and customer perception. As a result, it is vital that we collectively ensure that complete asset searches become standard practice for all works.

To highlight the importance of this, for the first time, we have used our search data to build a picture of the scale of excavation work taking place across the UK. The information contained in this report will help us better understand the level and type of risks that our underground utility infrastructure is exposed to on a daily basis and, in turn, highlight how vulnerable it is.

We also want to use this data to call on all asset owners to make information about the location of their utility networks easily and readily available to the 60,000 plus LSBUD users who rely on these plans to work safely – it is in everyone's interest to protect assets in this way.

After all, anyone can put a spade in the ground...

Richard Broome
Managing Director
LinesearchbeforeUdig

About LSBUD

LinesearchbeforeUdig (LSBUD) is a free service that any individual or organisation can use to check their works against over 70 asset owners' utility assets. These assets include hundreds of thousands of kilometres of underground and overhead pipes and cables in the electricity, gas, high pressure fuel, water and fibre optic networks. In 2017, the service processed over 2.25 million enquiries - that's more than one every 14 seconds.

Asset owners currently registered with the service range from national utility suppliers such as National Grid, UK Power Networks, Western Power Distribution and SGN to fuel suppliers like BP, Esso and Shell to telecoms providers including Zayo and Gigaclear.

Our goal is simple: to ensure all asset owners in the UK make their information available through LSBUD.

Executive Summary

The scale of digging and excavation works taking place across the UK at any one time is vast and almost half of it is carried out without an accurate picture of the underground utilities in the vicinity. As a result, our critical national utility infrastructure is at constant risk of strikes and damage.

For the first time, we have been able to build a picture of the construction activity that is creating this risk and it is surprisingly varied. As one would expect, the vast majority of digging work is carried out by contractors working on behalf of utility companies. But it is the wide range of other activities taking place that heightens the issue further still. From fencing to housebuilding to piling to industrial activity, it is nigh on impossible for asset owners to keep track of everything and everyone who could be putting their infrastructure in danger of damage.

Two other key factors are also impacting on the vulnerability of our underground infrastructure:

- asset owners currently use a myriad of differing practices for sharing asset information. Some supply maps by email or post, some use GIS viewers, some charge a fee and timescales can be up to 28 days. It is neither simple nor quick for third parties to source all the information they need.
- with responsibility on the person doing the work to get the plans and locate assets, it can be a considerable challenge as there are hundreds of organisations that own underground infrastructure.

In addition, there are other challenges to overcome:

- we need to raise awareness of the danger of asset strikes (among members of the public) and, by learning from international examples, encourage more excavators to search for assets before beginning work.
- County Councils and Local Authorities are significant asset owners thanks to the amount of infrastructure, such as street lighting, that they own. At present, less than 1% of councils make their asset information available to those searching via LSBUD.
- some sectors of infrastructure are more vulnerable to strikes than others. The water industry is a case in point with only a small number of companies making their asset information available through a collaborative portal.

It is therefore critical that two distinct outcomes arise as a result of this report:

- comprehensive utility asset searches are recognised as standard practice for all when planning and preparing for any works involving digging.
- all asset owners must protect their infrastructure by doing everything they can to make access to their data easy to those third parties that need it to work safely.

Only by achieving this can we manage and reduce the vulnerability of our national utility infrastructure.

Methodology

The data referenced in this report is drawn from three primary sources:

- LSBUD's database of utility asset location searches completed using its service between January 2016 and December 2017 – a total of over 4 million searches.
- Information provided by the Health and Safety Executive (HSE) detailing the number of underground electrical cable or gas line strikes reported between 2012 and 2017 under the requirements of the Electricity Safety, Quality and Continuity Regulations 2002 and RIDDOR.
- The Utility Strike Avoidance Group (USAG) 2015 & 16 Utility Strike Damages Report

1. The breadth of work being undertaken in the UK – how big is the risk to our infrastructure?

You only have to travel a few miles on any given day to come across some kind of digging work taking place - from road works to the construction of new developments to repair or maintenance work, there is always something going on. And every time a spade or digger or piece of machinery hits the ground, there is a danger that the utility assets lying buried beneath the ground could be damaged.

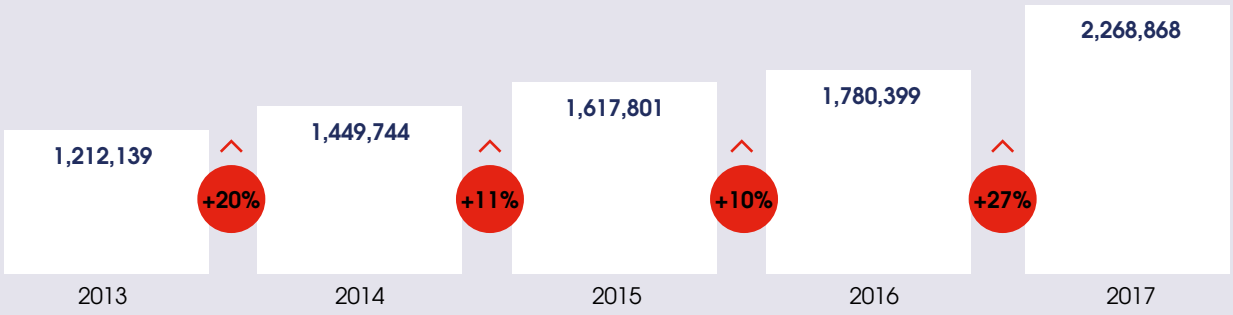
But what is the scale of this risk to our network of underground utilities and just how vulnerable are they?

By analysing LSBUD's data, we can identify that, during 2017, more than 2.25 million location-specific asset search enquiries were made – an average of four every minute and an increase of 27% on the previous year.

44%

of all work in the UK takes place without a thorough underground asset search

TOTAL NUMBER OF LSBUD SEARCHES EACH YEAR



What this data doesn't show, however, is the level of activity taking place with no knowledge of the location of underground utility assets; those works where no searches are carried out.

While there are no official figures, it is widely speculated within the industry that approximately four million works projects[1] take place each year; meaning that almost half of them are carried out without an accurate picture of the utility assets they are putting at risk.

We also know that of the UK's 1.5 million kilometres[2] of underground utility infrastructure, about 600,000km are covered by LSBUD – leaving 60% exposed to the risk of strikes.

Taking these two key statistics together, we begin to get a clear picture of the scale of the risk and the vulnerability of our utility assets.

By delving into LSBUD's wealth of data, we can build a representative picture of not only the volume of work that is taking place but also the type of work. Knowing that for every one person who checks what underground utilities are in place, there are likely to be many who don't, we can also get a feel for the enormity of the risk that our utility assets are placed under on a daily basis and begin to understand their vulnerability.

[1] *Ref: www.wwutilities.co.uk/media/2691/gas-network-innovation-strategy-2018.pdf*

[2] *Ref: www.ice.org.uk/news-and-insight/the-civil-engineer/april-2017/pas-256-is-here-increasing-the-quality*

60%

of the UK's utility assets are exposed to a greater risk of strikes

2. Digging up Britain: a snapshot of the work taking place across the UK

a. Who is doing the most digging?

TELECOMS

The highest volume of searches by sector came from LSBUD users working on behalf of telecoms companies, with the major operators and their contractors at the fore.

Between them, these organisations made 799,553 search enquiries during 2017 – more than a third of all enquiries received by the service. Using LSBUD's data as a representation of all work being carried out in the UK, it is therefore fair to say that over a third of all works being undertaken relate to the telecoms sector.

Given the Government's current drive towards rolling-out superfast broadband across the UK it is perhaps no surprise that telecoms providers have been particularly active over the last couple of years.

35%

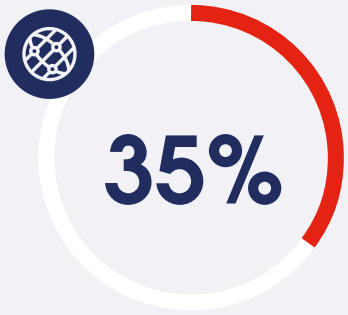
of all works undertaken across the UK during 2017 related to the telecoms sector

WATER

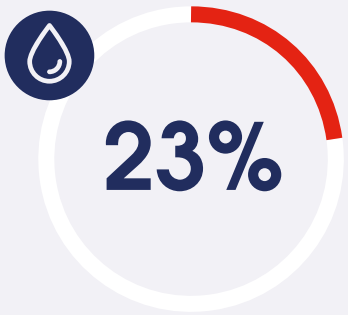
Water companies and their contractors generated the second highest volume of search enquiries during 2017. The six most prolific regional water suppliers requested details of underground assets on 523,043 occasions – 23% of all searches made during 2017.

Around 350,000km of water mains and 625,000km of sewers are owned and maintained by the water industry and this aging infrastructure is expected to require significant investment over the coming years to maintain service standards.[1] The large number of searches carried out by the water companies is an indicator of the amount of work that is already being carried out to repair these assets.

ENQUIRIES BY SECTOR:



Telecoms providers



Water companies

[1] *https://www.waterbriefing.org/home/finance-and-risk/item/13845-new-report-says-uk-water-firms-will-need-to-significantly-increase-infrastructure-investment*

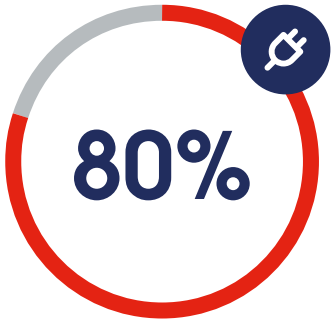
b. Why are they digging?

LSBUD not only captures information about who is undertaking the work that search enquiries relate to, but also the category and type of work being planned or carried out. As a result, for the first time we can build an accurate picture of the UK's construction activity.

UTILITY WORKS

Not surprisingly, given that users working on behalf of telecoms and water companies made the most searches, the area of activity cited as the reason for the highest number of enquiries was utility works. In fact, at well over 1.8 million enquiries, 80% percent of all searches made during 2017 related to utility works.

Of these, almost 41,000 were linear projects in highways and 10,500 enquiries related to cross-country linear routes.

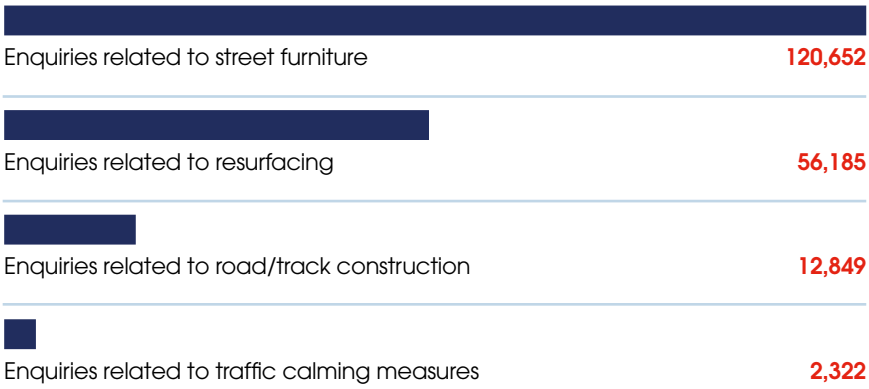


of all searches made during 2017 related to utility works.

HIGHWAY WORKS

The nation's roads are in a constant state of maintenance and repair and this is reflected by LSBUD's figures.

During 2017, 305,542 enquiries were made in relation to a range of highways-related works including the installation of street furniture and traffic calming measures, resurfacing, maintenance and the construction of new roads and tracks.



HOUSING

In the Autumn 2017 budget, the Chancellor set out an annual target of constructing 300,000 new homes in England and highlighted that house building is at 'record levels' with well over 200,000 dwellings built the previous year.

As a result, it is not a surprise that the number of LSBUD searches relating to housing projects rose by 34% from 2016 to 2017 with 26,104 searches made last year.

WATERCOURSES

As our climate changes, severe localised flooding seems to be becoming an increasing occurrence. As part of the effort to mitigate and alleviate the issue, there have been just over 20,500 searches relating to watercourses, canals and drainage over the last two years. This included 2,362 searches related to dredging and 4,360 related to field drainage.

2016 searches

9,485

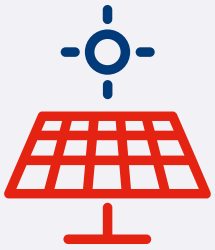
2017 searches

11,132

THE RENEWABLE ENERGY SECTOR

As the pipeline of large-scale solar farms in the UK reached 340 sites in Autumn 2017, 169 searches were carried out on sites earmarked for solar farms. Conversely, there was a drop in the number of searches for wind farm sites from almost 400 in 2016 to a little over 300 in 2017.

With investment in wind and solar power being dramatically cut by over 50% in single year[1] as a direct result of the withdrawal of political support for new renewable energy generation, it is anticipated that these numbers will fall again this year.



169

solar farm sites were searched in 2017

[1] *Bloomberg New Energy Finance*

TREES AND WOODLANDS

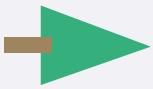
Tree roots can cause significant damage to underground cables and pipes and are a major cause of blockages to water and sewer systems. As a result, it is vital that anyone planting trees takes the location of underground infrastructure into consideration.

During 2017, a small number of enquiries were made relating to trees and woodlands. This included the maintenance and management of woodland and both the removal and planting of trees.

127

Tree planting enquiries

1,571



Tree removal enquiries

MAST SITES

Interestingly, the number of searches relating to mast sites fell by 21% from 2016 to 2017. This significant reduction is unexpected as there was a rush for completion of agreements for new sites before the Electronic Communications Code took effect in late 2017. This will be an interesting area to review in 2018 following the implementation of the Code.

2016 searches

1,343

2017 searches

1,059

MINERAL EXTRACTION

A total of 140 searches were made in 2017 in relation to mineral extraction sites. This category of work is of particular interest to the owners of gas pipelines as the vibrations caused by quarrying and mining can fracture underground pipes, even those located some distance away from the works.

44

sand and gravel

15

clay

15

mining

21

deep mining

Interestingly, and reassuringly, two searches were made under the work type category of explosives!

AGRICULTURE

Agriculture is recognised by the HSE as being the riskiest industry sector with high numbers and rates of fatalities. In fact, it highlights that unwise risk-taking is an underlying problem with those working on their own especially vulnerable.

With just over one in a hundred workers employed in the sector, health and safety is a fundamental requirement of sustainable farming and given the volume of digging involved, an understanding of the infrastructure below ground should be an essential. Yet only a very small number of searches – 804 - were categorised as relating to agricultural works. Just 75 of these were in preparation for 'deep agricultural groundworks'.

PRIVATE INDIVIDUALS

Enquiries made by the general public represented a very small percentage of the overall total, with 3,854 requests relating to domestic works made throughout the year.

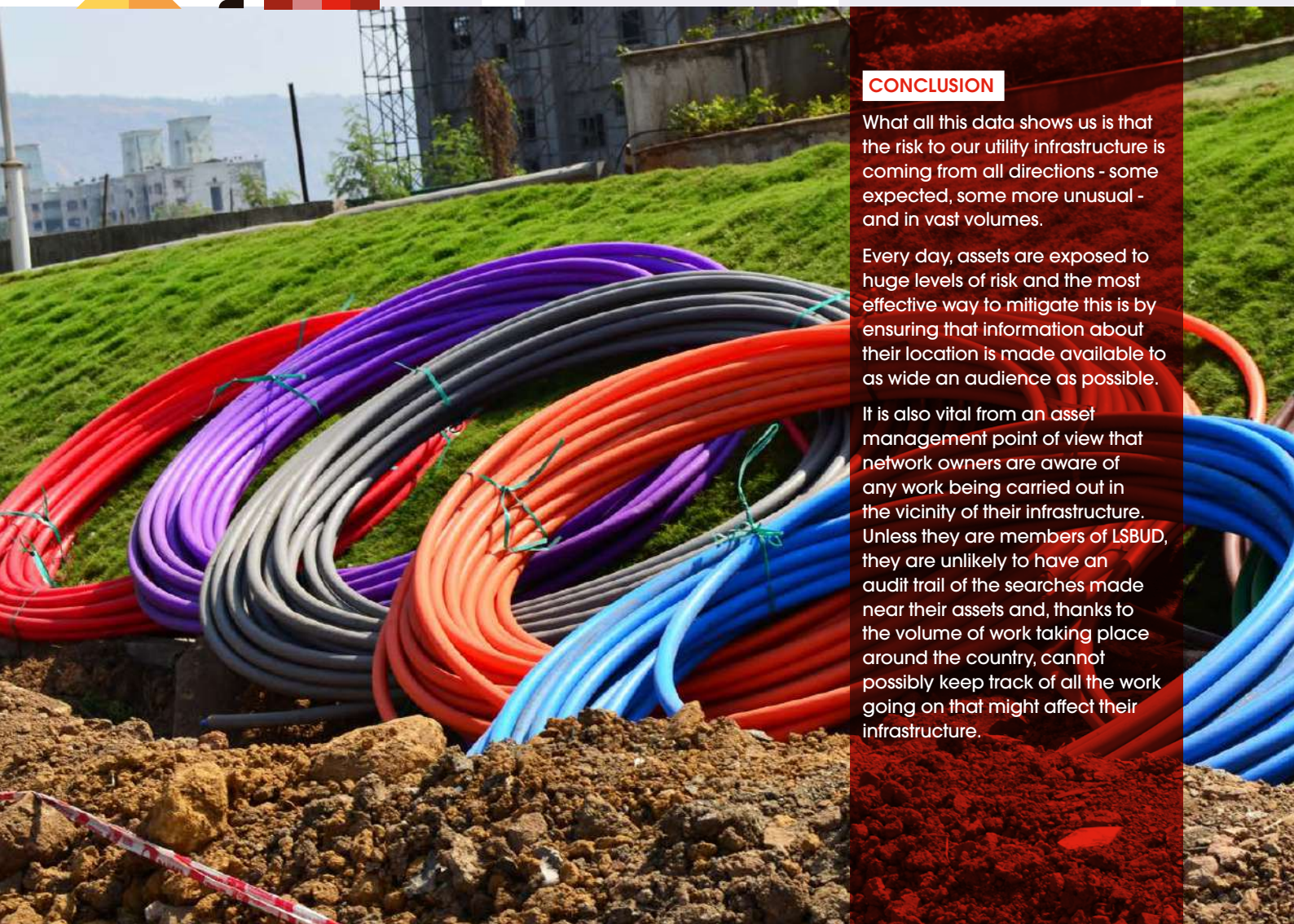
Against a backdrop of ever rising house prices, an increasing number of home owners are turning to self-building and home extensions. As a result, around 12,000 homes were expected to have been self-built during 2017,[1] meaning that the number of searches carried out by members of the public can be interpreted as being worryingly low.

Fencing is another high-risk activity often undertaken by home owners. With fence posts often sunk below the normal depth of utility pipes and cables, it is vital that people don't carry out this activity 'blind' and know if any infrastructure is buried in the ground they are digging into.

0.17%

Just 0.17% of searches were made by members of the public

[1] *https://www.propertywire.com/news/uk/rise-uk-home-owners-improving-property-rather-moving/*



CONCLUSION

What all this data shows us is that the risk to our utility infrastructure is coming from all directions - some expected, some more unusual - and in vast volumes.

Every day, assets are exposed to huge levels of risk and the most effective way to mitigate this is by ensuring that information about their location is made available to as wide an audience as possible.

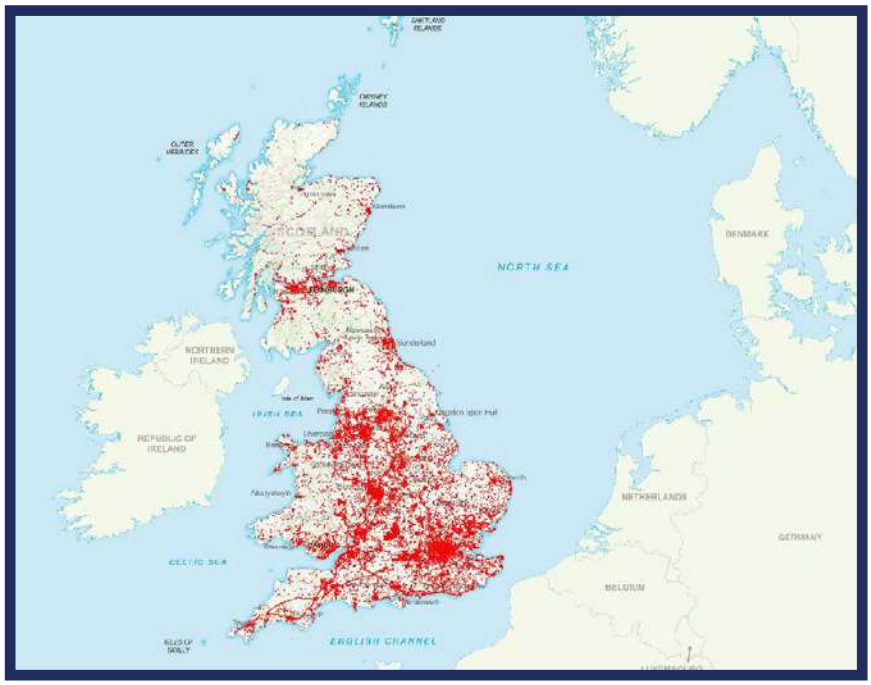
It is also vital from an asset management point of view that network owners are aware of any work being carried out in the vicinity of their infrastructure. Unless they are members of LSBUD, they are unlikely to have an audit trail of the searches made near their assets and, thanks to the volume of work taking place around the country, cannot possibly keep track of all the work going on that might affect their infrastructure.

A snapshot of searches

To illustrate the volume and density of searches across the UK, we have taken a snapshot of LSBUD's data from November 2017 when 219,217 searches were requested.

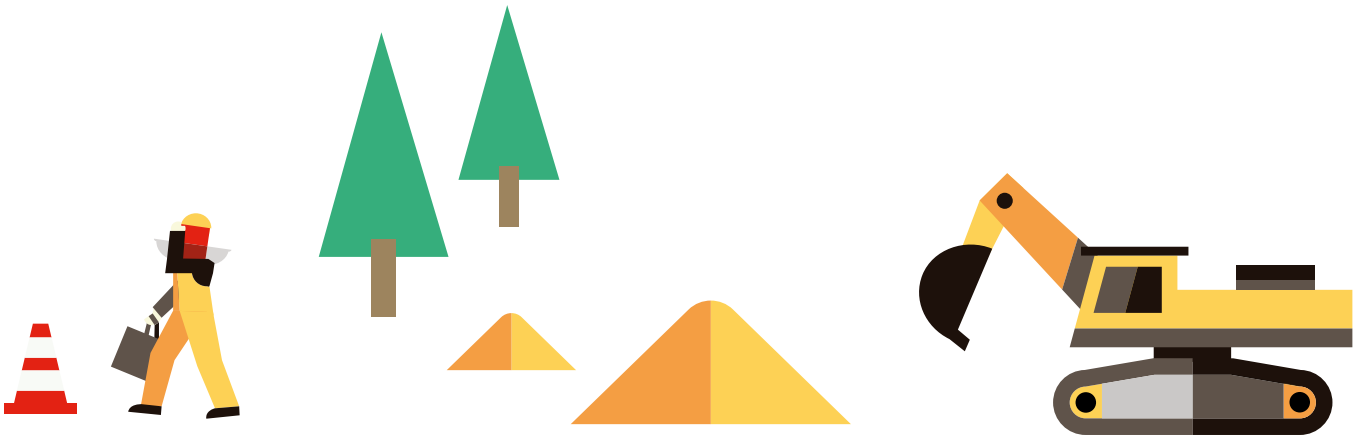
As the map shows, in just a single month, searches were made for locations across virtually the whole country – from the Shetland Islands to the southern most tip of Cornwall. This demonstrates both the reach of LSBUD's service and the desire of those undertaking digging work to understand the infrastructure beneath their sites.

As you would expect, the density of searches is highest in the major conurbations, but it is also clear to see that work that could impact on our utility infrastructure is happening all the time, everywhere.



219,217

Searches made across the UK in November 2017



3. Which sectors are most vulnerable to strikes?

As we have seen, LSBUD's search data gives us a significant indication of the level of activity taking place that may harm utility assets.

In parallel to this, by looking at the asset owners who make details of their infrastructure available through LSBUD (and conversely, those who don't), we can also see which geographical areas and sectors of asset owners are most exposed and therefore vulnerable to strikes.

WATER

It is clear to see from the map below that details of very little of the UK's water infrastructure is available to those searching for the location of underground assets, despite being the second biggest users of asset searches. This is putting the sector at huge risk of strikes.

ELECTRICITY

The location of the underground electricity infrastructure in approximately half of the UK is available to those searching for the location of underground assets.

GAS

As a whole, the gas sector is the best represented of all the utilities in terms of geographical coverage on the LSBUD service.

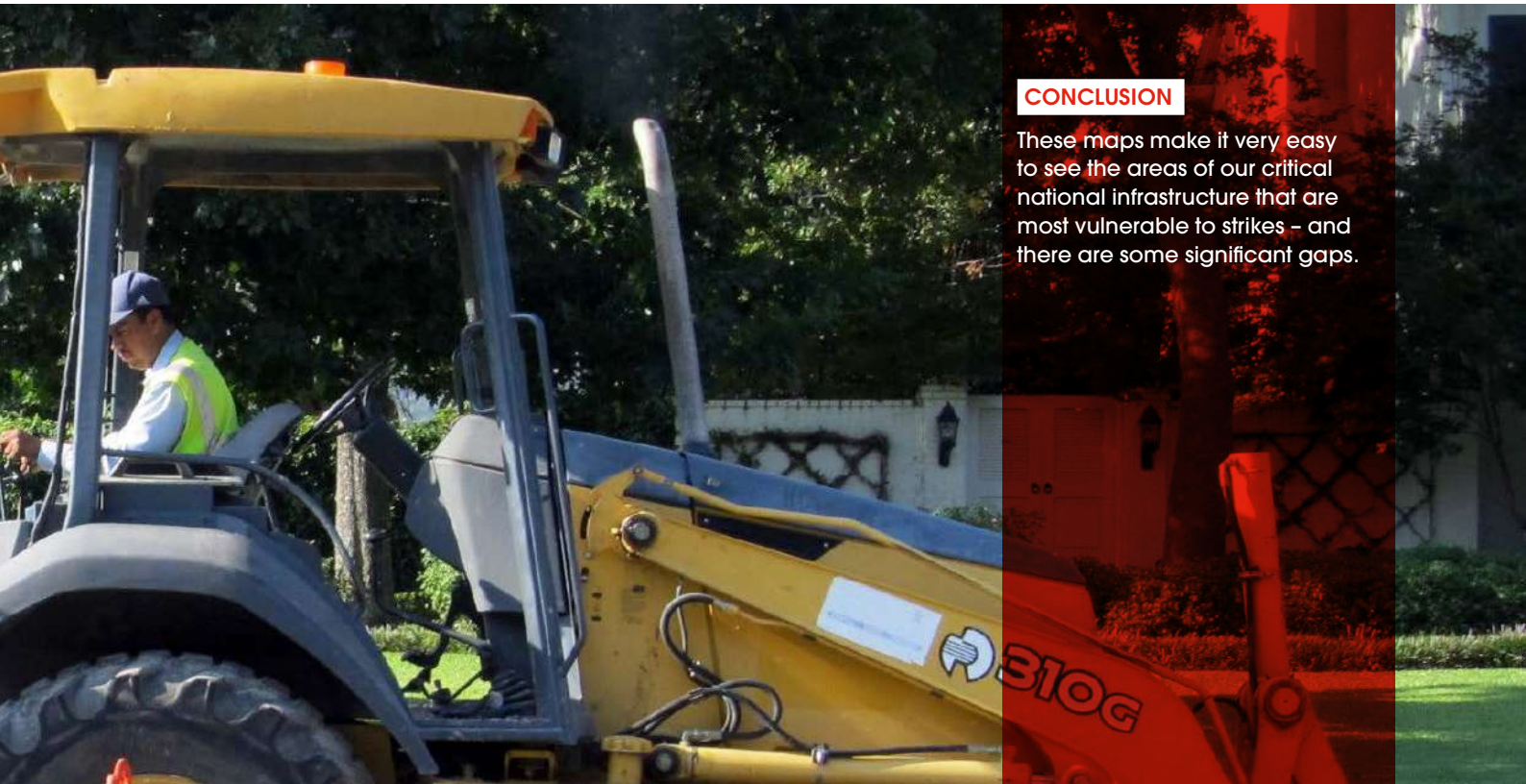
Note: In the areas where individual pipelines are highlighted, only the location of pipes that are above 2bar in pressure is available via LSBUD.

OTHER UTILITIES

LSBUD members also include the owners of the following assets, with the locations of their infrastructure shown on the map below:

- High pressure hydrocarbon pipelines
- Fibre optic cable networks and
- District heating networks

All maps show indicative asset owners as of March 2018



CONCLUSION

These maps make it very easy to see the areas of our critical national infrastructure that are most vulnerable to strikes – and there are some significant gaps.

The benefits of making data available

Taking the search data from one county as an example, it is clear to see the positive impact that new members joining the LSBUD service can have.

During 2016, 22,492 searches were made for locations in Kent. In 2017, that leapt up by 134% to 52,557.

The significant increase can be largely attributed to two major asset owners – SGN and UK Power Networks – becoming members of LSBUD and making their data for the county available to users through the service.

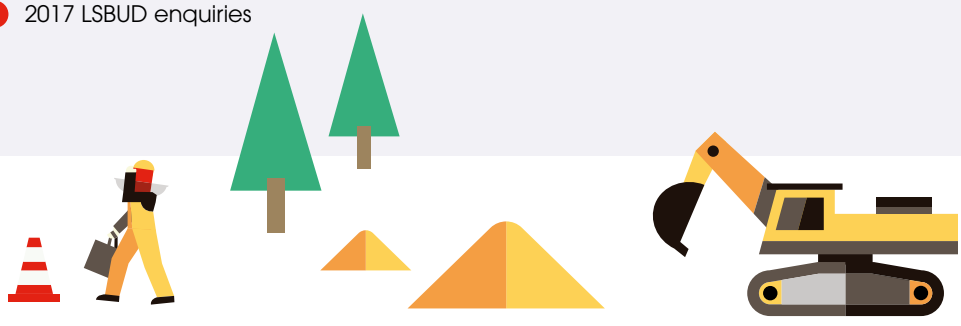
THE BENEFITS OF THIS ARE FOUR-FOLD:

- ✓ contractors who previously had to contact either SGN or UK Power Networks directly and individually to get their asset location data are now being directed to LSBUD, meaning they now get a comprehensive picture of all asset infrastructure in the vicinity of their site;
- ✓ where previously, contractors had to wait up to 28 days to receive asset location data they now get it within minutes;
- ✓ SGN and UK Power Networks receive data on all the searches taking place in and around their assets, enabling them to get a much clearer picture of the vulnerability of their infrastructure;
- ✓ all other LSBUD members with assets in the wider area receive a considerable uplift in the number of people who are searching against their assets in the area.

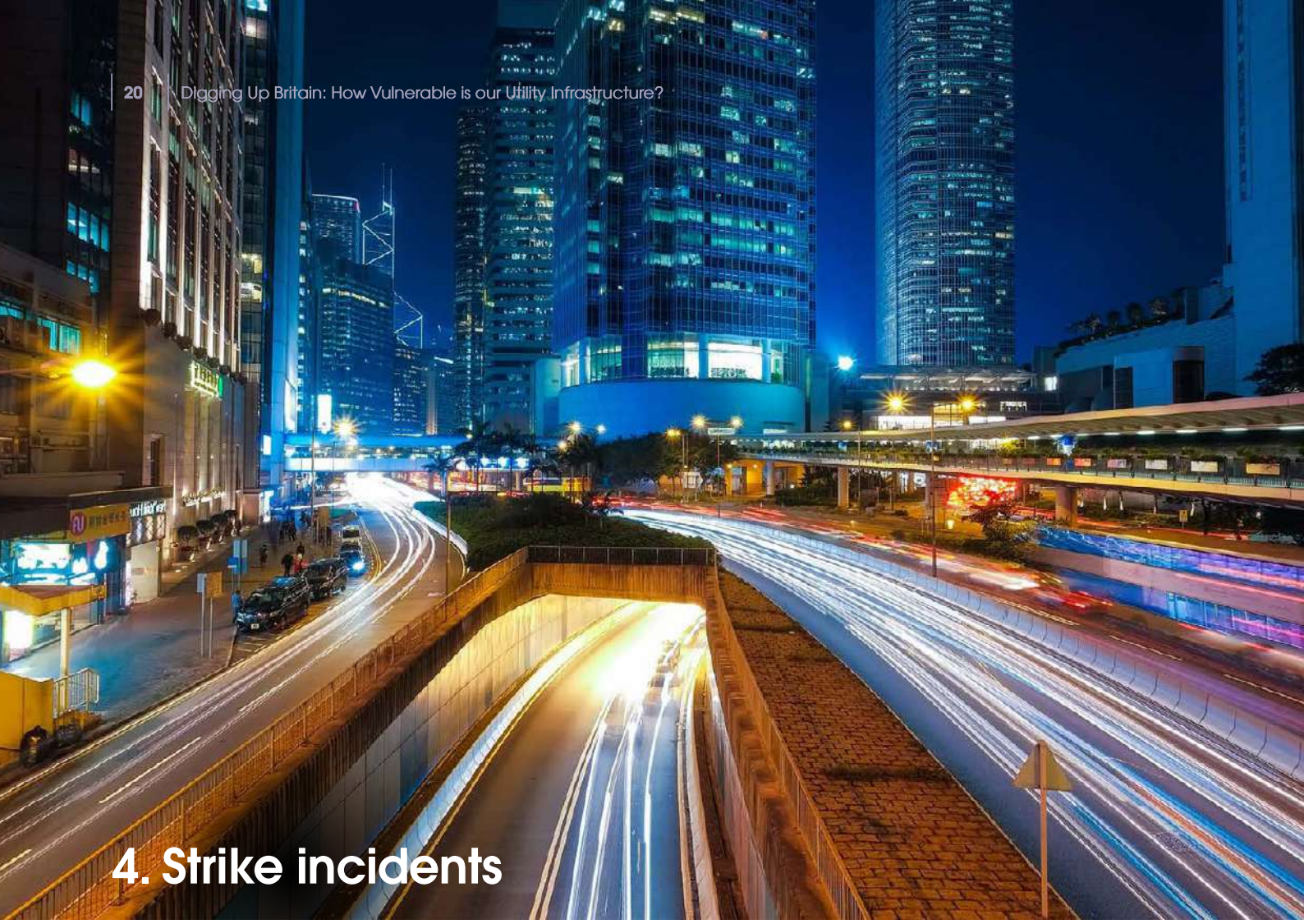
In essence, everyone benefits.

COMPARISON OF QUARTERLY ENQUIRIES RECEIVED IN COUNTY OF KENT

(area covered by UKPN and SGN)




STOP



4. Strike incidents

It is heartening that, over the course of the last five years, we can assume that well over 8 million potential underground asset strikes have been avoided thanks to the information provided by LSBUD's search facility.

In the last five years over

8m

underground asset strikes have been avoided

However, it is a sad fact that not all work sites are searched in this way and many projects are still undertaken without a clear understanding of the utility infrastructure present on the site. As a result, many entirely preventable strikes – and potential worker injuries and fatalities - occur each year.

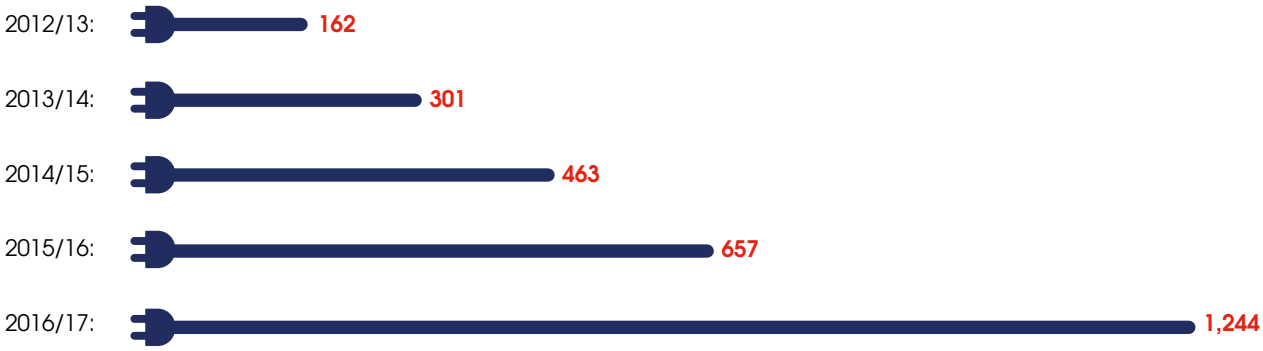
To gauge the scale of this problem, we have reviewed data from the HSE[1] which shows the number of reported underground asset strikes between 2012 and 2017. It is important to note that many more strikes or near misses are likely to have occurred but went unreported and that there may also have been inconsistency or uncertainty in the classification of incidents as some field operators are not properly aware of the reporting requirements of RIDDOR.

Looking back over the last five years, it is possible to see that the number of underground utility asset strike-related incidents reported to the HSE has grown steadily year-on-year.

[1] *Data issued by the HSE in response to Freedom of Information Request Reference No: 201711390, 21st December 2017*

REPORTED INCIDENCES OF ELECTRICAL CABLE STRIKES

The number of 'safety related electrical incidents' caused by underground cable, joint or link box damage reported under the requirements of the Electricity Safety, Quality and Continuity Regulations 2002 as reported to the HSE have risen by 668% in five years.

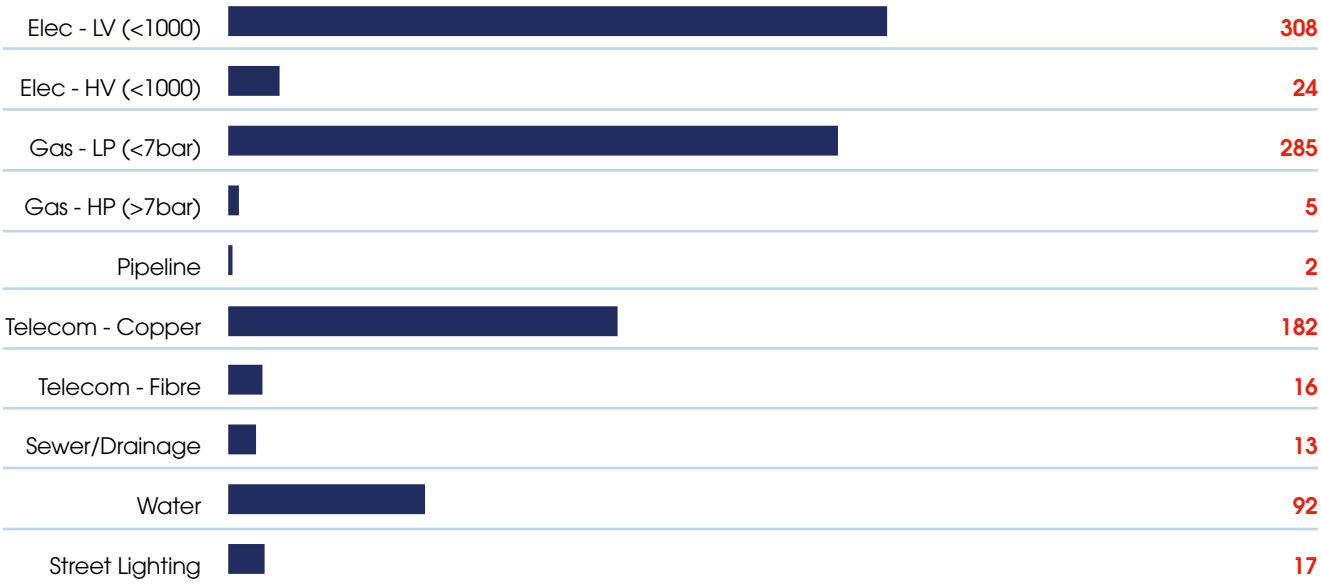


REPORTED INCIDENCES OF PIPELINE STRIKES

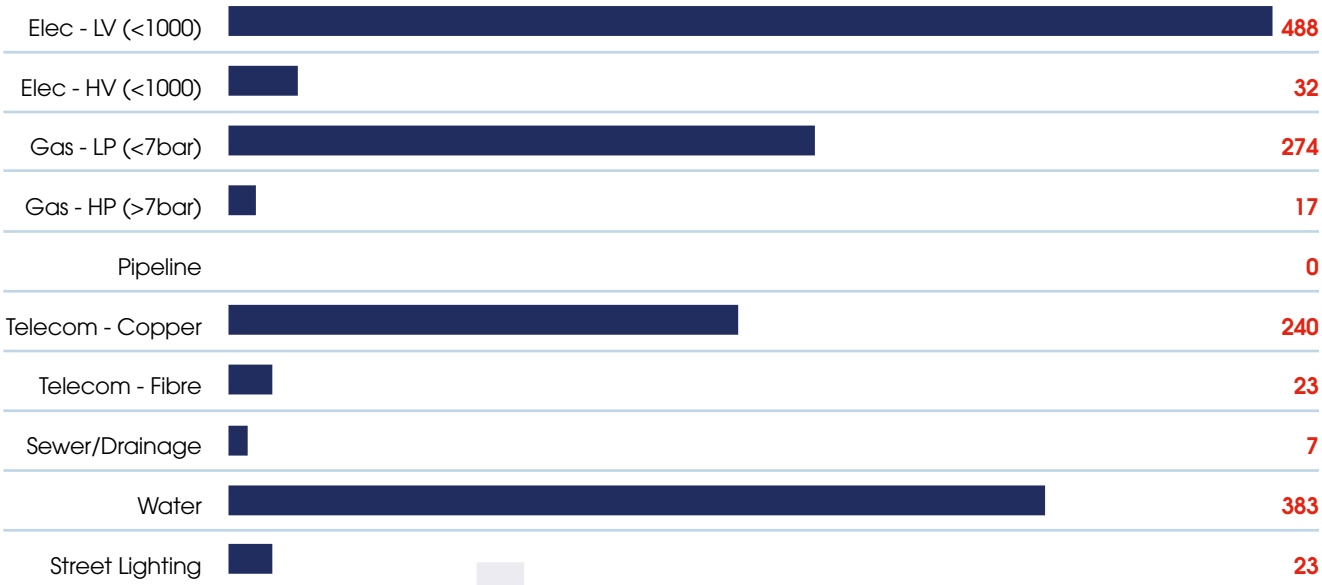
In the past five years, 6,746 incidents have been reported to the HSE involving pipelines and the escape of flammable substances liable to cause harm under the requirements of RIDDOR (The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations).

To delve deeper into the damage to assets caused by strikes, we can reference data provided by USAG – the Utility Strike Avoidance Group. USAG has analysed data provided by 32 of its members to assess the impact of asset strikes during 2015 and 2016. [1]

INCIDENTS BY ASSET DAMAGED - 2015



INCIDENTS BY ASSET DAMAGED - 2016



[1] *Data and commentary taken from USAG 2015 & 16 Utility Strike Damages Report*

During 2015 and 2016, the highest volume of strikes was against low voltage electricity cables (<1000V). These types of cable are mainly located in footpaths and are rarely identified on plans, are shallow and often difficult to locate as they don't always have a current running through them.

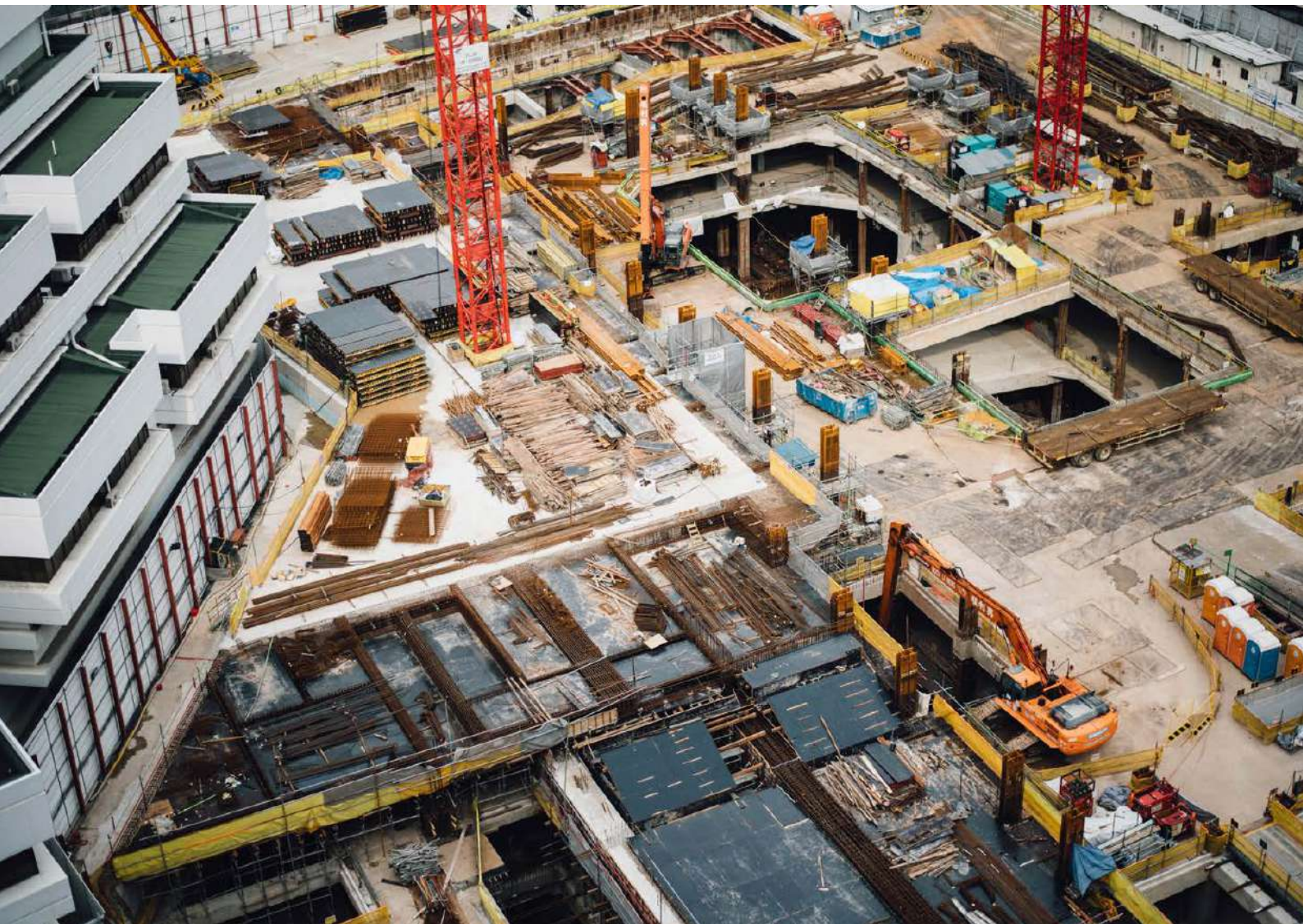
Strikes to copper and fibre telecoms networks are likely to be common due to them also being shallow and difficult to locate on site.

Low pressure gas and water pipes also showed significant volumes of strikes which is likely to be due to poorer standards of mapping and location difficulties with equipment typically used on site.

Nature of works resulting in strikes

USAG's data goes on to explore the relationship between the severity of a strike and the nature of the work being carried out. As the table below (representing data from 2015) shows, emergency and unplanned/reactive work appears more likely to result in a higher severity strike than planned work.

Incidents by nature of work	% of incidents of medium or high severity
Planned	31%
Unplanned/reactive	68%
Emergency	64%



5. Impact of strikes

Why is it so important that strikes are avoided?

HEALTH AND SAFETY OF WORKERS

Serious injuries and, in the most severe instances, fatalities can result from a cable or pipeline strike. During the period 2012 - 2017, 318 injuries (including fatalities) caused by underground electrical cable strikes were reported to the HSE and it is likely that many more strikes went unreported.

It is also important to consider the potential for more widespread harm to be caused; this is a particular risk when gas or fuel pipelines are struck.

A clear demonstration of the importance of locating underground assets is a high profile near miss that occurred in Birmingham in 2005. In a heavily populated area close to several major transport networks, workers were undertaking a gas connection but, thanks to incomplete plans, mistook a 12" multifuel pipeline for a 6" gas pipeline (which was actually located in an adjacent street) and started drilling into it. The contractors were unaware that, at the time, petrol was running through the pipe in excess of 50bar. The photo opposite, of a cut out cross section, shows how close the workers were to drilling through the pipe and causing what would have been the UK's most extreme fuel pipeline related incident. It remains a stark reminder of the importance of having site asset plans.

318

injuries caused by underground electrical cable strikes were reported to the HSE

FINANCIAL COST

The commercial cost of strikes to asset owners can be significant.

For the asset owner, strikes cause damage to assets which needs to be repaired. Associated costs to take into consideration include the additional materials and equipment required, time spent by back office staff in dealing with the incident and loss of normal operation while the pipe or cable is out of action.

For the contractors carrying out the work that led to the strike, there can be serious health and safety and legal implications. Depending on what damage is caused by the strike, the contractor could be subject to fines from the HSE and/or Environment Agency. If significant harm is caused, there could also be claims for compensation and the associated legal costs. A further knock-on impact could be an increase in the contractor's insurance premiums.

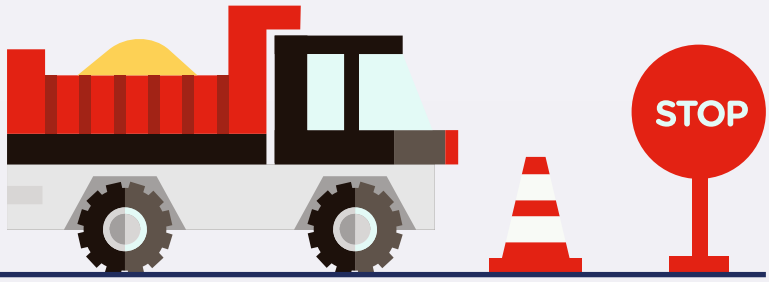
In 2017, a Tier 1 contractor was fined

£600,000

after a worker employed by one of its subcontractors was severely injured when he hit an underground electrical cable with a pneumatic drill.

In an effort to quantify the costs of a utility strike, one study used the outcomes of 16 strike case studies to identify a total cost ratio of indirect and social costs compared to the direct cost of repair as 29:1. In other words, for every £1,000 of direct cost arising from a utility strike, the true cost is actually £29,000.[1]

1 What do utility strikes really cost? by Dr Lewis Makana, Dr Nicole Metje, Prof. Ian Jefferson and Prof. Chris Rogers; University of Birmingham, School of Civil Engineering, College of Engineering and Physical Sciences; 04/01/2016

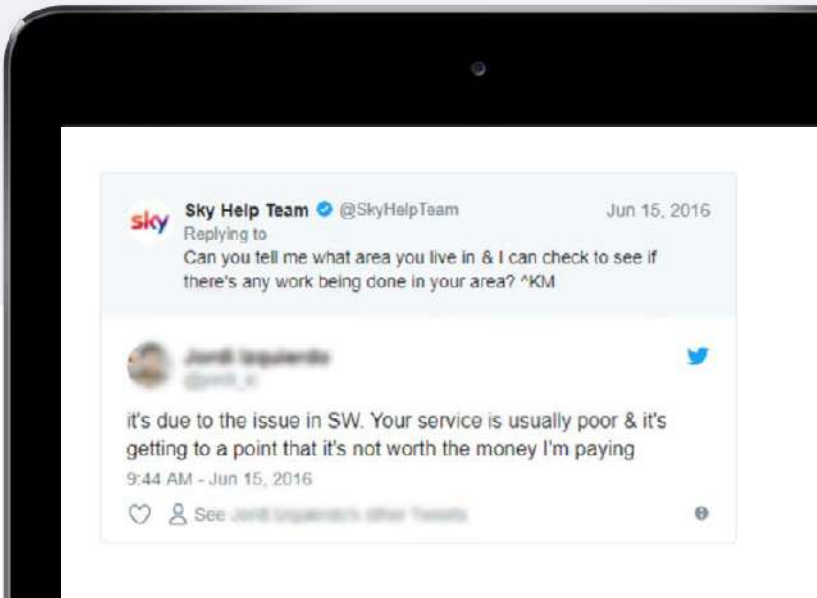


DAMAGE TO BRAND REPUTATION

Disruption of a utility service to members of the public following an asset strike is not only inconvenient but can also harm customer perception of the supplier or asset owners brand and reputation.

In July 2017, workers cut a telecoms cable in Hampshire, leaving local residents without phone or internet access for a day. Although the work was being carried out on behalf of the County Council, it was BT – the asset owner – whose brand was mentioned repeatedly in local media coverage.

In mid-2016, thousands of Londoners in six London districts lost their internet connections when a worker cut through a fibre cable. Again, it was the service providers (Virgin, Sky and BT) who suffered the consequences of the strike with customers like the one below complaining about the interrupted service.



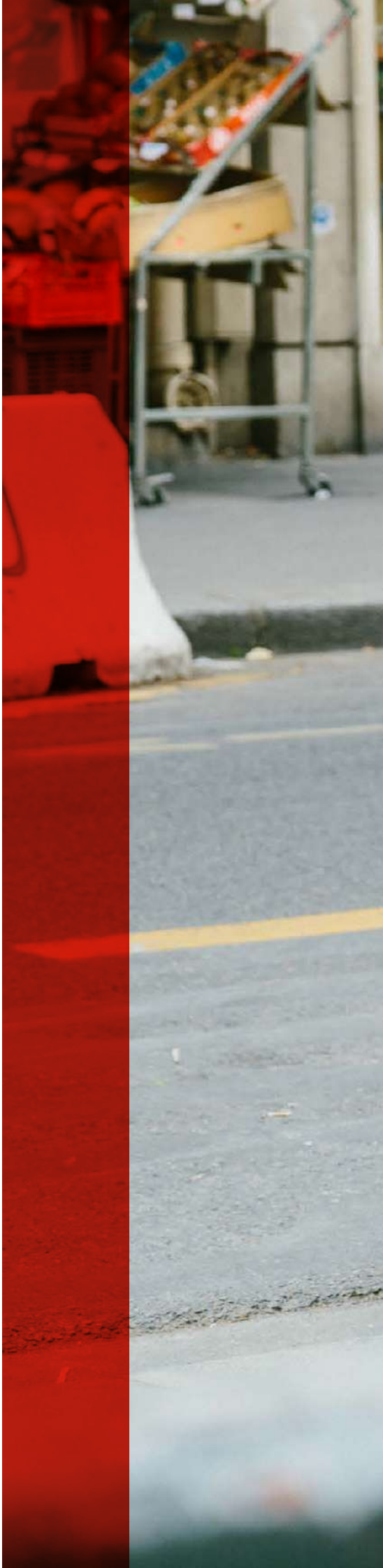
6. Conclusion

We believe that the data we have drawn together in this report builds a clear case for the need for asset searches to become standard practice for anyone planning excavation works, no matter what their nature or location.

We have demonstrated that the risk to our national network of underground infrastructure is huge and ever present – and yet improving their protection is simple. We have also highlighted the danger of asset strikes to the contractors carrying out the work, as well as the general public, and the benefits that asset protection brings to infrastructure owners.

It is now up to all of us to work together and ensure we protect our infrastructure and our people.

To find out more about becoming an LSBUD member or user, visit our website: www.linesearchbeforeudig.co.uk



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