

BEST WAYS TO MINIMISE UTILITY DEFECTS AND INFRASTRUCTURE DISRUPTION



How to reduce costs and keep both utilities
works and public traffic flowing

ABSTRACT:

This document sets out to understand the generational challenges facing utility companies, their contractors and the highway infrastructure asset owners, including increasing costs, delays to works and reputational damage.

Nearly 2.5 million roadworks every year are done by or on behalf of utility companies. This number is increasing with the need to modernise our infrastructure and the rising demand for utility services from domestic customers and businesses.

The cost of conducting works is a major factor for utility companies and their contractors, as is the compliance to complex regulation and the need to satisfy stakeholders. This is amidst moves by the government to impose fees on utility firms and hold them more accountable for congestion and poor utility reinstatement repairs that can develop into potholes or dangerous road surfaces.

The Department of Transport estimates that traffic delays caused by roadworks costs the UK economy £4.3 billion every year. They also estimate traffic levels will rise by 55% in the period from 2020 to 2040.



With every reinstatement that is carried out, utilities companies are faced with many challenges that need to be considered and overcome. It is a hard job that contractors are faced with, trying to satisfy stakeholders expectations whilst caring for the general public.



“ Public opinion surveys show that people feel strongly that utility companies are not doing enough to minimise the disruption that their works cause. The public get fed up with how often the roads are dug up, the time that’s wasted in traffic, and the resulting deterioration of the road surface as a result.

How can we change this perception that the public have of road works and workers? ”

AN E-BOOK OUTLINING:

BEST WAYS TO MINIMISE UTILITY DEFECTS AND INFRASTRUCTURE DISRUPTION

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ROADWORKS – THE HIGH COST OF INFRASTRUCTURE MAINTENANCE

Utilities companies are delivering the infrastructure that the UK needs to boost productivity, create economic growth and deliver on the government's priorities such as high-speed broadband and new homes.

Driving forward the network of water mains, drainage, gas pipes, electricity cables and telecommunications to meet the growing demand is no small feat.



Embarking on 30-year plans to upgrade a network is not an unusual situation for utilities companies. That is a lot of roads to dig up for a long time ahead in order to deliver a more reliable network that works for future generations, keeping the UK at the forefront of innovation and productivity.

TOP 10 MAJOR CHALLENGES UTILITY COMPANIES FACE:

1	Ageing Infrastructure	Networks are struggling with an asset base nearing the end of its lifetime. This makes the decision to replace or maintain more difficult.
2	Unpredictable Demand	What will the future hold and how do you plan for this? E.g. electricity demand has risen by 10% during the past decade and electric vehicles are predicted to become more common.
3	Regulatory Compliance	Utilities are subject to a complex web of constantly evolving regulations. Non-compliance results in enforcement actions and fines, not to mention the reputation damage from bad publicity.
4	Maintaining An Asset Register	Ensuring a complete up-to-date record of materials and associated assets is a substantial challenge.
5	Managing The Cost Base	Higher costs mean higher rates for customers. Maintaining existing assets and developing new ones is costly. Plus, ever-increasing regulatory changes and pressure to justify financial decision-making.
6	Minimising Restoration Time	Severe and prolonged outages can cause significant damage to reputation. Problems inevitably happen but being able to identify the location, cause and fix quickly is the challenge.
7	Environmental Change	Extreme weather has consequences. Building network resilience is a significant challenge. This requires predicting weather patterns, understanding critical network locations and identifying (and eliminating) risks.
8	Managing Customer Expectations	The negative publicity of outages can be damaging, and social media propagates bad reviews. Furthermore, customers often have unrealistic expectations about rate increases, roadworks and outage times.
9	Digitalisation	Going forward, a modern, intelligent grid will be digital. (See section on innovation and technology - pg 18).
10	An Ageing Workforce	Retirement is resulting in a shortage of qualified utility workers. More needs to be done to attract qualified professionals and graduates.



THE GROWING COST OF SUPPLY:

There are high costs associated with maintaining and driving utilities forward; from fixing the defect to the reputation damage caused by poor quality repairs and service disruption.



IMPOSED CHARGES AND FEES:

Utilities planning works must agree with the highway authority on how long it will reasonably take to complete them. If it takes longer, the highway authority may impose an 'overrun charge'. This regulation aims to incentivise utilities companies to complete the works on time to reduce disruption for motorists.

In 2018, ministers rolled out a nationwide scheme under which utilities have to pay up to £2,500 per day to carry out street works on busy roads. The charges are designed to reduce congestion and encourage companies to collaborate with each other to stop roads being disrupted multiple times.



QUALITY DEMANDS:

There are new government proposals released by the Department of Transport (DfT) that want to increase the 2-year guarantee on utility roadworks to 5-years. So, should a pothole form within five years as a result of a utility reinstatement, the company must return to repair the road surface. The DfT also propose introducing new asphalt standards to keep roads pothole-free for longer. This would mean insisting on the use of new innovative surfacing that has asphalt with a high bitumen content that is easier to compact to the required density; making it less prone to potholing.



In 2019, BT received what is thought to be one of the highest fines ever under the New Roads and Street Works Act 1991. This was for road repairs works carried out by external sub-contractor that were deemed 'shoddy' and 'put lives at risk.' The Telecom firm was prosecuted by Surrey County Council's highways team and fined £30,000 for unsafe road repairs after laying cables.

KEY ADVANTAGES OF USING PERFORMANCE ASSURED ROAD REPAIR SYSTEMS

THERE IS IMMENSE PRESSURE TO AVOID LONG PERIODS OF ROADWORKS THAT RESULT IN ROAD CLOSURES AND CONGESTION. THE TURNAROUND NEEDS TO BE HIGH QUALITY AS WELL AS SPEEDY.

The time it takes to repair the road surface needs to be kept at a minimum; this means efficiency and fast-curing materials are necessary, yet the resulting finish must be long-lasting. Companies do not want to be fined for dangerous repairs or the advent of potholes; bringing adverse publicity to their door.

This is where using performance assured road repair systems are most beneficial.



QUALITY OF ASSURANCE:

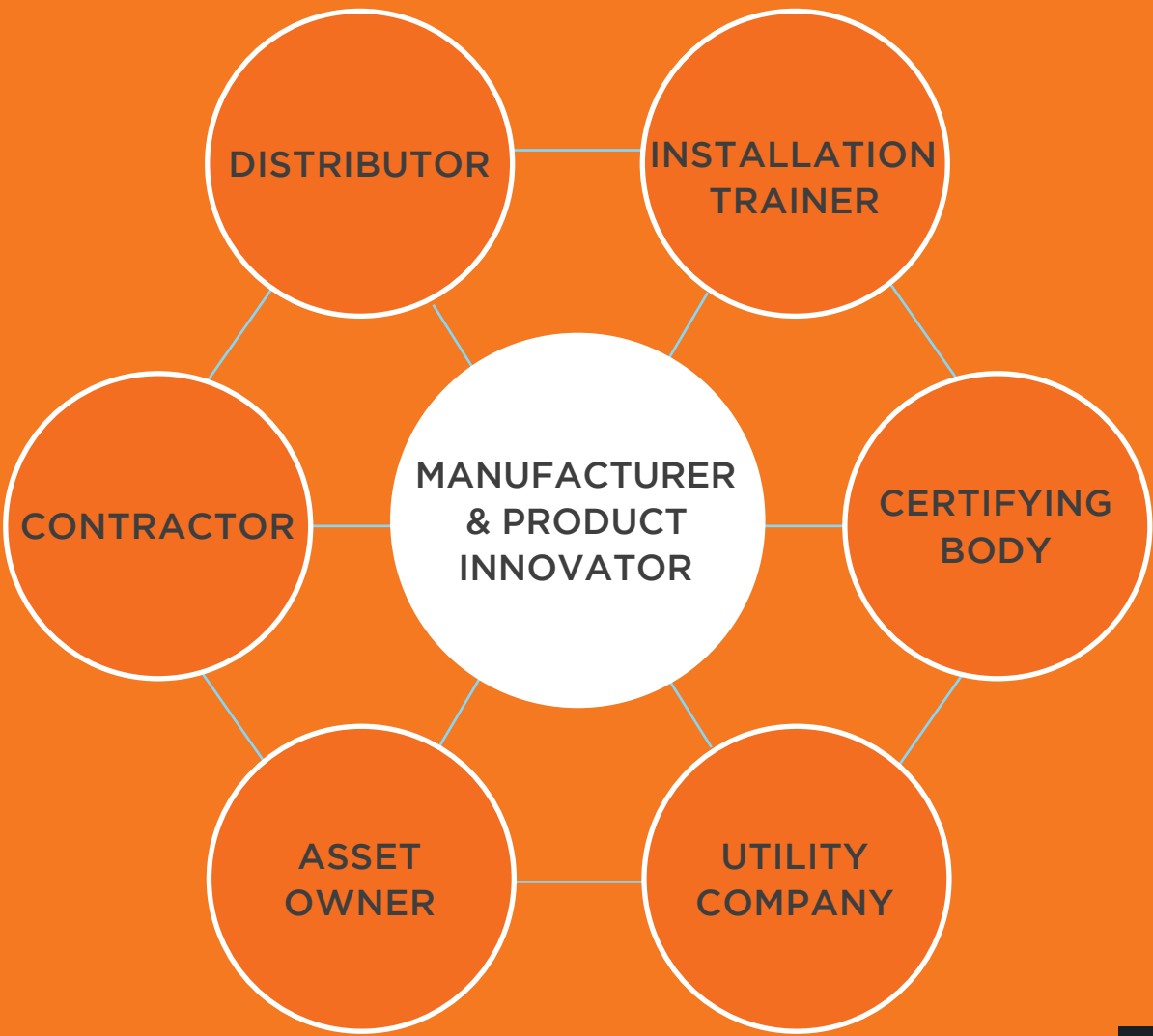
Using approved, tried and tested materials as well as reputable and experienced operators ensures a high-quality application and durable end result.



HOLISTIC APPROACH:

Find a supplier for your quality assured road repair system that understands your needs. Typically, they have a wealth of experience born out of a joined-up approach that ensures you get the right product for your needs. They can also ensure that it's applied efficiently to gain the best results by working with your installation team and providing training.

TRAINING FOR PERSONNEL IS A KEY NECESSITY, ESPECIALLY WHEN APPLYING PERFORMANCE ASSURED PRODUCTS.





COMPLETE RANGE SUPPLIERS:

Using a supplier that has researched inter-product capability and offers the complete range, will eliminate or reduce the need for multiple suppliers. In turn, this will save time, money and reduce lead times. Using products or systems from this kind of source will ensure that all ancillary and complimentary products will provide a holistic, solid result for reinstatement.

The following are materials that form the reinstatement montage:

POTHOLE REPAIR:

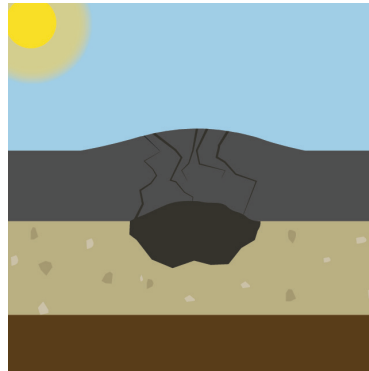
WHAT CAUSES POTHOLES?

An important aspect when aiming to beat potholes is understanding what most commonly causes them. While potholes are easily identifiable by sight, it is the activity below the surface that results in this failure in asphalt. Potholes are normally caused by the expansion and contraction of water that has entered the ground underneath the road surface: See illustration overleaf for more detail.

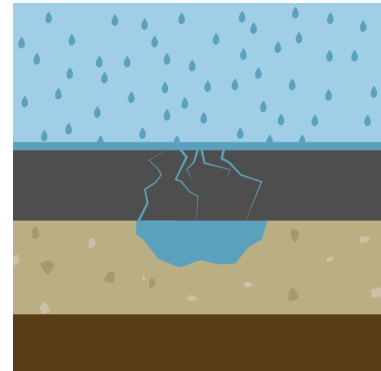




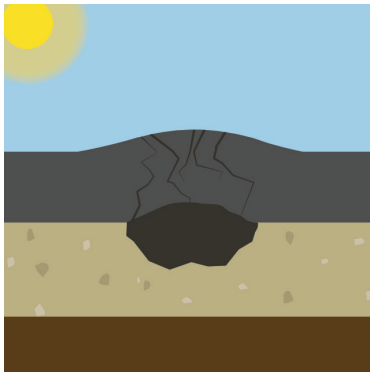
Cracks are formed in road through repeated traffic loading & utility cuts.



Water seeps through the cracks due to rainfall, softening the sub-base.



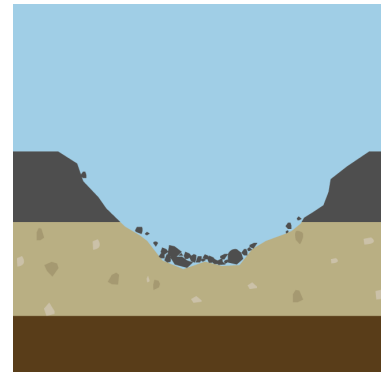
Water collects under the road, freezes and expands, forcing up the road surface.



Ice melts and eventually dries up over time, creating a gap underneath the road.



Weight of traffic collapses the road surface into the gap forming the pothole.



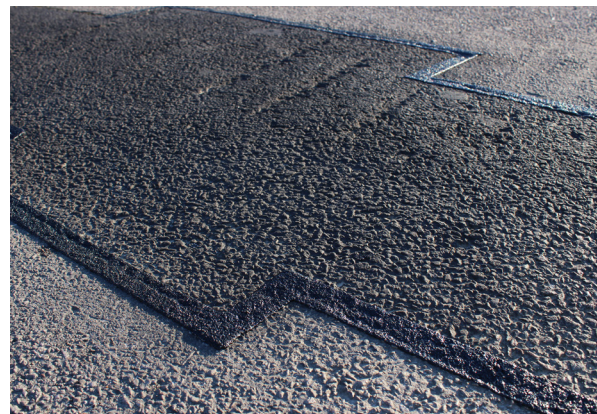
Where the surface has collapsed, repeated wear from traffic and freeze-thaw expands the hole.

CRACK REPAIR AND JOINT OVERBANDING:

To prevent a pothole from forming, you need to ensure no water is able to enter into any cracks or joints in the road surface; this can be done through the use of overbanding.

Preformed thermoplastic tape, bitumen and cold-plastic MMA systems are all popular products used for overbanding, as they provide a good skid-resistance and waterproof seal.

Overbanding products are laid over the crack to create a strong seal, preventing water ingress and surface deterioration.



CRACK INFILL:

A crack infill material can also be applied if there is an appreciable gap. Cold plastic MMA or bitumen products can be poured into the crack rather than laid over the top, therefore 'filling' the crack.

Highly durable MMA cold plastic is the optimal option for crack infill and overbanding. This is an easy application with very fast curing and high anti-skid properties for maximum efficiency.

WATER DRAINAGE:

Water getting below the road's surface causes potholes to form. Ensuring there is suitable and enough drainage systems surrounding the surface helps prevent this.

FILLING IN POTHOLES:

Potholes can be 'filled in' using temporary or permanent solutions.

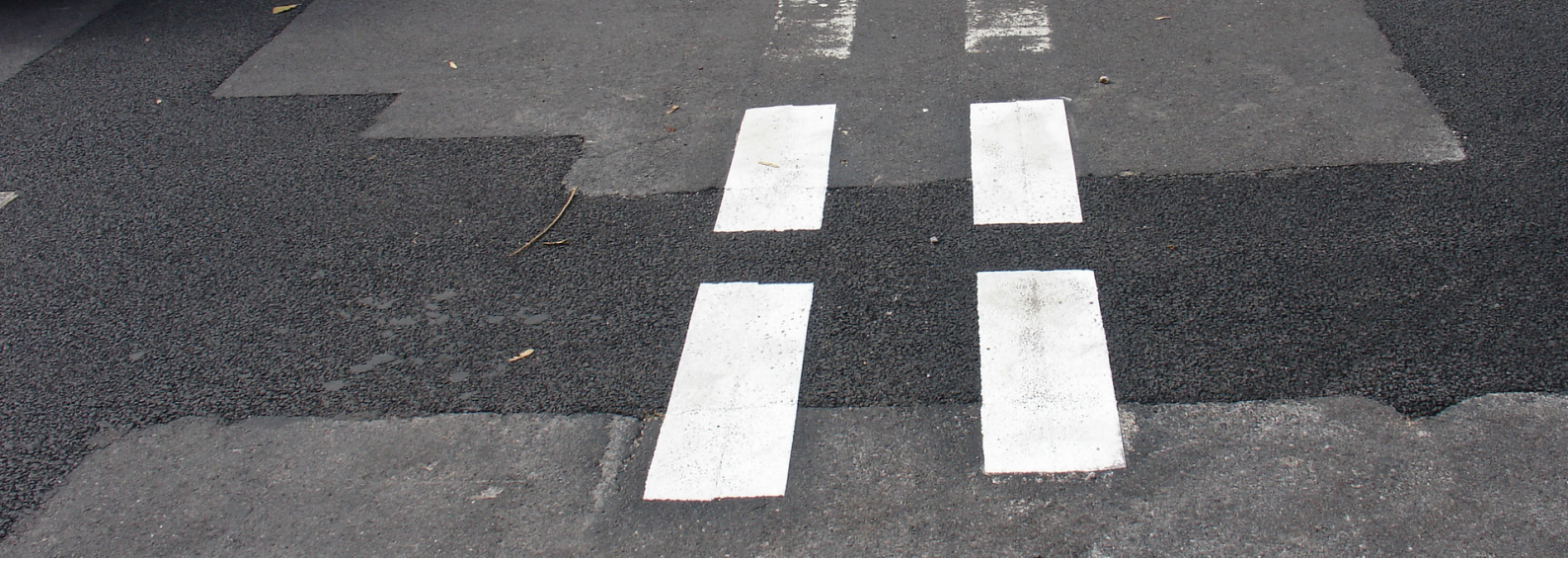
Cold-lay material is gradually layered into the pothole, being compacted down either by hand tamping or mechanical compactor after each layer. This creates a durable new surface that can be opened to traffic immediately after the job is finished.

There are permanent cold-lay options that ensure fast highway repairs to reduce road disruption.

Hot-work patch material is a permanent repair option that is designed to be extremely durable. It is heated and compressed with machinery, yet once it cools and hardens, it solidifies its bond with the surrounding area's asphalt.

For best result, look for performance assured repair solutions which can include certifications like **BBA**, **MPA**, **HAPAS**, and **PTS PAS**.





PREFORMED MARKINGS:

When repairing the road surface, sometimes it is necessary to re-lay removed surface markings. Preformed thermoplastic is an ideal solution for this. It is an easily laid, durable line marking product, meets highway standards and is an economic way of re-installing short runs.

ANTI-SKID REINSTATEMENT:

Once new tarmacadam has been applied, it is recommended to add a base primer to the surface before the anti-skid. This seals off the freshly laid tarmac and increases the durability of the repair, reducing the risk of future damage.

Anti-skid solutions deliver textured, slip-resistant coatings for zones where the highest durability is needed, and user safety is key. They can be procured as a self-contained kit that includes everything you need for a patch reinstatement application up to 10m². These systems are often a polyurethane (PU) resin system with broadcast aggregate; Other cost effective systems like preformed thermoplastic burn down pads with broadcast aggregate can be used. These are used more for smaller patch repairs that don't warrant the likely waste of large more expensive kits.



When a faster cure/traffic time is required, then the slightly more expensive methyl methacrylate (MMA) system can be used.

Anti-skid MMA bonded systems are best for areas where high stress and hard wearing is of high importance. Being MMA, it has excellent adhesion, very high durability and is fast, simple and easy to apply.

IRONWORK AND CONCRETE REPAIRS:

- There are many areas of concrete repair to focus on in the highways industry. In almost every situation the repair needs to be easy to process, fast-setting and extremely durable.
- It's not acceptable to use standard Portland cement and sand mix for these repairs, especially when repairing ironworks. This is due to the fact that standard cement doesn't compensate for shrinkage and inevitably leads to further defects. Cement mixes that have been specially engineered, boast an extremely high bond or 'grab strength', giving the repair a much longer lifespan.
- Concrete can be repaired using high-quality, easy to process, fast-setting repair mortar. It is qualified for general concrete repair and ideal when rapid strength, durability and low shrinkage is required.



IRONWORK REPAIR MORTARS:

Failing bedding mortars and backfill concretes for manhole ironworks is a continuous problem, on and off highways, resulting in unsafe and disruptive road surfaces.

Bedding mortars need to cure fast but also remain workable long enough to get the ironwork placed properly. These systems need to reach 20N/mm² compressive strength within 2 hours before opening to traffic. This also applies to concretes used for backfilling ironworks.

The majority of products used to reinstate or install ironworks are a specialist water based cementitious system. On many busy strategic networks and other heavily trafficked roads, it is a standard requirement to use a **HA104** approved material. **HA104** systems are generally formulated from water-based polyester technology that can achieve a strength of 40N/mm² within 3 hours. These bedding mortar systems are available as a trowel or flowable option, provide an incredible bond to ironworks and can be guaranteed to a much higher level.



BITUMEN SEALER:

Bitumen sealers are used to enhance the bond on vertical joint faces between new and existing tarmacadam surfaces.



A premium performance aerosol edge sealant is a handy product often used for bonding utility reinstatement cuts. For larger resurfacing applications, pourable and brush-on variations are used. These systems are specially formulated using flexible bitumen for long lasting results.

BITUMEN CLEANERS:

When working on site, tools and equipment often get neglected and dirty. There are solutions available where you can pre-treat equipment prior to use making it extremely easy to remove bitumen and the like after application. These same solutions can be used on untreated equipment to break down the bitumen and reinstate to nearly new condition.





INNOVATION AND TECHNOLOGY:

Although as a whole the reinstatement industry tends to be slightly behind others, there are certain technologies and innovation which are very advanced.

REMOTE REPAIR ROBOTS:

Wessex Water carries out 60,000 works on the road each year and uses robots to repair pipes underground allowing them to complete water and sewerage repairs quicker than ever before without needing to dig long trenches in the road.



REMOTE REPAIR ROBOTS: cont

The government has invested £26.6m into a similar project which they hope will put an end to the disruption caused by 1.5 million road excavations that take place every year across the UK. These robots are about 1cm in size and they are able to fly, swim and crawl through pipes used for water, gas and sewage. They enter through remote entry points and have the means to conduct repairs, general maintenance and inspections.

These robotic installations are highly mobile, safe and fast in highly sensitive areas where they may be subjected to potentially volatile and hazardous situations.

(Source: www.gov.uk)

DIGITAL GRID – POWERING THE FUTURE:

The digital grid is the digitalisation of electricity, gas and water networks using advanced technology. It allows for two-way communication between the utility and the network, including its customers, and enables insight, automation and control across the utilities' operations, empowering them to improve reliability, availability and efficiency of the grid.

Digital asset management, smart grid technologies and the Internet of Things are likely to play a large part in this process. This immediate insight across all the networks will enable identification of faults and their exact location to be accurately pinpointed for resolution.

SELF-REPAIRING POTHOLES:

Freedom of Information requests to local authorities by The Insurance Emporium revealed that reports of potholes are running at a million a year – that is almost two per minute.

It is estimated that it would cost England a massive £11.8 billion to repair its roads and it would take 14 years to complete.

Experts say that potholes could be ‘self-repairing’ in the next 30 years. By 2050, we may not have roads being dug up or temporary traffic lights; our infrastructure will learn how to repair itself.

- **Infrared preheating:**

This improves the bond between the road and the repair, reducing the need for repairs. Targeted and proactive road repairs in Blackpool costing £30m are expected to save £100m over 20 years – partly by cutting claims for personal injury.

- **Drones for preventative maintenance:**

A reconnaissance drone is used to identify and prioritise the cracks that need to be fixed. It then sends the location details to a second drone, equipped with a 3D printer which fabricates a seal to repair the road.

- **Surge in autonomous vehicles:**

Giant corporations such as Uber and Google may create a network of privately-operated pothole-free toll roads to protect their valuable fleets of self-driving cars.



CHANGING ROAD COMPOSITION:

Epoxy asphalt is not new but it's potential as a surfacing material for long life roads – lasting 30 years and more – is now deemed to be high. It is stiffer and more resistant to rutting, low temperature cracking, surface abrasion and fatigue. It is also less susceptible to water-induced degradation which creates potholes.

There are also new sealants being introduced that are designed to extend the life and rejuvenate old bitumen. Similarly, innovative chemical-based preservatives are arriving which will extend the life of asphalt by up to six years.

In parts of the world, asphalt-based roads are being replaced by environmentally friendly, organic resin-based roads such as Eco-Pave. Road surface manufacturers are investigating the possibility of using recycled plastics in road construction. It is proposed that waste plastic can have the performance enhancing effect achieved by expensive polymer-modified bitumen when added to asphalt mixtures.

There are also a number of projects underway to develop energy from our roads such as solar power panelled roads and piezoelectric. In the latter, piezoelectric crystals generate energy from the vibrations that vehicles give off as they drive along the road.



ENVIRONMENTAL CHANGE:

THE EFFECTS OF CLIMATE CHANGE ON ROADS, HIGHWAYS AND PAVEMENTS.

Highways are designed based on historic climate, however these designs could be open to failure due to different climate estimated in the very near future. The cost of not taking these changes into consideration could be vast, for highways owners and authorities, with a huge impact on traffic and public safety.

A change in climate will influence the most cost-effective method of carrying out highway maintenance. Climate change can both increase deterioration rates, necessitating more routine and structural maintenance, and more severe damage through increased frequency of extreme events.



In the report “The Changing Climate: Impact on the Department for Transport” (DfT, 2004) the key implications of climate change for highway maintenance were identified as:

- Increased risk of flooding from rivers, seas and inadequate drainage
- Deterioration and damage to highway structures from subsidence, heave and high temperatures
- Damages to structures from high winds
- Increased road safety problems as a result of adverse driving conditions and deterioration of infrastructure
- Effects on the management of trees, landscapes and biodiversity.

The London Climate Change Partnership (2006) also listed other potential impacts. These are

- Carriageway rutting
- Embankment subsidence
- Deterioration of concrete
- Problems with expansion joints
- Increase in dust levels
- Reduction in skid resistance
- Increased surface potholes

These factors are interlinked, for example greater traffic damage will occur to a surface when it is wet. Similarly, high temperatures and large volumes of heavy traffic may not be sufficient separately to cause significant damage, but when experienced together may result in deformation. Other problems such as diesel spills may only cause problems when certain climate conditions such as elevated temperatures exist.

INCREASED RAINFALL AND FLOODING:

Highway drainage is repeatedly found to be incapable of coping with more prolonged and heavy rainfall not only resulting in increased flooding, but also deterioration of the pavement structure.

More frequent extremes give a sample of what may be normal within the next 40 to 50 years. By preparing for the future climate there is a chance of reducing this cost.



IMPACTS OF FLOODING AND HEAVY RAINFALL:

CRACKING:

With flooding comes a string of disadvantages. The network including the surface structures suffers drastically. Some of the common road damages after flooding is cracking, striping and destabilisation.

Block cracking is an interconnected series of cracks that divides the pavement into irregular pieces. When the underlying soils water content becomes overloaded during flooding, the sub-grade soil structure under the road will be weakened and unable to accommodate the load.

IMPACTS OF FLOODING AND HEAVY RAINFALL: cont

Edge cracking typically starts as curved shapes at the edge of the pavement. They will expand from the edge and this type of cracking is resulted from lack of support in the road shoulder which is usually due to erosion and excess moisture.

DE-LAMINATING:

De-laminating tends to begin at the base of the susceptible asphalt layer, because that is where the water is retained, and is usually well advanced before there are any visible signs on the surface. De-laminating can lead to localised areas of deterioration and eventually total disintegration of the asphalt layer.



SURFACE DETERIORATION FROM WET:

In some cases, but not so commonly in the UK, excess flooding can destabilise the structure of the surface. This is where the sub-soil becomes over saturated and then starts to wash away. Over time with repeated heavy rainfall, the sub-surface will continue to erode until the top surface either slumps or caves in, causing sink holes, huge rutting and potholes entailing extensive costs to repair and make good.

EXTREME TEMPERATURES:

A number of reports have highlighted the need for guidance on adapting UK highways to the future climate, both to prevent disruption to the public and decrease local authority maintenance costs.

The climate often interacts with other factors which further influence deterioration, for example, heavy traffic and extreme temperatures combined, cause more severe rutting, cracking, deterioration of surfaces and anti-skid and increased potholes.



IMPACTS ON ROADS FROM EXTREME TEMPERATURES:

RUTTING:

Surface ruts are expected to develop quicker with higher temperatures particularly with asphalt surfaces. Rutting is caused when temperatures rise dramatically, heating the surface and making the surface less durable and more susceptible to damaged. When trafficked with Heavy Goods Vehicles (HGVs) the top surface gets squeezed/ pushed aside by the weight of the vehicle thus forming a rut. Water can collect in these ruts and increase the risk of hydroplaning and incidents

CRACKING:

Hotter weather will speed up the oxidation process and make the material more vulnerable to cracking and cooler temperatures will generate thermal tensile stresses that can cause crack initiation and propagation.

Cracks occur when the tensile stress and related strain induced by traffic and/or temperature variations exceed the breaking strength of the mixture. At elevated temperatures, stress relaxation will prevent these stresses reaching a level that can cause cracking. While at low temperatures, the tensile condition will persist and, therefore pavement cracking will be more probable.

ANTI-SKID DETERIORATION:

Skid resistance decreases over time with age and wear. It is also drastically influenced by climate parameters such as rainfall and temperature. Statistics suggests that about 8% of the total number of incidents in dry weather conditions involve skidding and for wet weather it increases to 27%.

IMPACTS ON ROADS FROM EXTREME TEMPERATURES:

POTHOLE DAMAGE:

As mentioned earlier in this document on page 12 & 13, water that has entered the pavement is subject to the process of freezing and thawing during the winter. The water expands when frozen and shrinks when melted generating tensile stress in the pavement. This can create cracks which propagate through the structure with each freeze-thaw cycle.

Frost heave will occur if the construction material absorbs water, so good drainage helps to prevent frost heave.

In addition, freezing draws up water from the sub-base, increasing the amount of water in the surface. Freezing of a surface takes place from the surface downwards, drawing water up from lower levels. Layers of ice form causing the road to expand upwards, i.e. "heave".

As this process repeats through the winter, and whilst still being heavily trafficked, the top surface slowly breaks away causing the pothole to form, and then increase in size.

CONCLUSION AND NEXT STEPS:

The management of utilities works has an ever-changing landscape to contend with perpetuated with increasing demands from the government and the public.

Using performance assured road repair systems, minimises any uncertainty, ensuring time and cost saving. The roadworks will be completed quickly and efficiently as well as being sustainable for the longer term.

The discerning highways asset owner should insist on performance assured products installed by qualified and trained contractors. In turn, this will save costs and enhance reputation not only for the highways body, but for Local authorities, utility companies and contractors alike.

“To begin enhancing your business and utilising approved road repair systems, seek advice as to what you need, and find yourself a reputable supplier of certified materials who can also support the installation by providing training to ensure a seamless quality of works. ”

ABOUT MEON:

Meon are a provider of quality surface repair and reinstatement materials and systems. Meon offers a wide range of high durable, easy to apply products with the support to back it up.

Meon can help, advise and supply the majority of systems and processes discussed in this document and carry out on-site demonstration and training.

Contact Phil Spencer for further information about the surface repair and reinstatement.

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Phil has been involved in the utilities and reinstatement sector for over 15 years. It is a area and market that he is deeply interested in and passionate about. Connect with Phil today on LinkedIn to discuss anything you may have found of interest in this document.



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