



The Essex Highways Asset Management Strategic Approach to ‘Reallocated HS2 Funding’:

Innovation, road safety, risk-based lifecycle planning and whole life costing, environmental sustainability, and ‘levelling up’.

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Innovation: Road Safety, 'Safe Systems' initiative

ECC 'Safe Systems' initiative is applied to all schemes in the highway where appropriate, including programmed maintenance, to identify opportunities to complement works with minor changes to improve road safety, in support of 'Vision Zero'.

Vision Zero is the aspiration that there should be no deaths or serious injuries on the roads by 2040. Vision Zero is the ethical position that deaths and serious injuries are not an acceptable consequence of human error on public roads.

Within the boundary of the traffic management that will be required for every scheme that is selected for road surface treatment, the road safety team will identify relatively minor infrastructure improvements that will reduce risk for all road user types. For example, these improvements may include repairing, removing, or relocating signs and their associated lighting units, or making them passively safe. Minor infrastructure improvements may also include removing or relocating pedestrian guard railing, reviewing white lining with a view to bringing them up to standard or making layouts more effective, and reviewing the design of any central islands with the focus of road safety.

This innovative approach will seek to ensure that risk reduction measures also reduce future maintenance requirements and associated costs. It will also seek to reduce energy costs where possible. For example, this will be achieved by eliminating or reducing the need for replacement signs and lighting units, which will accordingly reduce the volume of required maintenance inspections and asset replacement works. This will not only reduce road safety risk, but through improvement to asset service lives, will have a positive impact on routine maintenance costs and energy costs as well as reduce carbon emissions costs.

Innovation: Road Resurfacing

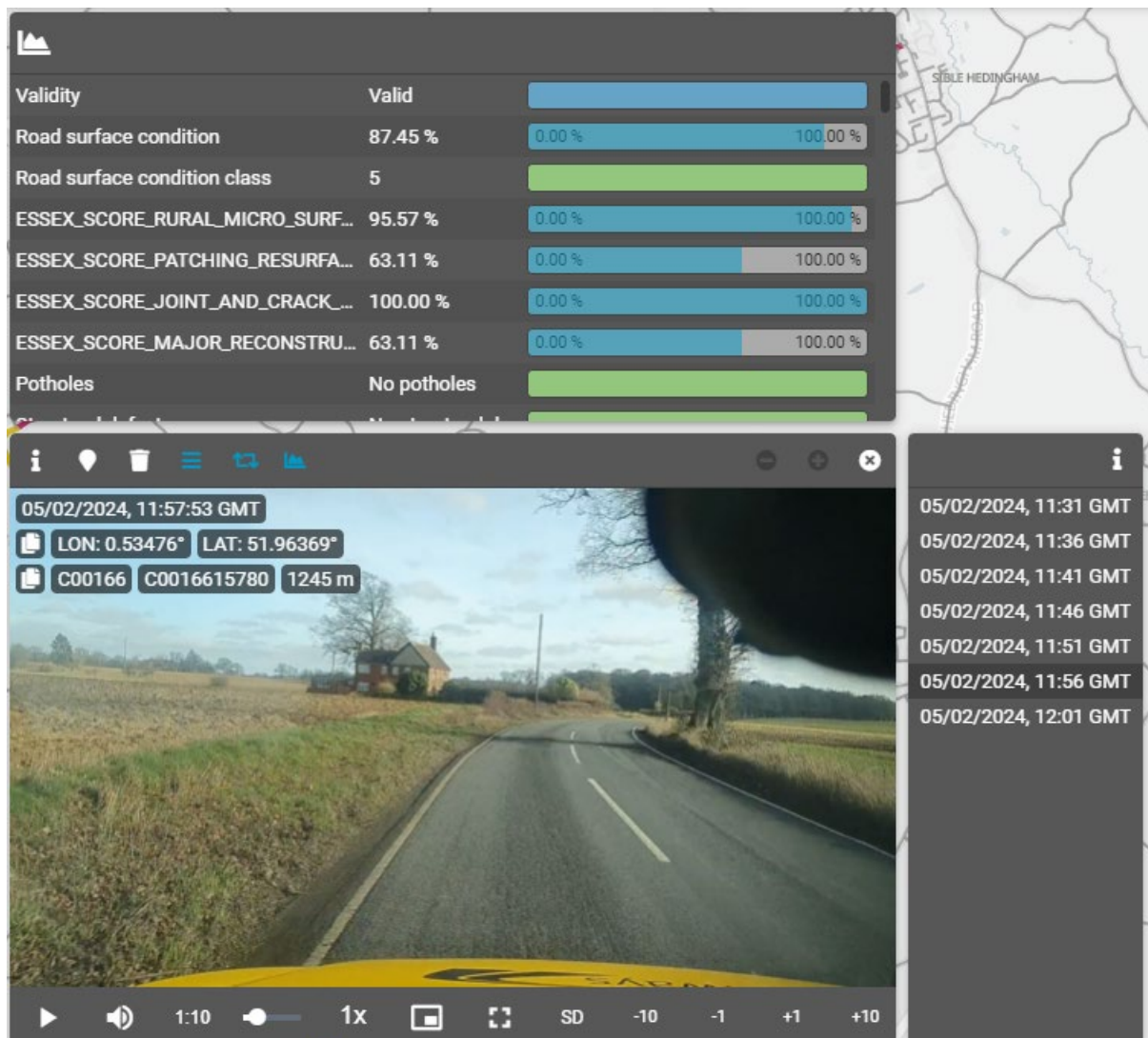
Oxidisation of bituminous road surfaces (exposure to the air over time) causes them to become brittle and crack. This allows the ingress of water which, through the action of traffic, creates delamination of the road surface layers, which creates potholes, especially during the freeze/thaw action over winter months. Defects such as potholes can be repaired using localised repairs for the area in question.

Roads in declining structural condition (overall condition of all layers including base layers) can be more susceptible to localised defects. Resurfacing roads restores their structural integrity, enhances their service life (durability), and makes them more resilient to the recurrence of localised defects.

Essex Highways is developing innovative ways of identifying road sites of declining structural condition that are suitable for road resurfacing:

Innovation: Artificial Intelligence (AI)

Rapid changes within the road condition assessment industry, have provided new, emerging technologies, such as artificial intelligence (AI). This enables automated recording, identifying, interpreting, and reporting of road defects, as well as identification and collection of inventory and other information. This is carried out by simply attaching a smart phone loaded with AI software, to the windshield of a vehicle, so the phone can record the surface of the road ahead.



Essex Highways has been using AI for several years, and investigations into the potential benefits of AI assessment are ongoing. For example, recently Essex Highways has been working successfully with an AI service provider to develop use of their software to automate the identification of sites requiring specific types of structural maintenance treatments, such as Surface Dressing, Micro Surfacing and Machine Surfacing.

This automated identification of prospective structural treatment sites was achieved through reference to the types of defects that could be automatically identified by the software, that are associated with each of the structural treatments in question. Specific settings within the software were then implemented to generate viable locations.

These potential sites for treatments are used to direct on-site investigations by our pavement engineers, so they can verify the accuracy of the defect information as well as verify or amend the treatment suggested by the software. Early results are very promising and will continue to be developed. The use of artificial intelligence in this way is recognised by the DfT, which is currently working with Local Authorities and software providers, to identify new national standard options for automated, road condition methodologies. Currently, SCANNER road condition assessment is the only officially recognised, automated road condition assessment process.

SCANNER is a long established, national standard process for measuring the condition of roads. This assessment process is undertaken by vehicles that carry out high speed electronic data acquisition and recording of road surface conditions, including automatic recognition of surface cracking. The Council has been undertaking SCANNER road condition surveys for nearly twenty years.

The SCANNER survey focuses on the types of defects which indicate the structural condition of the road, to identify where road resurfacing should be considered, rather than the identification of localised defects such as potholes which are recorded during routine highway safety inspections. However, localised defects do provide valuable road condition information, and every road in Essex is subject to at least one safety inspection annually; those roads of higher strategic importance are inspected at a greater frequency.

The SCANNER information enables structural maintenance works such as road resurfacing to be identified and prioritised. It also enables the calculation of national standard, road condition performance indicators to be calculated and compared with those of other Local Authorities. Comparison of performance with other Local Authorities is called Benchmarking, and it is a useful way of identifying if the asset management implemented by Essex is resulting in good value for money. For more information, refer to the Asset Management Performance Management Framework.

Innovation: Artificial Intelligence (AI) identifies defective road lining and markings

Artificial Intelligence condition assessment is being used to identify worn road lining and markings, as supplementary condition information to the defects recorded during the highway inspectors' routine, safety inspections, and as a means of collecting inventory information.

The AI information for road lining has been categorised according to its condition (it's level of defectiveness) and exported as a map layer showing the different condition categories as different coloured roads. This colour coded road lining map will be overlaid with a normal route map layer, so that the sections of road where road lining needs repair can be readily identified visually and geospatially and included in a capital programme for maintenance works.

Innovation: Artificial Intelligence (AI) for Highways Safety Inspections

Between 1,600km and 2,000km of Highway Safety Inspections are driven each month by Essex Highways Inspectors. The current AI software was originally procured for road condition assessment and is not optimised for virtual re-inspections, i.e. creating a digital, video-based route view allowing an inspector to re-inspect the network without re-visiting the site. However, AI was implemented for driven inspections due to a Covid requirement, where double driven inspections (driver and separate observer) were not possible during the pandemic. The use of AI for this service also created financial savings by removing the need for one of the operatives for driven inspections.

For this digital innovation, Essex Highways received highly commended in the Highways Magazine awards. Essex Highways remains committed to working smarter and pulling through innovation into service, particularly where it can add value, realise cost savings and work towards reducing negative impact on the environment.

Innovation: Review of current AI system for Safety Inspections

While the adoption of AI for road inspections was successful, Highway Inspectors spend more time reviewing electronic footage of a driven survey than driving the route. In addition, there is no electronic data interface between the current AI software and the Confirm Asset Management System where inspections defects are recorded and referenced for works programming.

The pace of development of AI software, with other suppliers entering the market, enabled a review of the current AI process to be undertaken in October 2023. Nine different AI service providers were identified, and their services reviewed, with the primary objective of identifying software that could deliver an inspections service similar to the current AI but reduce the inspector's driven inspection review time. The review included other objectives, such as to improve quality assurance, sustain a data interface with our Confirm asset management system, and possibly provide additional functionality. It was decided that the review process would focus on service provision relating to Highways Safety Inspections, rather than structural road condition assessment, however, to ensure the requirements of the inspector were prioritised. This did not preclude the use of the system for road condition assessment if it were available, however.

This review process identified a suitable service provided by a company called 'Route Reports', whose software is now being trialled by Essex Highways. It uses a dedicated camera fitted to the windscreen of a vehicle, and records information from the road ahead, but it holds static images, not video. It can detect and measure the dimensions of a carriageway defect and can make information available in an appropriate timescale.

This service has the potential to reduce the current AI inspector review time. It can also sustain a data interface with our Confirm asset management system. This will enable the downloading of a localised defect data set that could be used for value management (prioritisation) to rank prospective structural maintenance sites based on the number of localised defects present for each site in question. This would not only remove the localised defects in the proposed structural maintenance works but would also make the road more resilient to the occurrence of potholes.

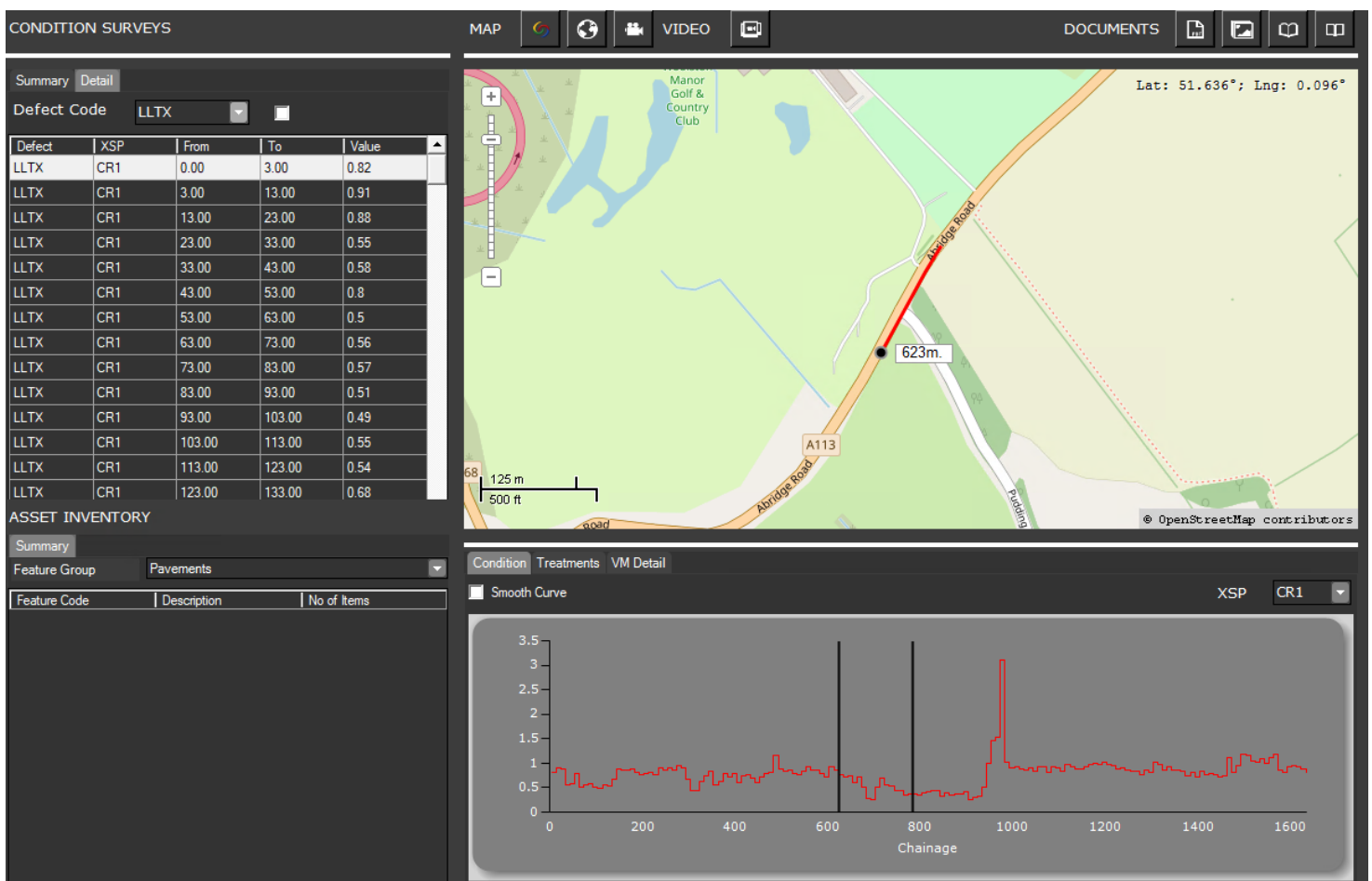
'Route Report' does not currently produce structural road condition assessment information, but the software provider may develop this functionality in due course.

Innovation: improved data processing using 'Expert Assets' (XA)

Road resurfacing requires forward planning and, in some cases, detailed design as part of preparations. There are comparatively limited resources within the industry in terms of machinery, materials and specialist operatives needed for such works delivery, therefore works are programmed ahead to obtain appropriate timing and economies of scale at favourable rates.

In addition to the implementation of AI road condition assessment, Essex Highways has also implemented a new asset management system called 'Expert Assets' (XA) which provides new opportunities through improved data processing.

The XA system not only processes data to generate prospective maintenance sites but enables prioritisation of sites through flexible Value Management (prioritisation) processes. The Value Management process allows the inclusion of other data sets with the formal road condition assessment data, such as localised defects recorded through the routine highway safety inspections, or any other data set designed to promote a specific maintenance initiative. The Value Management can be tailored and weighted to identify the scenario which best reflects the Council's strategic priorities. All prospective maintenance sites are subject to a site inspection by a pavement engineer, to review the condition characteristics and verify the treatment requirements. The outcomes of these processes are a 3-year forward capital road resurfacing works programme, updated annually. The screen shot below provides an example of how texture data from SCANNER road condition assessment, can be reviewed for a candidate maintenance site.



Innovation: Developing XA functionality

The XA system not only generates prospective maintenance sites but can also be used for lifecycle planning and whole life costing, to implement a plan to minimise treatment costs over the whole life of an asset. It can also project future road condition based on identified deterioration rates and proposed treatments and investment levels. This facilitates treatment strategies designed to intervene at the optimum time, to ensure value for money and to assist with predicting the investment levels and types of treatment required for road maintenance in future years.

Considerable knowledge and expertise have already been developed in the interpretation and use of road condition assessment data through the functionality of XA, and improvements are ongoing.

Innovation: Road Resurfacing - Trial Use of Gipave (Graphene)

Essex Highways has a long-established Technical Working Group whose role is to update current specifications and treatment options. This approach includes the exploration of the latest materials and technologies to achieve efficiency savings. This also includes reviewing and improving current materials and processes, with a view to reducing carbon emissions to help the Council achieve its target of net zero by 2050.

The Highways service also continues to work closely with Ringway Jacobs shareholders, with Eurovia's specialist pavement management consultancy John Lefebvre UK (JLUK), to benefit from their extensive knowledge and expertise in treatments experienced across the UK and overseas. This provides insight into new products emerging from Eurovia's extensive pavement research and development facilities which may benefit the Essex Highways contract.

Essex Highways has undertaken trial use of Graphene in its road resurfacing treatments and plans to undertake more trials. It is also a member of a recently created national forum that has been set up to investigate the potential of this material in road resurfacing applications. Graphene stands out for being tough and flexible – it's been calculated that this material is 200 times more resistant than steel and five times lighter than aluminium. The use of this material could result in doubling the current service life of some road resurfacing treatments, without varying the process of creating the material to any significant degree or creating significant additional cost. This could have the potential of financial savings as well as whole life carbon emissions savings. Early results are promising, and Essex Highways is currently arranging for core samples to be extracted from trial sites so that

these can be examined under laboratory conditions to determine how the road has performed under winter conditions.

Key to this innovation is a technology called Gipave, developed by an Italian company. It consists of adding an advanced product to a traditional surfacing material (in the case of current trials, hot rolled asphalt). JLUK has been fully testing and developing the materials used in the trial in the UK, which have been produced locally through one of Eurovia's East London asphalt manufacturing facilities.

Gipave contains graphene making the asphalt far less susceptible both to hardening and cracking in cold temperatures and softening in warm temperatures. It also increases the elasticity and strength to reduce the wear, particularly under high loading. This would make road resurfacing more resilient to the recurrence of localised defects such as potholes. Gipave further reduces environmental impacts and carbon emissions (up to 70%) as it contains a specific type of selected hard plastic, which is usually considered nonreusable and therefore this contributes to avoiding less sustainable disposal methods such as landfills.

Innovation: Road Resurfacing, Trial Use of Fine Milling

Essex has many miles of concrete roads, particularly on housing estates that were built decades ago. Concrete roads can last for many years, but eventually the slabs start to move, crack and break. Replacing sections, or doing large concrete patches, is very expensive. One solution used decades ago was to put a very thin layer of black 'micro-asphalt' on top. This made the roads smoother, quieter, and perhaps better-looking, but when patches of micro-asphalt peel away it looks unattractive, and it is problematic to repair. However, a new technique called 'Fine Milling' has now been trialled and approved for further use in Essex. This process treats the remaining micro-asphalt and any uneven concrete surface by grinding off the top, then any cracks, gaps or sunken areas are dug out and filled in with a purpose specific, slightly flexible aggregate, concrete- like material, coloured to match the existing surface. The new surface is smoother, looks better and resists further cracking.

Innovation: Roads – use of Warm Mix Asphalt and Recycled Materials

Warm Mix Asphalt is recognised nationally as an alternative material to regular asphalt and is lower in carbon emissions. Essex Highways has been using Warm Mix in its specifications for several years. While use has mainly been for binder layers, trials of use of Warm Mix for surface course layers in road resurfacing are ongoing.

In 2022/23, 22% of the asphalt materials specified included recycled materials, and it is anticipated that this proportion will increase in future years.

Innovation: Roads Drainage

Map 16 software has been fully installed in Essex, and analysis of gully pot levels measured during historic cleanses has provided a risk-based allocation of resources which has enabled an extension to gully cleansing coverage. This has reduced the costs for responding to blocked gullies and other surface water issues and has resulted in a significant saving to ECC annually.

Innovation: Localised Repairs for Roads – ‘Road Mender’ Trial

Currently, potholes and cracks are repaired by cutting out the road surface surrounding the defect, removing any previously applied material which is defective, then pouring hot asphalt into the excavated area. The asphalt is then compacted to complete the repair.

A new treatment has now been developed that no longer requires roads to be dug up, and the material used for repair is made up of recycled materials including old lorry tyres, that can be prepared on site as required. Once any holes have been filled and compacted, the new material is poured over the surface as molten liquid that forms a waterproof patch over the area. The liquid fills any minor defects, and it prevents further failure. It also cools within minutes, which reduces the amount of time a road needs to be closed compared to a more traditional repair.

Trials of this new treatment are ongoing and have so far resulted in reducing the amount of time repair gangs need to be on site, through removing the requirement to excavate, which has improved productivity relating to repairs. Assessment of the trials will be continued in the summer, to determine how well the repairs have endured during the winter period. If the overall assessment concludes the process is successful, the application of this treatment will be implemented more widely across the network, to repair defects quicker, more safely and with less waste and new material. This would result in financial savings as well as carbon emissions savings.

Innovation: Trial use of new Weed Spraying materials that are more Eco-friendly

Essex Highways has trialled two new weedkilling treatments which are more eco-friendly than the historic use of chemical-based sprays such as

glyphosate. One of the treatments is a plant-based foam weedkiller, and the second treatment is based on wood vinegar.

The plant-based foam weedkiller is first heated. Exposure to heat makes plants shrivel up and die, but using hot water and steam on weeds tends to be ineffective because heat escapes too quickly into the atmosphere to cause enough damage to the plants. A UK company has developed a foam made of natural oils and sugars from plants that is able to trap and retain heat when mixed with hot water. The foam is applied to weeds at a temperature of 97°C using a handheld spraying lance. This creates a thermal blanket around the weeds that kills them within 48 hours. The foam and dead weeds then biodegrade into the soil. This foam treatment is slightly more expensive than chemical weedkillers and is slower to apply, and assessment into the merits of using this treatment are ongoing. If it proves to offer a viable operational benefit to the service, then it may be implemented more widely.

Trials have also been undertaken with a weedkiller based on Wood Vinegar, made from a combination of wood sap and vinegar. Early results are inconclusive and further trials are ongoing.

Innovation: Trial of Electric JCB

Essex Highways is committed to assisting with the Council's target of net zero carbon emissions by 2050. It is currently developing a decarbonisation strategy to support this overarching objective. However, Essex Highways has only recently commenced its net zero journey, and therefore its approach is currently more an investigation into opportunities for carbon emissions reduction, rather than an embedded suite of defined measures.

As part of its ongoing investigations into carbon emissions reduction, Essex Highways has trialled an electric-powered JCB mini excavator, the construction industry's first, which is proving itself to be just as robust and capable as its fossil-fuel powered counterparts. The machine shares the same structure, canopy, dig end, hydraulics and controls as the diesel model and performs in exactly the same way. It is able to do a full day's work on a single charge, the power being supplied by a solar powered generator. Being electric brings with it several advantages over traditional diesel-powered plant. Electricity is cheaper than fossil fuel and there are no engine liquid checks, reducing time on daily vehicle checks. With zero emissions and low noise levels, the digger is environmentally friendly and well suited to sites located in built up urban areas. Its comparative quietness enables work to

be undertaken at times of the day that are usually 'out-of-hours', providing increased flexibility for scheme completion.

Innovation: Rubber Kerbs

Included in Essex Highways investigations into materials with lower carbon emissions materials, Essex Highways has trialled bolt-down high-quality rubber kerbing made from recycled truck tyres. The 'Harlow' kerbs, so called because of where they were originally used, are replacing 'stick-on' kerbs (mortared onto the road surface rather than dug-into foundations) which have historically been widely used, particularly on concrete roads. However, years of weathering and strike impacts from vehicles eventually take their toll on 'stick-on' kerbs; they become loose, easily dislodged and potentially dangerous. The Harlow kerbs are bolted into the road surface which means very small amounts of waste are generated, compared with the full digging out of reinforced concrete that would be required to replace fully dug-in concrete kerbs. Another advantage is that it is more convenient for utility companies to dig up the road or footway to lay pipes or cables, as the kerbs can be unbolted and then re-bolted into place with comparative ease. As they are made from recycled rubber, they help reduce waste material that might otherwise be sent to landfill, while the manufacturing process is low in carbon emissions compared to manufactured concrete kerbs. Harlow kerbs also have a significant weight advantage over their concrete counterparts, falling within manual handling limits. This makes them easy to move on site and means that there is less likelihood of injuries being sustained by operatives installing them. Although slightly more expensive than concrete kerbstones, costs may reduce through bulk production and are offset by the rapid installation and extreme durability, saving repeat maintenance cost over many years.

Innovation: Assessing Footway condition – Essex Footway Survey

There are currently no formal reporting measures required by central government relating to footway condition. Following a review of the current condition methodologies within the industry, and an investigation into the practice of other Local Authorities, the Council developed a value for money visual condition survey: Essex Footway Survey. This is carried out by the Highways Inspectors during their routine duties. This new survey is similar to but not directly comparable to the national standard, Footway Network Survey:

The Footway and Cycletrack Management Group (FCMG) developed the Footway Network Survey (FNS) to meet the need for a comprehensive survey

of the condition of Local Authority footway networks to support treatment identification and decision making.

The FNS Survey reports the condition of the footway in one of four condition levels:

1. As new (AN) (condition level 1)
2. Aesthetically impaired (AI) (condition level 2)
3. Functionally impaired (FI) (condition level 3)
4. Structurally unsound (SU) (condition level 4)

The Essex Footway Survey provides a measure of the condition of the footway in terms of safety and serviceability which may be more readily understood by customers than some more technical survey methodologies.

This condition information is also used to direct the attention of the engineer to assess sites for structural maintenance. The table below summarises the four, Essex Footway Survey condition assessment categories of Excellent, Good, Fair, and Requiring Improvement.

Footway Functional Quality	Essex Description	Functional Quality Description	Maintenance Liability Cost	Description of types of condition triggers present
Excellent	As New' Condition (Does not have to be new)	Sound Surface for foot pedestrians and other footway traffic	Very low	Subject to occasional localised minor imperfections, such as loss of joint filler or aesthetic imperfections
Good	Good condition, some aesthetic impairment due to historic repairs, some early stages of deterioration present which could lead to more frequent localised, minor issues forming	Good surface for pedestrians; intermittent but insignificant ride quality issues for other footway traffic.	Low to Moderate. These types of footway can be included in programmes for low cost, preventative treatment to arrest deterioration, such as slurry sealing and	More frequent localised, minor surface issues forming such as minor cracking or cracked but level modular surfaces
Fair	fair condition, but as well as aesthetic impairment due to historic repairs there is evidence of more advanced stages of deterioration and surface loss	Still provides accessible and serviceable surface for pedestrians; greater frequency of ride quality issues, however, for other footway traffic.	These types of footway will require a range of remedial measures. Moderate to high maintenance cost liability.	More significant larger areas of cracking and surface loss.
Requiring Improvement	These footways will exhibit a higher frequency of more significant issues	May provide accessible and serviceable surface for pedestrians, but significant ride quality issues for other footway traffic may create difficulties with use.	High maintenance cost liability.	These footways are likely to have areas of subsidence, settlement and major cracking issues.

Innovation: Footways – Nu-flex, ‘a green-hearted surfacing solution’

Essex Highways is constantly trying new techniques, products and tools as innovations that offer good combinations of efficiency, value, durability, and

usefulness. For example, in Herongate, Brentwood we trialled a promising new material, called 'Nu-flex' to re-build a Public Right of Way.

A pathway laid with Nu-flex is tough, hard-wearing, provides good grip and is slightly flexible, liked by walkers, runners, horse riders and cyclists alike. One huge advantage is that the material is porous, so even with heavy rain, surface water just runs straight through, draining into the supporting ground, leaving the surface dry and free of ice even in the coldest weather. Its design life is in excess of fifteen years, and its characteristics are:

- Resistance to rutting, defects and hazards,
- Durable, flexible, with good grip
- Environmentally friendly,
- Very low maintenance,
- SUDS (Sustainable Urban Drainage Schemes) compliant.

Three materials go into the mix to produce 'Nu-flex': some aggregate (small gravel); polyurethane binder, which holds it all together, and the key ingredient - recycled rubber tyres. The rubber gives much of the grip and flexibility and is very durable. The mix of this material has included tyres from Heavy Goods Vehicles (HGVs), which are more durable and enable far more rubber to be extracted from each tyre.

'Nu-flex' is laid cold, so the process doesn't require heating on site, a big advantage over traditional hot asphalt whose use would likely result in higher carbon emissions. Financial costs are currently comparable to traditional methods and when undertaken by specialist crews the material can be laid quicker. The material requires careful levelling but only needs a few hours to stabilise before it can be used. Historically, it has been difficult to find an economical use for used tyres, but through careful work in the lab to manage the critical ingredient of binder, this appears to be one answer. Use of Nu-flex has been more widespread since the first trials, and assessments are ongoing.

Innovation: Structures: use of drones to carry out safety inspections

In the Highways Magazine, Site Safety Initiative Award category, Essex Highways, Ringway Jacobs and Eurovia were Highly Commended for their collaboration in using Drone Technology for Surveying Structures.

Camera drones are already being used in industry, but now they are enabling our highway engineers in Essex to carefully inspect critical structures like bridges and culverts in better, safer, and recordable ways.

The use of drones provides significant benefits, as it provides acquisition of high definition airborne or waterborne views of spaces and areas that inspectors can't reach safely or easily. For example, areas such as the undersides or parapets of bridges over busy roads. The drone equipment can also be configured to take imagery in confined spaces, such as culverts under the road and even underwater – for example for the bridge foundations in a river.

The use of drones does not in any way replace the professional judgement and calculation of a professional structures engineer – drones are simply a more efficient, safer, and sometimes more effective way of making a visual inspection. Professional decisions are then taken using the visual information gathered. This is more efficient and reduces safety risks for inspectors. It also results in significant cost savings through negating the need for the cost of manned boats and safety platforms. The data produced is also better and significantly improves our historic records of the structure in question, which enables changes to be identified more easily over time.

Innovation: Structures - creation of vegetated retaining wall

The Structures team recently completed building an innovative vegetated retaining wall for the Public Rights of Way team. The retaining wall carries the Public Right of Way along the River Roding. The natural embankment had collapsed, so the Public Right of Way was no longer fit for purpose. The structures solution was a Flex MSE system, which was given the go ahead by the environment agency.

The Flex MSE system consists of earth and sand filled 'geobags' with joining plates, and layers of geogrid and structural fill behind the bagged facing. It is designed to outlast materials such as concrete and steel. The 'geobags' and interlocking plates adapt and move with the land, giving it the capability to endure events that would destroy traditional wall systems. Installation takes half the time and half the cost of most other walls, and accounts for only 3% of the carbon emissions.

The wall is hydroseeded (a spray seeding system) to allow for plants to take hold and grow from the retaining structure. The root system helps strengthen the wall and the finished product has a 120-year service life and 75-year warranty, making it extremely cost-effective.

For the project in question, the grass began growing within days and after a month had already thickened up on the top half of the wall. It is anticipated that the wall will naturalise and settle into its surrounding environment over time.



Innovation: Street Lighting: conversion to L.E.D Lighting, and the Central Management System

Increases in electrical energy charges place additional burdens on Local Authority budgets. As a result, the Council has installed remotely controlled 'Telecells' in each lighting column which link each column to an on-line central management system. This system facilitates individual control of the time periods in which the lighting columns are switched on. The system also registers the presence of a fault should a streetlight cease working, which enables the Council to plan repairs or replacement. The Central Management System facilitates efficient management of highway lighting with a view to reducing overall energy consumption, which in turn reduces costs and carbon emissions.

The Council has long been aware of the potential benefits of using LED lighting technology (light-emitting diode) to reduce energy consumption, reduce carbon emissions, improve service reliability and service life, and reduce light pollution. Following the success of an initial trial of sites in Essex market towns carried out some years ago, a substantial capital asset replacement programme has been in progress to replace existing sodium/mercury lamp technology with LED technology.

Illuminated bollards and signs, as well as a significant number of lighting columns have already been converted to LED technology. Implementation of the final phase to convert remaining assets to LED is in progress and is expected to be completed at the end of the 2023/24 financial year. After this programme, any assets still using sodium/mercury lamp technology will be converted to LED technology during maintenance operations over time.

Innovation: Conversion to LED lighting – background.

Following trials in 2016, Essex Highways started to replace existing inefficient sodium streetlights on our main roads with LED ('light-emitting diode') streetlight technology. LED lights use less electricity, provide better light, reduce maintenance costs, and reduce carbon emissions.

Our phase 4 LED installation began in May 2021, which saw crews replacing the first of the remaining 82,000 old style streetlights ECC operates. By the end of 2022, we had upgraded a total of 40,325 luminaires (37,000 units through the main programme and 3,000 units through maintenance activities). The replaced units have achieved an average energy reduction of over 75% and an annual carbon emissions reduction of over 1,300 tonnes.

The phase 4 programme was significantly impacted by the global shortage of components for the 'telecells' that are used to control the streetlights. This was due to major events out of our control such as the effects of the pandemic lockdowns and the war in Ukraine. We mitigated this risk for the most part by ordering a surplus of stock before the shortage hit but we were still slightly behind our target programme. Despite this, a recovery programme was agreed with our contractors to ensure works will be completed by the end of the financial year 2023/24.

You may have noticed that some streetlights in areas haven't yet been replaced and you may be concerned that they have been missed entirely. There are many reasons why this could be, such as operatives being unable to safely gain access to equipment due to foliage or parked cars, to concerns about the column structure. We will revisit them in due course, as we are continuing to work until all unfinished units are completed.

Innovation: Intelligent Traffic Management Systems (ITS)

Our strategic objective is to improve traffic flow along established corridors by systematic replacement of obsolete assets and components, as well as converting all traffic signals to operate using IP communications via 4G technology. This will enable comprehensive electronic links to software systems which will monitor and control operations in real time. Note that under the Department for Transport (DfT) additional funding for Traffic Signals, Essex was awarded £242k in 2023/24 from the obsolescence fund.

Essex Highways is already making significant progress with this strategic objective; it has already successfully implemented IP communications across the network. This presents a sound level of preparedness for anticipated future changes (e.g. to 5G technology), to provide increased connectivity of information with highway users, and facilitate appropriate data capacity for anticipated future data collection and sharing.

Data sharing between organisations and Authorities is viewed as a critical development in the traffic management process. This will enable us to maximise traffic efficiency and deliver benefits for all road users including buses, active travel, and vulnerable users. For example, currently through data sharing between ECC and National Highways, we can utilise the Essex roadside Vehicle Messaging System (VMS) to inform road users of any issues occurring on the Strategic Road Network. This is especially helpful during the hours when the Essex Traffic Control Centre (ETCC) is closed. Similarly, ECC can utilise the National Highways VMS to inform their road users of issues on the Essex network.

Our investment strategy also includes an ongoing conversion of assets to Extra Low Voltage and LED technology (around 70% of the asset base has been converted to date) to increase design life reliability and reduce energy consumption. These enhancements also contribute to carbon emissions reduction and improvements in air quality.

Our vision for the future is to collect and share additional data sets from other organisation such as International Ports and Airports. It is suspected that this development will position ECC well for implementing connected and autonomous vehicle technology in the future, although currently quite what this will look like is not comprehensively known.

To further future proof, our strategy includes installing artificial intelligence (AI) detectors at strategically important locations to collect traffic flow data and other data in a consistent format. These detectors can capture vehicle numbers and their classification, together with cyclist and pedestrian numbers (as well as their movements) and can therefore be utilised to capture and predict future mobility modes. This will provide a better understanding of how certain junctions are used, which will enable plans to be developed and aligned with demand. This data could also be shared with external stakeholders, such as housing developers and software developers, to help shape potential highway network improvements and journey time planning.

Innovation: Deploying Digital Innovation and Technology

At the end of June 2019, a collaboration between Ringway Jacobs, Ringway, Elgin and Essex County Council and Hertfordshire County Council, received a prestigious Association of Directors of Environment, Economy, Planning and Transport (ADEPT) Presidential Award. The group won the Deploying Digital Innovation and Technology category for working together to deliver live road

closure information to sat-nav devices and providing real-time roadworks monitoring across Essex and Hertfordshire.

Ringway and Ringway Jacobs working in partnership with Elgin developed a system called 'Traffic Management - Real Time' that utilises data direct from roadworks on the ground to and from Sat Nav providers like TomTom and Google Maps.

We have jointly collaborated with Elgin to test and further refine this product with the aim of delivering maximum value to our respective Hertfordshire and Essex County Council customers. The system is currently split into two distinct tools:

Real Time Closures: Enables Highways officers and our contractors to close or reopen a road instantly via a smartphone App directly from site and for that information to be transmitted directly to motorists using navigation apps in real-time.

Real Time Map: Provides an enhanced network management tool by joining the 'congestion caused by roadworks', to live journey data from TomTom devices on the road network.

Hertfordshire and Essex County Councils are the first local authorities in the country to start using the system, meaning when you are on a journey in either county, your Sat Nav will likely automatically direct you away from both planned and emergency road closures that could cause disruption on your route.

Key benefits of the new system are:

- Creation of a new channel of communication by allowing live updates from road closures being undertaken by in house delivery teams, Eurovia and other supply chain roadworks teams, to be delivered straight to driver's satellite navigation systems, helping motorists better avoid congestion;
- Enables delays across network to be quantified in minutes and communicated to the public online, via social media and via local radio bulletins;
- The control centres are able to actively identify network congestion along with its root cause in real time;
- Streetworks teams use the map to remotely monitor compliance with permit requirements or for illegal works on the highway;
- Provides a simplified display of information in one place, where real time disruption Information is available on a single map dashboard alongside existing road network condition data sets (roadworks permits, incidents, road closure and diversion plans);

- Allowed Hertfordshire County Council to decommission their aging ANPR network whilst providing far greater network coverage from less than 5% up to 40%
- Allowed the Essex Traffic Control Centre to cease recording of congestion incidents and refocus their time on improved twitter feed output such as attaching images of congestion, etc. improving quality.

Innovation: Further Digital Development - Real Time Disruption Analytics

A third tool is in development called Real Time Disruption Analytics which will display historic congestion on a map interface, along with the root cause as it happened. This will enable after incident root cause/impact analysis and allow for the impact of network issues to be more actively understood by all operational stakeholders.

Real Time Analytics will also become an integral tool for Streetworks decision makers who will be able to visualise and understand the impact of past and recent works to refine how they allow works to be conducted on the network. This capability will allow the service to take another step forward in Network Management.

Innovation in Highway Maintenance - Promoting Improvement through Sound Asset Management Practice

Our objective during these times of relatively high inflation and material shortages is to maximise the benefits of investment for priority routes. This provides the greatest benefits for Cabinet Member strategic direction as well as for responding to highway user priorities. It also exploits the best opportunities to encourage business recovery from recent global events, to create employment for all skills levels, and create the right environment for building a stronger economy for the future.

To promote this overarching objective, we strive for optimisation of resources, which is supported through recently implemented new technology and systems which have opened new opportunities from improved functionality. We will also continue to strive to reduce treatment costs through: exploring improvements to lifecycle planning via developments in existing data systems (including developments in whole life carbon emissions options); innovative use of existing treatments; exploring new materials and techniques (especially lower carbon emissions options); efficiency gains from long term scheduling of resources; embracing emerging technologies such as Artificial Intelligence (AI), and investing in specialist engineering advice and consultation where this is needed.

Asset Management: Performance Management Framework

Essex Highways activities are aligned to investment levels which reflect the standards of service desired by the Council. Standards are interpreted as 'performance standards' for which performance targets are set and duly

monitored to ensure that planned outcomes are realised. Monitoring of performance includes the measurement and reporting of performance on a frequency that is relevant for the service in question. Measurement of performance requires a regime of data collection and analysis which requires investment; the regime, therefore needs to be practicable and provide value for money.

Having the appropriate information when it is needed is essential to any decision-making process, and the data collection regime is part of the Essex Highways Information Strategy. This supports the service through improving the way in which the need for data is identified, and by improving the way data it is collected, used, stored, and shared.

An overall strategic approach to Highway service provision comprises a range of services, and therefore performance management can be expected to include a suite of performance targets. Accordingly, the Council has established a framework of performance indicators for measuring the delivery of the Asset Management Strategy, and this is monitored regularly by senior officers and Cabinet Members. Any over or under performance is investigated and, if necessary, improvement plans put in place to ensure delivery of the required performance. All performance measures contribute to keeping the highway network assets accessible, serviceable, sustainable, and safe using an approach that results in value for money.

Asset Management – Lifecycle Planning

Lifecycle planning comprises the approach to the maintenance of an asset from creation to disposal. It includes all maintenance activities and their timings required for the asset to reach its service life potential (whole life maintenance costing). There are essentially two different types of maintenance: reactive and routine (revenue funded) and planned (capital funded).

The objectives of lifecycle planning are to:

- Identify long-term investment for highway infrastructure assets and develop an appropriate maintenance strategy.
- Predict future performance of highway infrastructure assets for different levels of investment and different maintenance strategies.
- Determine the level of investment required to achieve the required performance (standard of service).
- Determine the performance that will be achieved for available funding and/or future investment.

- Support decision-making, through making the case for investing in maintenance activities, and demonstrate the impact of different funding scenarios.
- Minimise costs over the lifecycle, while maintaining the required performance.

Lifecycle Planning for Roads

The Highways Maintenance Efficiency Programme (HMEP) is a government funded but industry led initiative to improve asset management. The HMEP provides lifecycle planning toolkits that may be used by Local Authorities. These Toolkits focus on capital funded activities, since these are the activities which enhance asset life. Routine revenue funded activities, such as pot-hole filling, do not enhance asset life as these are ‘small part replacements’ as opposed to capital funded resurfacing or asset replacement.

The HMEP toolkits employ the key elements of lifecycle planning and facilitate the prediction of asset performance based on investment and maintenance strategy scenarios for a defined period (typically ten years). The HMEP provides Lifecycle Planning Toolkits for carriageways, footways, and ancillary assets (such as lighting columns). Essex employs the HMEP Lifecycle Planning Toolkits for carriageways and footways.

The HMEP toolkits undertake the performance predictions based on ‘whole life costing’ maintenance strategy principles. Whole life costing provides a basis for comparing alternative maintenance intervention strategies to identify the most economically advantageous option over a defined period.

The principle of whole life costing is applied through comparison of different maintenance strategy, investment, and performance scenarios at network level. In the case of roads, whole life costing is applied at network hierarchy level; a hierarchy is a group of roads whose construction and condition characteristics are broadly similar and therefore reflect where assets can be expected to perform in a similar manner. This enables specific types of treatment to be identified and aggregated into a network level maintenance strategy for each hierarchy. Lower cost, preventative treatment options are always the preferred choice where this can be supported through appropriate condition characteristics. For more information relating to the ‘Preventative Approach’, please refer to below.

Road condition characteristics are identified through the annual SCANNER road condition surveys and subsequent desk top analysis carried out by the nationally accredited United Kingdom Pavement Management System (UKPMS software). The UKPMS processes the SCANNER road survey data, to apply a score attributable to the defectiveness of each 10-metre road section

in question. The score is known as the Road Condition Indicator (RCI) which can be used to rank the defectiveness of road sections.

At the heart of the roads resurfacing prioritisation process is the 'Preventative Approach'. Resurfacing investment will, wherever appropriate, be prioritised towards roads in the early stages of deterioration where a lower cost treatment can be applied to prolong service life. Preventative maintenance typically comprises treatments such as thin applications that penetrate the texture of a road surface, or crack sealing, surface dressing, slurry or micro-surfacing and thin and hot-mix asphalt overlays.

The Preventative Approach, which aligns with HMEP good practice guidance as well as the Well-Managed Highway Infrastructure: a Code of Practice (UK Roads Liaison Group October 2016), has been fundamental to the Council's Asset Management Strategy for many years. This contrasts with a 'worst first' approach, which focuses the budget for resurfacing on higher cost strengthening treatments to address the worst conditioned roads.

The 'worst first' approach is known to result in inexorable road condition decline, as the proportion of the network in earlier stages of deterioration gets steadily worse to the point where it is included with the worst condition, and budgets then become inadequate to address this increased requirement for higher costs strengthening treatments. The current road resurfacing strategy combines the preventative approach with strengthening treatments, and results in holistic treatment for all stages of deterioration of the network, thereby controlling the network deterioration so those roads in the worst condition category can be minimised and addressed over current and future years.

The preventative approach seals the road surface, preventing the ingress of water which would otherwise lead to the breakdown of road construction layers and the creation of potholes. The preventative approach makes the network more resistant to the formation of localised defects, and it can therefore result in a reduction in investment required for reactive maintenance required for activities such as addressing potholes.

Essex Highways is also trialling the use of Preservative and Restorative Treatments which extend the service lives of roads in existing 'good' condition, and which do not require quarried aggregate. It is anticipated that these solutions could provide up to 5 years additional life from the surface per application, and it may be possible for repeat treatments to be applied consecutively. Extending the life of a road network in this way may also offer whole life cost savings reduction and result in lower whole life carbon emissions savings. Examination of trial sites is already showing

promising results, and trials and investigations are ongoing. For example, during the last quarter of 2023/24 these trial sites will be visited by our pavement engineers to assess how well they have endured the winter months and to assess their level of overall durability. It is anticipated that programmes of preservative and restorative treatments will be increased over future years. Similarly, recent recycling treatment sites will also be revisited and assessed, in the anticipation of increasing programmes for recycling over future years.

In-House Lifecycle Planning Models for Roads will enable comparison of carbon emissions costs.

In-house lifecycle planning models for roads are currently under development by Essex Highways. These will enable the comparison, by hierarchy and environment (urban or rural) of several scenarios relating to different combinations of road resurfacing treatments over a typical lifecycle period of sixty years. This will assist with determining the combination of treatments which results in lowest financial cost. The models will include estimation of Whole Life Carbon Emissions costs, to enable the results of different scenarios to be compared. It is anticipated, through investigations undertaken so far, that the lifecycle scenario which results in the lowest financial cost will rarely coincide with the scenario that results in the lowest carbon emissions costs. There may need to be a trade-off, therefore, between financial cost and carbon emissions costs to deliver the highest priorities of the Council.

Lifecycle Planning for Footways: Essex Footway Survey

There are currently no formal reporting measures required by central government relating to footway condition. Following a review of the current condition methodologies within the industry, and an investigation into the practice of other Local Authorities, the Council developed a value for money visual condition survey which is carried out by the Highways Inspectors during their routine duties, called the Essex Footway Survey. This new survey is similar to but not directly comparable to the national standard, Footway Network Survey:

The Footway and Cycletrack Management Group (FCMG) developed the Footway Network Survey (FNS) to meet the need for a comprehensive survey of the condition of Local Authority footway networks to support treatment identification and decision making.

The FNS Survey reports the condition of the footway in one of four condition levels:

- As new (AN) (condition level 1)
- Aesthetically impaired (AI) (condition level 2)
- Functionally impaired (FI) (condition level 3)
- Structurally unsound (SU) (condition level 4)

The Essex Footway Survey provides a measure of the condition of the footway in terms of safety and serviceability which may be more readily understood by customers than some more technical survey methodologies.

Ranking of prospective Footway structural maintenance schemes (prioritisation of funding) is based on a bespoke value management (prioritisation) process that combines the Essex Footway Survey condition observation information with information on localised defects recorded through the highway inspectors' routine safety inspections. Every footway in Essex is subject to at least one safety inspection annually; higher use footways are inspected more frequently. In this way, the value management process prioritises capital treatment for every footway in the County over current and future years.

Collection of this Essex Footway Survey condition observation data commenced in May 2015/16, and the data lends itself well to use within the HMEP Footways Lifecycle Planning Toolkit which assists with predicting future footway condition based on capital treatment/investment scenarios. The HMEP Footways Lifecycle Planning Toolkit operates in a very similar manner to the HMEP Carriageways Lifecycle Planning Toolkit, in that it is a 'whole life cost tool' that operates at hierarchy network level, and employs budgets, treatment costs, treatment strategies and deterioration rates to generate condition predictions.

The inclusion of prospective footway schemes into a forward works programme is dependent upon a site visit by an engineer to verify the condition characteristics and to determine the type of treatment required. Wherever practicable, areas that cannot be addressed through minor, reactive repairs will be added to the forward programme for capital works and will follow the 'Preventative Approach'; i.e. low-cost treatments that address early stages of deterioration to prevent deterioration to the point where higher cost strengthening treatments are required.

Footways and cycle routes provide alternative modes of travel, contribute to well-being through exercise, improve air quality by alleviating traffic congestion and reduce carbon emissions.

Lifecycle Planning for Structures

Lifecycle planning for structures is a combination of cyclical, preventative and other minor maintenance, as well as strengthening and other major refurbishment works, designed to balance competing demands in a manner which achieves good value while effectively managing risk. Lifecycle planning is augmented by the results of General and Principal Inspections and load bearing capacity Assessments.

To assist with lifecycle planning, Essex Highways employs a Structures Lifecycle Planning Toolkit called Savi (Structures Asset Valuation and Investment Tool), provided by the UK Bridges Board, which is endorsed by the Chartered Institute of Public Finance and Accountancy (CIPFA) and available from their website.

Structures are varied and complex assets which include bridges, footbridges, subways and underpasses, culverts, retaining walls, signs, and signal gantries. Structures also comprise many different elements (components), all of which are critical to accessibility, serviceability, sustainability, and safety of the asset. Some structures are heritage listed assets whose protection requires special consideration and treatments.

Prioritisation of works is risk based which is an essential part of asset management for structures, as structures will likely deteriorate in condition over time even when elements are replaced promptly at the end of their service life. Unlike roads and footways, however, the condition of structures is often not easily visible to the public, and the need for maintenance works or other rehabilitation measures may not be apparent or well understood.

Maintaining bridges and other structures to appropriate condition standards supports the efficiency of priority routes, thereby contributing directly to attracting investment to Essex. Applying this approach to sustaining links to communities with limited access also contributes to the development and strengthening of Essex communities.

Our objective is to maintain structures in a safe, serviceable, and sustainable condition. It is also to address weak structures where strengthening or reconstruction is required, thereby avoiding long term traffic management restrictions which can be disruptive to the travelling public and businesses. This is especially relevant where heavy goods vehicles are required to deliver essential goods and services to communities with limited access.

Weak bridges are those that fail to meet full load carrying capacity. This does not necessarily mean that they are in poor condition; some assets which are assessed as weak can be in good condition. It should be noted, however, that much of the structures stock was built during times when current demands could not have been foreseen or considered.

With Ringway Jacobs other shareholder, Jacobs, Essex Highways is continuing to explore new structural analysis techniques to better understand the load capacity of our bridges and other structures assets. In this way, weak structures will be more readily identified and assessed, and accordingly programmed for necessary remedial works. The Council maintains a list of weak bridges and culverts ascertained from load capacity Assessments.

While the risk of a structural failure is very low, its impact on road users and businesses can be very high. As a result, weak bridges are subject to the development of long-term structural rehabilitation schemes, typically strengthening or reconstruction. A corresponding future works programme is in place and is subject to regular review following new inspection and assessment information. In the meantime, measures to mitigate the risk of those structural elements receiving loads greater than their assessed capacity are implemented where necessary via vehicle weight limits, propping, edge protection, traffic management, or increased inspection and monitoring frequency, as determined appropriate.

Where need for a strengthening or reconstruction scheme is apparent, option studies are conducted where appropriate to assess alternative design solutions in terms of cost, risk, deliverability, timescale, network disruption and other factors before a preferred option is selected to progress through to detailed design then works implementation. Due to the complexity of Structures, works invariably require a longer planning time than most highways assets.

Lifecycle Planning - Lighting

All highway lighting assets are recorded in an asset register and are subject to an electrical test and inspection once every six years to ensure fitness of purpose. Lighting columns, illuminated signs, and beacons are also subject to a structural test and inspection once every six years, except for non-metallic lighting columns/posts which are subject to a structural test and inspection once every three years.

The structural inspection of a lighting column is a 'top to toe' assessment of a column above and below ground via a risk assessment procedure. Visual external inspection of the column's bracket, shaft and base section is augmented where appropriate using a probe for the internal examination of the column's shaft, base section, and underground root section. The condition of the root section of a metal street lighting column is assessed via the direct measurement of metal wall thickness within the underground section down to depths of 2.0 metres.

The overall, combined results of the structural assessment define the asset in question as either:

- Structural Red = high priority for asset replacement

- Structural Amber (non-repairable) = medium to high priority for asset replacement or re-test in three years
- Maintenance Red = high priority for asset repair (repairable)
- Maintenance Amber = medium to high priority for asset repair (repairable)
- Green = acceptable until next scheduled test

Asset repair and replacement is programmed according to an overall risk-based score priority.

Lifecycle Planning – Intelligent Transport Systems (ITS)

All ITS assets are recorded in asset registers which include date of installation and corresponding age of asset. Key ITS assets are linked electronically to sophisticated software systems which monitor operation in real time and register occurrence of faults. Equipment installations are inspected annually for electrical integrity and general condition, and traffic signals are also included within the routine, visual safety inspections undertaken by Highways Inspectors.

Reactive maintenance addresses relatively minor operational faults as well as any minor component replacement such as renewal of damaged/corroded poles. More complex refurbishment requirements to replace components and assets reaching the end of their service life are included in a 3-year forward works programme for capital works.

Lifecycle planning to identify and prioritise schemes utilises a risk-based matrix of information about the asset in question, i.e. age of asset, anticipated service life, number of faults logged over time, time needed to effect repairs, and road hierarchy of site in question.

Lifecycle Planning: Risk Based Capital Maintenance Allocations

For purpose of making the case for investment to ECC Financiers, and for assisting with the allocation of investment levels across the different asset groups – all of which present competing demands for investment – Essex Highways undertakes a risk assessment for each asset group. Following this, it compares the levels of risk for each asset group against the strategic priorities of the Council, then makes recommendations for levels of investment.

Historically, three investment scenarios have been routinely considered in the risk assessment for each asset group:

- steady state investment (investment required to maintain current condition),

- indicative funding (anticipated funding),
- and desired funding (to achieve performance targets or, in the absence of performance targets, specific maintenance challenges).

However, in recent years, in view of the financial challenges faced by the Council, the risk assessment has tended to focus on indicative investment levels. The risk assessment characteristics taken into consideration and individually scored are:

- Health and Safety Risk (risk to the travelling public)
- Legal Risk (risk of litigation)
- Performance Risk (risk of not achieving required standard of service)
- Risk of Accessibility and Serviceability (risk of disruption to the travelling public)
- Financial Risk (risk of creating a legacy of maintenance liability for future generations)
- Risk of Reputation for the Council (risk of adverse publicity).

Each risk characteristic is scored between 1 and 7 (1 being the highest risk). The scores are weighted to give priority to Health and Safety Risk, then the scores are totalled and accordingly assigned an ascending Risk RAG Band category, i.e. Green Band (lowest risk), Amber Band, High Amber Band, or Red Band (the highest risk).

Each asset group is subject to an assessment of the above risks over four separate risk periods:

- Risk at the end of the current year
- Risk in the short term: one year
- Risk in the mid-term: five-year period
- Risk in the long-term: additional five-year period.

The Risk RAG Band category can reflect change over time across the different time periods, and therefore assists financiers in making decisions regarding allocations of investment levels across the various asset groups, both in the short term as well as the mid and longer terms.

Environmental Sustainability

Innovation: Active Travel – improvements to Public Rights of Way map

Essex Highways has for some years published an online map of its Public Rights of Way, for PRow users to consult when planning an excursion. Using an ESRI-based web app, we have now introduced improvements, enabling users to better interact with the online map and its data source. Improvements include:

- The map now shows current temporary restrictions, long term seasonal restrictions and, where appropriate, any diversions to PRow routes;
- We have enabled the use of geolocation, so that users who are out and about on our highway and public right of way network will be able to follow the routes and check if there is a closure or restriction along their planned route;
- Users can now print a copy of the map with its associated legend/key information;
- Map locations can be shared by adding a ‘pin’ to the map then sharing a unique link to that location. This change could be useful for walking groups so they know where to meet up,

These are just some of the tools available on the new improved map.

Innovation: Active Travel – innovative ‘Pedal Power Clacton to Jaywick Sands - Wind and Solar Lighting’.

Essex Highways has been working on an innovative programme called ‘Pedal Power Clacton to Jaywick Sands - Wind and Solar Lighting’. The programme involves the delivery of a bespoke cycle network infrastructure aimed at helping to tackle inequality in one of the most deprived areas of the country.

To encourage the use of the cycle scheme, lighting was deemed important to ensure that users felt safe and secure during the hours of darkness. As there was no existing lighting or power supplies along the route, it was decided to investigate sustainable sources of lighting powered by renewable energy. The chosen solution was Kight’s off-grid, ultra-low power, smart street lighting control management, which combines a high-performance radio and microcontroller to offer a reliable, secure, and scalable solution, for complete monitoring of the street lighting.

The smart lighting control enables us to tailor our off-grid lighting to meet our needs, such as setting lighting and dimming schedules, dynamic dimming, and remote monitoring for optimising maintenance and detecting problems in real time. These units can be installed in any suitable location where there are no restrictions on wind flow and sunlight. They are particularly suitable where no existing electricity power supplies exist, saving on the considerable disruption

and expense of new supplies and connections. The anticipated benefits of the scheme are:

- cycling participation to level up inequalities,
- sustainable active travel through cycling, including developing local cycling infrastructure,
- employability of local people and local economy, including access to employment, education, and training opportunities,
- fitness and physical health of inactive people,
- mental wellbeing of inactive people and support to be job ready,
- resilience, connectedness, and social capital in local communities.

Through feedback this project has evolved from a relatively standard cycle route enhancement to a high-profile sustainable connection with enhanced environmental features that will provide many benefits to the local community for years to come.

Innovation: Active Travel – boost to Sustainable Travel

Ensuring that our streets become healthier is a priority if we're to deliver on our 2050 net zero carbon emissions goal. In support of this objective, the Sustainable Transport team secured significant investment from central government to design and implement changes to our roads infrastructure to boost active travel. This investment was used to implement several schemes designed to improve walking and cycling access in Basildon, Brentwood, Chelmsford, Colchester, and Harlow. By encouraging walking and cycling, especially for shorter journeys, this will contribute to meeting our environmental goals.

Sustainable travel will also give our residents increased choice in how they travel, helping them to improve their health and save money as well as making our streets healthier by reducing congestion, improving air quality, and freeing up the road network for those who can less easily avoid its use.

Other active travel initiatives also contribute to the Council's net zero target:

- free adult and child cycling training sessions,
- working with schools and businesses on their active travel plans,
- funding the 'Go Jauntily' walking app.

Innovation: Sustainable Travel – TravelEssex app.

ECC has launched a TravelEssex app, available from the Play or Apple app store. It is a free to use sustainable journey planner, to help people plan their journeys by foot, bike, bus, and train anywhere in the county.

Through the provision of real-time travel information, users are given detailed scheduled journey times for bus services, including First, Arriva, Hedingham, and Stephensons, as well as Greater Anglia and C2C rail, National Rail and London Underground trains.

The app has been launched to provide residents with a practical tool to make it easier to access sustainable travel choices, as part of the ECC's 'Safer, Greener, and Healthier Travel' vision. The app brings all sustainable travel options into one place for ease of use, and with features such as live alerts, it enables users to stay up to date with travel disruptions.

Sustainable travel choices can contribute to tackling climate change. For example, if more journeys are made on public transport, by bike or by foot, whether heading to work, taking the family out for the day, or simply exploring the countryside, this could make a tangible difference.

Innovation: Active Travel projects across Essex in 2023.

The projects below were designed to encourage people to use more sustainable modes of transport, including walking and cycling. This is particularly important for shorter journeys.

Highlights from 2023 include:

- giving away over 1,700 bikes in Clacton, Jaywick, Colchester, Basildon, and Harwich as part of the Pedal Power project,
- launching the new [EssexAir](#) website which highlights simple actions people can take to reduce their carbon emissions,
- installing new cycling and walking infrastructure in Braintree, Brentwood, Chelmsford, Colchester and Wickford,
- launching a new, door-to-door digital, journey-planning tool for residents of ten housing developments, with postcodes that aren't yet recognised on standard mapping tools,
- booking over 5,000 children onto Bikeability training sessions.
- The new Travel Essex website was launched: developed with our transport providers, we're pleased to introduce the new [Travel Essex website](#). Users can now plan their journeys and track buses in real time with the live bus map.

Innovation: Environmental Sustainability – trialling verge cutting to encourage wildflower growth

Roadside verges are viewed as important havens for many common and rare species of wildflowers, insects, and animals. Essex Highways is currently developing a strategy for how it manages its nature-based assets, with a

view to supporting biodiversity and Local Nature Recovery and improving its management of water.

In 2020, Braintree District Council and Essex County Council undertook a joint eco-friendly trial to leave sections of rural road verges in central Braintree uncut until the autumn. The trial followed a successful project along the A131 sowing wildflower seed. Fourteen roadside verge locations were monitored, and these included locations in Braintree and Bocking, Black Notley, Great Notley, Great Saling, Bardfield Saling, Shalford, Panfield, Stisted, Gosfield, Greanstead Green, Halstead Rural, Halstead, Colne Engaine, White Colne, and Earls Colne. This trial allowed plants to grow and flower and encouraged the insect life that is declining generally in the UK.

Typically, roadside verges are cut to maintain safe sightlines for road users and keep signs clearly visible. Under the trial, road sight lines were monitored, and it was agreed that if there were any safety issues, verges would be cut back as far as necessary. The follow up report concluded the trial resulted in environmental benefits and there was no adverse impact on road users in the trial areas compared to the non-trial areas.

The results of this trial will be taken into consideration during the development of the Essex Highways strategy.

The following Innovations have been implemented by ECC in its role as Lead Local Flood Authority. Essex Highways has not yet implemented similar schemes.

Innovation: Environmental Sustainability - the SPONGE project, 2020

Essex County Council worked with Basildon and Thurrock University Hospitals to retrofit the Basildon Hospital courtyard with a Sustainable Drainage System (SuDS). The project increases resilience to surface water flooding whilst simultaneously improving the communal space in Basildon Hospital for both patients and members of staff.

SuDS absorb rainwater like a sponge in order to minimise the effects of excessive rainfall. This can help to reduce water pollution in addition to reduce surface water runoff. SuDS also create green spaces and habitats that encourage and improve biodiversity.

Stakeholder engagement was carried out to find out what people wanted in the communal space. Some of the features included as a result of this stakeholder engagement included: easy maintenance planting, natural materials and permanent seating areas.



Innovation Environmental Sustainability: Leaky Dams

Leaky dams are a form of Natural Flood Management (NFM). Barriers made of natural woody materials are laid within water channels and allow normal base-flows of water to pass through. When flood flows are higher, they create an obstruction to reduce the flow. They are designed to reduce the downstream flood peak by temporarily storing water by holding it back within the stream's channel or encouraging it to spill onto the banks behind the barrier and slowing the flow.

Leaky dams typically result in a much lower carbon footprint than alternative flood mitigation methods, minimise disruption in the woodland area, enable the preservation of natural habitats while creating new riparian habitats.

Leaky dams in Harlow

ECC delivered a flood protection scheme involving a series of 'leaky dams' in Parndon and Risdén Woods to slow the water flow during periods of heavy rainfall. The scheme protects 38 homes in the Kingsmoor area of Harlow and won 'Small Project of the Year' at the British Construction Industry Awards in 2018. The project was led by ECC's Flood Team working in partnership with Harlow District Council, Place Services, Jacobs, and the Environment Agency.

By using the leaky dam method, as opposed to more traditional hard landscaping, it's estimated we saved approximately £38,000 and 95 tonnes of carbon emissions. If a more conventional earth bund method had been used, 40 trees would have needed to be removed, 236 litres of diesel would have been consumed, and 561km would have been travelled by vehicles transporting materials to and from the site. To minimize disruption a heavy horse was used to move the logs.

Leaky dams have also been used in Flood Alleviation Schemes to protect homes in Sturmer and Thaxted.

In 2020, ECC delivered a Natural Flood Management (NFM) Scheme at Thorndon Country Park in order to reduce the flood risk to residential properties downstream. The NFM scheme aimed to slow, intercept and store water flow through 10 leaky dams. These dams sit along both tributaries in the Country Park, upstream of West Horndon.

Thorndon Country Park is a designated Site of Special Scientific Interest with Grade II Listed Parkland. This meant there were restrictions on which materials and methodologies we could use to reduce the flood risk. We adopted a sustainable approach to delivery and used fallen ash wood from the woodlands to create the dams. We also sourced some local hardwood oak. We shaped the wood, and a Suffolk Punch horse moved it into position, and we secured augured stakes by hand. This meant we didn't need traditional machinery and we minimised our impact on the surrounding woodlands.



A Leaky Dam ready for Construction – photo credit: Tom Palmer / ECC



Roy the heavy horse – photo credit: Patrick Bailly / Harlow District Council

Leaky dams have also been built in Weald Country Park and Wivenhoe.

Innovation Environmental Sustainability: Detention Basin

Surface water flooding can happen very quickly, causing major damage to homes, roads, and land. Detention Basins temporarily hold excess stormwater and gradually release it over time reducing flooding and erosion downstream. When dry, the area is usually used for recreational purposes. Detention Basins are a form of Natural Flood Management (NFM) which enhances the local green/blue infrastructure network while also providing associated social, ecological, and environmental benefits.



Innovation Environmental Sustainability: Rain Gardens

Urban areas aren't always well-equipped for periods of heavy rain fall. Excess rainwater runs over concrete surfaces into sewers which, if overloaded, can result in flooding. Rainwater gardens are shallow depressions in the ground, planted with flowers and vegetation, which help absorb excess surface water runoff. They capture water and slow the rate at which it enters the drainage system, significantly reducing the risk of flooding. As surface water runs over impermeable surfaces, it picks up pollutants like oil and fertilisers, washing them into our waterways, but rain gardens help to purify storm water before it enters the ground or watercourses. Rain gardens also play an important part in greening our urban environments and providing habitats for wildlife.



Innovation Environmental Sustainability: Flood Mitigation in Schools

The ECC Green Infrastructure team has been working in partnership with the Department of Education, and funding from Anglian Water, to produce features for flood mitigation on eight schools across Essex. We work to incorporate green infrastructure assets, and sustainable drainage features for multifunctional benefits within the school grounds. These benefits range from increasing access to nature and biodiversity connectivity for students, to reducing the flood risk on site using natural flood management.

The schools we work with fall in the county's critical drainage zones, and the new assets help to alleviate pressures on the surface water drainage system. They are designed specifically to incorporate natural educational features, and they encourage enhanced interactions and learning opportunity for students.

Projects include, but are not limited to: Rain Gardens, Planters, Bug Hotels, SuDS Tree Pits, Tree Planting, Swale, Natural Play Features, and Grass Verges.



South Benfleet School (above) includes (1) SuDS Tree Pit, (2) Planters with educational features, (3) Planters with seating, (4) Information Board, (5) Bug Hotel, (6) Rain Garden

Everyone's Essex: Our plan for levelling up the county: 2021–2025.

The additional funding being provided by the DfT over the 11-year plan period 2023/24 to 2033/34, will assist with addressing Everyone's Essex.

Everyone's Economy – Strong Inclusive & Sustainable Economy

Essex County Council supports the commercial needs and economic growth desired in the County through ensuring its Highways assets are safe, accessible, serviceable, and sustainable. This provides access to key national and international destinations, supported by reliable journey times, which creates the right environment to attract investment and employers to the area.

These benefits address the impact of recent global events and the cost-of-living crisis, by supporting business recovery, creating employment opportunities for all skills levels, and creating the right environment for building a stronger economy for the future.

The highway network also provides access to colleges, universities, and other training establishments, enabling people to pursue the training they need to enter job markets and develop careers.

The highway network and related infrastructure assets provides access for heavy good vehicles, machinery, materials, and services to deliver new homes to communities.

Future Growth and Investment

We will maximise the use of available budgets by co-ordinating with major projects to ensure that asset management needs are considered and addressed in any funding bids, and that maintenance programmes where possible, complement works targeted at growth and investment.

Green Growth

Linking business corridors and enterprise zones through reliable roads, footways, and cycleways, increases the accessibility of these innovation centres. This enables job mobility, allowing the appropriate skills to move into the County bringing the benefits of innovation and investment.

Levelling up the Economy

By providing access for education and training, and creating an environment that encourages economic recovery, the highway network creates employment opportunities for everyone. This promotes growth which will bring the prosperity needed to address socio-economic inequality.

Supporting Net Zero

The use of materials with reduced carbon emissions are already embedded into the highway maintenance processes, and further opportunities to reduce carbon emissions as well as promote biodiversity gain are being explored. It also provides ever developing opportunities for active travel such as walking and cycling, thereby reducing traffic congestion, and improving air quality.

This approach will continue to address the recommendations of the Essex Climate Action Commission by contributing to the County's target of net zero by 2050. Essex Highways is also developing a Decarbonisation Strategy which will help support this objective.

Transport and Built Environment

New walking and cycling schemes have been announced as part of our ambition for Essex to become Safer, Greener and Healthier. This will reduce traffic congestion, cut air pollution, and improve residents' physical and

mental wellbeing. This will help deliver a step-change in sustainable travel, confirming Essex's place at the forefront of sustainable transport.

Essex Highways is a contributor to the Bus Service Improvement Plan. It is also working closely with developers to embrace new garden community developments, to create opportunities for sustainable and active travel as well as enhance the use of the Public Rights of Way network, wherever possible.

We will also endeavour to green and improve the amenity of public realm spaces, creating safe and comfortable places that encourage a feeling of community.

Minimising Waste

Essex Highways will continue to develop recycling treatments as part of its routine maintenance programme and will also continue to develop re-use of maintenance waste materials. The highway network also provides access to waste collection services and recycling centres.

Green Communities

Essex Highways supports ECC's vision and aim for Safer, Greener and Healthier Travel for current and future users of the transport network, and it ensures everything we do supports the drive towards active travel and sustainable transport, biodiversity net gain, an increase in green infrastructure, the promotion of local nature recovery and improved water management. Essex Highways will help achieve this through its work with the Local Highway Panels where the focus is on localism and communities. Essex Highways is also developing a Strategy for how it manages its green estate, which will also support this vision.

Levelling up the Environment

Reducing incidents of flooding remains a high priority for Essex Highways. Effective road drainage is vital to reducing the risk of property flooding and for preventing road user safety risk from excess water on the road surface. Its drainage asset cleansing, inspection and repair programmes remain vital services which make the network more resilient to climate change.

Improving our management of water, so we collect it and hold it back where appropriate, will enable it to be reused or released back into the environment, contributing to mitigating water shortages.

Essex Highways promotes ECC's vision and aim for Safer, Greener and Healthier Travel, through promoting opportunities for sustainable travel,

including active travel such as walking and cycling, all of which reduce traffic congestion and improve air quality.

Greening and improving the amenity of public realm spaces will assist with reducing heat stress, support increase in green infrastructure and aid local nature's recovery. It will also help foster a spirit of community through people feeling safe, comfortable, and included.

Healthy Lifestyles

The highway network affords opportunities for active travel, exercise, sport, leisure, entertainment, and access to green spaces, all of which promote physical and mental wellbeing. The highway network also provides access to social services and other health care and provides vital communication links between communities which ensures social inclusiveness.

We also provide opportunities for organised volunteer groups to undertake works on the Public Rights of Way network, which supports a community first approach. Encouraging group involvement promotes social interaction and adds to a sense of community, and improving access to green spaces encourages people to live active lives.

Improvements to public realm spaces, creates safe and comfortable places which also creates a sense of community and reduces feelings of social isolation. This brings improvements to health and well-being for communities.

Promoting Independence

The highway network promotes independent living through access to social services as well as to other health and domiciliary support. A safe, accessible, serviceable, and sustainable highway network also creates the right environment for economic growth, which creates opportunities for employment and training inclusive of those with low skills levels. It also enables access to the developing range of services that can be requested through digital communications.

Place Based Working

The highway network provides access to local and partner organisations as well as voluntary and community organisations which deliver health care and social services to residents.

Carers

The highway network will provide the communication links needed to deliver the required support to carers.

Levelling up Health

A safe, accessible, serviceable, and sustainable highway network creates the right environment for economic growth, which creates opportunities for employment and training inclusive of those with low skills. The highway network provides access to local and partner organisations to deliver social services as well as other health care and support services. It also provides access for heavy goods vehicles, machinery, materials, and services to improve existing homes and deliver new homes to communities.

Education Outcomes

The highway network gives people the opportunity to travel to schools, colleges, and libraries of their choice. It also creates the right environment for investment and economic growth, which creates opportunities for employment and training at all skills levels.

Family Resilience and Stability

A safe, accessible, serviceable, and sustainable highway network creates the right environment for economic growth, which creates opportunities for employment and training, which promotes family stability. The highway network also provides access to health care and support services which address vulnerability and family resilience.

We will continue to acknowledge the importance of the family unit through our work with our Local Highway Panels where there is a focus of localism and the development of community.

Safety

Essex Highways prioritises a safe environment for everyone travelling or working on its network, including safe design, delivery, and use. It also promotes a safe environment through access to emergency services such as the fire, police, and ambulance services, as well as access to vital support

services such as safeguarding. It also maintains essential links to communities with limited access.

Outcomes for Vulnerable Children

The highway network provides access to local and partner organisations as well as voluntary and community organisations which deliver health care and social services to children and other residents.

Levelling up Outcomes for Families

The highway network provides access to key national and international destinations, supported by reliable journey times, thereby creating the right environment to attract investment and employers to the area. These benefits address the impact of recent global events and the cost-of-living crisis on unemployment by supporting business recovery, creating employment and training opportunities for all skills levels.

The highway network affords opportunities for active travel, exercise, sport, leisure, entertainment, and access to green spaces, all of which promote physical and mental wellbeing. The highway network provides access to social services as well as to other health care and domiciliary services. It also maintains essential links to communities with limited access which promotes social inclusiveness and independent living.