

**INFRASTRUCTURE ASSET MANAGEMENT: OPPORTUNITIES AND
CHALLENGES FOR THE UK BUSINESSES****Amanjeet Singh¹
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Asset Management is the industry that inspects and maintains the existing highway network to ensure that it is safe for public use and free for passage by all users. Historically, highway asset management has been underfunded, leading to a large backlog of defects which would cost billions of pounds over many years to rectify. This research looks at the benefits that could be provided to the asset management industry through the development of a regional and/or national framework for Highways Asset management concludes that working within a framework where two or more highway authorities join to make a combined authority approach, some of the biggest challenges currently faced by the industry may be relieved. The research draws on the experiences of professionals currently working in the Asset Management industry through a survey gathering their opinions and experience of how the industry currently operates and what could be improved. Through the survey, there was overwhelming support for the development of a national and or regional framework and positive support for the benefits this could bring to the industry, including potential cost savings; better access to training, knowledge, and experience; improvement of data collection and management; plus a greater opportunity for access to larger funding. The introduction of a national and or regional framework, though, does not come without challenges, especially on the commercial and contracts side. Should a national and or regional framework be developed, this has the potential to revolutionize the way that the public highway is currently maintained, with long-term commitment to ensuring that the highway receives the funding it requires to maintain one of Britain's largest assets.

Keywords: Highways Asset Management, UK Highway Network, ISO 55000, British Standards (BSI), Highway Maintenance Standards

Introduction

Asset Management within the UK is governed by the British Standard with the latest ISO 55000:2014 standard. According to ISO 55000:2014, Asset management involves the balancing of costs, opportunities, and risks against the desired performance of assets to achieve organizational objectives (BSI, 2014). An Asset is defined as 'an item, thing or entity that has the potential or actual value'. (BSI, 2014) Within the UK, the built environment is an asset; some assets, such as buildings, may be privately owned and maintained, and other assets such as highways and infrastructure, are publicly owned and maintained by the UK government. To stop these assets from deteriorating, many assets, especially those owned by the government and companies, are included within an asset management plan.

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The management of infrastructure assets is crucial to keep the UK transport industry operational. ISO 55000: 2014 standards define asset management as ‘the coordinated activity of an organization to realize value from assets. Mike Wilson, Highways England Chief Highways Engineer, describes asset management as “how we use our assets – bridges, roads, drainage technology data and even our staff skills and capabilities – to deliver a service to our customers” (Wilson, 2022). Wilson also describes good asset management as “understanding our customers and stakeholders, identifying what they need and then using our assets to effectively deliver the right level of service”. (Wilson, 2022)

The above definition suggests that Asset Management is a service to the public, which in part can help contribute to the social prosperity of an area or metropolitan and provide a platform to enable economic growth through increased commercial enterprises and retail outlets as well as homes for people during the national housing shortage. Providing the freedom of movement between all of these is the national transport infrastructure and industry.

Within the UK Asset Management industry, the tendency is for individual asset management authorities to work independently from each other despite having a common aim. Whilst the budgets for each highway authority differ depending on the local authorities’ budgets, the legal obligation remains. Should multiple authorities work together as part of a common aim of managing highways, a larger combined highway authority is likely to have access to a greater number of resources and money, as well as the knowledge from highway engineers to maintain the highway effectively. Throughout this research report, I will explore the benefits and drawbacks of cross-highway authority working, to provide supporting research as to whether a national framework or policy supporting cross-highway authority working would be beneficial for the highway asset management industry.

Objectives of Research

This research aims to explore the business opportunities, challenges, and cutting-edge developments in the field of highway infrastructure asset management. The following key research questions were addressed:

- What are the key drivers for managing highway infrastructure assets?
- What are the key highway infrastructure asset management strategies currently being implemented in the UK industry?
- What are the key cutting-edge developments in the field of highway infrastructure asset management?
- How do highway authorities collect, manage, store, and use highway infrastructure assets data?
- What difficulties do asset managers face when implementing highway asset management policies and strategies?
- Is there a need for developing a practical and viable framework for managing highway assets?

Related Work

What are the key drivers for managing highway infrastructure assets?

1.1 Risk Management – Corporate Manslaughter

Risk management within highways asset management can be a complex area balancing the legal obligations placed on a highway authority, with the financial constraints whilst maintaining the relationship of stakeholders, balancing engineering judgement and standards, which if not correctly delivered as a service could pose a threat of corporate manslaughter should the worst-case scenario unfold on a below standard highway. Having a legal obligation 'to take such care as in all the circumstances was reasonably required to secure that the part of the highway to which the action relates was not dangerous for traffic' (UK Government, 1980) drives authorities to firstly ensure that the highway remains safe for the free passage of traffic and should at any point, a section of the asset become deemed unsafe for the public, appropriate action is taken to minimise the safety risk to the public. Adopting a safety-first approach for all road users ensures that should any risk of corporate manslaughter is reduced.

As part of the risk management of highway assets, highway asset managers not only have to ensure that the highway is within a good state of repair but also it is their duty 'to ensure, as far as is reasonably practicable, that safe passage along a highway is not endangered by snow or ice' (UK Government, 1980). This highlights the importance of ensuring the highway can be used at all times of the year in every condition. Winter maintenance of highways often means that highway authorities are required to spread rock salt over the carriageways and footway to stop the formation of ice and snow. The freeze thaw effect on a carriageway can accelerate the deterioration of the asphalt meaning the winter maintenance operations need to be managed efficiently and effectively. Over salting of the carriageway can cause more harm to the motorist and the asset condition than it provides in safety during wintery conditions.

When maintaining assets it's important to consider the effect on climate change that any project is likely to have. Asset management programmes and strategies need to be carefully planned and coordinated to reduce the emissions released into the atmosphere. Careful planning and programming of operations as well as innovative design can reduce the carbon footprint associated with an asset management program. With the climate emergency declared in 2020 by the UK government any emissions released into the atmosphere should be carefully monitored and where possible mitigated to achieve net zero targets.

1.2 Road Safety

Managing safety on the highway is vital for any highway authority. Not only do they have a legal obligation to ensure that the highway is safe for all users, but any incidents on the network can also cost a highway authority money with a clear up operation to ensure the highway is free of debris and obstructions, repairs required to highway assets, and delays caused from the incident costing affecting the local economy. By reducing the number of accidents per year on the network the operational expenses

associated are also reduced, meaning any costs can be reallocated to a capital budget to help fund maintenance programmes.

1.3 What are the key highway infrastructure asset management strategies currently being implemented in the UK industry?

1.4 Customer Focused Delivery

Due to the way highways are constructed and all the technology and components required for a highway to operate; many asset management strategies are often layered and can sometimes be complex. The fundamentals of any asset management strategy involve around delivering a service for the assets customer, in this instance the road users, ensuring that the operations are done efficiently with a focus on quality and ensuring the construction is right first time, ensuring that the operations carried out are sustainable and where possible strive for innovation on the road to net zero, all being delivered on an ever decreasing budget, therefore whole life cost is more crucial than ever due to the continuous lack of funding leading to the demise of the highway networks condition. National Highways discuss a customer focused approach to asset management pushes the culture that asset management is a service that is delivered for the public. This relies on improving the network to increase network resilience, and though public communications build and trust that the managing agency has the skills and expertise to deliver a service with integrity. A customer focus approach focuses on the ride quality for the road user and where possible improve on network management so each time a road user travels, they can rely on the road network to allow them to travel safely for both work and leisure. (National Highways, 2022) The UK Roads Liaison group suggested that improved communication with the stakeholders and customers is important to the success of asset management. Many stakeholders and customers confuse highway maintenance with asset management. Maintaining a highway to a minimum acceptable level by filling in potholes in a reaction to a either a safety concern or to satisfy complaints made by customers and stakeholders can cost up to 4 times as much (UKRLG, 2012) This approach whilst customer focused does not promote the efficiency that can be recognised with a clear plan and policy.

2. 'Red, Amber Green Rating'

When surveying highways, many authorities adopt a red, amber, and green rating to classify their assets. Red being in urgent need of repair, an amber asset requiring consideration for repair and green rated assets not requiring repair. Many authorities target the amber assets to prevent them deteriorating further to red where they would require significant investment to improve the asset condition. Often many of the red rated sites would cost too much to recover, so that stretch of the network enters the managed decline stage which is a balance between the risk and the return of the investment. Authorities may benefit from applying a treatment such as a surface dressing to hold the road together allowing the pavement structure to deteriorate

knowing that each year the pavement structure lasts, the further the costs of the original investment stretches. Most major networks are inspected on an annual basis, with the lower classification roads inspected bi-annually. With the A and B networks maintained to a green rating this allows for most of the kilometres travelled on the network to be done on a defect free surface.

3. What are the key cutting-edge developments in the field of highway infrastructure asset management?

3.1 Partnerships

Partnerships within the built environment are common. Many companies offer a supply and monitor servicing which allow remote access to features within the asset. An example of such is Zephyr by Swarco (Swarco, 2018) for their variable messages signs and vehicle activated signs. Through the system, the client, or a 3rd party such as the client's asset manager can access the system and to check the status of the equipment, update messages displayed or access system data and logged data.

3.2 Digital/remote monitoring

Digital and remote monitoring of the network allows for asset managers to make informed decisions about the asset they are managing remotely. Working remotely brings many benefits to any works carried out, including reduced emissions, increased productivity, and increased reproductivity. With the national climate emergency, the emissions experienced from multiple site visits by the engineers and contractors can be reduced if this work can be done remotely. In addition to this the time spent travelling to and from the site is also reduced thus increasing productivity. A remote monitoring system can have set parameters introduced which when calibrated can create alerts should any part of the asset fall outside 12 | Page of the criteria. This could be useful in highway structures where monitoring system can detect loads and stresses through a structure to determine if there is likely to be any damage.

3.3 Digital surveys, 3D Mapping, Defect Categorisation

With the advancement of technology, it is now possible to digitalise parts of the asset management processes further with the use of 3d mapping and digital defect categorisation. Using mobile surveys and high-definition cameras, it is possible to drive the highway network, record data using surveillance cameras and radars to build a 3D model of the network that can be used to assess defects. Gaist is a leading provider in this field (GAIST, 2024) and with their technology they can detect up to 35 different defects, these defects can then be mapped on their software to create a mapping system that is compatible with many Pavements Management System software's. By using a mobile camera system this removes the need for inspectors to be on the highway, thus reducing delays and improving working safety. In a similar scheme, Transport for West Midlands collaborated with Mobileye and retrofitted a camera system to their refuse and recycling trucks allowing them to continuously scan

the roadside infrastructure and marking as the vehicles travel around the network recording data. Making use of an existing fleet of vehicles saves operational costs associated with the manual inspection of highways.

3.4 How do highway authorities collect, manage, store, and use highway infrastructure assets data?

Many highway authorities collect data to make decisions about how to manage their assets, the data collection is usually carried out by specially designed vehicles and operated by either 3rd parties or trained specialists within the organisation. Examples of such data is a TRACS (TRAffic-Speed Condition Survey), SCRIM (Sideways-force Coefficient Routine Investigation Machine) tests, Deflectograph tests, and visual and/or digital condition surveys are the most common types. All these different tests will produce different results, and these must be inputted into a system, National Highways, using a system called Confirm that is developed by Brightly. Confirm is an Enterprise Asset Management Software, which stores data based on a unique asset number and allows all the information to be accessed from one data source by using a single data source, asset managers can access the information required in a single place to make a better more informed decision about when to maintain an asset. (Brightly, 2024) For highways, every piece of street furniture and all highway assets maintained by the authority can be mapped showing areas with a high cluster of defects, allowing Asset Managers to develop a comprehensive scheme.

The current data collection method for highway asset management have been used for several years with many methods of data collect still a manual process. With the digital evolution of highway asset management, it is possible to now collect more data via different mechanisms that allow for more up to date data and a wider range of techniques for data collection. (TRL & Adept, 2022) In the age of smartphones, many highway authorities have a system allowing a member of the public to report a problem with a highway asset. Whilst this system cannot substitute the professional experience of a highways engineer, to gather data on location of defects via the public, also known as crowd sourcing, will demonstrate 13 | Page and area where a trained inspector may wish to visit thus improving efficiency. Other benefits of using crowd sourcing within asset management is improved customer relationships and stakeholder relationships. (TRL & Adept, 2022) Due to the time constraints and budget constraints in the highways sector, it is impossible to inspect all the highway network every year. As a result, highways are inspected on a priority system, usually starting with the highest classification of roads which and other which carry a high volume of traffic or are important for equality such as those within a town centre. When using a crowd sourcing method, this allows customers and stakeholders using assets in a lower priority area to raise and concerns and then once defects are verified and repaired, those which had the concern will gain a trust that the highway authority do carry out works which are important to that person. On the contrary if the defect is not rectified in a timely manner, crowd sourcing also has the potential to lose the public

trust where if a defect is raised and not rectified or the individual not contacted, there could be a loss of trust within the community and a feeling of neglect or a breach in the highway authority duty.

3.5 What difficulties do asset managers face when implementing highway asset management policies and strategies?

3.5.1 Continuous lack of funding

The highways industry has been unfunded for several years. With a continuous lack of funding the highway network across the UK has slowly deteriorated. According to the Asphalt Industry Alliance, the 2023 Annual Local Authority Road Maintenance Survey reports estimates that an investment of £14 billion is required to transform the network back to a defect free condition. With the current UK economy proving a challenge with high inflation and high interest rates, despite an increase in the highways budget in 2023 in England and Wales due to inflation this is a real term decrease in funds available. And an estimated short fall by approximately £300 million. Due to the amount of work required to improve the network condition, it is estimated that 11 years to rectify the condition of the road network. In this time frame budgets would have to be increased by approximately £1.27 billion per year. (Asphalt Industry Alliance, 2023) In addition to this, the Local Council Roads Innovation Group suggests in their 2023 Skills in Highways report that there is a nations skills shortage with 37% (34 of 91 local highway authority) suggested that accessing technical knowledge has become increasingly difficult (LCRIG, 2023).

3.5.2 Siloed approach

Many highway authorities carry out their duties with a budget split between different teams with different specialisms. Those responsible for the carriageway pavements, separate from those maintaining structures, who are separate from those maintaining street lighting, etc. Often this creates an asset management program where assets are not maintained at the same time, compromising network efficiency and increasing costs associated with construction site preliminaries. This siloed approach to asset management means that the public and stakeholders are often presented with additional delays from poor coordination of resources. On a regional level, the silo approach can be seen from one highway authority to the next. Where the highway extends across a county's border, and continued, there is limited evidence of cross-border collaboration and sharing of best practices to maintain the nation's road network. Despite the same common aim for all highway authorities to take such care as in all the circumstances was reasonably required to secure that the part of the highway to which the action relates was not dangerous for traffic' (Highways Traffic Act), collaboration could be better fostered by sharing knowledge, experience, and resources where appropriate. Many highway authorities have their own procurement

mechanisms to ensure their obligations are met. The DfT Local Transport Data Discovery report 'recognizes the disparate policies and objectives of the 150 plus highway authorities in England' and notes that the department should take a 'more proactive role and consider the appropriate framework for establishing better communication, co-ordination and investment.

3.6 Literature Review Findings and Gap in Research

As part of the literature review, I have identified that there is a lack of research covering the benefits of cross-highway authority working and the benefits as well as drawbacks this could present to the industry. This aligns with the aims and objectives of this research report by exploring opportunities for improvement to the highway asset management industry and presenting the challenges these may also present.

4. Methodology

To conduct this research on aims and objectives set at the start of the research, I have undertaken an online questionnaire using the survs website, which has been circulated through industry professionals.

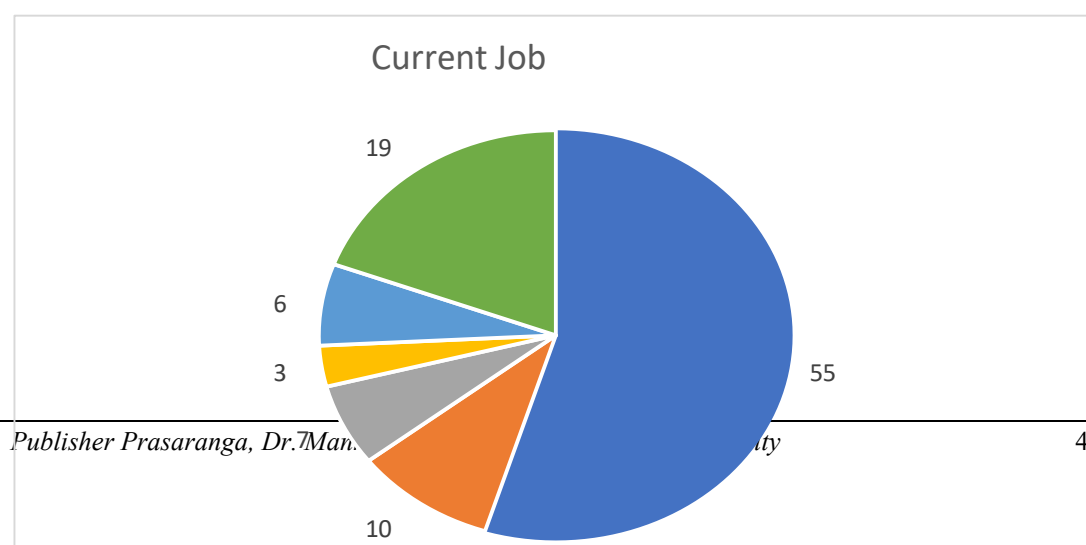
The questionnaire was developed to target the aims, with a strong focus on the cross-highway authority projects and the perceived benefits this could provide the asset management industry and to gauge industry support for a national and/or regional framework should one be developed.

The questionnaire was disseminated across technical expertise groups nationally within the UK, with a focus on highways teams working on large scale roads projects, local government professional services contracts and through a team of structural engineers focusing on maintenance of highways structures in England and Wales. The suspected audience was in the region of 400 – 500, with 90 survey views and 31 responses. Whilst the response rate was low, common themes were evident throughout the survey responses.

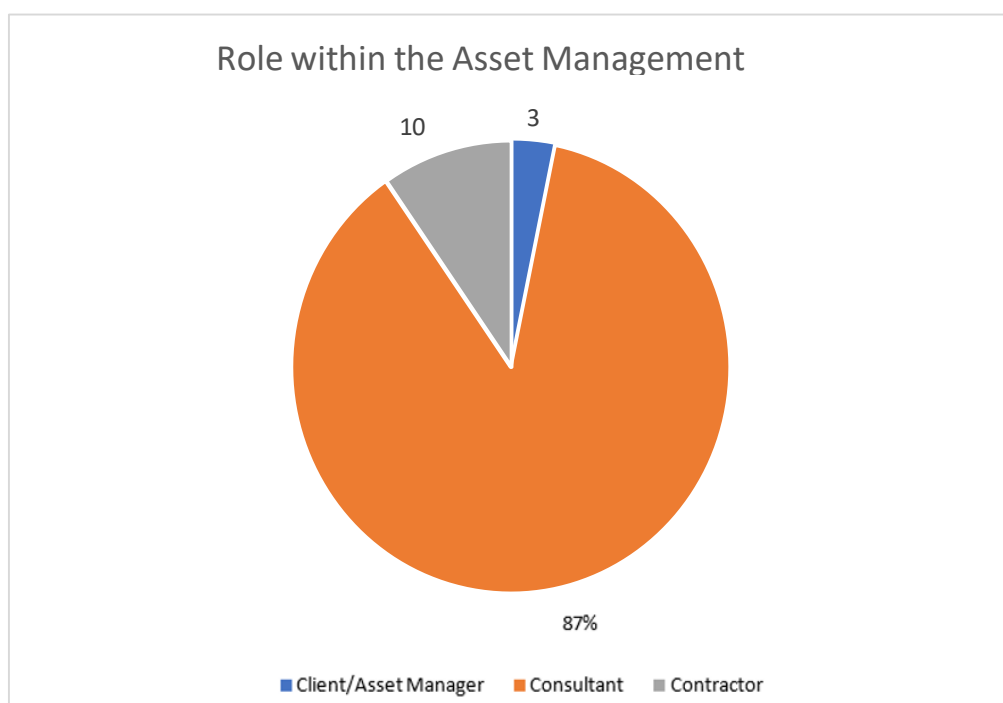
5 Results and Discussion

This section includes the questions circulated by industry professionals and results to gather data around the support for a national and/or regional Asset Management Framework. The results have been presented in a graphical format in figures 1 to 20.

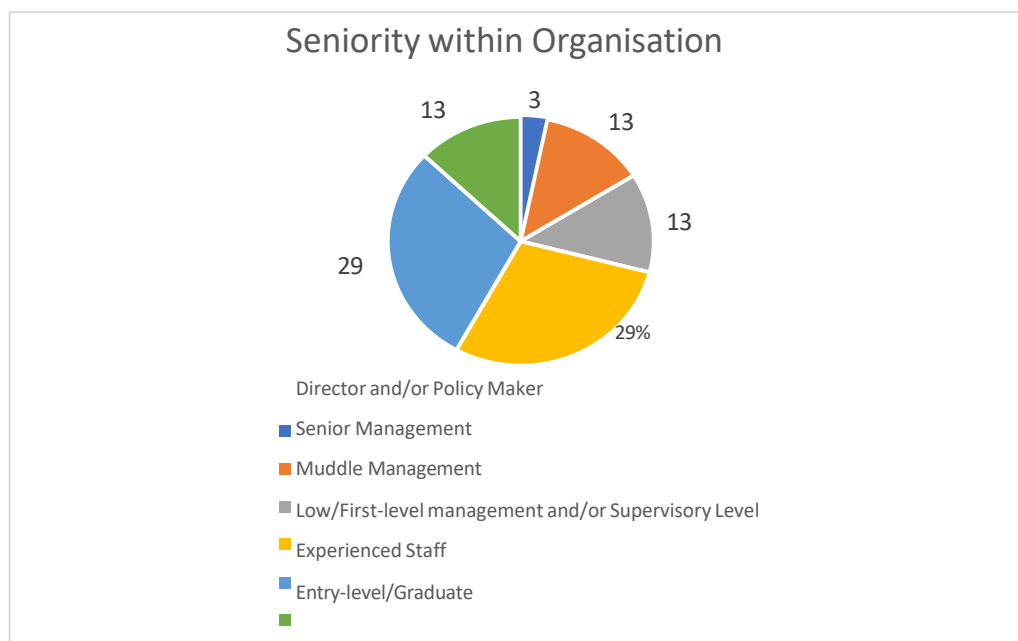
Graph-1 Please indicate your current Job title/position?



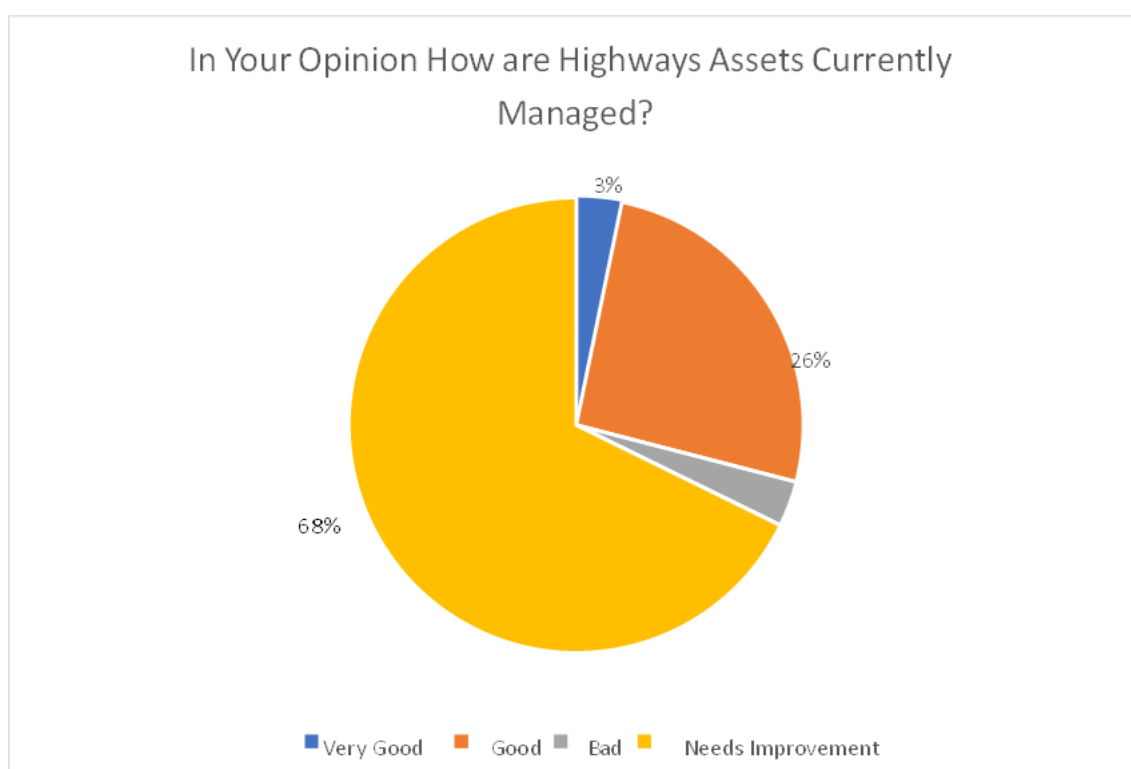
Graph-2: Please indicate your role within the asset management industry?



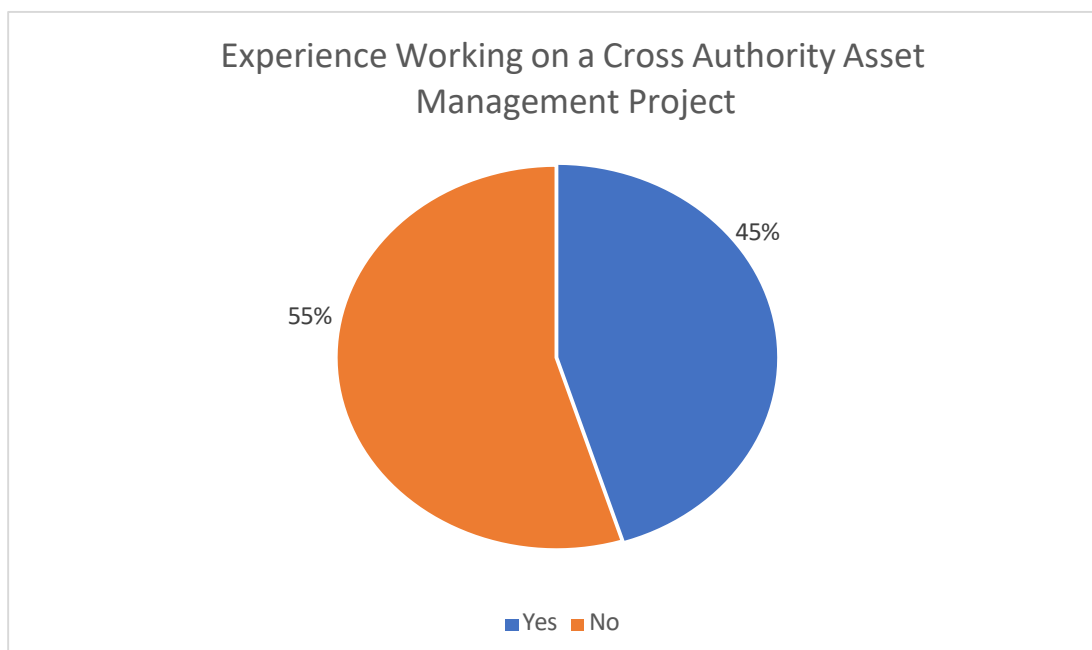
Graph-3: Please indicate your level of seniority within your organisation?



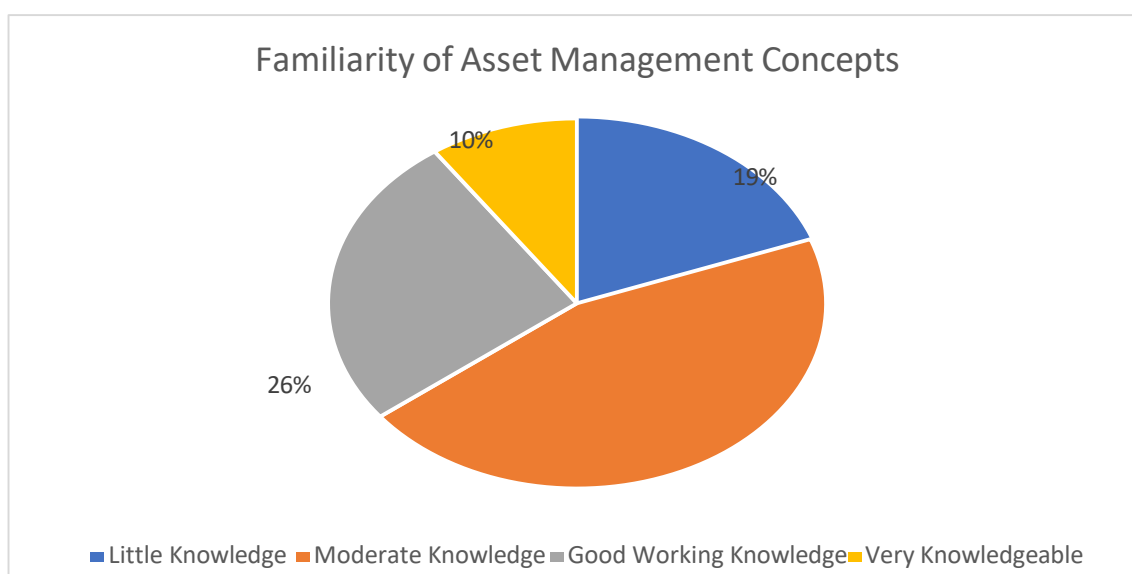
Graph-4: In Your Opinion How are Highways Assets Currently Managed?



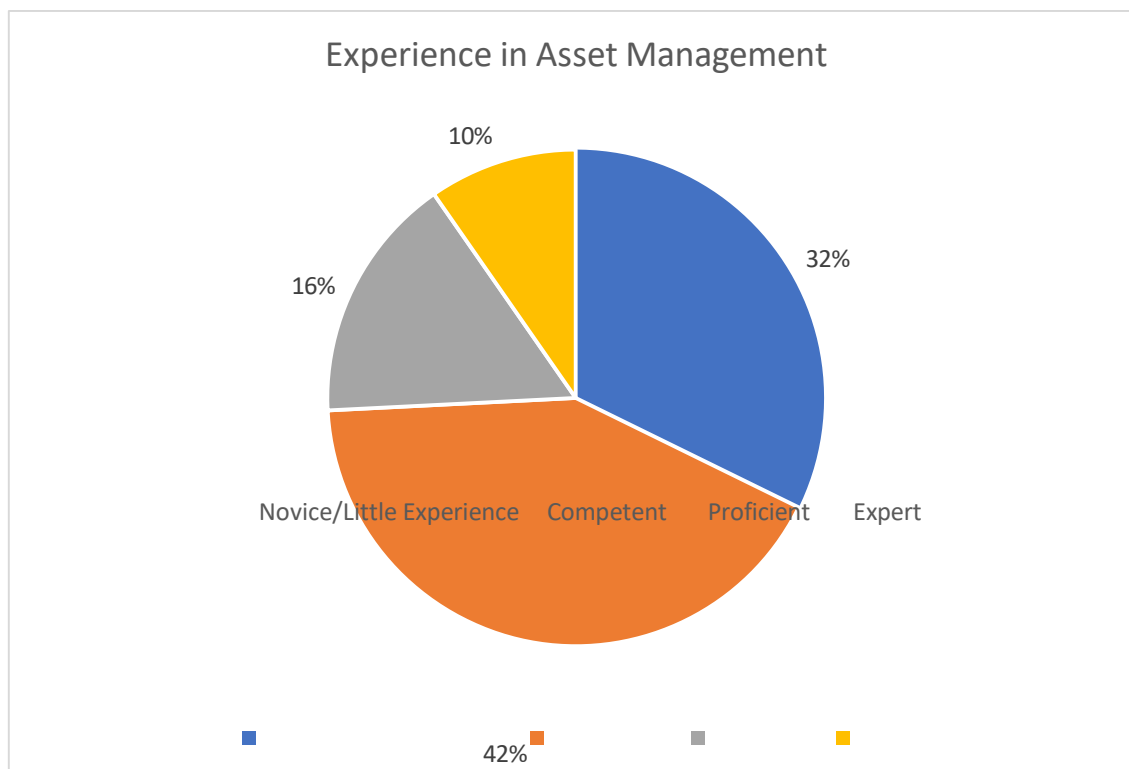
Graph 5: Please indicate if you have experience working on an asset management project where 2 or more highway authorities have worked together to deliver a project?



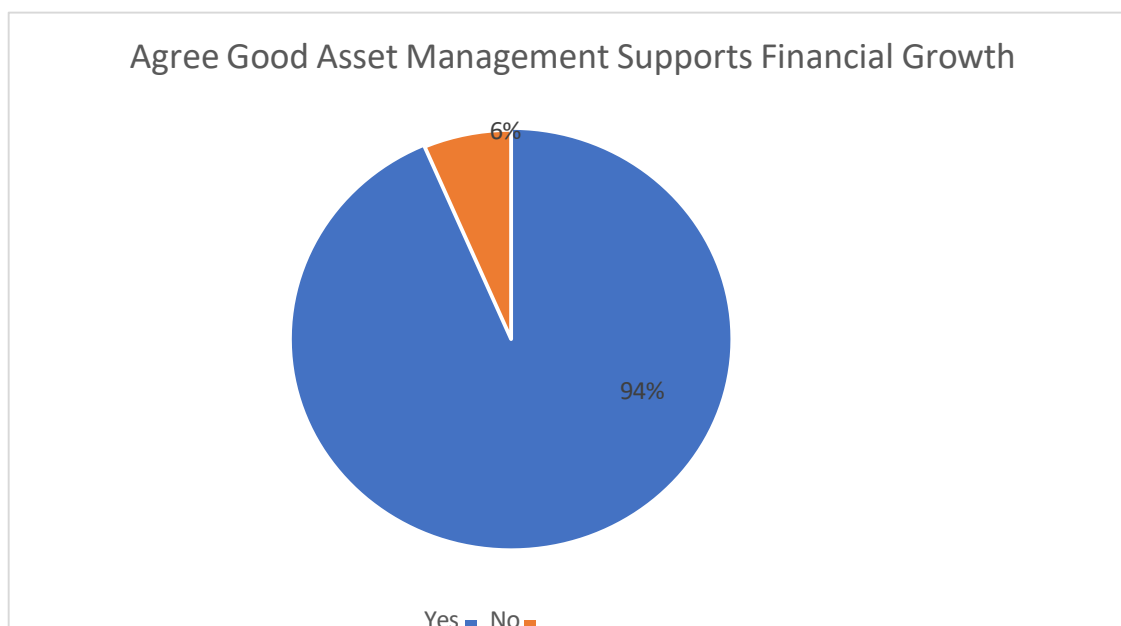
Graph 6: Aside from the information provided, how familiar are you with the concepts of asset management?



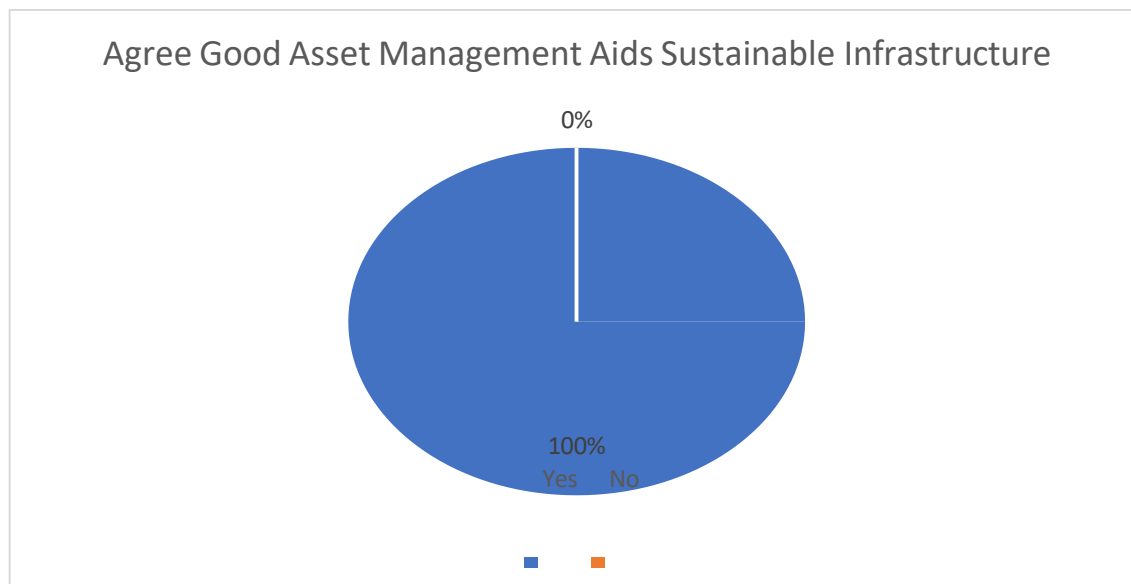
Graph-7: How much experience do you have in an asset management industry/career?



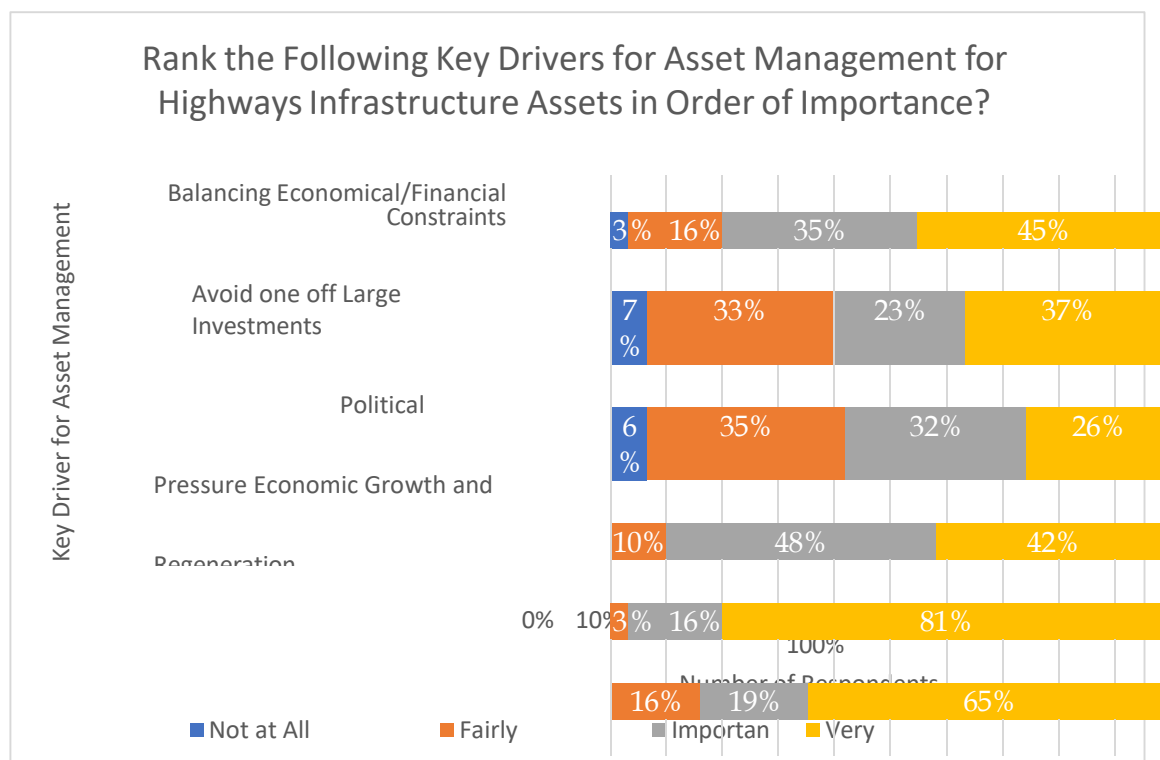
Graph-8: Do you agree that good asset management supports financial growth?



Graph-9: Do you agree that good asset management will aid in creating a sustainable highway infrastructure?

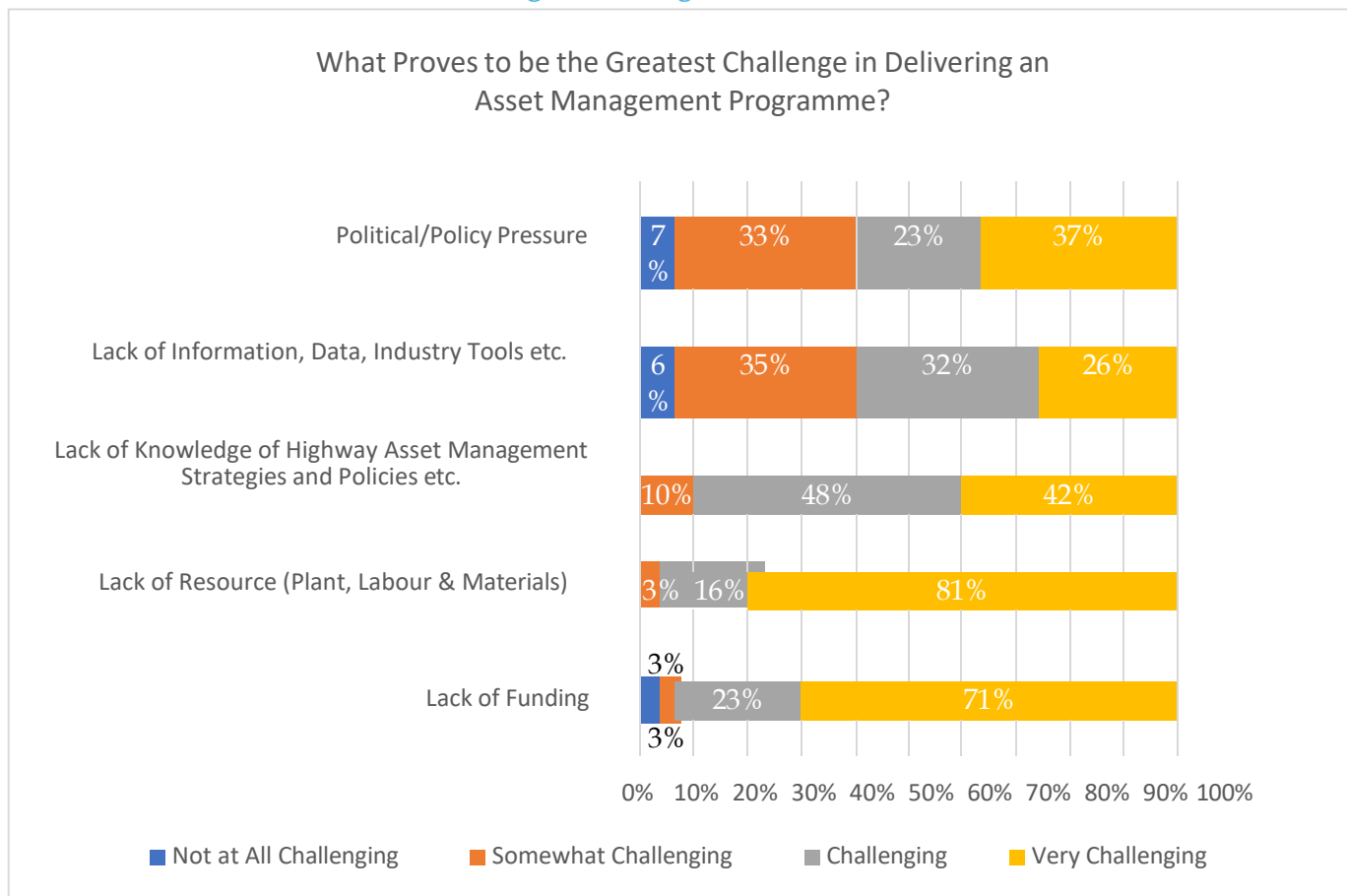


Graph-10: Rank the Following Key Drivers for Asset Management for Highways Infrastructure Assets in Order of Importance?

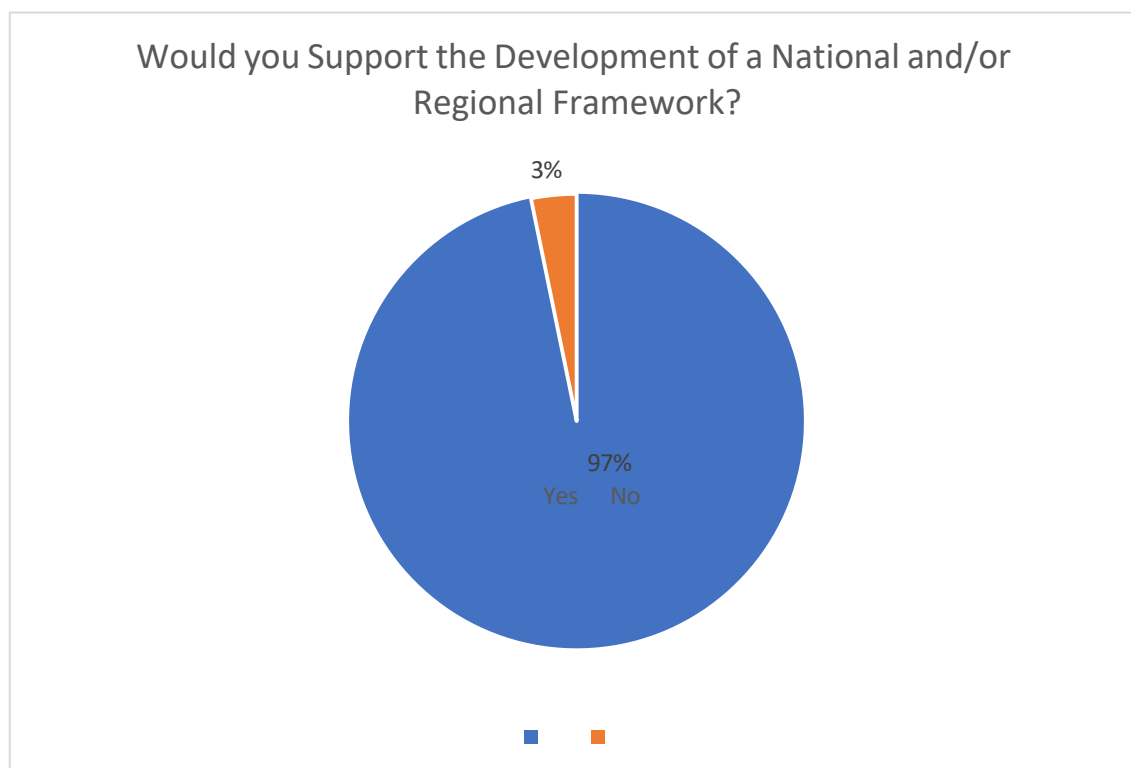


Key drivers for asset management include the economics and budgetary constraints of the highway authority, political pressure based on the current condition of the network, economic growth and regeneration in an area, road safety, and legal aspects arising from a highway authority's statutory duties. The survey conducted for this research suggested that, among these key drivers, Road Safety was the most important, with 81% of respondents categorizing it as very important and 97% as either important or very important. The least important key driver proved to be political pressure with only 56% of respondents categorizing this as either important or very important. The full results can be found in Figure. The key drivers are discussed in greater detail below.

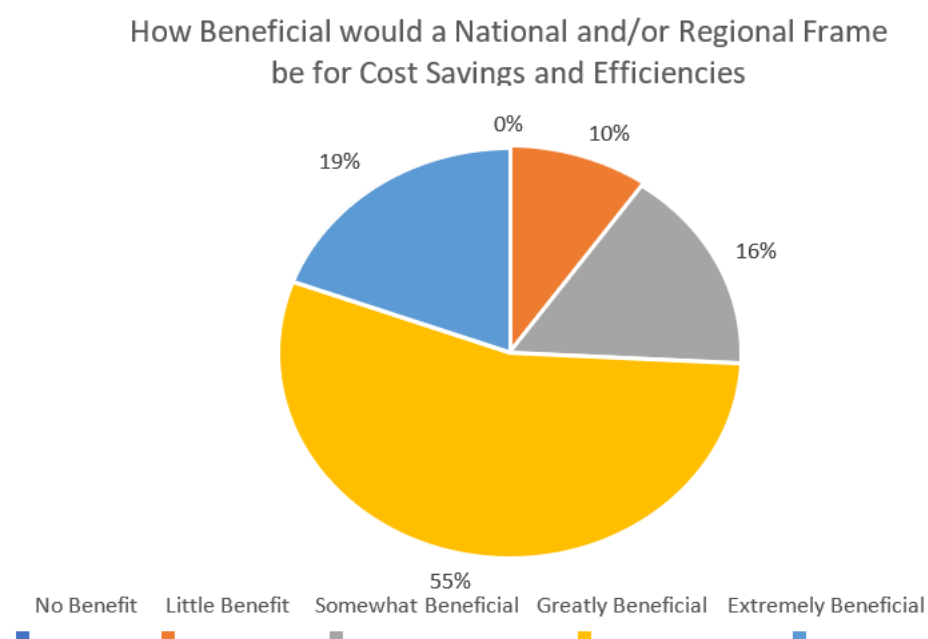
Graph-11: What Proves to be the Greatest Challenge in Delivering an Asset Management Programme?



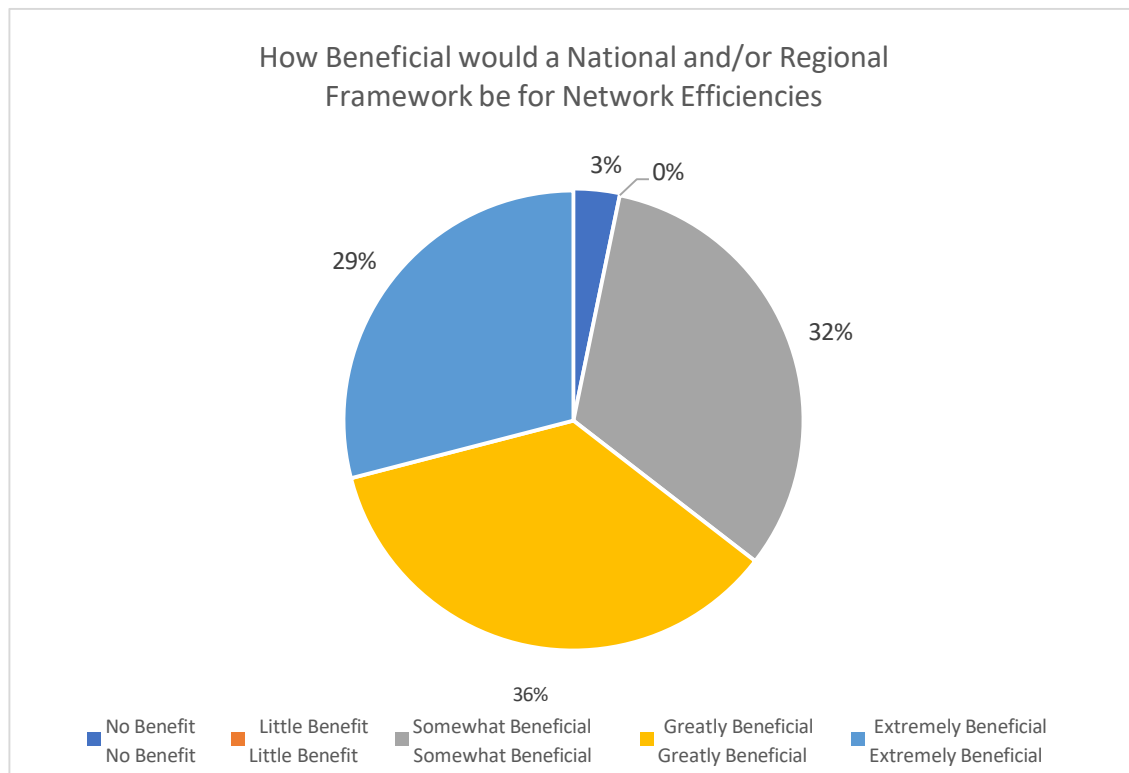
Graph-12: Would you Support the Development of a National and/or Regional Framework?



Graph-13: How Beneficial would a National and/or Regional Frame be for Cost Savings and Efficiencies?



Graph-14: How Beneficial would a National and/or Regional Framework be for Network Efficiencies?



Road Safety & Legal Responsibilities

Within the highways asset management industry, the road safety and legal responsibilities placed upon a highway authority go hand in hand. The regulations enforce that the road safety message and put a requirement on highway authorities to maintain highways to ensure that they are safe for traffic and free from defects where possible. Where highway authorities do not comply with the road safety or legal responsibilities, they are at risk of prosecution.

The safety of all road users is a legal duty that highway authorities have through both the Highways Act 1980 and the Equalities Act 2010 and the Road Traffic Act 1988. The Highways Act 1980 states highway authorities should 'take such care as in all the circumstance was reasonably required to secure that the part of the highway to which the action relates was not dangerous to traffic' (UK Government, 1980), and to ensure that as far as practical, that safe passage along a highway is not endangered by snow or ice (UK Government, 1980). The Equalities Act 2010 state that there is a 'right to travel, the right to information in an accessible form, the requirement that disabled people should not be treated less favourably, and the need to make reasonable

adjustments (UK Government, 2010). Section 39 of the Road Traffic Act 1988 puts a requirement on 'each relevant authority must carry out studies into accidents arising out of the use of vehicles' and 'must consider those studies, take such measures as appear to the authority to be appropriate to prevent such accidents' (UK Government, 1988).

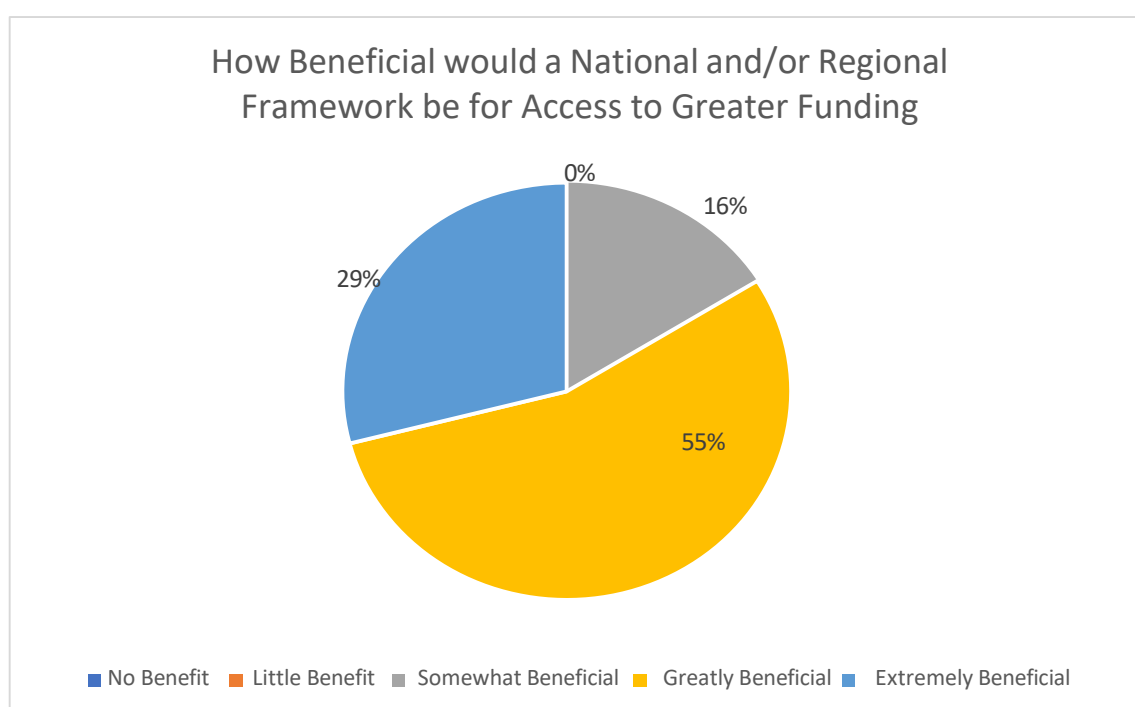
Road safety is mentioned in three separate acts highlighting the importance of road safety to the UK Government. Under the above acts, local highway authorities are required to ensure that all stretches of the network are safe for public use, and should there be an accident where there is a loss of life, there is a risk of corporate manslaughter should the highway be deemed as a major contributor especially if the area is known to the highway authority as an area of local safety concern. As a result, highway authorities usually perform routine accident investigations and analysis work on the areas of network with the highest killed or seriously injured rate over a defined period of time, usually ranging from three to five years. From these studies, a regular programme of work is often established with the aim of improving the operation safety of the asset.

In 2019 the Department for Transport released a report entitled The Road Safety Statement 2019: A Lifetime of Road Safety. In this report Michael Ellis MP, the Minister of State (Department for Transport) at the time the report was released suggests that "The need for road safety begins the moment a newborn leaves hospital and continues throughout their life into old age. In principle it covers every step walked, every bicycle or horse ride, or every mile travelled by vehicle" (Ellis MP, 2019). This statement suggests that road safety is an essential part of life everyday society with a recognition that highways need to be a safe place for all users of the public highway. Ellis wanted the UK to move towards an 'integrated approach to road safety' suggesting that this is a "commitment to the idea that road deaths and casualties are not merely the result of poor driving, but of a transport system as a whole, from signage to road user education, from enforcement to infrastructure design and construction" (Department for Transport, 2019)

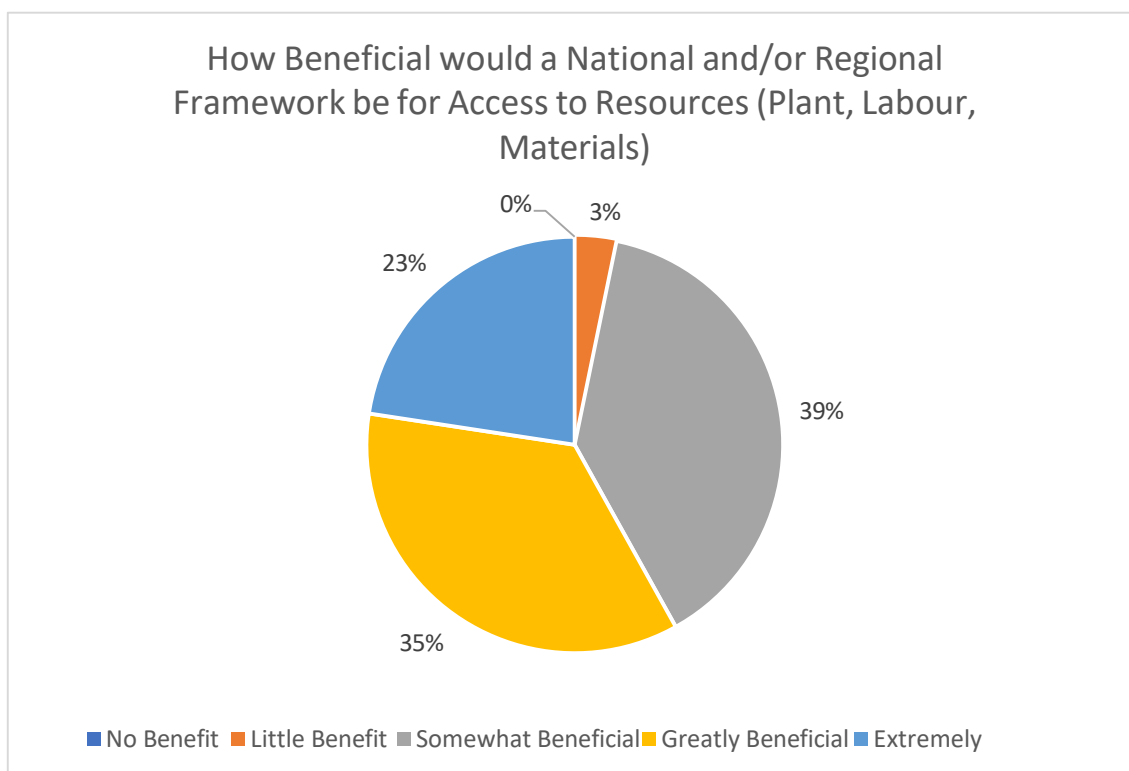
Within the highways asset management industry the design and construction of any construction project falls under the construction design and management (CDM) regulations 2015. CDM puts a requirement on all designers to follow the principles of

prevention to eliminate, reduce, isolate or control risks within design. When undertaking asset management work, the same principles should be followed on road maintenance or improvement schemes. By reducing the risk of injury through design, not only does the number of accidents reduce thus reducing the operational burden associated with the closure and clean up operation of the highway, but also highway authorities are able to comply with their duties to protect all road users on the highway network.

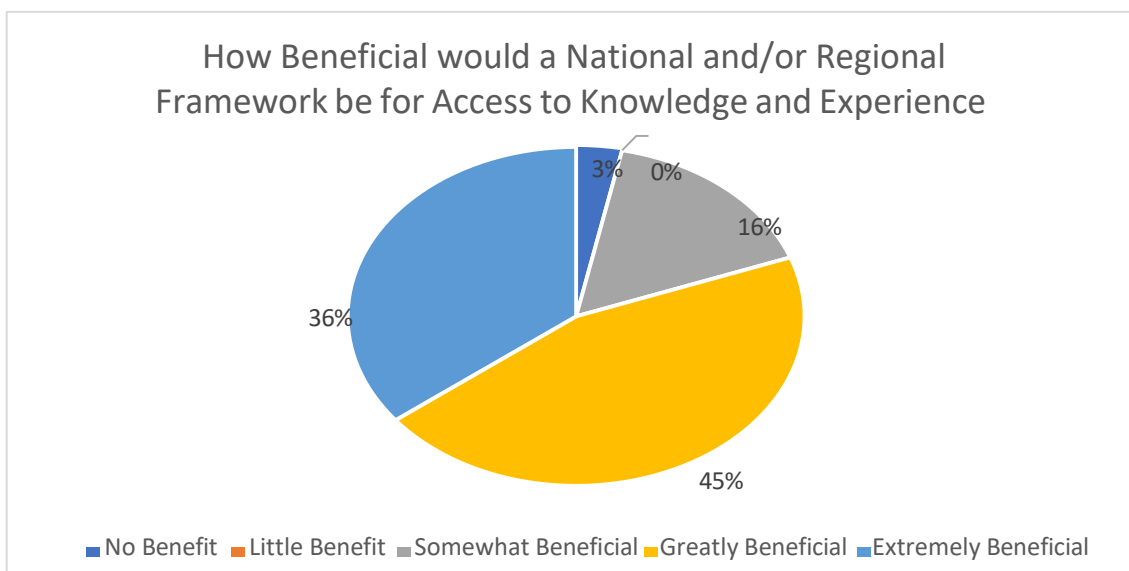
Graph-18: How Beneficial would a National and/or Regional Framework be for Access to Greater Funding?



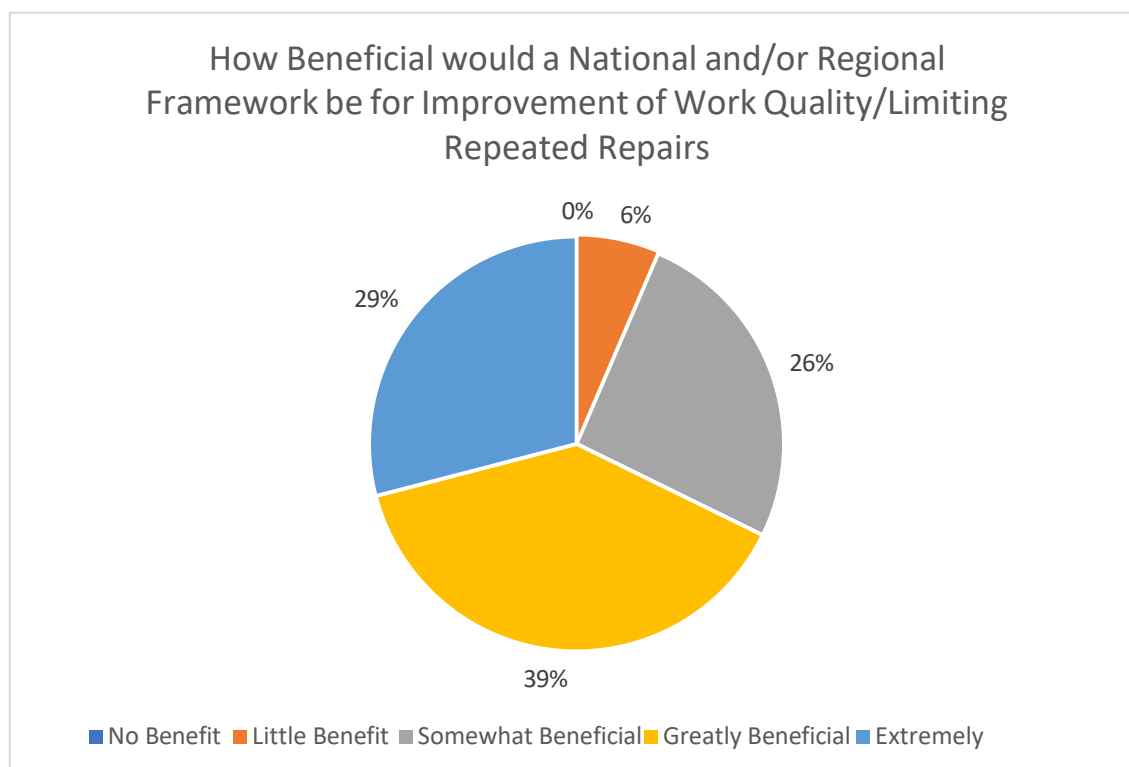
Graph-19: How Beneficial would a National and/or Regional Framework be for Access to Resources (Plant, Labour, Materials)?



Graph-20: How Beneficial would a National and/or Regional Framework be for Access to Knowledge and Experience?

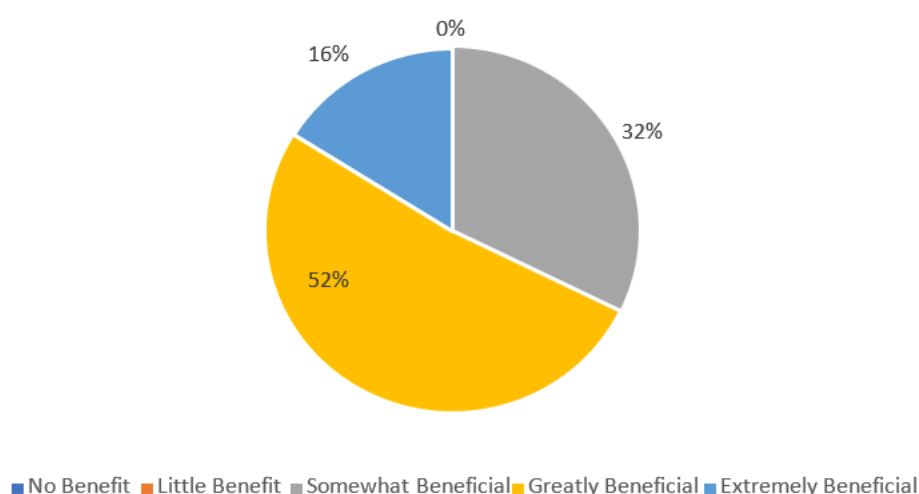


Graph-20: How Beneficial would a National and/or Regional Framework be for Improvement of Work Quality and Limit Repeated Repairs?

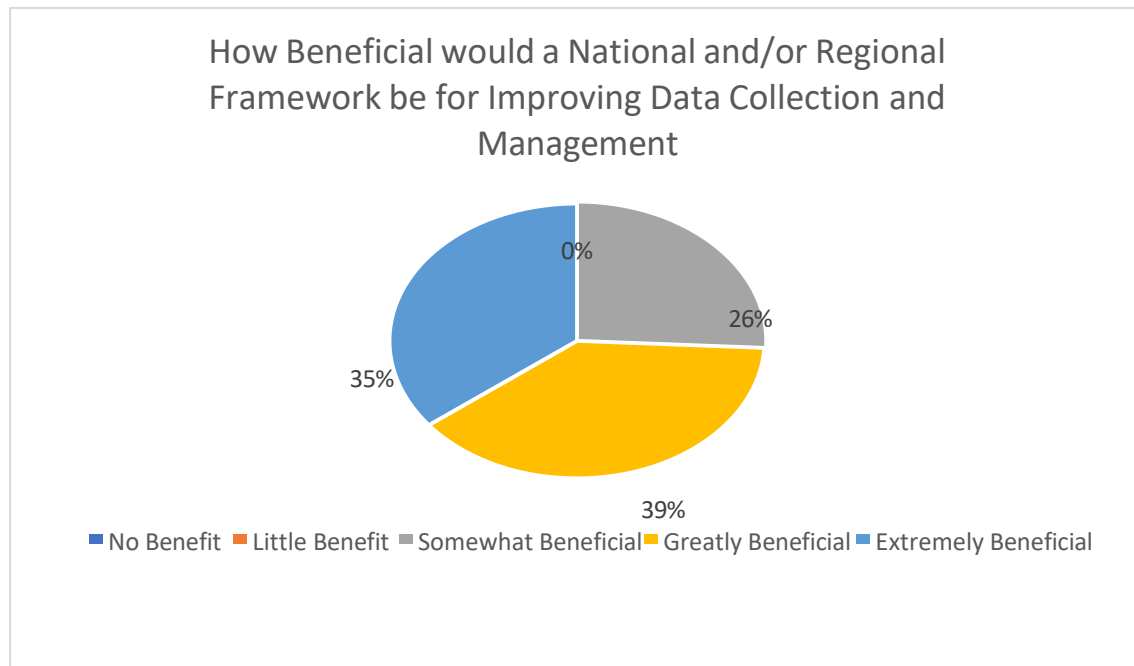


Graph-21: How Beneficial would a National and/or Regional Framework be for Providing Opportunities for Economic Growth?

How Beneficial would a National and/or Regional Framework be for Providing Opportunities for Economic Growth



Graph-22: How Beneficial would a National and/or Regional Framework be for Improving Data Collection and Management?



Economic Growth and Regeneration

The asset management industry is important for an area's economic growth and regeneration. Economic growth and regeneration from asset management stems from two main areas, the employment of local people, and through improvements to the local road network making the area an attractive proposition for retail and hospitality from those living in the surrounding areas. As part an asset management project a wealth of skill sets are used throughout the preconstruction and construction stages. If those skill sets are employed locally, those working on the project, are likely to spend their earning within local businesses and hospitality venues. This then brings an injection of money into the local economy often from central government and taxes, leading to an influx of sustainable businesses being established, all then providing income back into the local authority through business rates and centrally via business taxes. Highway projects are often significant in value and labour-intensive, providing opportunities for longer-term employment in the area.

In addition to maintaining the road network, highway authorities are often responsible for town centre and urbanized areas which should funding be available for public realm improvement schemes as part of a wider asset management strategy, this increases the appeal to those living in the surrounding areas, travelling for day trips and tourism purposes. The public appeal for an area through regeneration schemes is likely to increase the footfall of an area thus likely to increase the local expenditure, all contributing the economic growth. As part of UK planning legislation, a developer is required to ensure that the effects of local development do not have an adverse impact on the local highway network. Should a highway network be in a good state of repair and have spare capacity, developers are more likely to invest in the area providing opportunities for increased housing, commercial units, retail and

hospitality settings as well as public services such as schools, medical centres and local parks or green spaces. This attracts a greater population, all helping to contribute to the local economy. Should the highway network be in a state of disrepair or currently at or above capacity, the works required from a developer to upgrade the network may make the development economically unviable, so the above-mentioned benefits are not realized.

Balancing Economical and Financial Constraints and Avoiding one off Large Investments

When carrying out highway asset management projects, there is a need for highway authorities and governments to balance budgets to ensure that all areas of public services are fully funded and supporting in a financially sustainable way. According to the latest ALARM report, the current highway network would require a one-off investment of £14 billion over 11 years to improve the national network to a reasonable standard (Asphalt Industry Alliance, 2023). Due to continuous underfunding, highway networks are continually deteriorating which makes the asset management industry all the more critical. Whilst a one off investment would solve the issue at hand, the likelihood of such funding becoming available would be very unlikely and so asset management is often seen as a balance of costs between reactive maintenance to ensure road users are safe, and proactive preventative measures to stop the carriageway from deteriorating further paired with a programme of major maintenance for renewing assets. Part of an asset managers job is to recognise where a stretch of the highway network becomes the point of economically viable to repair and enters a stage of managed decline until the point where the asset requires major investment to replace. In highways this could be a carriageway renewal programme, partial bridge replacement such as deck replacement projects, or lighting replacement for modern equipment. There are a number of options available to highway asset managers for preventative measures depending on the current condition of the carriageway. Generally preventative measures cost less than repair work which costs less than replacement works. An effective programme of preventative measures may extend the assets lifespan by a quarter or a half for a fraction of the cost. The key for asset managers is selection of the correct preventative measure for the network at the right time.

Political Pressure

As part of the survey conducted for research report, political pressure was ranked as the least important key driver for highway asset management. The full results can be seen in figure 10 within this report. As an industry, it is important to not allow political pressure come in the way of the engineering side of the asset management. Whilst the highway network is a public asset which is maintained at public expense, due to the continuous lack of underfunding as highlighting in the ALARM report by the Asphalt Industry Alliance (Asphalt Industry Alliance, 2023), there will inevitably be sections of the network which fall below the public expectations. Whilst there may be pressure to maintain these, from an engineering perspective it may be more economically viable to manage the asset through the end of its life to a point where it needs complete replacement. This is often difficult to communicate out to stakeholders which do not have a technical background and more could be done to educate those that have political power on the viability of repair, and where necessary explain the risks with allowing a highway to deteriorate until the point where it is replaced. The UK Roads

Liaison Group highlights this within their report titled 'What should Councillors know about Asset Management' (UKRLG, 2012). By responding to political pressure, the engineering judgement around asset management could become lost with public money being spent in a way which does not provide the best value for money.

WHAT DIFFICULTIES DO ASSET MANAGERS FACE WHEN IMPLEMENTING HIGHWAY ASSET MANAGEMENT POLICIES AND STRATEGIES

Lack of Resources (Plant, Labour & Materials)

The survey undertaken as part of this research project highlighted that one of the greatest challenges faced by Highway Asset managers is the lack of appropriately skilled resource in the industry. Highways as an industry is facing an unprecedented age gap in skills with a shortage of new engineers joining the industry and knowledge and experience lost when the older generation retire. Local Council Roads Innovation Group recognise that through the use of apprenticeships, consultants, contractors and highway authorities alike are supplementing the industry with trained and professionally qualified engineers and workers that can drive the industry forward and provide new thinking and innovations to drive quality and efficiency at a time where the industry requires it the most (LCRIG, 2023).

Materials not only come in short supply but are also continuously fluctuating in price. During recent years material shortage and inflation due to the demand has caused construction projects costs to skyrocket with many projects becoming uneconomically viable. This is due to a number of reasons however the COVID-19 pandemic changed the world economics severely and due to the size and complexity of many construction projects the industry was struggling. Andy Mitchell Co-Chair of the Construction Leadership Council wrote a letter to industry in July 2021 asking for a continuation of the collaborative approach taken by the construction industry for the delays and rising costs seen as a result of the shortage of materials (Mitchell, 2021). Since then the industry has recovered slightly with materials now more available however the long term economic impact of COVID-19 is still present with the British Construction Indexation Scheme (BCIS) predicting an increase of 13.8% in material costs from Q1 2023 to Q1 2028. For the highways asset management industry, this further highlights the importance of ensuring that the projects worked on provide good value for money and the correct procedures and policies are put in place to allow for the maintenance of highways in an economically viable manner.

Lack of Funding

As highlighted in figure 10 and in the ALARM survey (Asphalt Industry Alliance, 2023), lack of funding for highway asset management projects and programmes still proves to be one of the greatest challenges. The ALARM 2023 statistics suggest that one of £14 billion investment is required over 11 years. Each year that the industry is underfunded by the UK government and local highway authorities, those statistics are likely to worsen paired with rising material costs and lack of resources may lead to a situation in the future where the state of the highway network as a whole is critical and requires major investment to repair or the network may be at risk of becoming unfit for use leading to a reduction in road use and causing an over reliance of other transportation networks such as rail or river which may benefit the environment, however could have a significant impact on the economy. Whilst the likelihood of the demise in road transport is very low, the costs to resurrect the network is forever

increasing placing greater strain on local budgets. With the recent change in political stance on the suitability of HS2, in April 2024 the UK government has allocated an additional £8.3 billion to 102 highway authorities in the UK (Harper MP & Department for Transport, 2024). This makes up around 75% of the current funding required to repair the road network, without careful planning from asset managers there's a risk that the money is not spent wisely and with the predicted 11-year timeline to rectify the current condition of the network the likelihood of the funding reducing the required budget by 75% is unrealistic which highlights the significant investment required in the UK road network.

Lack of Knowledge of Highway Asset Management Strategies and Policies

A lack of knowledge of highway asset management strategies and policies was highlighted as the 3rd biggest challenge in the survey responses. The full results can be found in figure 11 of this report. The 2023 Local Council Roads Innovation Group (LCRIG) Report on Skills in Highways suggests that whilst there is a variety of training available to the industry, the expense of attending the training and then the lack of employee loyalty paired with small training budgets limits the training which engineers receive from their employers, due to a lack of perceived return on the investment. (LCRIG, 2023) The report acknowledges that the recent trend in the uptake of apprenticeships is positive however more must be done to train and retain highway asset managers on strategies and policies. Within the industry the age gap between the experienced engineers and the next generation is large this increases fears that over coming years a lot of industry knowledge and experience will be lost due to the retirement of the workforce. The risk of this for the industry could delay progression and innovation all impacting the condition of the highway network. The skills for Highways LCRIG report suggests that 34 of the 102 respondents from English councils flagged that they need support in technical training in the short term.

With the governments net zero targets, the skills for highways LCRIG report also recognises that there is a recent demand for training around the preparation for net zero.

This is being reported from LCRIG, the Institute of Highway Engineers, Road Surface Treatment Association and the Chartered Institute of Highways and Transportation, as well as expressed by many of the local authorities surveyed to produce the report on skills document (LCRIG, 2023). This comes from an industry drive to ensure that the works carried out are done in a sustainable way in an industry that typically has a high use of fossil fuels and raw materials.

Lack of Information, Data, and Industry Tools

The lack of information, data and industry tools was the 2nd least challenging aspect of highways asset management according to the results of the survey undertaken for this research project. Previously this had provided a greater challenge however through recent innovations and digitalisation of some of the highway asset management practices, the tools and data available to the industry is improving and through further innovations is likely to improve further in the future. Historically data may have been collected manually and stored within paper-based systems with information sometimes being misplaced and requiring an asset manager to be aware of that the information existing in the first place. With the improvement of technology and advancement in digitalisation paired with new best practices and regulations such as BIM, the information is now more accessible. One issue that is still persistent is the

siload approach to data collection and the multitude of storage options available. Whilst the information may be more accessible, improvements are still required to make it more coherent to provide asset managers with all the tools required to make an informed decision on all aspects of the network, not just the individual asset on the highway flagged for improvement. By removing silos both from data storage and collection, as well as funding, this will help to provide a more efficient asset management service to the public.

Political and Policy Pressure

The survey carried out to assist with this research project suggests that political and policy pressure is the least challenging of the areas highlighted. The respondents to the survey were primarily consultants, with some contractors and one client. This response is likely seen due to the lack of client responses with consultants generally removed from the politics of asset management and focused on the engineering delivery of projects, the recent injection of spending from the UK government following the cancellation of the northern leg of HS2 (Harper MP & Department for Transport, 2024) suggests that highways asset management is important to the public and in a client or asset manager role the result is likely to be different. The UK Roads Liaison Group produced a document in 2012 titled Highways – Maintaining a vital asset, What Should Councillors Know About Asset Management. Within this document, there is a suggestion that strong leadership and commitment from elected councillors and senior officers within councils are required to ensure that highways are maintained effectively. The document promoted asset management as a business-like way to maintain a highway, making better use of resources and delivering a project that is good value for money, making the best use of public funding available (UKRLG, 2012). The challenge with this approach is the ever-diminishing budgets paired with an aging network, so council support is required to assist asset managers in providing the best service possible to the public.

IS THERE A NEED FOR THE DEVELOPMENT OF A NATIONAL FRAMEWORK

A national and or regional framework requires multiple highway authorities work in collaboratively to develop and deliver a programme of asset management across multiple highway authority areas. The current single highway authority approach does not appear to be very successful with both the ALARM survey by the Asphalt Industry Alliance (Asphalt Industry Alliance, 2023) and 68% of the respondents to the survey conducted for this research project both agreeing that the way highways are currently maintained require improvement. Refer to figure 4 for survey results. Of the survey respondents, 45% have previously worked on a project where 2 or more authorities have benefited from a collaborative project and 68% of the respondents either being competent, proficient or an expert in the asset management industry. Of the respondents 97%, would support the creation of a national and/or regional framework (refer to figure 12) which demonstrates an overwhelming agreement that the benefits that are detailed below can be achieved through cross authority partnerships and could provide great opportunities for the highways asset management industry. In addition, 94% of the respondents agreed that good asset management supports financial growth, refer to figure 8, and 100% of respondents agreed that good asset management will aid the creation of sustainable highway infrastructure.

Cost Savings and Efficiencies

Cost Savings and Efficiencies are one of the many benefits that could be realised through the creation of a national and/or regional framework. 74% of the respondents to the survey undertaken to complete this research project agree that by working on a project with multiple highway authorities, suggesting it would be either extremely or greatly beneficial. The efficiencies and cost savings could be realised through all stages of the project with designers working on uniform approach and treatment to a section of the network with efficiencies gained from one set of survey results required, one design organisation working on the project with a single specification and procurement. During construction, due to the additional volume, there are cost savings to be realised from contractors for using a greater volume of materials, with only one site set up and management costs, and a shorter programme than if the project would have been delivered in sections by different highway authorities.

Improving Network Efficiency

When undertaking one larger project rather than two smaller projects, there is an opportunity to share on the traffic management and only close the highway network once rather than twice. It may also be possible to reduce the combined programme due to an enlarged construction site meaning multiple contractors could be working on different sections at once. Of the respondents to the survey undertaken for this research project, 65% agreed that by working on a project with 2 or more highway authorities, this will be either extremely or greatly beneficial for improving network efficiencies, refer to figure 14. Network efficiencies are important to maintain a strong public relationship. Highways asset management projects often cause local delays on the surrounding network due to the rerouting of traffic that would normally use the closed road. Therefore by reducing the time taken on the network to maintain the network, the less aggravated the public becomes with the highway authority.

Improved Access to Grant Funding

Of the respondents to the survey conducted to undertake this research project, 84% agreed that a national and or regional framework would be extremely or greatly beneficial for providing access to greater funding opportunities, refer to figure 15. This is particularly important due to the significant lack of funding historically for highway authorities. By working as a combined authority, the number of constituents affected by the activities carried out by the local authority means a greater access to funding. With a larger area of network to cover with more money to the authority, the savings from the contractors and consultants means the funding available is likely to stretch further and be used in a more strategic way thus greatly improving the local network. Improved Access to Resources (Plant, Labour, Materials)

Combined authority highway working requires a large work force to maintain the highway however whilst there may be an increase in operational staff, there could be a reduction in other staff such as those in management, supervision, or specialists. Of the respondent to the survey conducted for this research project 58% agreed that a combined authority approach to highway asset management would be likely to provide greater access to resources including plant, labour and materials. Whilst the materials are largely controlled by independent markets, the plant and labour could be shared across the two authorities, to help target the areas requiring the greatest attention. By having an expanded workforce, this minimise downtime from annual

leave or illness due the greater flexibility in where the resource could be deployed. This could also provide an opportunity for more winter maintenance workers reducing lost time in the wintertime due to the required rest periods from the winter maintenance drivers and managers.

Improved Access to Knowledge and Experience

When conducting work on a combined highway authority, there will be more engineers required to maintain the larger area. 81% of the respondents to the survey suggest that a national and or regional framework would be extremely beneficial or greatly beneficial for providing access to knowledge and experience, refer to figure 17 for the survey results. Access to knowledge and experience would assist highway authorities by achieving the right first-time approach to all asset management projects. This helps provide better value for money. Access to knowledge and experience has been highlighted as one of the main challenges when undertaking highway asset management work, especially with a lack of technical knowledge so with by having a larger area with more engineers and asset managers focusing on the network, every highway authority is more likely to have access to a technical expert in some capacity whether that be to assist with the development of a particular challenging scheme or to assist with the development of an asset management policy or strategy.

Improvement in Quality of Work and Limiting Repeated Repairs

Working within a larger combined authority with greater access to funding, materials, labour and knowledge should lead to a great quality of work on the highway network and avoid repeated visits to the same stretch of road for repairs. Whilst the area requiring maintenance is larger than if authorities are separate, the ability to share skilled labour across the whole area will help to ensure that the appropriately trained and competent workforce are carrying out the work on the network. By reducing repeated repairs this will help to drive network efficiency as well as save on reactive budgets thus increasing funding available for preventative works. For a highway authority this helps to reduce the number of defects. Of the respondents to the survey undertaken as part of this research project, 16% suggested that a national and or regional framework would be extremely beneficial for improvement to the quality of work and the limiting repeat works, with a further 39% suggesting that this it would be greatly beneficial, refer to figure 18 for survey results.

Providing Opportunities for Economic Growth

When working on a national and or regional framework, there will be opportunities for more local engineers to on larger highway asset management projects. By employing local engineers, the money earnt is more likely to be spent locally thus improving the local economy. With a larger regional and or framework, there will also be greater opportunities for local small and medium enterprises to work as part of a large contract gaining valuable skills and experience to allow for their expansion. The directors of the SMEs are likely to be local people that will employ local staff and with a larger area to work across a larger opportunity for more regular work especially if their specialism is niche. Out of the respondents to the survey carried out for this research project, 16% suggested that a national and or regional framework would be extremely beneficial for providing opportunities for economic growth with a further 52% suggesting that it will be greatly beneficial, refer to figure 19 for the survey results.

Opportunities for Improving Data Collection and Management

With an increase in the area of the highway network being maintained through a national and or regional framework, opportunities for improved data collection and management present themselves by having greater funding available in order to collect data, opportunities for greater infrastructure to store the data, and more data available for a comparison matrix in order to determine the areas of the highway network which requires treatment. As part of the survey conducted as part of this research project, 74% of the respondents suggested that a national and or regional framework would be extremely beneficial or greatly beneficial for opportunities for improved data collection and management. As previously suggested in this report, in recent year with the advancement in digitalisation of the highway asset management industry, the way in which asset managers can collect and store data have improved and with future developments in the industry this likely to increase further. The greater area of highway with improved data, helps to provide more effective asset management projects within a regional area.

Conclusion and future work

From this research project, it is evident that there are many factors that contribute to the highway asset management industry, which require a careful balance of funding and engineering interventions to ensure the highway is maintained at a reasonable standard. The key drivers for asset management include the legal duty for highway authorities to ensure that the road is safe for the passage of all road users, provide opportunities for economic growth through maintaining an acceptable standard of highway, and to some extent political pressure from policymakers due to the highway being a public asset maintained at public expense and failure to maintain a highway to an acceptable standard could cause public relations to deteriorate. This also makes political pressure one of the challenges faced by asset managers; however, with a strong local policy and strong leadership, this can be turned into a positive. Other challenges in providing asset management schemes include the lack of funding, lack of resources, including plant, labour and materials, as well as a lack of technical knowledge of highway asset management strategies and policies.

One key conclusion from this research is the overwhelming support for the development of a national and or regional framework and the agreement with the benefits this could bring the region and the asset management industry including cost savings and efficiencies; network efficiencies; access to greater funding opportunities; access to resources including plant, labour and materials; access to greater knowledge and expertise; the improvement of work quality and limitation of repeated visits to repair section of the highway; providing opportunities for economic growth; and opportunities to improve data collection and management.

As part of this research, further research could be carried out around the commercial challenges of managing a framework where multiple authorities are involved; ironing out the differences between current local and national standards, especially where a local authority has a standard which is more stringent than the national DMRB standards; how funding could be equally distributed between the region and not focusing on areas with the greatest political influence but rather on areas which have the greatest requirement for improvement; and how to ensure that local knowledge, ownership and accountability is not lost within a larger regional and/or national framework.

Other areas for improvement in this area of research include obtaining research from a wider range of respondents, especially a wider range of clients or budget holders for asset management.

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