FOREWORD

It is becoming generally accepted that continuing to manage demand through building more road capacity and traditional "command and control" traffic management is no longer sustainable whether from a financial, social, economic or environmental viewpoint. It is also understood that more needs to be done to exploit the potential of new technologies in terms of making better use of capacity and enabling smarter choices by all users so as to reduce the negative impacts of travel. This also reflects current trends and their effects on transport and behaviours. These trends include the rapid pace of technological development and the greater focus on improved customer performance. The effect of these trends are innovation in products and solutions enabled by big data analytics and improved engagement and information through multiple communication channels. These trends and their effects demand a much more integrated approach with the local transport authority increasingly adopting the role of an "enabler" rather than a "controller". They also mean moving away from self-standing projects focusing on a single technology or user.

This is exactly what we are doing in Northamptonshire through the development of the Smart Corridors concept. This will enable us maximise synergies and impact, respond to multiple users’ needs, and create improved travel performance across the network through the use of new technology, services and applications. The Smart Corridors initiative is pivotal to this broader concept. It will bring together a number of technology-based solutions, including journey time sensors, pollution detectors, real-time messaging and alerts, and automatic fault detection, in a comprehensive and integrated way in four demonstration corridors in Northampton. The aim is to deliver real benefits to the users including enhancing network reliability, reducing congestion and improving safety. The success of this initiative is also critical to enabling the ambitious growth targets for the county to be achieved.

I believe that this is an ambitious and deliverable agenda for shifting the way we manage the network and "mobility as a service". I look forward to working with partners to deliver this agenda and implement the Smart Corridors initiative.

Tony Ciaburro
Director of Environment, Development and Transport
Northamptonshire County Council
THE SMART CORRIDORS INITIATIVE

Introduction
Northamptonshire’s Smart Corridors initiative will showcase the latest developments in infrastructure and technology in a series of demonstration corridors. The aim through this is to improve how the corridors function and benefit motorists, bus operators and passengers, cyclists, local businesses and other users.

The use of technology to manage the network is not new. However, most technology solutions have been locally developed as stand-alone projects often focusing on a single technology or user - for example bus passengers. What is new about the Smart Corridors initiative, and Northamptonshire’s approach, is that it brings together a number of technology-based solutions in a comprehensive and integrated way in the same corridor to maximise synergies, impact and respond to multiple users’ needs and enable improved travel performance.

From 2016 we will be implementing a series of demonstration corridors on the local network in Northampton. This will initially utilise £3.5m of Local Growth Fund support from Government, but also bring in additional match funding from other sources including new housing and commercial developments directly impacting on the corridors. A particular emphasis will be placed on exploring opportunities to collaborate with others including technology suppliers, academia, research and development institutes, technical networks and think-tanks, and the UK Government’s Catapult Centres in the planning, deployment and evaluation of the Smart Corridors initiative. This will involve investigating potential collaborative activity through the European Commission’s Horizon 2020 programmes. We will also be discussing with the Department for Transport and Highways England how we can ‘hit and run’ and then roll-out the Smart Corridors approach more widely across the strategic routes through the county including the A43 and A45 artery and complementing the existing and planned investment on routes such as the A14, M1 and M40 through the national ‘Managed Motorways’ programme.

This prospectus has been produced to explain more about the Smart Corridors initiative to these different audiences and the users. This includes the types of technologies that will be involved and how this could differ depending on the physical context, the benefits it will bring to different users, and how its success will be monitored and evaluated.

Background
The Smart Corridors initiative is part of the wider Northamptonshire Arc portfolio and Northamptonshire County Council’s Smart Living Programme. It also ties in closely with the proposals outlined in the Smart Move for Northamptonshire document.

The Northamptonshire Arc provides the spatial concept for the county and is underpinned by the pursuit of three high level outcomes: transformed connectivity; a naturally resilient and low carbon Northamptonshire; and a stronger and greener economy.

Whilst the Northamptonshire Arc spatial plan is wide ranging, there are a number of specific priorities that the introduction of the Smart Corridors initiative will support. These include:

- Enhancing strategic connections and addressing congestion on the road network, making public transport more attractive and supporting innovation.

- The county’s commitment to realising the above has been underpinned by the County Council’s proposals to establish the Smart Corridors initiative.

Under these proposals, a Smart Corridor will bring real-world benefits to multiple users, network managers and local businesses. In addition, it will enable Northamptonshire to become a test-bed for new technologies and applications, and will establish an environment that will act as a launch-pad for new products focused on the user and their experience.

The Smart Corridors Initiative has close ties with other projects being pursued by the County Council in collaboration with others including the Network Northamptonshire and the oneTRANSPORT initiative. Both these projects are innovative in their own right. The Network Northamptonshire project involves the County Council working with the University of Northampton, National Health Service partners and others to explore the feasibility of delivering transport services to the public in a radically different way which saves money and delivers better services for the user through a ‘total place’ approach. oneTRANSPORT is a collaborative transport data-sharing and analytics project. It is expected to lead to the development of new applications and services which will benefit transport users across a wider area covering Northamptonshire, Buckinghamshire, Hertfordshire and Oxfordshire. The intention is that the synergies with these two projects, and other initiatives which are part of the wider Smart Living Programme, will be harnessed to develop a truly digitally integrated transport system.

Enabling Growth
Northamptonshire has one of the fastest growing economies in the country. It also has bold aspirations for growth with 70,000 new jobs and 80,000 new homes planned over the next 15 years. Levels of car usage are also high and traffic growth on the road network is the fastest in the country.

These trends are not sustainable without new investment in the network and how it is managed. This was recognised in the Northamptonshire Arc spatial plan. The plan states that economic growth in Northamptonshire would be slowed or stalemated altogether without further investment. It also recognised the need for investment in new technology, low carbon modes of transport and ‘smarter choices’.

The Smart Corridors Initiative brings together these three components through a new and innovative approach.
WHEN AND WHERE WILL THE SMART CORRIDORS BE PROGRESSED?

From 2016 we will be implementing a series of trial corridors. This will help us to measure the effectiveness of the interventions both individually and collectively. The initial focus is Northampton and four selected routes. Northampton has been chosen because it is where the network is under most pressure, where users are more likely to suffer delays due to congestion, and where there is most scope to promote low carbon modes and ‘smarter choices’. Northampton is also the main commercial centre and where much of the future new housing and other development will be located. The initial trial corridors forming the demonstration package are the Kingsthorpe Road, Kettering Road, Bedford Road and Weedon Road. These are indicated on the map below. Modelling and planning work has already started to help inform the types of interventions that will be deployed in these corridors and ensure that these are ‘future proofed’ to take account of future growth plans. Discussions are also taking place to understand competing demands, the challenges relating to these, and the opportunities to meet the needs of different users through the deployment of technology and improved infrastructure in these corridors.

The routes which have been selected to be Smart Corridors, and part of the demonstration package, are already very busy. Experience competing demands for road space and are under further pressures as further housing and other development is planned. They have also been selected because they already contain new traffic signal equipment, are under urban traffic control and have established communications which enable new technology to be incorporated more easily and quickly and with less disruption for existing users.

WHAT IS A SMART CORRIDOR?
KEY OBJECTIVES

A Smart Corridor allows multiple transport networks to interoperate in a coordinated fashion through use of infrastructure and technology. The overall aim is to improve the performance and reliability of the network whilst managing competing demands and promoting the use of sustainable transport. This includes getting real-time information to users enabling them to make ‘smart choices’ on how they travel and what they do, tailored to their requirements and preferences. This reflects the three high-level Northamptonshire Arc outcomes which are transformed connectivity, a naturally resilient and low carbon Northamptonshire and a stronger greener economy. Interventions will be tailored to meet a wide variety of different, but related, objectives. These include:

- Reducing congestion
- Enhancing network resilience and reliability
- Smoothing traffic flow
- Improving air quality
- Promoting low carbon travel including the use of low carbon vehicles
- Enabling new development and jobs
- Supporting local businesses and events
- Improving safety
- Promoting the benefits of cycling and active travel
- Improving the user experience
KEY COMPONENTS OF A SMART CORRIDOR

Examples of infrastructure and technology-related investments

A range of infrastructure and technologies will be introduced in the Smart Corridors. Some examples are provided in the table below. These enabling investments can then lead, either directly or indirectly, to additional services being introduced that help realise the objectives for the Smart Corridors and the area more widely.

<table>
<thead>
<tr>
<th>Investment type</th>
<th>Example investment and resulting application</th>
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</thead>
<tbody>
<tr>
<td>Sensor networks</td>
<td>• Fixed sensors (e.g. Bluetooth sensors, inductive loops, ANPR cameras etc.) to detect travel time and derive information about the network status</td>
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<td></td>
<td>• Floating vehicle data and imagery from buses or taxi fleets to inform journey time, adherence to schedules, asset status, vehicle location etc.</td>
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<tr>
<td></td>
<td>• Data from other communications devices (e.g. mobile phone data to capture wide scale movements, origin-destination matrices, modal split, assess travel times etc.)</td>
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<tr>
<td></td>
<td>• Parking sensors to detect bay-occupancy and assist with asset management</td>
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<tr>
<td>Communications infrastructure</td>
<td>• Exchange data from sensors to data management systems (e.g. using mesh networks, or dedicated fibre networks for smart motorways);</td>
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<td></td>
<td>• Support growth in new employment sites or to encourage remote working (e.g. wide-scale, high speed broadband);</td>
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<td></td>
<td>• Provide the basis for V2X communications (e.g. 5.9 GHz DSRC) that would facilitate the introduction of autonomous vehicles in Smart Corridors;</td>
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<td>• Support point specific and localised services (e.g. NFC or Bluetooth beacons on specific infrastructure)</td>
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<tr>
<td>Solutions for collecting and processing data on the transport network (and potentially other sources)</td>
<td>• Open data management platforms to facilitate the exchange of open source data by centralising the data or acting as a brokering service between different entities</td>
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<td></td>
<td>• Cloud based UMTS to centralise the outputs from different ITS applications and other systems (e.g. parking management data, public transport)</td>
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<tr>
<td>Systems to share information about the network and services</td>
<td>• Variable messaging signs</td>
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<td></td>
<td>• In-vehicle displays and telematics to share data on the move</td>
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<td></td>
<td>• Travel Information services</td>
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<td></td>
<td>• Digital wayfinding services</td>
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<td></td>
<td>• Real-time information at displayed stops, timetables or direct to users via apps and mobile sites, etc.</td>
</tr>
<tr>
<td>Payment services</td>
<td>• Integrated ticketing services across modes and services</td>
</tr>
<tr>
<td></td>
<td>• Cashless payment on public transport</td>
</tr>
<tr>
<td></td>
<td>• Shared mobility payment platforms (to enable the user to access shared services such as cycle hire schemes or car clubs)</td>
</tr>
<tr>
<td>Smart infrastructure</td>
<td>• Enhanced traffic signals (for example, to support the introduction of bus priority systems)</td>
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<tr>
<td></td>
<td>• Segregated infrastructure (for example dedicated cycle lanes etc.)</td>
</tr>
<tr>
<td></td>
<td>• Charging infrastructure for electric vehicles e.g. fixed points, dynamic charging</td>
</tr>
<tr>
<td></td>
<td>• Shared mobility hubs</td>
</tr>
</tbody>
</table>

WHAT WOULD SMART CORRIDORS LOOK LIKE?

Corridor Visualisations

To demonstrate what Smart Corridors could look like in Northamptonshire, four different corridor types have been described and visualised below. They give an indication of what could be achieved and the benefits for users.

SUBURBAN

A significant proportion of users will be starting their daily commute from a suburban environment and the information they receive here will very much dictate the way they choose to travel, so it is important that it is readily available and accurate.

As a result of the infrastructure being in place to access and share real time transport information, users will have access to a connected mobile application which will push current journey times to a user for their regular journeys. It will alert the user to any delays on their bus service, or whether or not there are issues on the roads into the town centre and then offer alternatives and estimated journey times. It will also suggest car sharing opportunities if they wished to leave their own vehicle at home.

Key transport interchange can be established in sub-urban areas on the Smart Corridors, where users have a choice of a number of different modes of transport, including bus, bike hire and car clubs. Dedicated cycle lanes will allow users to safely access the hub from residential areas with secure cycle parking nearby. Technology will be used to make these lanes safer.

Bus stops will be equipped with real time information displays which will detail current departures as well as any disruption affecting service. Buses themselves will be equipped with short range communications so that they can trigger the display to say it has arrived.

There will also be localised information detailing the current availability of car clubs and cycle hire.
A SMART MOVE FOR NORTHAMPTONSHIRE

WHAT WOULD SMART CORRIDORS LOOK LIKE?

INTER-URBAN

The Inter-urban routes in Northamptonshire are some of the busiest and fastest moving, and if poorly managed are susceptible to congestion and delays from relatively minor incidents. The knock-on effects can be significant across the entire network as users try to find alternative routes. Data collection is the key tool in allowing network managers to get a handle on the current situation and should an incident occur, know the best actions to take to get the network back to normal as quickly as possible.

On-road sensors can be used to measure current journey speeds as well as average journey time between two points. Data can also be gathered from floating vehicle data, or other communications devices such as mobile phones to acquire travel times and other indicators. Data from various sources can be acquired, processed and shared with network managers who can take action to prevent it becoming more serious. This will be particularly effective on sections of managed motorways, and multi-lane corridors approaching the urban areas and key junctions, where lane speeds can be varied or hard shoulder running can be initiated to alleviate congestion.

This data will then be fed back to the central Urban Traffic Management Centre (UTMC) system and the information shared with users on-screen via Variable Message Signs (VMS), online to websites and travel apps and also in-car to road users. This will influence people’s journey choice and they may decide to take an alternative mode such as public transport, rather than using the car on this occasion, or a different smarter choice.

URBAN

In an urban environment, such as Northampton, there is a substantial level of interaction between modes of transport, so here more than anywhere, it will be crucial that the infrastructure and technology is in place to allow efficient interoperability.

Buses are the most space efficient road vehicles for moving people around more dense urban environments. One component of a Smart Corridor can be to provide buses with priority at key junctions to ensure that they can keep to schedule or minimise delays. Their approach to a junction would be detected, and if required, the phasing of the traffic lights will be altered to allow the bus to travel through without waiting for the normal sequence of priorities.

Drivers will benefit from better information about town centre parking. Each space could have a sensor able that detects whether or not it is occupied. This will provide accurate occupancy information which can be displayed on-screen via VMS signs, to a website or mobile phone app or even in-car navigation systems. This will allow drivers to plan ahead and go somewhere where they know there is likely to be a space, rather than wasting time circling for one and creating congestion. Similarly, autonomous vehicles can route themselves to where they know there will be spaces. For those with electric vehicles, similar information can be provided about current availability of charging points.

For pedestrians, there will be on-street technology to help direct people to key points of interest in the urban core such as the Cultural Quarter in Northampton. They will also have integrated departure information for local bus and rail services. Each one would be Near Field Communication (NFC) enabled, allowing users to touch a reader with their phone to find out more information about a given location and be pushed information about local offers and events taking place.

The area’s cycle hire scheme will have a companion app, allowing users to find out where there is bike availability or space if they are returning one. This information will also be displayed at bus stops which will benefit passengers who might consider completing their journey on bike if there are service delays.

Find out more
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WHAT WOULD SMART CORRIDORS LOOK LIKE?

EMPLOYMENT/LEISURE HUB

Just because someone has arrived at work or a major destination by one mode of transport, does not necessarily mean they have to use the same one to get home. Providing users with access to alternative modes at the workplace or destination alongside high-quality information provision will encourage greater flexibility.

These hubs will operate in a similar fashion to those in the suburbs, with bus interchanges, closely located to cycle hire and car club bays. Secure parking for both bikes and cars will be provided, as well as dedicated Electric Vehicle (EV) charging bays.

Commuters will be incentivised to use more sustainable modes of transport with a workplace challenge. Those who commit to a change for a period of time will automatically be rewarded with a relevant price based on their travel behaviour, facilitated through contact payment cards or smartcards. For example, if someone has committed to using the bus for their travel all month, they could automatically be given a week’s free travel.

Employers in the region could have a dedicated transport portal which will collate relevant transport information such as bus departures, times, journey time information, availability at local cycle hire docks as well as people heading home who are willing to car share. There will be an online journey planner which is linked to the UMC control centre feeds, allowing the planner to route people away from areas of disruption. This will sync with a mobile application, so if a user is making an unfamiliar journey, they are prompted throughout about where to interchange or alight.

Digital micro-maps provide live information and local weather
Car parking
Car club services to support car sharing
WiFi integrated into infrastructure
Public service parking
In-office displays with network status and Real Time Information
Route information via smartphone apps
Commuter challenges and bonuses
Smart apps push personalisation information on local events, attractions and offers
Personalised real-time journey planning
Bluetooth beacons provide enhanced data

Personalised real-time journey planning
Now the kids are a bit older, Adam and Kate enjoy taking them out and about at weekends to explore their local area. They recently caught the bus to a festival at the Racecourse Park to enjoy a sunny Saturday. Anna and Mark love going on buses, particularly when there is space upstairs, and Kate and Adam are happy with the savings they make on their family bus pass compared to fuel for the car and parking. Kate is impressed about the latest buses which have been introduced and how far they have advanced compared to when she was growing up - there is real-time information and interactive route maps displayed at bus shelters and Wi-Fi available on all of the buses. Anna and Mark are fascinated by the route maps and like learning about the attractions that await them at the festival from the smart phone app they downloaded.

The app connects to wayfinding totems and other smart infrastructure in the park via Bluetooth, sending Adam information along the guided walk. The app is also a great way to teach the children about the ecology and history of the park. The totems provide free Wi-Fi for people in the park, so Kate takes the opportunity to upload a family photo to social media for the grandparents to see.

Adam and Kate live in Moulton with their two children Anna, 10, and Mark, 7. They both work in Northampton and their children go to school locally at Moulton C of E primary school. Adam and Kate met when they were starting their careers in London and moved to Northamptonshire, where Kate grew up, to start their family. They enjoy living in Moulton as it is close to Northampton and has the countryside feel that they wanted to bring their children up in.

Geoff works for a delivery company based at Breckmills Industrial Park on the edge of Northampton. After noticing that there are Cycle Connect stations both close to his home and the depot he decided to sign up to the cycle scheme. The route he uses follows a Smart Corridor and is now much safer due to the investment which has been put in. This has reduced his daily commuter costs. He enjoys the workout and his general health has improved because of it - as has his bank balance.

The business is growing which means Geoff needs to make more deliveries. This means that whilst out in the van it is imperative that Geoff is kept up to date with the latest traffic information so that he can navigate around any major incidents to avoid missing delivery slots. Whilst navigating him to his next address, the Northamptonshire Smart Commuter app alerts him to any disruption on his route and offers alternatives. However, what Geoff really finds helpful in keeping the traffic flowing in peak hours are the tidal flow lanes, which alternate direction depending on which traffic flow is greatest. This often coincides with the morning and afternoon peaks and the 'school run'. The variable message signs on the Smart Corridors are also really helpful to Geoff when he has to make deliveries to the town centre, and to local businesses on surrounding business parks. The signs are updated using real time information feeds. Again this helps him to avoid congestion. Geoff has found that it is much easier to keep on time, meaning customer satisfaction has improved.

For the delivery company this means that it is able to plan more deliveries than before as there are less delays. It also means less late finishes for Geoff.

Find out more:
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USER EXPERIENCE - COMMUTER

Ariane has recently graduated from the University of Northampton and lives in a house-share near Abington Park with two friends. Ariane and her housemates enjoy living near Abington Park as they are close to the park's facilities, the bars and restaurants on Wellingborough Road and can walk to Northampton town centre in half an hour.

Ariane used to drive to work at Northampton Science Park but has recently begun car sharing. As a car-sharer she gets free access to the car sharing bays on her road and gets to use the premium car sharing bays at work. The Northants car sharing app enables her to find people who are making a similar journey to her and has a messaging facility so she can organise pick up times and locations with other car-sharers. Since she began car sharing, Ariane has noticed the money she's saved on petrol, which is a great incentive. Car-sharing also counts as a sustainable journey in her work's online commuter challenge so she is gleefully climbing up the challenge leader board.

Ariane's work has invested in a display totem located in the foyer of the building, so people can check the status of the road network and get real-time bus information. The information is also available on people's computers so they can monitor the traffic and re-time their journeys to avoid congestion. Ariane is impressed with the quality and accuracy of the In-Office Network Information. She is also a fan of the tidal flow system that has been installed along her route to work, which allows traffic to travel in either direction based on traffic conditions, controlled by variable messaging signs. It really helps speed up her journeys to and from work in rush hour traffic.

USER EXPERIENCE - OPERATOR

John decided to become a bus driver in Northamptonshire after he retired from his job at Nationwide's Administration Centre five years ago, as he didn't want to give up working completely. John loves technology and has enjoyed getting to grips with the various features on-board his bus and learning how it communicates with the wider network. He is really impressed with the advanced driver assistance systems on the bus; it is fitted with sensors to improve driver awareness of cyclists. Alarms are provided when there is an imminent risk to a cyclist. This is very reassuring and has certainly cut down on the number of accidents and near misses in recent years.

Bus priority measures have been implemented along the majority of John's routes, including the Smart Corridor into the town centre which is one of his main routes. This speeds-up journey times for passengers and gives bus travel a competitive edge over driving. The bus also communicates with traffic signals as it approaches junctions, which reorders the signal phasing to allow the bus through at the earliest opportunity.

John has downloaded the Northants transport app and, outside of work, he benefits from notifications about traffic conditions and real-time information about public transport options. The information is collected via roadside beacons which detect conditions on the road network and through live communication between buses and their central management system. It also provides him with alerts on upcoming events in and around the town as well as notifications offers from his favourite local retailers and cafes. This means John and Sue are spending more time in the town centre and enjoying finding out what's on offer.
A SMART MOVE FOR NORTHAMPTONSHIRE

USER EXPERIENCE - CAR DEPENDENT

His wife downloaded the Northamptonshire’s Smart Commuter app to his phone to help him make more informed choices about his travelling. He particularly likes the fact that it syncs with his calendar and provides him with journey planning between all of his appointments without him needing to do anything - which is really handy as he always used to get lost!

The app is also connected to live travel information and will alert Mike if there is any disruption on his planned journeys. This helps him to make a decision about whether to use the country roads rather than the M1 when it’s really congested. On the days he’s due to work in the office the app is particularly useful, because he may decide to work from home rather than getting stuck in the traffic, which would be a waste of his time and petrol.

If he does go into the office, the VMS signs on his Smart Corridor route into the town point him in the direction of the nearest available car park space to the office so he doesn’t have to spend time circling the centre – playing his part in cutting unnecessary travel within the town centre. This also saves him time when he has to get back to his car during the day to attend appointments.

He’s a big fan of a click and collect for his groceries and because it adds a calendar appointment to his diary, the app favours a car parking spot closer to the supermarket so he can put the shopping straight into his boot at the end of the day.

A SMART MOVE FOR NORTHAMPTONSHIRE

MONITORING AND EVALUATION

It is important that the effectiveness of the Smart Corridor approach can be measured to help inform and promote a wider rollout, so feedback mechanisms will form a key part of the infrastructure to allow performance to be measured against a set of agreed key performance indicators (KPIs).

These would include:
- Journey times
- Traffic flows
- Network reliability
- Road traffic accidents
- Bus punctuality
- Bicycle usage
- Air quality

These measures will be analysed in parallel with use-based metrics and updates of services including:
- Customer satisfaction
- Business engagement
- Mobile application downloads
- Website usage
- Bus patronage
- Car sharing / club memberships
- Cycle hire usage
- Footfall

Following the initial implementation period, an evaluation report will provide coverage of the key outcomes from the trial. The benefits highlighted in this report will then be used to develop the business plan for the further roll out of the initiative, backed by a clear quantifiable evidence base.

Through this process of continued monitoring and evaluation, alongside the physical deployment in the network, we will be exploring opportunities to collaborate with other regions pioneering smart solutions, technology suppliers, academia, research and development organisations, leading technology networks (including ENTCO), and the UK Government’s Catapult Centres. A particular focus will be investigating collaborative activity through the European Commission’s Horizon 2020 programmes and associated funding, learning and development opportunities to optimise impact of the Smart Corridors initiative and related investment.
FURTHER INFORMATION

For further information on the Smart Corridors initiative please contact bigidea@northamptonshire.gov.uk