Transport Systems

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ANNEX F

NPIF Bid: Smarter Transport Evolution Programme (STEP)

Executive Summary

1. York is a vibrant city, with traffic congestion, emissions and accessibility issues similar to many other UK cities, compounded by its historic core and increasing productivity, generating more and more travel. The move to a predominantly service and tourism based economy means land use is changing, with pressure for new residential, commercial and retail development in the City that will generate additional travel. This, and the likely developments associated with HS2 and the Northern Powerhouse initiatives are major challenges to the transport network, yet York has neither the space or policy appetite for road building to unlock unserved demand. Emissions are also a challenge the City is already investing in through park and ride and electric buses, but there is more to do.

2. Like many UK cities, York needs is a new approach to providing access for new developments and evolving current infrastructure to reduce congestion to unlock productivity. STEP will deliver this evolution through digital approaches to development planning and traffic management using rich data, not simply physical infrastructure. The core approach will optimise both the current network and network planning for future investment through city wide data used for both network management and to influence travel behaviour.

3. The Smarter Transport Evolution Programme (STEP) will drive York towards being the first city in the UK truly ready for managing whole city mobility, through new data and the gradual adoption of connected and autonomous vehicles, rather than traditional traffic control using roadside infrastructure. By applying technologies already in use in the UK in trials to a whole City, we will maximise benefits and be a beacon for other similar small cities. In particular we will deploy “co-operative UTC”, via vehicles and traffic signals working together to reduce both congestion and emissions and provide rich data for modelling.

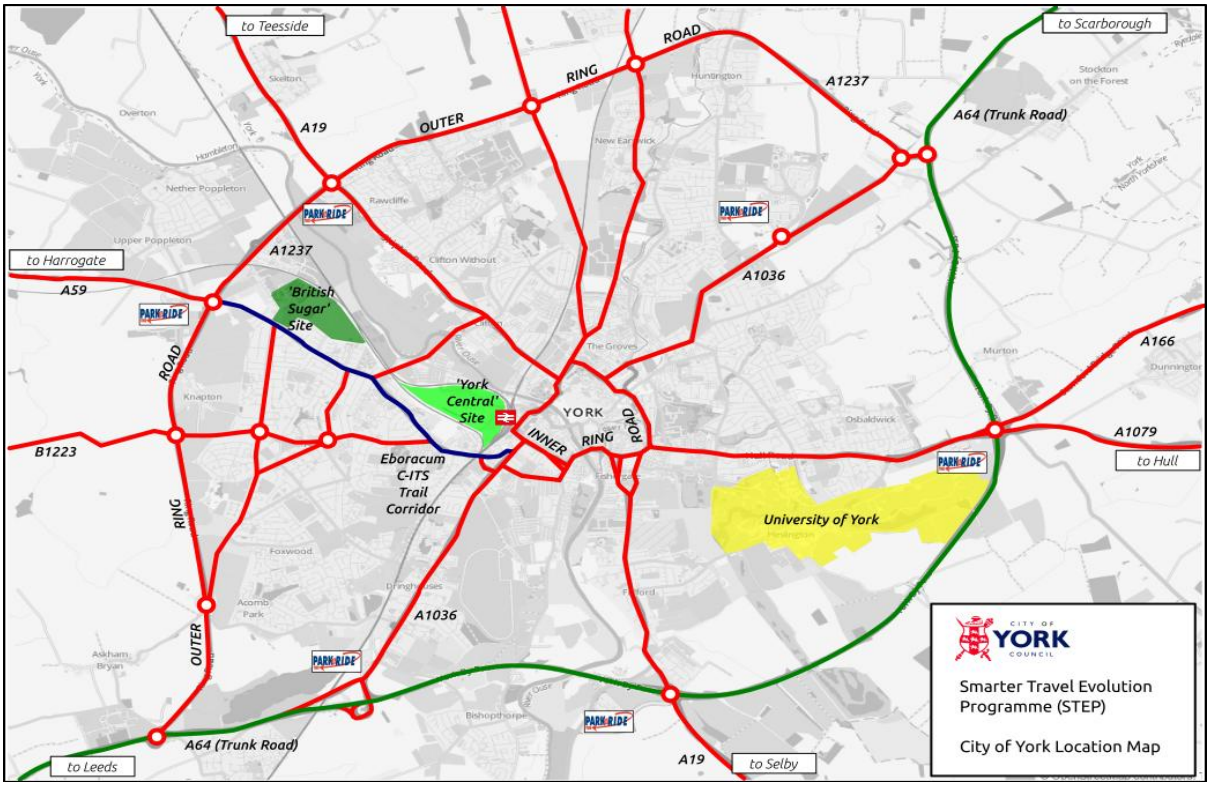
4. At the project’s core is a single source of network wide data for all levels of mobility modelling and network management, collected and owned by the City for all to use openly. This integrated data will manage emissions, strategic and tactical control of traffic, provide smarter parking and support Connected and Autonomous Vehicles (CAVs), enhancing current data sources from connected people and vehicles to gain a city wide dataset to make travel better. This will use York’s investment in full city

fibre, advanced modelling to plan both strategic land use and real time traffic management, better use of existing tools like traffic signals and an open data approach serving the community. The project as by products will deliver new standards for parking and Traffic Order information and CAV friendly junctions, of widespread value to UK PLC. STEP will also build on the current investments York is making in transport, including the capital funded Traffic Signals Asset Renewals (TSAR) programme and ongoing DfT funded T-TRIG and C-ITS research initiatives.

5. STEP's funds are needed for data management and modelling but also required to extend wi-fi data collection across the city, equip signal junctions for "co-operative UTC" in communications and physical attributes, convert traffic and parking order data to a standard digital format services can use and also for benefits measurement, building on and informed by research projects already underway in York and elsewhere in the DfT C-ITS projects.

6. The future of cities like York lies in smarter planning and management and influencing demand, using better information and new policies. STEP delivers data to evaluate new mobility proposals and deliver technology tools. These will influence congestion and emissions far more quickly than larger spend on physical infrastructure. STEP blends technology opportunity with real world problems and constraints to evolve to a City where data on mobility drives future thinking and policy deployment.

7. This is a City-wide programme. A Location Plan showing the issues indentified in this note is produced below and appended as Annex A



The problem - Unlocking productivity

8. York has many opportunities to grow both in residential and industrial productivity terms. Many of York's proposals including the York Central development, the former British Sugar site and the Local Plan housing allocations mean changes to mobility. Planning the City's response to HS2 and the transport improvements delivered by the Northern Power House needs an informed approach that balances growth with network capability. In the shorter term, major highway improvements to the Outer Ring Road and other schemes in the City also need a coordinated response based on sound data and realistic modelling.

The problem - congestion

9. York suffers from congestion on the radials into the city, in the core of the old city and on the inner and outer ring roads. The service industry and tourism attractions in the city allied to industry on the periphery of the city plus a constricted road layout based on Viking origins has resulted in the City for many years promoting policies that discourage car borne commuting through attractive park and ride, (now starting to use electric buses), traditional bus priority, live travel information and innovative parking. Reallocating green time at traffic signals from private vehicles to cyclists and pedestrians is a City priority, but has to be balanced with productivity. For many years the City has operated a 'Road User Hierarchy' to ensure this policy aim is effectively delivered.

10. The Floating Vehicle Data provided by INRIX shows that the average peak time speed across the city is less than 20mph, significantly less on key corridors.

11. The traffic network does not lend itself well to approaches like SCOOT and the ability to invest in wholescale new systems is restricted by funds. Like most UK cities, York has to evolve a programme to move to Smarter Travel, it cannot simply swap to new approaches wholesale. This will have significant impacts on the ability of the city to support CAVs, but by looking at connected vehicles and people as data sources, the first steps can be taken.

The problem – emissions

12. As with most UK cities, York has issues with air quality that are primarily due to transport activity. The City is leading the development of responses to this and has made good progress in the electrification of the vehicle fleet, through DfT funded initiatives including the introduction of electric buses on Park and Ride services and the development of a city-wide EV charging point network. Currently however, the link between actual air quality levels and traffic control is weak, because of the lack of data and modelling to allow UTC strategies to be influenced by air quality data.

13. STEP will address this both through the provision of a city-wide travel data platform and the multi-layered model that this data will drive. This will allow real-time strategy assessment and selection for UTC that is based both on current and

predicted traffic levels and also real time air quality and meteorological data. In operation, this will allow UTC to select plans that support the air quality management strategies required in any given conditions.

The solution

14. STEP is about deploying technology to better meet the transport challenges the City faces today. The greatly improved intelligence about the City's transport network that the innovative and new technologies underpinning STEP deliver will fundamentally change how we deal with congestion and air quality issues and build on improvements to Public Transport the City is already making.

15. Like many UK cities, York needs to provide capacity for new developments and make the most of current infrastructure to unlock productivity. This project will deliver this evolution through new digital approaches to both development planning and traffic management based on using rich data, not simply physical infrastructure changes. The core approach is to optimise both the current network and access for future development through city wide data, used for both network planning and operation, and to influence travel behaviour.

16. STEP is a programme of delivery – not research – that will drive York towards being the first city in the UK truly ready for the coming revolution in managing whole city mobility, through new data and the gradual adoption of connected and autonomous vehicles, rather than traditional traffic control using road infrastructure. By applying technologies that are already in use in the UK in trials and deployments to a whole City, we will be able to maximise benefits and act as a beacon for other similar cities.

17. In particular we will deploy "co-operative UTC", via vehicles and traffic signals working together to reduce both congestion and emissions and provide rich data for modelling. This builds on early developments in the DfT funded C-ITS Eboracum project to roll out from a pilot corridor to a city wide deployment.

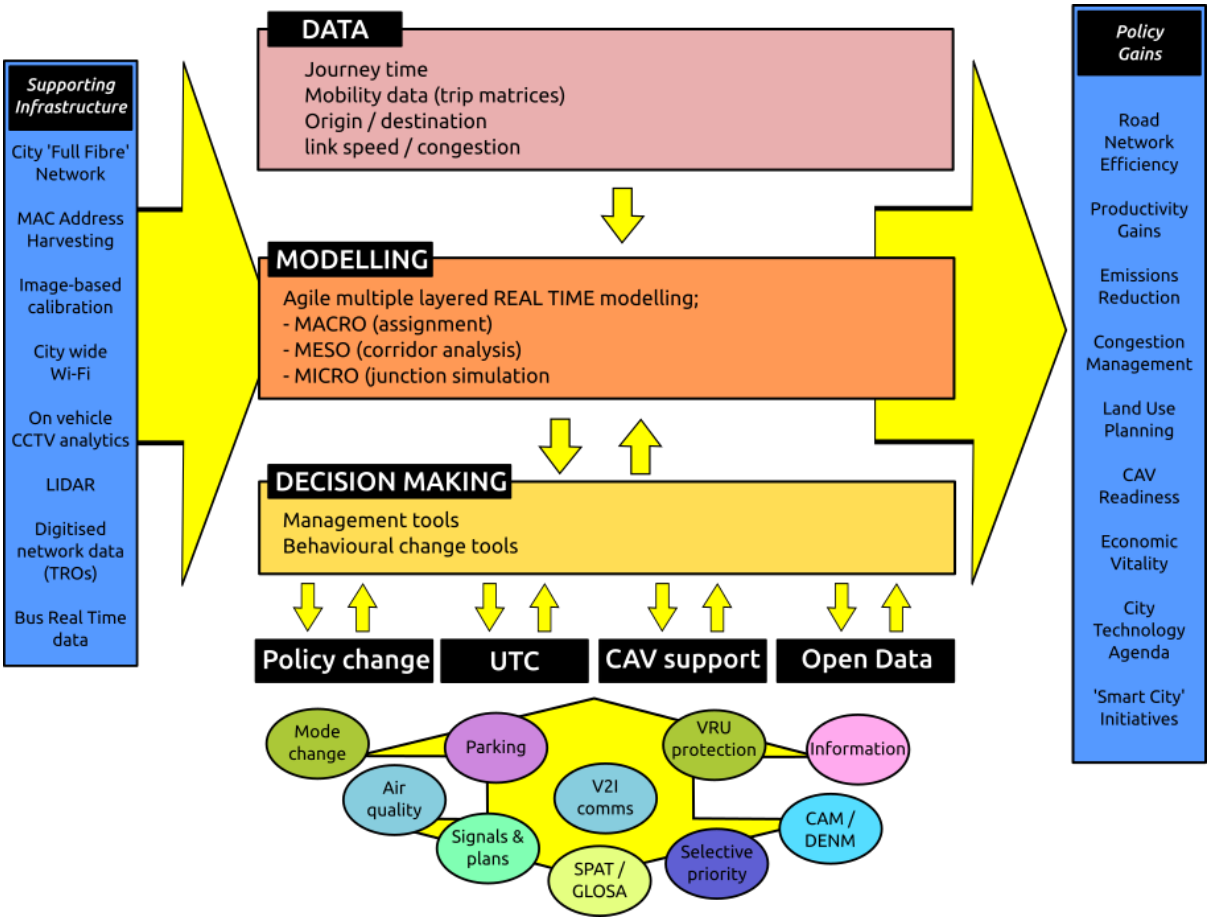
18. At the project's core is a single source of network wide data for all levels of mobility modelling and network operations, collected and owned by the City for all to use. This integrated data can be used to manage emissions, strategically control traffic, provide smarter parking where appropriate and support CAVs. The key to the project is enhancing current data sources from connected people and vehicles to gain a city wide dataset. This will use advanced modelling to plan both future strategic land use and day to day traffic management, better use of existing tools like traffic signals through "co-operative UTC" and an open data approach serving the community. It will include new standards for parking information and CAV friendly junctions, of widespread value to UK PLC.

19. We will build on other major capital investments in the City. The TSAR (Traffic Signal Asset Renewal) Programme which is delivering upgraded and refurbished traffic signals across the City. The investments in fibre-optic and wireless communications we have made have resulted in York becoming a national leader ultra-fast broadband

provision and data, and this will form the backbone of STEP, providing the City wide communications network we need.

20. Additionally, the current C-ITS funded Eboracum research programme will provide early experience of the CAV elements and the DfT funded on vehicle CCTV asset trial will be used to verify parking information. The project therefore levers off many threads of existing investment and research to bring them under one umbrella and deliver better transport in York. The project (as by products) will also deliver new standards for parking and Traffic Order information and CAV friendly junctions, of widespread value to UK PLC, but its focus is on wide scale deployment not research.

21. The diagram below illustrates the aims of STEP. This can also be found in Annex G.



STEP Project Tasks

22. A detailed break of tasks and associated costs is included as ANNEX E.

Data Collection

Roll-out a city-wide travel dataset, based on FVD and road side MAC harvesting

- Build City wide travel data platform
- Publish city-wide Journey times as open data, on VMS and as apps

23. We will install MAC address harvesting equipment across the City at every point where we have internet connectivity including traffic signals sites, Variable Message Signs and CCTV camera sites. We also install camera based image processing at locations around the City to allow calibration of data we collect against volumetric data and enhanced video analytics opportunities.

24. This data will form the basis of a City-wide travel data platform. This platform will store journey and highway link based travel data for live travel information and as the basis for live modelling, calibration of our strategic model and traffic dynamic management strategies.

25. This data will be owned by the City and will provide raw travel data; it will free the City from reliance on third party commercial processed data and ensure we have the data we need. We will also be able to make sets of this data available through the Council's Open Data Store for use by the public and third-party developers.We will also use INRIX data as an independent evaluation source and monitoring tool for comparing corridor performance.

Communications for data and signalling

Develop 'IP Anywhere' approach to communications on the highway network

- Develop 'mixed estate' technology neutral solution to provide IP communications on the majority of the highway network.
- Complete IP presence at all traffic signal sites
- Work with communications providers to develop on-highway connectivity as a prime aim of Citywide fibre
- Develop IP presence away from main routes, to increase data and connectivity penetration into commercial and residential areas

26. City of York Council is leading in the roll-out of urban ultra-fast broadband. Working with private sector partners, COYC is delivering the aims of the Department of Culture Media and Sport's Local Full Fibre Networks initiative. This has already delivered high-speed IP connectivity to most transport sites (traffic signals and CCTV camera locations) and this will form the backbone of the STEP programme. Where needed, we will extend this utilising wireless technologies to achieve full IP connectivity on the main road network. This form the basis of our data collection network and the means by which we will support enhanced UTC operation and 'V2I' messaging.

27. The City is developing 'use cases' around the development of the Full Fibre Network with Digital inclusion based around the Library Service and Travel Management based around this STEP proposal our initial focus. The roll-out of the STEP programme and the benefits it brings will be a key early benefit of the initiative.

28. As the roll-out of fibre optic in the City continues, and more premises receive 'Fibre to the Home' (FttH) provision, we will work with the communications providers to ensure IP connectivity for the transport network is also expanded. This will ensure the visibility of the network, which has been traditionally restricted to the main routes and junctions, spreads into other parts of the road network and gives us an increasingly complete data set (and therefore understanding), of travel in the City.

Three-tier modelling

Develop city-wide multi-layered model to allow for pre-emptive UTC modification

- Based on city-wide JT model
- 'live' model updated and calibrated via live JTA / O&D
- Co-operative UTC optimisation / operation
- Air quality / meteorological data input to allow AQMA management
- City strategic level assignment model updated from live data

29. A primary aim is to deliver a three-level live model for the City. This will deliver short term traffic predictions to run genuinely proactive "co-operative UTC", as opposed to the reactive UTC that is normally the case. It will also allow us, by adding air quality / meteorological and public transport modules, to effectively 'weight' the signals to react to the needs of public transport and specific air quality issues.

30. This will allow the 'fixed time' based UTC we operate, which is fundamentally well suited the needs of compact, ancient city like York to be futureproof and co-operative. UTC decision making will be based on a live updated high-speed model able to test scenarios and direct UTC operation in real time. This will not only improve on the SCOOT style dynamic UTC systems in use today, which are not well suited to cities like York, but will also provide a solid platform of the generation of SPAT (Signal Phase and Timing) and GLOSA (Green Light Optimisation Advice), to ensure the City is ideally positioned to provide these services as the market requires them.

31. Another key benefit will be greatly enhanced strategic, level assignment modelling. York faces growing challenges from development and needs to address the impacts of numerous major development sites including York Central, British Sugar and the Local Plan Allocations. There are also many changes to the transport network of the City and region, such as HS2 and emerging North Power House proposals that must be contemplated and in order to do this, we need highly effective macroscopic, mesoscopic and micro-simulation models.

32. The multi-layered modelling will deliver this, as well as the immediate-term travel management aims. The ability to provide live updates to trip matrices used by the strategic models will greatly enhance our ability model changing travel patterns and different times of the day, with increased agility and reduced costs.

33. Several modelling providers have been involved in the development of this vision and have demonstrated the core technologies in use today.

Making York's junctions and car parks CAV ready

City-wide readiness for CAVs

- 'Up-lift' all traffic signal sites with V2I capability, either 5G or G5 depending on the results of the Eboracum project
- City-wide CAM / DENM roll-out to support CAVS
- Prepare foundations for SPAT / GLOSA

34. The programme will place York in a leading position to react to the challenges and opportunities presented by Connected and Autonomous Vehicles. As the global technical community continues to develop standards for communications between vehicles and infrastructure and the types and forms of data services that can be supported, there will be a growing need for highway authorities to react.

35. STEP will give York the lead in providing the highway authority elements;

- the travel data platform will allow live journey time and route decision support for vehicles
- UTC decision support will provide data for SPAT and GLOSA services; and
- the supporting work we will undertake on network and asset knowledge to make junctions CAV ready will support CAM and MAP.

36. Additionally, City wide Internet Protocol (IP) communications and the ongoing upgrade of traffic signal equipment to fully IP technologies (a task shared with the TSAR Programme) will provide the physical platform for CAV support.

37. The work currently being pioneered in the City through the DfT C-ITS funded 'Eboracum' research project on the A59 corridor will inform decisions about on-street deployment of equipment, as will the outcomes of other research in the UK, such as Compass-4D and the A2-M2 trials. City of York Council's involvement in the Transport Technology Forum, the work of the IET and general engagement with DfT research activities will ensure we are able to utilise a wide range of research and innovation to deliver the best outcome. The small size and compact nature of York means that the intention to be the first UK city to offer city wide CAV V2I support is realistic.

Supporting UK C-ITS developments

Roll-out digitised TRO database (links to TN-ITS)

- Increase modelling accuracy through better network constraint awareness
- Additional data stream to CAM / DENM
- Implement appropriate CIMEC Use Cases, based on the above technologies

38. To deliver a full Vehicle to Infrastructure (V2I) service, and to increase the accuracy of the live multi-layered model, we will develop a standard for digitised storage and transmission of Traffic Regulation Order (TRO) data, working with national and EU wide development projects working in this area, particular the TN-ITS project with whom we have had detailed dialogue.

39. As Annex L shows, currently our Traffic Orders are paper based; a situation that prevails in most UK local authorities, CAVs will need to be able to access these as we

change them and we will work with the TN-ITS project to deliver a standard low cost way for authorities to link to vehicles.

40. STEP will also maintain links to wider developments in connected and autonomous vehicles and associated technologies and initiatives. Particularly, STEP will aim to demonstrate practical implementations of some of the use cases identified in the recent CIMEC Project Final Report. The strong commitment by the City Council to continue the underlying data and analytical platforms that STEP will deliver will make York a prime UK site to test and then deliver the benefits identified through the work of CIMEC and others such as the C-ITS projects

Outcomes

41. This initiative will provide the City of York with new data platforms to address the challenges and opportunities that coming innovations offer, and be a major advance in the City's abilities to deal with congestion, air quality and promoting public transport. It will also help York to meet the land development challenges we face and provide tools to make the most of the opportunity. The challenge of planning for connected and autonomous vehicles and developments such as MaaS (Mobility as a Service), is something all UK authorities will need to address, yet one that is not yet well understood. STEP will place York in a position to inform other Cities as a beacon City to guide others.

42. As further outcomes, we will deliver;

- Standards to convert paper based parking and management orders into the digital formats automotive and service providers need to deploy CAVS in UK cities, to remove a further barrier to uptake
- A tool for monitoring managing different corridors into York against different policy objectives and optimising signal timings based on in vehicle data
- A prototype "CAV ready" UK signal junction as an exemplar

Summary

43. STEP takes work already done in the UK research projects to a new level of evolution – city wide deployment for congestion, productivity and emissions. It focuses on "co-operative ITS" as a an exemplar for deployment of data from vehicles and people to make small city travel and emissions better, especially in terms of co-operative traffic signals. At the same time, the data it collects will reduce risks for new investment to continue growth in the city.

44. It is not a research project but some of the outcomes from deployment will fill gaps in current projects.

Glossary

JT	-	Journey Time Analysis
ANPR	-	Automated Number Plate Recognition
CCTV	-	Closed Circuit Tele-Vision
O&D	-	Origin and Destination
FVD	-	Floating Vehicle Data
UTC	-	Urban Traffic Control
TSAR	-	Traffic Signal Asset Renewal [Programme]
MAC	-	Media Access Code *(mobile phones / devices)*
CAV	-	Connected and Autonomous Vehicles
V2I	-	Vehicle to Infrastructure [communications]
SCOOT	-	Split, Cycle and Offset Optimisation Technique
CAM	-	Cooperative Awareness Messaging *(information for connected vehicles)*
DENM	-	Decentralised Environment Notification Messaging *(connected vehicles)*
SPAT	-	Signal Phase And Timing *(information for connected vehicles)*
GLOSA	-	Green Light Optimised Speed Advice *(information for connected vehicles)*
TRO	-	Traffic Regulation Order
TN-ITS	-	Traffic Notification for Intelligent Transport Systems *(EU Project)*
CIMEC	-	Cooperative ITS for Mobility in European Cities *(EU Project)*