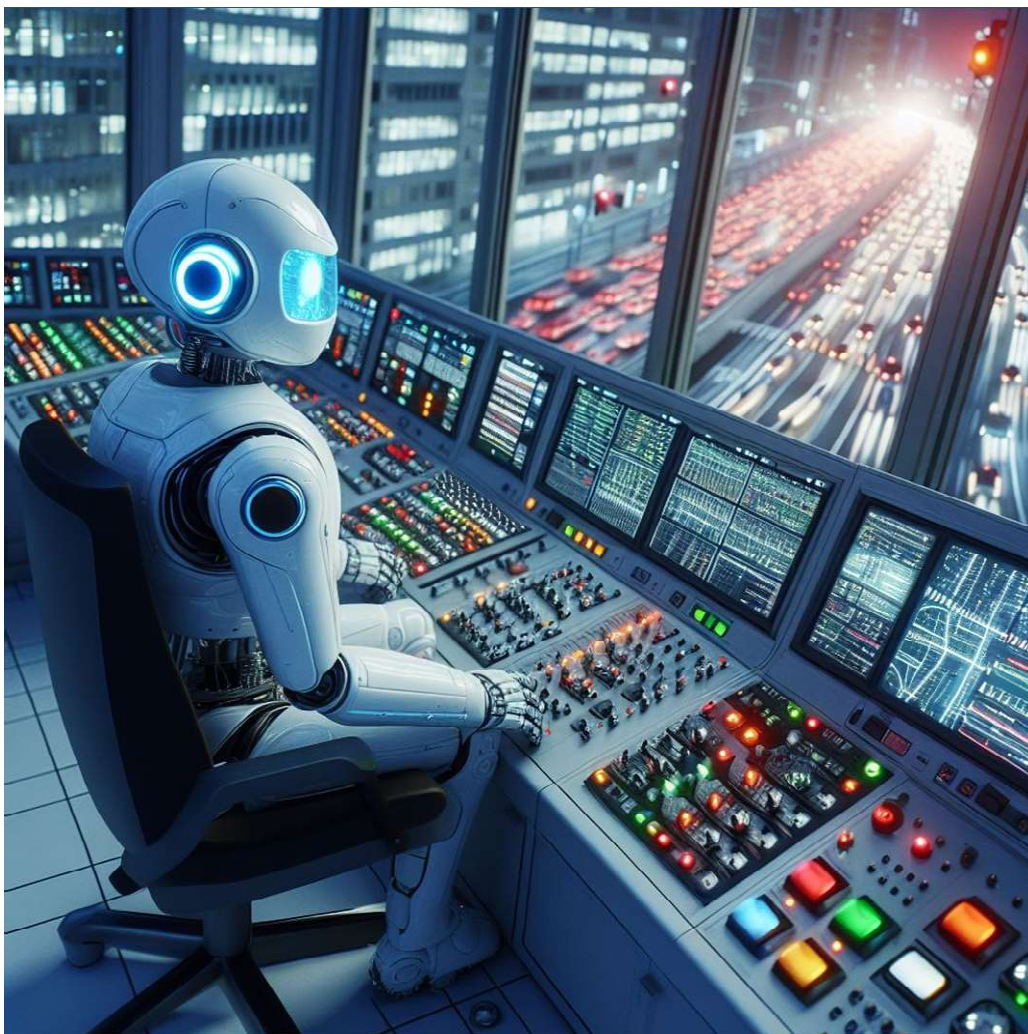


# How should we use Artificial Intelligence in Traffic Systems?

Alistair Gollop FIHE MIET, Technical Advisory Executive at The Alistair Gollop ITS & Traffic Signal Consultancy (AlistairGollop.com) and Founder of the ITS Now initiative (ITSNow.org).

[ag@alistairgollop.com](mailto:ag@alistairgollop.com) | [alistair.gollop@itsnow.org](mailto:alistair.gollop@itsnow.org) | 07717 224 366



Over the past few years, we have seen increasing use of Artificial Intelligence (AI) in equipment and systems used for traffic management. However, at this point, their application is rather sporadic and lacks a cohesive approach to their use to achieve a strategic implementation. Most vendors have been using AI for specific applications and to provide additional capabilities to their products, but we are now starting to see the emergence of larger scale systems implementations.

## *But as traffic engineers, what are the issues we should be thinking of using AI to provide solutions for?*

The major areas of concern facing the sector over the coming years are largely split across the following five topic areas:

1. We are facing a huge skills shortage across the whole highways sector, and in particular within the traffic systems field. AI has a huge potential to revolutionise the effectiveness of traffic management, by overcoming many of the resourcing constraints most highway authorities are experiencing due to having far smaller teams than were common a decade ago.
2. The whole reason for traffic systems is to balance the issues of the safety and efficiency of traffic flows, but this can be difficult to achieve with increasing levels of congestion and changing traffic patterns over the course of the years. This is also becoming particularly exacerbated by changing priorities for the use of our road network, such as the prioritisation of active transport modes resulting in the reapportioning of road capacity away from traditional vehicular traffic.
3. The reduction of carbon emissions and improving air quality are critical goals for the transport sector. Implementing effective solutions for this are at best problematic, for traditional traffic systems because they were not designed with these goals as part of their primary functionality. The increasing use of IoT based technologies to provide high levels of environmental data granularity would benefit from the use of AI to implement far more dynamic methods of control to alleviate issues.
4. Most highway authorities are highly constrained financially, so need to make the best use of their highway assets to deliver their statutory requirements. Austerity measures resulted in much of the technology estate used on highways degrading, due to a lack of funds to implement modernisation programmes to replace life-expired equipment and to periodically re-validate the operation of installations.
5. The emergence and adoption of new technologies will be a key to the advancement of ITS infrastructure over the coming decades. We know that advanced technologies, such as connected vehicles, will have the biggest impact ever seen in the history of ITS infrastructure. A key element will be major changes to the architecture of technology systems and a huge increase in the quantity and type of data available to assist in the management of traffic.

There are of course many nuanced issues which surround the problems facing traffic systems over the coming years, but the five topic areas above form the major issues that should be addressed as a matter of urgency, and for which a variety of Artificial Intelligence features are being produced to help tackle.

We can't just hope that Connected, Automated and Zero Emissions vehicles will somehow solve all the issues we face on a daily basis across the road network. However, AI will not be a panacea to immediately overcome all these issues, it will need to be used in an educated and intelligent manner to start achieving solutions for these problematic areas, whilst at the same time recognising the uncertainty of the emerging technology landscape over the next decades.

## *So, what should we be considering within the traffic systems sector to get the maximum strategic benefits from this emerging technology?*

Obviously, we are hoping that AI will be able to make sense intelligently of the 'data lakes' which will be produced as part of the variety of emerging technologies. The sheer volume of this data would be problematic for current systems to use, and wholly beyond the capabilities of human operators to comprehend and respond to efficiently. Using predictive analytics, AI should be able to use both historical information and machine learning to predict traffic patterns and respond accurately to real-time data used to optimise the operation of the traffic systems.

With the prioritisation of users changing away from private vehicular traffic to pedestrians and active transport modes, one particular area where AI could be leveraged to enhance capabilities is to provide network wide pedestrian and cycle flow measurements in a similar vein to how Scoot uses vehicle detection. This could provide the ability to treat active transport modes in a much more strategic manner than the current situation, where the vast majority of sites simply rely on presence detection, which is reactive to demand being placed without any foresight of pedestrian or cycle movements.

We should also be looking to enhance safety by using the technology in new and innovative ways to quickly and accurately identify incidents across all modes of transport. This should alert authorities to provide a relevant response and modify the operation of the traffic systems to protect those effected by the issue and where feasible, to re-route traffic away from the area of the incident.

AI should also be able to provide assistance to optimise the movements of public transport across our cities, by making informed decisions to implement priority features where required in an intelligent manner.

These systems should also be used to reduce the environmental impact of transport using real-time optimisation of traffic flow to reduce unnecessary vehicle idling at signalised junctions and providing information to vehicle navigation systems to achieve the optimal route for each journey.

They should also provide information freely so that real-time information is available to the public, including through third-party apps, so that they can make informed decisions about the journeys and have confidence in this information so that it encourages users to make healthy choices for their movements, including promoting active transport, micro-mobility platforms, Mobility as a Service (MaaS) and public transport.

## *What do we need to look out for when implementing these new systems?*

Integration of both emerging technologies and legacy systems will inevitably throw up lots of issues, especially as we need to plan for features which we haven't even thought of yet! The whole manner of ITS infrastructure is likely to change to such an extent that we need to plan for this so that we reduce abortive investments in short-term solutions. We are already seeing how some equipment which is still being installed could become redundant before it is life-expired, something that has been happening in tech for some time, but which we are not used to in traffic systems.

We are also seeing how our traditional 'heavy engineering' approach to solutions will gradually move to much lighter equipment deployments, this is a result of ongoing processing advancements of

micro-computers along with vast improvements in wireless communications and battery technologies. This will result in the adoption of IoT and similar equipment, but in itself then also increases the risk of cyber-attacks. This illustrates that the wholehearted reliance on digital systems for traffic management will require that robust cybersecurity measures are in place to protect these systems.

With the vast amount of data being used and generated by transport systems, we will need to ensure that privacy and ethical concerns are always at the forefront of our thoughts when implementing these systems. It is essential that ethical concerns are addressed from the start, ensuring privacy is maintained, and that bias isn't allowed to negatively impact any segments of the population.

It is therefore important that AI systems are transparent and explainable, allowing stakeholders to understand how decisions are made and to create frameworks for accountability that define who is responsible for AI system decisions and outcomes.

The use of these advanced systems should also be optimised to allow them to work with other Smart City applications, so that transport is at the very heart of the digital management for our cities.

It is likely that changes in statutory requirements from Government will impinge in this area, as a sector therefore, we will need to engage with politicians to lobby for policy decisions that support and drive the transition to allow emerging mobility technologies to be used effectively.

### *With wide ranging concerns about transport technology in recent years, how do we bring the public along with us through this transition?*

A lack of public acceptance of technology deployments for Smart Motorways and LEZ in London illustrate the care needed before new features are deployed. Unfortunately, the level of distrust for technology used in transport will also not be helped with proposals for Road User Charging. As an industry we therefore need to ensure that AI used for traffic systems isn't perceived to be a 'Big Brother' implementation for intrusive surveillance and monitoring.

It is critical that the use of these systems is understood by users and that their presence provides clear advantages to them that they can recognise and value. We want to ensure that we avoid the sight of members of the public cutting down poles or bad media stories about the use of these facilities.

Artificial Intelligence (AI) has the potential to significantly enhance traffic management systems. By leveraging AI, we can look to tackle issues of skills shortages, improve safety and efficiency, provide environmental and financial benefits and to make the transition to using other emerging technologies across the transport and Smart Cities fronts far easier to integrate.

We just need to be mindful of the potential pitfalls for AI's use, and as an industry undertake a multi-faceted approach to explaining to the public, media and politicians how its use will provide benefits.

To find out more about these issues, visit the **ITS Now** website at [www.ITSNow.org](http://www.ITSNow.org) or have a look at the associate YouTube Channel at [www.YouTube.com/@ITSNow](http://www.YouTube.com/@ITSNow).

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