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Prioritising Active Travel through Next-generation Traffic Data

Eliza Moyse (Head of Operations), **John Chapman** (Chief Commercial Officer)

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Abstract

This paper will cover the importance of active travel data to our sustainability ambitions; how vision-based AI solutions are superseding traditional methods for the collection of traffic and active travel data; and some illustrative examples of the ngenius.ai solution in practice.

Why active travel really (really) matters

Increasing the uptake of active travel is fundamental to the Government's ambition to create clean, safe, and effective transport networks across the UK. Increasing cycling and walking can help tackle some of the most challenging issues we face as a society – improving air quality, combatting climate change, improving health and wellbeing, addressing inequalities, and tackling congestion on our roads[1]. On top of this, it is small changes that can lead to dramatic benefits for the wider community.

- Reducing Carbon Emissions

  In 2021, a study led by the University of Oxford demonstrated that swapping one trip per day from driving to cycling reduces carbon output by over 0.5 tonnes per year[2].
- Improving Health

  Analysis by the WHO shows that walking for 30 minutes or cycling for 20 minutes on most days reduces mortality risk by at least 10%[3]. Active commuting is associated with an estimated 10% decrease in risk for cardiovascular disease and a 30% decrease in type 2 diabetes risk[4].
- Reducing Congestion

[1]Department for Transport, "Gear Change: A bold vision for cycling and walking", 2020, 8.
[2] University of Oxford, "Get on your bike: Active transport makes a significant impact on carbon emissions", 2 February 2021. Viewed 10 August 2022.
[3] World Health Organisation (WHO), "Cycling and walking can help reduce physical inactivity and air pollution, save lives and mitigate climate change", 2022. Viewed 11 August 2022.
[4] WHO, "Cycling and walking can help reduce physical inactivity and air pollution, save lives and mitigate climate change", 2022. Viewed 11 August 2022.

> The city of Copenhagen reduced car traffic by 45% through a combination of wider bicycle and pedestrian paths, dedicated bus lanes and lower speed limits.[5]

The Department for Transport's (DfT) "Gear Change: A bold vision for walking and cycling" report puts this into context for UK authorities. It makes clear the DfT's commitment to supporting local authorities' ambitious goals to make a considerable step change in the promotion of active travel and its renewed importance in maintaining public health in the wake of the coronavirus pandemic. It also highlights the mistakes that have been made when trying to implement active travel-focussed schemes and the measures the DfT is putting in place to mitigate the funding of unsuccessful schemes.

These measures require authorities to capture increasingly detailed and qualitative data on active travel.

The role of data

High-quality, timely and actionable active travel data is an essential part of managing more efficient and sustainable transport networks. This has not just been recognised by the Department for Transport, but also by the European Commission, whose "Horizon 2022 FLOW Project" studied active travel schemes across 6 major capitals in Europe. Their report stated: "Transport analysis techniques and models must be significantly improved to place walking and cycling on an equal footing with motorised modes… few authorities – at any level of government – collect sufficient data on walking and cycling"[6].

This is largely due to the lack of accurate, reliable, and cost-effective solutions to provide this data, with current state-of-the-art solutions relying heavily on bespoke hardware or even manual interventions.

Limitations of Existing Approaches

The current methods for capturing traffic data have simply not been designed to consider active travel usage.

[5] Carlton Reid, "Copenhagen Plans Greater Restrictions On Car Use As Cycling Surges To 49% Of Commuter Journeys", Forbes. 28 May 2019.
[6] European Commission, "The Role of Walking and Cycling in Reducing Congestion", 2020. 5

	Advantages	Disadvantages	Active travel
Manual counts	Highly flexible classification; trusted data capture methodology	Expensive, highly inefficient, slow, inaccurate	Counts possible, cannot provide detailed data on travel behaviour
Automatic traffic counters	Low cost, quick to install	Limited data capture; prone to malfunction which can lead to accidents, short term studies only	Cannot capture active travel data
Inductive loops	High cost, trusted data capture method, long-term solution	Disruptive and costly installation, limited data capture, multiple detectors required per location	Cannot capture active travel data
Radar/Lidar	Accurate speed measurements; quick installation; provides geo-spatial data.	Poor classification capability; limited range, difficulty in detecting decelerating vehicles,	Cannot capture active travel
Mobile data	Provide origin-destination data over a large area, some classification possible through sensor analysis	Very limited travel mode classification; poor coverage; geospatial data is highly inaccurate; intrusive data capture.	Can be used to track active travel journeys although this is provider-dependent and coverage is often poor

Figure 1. Comparison of existing data collection methods and active travel capability

Next generation traffic data

To design infrastructure to increase uptake in walking and cycling, authorities and designers need data on current behaviours – above and beyond empirical count data. The current approaches to data collection do not address the need for active travel data, and radical new approaches are required to fill the gap.

Radical new approaches – Vision

To address the limitations of existing approaches to gathering traffic data, there have been a number of entrants to the market providing "AI Cameras". These solutions use deep-learning, machine vision technology built-in to bespoke hardware to analyse footage as it is recorded and detect a wide range of objects within their field of view. In essence, this technology allows a machine to acquire a similar level of visual acuity to that of a human being, in controlled, pre-defined tasks.

These solutions have changed the way that active travel data can be collected, by providing a human-level of classification with drastically decreased operational effort. The use of video data as input to these technologies allows solutions to provide both the quantitative and qualitative data that is needed to effectively plan for active travel.

New data types

AI solutions can provide a level of data that has previously been impossible. By using sophisticated AI models and mapping integrations, they can deliver insights that speak directly to the need for authorities to understand habitual behaviour as well as numbers.

	ATC	Manual Count	Machine Vision
Vehicles Counts	Yes	Yes	Yes
Speeds	Yes	No	Yes
Active Travel	No	Yes	Yes
Desire Lines	No	No	Yes
Movement Heatmaps	No	No	Yes
Passing Distances	No	No	Yes

Figure 2. Feature comparison between traditional data capture and machine vision solutions

The ngenius.ai platform

At ngenius.ai, we are transforming the way that movement data is understood, using advanced machine vision technology to automate traffic & active travel data collection using the camera infrastructure that our partners already have.

We deliver next-generation insight directly from the cloud, at five times the speed and one-fifth of the price of existing approaches, using footage captured from any camera, anywhere, to produce actionable insights with a geo-location accuracy of 20cm and a classification accuracy of 99%+.

Our highly advanced geospatial movement data can be captured on any camera with no physical installation and a simple eight-click calibration process that accounts for the height, pitch, resolution, and view of any camera set up.

This approach means we are able to deliver the data authorities need in a highly cost-effective way with zero disruption to the network.

How it works

We have two models for data processing:

1. Connected cameras: stream any IP camera directly to the platform to produce 24/7 real-time traffic data, directly as it happens
2. Automated surveys: Capture footage anywhere and upload it directly to the platform to gather next-generation insights.

Case study: Norfolk County Council

Context

Norfolk County Council (NCC) aims to make walking and cycling the preferred mode of transport for both travel and leisure in rural and urban areas in the county[7]. To achieve this ambitious goal, they are working to transform the walking and cycling infrastructure in the Greater Norwich area. The council have received £32 Million of funding from the DfT's Transforming Cities and active travel funds to make changes to increase active travel uptake and reduce the reliance on motorised transport for shorter journeys.

What we do for NCC

- Connected to existing cameras

  NCC has introduced our Connected camera model to Norfolk's Transforming Cities sites to receive 24/7 real-time traffic and active travel data, streaming directly from their PTZ cameras. As well as 24/7 empirical count data for reporting to DfT and members, the council are also seeing fully classified wait times in customisable zones; movement heatmaps that show exact

[7] Norfolk County Council, "Greater Norwich: Local Cycling and Walking Infrastructure Plan", March 2022. 3.

'desire lines' for all road users; and junction efficiency measurements that have previously been impossible.

- Ad-hoc surveys

  NCC is also utilising our Automated surveys model to enhance their ad-hoc data collection. Whilst core TCF sites require 24/7 monitoring, NCC also has a number of other sites where schemes are ongoing and require shorter analysis periods with a quick turnaround. This model allows them to capture data with their own camera across their entire county-wide road network and simply upload it to us for analysis.

Challenge

The challenge that NCC face whilst delivering such a large package of improvements is continually proving the effectiveness of staged schemes and avoiding limited feedback from a minority of biased users. For example, NCC needed to use our Automated survey model to run a study to qualify anecdotal evidence that cyclists were choosing to use the roadway rather than the new dedicated infrastructure at a key site in Norwich City centre.

Method

NCC uploaded 8 hours of footage from one of their existing 4G UTMC cameras that were already in place for traffic monitoring at the location. We ran a one-off survey of the footage to provide:

- Fully classified counts of Pedestrians, Cyclists & Vehicles on both count lines (see figure 3 below);
- Usage per lane on the roundabout; and
- Fully classified heatmaps

Results

Using our analysis, we were able to provide a complete breakdown of Cycle, Pedestrian and Vehicle usage. The results provided the empirical data for NCC to prove the benefits of having dedicated cycle infrastructure at a key crossing into the city. These results were passed on to elected members and cycling groups to demonstrate that the changes to infrastructure had been a success, with 89% of cyclists choosing to use the dedicated cycle infrastructure.

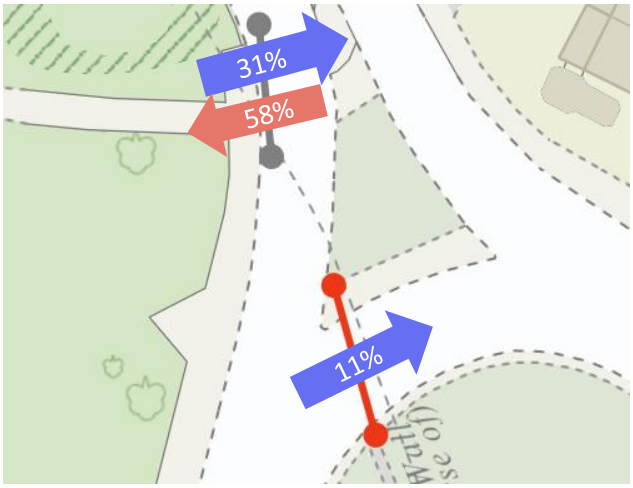

Figure 3. Directional Breakdown of cycle usage at Grapes Hill site

Heatmaps/wait times

Alongside the basic count data, we produced a heatmap to visualise cyclists' behaviour at the site and look at popular paths of movement across the roundabout. As seen below, the heatmap demonstrates that cyclists preferred to use the newly configured infrastructure and footpaths rather than the roundabout lanes. This strongly disproves the anecdotal evidence offered by some as it clearly shows that, even where the infrastructure hadn't been changed as part of this scheme, cyclists still strongly prefer the use of pedestrian-specific infrastructure over the shared roadway.

Figure 4. Cyclist Heatmap results for Grapes Hill Survey

Results/next steps

The data we were able to provide meant that NCC was able to make significant progress with approvals for the expansion of the scheme at Grapes Hill, and they are commissioning a number of

further studies in the coming weeks to move the project into its second phase. This is a key site that could transform journeys in Norwich City centre, and where we were able to use existing hardware to provide the next-generation data that was needed to prove the scheme's success.

We are continuing to work with NCC on a range of active travel focussed projects where our data will be the core differentiator for scheme design and evaluation.

Where do we go from here?

With the DfT introducing new criteria to measure local authorities' performance in promoting active travel, particularly cycling and walking, next-generation solutions are crucial to secure funding to make improvements to infrastructure and ensure that previous schemes continue to provide value.

Our platform allows our partners to gather data on their sites using the infrastructure they already have at a fraction of the cost of traditional approaches and bespoke sensors and provides a level of insight previously impossible.

As it stands today, planning for active travel infrastructure is fragmented[8], and authorities need to adopt solutions that provide next-generation traffic and active travel data to design infrastructure and urban spaces that meet the needs of commuters and active travellers. If you would like to speak to us about how we can help you to start collecting this data, please visit our website https://ngenius.ai or contact us at contact-us@ngenius.ai.

[8] WHO, "Cycling and walking can help reduce physical inactivity and air pollution, save lives and mitigate climate change", 2022. Viewed 11 August 2022.