# Digitising Temporary Traffic Management

## Modernising and de-carbonising our sector

Between April 2020 and March 2025, the UK government will spend £24bn to improve and modernise our Strategic Road Network (second Road Investment Strategy - RIS2)[1]. Part of this is a strong commitment to reduce carbon emissions and support the government's ambition to achieve net zero carbon emissions by 2050. The roadworks associated with this ambitious programme will require effective temporary traffic management (TTM) to keep traffic flowing smoothly and safely, and deliver a positive road user experience during the works. In research carried out by Transport Focus[2] in August 2021, road users ranked better management of roadworks as a top three priority.


The UK prides itself as a world leader in the field of TTM and has consistently improved working methods to reduce risk to both road workers and road users. As an example, the elimination of live carriageway crossings for workers to deploy temporary signs has saved 3.7 million crossings per year, preventing potential harm to road workers and road users.

Despite these advances in working methods, the actual equipment used to create temporary working environments (namely cones, barriers and fixed plate signage) is nearly identical to that used over 20 years ago. This is in stark contrast to the Strategic Road Network (SRN) which has become progressively smart with the addition of sensors and overhead gantry mounted variable message signs (VMS). This progress is helping to create the infrastructure of the future which can respond to changes in conditions and optimise journeys as well as accommodate more advanced forms of transport such as connected and autonomous vehicles.

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## The situation

In its current form, TTM significantly downgrades road user experience and the ability for connected and autonomous vehicles to operate in this environment. This is due to the following:

- Messaging and signage at temporary work sites are typically not dynamic and hence do not allow optimisation of traffic flows (i.e. variable speed). With increasing calls to run traffic at 60mph this increases risk to road workers during peak site activity, breakdown recovery personnel and road users during incidents
- Temporary traffic management equipment such as cones and signs are easier to displace than permanent infrastructure creating potential hazards impacting on road user and road worker safety
- Provision of road works information is subject to manual call-in processes which are not real-time, and are subject to change and human error. This can lead to misinformation, poor communication, delays and ultimately dissatisfied road users

**Current best practice in England requires the inspection of all TTM every 2-4 hours. This necessitates a large number of vehicle movements and mileage which is costly, carbon intensive and inherently risky.**

**On a single large Type A scheme, mandatory inspections could equate to over 260,000 miles travelled per annum with a carbon footprint in excess of 100,000 kg, just to visually inspect signs and cones.**

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## Using digitally-enabled temporary traffic management assets

Digitally-enabling safety critical TTM assets opens up a world of opportunities to generate real-time information which will improve safety, customer experience and efficiency whilst significantly reducing our industry's carbon footprint.

Opportunities include:

- **Smart temporary signs determine their location and status creating a digital twin, matching this to planned maintenance and TTM design**. This could enable remote monitoring of safety critical signs as opposed to current practise of visual inspection every 2-4 hours. This improves speed of response to problems, reduces time spent on carbon intensive inspections and provides upcoming road works information directly to connected vehicles (C2X)


- **Smart delineation (i.e. cones)** will identify the location of cones and allow a digital twin to be created. The technology will automatically link to planned maintenance interventions and provide updates to regional operational control rooms and back-end systems when deployed. When hit (i.e. taper strike) they relay this information to the traffic management crew to respond instantly and update nearby gantries to warn road users of debris in the carriageway. Again, they can also provide this information directly to connected vehicles (C2X)

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- Dynamic speed management[3] of roadworks to replicate existing gantry infrastructure. Being able to set the appropriate speed for the conditions i.e. 60mph when there is no works activity, 50mph when there is peak site activity and 40mph during an incident improves road user experience and safety at the same time. It also reduces unnecessary delays and reproduces what road users expect to see (i.e. permanent infrastructure)


**Running at 60mph where possible can save UK PLC £160,000 per day on a typical scheme by reducing delays.**

- Connected temporary traffic management vehicles to alert road users to slow moving vehicles ahead. This could reduce Impact Protection Vehicle (IPV) strikes and improve traffic flows when for example Enhanced Mobile Carriageway Closures (EMCC) are used. In the UK there are dozens of IPV strikes every year.

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## The future is here today

The technology is available to transform the industry and bring temporary traffic management into the 21st century. Companies like UK-based HRS are bringing this to life with a range of digitally-enabled products and services.

It has developed the technology to provide real-time information on roadworks deployments which can be linked to network occupancy systems and directly to third party mapping/mobility solutions systems provided by companies such as Google, TomTom and HERE.

This technology creates a **digital twin** for each work zone to deliver targeted safety alerts, automated remote monitoring of safety critical assets, real-time information of works deployments and dynamic speed management. The digital twin is produced by creating a geozone that corresponds with the works area. This provides several significant opportunities:

- Cost effectively digitising safety critical assets using Internet of Things (IoT) enabled devices
- Automating flow of information directly from site to decision makers and stakeholders
- Monitoring and controlling safety critical assets remotely.

This provides the following major benefits:

- Remote condition monitoring of temporary signs and cone barriers to reduce visual inspection requirements and improve response time to incidents
- Accurate reporting and time stamping to allow better decision making and create incident hot spot maps
- Automation of the communication around network occupancy management, leading to better information getting to road users quicker to improve journey times and experience.

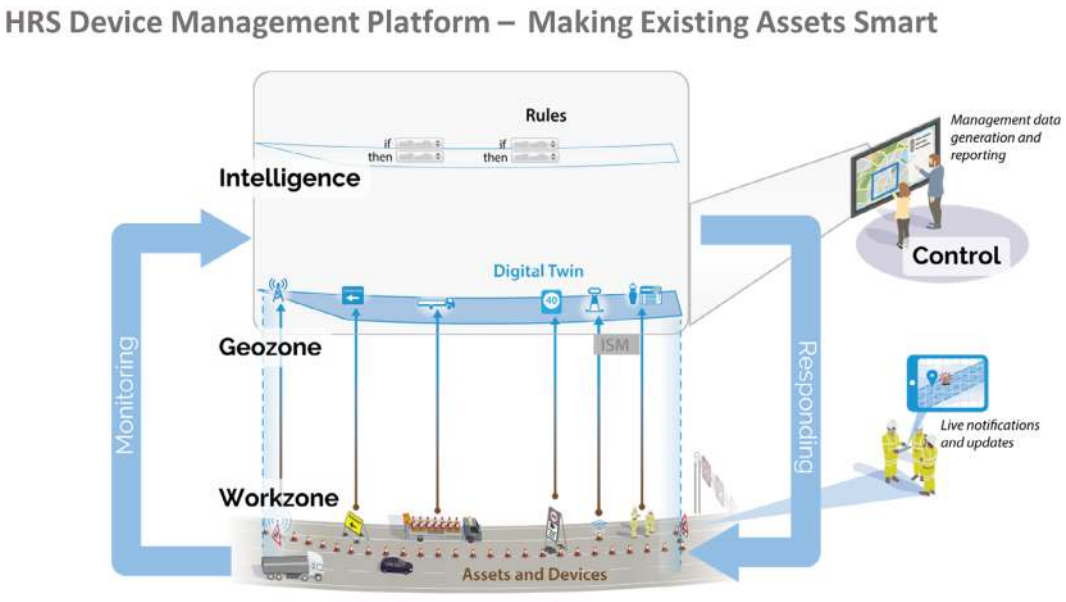


*Figure 1. HRS's platform enables the creation of a digital twin for each site, creating a fully automated eco-system to manage and monitor safety critical TTM and other work zone assets*

# Digitising Temporary Traffic Management

## Remote condition monitoring – event-based maintenance

Currently, industry best practice in the UK is to inspect temporary traffic management assets every 2-4 hours. This is labour intensive, has a high carbon footprint (see examples below) and carries a risk of an incident due to long periods with debris in the carriageway, or missing or misplaced signs.

Documentation is typically either via paper record or an electronic equivalent prepared manually which leads to potential for human error as well as creating administrative overheads.

The ability to remotely monitor safety critical signs and delineation (i.e. cones) will move the industry towards an **event-based approach** to maintenance.

HRS's Intellicone® Smart Taper and Intelliframe® technology can help make this a reality today. Smart Taper enables detection of taper strikes whereas Intelliframe® can be applied to all temporary traffic management signage. When combined, this provides a live view from site backed up by two-hourly time stamps to correspond with traditional manual inspection sheets.

A taper strike on the A45 Chowns Mill Improvement Scheme[4] which took out 50 cones and eight sequential lamps, was detected, assessed and reinstated in less than an hour thanks to the implementation of digital technology into the TTM plans. HRS Intellicone® Smart Taper had been installed and alerted the TMO immediately which activated an immediate assess and reinstate plan.

*Figure 2. Smart Cone Lamps with the ability to detect motion to enable taper strike detection and warning*

Building technology into existing traffic management assets makes the process of digitisation smoother and easier for the industry to adapt and for the general public to accept. Using Smart Batteries in existing cone lamps in a taper, creates a Smart Taper which will detect any taper strike instantly and allow the assessment and reinstatement to begin immediately. The risk of debris causing further incidents is further minimised.

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## Remote condition monitoring – event-based maintenance (continued)

*Figure 3. Intelliframe® Lite can be retrofitted to existing frame in seconds allowing remote monitoring of their status and plotting them on a map interface*

Traffic management contractors can use Intelliframe® and Intelliframe® Lite to move to an enhanced method of site inspection, with the majority based on exception (events/incidents) as opposed to purely routine. They will deliver instant carbon and fuel cost savings, reduce human resource requirements whilst being able to respond to actual incidents quicker. This reduces risk to road users and road workers.


**Using digital technology on works on the M60 has replaced routine inspections to event-based maintenance[5]. In the first six months of these works, the following savings have been made:**

- **13,815 kg carbon saved**
- **720 live traffic/operative interfaces eliminated**

# Digitising Temporary Traffic Management

The illustrations below show the likely impact this would have on direct fuel cost and $CO_2$ emissions across our industry:

**Type A site example** - M6 J21a to 26 Upgrade Works

Total length 42.1 miles (to inspect both directions) + 17.3 miles diversion route

12 checks per 24-hour period equate to 712.8 miles, 292 kg of $CO_2$ and £140 in fuel cost

Calculation (based on 29.1mpg over 1 year)

- 260,172 miles for 365 shifts
- 106,580 kg of $CO_2$ produced

It would take 5,075 fully grown trees to capture this $CO_2$ over one year. This is just for one site and there are typically around 10 similar sites in the UK. This equates to total emissions of 1,065,800 kg $CO_2$, 2.6 million miles driven and 50,752 trees.

**Type B site example** – Overnight Works (average site)

Total length 2.5 miles (single direction) and 10.5 miles (round trip) to check TTM. On average three checks per shift (night only) totalling 31.5 miles, 12.8 kg of $CO_2$ and £6.20 fuel cost

Calculation (based on 29.1mpg over 1 year)

- 9,450 miles for 300 shifts
- 3,867.10 kg of $CO_2$ produced

With an average of 400 Type B sites/ subs sites operational at any one time this totals 1.6 million kg per annum, or 3.7 million miles driven over 300 shifts.

## Conclusion

Moving towards event-based maintenance could deliver the following major benefits to stakeholders:

- Reducing $CO_2$ emission by 2.6 million kg per annum
- Removing unnecessary vehicle journeys - 6.3 million miles
- Freeing up scarce skilled human resources - 2.8 million hours. The industry is experiencing skills shortages and working smarter will improve productivity and allow a focus on higher value-added activities
- Reducing vehicles accessing and egressing sites
- Enabling quicker response to events such as fallen cones or signs.

## References


1. Road Investment Strategy 2
2. Transport Focus Road Users Priorities for Improvement
3. HRS - Dynamic Speed Sign Case Study
4. Chevron Traffic Management - Chowns Mill Taper Strike Case Study
5. HRS - M60 Case Study