

REMOS vs. Manual Control: A Comparative Analysis for Smarter Temporary Traffic Infrastructure

September 2025

About this White Paper

This technical paper was produced by SRL Traffic Systems to introduce a new approach to temporary traffic system operation and control. The paper and trial data has been written by the REMOS team.

To find out more about SRL Traffic Systems, visit srl.co.uk

Executive Summary

As the demand on UK road infrastructure continues to grow, intelligent transport systems must evolve to be safer, more efficient, and environmentally responsible. SRL's **Remotely Operated Signals (REMOS)** system represents a significant leap forward in portable signal technology, replacing traditional on-site manual operation with centralised, intelligent control.

This white paper presents evidence demonstrating the value of REMOS. By combining centralised control with intelligent Multiphase Adaptive Detection System (ADS) technology, REMOS improves safety for workers, reduces operational costs, and enables smoother, more sustainable traffic flow.

Through comparative analysis, case studies, and technical breakdowns, this paper aims to offer meaningful insights into how REMOS not only enhances site performance but also helps Local Authorities and contractors futureproof their operations.

Context:

The Need for Innovation in Temporary Traffic Management

The UK's road network is under constant strain, with urban centres like London, Birmingham, and Manchester experiencing increasing levels of congestion year after year. According to the Department for Transport (DfT), over 331 billion vehicle miles were travelled on UK roads in 2023, with temporary roadworks accounting for a significant share of delays and emissions.[1] These challenges demand smarter, more responsive traffic management systems.

Traditional approaches to manual control of traffic management rely heavily on manual labour; operators stationed at temporary traffic lights, often under the NCT08b Local Authority Permit (manual control of traffic management), within the DfT's Statutory Guidance for Local Authorities.

Statutory Guidance for Local Authorities

The Department for Transport (DfT) believes that well-designed and properly implemented permit schemes are the most effective way to manage road networks and works on public highways. These schemes aim to minimise disruption by improving coordination and oversight of works, particularly those carried outby highway authorities and utility companies. The guidance supports the use of permit schemes by detailing the correct application, recording, enforcement, and examples of conditions, helping to reduce impact on communities and road users.[2]

NCT08B – Statement of Technology

Developments in technology in this area have provided proven intelligent portable light systems which are a reliable alternative to two-way control. They should be approved and accepted as a 'manual control' method of operation. Where a promoter utilises 'intelligent' portable light systems, this should be communicated to the authority 'in the additional information field' in the permit application.

Other than for the set up and maintenance of these lights, an operative's presence is not required. The requirement for manually operated/control here is deemed to be met by a qualified/competent person being onsite monitoring flow and intervening to manual control setting when needed in accordance with the safety code of practice where temporary measures are identified.

1. Road Traffic Estimates in Great Britain, 2023: Headline Figures, Department for Transport (May 2024)
2. Statutory Guidance for Local Authorities, Department for Transport, (2022), Statutory guidance for highway authorities: permit scheme national conditions.

Context:

The Need for Innovation in Temporary Traffic Management

Permit Applicability

The NCT08b permit condition is applied as per the instruction of the authority with the purpose of improving traffic flow. It is site specific. Where a promoter uses intelligent portable light systems, an operative's presence is not required, though it is often still stipulated to improve tidal flows.

While effective in certain scenarios, this model presents several serious drawbacks:

- **Health and Safety Risks** - On-site operators are exposed to roadside hazards, unpredictable driver behaviour, and verbal abuse - placing their wellbeing at risk.
- **Unconscious Bias and Limited Visibility** - Operators positioned at one approach often develop biases in their control of signal timings. With limited line-of-sight and no full network overview, decisions can unintentionally favour one direction of traffic, causing unnecessary delays elsewhere.
- **Labour Challenges and Cost Inefficiencies** - The industry is facing a scarcity of trained, reliable operators. Rising labour costs, inconsistency in performance, and operational unreliability make this model increasingly unsustainable.

These issues collectively impact road user experience, delay construction timelines, and increase the carbon footprint of roadworks.

REMOS was developed in direct response to these challenges. It leverages real-time streaming, and centralised control to address operational inefficiencies and create safer, more intelligent traffic control strategies.

Introducing REMOS: Concept, Development & Operation

REMOS is SRL's innovative response to the logistical, operational, and safety challenges faced in temporary traffic signal management.

Developed through collaboration with Local Authorities, traffic management companies, and frontline operatives, REMOS offers a centralised model where trained operators oversee multiple active sites from SRL's dedicated REMOS Control Centre in Birmingham. This model significantly reduces the need for on-site staffing and eliminates common inefficiencies related to manual operation.

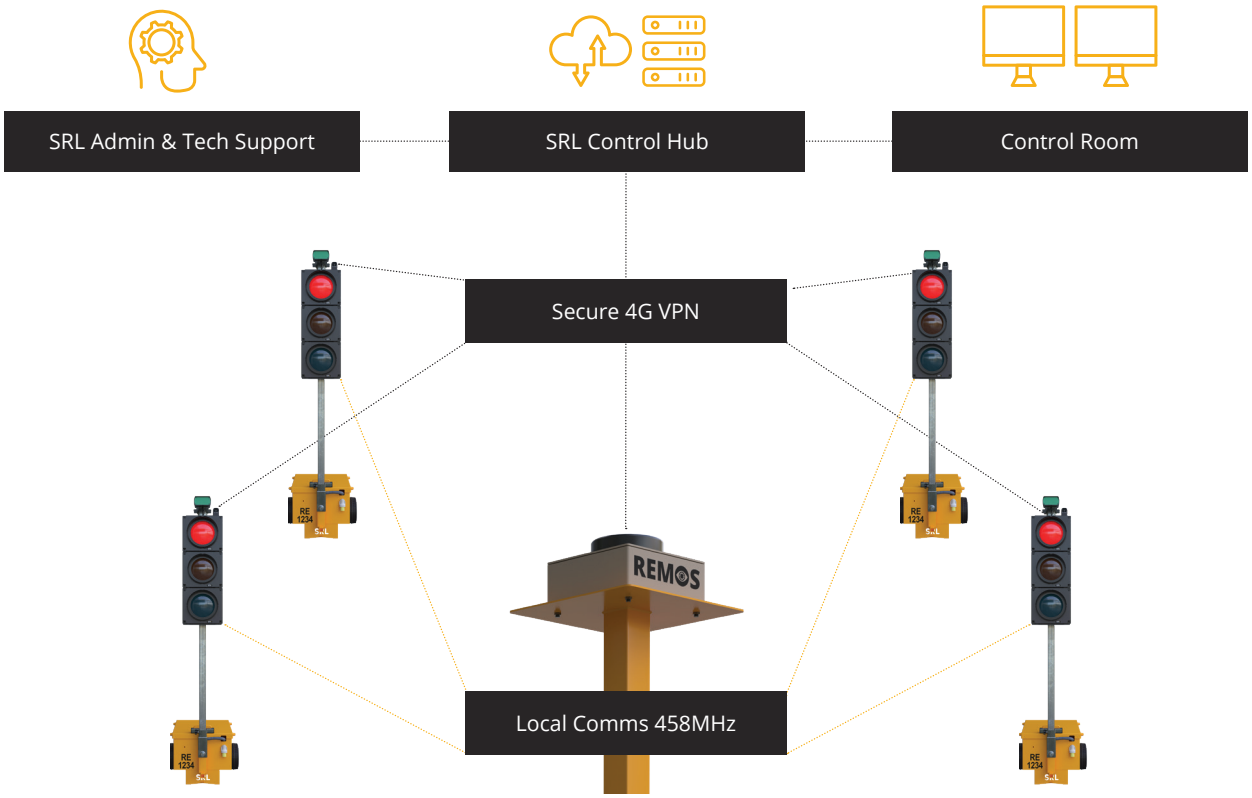
Key concerns such as unconscious bias in signal timing, poor visibility of all approaches, and exposure to driver aggression are all directly addressed by the REMOS approach. The platform is also GDPR-compliant, streaming live video without storing images, ensuring full regulatory alignment.

How Does REMOS Work?

REMOS systems are equipped with radar sensors and CCTV cameras that continuously monitor traffic flow at the site. The radar detects vehicle movement, while cameras live stream footage of the approach to each signal.

The video is transmitted in real-time to SRL's Central Control Room via the SRL Control Hub. The web-based platform allows operatives to access live traffic video and video feeds from multiple sites, simultaneously. Trained operators in the control room analyse the real-time live traffic video feeds and remotely manage the traffic signals. They can switch between automated modes and manual control as needed, ensuring optimal traffic flow at all times. 'All Red' is actionable, if required.

Introducing REMOS:
Concept, Development & Operation



Signal radar scans area and detects vehicle movement → Detected video is transmitted to central controller

CCTV streams live traffic footage → Live video feed is streamed to control room via SRL Control Hub

Central Control → Operators analyse real-time video and control signal operations remotely

Introducing REMOS:
Concept, Development & Operation

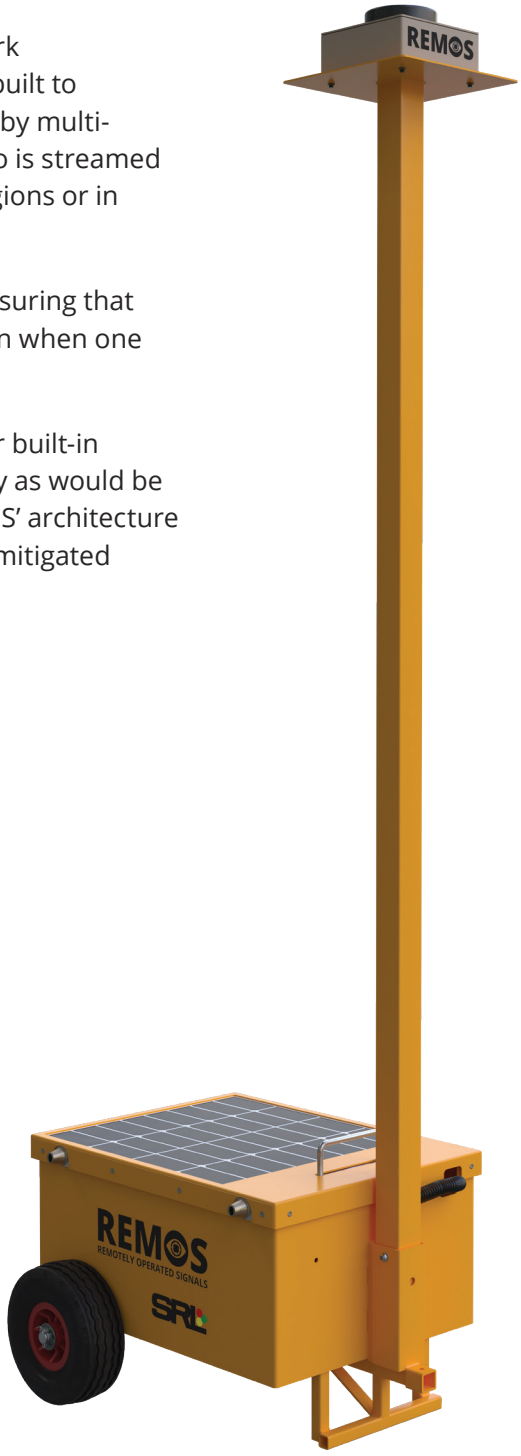
Remote Reliability – A Clear Signal

For REMOS, providing robust, uninterrupted GSM network transmission is a cornerstone of our solution. REMOS is built to deliver an impressive 99.5% network coverage, powered by multi-network roaming SIM technology. This ensures that video is streamed seamlessly, regardless of location, whether in remote regions or in areas suffering from signal congestion.

The solution intelligently switches between networks, ensuring that video images continues to flow without interruption, even when one network falters or becomes overloaded.

This secure, consistent flow of video is guaranteed by our built-in redundancies, which maintain the same level of reliability as would be expected from a full-time operator on the ground. REMOS' architecture ensures that any potential disruptions are detected and mitigated accordingly.





Multiphase ADS – Default Mode of Operation

Each REMOS portable traffic signal is also equipped with SRL's Multiphase ADS, a sophisticated form of vehicle actuation, which uses high-precision radar to monitor vehicle volumes and speeds. The ADS detector outputs are fed into a proprietary algorithm that dynamically adjusts green times for optimal flow. This is the default mode of operation.

While others offer limited, often single-phase solutions, Multiphase ADS stands alone in its ability to seamlessly control 2, 3, and even 4-way temporary junctions—without manual intervention.

Multiphase ADS is also compatible with some of SRL's standard portable signals. Most notably, UltraLight, in which it is autoconfigured.

How does Multiphase ADS work?

Once Multiphase ADS is set up it begins to optimise max set timings, adding time to each approach (four seconds per cycle) when it has reached its saturation point. The system also allows for HGV start lag allowing extra time to get moving and clear the site.

The system uses FMCW (Frequency-Modulated Continuous Wave) radar and FSK (Frequency Shift Keying) radar, as a hybrid system, to determine range and speed of the vehicles. It is configured to ignore vehicles going away from the signals, so there are no false detects from vehicles on the opposite carriageway.

The system relies on the detector's high accuracy to detect vehicles and cyclists at the farthest point of 60m and track them to the stop line (the point where vehicles and cyclists must stop when red light shows) this will track multiple vehicles through each zone allowing the system to identify platoons of vehicles and identify any gaps in traffic. This will allow for the signals to gap out (go to red) and allow vehicles green on another phase as efficiently as possible

Multiphase ADS will adapt aligned to tidal flows to allow greater volumes of traffic to pass through the site more efficiently. The greater the demand, the greater the benefit of using Multiphase ADS.

Multiphase ADS –
Default Mode of Operation

Modelled ADS Benefits

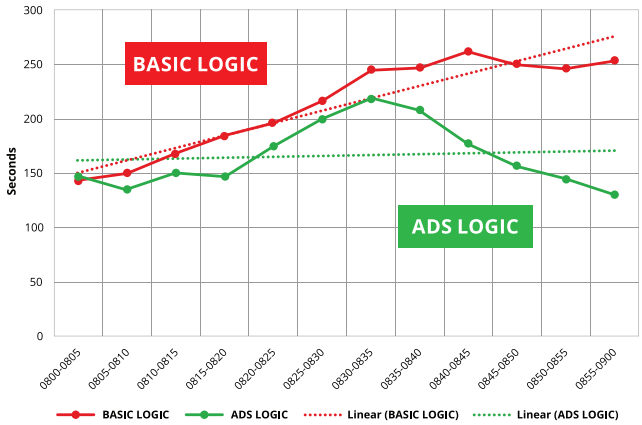
Confident in the rigorous development and testing of Multiphase ADS in reducing congestion SRL substantiated in-house findings with the help of independent consultants and industry experts at IRConsultancy/Bryan G Hall.

Bryan G Hall conducted an objective study of the system using a 'live' scenario with 3-way control, in a heavily saturated tidal flow location in Yorkshire. Over a one-hour period at the test junction with 3-way control, the impact of replacing basic logic with SRL's Multiphase ADS was:

- Reduction in queue lengths by 50%
- Reduction in maximum queue length by 29%
- Reduction in average journey time during peak flow by 40% (between 8.40am and 9.00am across all routes)
- Reduction in journey time for the route with the highest flow of traffic by 52% (North to South in the study)

Overlaid with REMOS, the partnership of these two systems provides an intelligent way of improving traffic flow. This means that when an operator is not intervening, the system is already running the most efficient timings.

Reduction in journey time using Multiphase ADS



BRYAN G HALL
CONSULTING CIVIL & TRANSPORTATION PLANNING ENGINEERS

Study conducted by IRConsultancy/Bryan G Hall is available in full on request.

Methods of Temporary Signal Control

An objective review of the various methods of control is outlined below.

Control Method	Technology Used	Limitations
Standard Portable Signals	Fixed-time or vehicle actuation	No real-time responsiveness, inefficient in changing traffic
Manual Control (NCT08b)	Human operator at site	Safety risks, limited visibility, high labour cost
UltraLight (with Multiphase ADS)	Real-time radar, adaptive algorithms	No remote intervention, requires higher spec hardware
REMOS (with Multiphase ADS)	Centralised remote ops + adaptive	Requires central setup & connectivity

Comparing the impact of REMOS Vs Manual Operative on site

To provide a robust, evidence-led case for the benefits of REMOS, SRL has undertaken a trial comparing these two methods of manual traffic control on portable signals:

1. **Manual Control (NCT08b)**
2. **REMOS (Remote Operation + Multiphase ADS)**

The objective of the study was to quantify and compare performance across metrics such as throughput, queue length, emissions, labour use, and response time. The research aimed to validate REMOS' efficiency and environmental impact claims, model labour and cost savings and demonstrate the system's unique capability in high-pressure traffic environments.

Component	Description
Site Selection	Rotating identical traffic environments through each method—Eastwood Rd, Boston - Lincolnshire
Duration	Minimum 5 consecutive days per method at each site, covering weekday patterns.
Metrics Captured	- Vehicle throughput/hour - Average queue length - On-site personnel hours - Complaints & public feedback
Measurement Tools	Radar counters (SWARCO engineered portable Variable Message Signs), camera footage (live streamed, not stored), time-motion logs, operator interviews.
Compliance	GDPR-compliant.

Note that Monday AM and Friday PM data is omitted from this paper as the site was installed and decommissioned during these times.

Comparing the impact of REMOS Vs Manual Operative on site

Eastwood Rd, Boston - Lincolnshire
Images taken from Google Maps.







Operational Capacity Assessment Through Comparative Flow Analysis

Vehicle flow measurements were conducted to determine the operational capacity achieved under two distinct traffic management methods. This data collection was essential to ensure the accuracy and reliability of the performance analysis, enabling a robust comparison between the approaches under evaluation.

Over a cumulative period of 15 hours during peak traffic conditions, the total vehicle throughput was recorded for both traffic management methods under evaluation.

- REMOS facilitated the movement of 5,320 vehicles.
- TM Operative facilitated the movement of 4,191 vehicles.

This represents a 27% increase in throughput under REMOS, highlighting its efficacy in optimising traffic flow and maximising junction efficiency.

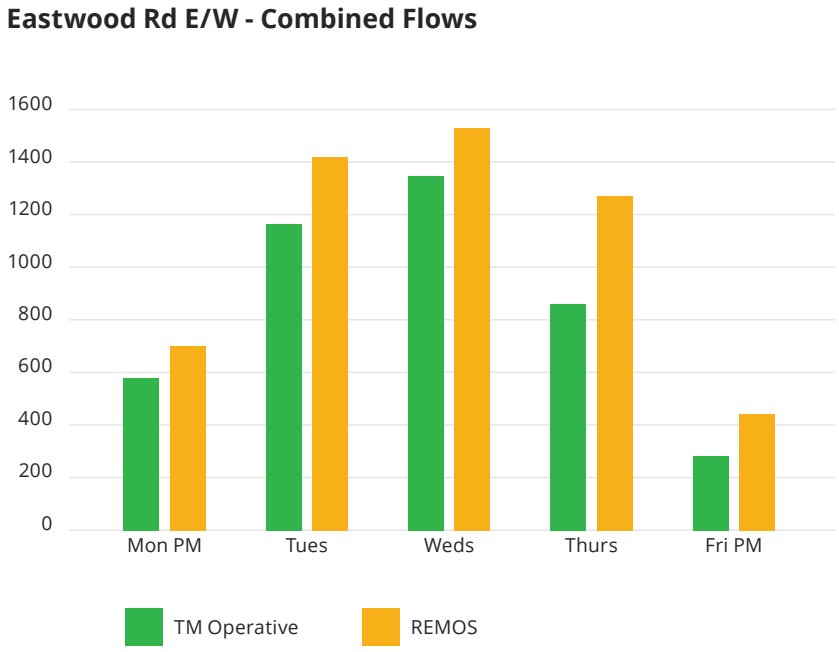


Figure 1: A graph to show the comparison between combined max vehicle flow per day, when under TM operative or REMOS control.

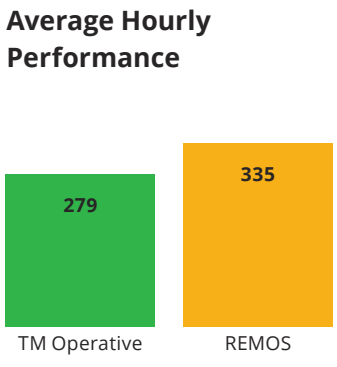


Figure 2: A graph to show comparative average hourly peak flows between TM Operative and REMOS.

Driving the Need for Balanced Traffic Management

The next objective of this evaluation was to demonstrate the effectiveness of REMOS in delivering a more balanced and efficient vehicle flow at junctions, compared to the traditional method of manual traffic control by a TM Operative.

In traffic management, achieving a balanced flow is critical for reducing congestion, improving safety, and maximising throughput.

By comparing the performance of REMOS against manual operation, this study aimed to provide quantifiable evidence of REMOS' ability to maintain optimal flow distribution, particularly during peak traffic periods.

This analysis supports informed decision-making regarding the deployment of intelligent traffic systems and highlights the potential of REMOS to enhance operational efficiency across a range of traffic scenarios.

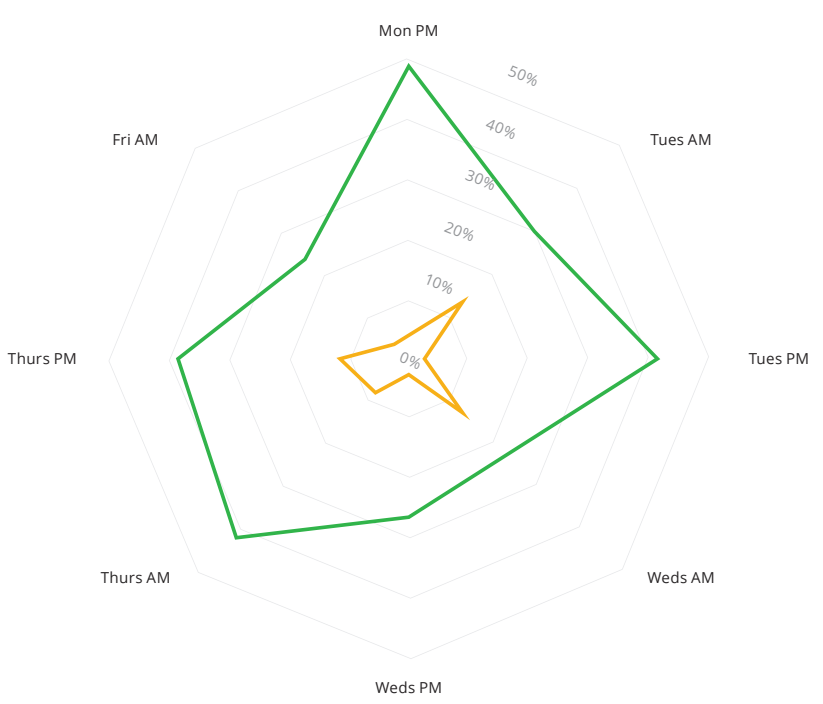
Methodology

- Vehicles counted in both directions at a two-way junction
- Optimal balance defined as 50/50 split
- Discrepancy calculated as deviation from 50%
- Lower percentage indicates better balance
- Comparison made between TM Operative and REMOS across peak periods

The graph on the next page shows the inconsistent, unbalanced flow derived from traditional TM operative control, vs the balanced flow derived from REMOS control.

Driving the Need for Balanced Traffic Management

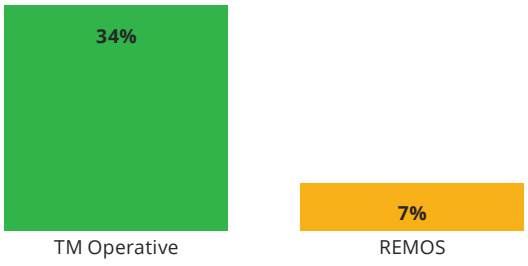
Balancing the Flow: Lower % = Better Performance



	TM Op.	REMOS
Mon PM	49%	4%
Tues AM	30%	13%
Tues PM	42%	2%
Weds AM	24%	12%
Weds PM	26%	2%
Thurs AM	42%	8%
Thurs PM	39%	11%
Fri AM	24%	4%

Figure 3: A graph to show the comparative flow balance between traditional TM control and REMOS

Average Flow Discrepancy



Findings

- REMOS consistently achieved lower discrepancy percentages.
- Indicates superior flow balance compared to TM Operative.
- Supports adoption of REMOS for improved traffic management.
- Data-driven approach enhances decision-making.

Visibility and Operational Challenges in Manual Signal Control

To contextualise the results presented above, it is important to note that the comparison was conducted at a three-way junction spanning approximately 300 meters. A side road intersected the main route 50 meters from one end, with relatively low but consistent traffic demand.

The REMOS system demonstrated a clear operational advantage in this scenario. With full visibility of all approaches, REMOS operators were able to make informed decisions, ensuring that even the less trafficked side road was serviced appropriately based on real-time demand.

In contrast, a traditional operative positioned at one end of the site faced significant visibility limitations. It was not feasible for them to observe traffic conditions 300 meters away on the opposite approach, nor could they see the signal heads located 20 meters down the side road. This lack of visibility often results in a natural bias toward the traffic closest to the operative's position, a well-documented challenge within the traffic management industry.

This type of scenario is not uncommon. In fact, it is frequently encountered across the UK's road network, where manual control is still widely used. The implications of such limitations are significant.



The Broader Impact of Flow Imbalance

To illustrate the potential scale of this issue, consider the impact of a 34% flow discrepancy (such as the one observed in this study) across the estimated 1,800 sites that require manual signal control each day in the UK. The cumulative effect on congestion, journey times, and network efficiency is substantial, reinforcing the need for more intelligent, visibility-driven solutions like REMOS.

The People & Process Behind REMOS Success

While the architecture and technology behind REMOS are fundamental to its deployment, the true success of the system is underpinned by the expertise and intervention of skilled human operators. Technology alone does not deliver results, it's the people and processes behind the system who ensure its effectiveness.

Embedding Quality Through Defined Procedures

When introducing a new technical system and operational model such as REMOS, ensuring consistency across all aspects of delivery is critical. This consistency must be embedded from the Control Room through to on-site operational teams to maintain service quality and reliability.

To support this, SRL developed a comprehensive Service Definition Document prior to the first live deployments. This document outlines clear, standardised procedures for every stage of a REMOS project, from initial order through to final deployment, ensuring all stakeholders are aligned and fully informed.

As part of this structured approach, a detailed four-page checklist is completed for each set of signals before activation. This checklist verifies that all technical checks, site surveys, and client communications have been carried out thoroughly. By embedding this level of rigour into the process, SRL ensures that every REMOS deployment meets the highest standards of operational readiness and customer satisfaction.

The People & Process Behind REMOS Success

The Human Touch

REMOS operators are far more than passive observers monitoring screens. They are actively engaged throughout the entire project lifecycle, from initial enquiry and planning stages, through to live deployment and successful delivery. Their role is both proactive and reactive, enabling them to anticipate potential issues, respond swiftly to real-time conditions, and make informed decisions that help mitigate congestion and meet client expectations.

This human oversight ensures that REMOS is not only a technological solution but also a strategically managed service that adapts to the dynamic nature of traffic environments.

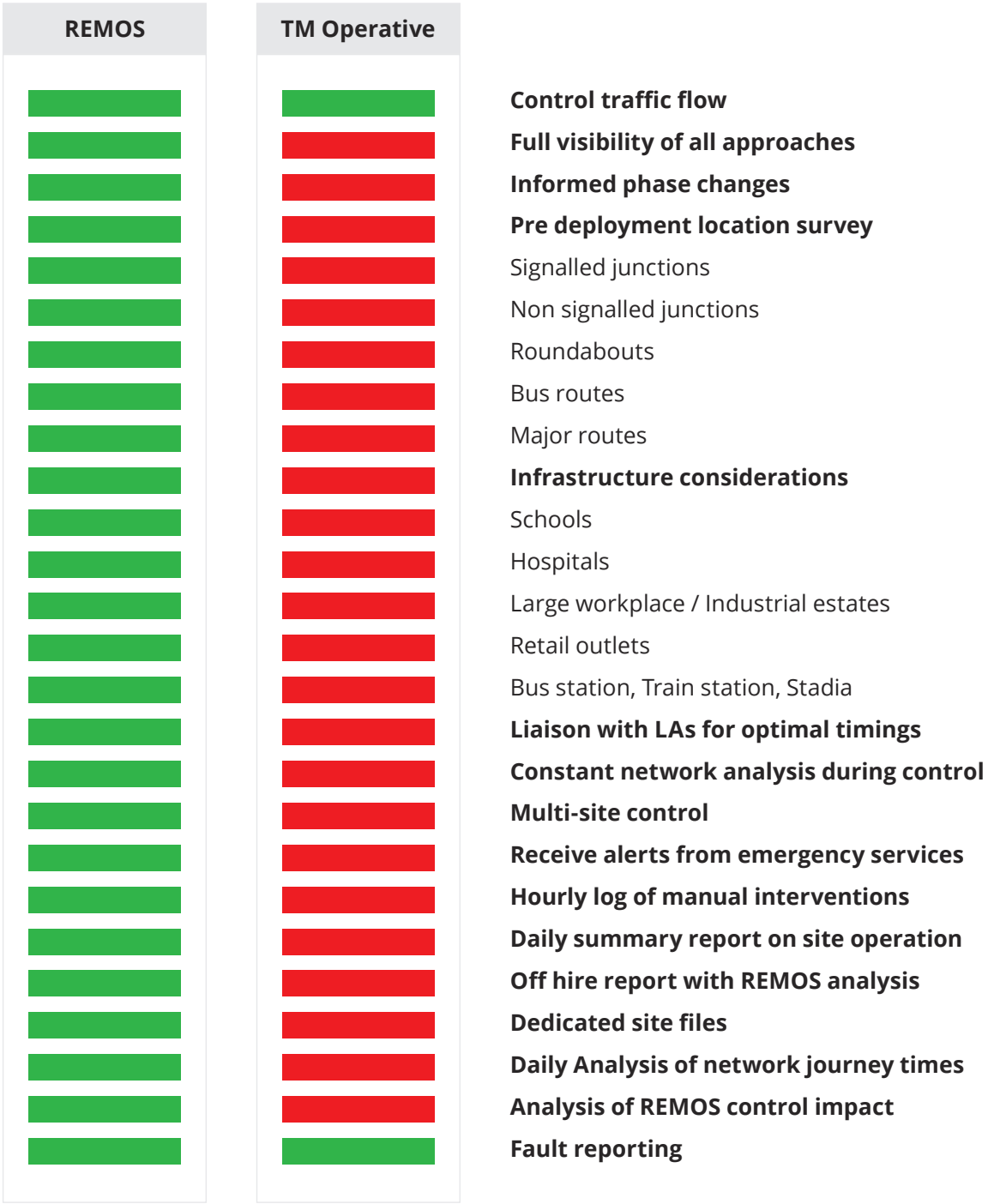
To fully appreciate the value REMOS operators bring, it is important to evaluate their role in contrast to that of a traditional operative manually controlling signals on-site.



REMOS Operator

The People & Process Behind REMOS Success

A comparison of the roles of a REMOS Operative and traditional, On-site Operative



Strategic Workforce Development for REMOS Innovation

When defining the role of the REMOS Control Room Operator, SRL adopted an open-minded approach regarding candidate qualifications and prior experience. Recognising the well-documented challenges in attracting younger talent to the traffic management industry, SRL was intentional in designing a recruitment process that would appeal to a broader and more diverse pool of applicants.

SRL also understood the importance of positioning REMOS as a forward-looking solution, representing the future of traffic management. To support this vision, the company invested in a comprehensive training programme to ensure new recruits are not only technically competent but also aligned with the strategic direction of the business.

Four core competencies were identified as essential to the REMOS Control Room Operator role.

Lantra M7 - NHSS12D M7
The Lantra 12D M7 course is designed for supervisors, managers, designers, client officers, and technicians who do not install temporary traffic management (TTM) but require a solid understanding of its principles and practices. It is a mandatory qualification for Technical Officers and Temporary Traffic Management Managers under the National Highway Sector Scheme (NHSS).

JCT Basic Introduction to Traffic Signals
The JCT Basic Introduction to Traffic Signals course is a two-day foundational programme tailored for individuals new to the traffic and transport industry. It provides a clear, accessible overview of traffic signal principles, terminology, legislation, and control strategies.

SIA CCTV Operator Training:
The SIA CCTV Operator Training course is a mandatory qualification for individuals seeking to work in public space surveillance within the UK's private security industry. Designed for entry-level participants, the course covers the legal, operational, and technical aspects of CCTV monitoring, including surveillance principles, emergency procedures, and communication protocols.

Internal SRL Training
SRL's training department plays a vital role in supporting all areas of the business while establishing a clear and structured development pathway for all new recruits.

Further Benefits of REMOS Deployment

In response to an emergency involving a structurally compromised building at a high traffic crossroads on the High Street, East Sussex County Council commissioned an immediate and effective temporary traffic control solution. The high-profile nature of the location, combined with public safety risks, meant traditional signal deployment would not be sufficient.

Local authority permit conditions mandated manual control of a four-way signal system during peak times - specifically from 07:30 to 09:30 and 16:00 to 19:00. This condition presented several operational hurdles akin to those previously highlighted.

Deploying REMOS on this site, presented benefits a-typical of those seen throughout the system's market familiarisation phase:

- **Financial** - No full-day on-site employees were required as opposed to the three normally deployed on comparable schemes. This promoted cost effectiveness, and flexibility, **reducing staff costs by an estimated 30%**.
- **Improved efficiency** - An analysis of journey times over 350m through the REMOS junction generated **favourable results in relation to comparable analysis of nearby permanent signals** on the same road. Northbound results were particularly strong:
    - **AM average** 84 seconds - **26% quicker** than at the permanent lights;
    - **PM average** 147 seconds - **26% quicker**;
    - **Off-peak average** 103 seconds – **79% quicker**.

This site demonstrates benefits, not simply in relation to temporary signal control, but also to the pre-existing permanent infrastructure.

REMOS Development

The REMOS concept was initiated in early 2024, driven by feedback from local authorities, traffic engineers, and SRL's operational insights. After a period of rigorous testing and market familiarisation, the system was officially released to market in Summer 2025.

REMOS has been successfully deployed across a range of high-pressure and strategically critical sites. These include:

- The **NEC Birmingham**, supporting complex event traffic management scenarios.
- **Transport for Greater Manchester**, including live junctions in Wigan and Bolton, showcasing the system's ability to adapt to diverse urban traffic conditions.
- At **HS2** project sites, REMOS has proven to be an essential tool for coordinating large-scale infrastructure projects while minimising disruption to the public. Its effectiveness in meeting client requirements and providing comprehensive journey time data has led to repeat orders and a strong ongoing partnership.
- **East Sussex** – a highly congested site located on a key arterial route, where persistent issues such as road worker abuse provided an opportunity for REMOS to showcase its strengths. The system was well-received by both contractors and the local authority for its positive impact in the region
- **Southwest** – Local authorities, utility companies, and traffic management operators are collaborating effectively to deliver multiple projects across the region. This joint effort has led to significant success and uncovered tangible commercial benefits across all areas of the work.
- **UK Utilities** – Following presentations and promotional efforts to various HAUC groups at both national and regional levels, the response has been overwhelmingly positive. Stakeholders have expressed strong interest in the future adoption of REMOS, recognising its potential benefits.

As REMOS continues to evolve, SRL's ambition is to lead the industry in intelligent and collaborative temporary traffic management. The system continues to transform site safety and signal efficiency, but its roadmap promises even more powerful capabilities built on real-world learning, AI integration, and stronger stakeholder engagement.

Conclusion

SRL's REMOS system offers a scalable and safe alternative to traditional traffic control methods. With measurable benefits across operational efficiency, safety, and environmental sustainability, REMOS is shaping the future of temporary traffic management.