

Conceptualising the next generation of Intelligent Traffic Signage

Stewart Scotland Hill TWM Traffic Control Systems

Abstract—The concept and real-life applications of the next generation of TSRGD LED signage in the UK. Specifically, how this new Mini Matrix™ sign system is being deployed on the Tay Road Bridge (Dundee, Scotland) to enable adaptive speed control, with real time speed detection, monitoring and logging, while supporting the first resurfacing works of the bridge since its opening in 1966.

Index Terms— Mini Matrix™, LED Signage, Tay Road Bridge.

I. INTRODUCTION

THE TAY ROAD BRIDGE IS 2250M IN LENGTH AND SPANS THE ESTUARY OF THE RIVER TAY BETWEEN DUNDEE AND NEWPORT-ON-TAY, IN FIFE. THE BRIDGE WAS DESIGNED BY WILLIAM A FAIRHURST, AND TOOK THREE YEARS TO BUILD BETWEEN 1963 AND 1966. THE ROADWAY COMPRISES OF DUAL CARRIAGEWAYS 6.7M WIDE WITH A 3M WIDE CENTRAL WALKWAY/CYCLEWAY. IN MAY 2023 THE BRIDGE WILL BE RESURFACED FOR THE FIRST TIME IN ITS HISTORY. THE BRIDGE CONSISTS OF A NUMBER OF AGING VMS SIGNS PROVIDED BY TECHSPAN SYSTEMS AND VMSL. A NUMBER OF THESE SIGNS ARE NOW AT THE END OF THEIR DESIGN LIFE. THIS PRESENTED AN OPPORTUNITY TO DEPLOY A NEW CONCEPT IN SIGNAGE: THE MINI MATRIX™

II. DESIGN PHILOSOPHY

To understand the concept of the design we must first understand a real-life scenario. As with most bridges and roads, the Tay Road Bridge must modify the speed of the road due to adverse weather conditions. In this example there are existing matrix signs on the entrance to the bridge, with smaller fixed repeater plate signs along the carriageway. When an adverse weather event occurs, maintenance personnel change the speed limit on the existing matrix signs. However as described, this action has limited effectiveness as the speed limit repeaters are along the length of the bridge only show the unrestricted speed limit, leading to a confusing message being delivered to the road user. This is typically where an AMI (Advanced Motorway Indicator) would be used, and indeed this is the philosophy that the Forth Road Bridge utilised, using VMS AMI's. The AMI provides a TSRGD compliant front face, but due to the restrictions of the National Highways/Highways England specifications, does not currently support a full matrix front, instead insisting on a dedicated red ring segment in a similar way to the way that Vehicle Activated Signs (VAS), typically consisting of a

number of fixed LED aspects, that display separately. Thus, was born the concept of the Mini Matrix™, a TSRGD compliant Full Matrix “Urban AMI” that is capable of detecting a vehicle, monitoring the speed of the vehicle and logging the speed, while providing the transport control room the option to reduce the speed displayed on the sign via fully flexible cloud based back-office control system based on the latest IOT (Internet of Things) technologies and architectures. This state-of-the-art cybersecure Backoffice is designed with simplicity in mind while offering powerful access to select and display TSRGD compliant pictograms for speeds up to 70mph using the mobile telecoms network as a communications backbone. Other considerations have been given to communications such as Wifi® and Wired Ethernet connections, that the Mini Matrix™ natively supports. However, the practical implications of rewiring the full bridge for communications was deemed to be out of the scope of the project.

The existing aging VMS and Techspan signs are to be adapted to the latest communications technology and adopted into the Backoffice. Ensuring that the whole bridge signage infrastructure is operating within the same control environment.

The open architecture of the Backoffice system ensures that all signs, from all manufacturers can be communicated with and controlled. Equally, this open architecture allows for the integration of all sensor types, from weather, to CCTV, induction loops, to ANPR, to speed enforcement and barrier controls. Equally the signs controller have an open architecture which allows them communicate with existing control infrastructure such as UTMCS, NMCS, NMCS2, NTCPIP and variants therein, over a variety of communications media.

III. RESURFACING THE TAY ROAD BRIDGE

Starting in 2023 with a contraflow, one dual carriageway will be closed for approximately 6 months to allow resurfacing works.

During the winter months 2023-24 both carriageways will be opened to traffic. Then in 2024 the alternate dual carriageway will be resurfaced for approximately 6 months, with a contraflow running on the other dual carriageway. It is hoped both carriageways will be reopened fully in late 2024 having completed the resurfacing works on both North and

Southbound carriageways.

During the resurfacing periods in 2023 and 2024 the bridge will be subject to all that the Scottish weather can throw at it. For example, there will be the requirement to reduce road speed in the contraflow, but additionally to provide the road users with information on wind, accidents, breakdowns, the contraflow itself, or other relevant and pertinent information. Once the resurfacing work is completed the regular road bridge activities will be resumed, and any system should be flexible enough to support the changeover between modes.

IV. THE SYSTEM

As the Tay Road Bridge has a central walkway and combined with available power points allowed the Mini Matrix™ to be positioned in the central walkway facing the oncoming vehicles in the carriageway.

Due to the compact size and weight of the Mini Matrix™ it allows the signs to be positioned without the requirement for heavy lifting machinery as would be the case with traditional signage.

This ease of positioning and movement allows the Mini Matrix signs to be positioned and then repositioned as required during the contraflow works.

Phased inline with the civil engineering works the Mini Matrix™ signs will be positioned as shown in Fig 1. Showing the Northbound closure while Fig 2. Demonstrates the Southbound closure.

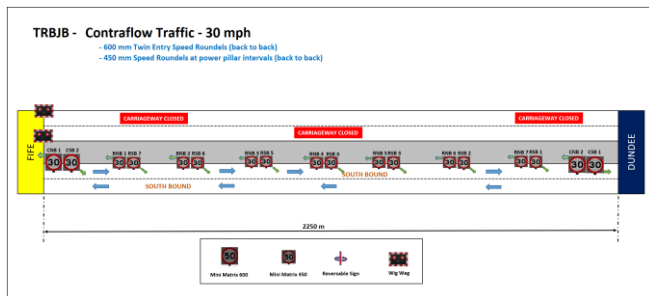
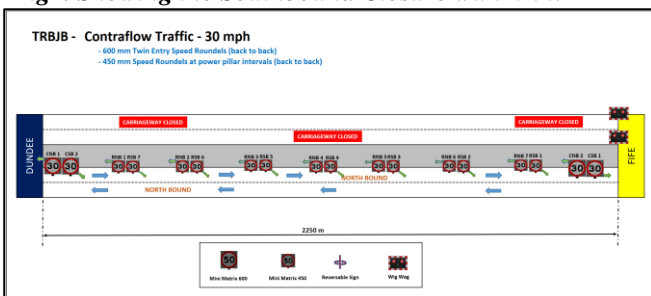


Fig1. Showing the Northbound Closure with Mini Matrix™ positioned on the central walkway facing traffic in the contraflow.

Fig2. Showing the Southbound Closure with Mini



Matrix™ positioned on the central walkway facing traffic in the contraflow.

Thanks to the light weight and easy of fitment, the Mini Matrix™ signs are mounted on a rotatable post which allows the Mini Matrix™ to be mounted back-to-back. This approach ensures that Northbound and Southbound traffic can be provided information, while traffic conditions can be monitored. During the winter months between the resurfacing works on each carriageway, when the bridge is returned to normal operations, the Mini Matrix™ signs are repositioned from the safety of the central walkway to cover both Northbound and Southbound as shown in Fig 3.

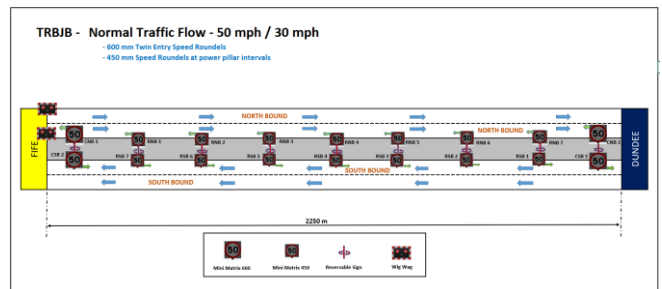


Fig3. Normal Operations, with both carriageways open and Mini Matrix™ facing both carriageways.

During these periods, of contraflow and normal operations, the Mini Matrix™ System can be used to monitor road traffic speed. Critically the system can advise on infringements of the displayed road speed, during the resurfacing works and contraflow, which will allow the Tay Road Bridge Joint Board and Management team to make decisions on any requirement for speed enforcement.

These Smart Assets allow for data collection on a number of key metrics for any road operator in the urban setting, as well as delivering a TSRGD compliant message in real time. This provides decision makers with real, live information, and the power to make real-time effective changes to traffic flow, to influence positively driver behaviour, to increase road safety, and to reduce transport related pollution while increasing the user experience of travelling on the roads around the UK and specifically on the Tay Road Bridge.