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September 2018

The “Cambridge Method”

Shuttle Working and VMS with Overheight Detection

The historic City of Ely was once an island, but is now bordered to the south by a railway line and river. The main route into Ely from the South and East, the A142, crosses both. A level crossing carries large vehicles over the railway line, while a bridge allows smaller vehicles to pass under without waiting.

Large vehicles using the crossing frequently block the main road, adding delay and congestion for all road users. As a result, the ‘Ely Southern Bypass’ is being built to relieve congestion where the road, rail and river meet.

The bypass is west of the current crossing, leaving only local traffic using the existing road.

The railbridge over the road, allowing the A142 to pass under it, is one of the lowest in the country, at just 2.7m clearance, and is frequently struck.

Once the new bypass is open, the level crossing (on the right of the photo) is to be closed to both vehicles and pedestrians. Instead, an improved footway and cycleway is to be built passing under the bridge.

Green Signals Consulting were engaged by Skanska to undertake the design of shuttle-working signals and an improved overheight vehicle warning system, to allow construction of the wide footway.

Bridge strikes are already a frequent problem at the bridge, due to the unusually low height. This is despite the high visibility of the bridge.

And the existing Variable Message Signs, triggered by Overheight Vehicle Detectors, do not seem to make much difference.

This may be due to the short distances from the OVD to the VMS, or from the signs to the bridge, which allow little reaction time.

The existing VMS are small and not highly visible, even when they are lit. They are also text-only.

Having looked at the existing equipment and problems, we concluded that there were several problems with the existing layout, which we needed to address to be successful.

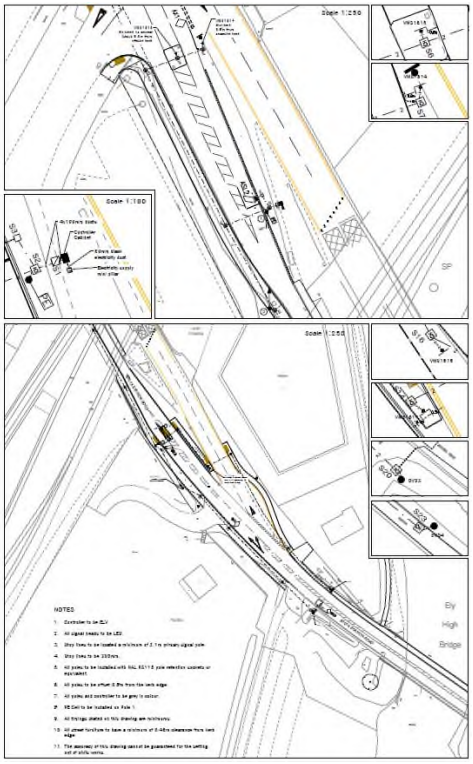
- Short journey times between OVD and VMS do not give drivers time to react.
- There is not enough time to read the message once it is shown.
- The VMS are of no use to drivers who cannot read English
- There is not enough stopping distance from the VMS to the bridge.

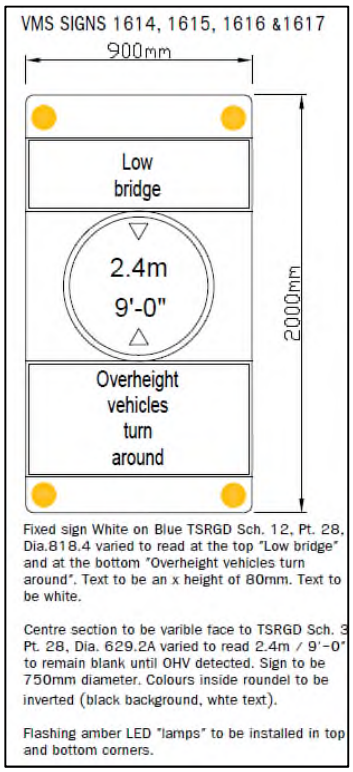
Our solution was to redesign the location of equipment and to change the sign faces. The new VMS are now located as 'Gateways' at the entrances to the cutting. The overheight vehicle detection is mounted much further back, giving a much greater distance from OVD to VMS.

The VMS themselves are larger, including fixed text at the top and bottom, with a variable symbol that can be shown in the centre and amber flashing lamps above and below the text. The unusual sign face did generate much debate!

The OVD southbound is now placed on a nearby Toucan Crossing, which is being refurbished as part of the scheme.

For northbound vehicles, standalone poles are being used.





The detectors will now trigger approximately 5 seconds journey time away from the signs, giving drivers time to read and react to the sign. The crossing, OVD and signs will all be linked back to the shuttle working signals for monitoring.

Why the "Cambridge Method" of Shuttle Working?

Cambridgeshire County Council only had two shuttle working sites for many years, both originally Siemens T400 controllers, using an unusual configuration. These sites had been in use for VA shuttle working for more than 20 years, but recently more shuttle working sites have started to be built in the area and the configuration ideas have been introduced on sites in Norfolk.

With more sites, including Ely, being planned and built, the method is being 'rediscovered' and shared.

The site is configured with two real phases, A and B, and also two extendable 'clearance' phases, C and D. There is also an additional dummy phase for a revertive all red, E.

There is one phase per stage and each real-traffic stage is always followed by an associated all red clearance stage (1 to 2, or 3 to 4).

Stages 2 and 4 have short intergreens back to the previous stage, but have a higher minimum intergreen to the next stage.

The dummy extendable all red phases are extended in the controller by all-red detection, when an opposing demand (real, or revertive) is present. Controller Phase Maxes are used to limit the extendable all red.

The revertive stage has a separate dummy phase and stage, with short intergreens, but can only run once the previous all-red (either stage 2 or 4) is no longer extending.

Intergreen Matrix | **Interstage Matrix** | **Banned Stage Changes**

Auto Set ☑

From \ To	1	2	3	4	5
1	-	3	(banned)	(banned)	(banned)
2	2	-	7	(banned)	2
3	(banned)	(banned)	-	3	(banned)
4	7	(banned)	2	-	2
5	2	(banned)	2	(banned)	-

Extensions of the all red stages are controlled by special conditioning, which also triggers outputs, wired to MOVA detectors. These are configured in MOVA as priority detectors, demanding and extending the all-red stages.

If in Stage 1 and there is a move away including the revertive stage, demand Phase C and activate MOVA det 6. MOVA detector 6 is to be held on until dummy phase C at green, minimum timer has expired, extension expired or the maximum timer has been reached.
If in Stage 3 and there is a move away including the revertive stage, demand Phase D and activate MOVA det 7. MOVA detector 7 is to be held on until dummy phase D at green, minimum timer has expired, extension expired or the maximum timer has been reached.

Revert to all red (Stage 5).
Output to MOVA Det 8/Phase E to force revert to Stage 5 in the absence of any demands/extensions. Facility to be switchable. Default On.
Output 8 is to be kept on and only drop on receipt of a vehicle demand on any of the loops

Although MOVA extends the stages using force bits, the extendable all-red stages cannot be skipped or shortened and are only really controlled by the controller. Allowing MOVA to send force bits simply avoids triggering long interstage faults.

Emergency/Priority: Links | **Emergency/Priority: Stages**

Link	3	4	5
Use Bus Weighting?	☐	☐	☐
EP1: Has Detector?	☑	☑	☑
EP1: Detector ID [EPDET1]	6	7	8
EP1: Extension [EPEXT1] (s)	1	1	1
EP2: Has Detector?	☐	☐	☐
EP2: Detector ID [EPDET2]			
EP2: Extension [EPEXT2] (s)			
Hold Time [HOLDTM] (s)	1	1	1
Cancel Detector Type	None	None	None
Cancel Detector ID [CANDET]			

This method of operation allows very rapid ripple back to the previous stage from the revertive. It will not ever repeat or skip stages while opposed and avoids delays when reverting, giving better end-of-stage changes. It also enables the use of MOVA on sites with long, extendable intergreens.

Acknowledgements

With thanks to Cambridgeshire County Council and Skanska. Photos by Author, Google and Cambridge Evening News.

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