Jacksons Edge Road: Shuttle Innovations

Jacksons Edge Road in Disley, Cheshire East is a quiet, picturesque small village.

At one end of the village the road goes into a wooded area, through a set of narrow, downhill turns, known locally as 'risky bends'. With no footway, pedestrian access along this section of road was poor, visibility was very limited and if two way traffic met each other on the bends, passing was difficult.

Cheshire East Council, through its Cheshire East Highways partnership with Ringway Jacobs identified a need to implement a new footway along this section of road to improve pedestrian access. In turn, this would make the carriageway width narrower, preventing two way traffic passing each other. Consequently, a need for shuttle working traffic signals to control this section of road was identified. Ringway Jacobs turned to Dynniq to design and implement the signals installation.
The site presented a number of specific difficulties in the signal design:

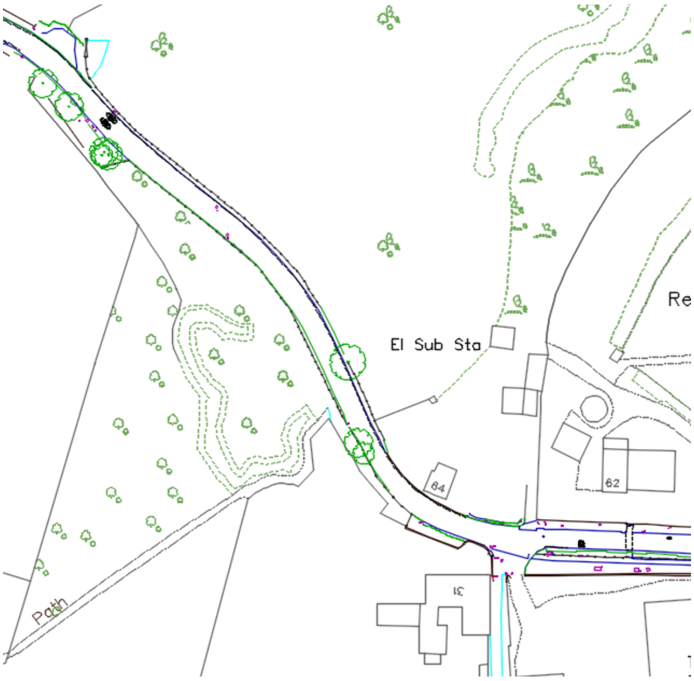

Figure 1 General site layout

- There would be no visibility of waiting vehicles from one end of the shuttle working to the other. Waiting vehicles may 'feel' they were having to wait unnecessarily long and could be tempted to jump red signals.
- Popular cycle route and with a steep uphill approach. Cyclists could be anticipated to be particularly slow at clearing the shuttle working.
- Private accesses in area of shuttle working. One of these accesses serviced the entrance to a sports centre car park and there was no control over how the sports centre used their one-way system. In theory, this entrance could be turned into a popular car park exit, discharging vehicles into the shuttle working area.
- The village is picturesque with a number of 'country cottages' in the vicinity of the signals. The local population was known to be quite 'vocal' and the signals would need to be as appropriate and as in-keeping with the surrounding area as possible.

To address the specific difficulties, a number of innovations were developed and made part of the design. All of the innovations were low cost to both develop and implement and the ethos behind all of them was to tailor the design to fit the needs of the site and users, rather than applying a 'generic' shuttle working design.

The innovations included solutions for:

Signals Reactiveness

To help make the signal timings appear as appropriate as possible to drivers, waiting times would need to be kept as short as possible. Traffic flows at the site can be particularly low, especially in the off peak periods, in the region of one vehicle every 1-2 minutes. There was no clear dominant direction of flow.

Common to many shuttle workings and to ensure vehicles can safely clear the conflict area, All-Red detection and the controller's extend all-red facility was utilised. However, with the potential for very slow moving cyclists on the uphill approach, the maximum clearance time was required to be very long (approximately 25s). There were concerns that if an all-red detector were to fail, the site would default to maximum clearance times, which would then appear, and be, inappropriate to the majority of users.

To counter this, the conflict area was split into a number of zones. Each zone was fully covered by two different above ground radar detectors, mounted on two different poles. Should any one of those detectors fail, the operation would continue as normal, using the second detector for the zone. With the detectors being both cost effective and mounted above ground, a simple and speedy maintenance fix could be anticipated with no road space needing to be closed. Should both detectors covering a zone fail, the all-red clearance would then extend to maximum.

This operation was intended to be totally invisible to the user, in both normal and fault conditions, ensuring clearance times were as short as possible, but as long as necessary.

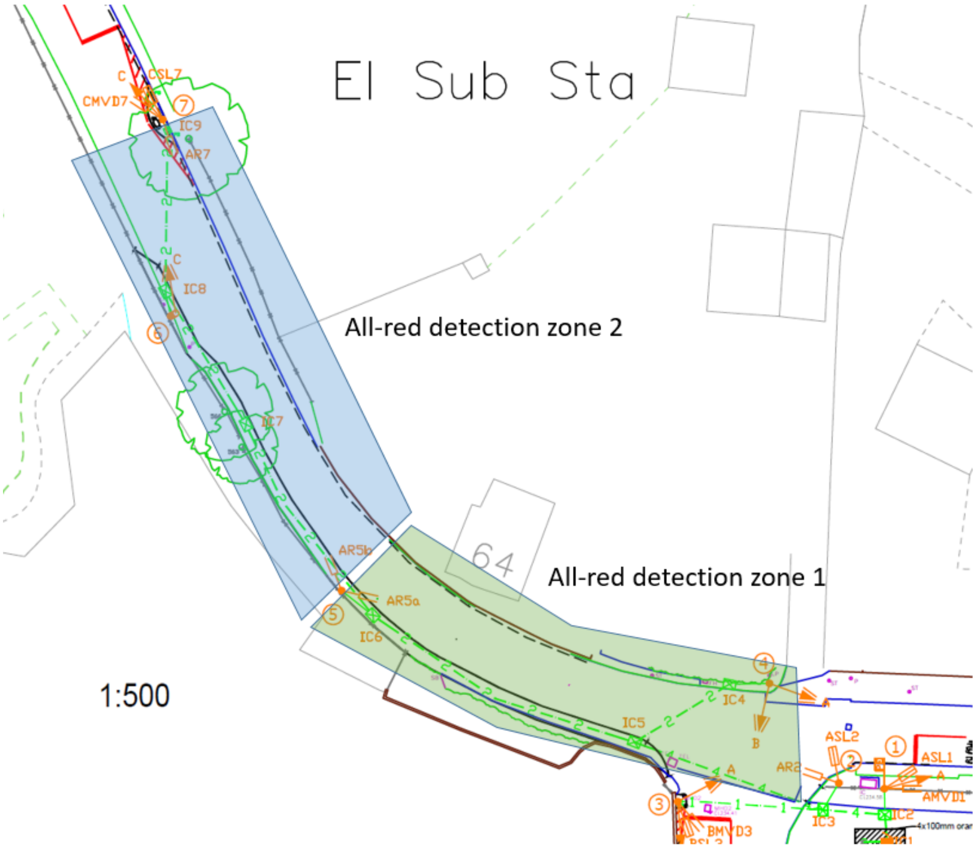

Figure 2 All-red detection zones

With very light traffic flows and no clear dominant movement, ensuring an appropriate stage sequence that was conducive to minimising waiting times was required. To assist this, in the absence of conflicting demands it was thought beneficial to revert to all-red just as soon as vehicles had cleared the stop line and the minimum green expired. But this stage revert also had to work well with the 'extend all-red facility', ensuring that if the next vehicle demand was conflicting with the last vehicle entering the shuttle, the extend all-red facility worked normally. But if the next vehicle came from the same direction as the first, the extend all-red was not to operate as the vehicles would follow nose-to-tail as normal traffic.

To assist this, a slightly unusual stage sequence was used, with two different all-red stages that could both operate as a revertive stage. The operation was:

- At times of continuous, cyclic demands, the site would cycle 2-3-5-2-3-5 and the extend all-red facility would work normally.
- Under revertive conditions, the site would always 'hop backwards' to the revertive all-red stage. So if the site was in stages 2 or 3, it would always revert to stage 1. If it was in stage 5 it would always revert to stage 4. No extend all-red facility would operate on this stage change.
    - The site was then ready to respond immediately to the next demand.
    - If the site was in stage 1 and the next demand was for stages 2 or 3 the site would change immediately to that stage and the extend all-red facility would not operate – There could be no conflicting movements requiring the all-red extension.
    - If the site was in stage 1 and the next demand was for stage 5 the site would commit to the interstage and then use the extend all-red facility to extend the intergreen appropriately.
    - The same logic follows for movements from stage 4.

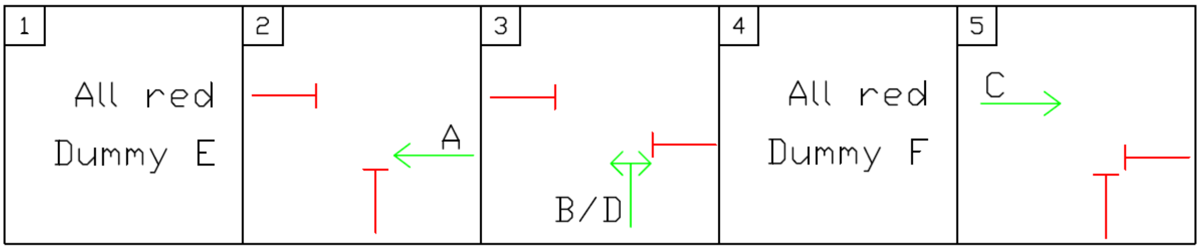

Figure 3 Stage sequence

This stage sequence led to a controller configuration that needed a minimum of special conditioning to provide what proved on site to be very effective operation.

Waiting times at the site are typically very short, and with vehicle demands coming from radar detectors covering the approaching 40-50m before the signals, the signals are often at green just before the vehicle reaches the stop line.

Cycle Facilities

To allow potentially very slow, uphill cyclists safe passage through the shuttle workings, two particular steps were taken:

The extend all-red facility was specifically designed and commissioned to allow sufficient clearance times and reliable detection for what was considered to be a 'reasonably slow' uphill cyclist. This was tested repeatedly during the site's commissioning, by the simple test of repeatedly cycling slowly up the hill (without conflicting demand, just in case of problems in the operation).

To further protect very slow cyclists, the design team at Cheshire East Highways used white lining to encourage all drivers to keep to one side of the road, leaving a clear area that could be used by uphill cyclists, removing them from likely conflict with on-coming vehicles should the all-red maximum clearance time be exceeded.

Figure 4 Uphill white lining

Downhill cyclists were not anticipated to present a problem to the signal operation. They would typically be anticipated to be moving at speeds similar to powered vehicles, due to the steepness of the hill.

Private Accesses

Two private accesses entered the shuttle working, in the area of the conflict zone and after the main signals and stop line.

The first of these was a driveway serving a single property. Visibility from this drive to the eastern end of the signals was good, but completely obstructed towards the west. It was decided to not signalise this access, but to provide above ground detection to ensure they had safe access (calling green on phase A, westbound traffic, of which the secondary signal head was visible from the driveway).

The second access proved more difficult. It served more properties, was busier, had no visibility of the other signal heads and the adjacent car park entrance could easily be reversed as an exit in the future, or have vehicles leaving the car park there, against 'no exit' signage. Therefore it was felt this access had to be signalised.

The challenge was then to make the additional signalisation appear appropriate to the surroundings, and not an overkill of signal heads.

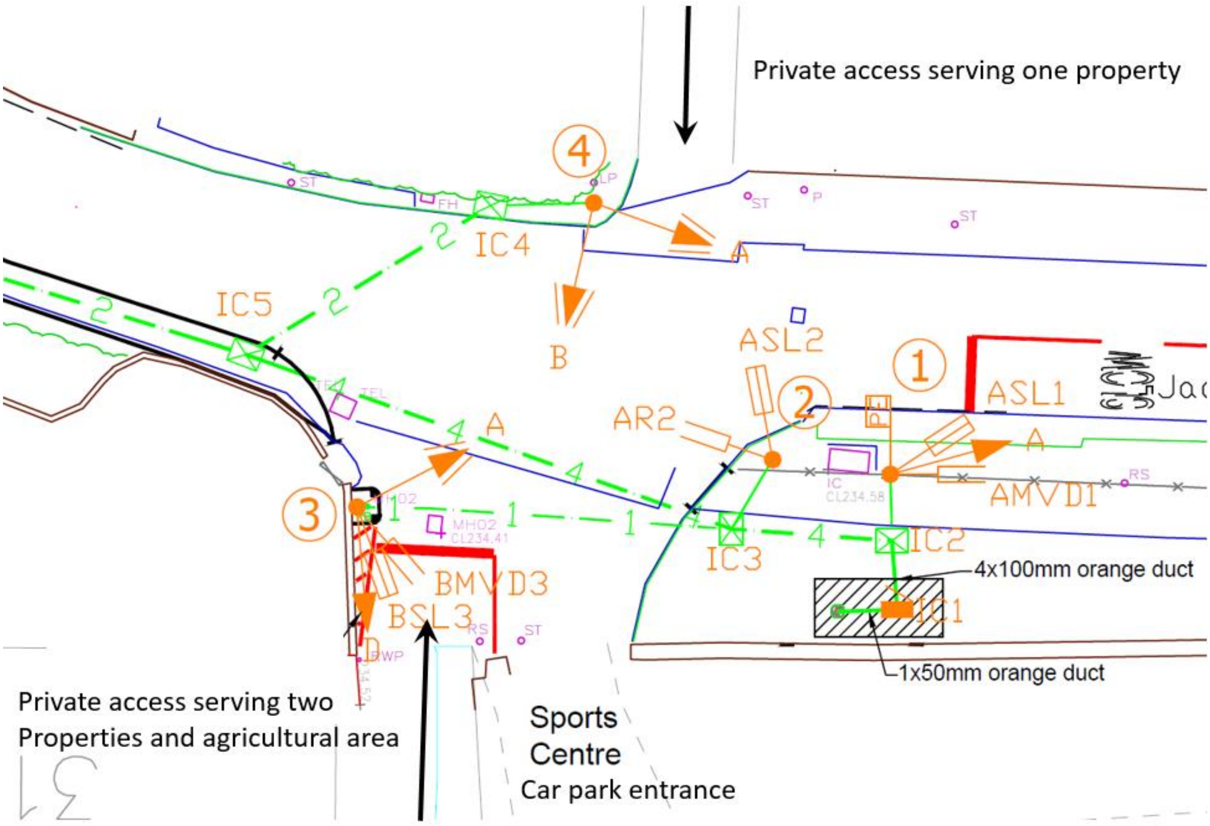

Figure 5 Private access arrangement

Signals 'Appropriateness'

To make the signals appear as appropriate to the surroundings as possible and in keeping with the picturesque setting the minimum amount of signals equipment as possible was used. Signal equipment was black and the good reactiveness of the signals means that queues don't normally form.

However, the decision to signalise the one private access presented one particular challenge: The position and height of a conventional primary signal head, which would normally be on red, would shine almost directly into the adjacent cottage window.

Figure 6 Private access primary head position

Whilst the use of tunnel hoods or similar would probably have solved the light pollution problem, they would have made the signals appear larger and more out-of-keeping with the area.

So there was a desire to solve the light pollution and for the signals to become smaller in size. The solution was the use of a modified low level cycle signal head, using a full roundel instead of a cycle aspect. Whilst not a prescribed sign in the TSRGD, in agreement with the highway authority, as the use of this small head was signalising a private access, was backed up with a conventional secondary head and solved a specifically identified problem, it was thought the most appropriate solution.

Figure 7 Low level, private access primary signal head

Conclusions

Through the use of intelligent design, the new Jacksons Edge Road shuttle signals and their operation have been tailored closely to the needs of the users and setting.

Whilst individually no one aspect of the design is revolutionary, together the small innovations have taken what could have been an 'ordinary' signal design and finessed it into something far more appropriate to the site.

Potential issues were identified during the design phase and solutions implemented in design and on site, so that when switched on, the signals appeared unobtrusive, almost invisible in their operation as they cycle rapidly, minimise delays and waiting times, remove conflicts and don't add an unnecessary eye-sore to a picturesque area.

The innovations have cost very little to design and install and those costs are believed to be greatly outweighed by the site's layout, performance, lack of delay and lack of public complaints.

Cheshire East Council Highways

RINGWAY JACOBS integrated expertise

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