Removing traffic engineering control – the awkward truth?

Keith Firth

This paper analyses the results from the Cabstand junction in Portishead, near Bristol, which failed for a few hours in June 2009 and has since been the site of a grround-breaking experiment to remove all junction controls. The Cabstand trial, still ongoing over a year later, has been followed by a further two trials in Bristol and the results from these trials are analysed. Although it is acknowledged that further research is needed nevertheless the trials demonstrated that despite their differences the junctions generally performed better without traffic signal or any formal control.

TRIALS AND TRIBULATIONS

Some years ago, Ben Hamilton-Baillie, a UK expert in the ideas of 'shared space' and simplified streetscape design, published an obituary to lowly traffic engineers, who were to be put out to pasture (literally, as landscape gardeners) by 2010 following the enlightened discovery that traffic engineering was no longer required, because road users could quite happily optimise the use of road space and behave perfectly adequately without any need for the modern traffic management paraphernalia; just simple, aesthetic urban design. This was followed by an equally assaulting polemic from Martin Cassini, a TV producer and campaigner for traffic system reform, who asserted that our need for establishing priority was completely misplaced, and called for the removal of traffic signals and all forms of junction control.

At about this time, the scheme in Ashford, Kent, was being completed and certainly seemed to demonstrate that these ideas of shared space (that had been developed in Netherlands, Sweden and Germany, for example see TEC Sep 2006)) could work in the UK. But it was going to take a great deal of effort to convince traffic engineers and traffic managers that the absence of formal control at busy junctions might provide the best form of control. The only way would be through monitored trials at numerous sites to gather enough data and evidence to test the Buchanan/Cassini hypothesis that:

At given junctions within a given road network, the removal (or absence) of automatic traffic signal control and standard priority rules will have economic, social and environmental benefits, will improve road safety, vulnerable road-user amenity and traffic management functions.

CONTACT DETAILS
Keith Firthis Director - Traffic Engineering with Colin Buchanan. He can be contacted on +44 (0) 117 917 0800 or by email at Keith.Firth@cbuchanan.co.uk

Advance warning at the Cabstand junction in Portishead, near Bristol.

Although the idea of such trials was generally welcomed by highway authorities we approached, and each would be very interested in any results gleaned, no authority was willing to undertake the risk. Until, that is, a particularly unpopular set of MOVA controlled signals at the Cabstand staggered crossroad junction in Portishead, near Bristol, failed for a few hours in June 2009. The resulting disappearance of queues and delays spurred the local press to run a front page story on how well the junction seemed to perform without controls. After contacting the local councillor, David Pasley, and further discussions with North Somerset Council (NSC) engineers (Frank Cox and Ian Wilson), it was decided that this would be an ideal site for the first of these potentially risky, but truly groundbreaking experiments.

NSC, with Colin Buchanan and Martin Cassini (CB/MC), worked on the trial and monitoring methodology, advised stakeholders and emergency services, carried out a safety audit and risk assessment of the proposed experiment and devised an advance warning signing strategy. The trial date was set for September 2009 and would run for up to four weeks, depending on the outcome at the end of the first day. Monitoring of typical, controlled behaviour at the junction started a week before the big switch-off.

Within hours of hooding the signals, things were looking bleak for the traffic engineering fraternity. Up to 2000 vehicles per hour sailed through the junction with little, if any, delay and queues disappeared on all the approaches. Drivers were courteous to each other, a good proportion slowed to allow pedestrians to cross, and road users interviewed a few days before the trial who had said it would be chaos, now reported that they were prepared to have a three-course millinery delight.

The signals at Cabstand have now been out of action for over a year. There have been just two reported slight (driver/passenger) injury accidents following minor collisions, as well as two damage-only incidents that we know of, one of which occurred (most unfortunately) when the BBC were filming at the roadside for a report on the upcoming Bristol Trials. Zebra crossings have been installed at two crossing points to provide formal crossing facilities on a key desire line, but other than that the trial demonstrated that removing all forms of conventional junction control resulted in less traffic congestion, fewer delays and queues, and greater capacity, with little impact on pedestrian amenity. There are now plans to re-think the design of the space entirely to facilitate a more simplified streetscape.

This led to a campaign by the local press to switch off traffic signals across Bristol. With the immediate backing from the Executive Member for Transport at the time, Lib Dem Councillor Dr Jon Rogers, Bristol City Council (BCC) engineers (Terry Bullock, John Laite and Adam Crowther) were confronted with the task of identifying suitable trial sites. From a list of nine potential sites, two were chosen that were considered not to be too risky, but at the same time would give a good indication of behaviour and junction performance. These were Union Street/ Broadmead/ Nelson Street and Broad Quay/ Marsh Street, both in the centre of the City. These were junctions that did not experience significant congestion problems, and so it would be interesting to see if lack of control could perform better than typical, good quality vehicle and pedestrian actuation systems.

BCC and CB/MC organised stakeholder and road-user group consultation events, developed the trial and monitoring methodology (to include a road-user satisfaction survey) and a slightly different signing strategy to that used at Cabstand. BCC were keen not to provide guidance on behaviour, but were interested in how road users responded to simple warning signs. The trials were held in March 2010, with monitoring occurring a week before and a week after switch-off at each site. Unlike Cabstand, it was decided that the signals would be switched back on at the end of the trial period regardless of results, with any decisions on the implications being deferred until after CB submitted the monitoring reports.

Once again, we found ourselves writing a report that concluded that the disabling of all junction controls resulted in improvements to traffic capacity and reductions in journey time for both vehicles and pedestrian alike, and hence a reduction in queues and delays. The road-user satisfaction surveys showed, however, that a high proportion of pedestrians did not feel as safe without control and would prefer green man crossing facilities, even though most acknowledged there was less delay. Indeed, the idea of the lack of any formal control was particularly opposed by local visually impaired groups and some disabled pedestrians. Nevertheless, during the weeks of the trials there were no incidents or accidents.

The success of the trial in showing journey time benefits prompted BCC officers to recommend that the Executive progress with the evaluation of additional sites across Bristol.

TRIAL BY JURY

The trials clearly had to be developed with public safety at the forefront of any strategy and methodology. Under normal conditions of signal failure, Traffic Signs Manual/ legislation requires posting of 'lights out' signing, which is sufficient to advise motorists of the lack of control and the need to proceed with caution. The trials, however, would need far greater consideration to the risk of accidents and litigation and the avoidance of any confusion by users of the junctions.

There was undoubtedly a risk of accidents, yet without any precedent upon which to base the experiment there was no way of evaluating the risk other than engineering judgement. In any case, this risk had been accepted by the respective Executive Members of the councils when the bold decision was made to proceed with the trials. Litigation against councils for embarking on experiments of this nature, or indeed for unconventional or even conventional traffic engineering and management solutions is rarely, if at all, successful. It was evident that with appropriate planning and advance warning of the trials, there was no risk of successful litigation in the event of an accident or incident.

The trial methodology developed by CB and the respective councils was scrutinised under standard Equality Impact Assessment (EquIA) and Stage 1 Safety Audit. In both the Cabstand and Bristol trials, slight modifications to the temporary highway arrangements were recommended by the Safety Audit, including the introduction of a 20mph zone around the Cabstand junction. Some of these proved somewhat detrimental and influenced the trial results to the extent that, at Cabstand, the measures to prevent pedestrians from using a particular crossing point were removed shortly after the trial commenced.

The signing strategy was considered fundamental to the outcomes of the trial. Signing that was too prescriptive would not provide road users with the freedom to behave in the altruistic manner that might be expected under a truly shared space environment. Ambiguous signing might, however, introduce undesirable risk. In

both cases, advance warning of the signal switch-off trials was provided on all approaches to the junctions, and media coverage ensured that a good proportion of road users were aware of the experiment in advance. At Cabstand, drivers were advised to give way to pedestrians and that there is no vehicle priority. At the Bristol sites, all users were simply advised to proceed with care.

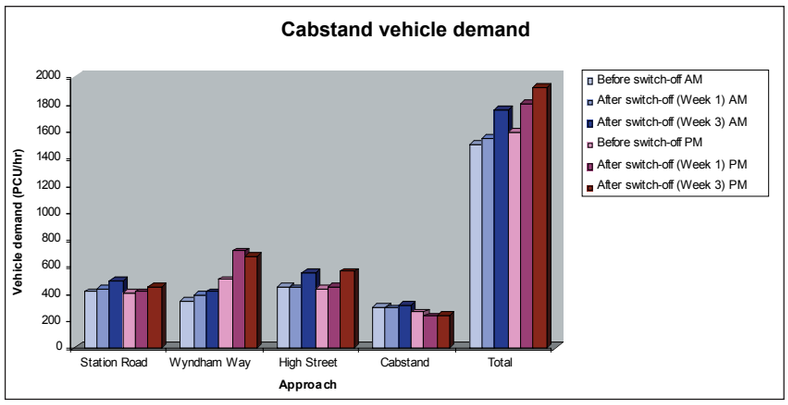
Wider public consultation on the value or methodology of the trial was not necessary, as the decision to go ahead with the experiments was made at Executive level within the councils, however it was considered important to advise a range of road-user groups of the trials and expected conditions. The greatest objections were, not surprisingly, made by vulnerable pedestrian groups, particularly those representing the blind and visually impaired. A major concern was the loss of formal crossing facilities introduced for the purposes of social inclusion, now being removed without any physical mitigation measure to replace them. The idea of inclusion through a change in social behaviour was not considered reasonable.

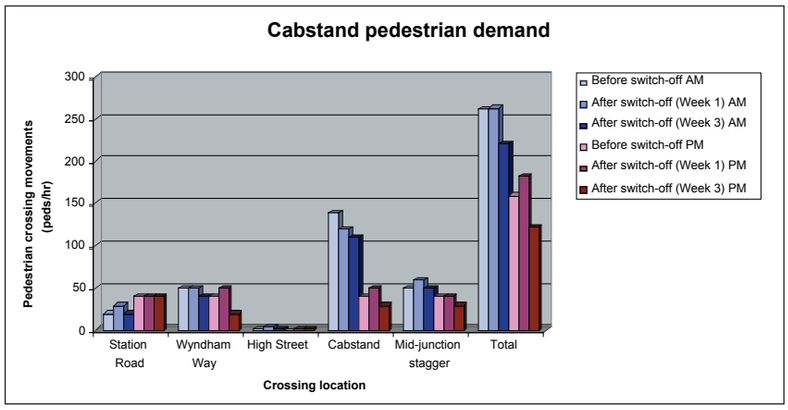
TRIAL BLAZING

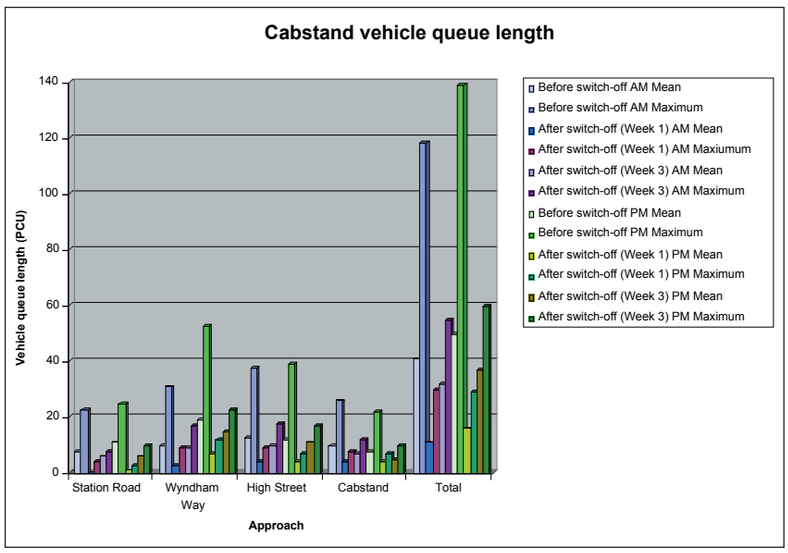
Site Cabstand, Portishead
Street (Arm) A369 Wyndham Way (2-lane dual carriageway)/ B3124 High Street (south)/ Cabstand (west)/ Station Road (north)
Signal control Full time MOVA, 6 traffic phases, 6 pedestrian/cyclist phases (including 2 staggered crossings) Peak hour mean cycle time 125sec, maximum cycle time 160sec
Trial dates Pre-trial surveys week commencing 7 September 2009 Signal switch-off for 4 weeks commencing 14 September 2009
Site layout 

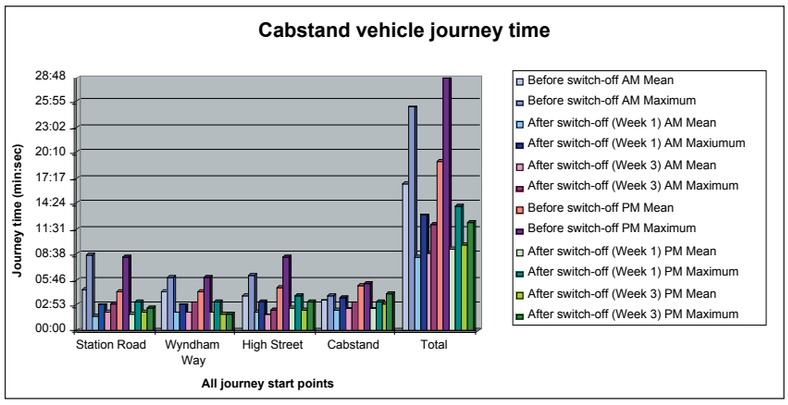
The traffic signal control at Cabstand was introduced in 2005 as part of a major public realm modification scheme associated with a large residential development in the town. The signal control was introduced in order to facilitate formal pedestrian crossings and to allow for potential traffic growth. The long cycle time and complex staging arrangements, however, gave rise to long delays and the junction was operating close to capacity during the peak hours, resulting in long queues particularly back up the High Street approach. A pedestrian crossing demand of between 200-300 movements per hour comprises schoolchilden, shoppers and commuters. Traffic demand was around 1500pcu/hr during the peak hours, with very few buses. A parallel residential street to the west, Slade Road, was used as a rat-run by local traffic and so ATC loops were installed to monitor any changes resulting from the trial. Two-way vehicle demand on this route was around 2000veh/hr during the peak hours.

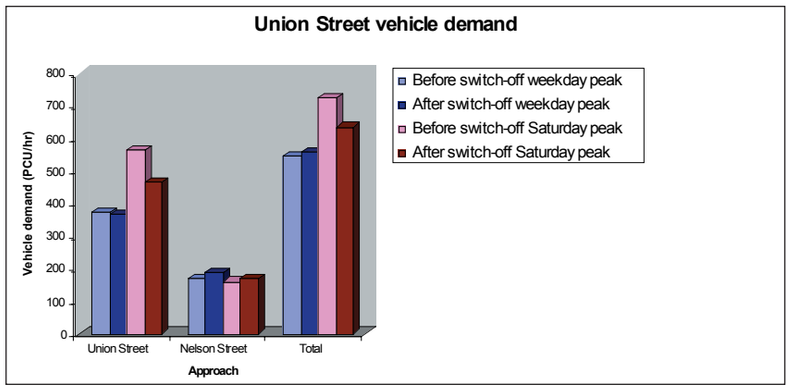
Immediately following signal switch-off, vehicle delays

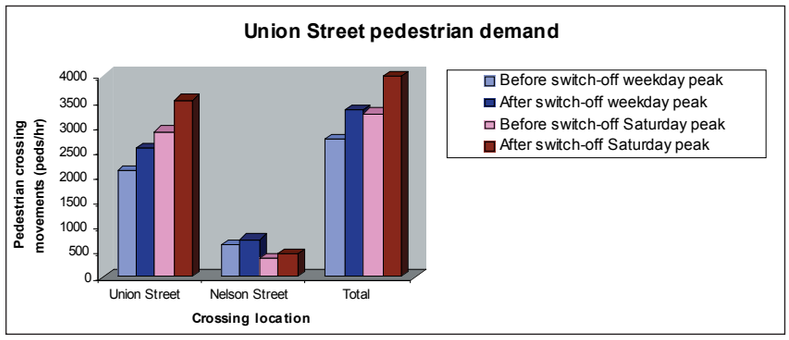


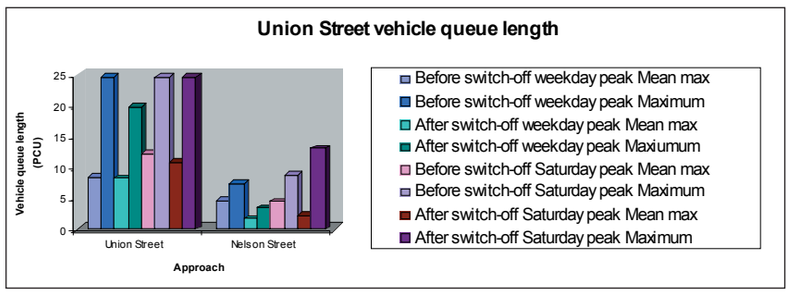


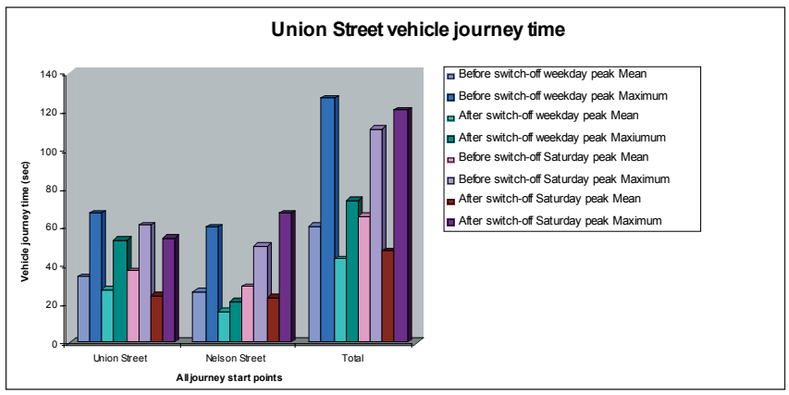


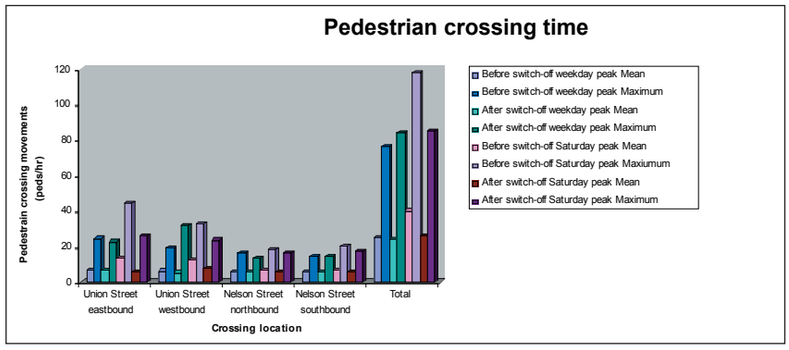












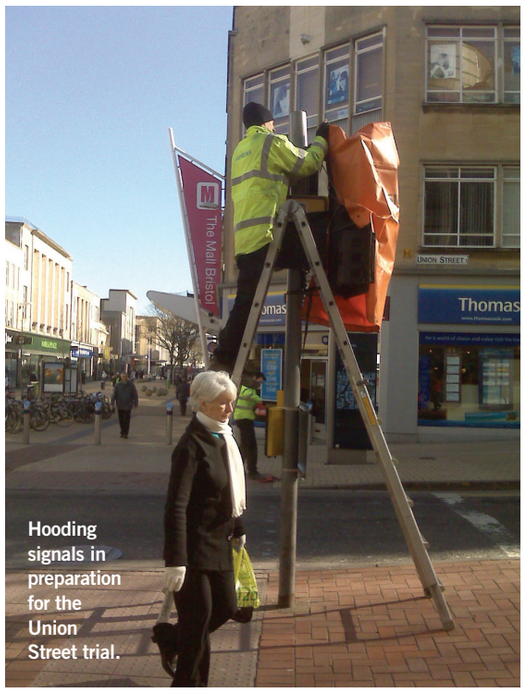
and queues reduced by 50%. As a consequence, traffic demand through the junction grew by 20% to over 2000pcu/hr during the peaks, with monitoring of the residential streets showing a compensating reduction in rat-running. Although this led to a slight increase in journey times by Week 3, delays were still broadly half the pre-trial values. Pedestrian demand fell during Week 3 due to poor weather conditions, so data from Week 1 was used to compare crossing times and delays. If pedestrians waited for the green man invitation, average crossing times would be expected to be around a minute, however surveys showed the mean crossing time to be around 20 seconds, indicating that pedestrians rarely used the formal facilities provided. Following switch-off, mean crossing times were very similar to pre-trial values, indicating that general behaviour was hardly affected and pedestrians were content to cross in gaps appearing, or that were provided, in traffic streams. What was evident, however, was that the maximum crossing times reduced in most cases, giving average reductions of at least 20%.

Interestingly, post-trial traffic capacity analysis using ARCADY showed that the introduction of mini-roundabout markings would be likely to create internal queue storage problems, something that has not occurred under uncontrolled conditions.

Site Union Street, Bristol
Street (Arm) Union Street (one-way northbound)/ Nelson Street (one-way eastbound)/ Broadmead (pedestrianised)
Signal control Non-UTC VA and pedestrian actuation, 2 traffic phases, 2 pedestrian phases Peak hour typical cycle time 40sec
Trial dates Pre-trial surveys week commencing 28 February 2010 Signal switch-off for 1 week commencing 7 March 2010
Site layout

The traffic signal control at Union Street mainly provides controlled crossing facilities for the high volume of pedestrians moving between Nelson Street and the Broadmead pedestrianised shopping street, yet also provides a bus gate facility and manages northbound vehicular traffic. Traffic queues from the downstream junction can block back through the junction, although generally the junction performs well. Vehicular demand is between 500-600pcu/hr, including around 100 buses, and there are usually over 3000 pedestrian crossing movements during the peaks. The number of cyclists is generally low, at around 20-30 per hour.

During the period of signal switch-off, vehicle and pedestrian demand was generally higher, although this was not felt to be as a consequence of the trial, rather patterns in shopping behaviour. Despite this increase, mean vehicle queues and delays reduced by 30%. Pedestrian be-



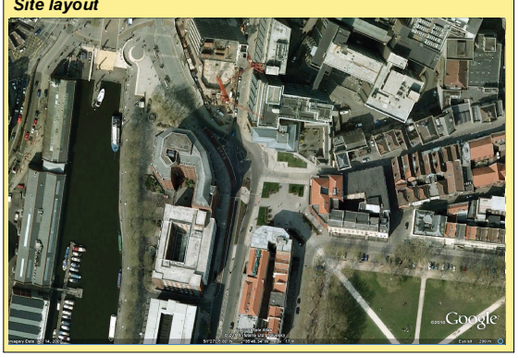
Hooding signals in preparation for the Union Street trial.

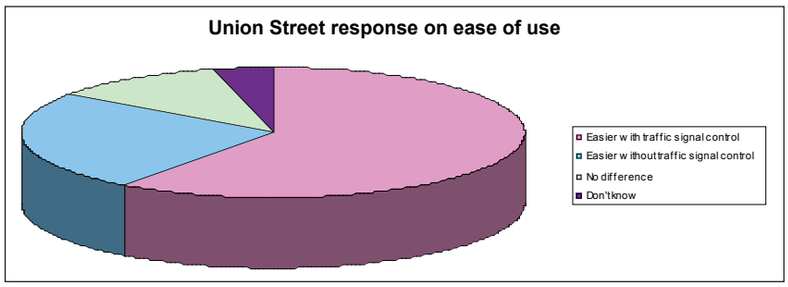
haviour varied between the weekday and Saturday peak periods, with more green man compliance on a Saturday. This meant that the reduction in both mean and maximum crossing times following switch-off was more marked on the Saturday, at around 30%, yet there were benefits during the rest of the week.

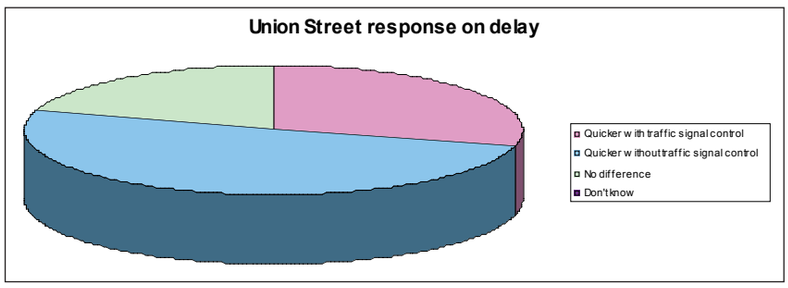
Road-user satisfaction surveys showed that two thirds of all those surveyed (mostly pedestrians who had not travelled through the junction by car) believed the junction to be safer and easier to use under signal control, and 75% of all respondents would prefer the signals to be switched back on, yet interestingly only half recognised that there were fewer delays without signal control.

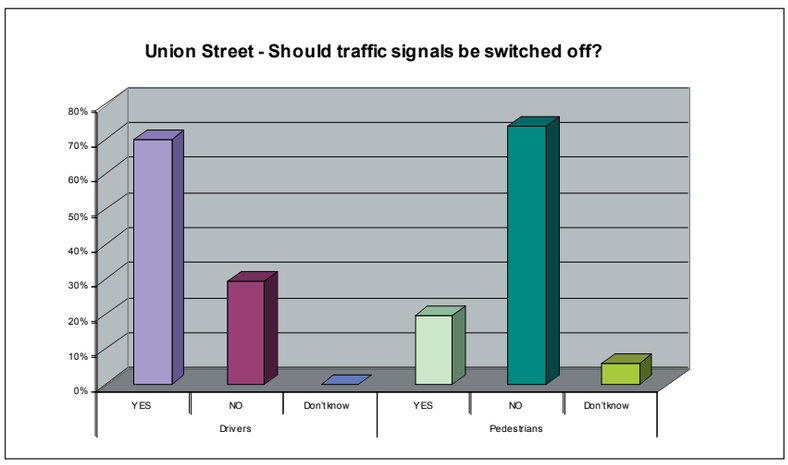
The traffic signal control at Broad Quay was introduced

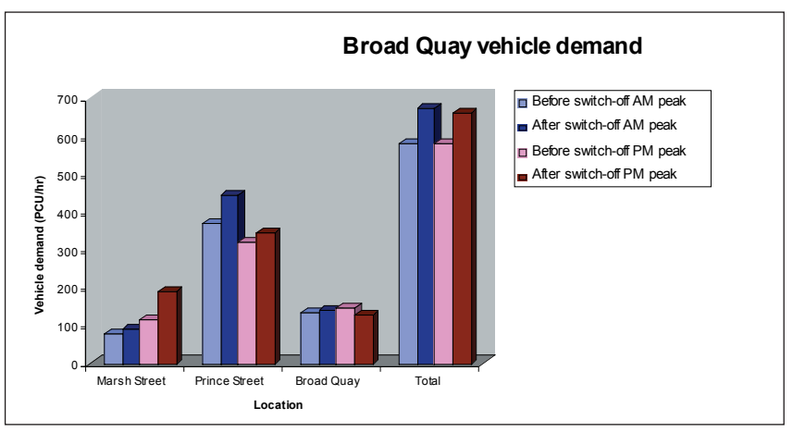
Site Broad Quay, Bristol
Street (Arm) Marsh Street (north)/ King Street (minor access road)/ Prince Street (south)/ Broad Quay (bus/cycle only to northwest)
Signal control Non-UTC VA and parallel stage stream exit crossing, 6 traffic phases, 4 pedestrian phases (including 1 staggered crossing) Peak hour typical cycle time 50sec
Trial dates Pre-trial surveys week commencing 14 March 2010 Signal switch-off for 1 week commencing 21 March 2010
Site layout

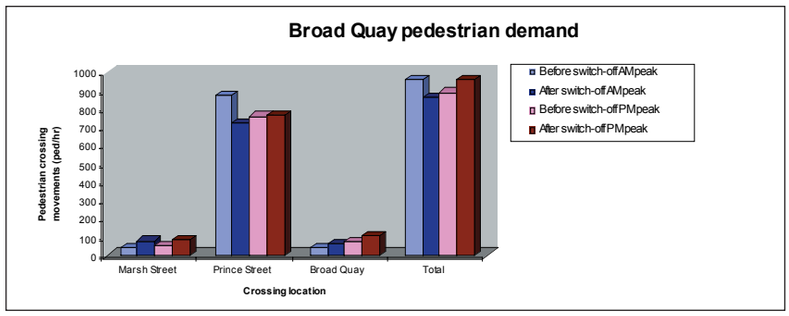


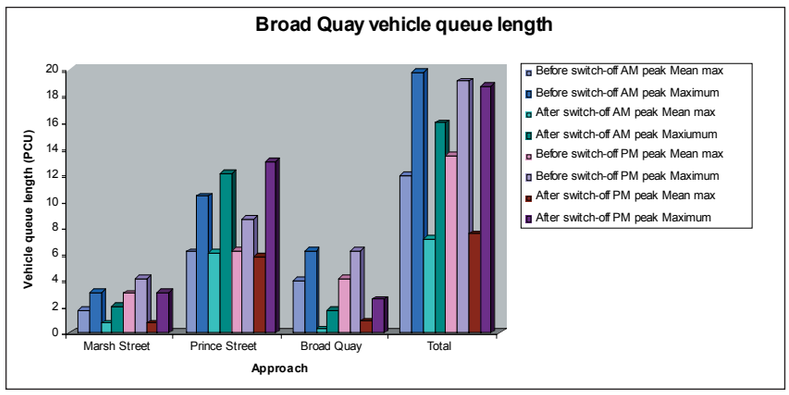


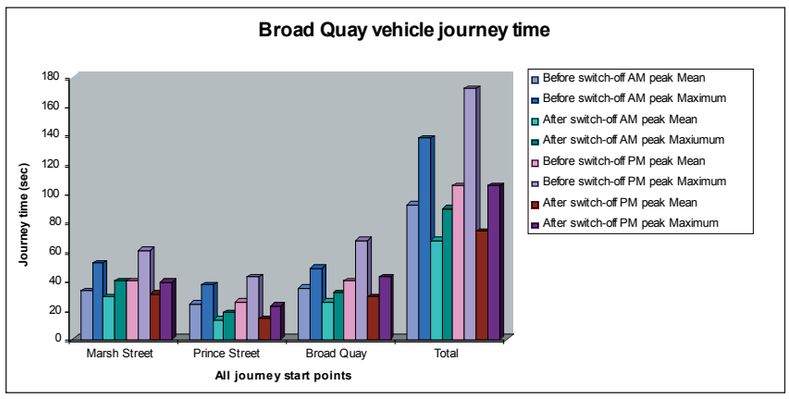


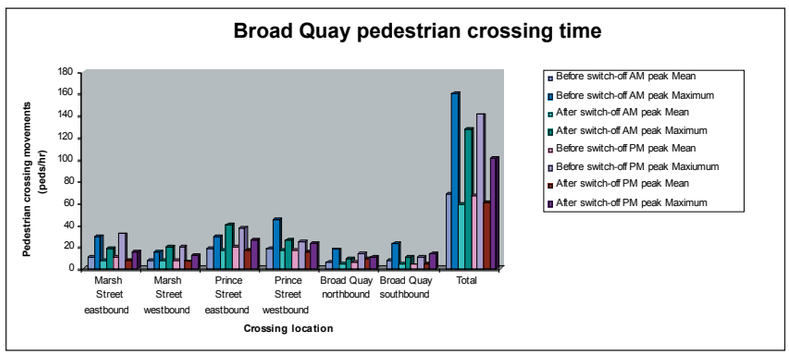


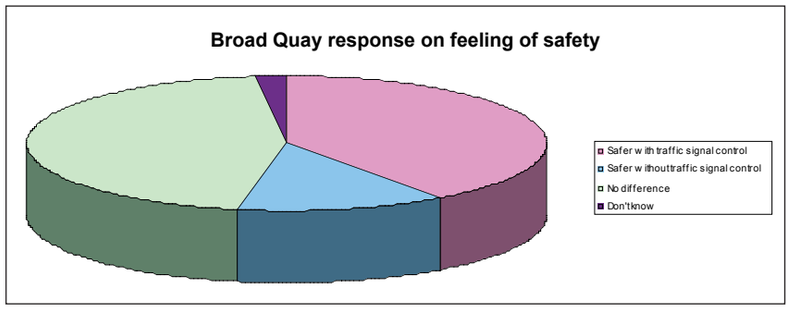


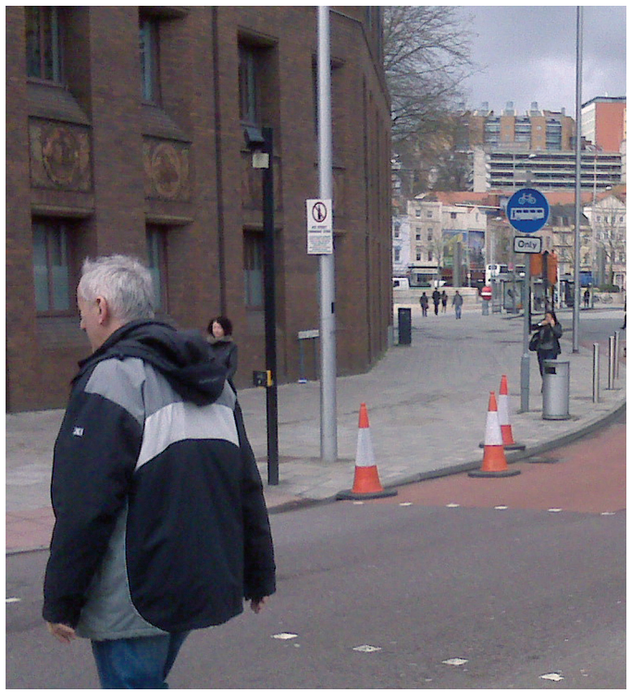












in 2006 and incorporated bus lanes, a bus gate and all-round controlled pedestrian crossing facilities. Traffic can sometimes queue from the downstream junction to the north and block back through the junction, although generally the junction performs well. Vehicular demand is around 600pcu/hr (including around 100 buses) and there are around 300 cyclists and 1000 pedestrian crossing movements during the peaks. The junction is located on a popular through-route for pedestrians and cyclists travelling between the Temple Meads station and quayside areas of Bristol. A lot of pedestrians tend to use gaps in traffic created by the signals to cross all around the junction, and not just at the formal crossing points.

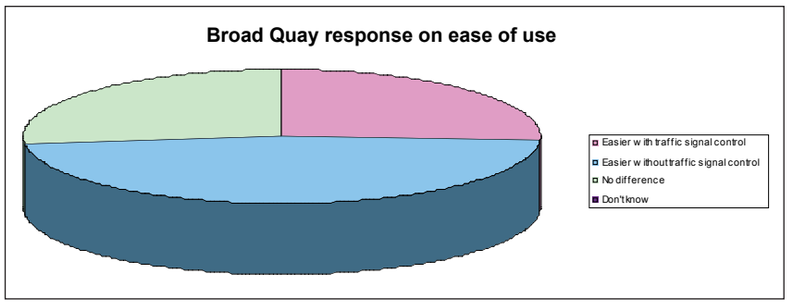
Following signal switch-off, vehicle, pedestrian and cyclist demand were unaltered. The results show that in most cases, and therefore overall, mean and maximum journey times reduced by around 30%, with mean queue lengths reducing by 40% and yet, rather interestingly, maximum queue lengths were not as greatly improved. Mean pedestrian crossing times reduced by a few seconds and thus, overall, by around 10% and the maximum crossing times were reduced by at least 20%.

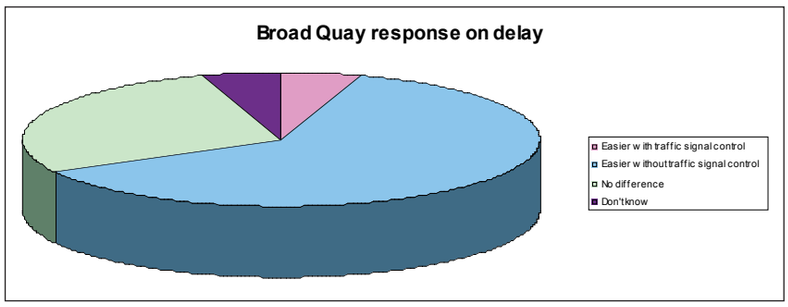
Road-user satisfaction surveys showed that most felt the junction to be safer, easier to use and quicker to pass through without signal control, and some 70% would prefer to keep the signals switched off. Of those that would prefer signal control, all acknowledged that it was quicker, or certainly no slower, without controls.

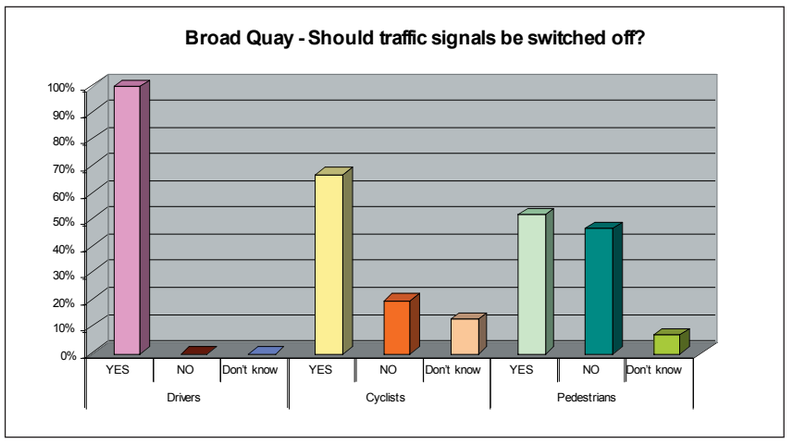
These results were almost the complete opposite of the views from respondents at Union Street, yet the junctions are located less than 2km apart. It was felt that this was due to the difference in the type of pedestrian at each of the sites. At Union Street, those surveyed were part of groups or families with children out shopping on a Saturday, not necessarily familiar with the junction. At Broad Quay, pedestrians tended to be alone or as part of a pair on a regular and familiar commuting trip.

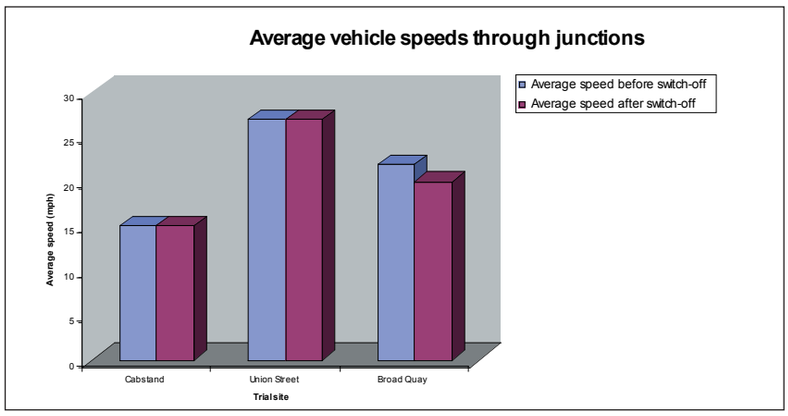
TRIAL CALMING

Average vehicle speeds were monitored at each of the sites. At Cabstand, a 20mph zone had been introduced as









a consequence of Safety Audit recommendations, yet speeds may have remained at around 15mph, it was felt, due to the geometric constraints of the staggered junction arrangement. At Union Street, speeds stayed at around 25mph, which was perhaps higher than might be expected, but probably due to the downhill approach to the junction. At Broad Quay, speeds reduced slightly to less than 20mph, perhaps indicating that the signal switch-off resulted in a traffic calming effect.

CONCLUSIONS

With data from only three trial sites where the effects of removing traffic control regulations, in these cases signal control, have been monitored (despite the significant level of scrutiny), it is not really possible to provide proof, or otherwise, of the Buchanan/Cassini hypothesis. It is clear that further research at a much greater number of junctions and network arrangements and over a longer period of time will be required before any satisfactory conclusions can be drawn. The trials have not been in operation for long enough to understand impact on road safety, and the issue of appropriate crossing facilities for vulnerable road users needs to be addressed rationally.

Nevertheless, the trials have all demonstrated that despite their differences the junctions generally performed better without traffic signal, or indeed any, formal control. Vehicle delays and pedestrian crossing times generally reduced under the shared space arrangement, to varying degrees depending on how well the junction performed previously under formal controls; where the junction is operating efficiently, only small improvements were found. Yet this is perhaps the most important conclusion, that removing or not providing formal controls at busy, urban junctions seems to offer a legitimate form of traffic management, that may not be any worse than conventional priority or signal controlled methods, and indeed may show significant benefits. Further benefits might also be achieved through a greater public understanding and acceptance of uncontrolled, shared space principles.

CB has used the wealth of data collected during the trials to develop innovative micro-simulation modelling techniques to forecast how other, even busier junctions might perform, and this has shown some limitations to where we believe shared space principles might be applied. Yet this research has demonstrated that there is a far greater opportunity to develop designs and traffic management strategies with emphasis on the characteristics of the 'place', rather than traffic management technology, than might previously have been thought.

The Broad Quay junction during switch-off.