Why don't you…just switch off those traffic signals and go and do something more challenging instead?

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Background

In recent months the mainstream media has been increasingly interested in traffic signal control. About time, perhaps, but the fuss is not about the latest technological developments in evermore sophisticated and intelligent traffic management systems, more about switching-off traffic lights and removing unwanted delays and infrastructure. A wave of switch-off mania is hitting the UK, and this has begun to divide opinion on what the benefits are, what the issues and challenges are, or indeed why this should be allowed to happen at all.

In 2001, the traffic signal controlled intersection known as the Laweiplein in Drachten, Netherlands, was converted into a public square with a roundabout, and was part of a wider project to remove traffic signals across the town, which has a population of around 50,000. The project was the brainchild of the late Hans Monderman, who felt that 'traffic lights are no solution, they cause people to speed like hell and brake like idiots[1]'. A report published in 2006[2] on the impact of removing the traffic signals, or perhaps more importantly introducing a roundabout, showed that traffic capacity and journey times improved, which led to an increase in demand to around 22,000 vehicles per day. All types of road user were interviewed before and after the changes and it was reported that although drivers found that it was easier to get through the junction, most people, particularly the elderly, perceived the traffic conditions at the roundabout to be less safe than with signal control. Despite this, the number and severity of accidents reduced considerably. An updated study conducted by the Department for Transport[3] shows there were no injury accidents in the 3 years up to 2006. The traffic impact and road user satisfaction data was very limited (only 2 hours worth of traffic data on a single day before and after the changes was collected, and only 18 pedestrians were asked for their opinions, for example), but the numerous videos of this, other sites in Drachten and from across the continent that can be found on YouTube demonstrate how well the streets seem to function without formal controls.

Another example of where some analysis[4] has been carried out is Gossip Square (Skvallertorget) in Norrköping, Sweden. The uncontrolled, unregulated intersection carries some 14,000 vehicles per day, but also has over 500 pedestrians per hour passing through the square during the peak hours. A further example of monitoring can be found in Berne, Switzerland, where the Könizstrasse, a 2-way suburban arterial route, carries around 700 vehicles per hour in each direction while over 1000 pedestrians cross comfortably between slow-moving traffic within a 'shared space'.

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[1] *Traffic Engineering Control,* Shared Space – the alternative approach to traffic calming, Emma Clarke, (September 2006)

[2] *Noordeluke Hogeschool Leeuwarden,* The Laweiplein: Evaluation of the reconstruction into a square with roundabout (March 2006)

[3] *Department for Transport/ MVA Consultancy,* DfT Shared Space Project Stage 1: Appraisal of Shared Space (November 2009)

[4] *Tyrens,* Shared Space in Sweden (2005)

Top: Before and after traffic signal control at Gossip Square, Norrköping
Bottom: Unregulated high street and junction in Berne, Switzerland




There is no 'before' data from either Gossip Square or Könizstrasse, and so it's not possible to determine whether or not delays and queues have altered since the changes, however simple calculations reveal how capacity might have been affected. Take Könizstrasse, which is some 12 metres wide, and assume a 60 second cycle time with half this time lost to a straight-over signal controlled pedestrian crossing. Using a conservative saturation flow of 1800pcu/hr gives a sensible operating capacity of around 800 pcu/hr. We could say that the crossing actually operates in two halves, due to the wide refuge down the centre, and so compare it to a staggered crossing. This might reduce lost time to traffic to around 20 seconds every minute, and so improves operating capacity to over 1000pcu/hr. Though this is a considerable improvement on the 700 vehicles per hour slowly passing through the corridor at the moment, pedestrians would have an average delay of about 20 seconds (if they actually chose to wait for the green man), while under shared space it is practically zero.

Of course, simplified streetscape design is not new, and across the UK there have been initiatives throughout the 1980s and 1990s to develop the ideas of Mixed Priority Routes and Historic Core Zones that rely on courteous road-user behaviour. Recent research[5] concluded that *'at the few UK schemes where exposure data are available there does appear to be a positive effect in reducing the number of casualties and the level of risk to pedestrians and cyclists*'. The publication of Manual for Streets, MfS2 and LTN 1/08 has also provided designers with guidance and an evidence-base for considering alternative design strategies. There are also the high profile but expensive projects such as those in Ashford, Kent and Exhibition Road in the Royal Borough of Kensington and Chelsea, which show a greater emphasis on public realm and courteous road user behaviour and less on conventional traffic management controls. Yet all this raises the question of precisely under what traffic conditions is this relaxation in formal traffic control suitable, if at all?

[5] *Department for Transport/ MVA Consultancy,* DfT Shared Space Project Stage 1: Appraisal of Shared Space (November 2009)

As a starting point, there is no statutory requirement for traffic signs, road markings, priority controls or traffic signals on our roads[6]. It is perfectly legitimate to allow a network of streets to function without any intervention whatsoever and, providing reasonable justification can be provided for doing so, there is no case evidence of any risk of litigation[7]. Yet our typically risk averse design culture of received wisdom and a focus on the need to increase road capacity, deliver journey time reliability and road network resilience and even manage air quality currently avoids the possibility of using unconventional solutions. The UK Roads Board and ICE write that *'defensive design…has hampered innovation, improvement and necessary change, being both against the spirit of Best Value and the interests of the public'*. Yet without good evidence of any benefits or reliable modelling techniques for unregulated junctions and streets, it is difficult for council members and officers, especially traffic managers and safety officers, to form an objective view on unconventional solutions.

The Cabstand Junction Trial

In June 2009, an unpopular set of MOVA (Microprocessor Optimised Vehicle Actuation) controlled signals at the Cabstand staggered crossroad junction in Portishead, near Bristol, failed for a few hours, resulting in queues and delays disappearing. The local press ran a front page story on how well the junction seemed to perform without traffic lights. The junction was complex, and needed lots of traffic and pedestrian crossing phases to provide the level of service and control expected when it was introduced in 2005, but delays and queues were notoriously long. The traffic signal failure was enough to convince councillors and officers to carry out a potentially risky, but truly groundbreaking experiment of unregulated behaviour at the junction.

A locally well-publicised, formal signal removal trial was organised by North Somerset Council (NSC) with SKM Colin Buchanan (SKM CB) undertaking the monitoring, analysis and reporting of 'before' and after' conditions. The trial clearly had to be developed with public safety at the forefront and there was undoubtedly a chance that accidents might occur, yet without any precedent upon which to base the experiment there was no evidence-based method of evaluating the risks. A Safety Audit recommended the introduction of a 20mph zone, and careful consideration was given to the signing strategy, advising all road users that there was no priority and that drivers should give way to pedestrians.

The trial started in September 2009. Monitoring of traffic and pedestrian behaviour was carried out 24 hours a day for a week before the lights were switched off, then for a 4-week period following switch-off, using a series of CCTV cameras located around and on the approaches to the junction. Road users soon adapted to the loss of traffic signal control, behaving as they would do under any form of signal failure. Most were courteous and a good proportion slowed to allow pedestrians to cross.

Cabstand junction, Portishead

Cabstand junction before signal switch-off

[6] *Department for Transport*, LTN 1/08 Traffic Management and Streetscape (2008)
[7] *ICE and UK Roads Board*, Highway Risk and Liability Claims (Nov 2009)

Cabstand junction advice to road users

Cabstand junction following switch-off

Cabstand junction today

Cabstand junction today

The monitoring showed that before switch-off pedestrian crossing demand was between 200-300 movements per hour, being on a school route and located at the edge of the town centre. 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 from the Slade Road rat-run was attracted back onto the main route, and demand through the junction grew by 20% to over 2000pcu/hr during the peaks. After an initial settling down period of a few weeks, delays were still broadly half the pre-Trial values. If pedestrians waited for the green man invitation under signal control, average crossing times should have been 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 average crossing times were very similar to pre-Trial values, indicating that general behaviour was hardly affected and pedestrians were content to cross in gaps in the traffic or when drivers slowed to allow them to cross. What was evident, however, was that the maximum crossing times reduced in most cases, giving average reductions of at least 20%. Traffic speeds have remained low, averaging 15mph on all routes through the junctions.

It's been almost two years since the Trials at Cabstand, and the signal infrastructure has now been removed. There have been a small number of damage-only or slight injury accidents, as might be expected at any junction, but the accident rate and severity is no worse than under traffic light control, and these involve drivers, not pedestrians.

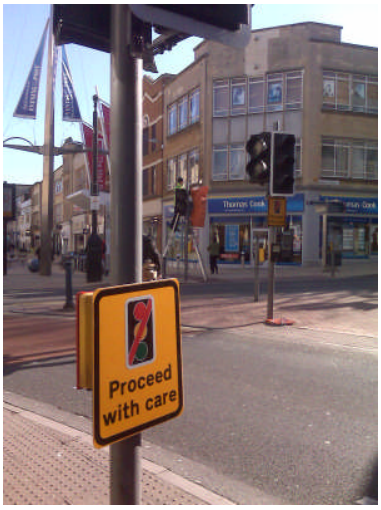
Nevertheless, NSC decided to install Zebra crossings at two crossing points to provide formal crossing facilities on a key desire line, and have also installed formal mini-roundabout control at one of the intersections. This might seem a retrograde step, as the measures require a high degree of perhaps unnecessary street clutter and road marking and, afterall, 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. The space is, however, continually evolving and so it will be interesting to see what emerges in another two years.

Bristol follows suit

The success of the Cabstand Trial led directly to further Trials across nearby Bristol. From a list of nine potential sites, Bristol City Council (BCC) chose two that were considered not to be too risky, but at the same time would provide 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, neither of which experienced significant congestion problems. This provided an opportunity to see if lack of formal control could perform better than typical, good quality vehicle and pedestrian traffic signal actuation systems.

Union Street before signal switch-off

Union Street advance warning of trials



Union Street during switch-off trial

Pedestrians at Union Street during switch-off

Broad Quay before signal switch-off

Broad Quay switch-off receives opposition

Broad Quay during switch-off trial

Pedestrians at Broad Quay during switch-off

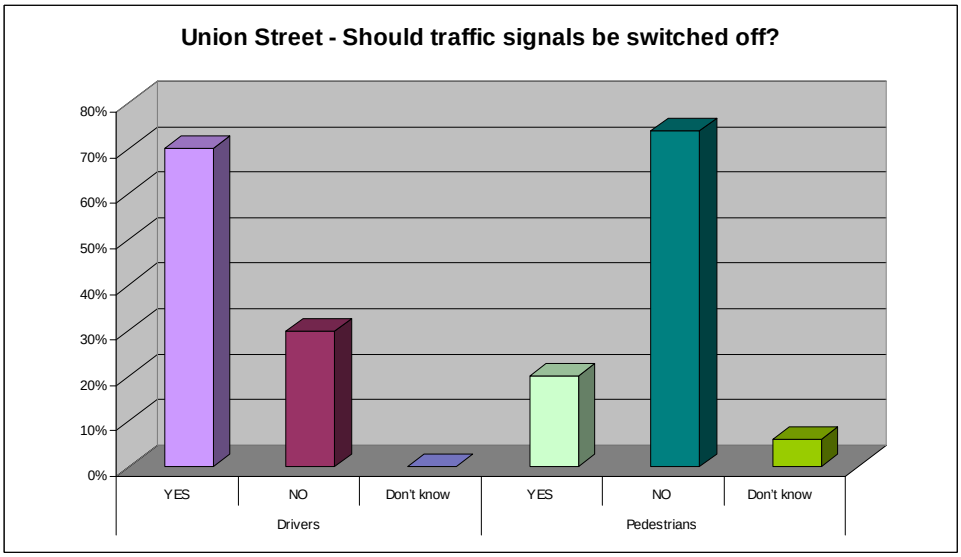
Comprehensive stakeholder and road-user group consultation events were carried out by BCC and SKM CB, who also developed the Trial and monitoring methodology (to include a road-user satisfaction survey) and a slightly different signing strategy to that used at Cabstand. BCC were keen not to provide guidance on behaviour, but were interested in how road users responded to simple warning signs. The greatest objections were, perhaps not surprisingly, received from 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 driver behaviour and attitude towards a more courteous approach was not considered to be reasonable.

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 SKM CB submitted the monitoring reports.

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 behaviour 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.

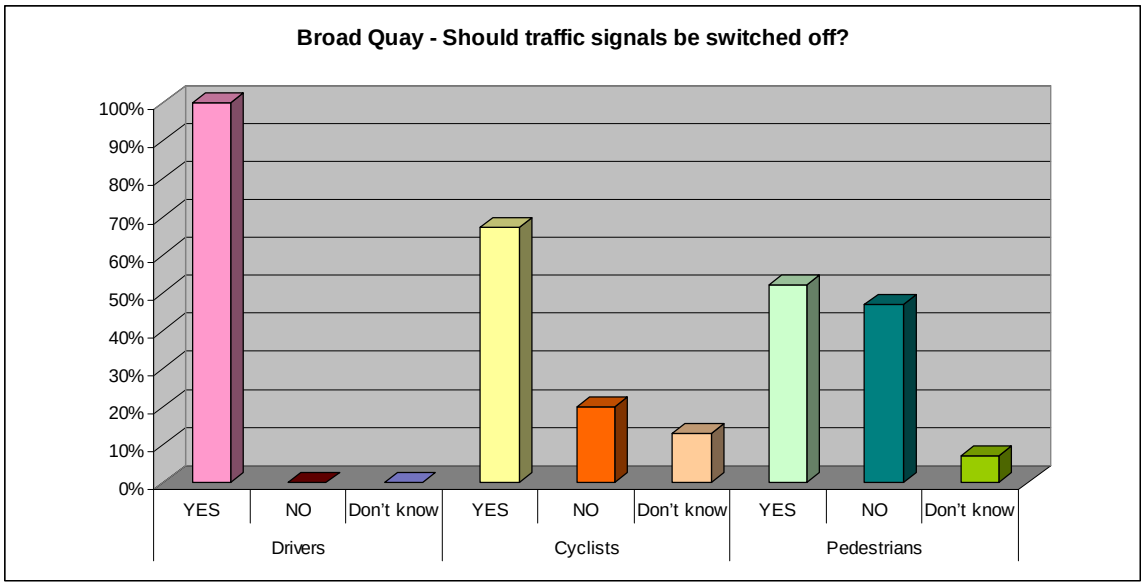
Road-user satisfaction surveys showed that two thirds of all those surveyed (mostly pedestrians who had not travelled through the junction by car) believed the junction to be safer and easier to use under signal control, and 75% of all respondents would prefer the signals to be switched back on, yet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



The traffic signal control at Broad Quay was introduced 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.

What the Trials have taught us

With data from only three trial sites where the effects of removing traffic signals have been monitored in some detail, we have to be cautious about drawing too many conclusions. The trials have not been in operation for long enough to understand fully the impact on road safety, or the effects of changes to geometry or public realm design, 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; the research has shown that attitudes can vary considerably from site to site.

Traffic signal removal, or not providing some form of conventional priority/ signal controlled junction in the first place, is not going to be suitable at a large number, possibly a large proportion, of sites in the UK. Nevertheless, it certainly seems to be prudent for highway authorities to review the form of junction controls under their control to determine whether or not there are opportunities to achieve benefits by using simpler, perhaps unconventional traffic management techniques. It's possible that signal operation is no longer necessary at sites due to changes brought about on other parts of the road network, or perhaps it does not achieve initial objectives such as accident reduction. There may be a desire to reduce the dominance of vehicles and enhance public realm by focussing on the 'place' function of a site, or to improve the traffic management function, smooth traffic flow and improve air quality or perhaps reduce the number or severity of accidents. There could also be significant cost savings, in terms of implementation, operation and maintenance but also in terms of the economic benefit of improved public realm and reduced journey times.

In London, Transport for London has identified around 150 sites out of almost 6,000 signal installations that no longer comply with their traffic signal justification criteria. There are even more that, although justified in a conventional sense, could still experience benefits in journey time savings despite having high traffic volumes. This has been demonstrated at sites in the Boroughs of Ealing, Westminster, Camden and Bexley to name a few, where signal control has been replaced with conventional priority solutions. In Reading, some 20 sites have been identified as having potential for alteration or removal. In Blackburn, 2 sets of signals have been disabled as part of an improvement scheme and are unlikely to be switched back on. In Poynton, just to the southeast of Manchester, a busy set of signals was disabled to test the likely effects of introducing a shared space scheme, and following a successful trial the scheme will be completed later this year. In Coventry, there are at least 3 sites within the city centre where traffic signals will be removed in favour of shared space as part of a wider strategy to improve the public realm and reduce the dominance of the car. In Cheltenham, a trial is scheduled to take place later in the summer to assess the impact of removing controls at 3 adjacent sites along a busy corridor where the signals are linked as part of a wider Urban Traffic Control (UTC) system, with the aim of identifying potential scope for wider public realm improvements.

Courtesy: Coventry City Council

High Street, Coventry - today

Courtesy: Coventry City Council

High Street, Coventry – after signal removal

Poynton, Cheshire - today

Acknowledgement: Hamilton-Baillie Associates

Poynton, Cheshire – after signal removal

A long way to go?

A scheme recently completed within Gloucester involved the removal of traffic signals in favour of a shared space public realm scheme at Kimbrose Way, and although the newly created place is attractive and transforms the area, and there does not seem to be any traffic congestion issue, the press and media reports have focussed on the potential risks, with headlines such as, *'Gloucester's "deadly" shared space'* and *'Pram clipped by car in Gloucester's controversial shared space'*.

Kimbrose Way, Gloucester – before

Kimbrose Way, Gloucester – after signal removal

For simplified streetscape designs to become commonplace, behavioural change is essential and so public acceptance and understanding of the schemes and their benefits needs to be widespread. It may even be necessary to consider legislative change to define what is meant by 'courteous' behaviour and where it should be applied. Benefits need to be demonstrated quantitatively and, as it will not always be possible to simply switch-off signals as part of a trial, micro-simulation modelling techniques offer the best way to identify the likely outcomes of removing conventional controls. Yet these techniques have their critics and are, in any case, in the early days of calibrating to observed behaviour and response to various design elements, and then being validated against actual schemes. We still don't really know what impact there might be over a wider network of busy streets, and the effect on journey time reliability and network resilience to incidents and traffic demand fluctuations.

So, possibly a long way to go before practitioners really get to grips with the potential for switching off or positively discriminating against traffic signals in streetscape and traffic management projects. These are exciting times for traffic signal scheme designers, engineers and traffic managers faced with the task of keeping their networks moving and improving capacity and journey times, while at the same time respecting the need to enhance the public realm, reduce street clutter, avoid unnecessary delays and improve road safety. We need to embrace the ideas of simplified streetscape design and consider, wherever possible, if it's possible to switch off those traffic signals and go and do something more challenging instead!

> *TfL's Traffic Directorate will refuse proposals for new signal installations in cases where it is evident that alternative methods of traffic control have not been considered, or where installation will cause unacceptable levels of disruption to traffic and will not produce significant safety, pedestrian, cycle, public transport or other benefits.*