April 2005

Do traffic signals at roundabouts save lives?

Roundabouts are a very effective method of junction control, but queues can form in busy periods and there can be safety problems for pedestrians and cyclists. Signalising roundabouts allows better management of queues, but are there also safety benefits for pedestrians and cyclists?

In 2003 the London Road Safety Unit undertook a study to measure the effect of traffic signals at roundabouts.

Signal control is usually installed at a roundabout to improve traffic capacity and to balance a junction at high flows. Supporting reasons may include reducing collisions or provide surface level crossings for pedestrians. With the increasing vehicle demand, signal control at roundabouts is becoming a common measure in traffic management.

The study analysed the casualty data at selected roundabouts ‘before’ and ‘after’ signal control was implemented. A total of twenty sites were selected, equally divided between at grade (standard) and grade separated junctions.

Shepherd’s Bush Roundabout

The standard sites selected include major junctions such as ‘Shepherds Bush Roundabout’ and two sites that had signals operating on a part time basis. These were ‘Apex Corner’ and ‘Stirling Corner’.

Chiswick Roundabout

For the grade separated sites, major junctions such as ‘Chiswick Roundabout’ were chosen. The selection included two sites that operated on a part time basis. These were the ‘Tolworth Junction’ and ’Staples Corner’ which was also partly signalled.

For each of the twenty sites the casualty data was obtained for the 36 month period ‘before’ and for the same length of time ‘after’ the date of signal implementation. When signals were implemented as part time operation, the ‘before’ and ‘after’ data were re-examined and casualty data analysed for the specific times of operation.

Collisions were analysed in the following categories:

- during the hours of darkness;
- on a wet road surface;
- involving a pedestrian;
- fatal / serious injury;
- nose-to-tail shunt type;
- involving a vehicle that changed lane;
- single vehicle non pedestrian;
- emerging onto the roundabout;
- collisions coded by the Metropolitan Police as ‘speed related’.

Changes in casualties were tested for statistical significance using a K-test.

Significance levels varied from 1%, 2%, 5% and 10%. These provided confidence levels of 99%, 98%, 95% and 90%. When the results were not significant in accordance with these levels it is not possible to say with reasonable confidence, whether signal control at the site has had an effect or not.

Tables to show the combined results of these collision categories are given below for ‘standard’ roundabouts and for ‘grade separated’ sites. The Tanner T-test was used to test the statistical significance of the combined effects of the change to signal control at each of the two different types of roundabout.

Table 1: Collisions at all 10 standard roundabouts

Collision type	'Before' collisions	'After' collisions	± Change (%)	Significance *1
Total collisions	384	277	-107 (28%)	****
During the hours of darkness	101	73	-28 (28%)	**
On a wet road surface	79	49	-30 (38%)	****
Involving a pedestrian	22	17	-5 (23/%)	ns
Involving a powered two wheeler	85	63	-22 (26%)	*
Involving a pedal cycle	70	14	-56 (80%)	****
Fatal / serious injury	34	29	-5 (15%)	ns
Nose-to-tail shunt type	169	146	-23 (14%)	ns
Involving a vehicle changing lane	46	39	-7 (15%)	ns
Single vehicle non pedestrian	30	24	-6 (20%)	ns
Emerging onto a roundabout	71	30	-41 (58%)	****
Coded by the Metropolitan Police as 'speed related'	26	44	+18 (69%)	***

Significant*[1] = Significant at: 1% is **** 2% is *** 5% is ** 10% is * and not significant is ns.

At these standard roundabouts there was a good decrease in total collisions of 107 (28%), which is an average reduction of 10.7 collisions at each site for a 36 month period. This is a saving of just over 3.5 collisions per site each year.

There were significant casualty reductions in most categories. The largest was in collisions involving a pedal cycle which reduced by 56 collisions (80%); this is an average of just over five and half collisions at each site. Collisions in the group emerging onto a roundabout reduced from 71 'before' to 30 'after', representing a 58% change; this is an average saving of just over four collisions at each site. Collisions on a wet road surface reduced by 30, representing a 38% decrease. Collisions during the hours of darkness decreased by 28, representing a 28% reduction. The smallest significant reduction was in collisions that involved a powered two wheeler, which decreased by 22 representing a 26% change

The only increase occurred in collisions coded by the Metropolitan Police as 'speed related'. These increased by 69% from 26 in the 'before' period to 44 'after'.

The Tanner T-test result has indicated that the 28% reduction for total collisions in the 36 months 'after' signal control was implemented at these selected

standard is significant at the 5% level. Consequently, there is a 95% confidence that the casualty reduction at these selected standard roundabouts was as a result of signal control.

These results show that signalising junctions of this type produces good safety benefits, particularly for cyclists. Given the problems faced by cyclists at busy roundabouts, this study gives confidence that signalising is effective in reducing cyclist casualties.

Table 2 gives results for the ten grade separated roundabouts selected.

Table 2: Collisions at all 10 grade separated roundabouts

Collision type	'Before' collisions	'After' collisions	± Change (%)	Significance *1
Total collisions	516	486	-30 (6%)	ns
During the hours of darkness	150	133	-17 (11%)	ns
On a wet road surface	89	98	+9 (10%)	ns
Involving a pedestrian	22	9	-13 (59%)	***
Involving a powered two wheeler	61	65	+4 (7%)	ns
Involving a pedal cycle	33	23	-10 (30%)	ns
Fatal / serious injury	54	56	+2 (4%)	ns
Nose-to-tail shunt type	271	291	+20 (7%)	ns
Involving a vehicle changing lane	50	58	+8 (16%)	ns
Single vehicle non pedestrian	64	47	-17 (27%)	ns
Emerging onto a roundabout	53	24	-29 (55%)	****
Coded by the Metropolitan Police as 'speed related'	60	148	+88 (147%)	****

Significant*[1] = Significant at: 1% is **** 2% is *** 5% is ** 10% is * and not significant is ns.

At these grade separated roundabouts total collisions have decreased slightly by 6%. This change is not statistically significant.

There was an increase of collisions in six groups. The only significant increase was in collisions coded by the Metropolitan Police as 'speed related', which had a 147% increase; this is an average increase of almost three collisions at each of the 10 sites per year.

There were significant reductions in two collision types. The largest reduction was 55% in emerging onto the roundabout, saving an average of almost three collisions at each of the 10 sites, over a 36 month period. The only other significant saving was in casualties that involved a pedestrian, which reduced to an average of just over one collision at each site within a 36 month period.

The Tanner T-test result has shown that the 6% saving for total casualties in the 36 months ‘after’ signals were implemented at the selected grade separated roundabouts is not significant at the 5% level. Consequently, at the 95% confidence level the reduction in collisions cannot be proven to be the result of signal control. The Chi^2 statistic indicates that the effects of the change, when signal control was implemented varied from site to site. The basic conclusion is that providing signal control at grade separated roundabout will not necessarily have any beneficial affect on casualties.

Conclusions

This study has shown that casualties were reduced following signalisation of the standard roundabouts, but a similar reduction was not found at grade separated locations.

The analysis of collisions ‘before’ and ‘after’ signals were implemented at all 20 selected sites has revealed that at both types of roundabout, signal control has a great benefit for collisions that involve a vehicle emerging onto the circulatory area. Reductions in casualties can be expected for collision types: During hours of darkness; Involving a pedestrian; Involving a pedal cycle or; Single vehicle non pedestrian. However, for both standard and grade separated sites there is a likely increase in collisions coded by the Metropolitan Police as 'speed related'.

These results can be a vital tool for practitioners in traffic management. When considering the implementation of signal control at a roundabout, road safety should be the main component of any engineering scheme. Designers can be mindful of the benefits signal control can achieve at roundabouts while being aware of the likely dangers, to reduce road tragedy and enable success.

This article was published in IHT’s Transportation Professional, April 2005 issue.