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## **Economic & City Development Overview & Scrutiny Committee**

### **Technical Briefing Note:**

### **Junction Analysis Modelling of Clifton Green – Westminster Road / The Avenue Closure.**

#### **Summary**

1. This note reports on the highway impacts of the closure of the through route between Water End and Clifton via Westminster Road and The Avenue. It also investigates an option of partially reinstating the left turn lane and filter at the Water End approach to Clifton Green, as mitigation for closure of Westminster Road.

#### **Background**

2. The removal of the left turn filter and lane at Water End junction with Clifton Green, as part of the Water End cycle scheme and consequential loss of capacity at the junction resulted in an increase in delay on Water End. Since implementation of the scheme some traffic has redistributed away from the Clifton Green junction to avoid the delays and an element of traffic is using Westminster Road and The Avenue as a through route to avoid queuing at the traffic lights.
3. Modelling work has been undertaken to assess the impact on Clifton Green junction of a closure on Westminster Road or The Avenue. The modelling work is based on traffic surveys undertaken on 29<sup>th</sup> September 2009 and 5<sup>th</sup> November 2009. Signal timings used are as provided by the Council's Network Management team.
4. An investigation into the benefits of a partial reinstatement of a short left turn lane and filter on Water End has been made.

#### **Modelling Analysis**

5. Ten scenarios were modelled. Table 1 is a summary of the modelling outputs. Practical Reserve Capacity (PRC) is a measure of the capacity of the junction. Negative values indicate that the junction is over capacity and will be experiencing delays. Flow is measured in passenger car units (pcu) where 1 car occupies 1 pcu of road space, a bus occupies 2.5 pcu, HGV =

2.9 pcu. Total delay is measured in pcu hours, this being a measure of the amount of delay experienced over the hour on all legs of the junction.

6. The queue lengths presented in Table 1 are mean queues. Queues at saturated junctions tend to build as the peak hour progresses therefore observed queues can be up to twice the mean queue. It has also been noted that long queues are longer per vehicle than shorter queues because drivers leave bigger gaps when far back in the queue. For reference Westminster Road is 300m back from the signals at Clifton Green, Clifton Bridge 500m, Salisbury Road 1000m and the Boroughbridge Road junction 1500m.
7. The analysis is based on traffic surveys undertaken on 29<sup>th</sup> September 2009 and 5<sup>th</sup> November 2009.

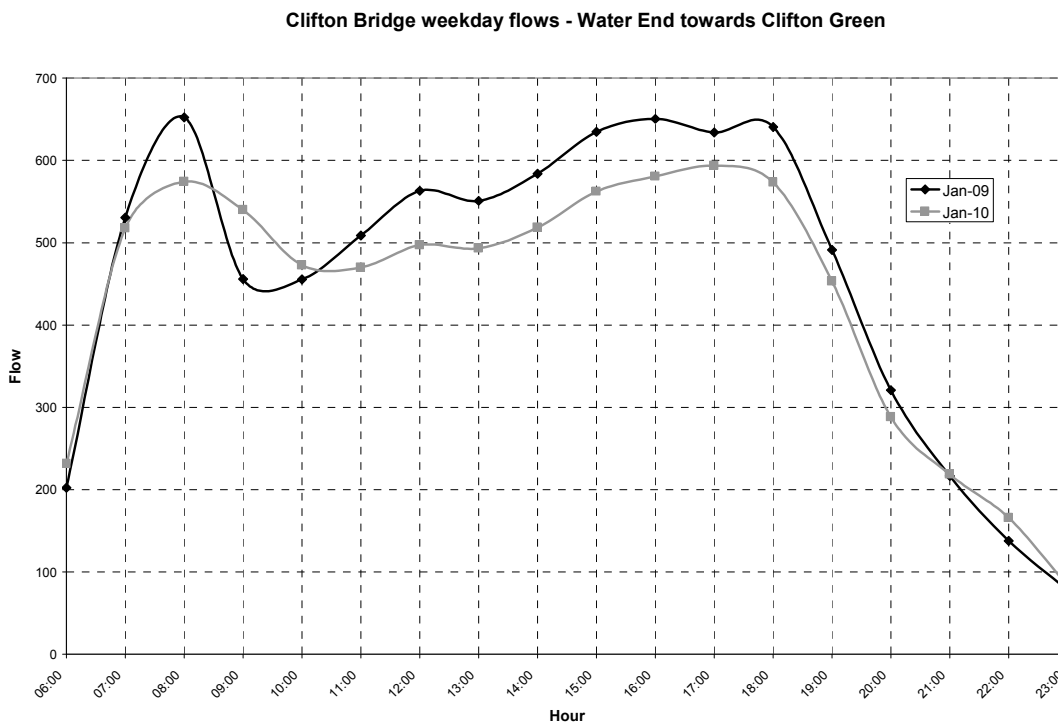
Table 1.

Scenario:	Practical Reserve Capacity	Total delay (pcu hr)	Water End average delay per pcu (mins)	Water End Mean Queue (pcus)	Water End Mean Queue (meters)
1. AM at opening (April 2009)	-111%	270	16.9	263	1576
2. AM peak post scheme (Nov 2009)	-20%	58	3.8	42	253
3. AM peak post scheme + closure	-42%	121	5.7	77	460
4. AM peak post scheme + 8 veh filter	-8%	35	1.0	19	111
5. AM peak post scheme + 8 veh filter + closure	-27%	82	5.0	69	413
6. PM at opening (April 2009)	-94%	195	15.4	186	1115
7. PM peak post scheme (Nov 2009)	-15%	51	2.6	38	230
8. PM peak post scheme + closure	-31%	93	6.1	82	490
9. PM peak post scheme + 8 veh filter	-14%	34	0.9	21	125
10. PM peak post scheme +8 veh filter +closure	-14%	42	1.5	32	191

8. Scenarios 1 and 6 clearly indicate the scale of the delays that were experienced when the scheme was first implemented in April 2009.
9. The changes that have occurred in the months since opening are that traffic has redistributed its self on the network in order to avoid the delays on Water End and some traffic is using Westminster Road and The Avenue to avoid the signals. In terms of traffic volumes during the peaks these are down 10%-15% on Clifton Bridge (Figure 1). It is interesting to note that the post AM peak traffic is up, an indication that people are changing their time of travel to avoid the delays? The signal timings have also been altered to take account of the new arrangement and flows. Scenarios 2 and 7 represent the current situation.
10. It was noted during the analysis that the signal timings that are currently running on the junction are less than optimal particularly for the AM peak. This is due in part to the need to protect the running times on the Rawcliffe Park and Ride service. It is noted however that the latest changes to the signal timings was in April 2009, when there is a possibility that the scheme may still have been 'bedding in'. It is recommended that a further review of the signal timings is made by the Council, making use of the November 2009

survey results. It is also recommended that a Saturday and Sunday survey be undertaken and that the signal timings be reviewed for these days. It is understood from Network Management that they are planning on linking the Toucan crossing with the signals, the review should take place to coincide with this change.

Figure 1.



11. Scenarios 3 and 8 indicate the impact of closure of Westminster Road / The Avenue. The assumption has been made that all traffic turning right into Westminster Road from Water End will post closure make the right turn at Clifton Green. This is a 'worst case scenario' dependant on where the closure was implemented this figure could be less. The modelling shows a significant impact on the level of queuing and delay on Water End. It might be expected that some further redistribution of traffic will take place, although it may be that the traffic that has remained using Water End has little alternative or it would have already done so. If this is the case the further reductions in traffic volumes on Clifton Bridge will be small and the delays will remain at this level. Overall in this situation the modelling is indicating a doubling in the level of congestion (queues and delays) at Clifton Green during both peaks. As a consequence it is likely that there would be a further spreading of the peaks.
12. Scenarios 4 and 9 show the impact of the reinstatement of a filter lane and signal at Clifton Green without the closure. This has been modelled at 7 vehicle lengths (expected use 4 vehicles per cycle of the lights) and is shorter than the pre-scheme situation 18 vehicle lengths (expected use 9 vehicles per cycle). The results indicate a big improvement during the AM peak but only a moderate improvement PM due to there being less vehicles turning left. It should be noted that whilst improvements would be realised on

opening 'day 1' of the proposal it is highly likely that traffic would gravitate back to Water End and the benefits seen would rapidly be reduced. This is not to say that this would not provide some relief on the routes that the traffic has been displaced to i.e. the Outer and Inner Ring Roads.

13. Scenarios 5 and 10 show the impact of closure accompanied by reinstatement of the shorter filter lane. In the AM peak the filter only partially mitigates against the impact of the closure. In the PM peak it more than mitigates and the situation represents an improvement over the current situation. The reason for it not being fully successful in the AM is that there is more traffic displaced onto the right turn with the short lane this blocks the left filter so its benefit is not realised.

### **Conclusion**

14. Point closure on Westminster Road or The Avenue preventing through traffic is demonstrated to have a significant adverse impact on the highway network.
15. The impact of the point closure could be mitigated by the partial reinstatement of the left turn lane and filter at Clifton Green during the evening (and off) peak periods. The morning peak remains problematic, in that the impact of the closure is not fully mitigated by this measure and would see a significant worsening of congestion over the current situation.
16. Should the point closure take place and the left turn be reinstated then ideally these measures should be implemented together so as to avoid traffic trip redistribution taking the benefit of the added capacity afforded by the reinstatement of the left turn.
17. A further review of the signal timings will be made following any changes to include Saturdays and Sundays as well as the peak periods.

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