TECHNICAL NOTE: TIDAL FLOW BUS LANE OPTION ASSESSMENT

Purpose

1 This technical note considers the issues associated with the use of tidal flow bus lanes on key public transport corridors in Cambridge.

Background

2 Bus priority measures are being developed on several key public transport routes into Cambridge as part of the City Deal Infrastructure Programme. These projects aim to balance the need for high quality, reliable bus services with enhancement of the streetscape. Therefore, as part of project development, there will be a need to demonstrate that the best use of current carriageway widths has been considered alongside any need for carriageway widening options to accommodate future transport needs.

3 Tidal flow bus lane layouts potentially offer a way of optimising carriageway width to minimise the amount of space needed to achieve reliable and efficient bus journey times and to allow adequate highway space for other users and uses. However, the use of tidal flow schemes to date appears limited to urban highways with limited side access points and their future use on key radial routes in Cambridge presents safety, design and operational challenges.

4 As part of the development of City Deal schemes, consultants, Atkins, have prepared a technical note on existing tidal flow schemes across the globe.

Tidal Bus Lane Options

5 This technical note assesses two tidal bus lane options using a 3 traffic lane layout.

Option A: this comprises a central bus lane with traffic lanes either side. The bus lane would operate inbound during the morning peak period and outbound during the evening peak period, being closed to all traffic at all other times

Option B: during the morning peak period this would comprise of a kerb side inbound bus lane, an inbound central traffic lane and an outbound kerbside traffic lane. During the evening peak period the morning peak period operation would be reversed to comprise of a kerb side outbound bus lane, an outbound central traffic lane and an inbound kerb side traffic lane. Outside of the peak periods the central lane would be closed to all traffic with the kerb side lanes providing for inbound and outbound traffic.

Diagram 1 shows the daily sequence for each option.

Signing and Safety Issues

<u>Signing</u>

6 In the UK, existing lane control schemes are controlled through the use of overhead gantries which contain signals. Section 16 of Schedule 14 (Signs for traffic control by light signals, signs for crossing and signs for lane control) of the Traffic Signs Regulations and General Directions (TSRGD) (2016) states that for light signals for lane control of vehicular traffic the height of the centre of each light signal from the surface of the carriageway in the immediate vicinity shall be not less than 5.5 metres or more than 9 metres.

7 On routes with multiple private access points and side roads, gantries would be required in locations and at an interval which would ensure that all emerging side access traffic had clear line of sight of a gantry in both directions to ensure that drivers were aware of the lane dedication in operation in both directions at the time of entering the main road. Therefore, on most radial routes feeding into Cambridge where bus priority measures are being considered, it

may mean that gantry signs have to be provided at very frequent intervals appropriate to the available main road forward visibility and side access visibility; a spacing of perhaps 100 metres may be required in some locations. With such spacing requirements, the number of gantry signs required would be very high given the length of the transport corridors under consideration as part of the City Deal programme. As well as gantry signings along the main road, some form of advisory signing would be required on all side road approaches to warn/advise drivers as they approach the main road.

8 Generally, existing tidal flow schemes involve reversing the direction of flow of a traffic lane or lanes by time of day. In the City Deal scenario, the arrangements could also involve changes in traffic lane designation (i.e. lanes that are used by general traffic at certain times and by buses only at other times): this scenario becomes much more challenging in terms of developing a safe and understandable method of operation. It would be particularly challenging to ensure that drivers entering from side road/private accesses were aware when the lane dedication was changing between peak period and off-peak periods and from general traffic use to 'bus only' use. Careful thought would need to be given to how a signal/variable sign system was sequenced to avoid conflict between opposing traffic movements when lane control was changed. Advice on signing arrangements would need to be sought from the Department of Transport (DfT) for such an innovative design. Experience suggests that gaining approval for a gantry based signal/signing system that satisfies relevant DfT regulations could take some considerable time.

Safety

9 At the times when lane control and designation is changed at the start and end of peak periods there could be the potential for conflict between certain vehicle manoeuvres. Appendix A sets out some potential conflict scenarios.

Construction, Operational and Maintenance Issues

Construction

10 Signing gantries generally require large mass concrete foundations to achieve the stability required for such structures. Within rural environments and on high speed roads, where gantries are more often employed, space is more likely to be available. In urban environments such as the radial routes feeding into Cambridge, it is likely to be far more challenging to identify adequate space given the presence of public utility apparatus which could be expected to limit the locations where foundations could be constructed within the highway. It may be possible to sleeve some services through the foundations but it is more likely that utility services would require relocate provided space was available within highway boundaries

Operational

11 An operational regime would need to be developed to ensure that any gantry signing system was proactively managed to ensure its safe operation. This could be undertaken by the County Council's Highways Integrated Management Centre and the associated ongoing costs would need to be factored into a business case to ensure adequate resources were available.

12 The introduction of gantry signing would have potential implications for high load routing and this aspect would need to be explored to ensure that existing high load routes were not compromised.

13 The option of a central tidal bus lane as shown in Option A could work well for express bus services but local services would need to use the nearside traffic lane to access local bus stops which would cause additional delay to general traffic movements detracting from the overall journey time benefits achieved. Whilst 'island' bus stops could be used to address this issue, it is very unlikely that adequate highway width would be available on many routes to accommodate this without compromising other highway user needs.

Maintenance

14 The County Council, as highway authority, has no in-house experience of maintaining gantry mounted signing and the expertise needed would most probably have to be procured possibly through its Highway Services contract or through partnership working with other agencies such as Highways England. The life long maintenance costs associated with multiple gantry structures are likely to be significant and would need to be evaluated as part of any business case.

Costs

15 A typical cost for the installation of a gantry across three traffic lanes with appropriate signal/sign aspects might be in the order of £30,000 to £40,000 excluding any costs associated with service diversions and traffic management during construction.

Public Realm Implications

16 One of the primary reasons for considering the use of tidal flow bus lanes is to avoid a need for carriageway widening to accommodate bus lanes in both directions which can have a significant impact on the quality of the street scene. However, there is the potential for the 'cure' to be as bad as the 'disease' as the installation of multiple gantries along some radial routes would, by their very nature, create significant visual intrusion into the street scene. This may have as great an impact as road widening in some situations. Just as road widening can require the removal of trees, there may also be a need for tree removal to accommodate the installation of gantries and/or the significant pruning of trees to provide adequate visibility of the gantry signs/signals.

Conclusions

17 Whilst tidal flow bus lane options may offer an alternative to carriageway widening through the better optimisation of road width, there are significant challenges that would need to be addressed to allow their use. As part of the assessment of options all bus lane layouts should be modelled to allow comparison of the journey time benefits before determining which provides the optimum solution. Experience suggests that securing the necessary DfT authorisation for the gantry mounted sign aspects is likely to be a lengthy process. A detailed risk assessment of the potential vehicle conflicts at those times when traffic lane control is changed between peak period and off peak operations and how they would be managed/mitigated could be expected to form a vital part of gaining the required signing authorisation.

18 Developing a safe operation for changing lane control is a key challenge and risk given the lack of relevant national and internationally experience to draw on. An independent risk assessment would be a useful way of assessing the scale of the risk.

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Background documents

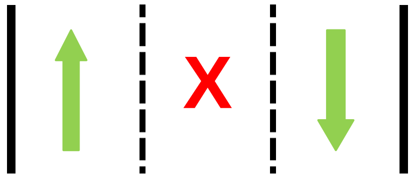
Technical note: Tidal bus lane review (Atkins) 29th January 2016

DIAGRAM 1: TIDAL BUS LANE OPTIONS DAILY OPERATIONAL SEQUENCE

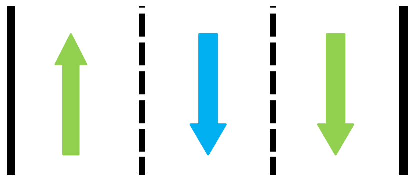
KEY:

X LANE CLOSED TO ALL TRAFFIC TRAFFIC LANE BUS LANE

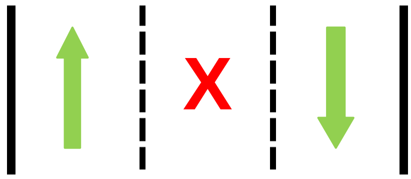
OPTION A: ALTERNATING PEAK PERIOD CENTRAL BUS LANE



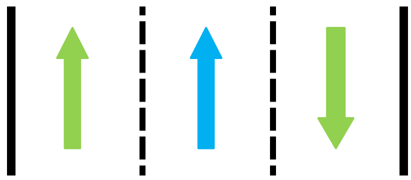
OFF PEAK
Kerbside inbound and outbound traffic lane with central lane closed to all traffic



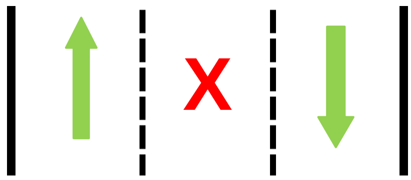
MORNING PEAK
Kerb side inbound and outbound traffic lane with an inbound central bus lane



OFF PEAK
Kerbside inbound and outbound traffic lane with central lane closed to all traffic

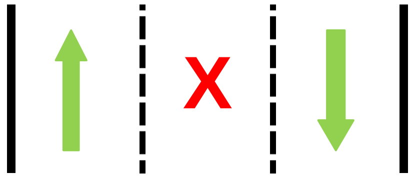


EVENING PEAK
Kerb side inbound and outbound traffic lane with an outbound central bus lane

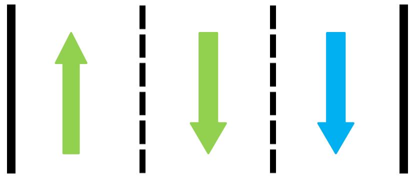


OFF PEAK
Kerbside inbound and outbound traffic lane with central lane closed to all traffic

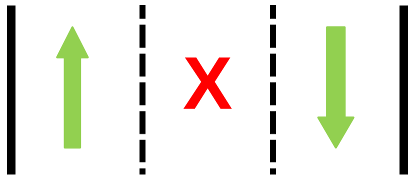
OPTION B: ALTERNATING KERBSIDE PEAK PERIOD BUS LANE



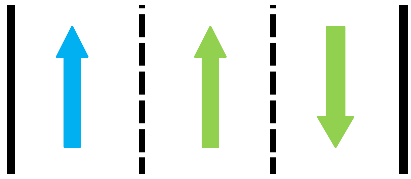
OFF PEAK
Inbound and outbound traffic lane with central lane closed to all traffic



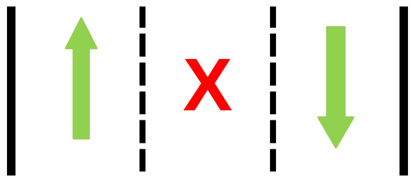
MORNING PEAK
Kerb side inbound bus lane with an inbound central traffic lane and an outbound kerbside traffic lane



OFF PEAK
Inbound and outbound traffic lane with central lane closed to all traffic



EVENING PEAK
Kerb side outbound bus lane with an outbound central traffic lane and an inbound kerbside traffic lane



OFF PEAK
Inbound and outbound traffic lane with central lane closed to all traffic

APPENDIX A

POTENTIAL CONFLICTS DURING CHANGE OF LANE CONTROL

Manoeuvre	Scenario	Conflict	Comment
Vehicle turning right from a side road/private access immediately before central lane is reopened	Vehicle pulls across nearside lane into closed central lane and waits for traffic from the left to clear to complete right turn Vehicle is stationery/held in central lane as traffic is directed into the central lane	Potential for side impact collision	Risk is likely to be greater when turning right into the dominant peak period traffic lane when a delay in completing the right turn is more likely
Vehicle turning right from main road into side road/private access immediately before central lane is reopened to traffic	To avoid holding up following traffic, vehicle pulls across into closed central lane and waits for opposing traffic to clear to complete right turn Vehicle is stationery/held in central lane as traffic is directed into the central lane	Potential for rear/head-on impact collision	Risk is likely to be greater when turning right from the dominant peak period traffic lane when the likelihood of holding up following traffic is greater
	Vehicle is waiting in nearside lane for opposing traffic to clear to turn right into side road/private access Vehicle commences right turn across central lane as traffic / buses are directed into the central lane	Potential for side impact collision	Risk is likely to be greater when turning across dominant peak period traffic lane when a delay in completing the right turn is more likely