Technical Note C

Project:	5097385 – Wisbech TIF	**To:**	Fenland District Council
Subject:	PT Mode Choice Model	**From:**	Atkins Transport Planning
Date:	6th January 2011	**cc:**	

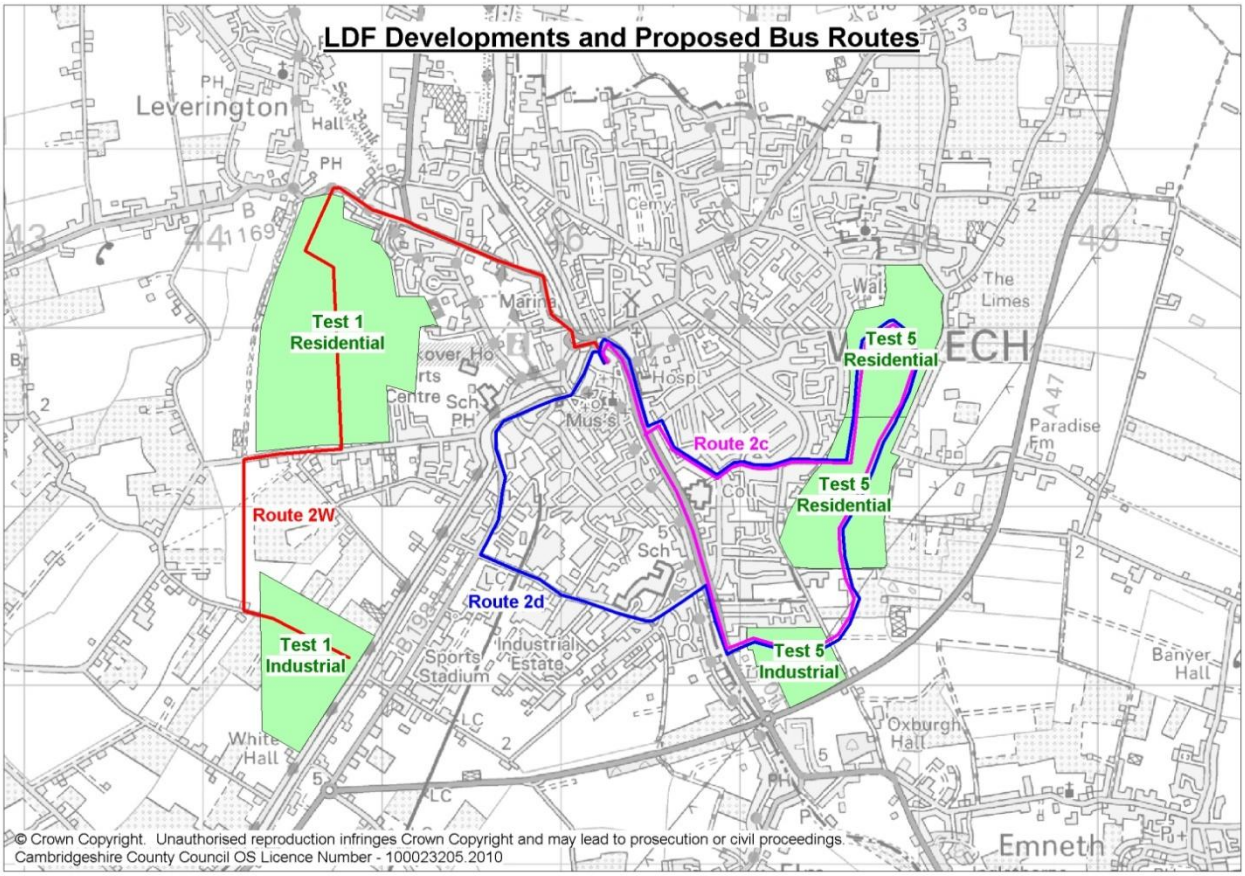
1. Introduction

This technical note concerns the Public Transport (PT) Mode Choice model that has been developed in order to assess the effectiveness of different potential bus service options for Wisbech. Two possible scenarios for the location of major developments under the Local Development Framework (LDF) have been considered: these were assessed in broad highway terms in the previous work on the Wisbech Area Transport Study (WATS).

Under Test 1, the LDF development is situated to the west of Wisbech, as shown in Figure 1.1. Two scenarios have been considered for this test: one with no extra buses, and one with an extra route (known as 2W) serving the western development.

The LDF development in Test 5 is located to the east of Wisbech, also shown in Figure 1.1. Three scenarios have been considered for this test: one with no extra buses, one with a new route (2c) serving the LDF development, and another with a route (2d) that serves both the LDF development and the industrial areas to the south of Wisbech.

Figure 1.1 – Map Showing LDF Developments and Proposed New Bus Routes



The proposed bus routes were developed by considering the number of buses that would be required to run the service with a 30 minute frequency: to keep running costs down, this was limited to one bus per option (in addition to the bus serving the existing town circular route (66)). This ruled out the possibility of a longer service serving the eastern LDF developments and the heart of the industrial area south of Weasenham Lane, because the length of this route would either require two buses or a headway of more than 30 minutes. However, a service that runs along Weasenham Lane itself (and does not detour south into the heart of this industrial area) is feasible, and has been labelled Route 2d.

Routes 2c and 2d are circular, and have both been assumed to run in a clockwise direction for the purpose of testing these options. Route 2W is not circular, since this made the journey time unreasonably long from the bus station to the residential area (again assuming clockwise; or from the residential area to the bus station if assuming anticlockwise). In order to make the route circular, it would run out along B198 Cromwell Road, then across the river and through the Test 1 Industrial area, through the Test 1 Residential area and back to the bus station. A person travelling from the bus station to the Test 1 Residential area would therefore have to travel three-quarters of the way around this loop, despite the crow-fly distance of their journey being much shorter – this would discourage people from using the service. Proposing Route 2W as an 'out and back' service, rather than circular, eliminates this problem. The existing developments along B198 Cromwell Road are already well served by the half-hourly X1 service, so it was not necessary for this route also to serve that area.

It is worth noting that as a simple out and back route, Route 2W has the potential to be easily connected to the existing town circular route (66), sharing vehicles such that there is no need to change bus to travel between the residential areas in the north and east of Wisbech and the LDF industrial development in the south west. In this instance, instead of one bus running round Route 66 all day and a different bus running back and forth along route 2W all day, the two buses would take it in turns to run each route – so a person could travel from the residential areas in the north and east of Wisbech (on Route 66) to the Test 1 Industrial area in the south west (on Route 2W) without physically changing bus.

A similar scenario, with Routes 2c or 2d sharing vehicles with Route 66, is also possible but less likely to be perceived as viable travel option for certain journeys - for instance, with a clockwise loop, a person travelling from the LDF industrial area to the LDF residential area would have to travel around most of one and the whole of another loop. This could be countered by operating both ways round the loop, but this then halves the perceived frequency and so is not recommended.

These five PT scenarios are known as Test 1, Test 1 + 2W, Test 5, Test 5 + 2c and Test 5 + 2d. The WATS zone system has been adopted for this work.

2. Mode Choice Model

A Mode Choice model has been developed for each of the five scenarios, for the AM Peak and Inter Peak periods. This spreadsheet model takes highway inputs from WATS for the year 2026, along with up-to-date (October 2010) bus timetables, fares and route information. Each zone-to-zone movement within Wisbech is considered separately.

The first stage of the model is to calculate the Generalised Cost (GC) of travel between each pair of zones, for car trips and for bus trips. Generalised Cost is a combination of time and distance, expressed in minutes based on DfT valuations of the relative costs of time for personal travel as well as fuel and non-fuel elements of travel cost.

For each zone-to-zone movement:

$$Car\ GC = Time\ (mins) + \left(\frac{Distance\ (km) * VOC\ coefficient\ (pence/km)}{VOT\ coefficient\ (pence/min)}\right)$$

$$Bus\ GC = Time\ (mins) + \frac{Fare\ (pence)}{VOT\ coefficient\ (pence/min)} + Modal\ Constant + (No.interchanges * Interchange\ Penalty)$$

where

- *Time* is the measured journey time, in minutes. For car trips, this was taken from the WATS SATURN model; for bus trips, it was calculated from timetables and includes the time spent waiting to change route if applicable.
- *Distance* is the measured distance of the journey, in kilometres. This was taken from the WATS SATURN model.
- *Fare* is the bus fare in pence, taken from the Norfolk Green website as this is the predominant bus company operating in Wisbech. For simplicity, all journey stages are assumed to be single adult fares (i.e. no return tickets, multi-person discounts or other offers have been taken into account).
- *VOC coefficient, VOT coefficient, Modal Constant* and *Interchange Penalty* are parameters that were originally derived for the CHUMMS mode choice model. They have since been used for a study in Mereham, and are very similar to those used in the Norwich to Peterborough Multi-Modal Study.
  - *VOC coefficient* is a measure of the Vehicle Operating Cost for the journey.
  - *VOT coefficient* is a measure of the traveller's Value Of Time: in the AM Peak, it was assumed that the majority of travellers are commuters; in the Inter peak, it was assumed they were mostly travelling for other (non-commuting) purposes.
  - *Modal Constant* reflects the inherent disutility[1] associated with using public transport, even when all other variables are equal.
  - *Interchange Penalty* is a measure of the 'inconvenience' of changing bus – this is separate to the actual interchange time that was included in the journey time.

[1] The term 'Inherent Disutility' reflects that for those users with a choice of mode, there is a preference for using the car. It represents the impact of negative aspects of using public transport that cannot be measured by the time and fare elements of the Generalised Cost equation. This includes: 1) The fact the user is occupying his/her own space as opposed to sharing space with others, 2) Lack of knowledge of the public transport alternative.

Having calculated the GC for car trips and bus trips for all the available zone pairs within Wisbech, the two can be compared to deduce a mode share for each movement. This comparison is undertaken using an exponential logit function as shown below:

$$Mode\ Share\ (\%\ bus\ trips) = \frac{e^{Car\ GC * Scale\ Factor}}{e^{Car\ GC * Scale\ Factor} + e^{Bus\ GC * Scale\ Factor}}$$

where

- *Car GC* and *Bus GC* are calculated as described above.
- *Scale Factor* is a calibrated value from the CHUMMS mode choice model.

This gives a predicted mode share for bus trips, for each zone-to-zone movement within Wisbech.

3. Results

After the Mode Choice model was run for each of the five scenarios, information was extracted about the percentage of trips within Wisbech that are expected to take place by bus in 2026.

These results are summarised for the AM Peak in Table 3.1 and for the Inter Peak in Table 3.2.

Table 3.1 – Bus Mode Shares in the AM Peak

Test 1		To	
		Rest of Wisbech	LDF Developments
From	Rest of Wisbech	7.3%	0%
	LDF Developments	0%	0%
Test 1 + 2W		**To**	
		Rest of Wisbech	LDF Developments
From	Rest of Wisbech	7.3%	4.6%
	LDF Developments	4.6%	13.2%
Test 5		**To**	
		Rest of Wisbech	LDF Developments
From	Rest of Wisbech	7.7%	6.7%
	LDF Developments	6.0%	0%
Test 5 + 2c		**To**	
		Rest of Wisbech	LDF Developments
From	Rest of Wisbech	7.4%	5.9%
	LDF Developments	5.6%	7.7%
Test 5 + 2d		**To**	
		Rest of Wisbech	LDF Developments
From	Rest of Wisbech	7.3%	7.0%
	LDF Developments	9.6%	7.7%

Table 3.2 – Bus Mode Shares in the Inter Peak

Test 1		To	
		Rest of Wisbech	LDF Developments
From	Rest of Wisbech	3.8%	0%
	LDF Developments	0%	0%
Test 1 + 2W		**To**	
		Rest of Wisbech	LDF Developments
From	Rest of Wisbech	3.8%	2.2%
	LDF Developments	2.2%	7.7%
Test 5		**To**	
		Rest of Wisbech	LDF Developments
From	Rest of Wisbech	4.0%	3.3%
	LDF Developments	3.3%	0%
Test 5 + 2c		**To**	
		Rest of Wisbech	LDF Developments
From	Rest of Wisbech	3.8%	2.9%
	LDF Developments	2.7%	4.1%
Test 5 + 2d		**To**	
		Rest of Wisbech	LDF Developments
From	Rest of Wisbech	3.7%	3.5%
	LDF Developments	5.2%	4.1%

The overall bus mode shares in the AM Peak are higher than those in the Inter Peak, because car travel becomes relatively more attractive when the roads are less congested during the Inter Peak.

The LDF developments in Test 1 are not served by any existing buses, so their bus mode share is zero until a new bus service is (2W) introduced specifically to serve these developments. Similarly, the residential parts of the LDF developments in Test 5 are not served by any existing buses, but the industrial development next to A1101 Churchill Road is served by the route 56.

The average bus mode share for trips originating in the specific LDF development sites under each scenario in the AM Peak is shown in Figure 3.1, and for trips terminating at the sites is shown in Figure 3.2. The average bus mode share for trips originating at these sites in the Inter Peak is shown in Figure 3.3 and for those terminating is shown in Figure 3.4.

Figure 3.1 – Average Bus Mode Share for Trips Originating in LDF Development Sites, AM Peak

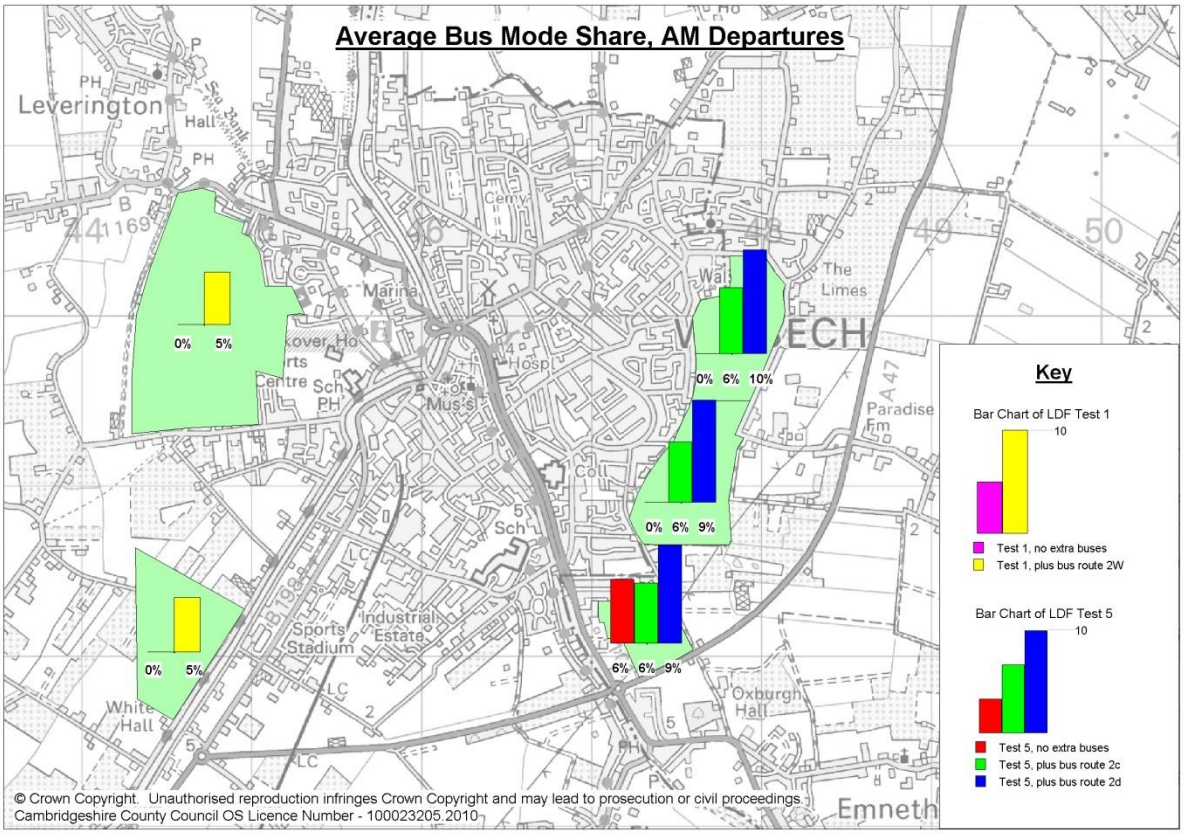


Figure 3.2 – Average Bus Mode Share for Trips Terminating in LDF Development Sites, AM Peak

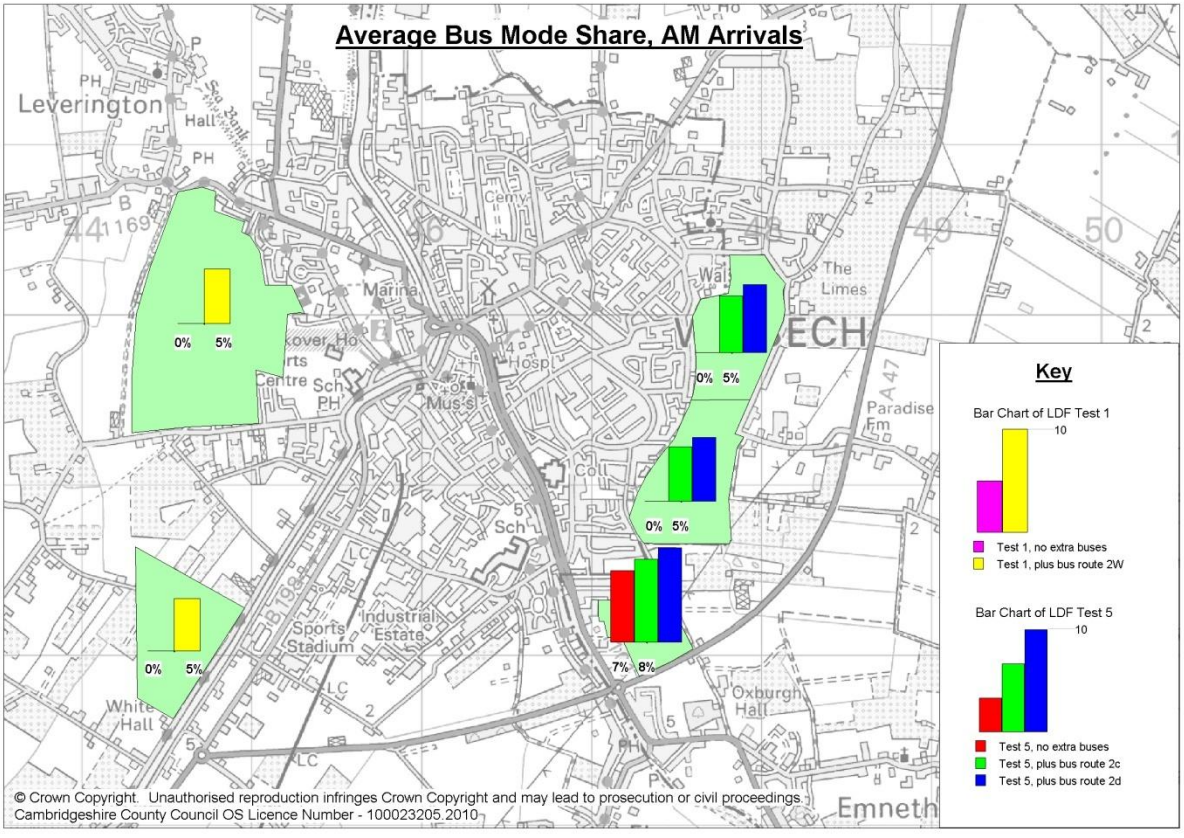


Figure 3.3 – Average Bus Mode Share for Trips Originating in LDF Development Sites, Inter Peak

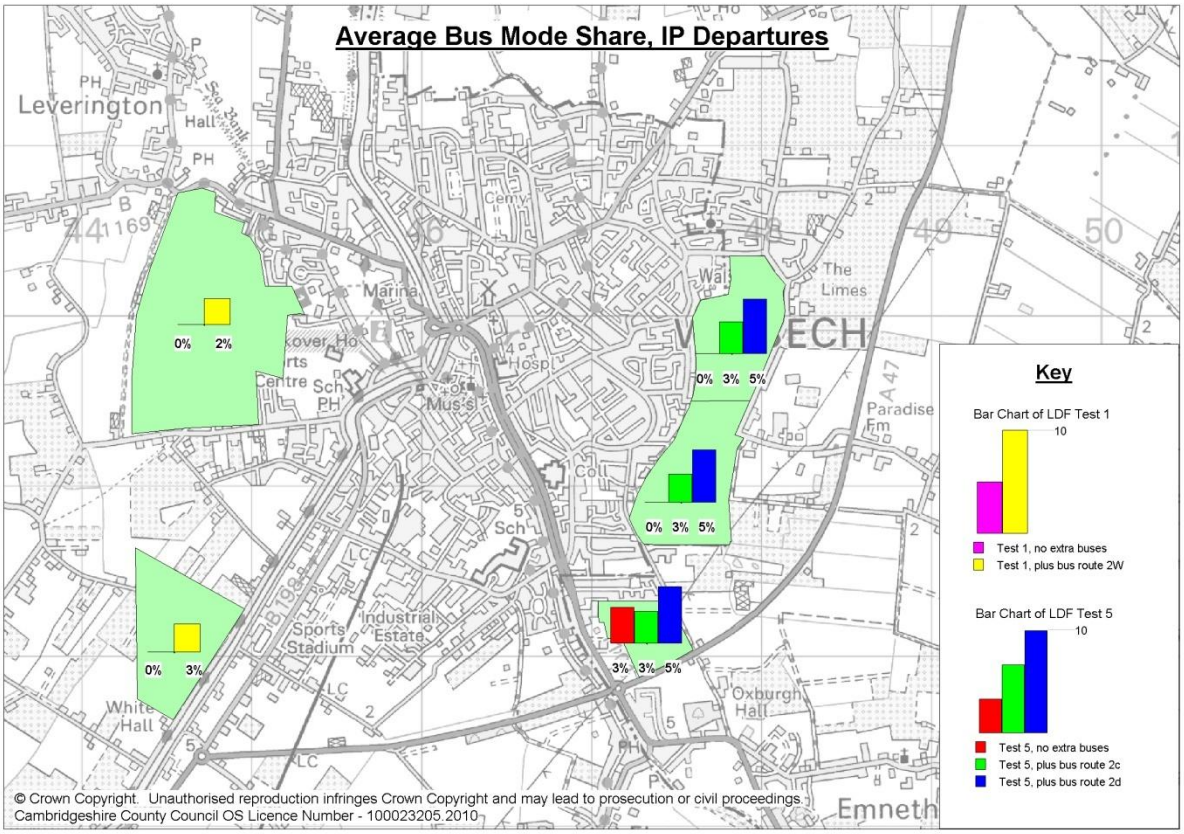
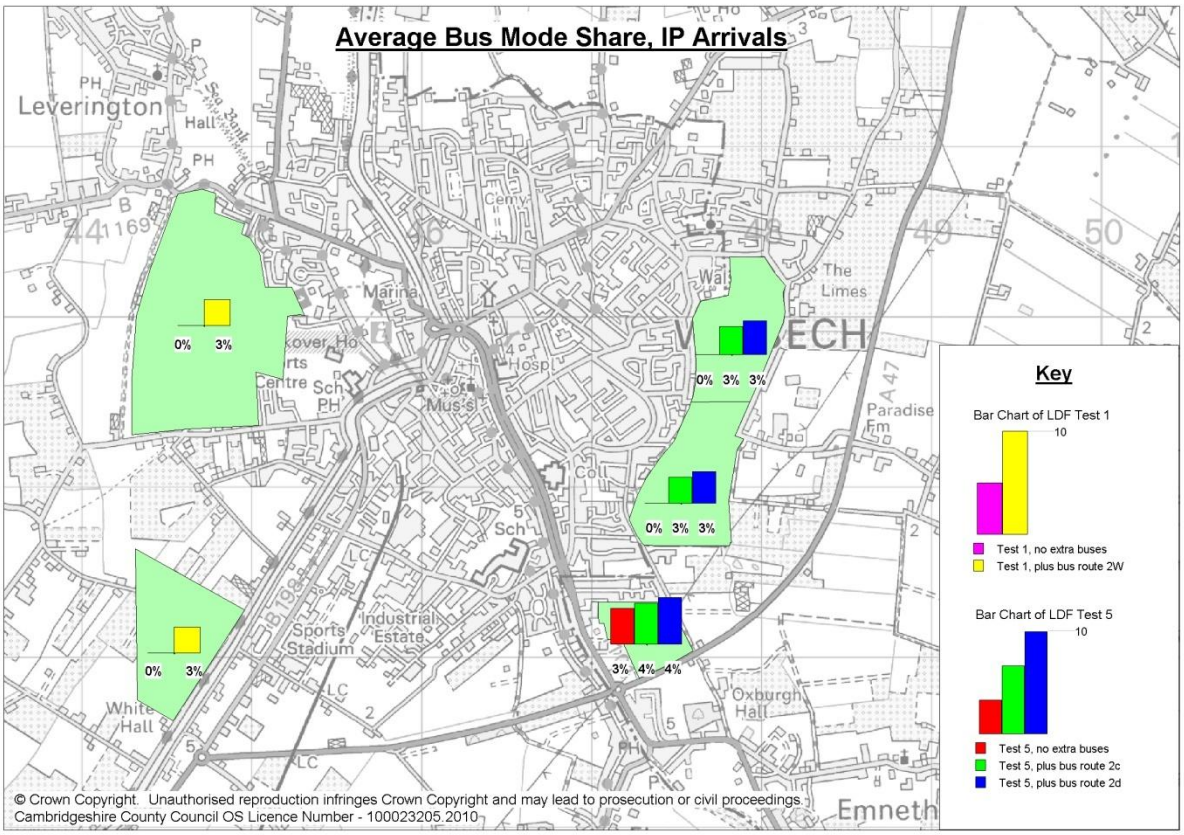


Figure 3.4 – Average Bus Mode Share for Trips Terminating in LDF Development Sites, Inter Peak



4. Conclusions

Figure 3.1 to Figure 3.4 reiterate the results shown in Table 3.1 and Table 3.2, suggesting that the best option overall to achieve the highest bus mode shares is to build the LDF developments to the east of Wisbech (Test 5) and to provide a bus service that also serves the Weasenham Lane industrial areas (route 2d).

It is worth noting that this test is a mode choice exercise, and does not take account of captive public transport users: so if a particular area of Wisbech has unusually low car ownership and therefore high public transport usage, this has not been reflected.

In comparison with another similar project in a different part of Cambridgeshire, these results are very similar, with the exception that the other study was much closer to Cambridge city centre and achieved a higher bus mode share for trips into Cambridge. This is partly due to the much higher parking charges in Cambridge than in Wisbech.