APPENDIX C

The Park and Ride Model

C. The Park and Ride Model

INTRODUCTION

C.1 The Yeovil Traffic model was developed by Atkins for Somerset County Council and the Highways Agency (HA), under a joint agreement. It includes Yeovil and the surrounding rural area and represents an AM peak hour and PM peak hour. The model was calibrated and validated using 2002 traffic data.

C.2 The model is a highways model assigning trips to a representation of the highway network. Buses are included as fixed flow to represent their impact on highway capacity, thus public transport passenger demand is not incorporated into the modelling framework.

C.3 There have been a number of proposals to introduce a park and ride service in Yeovil and the brief for the YTSR required this to be considered. There are a number of alternative methods of forecasting park and ride demand but for this study it was decided to develop a park and ride model as a sub-model of the Yeovil Traffic Model. This provides consistency as it allows park and ride to be assessed to the same level of detail as the other elements of the strategy.

C.4 The model allows the forecast passenger demand from two park and ride sites proposed at Bunford and Babylon Hill and the effect of removing these trips from the highway network. It uses travel costs skimmed from the model, together with local and imported mode choice parameters, to estimate the number of car drivers who would switch to park and ride under future traffic conditions.

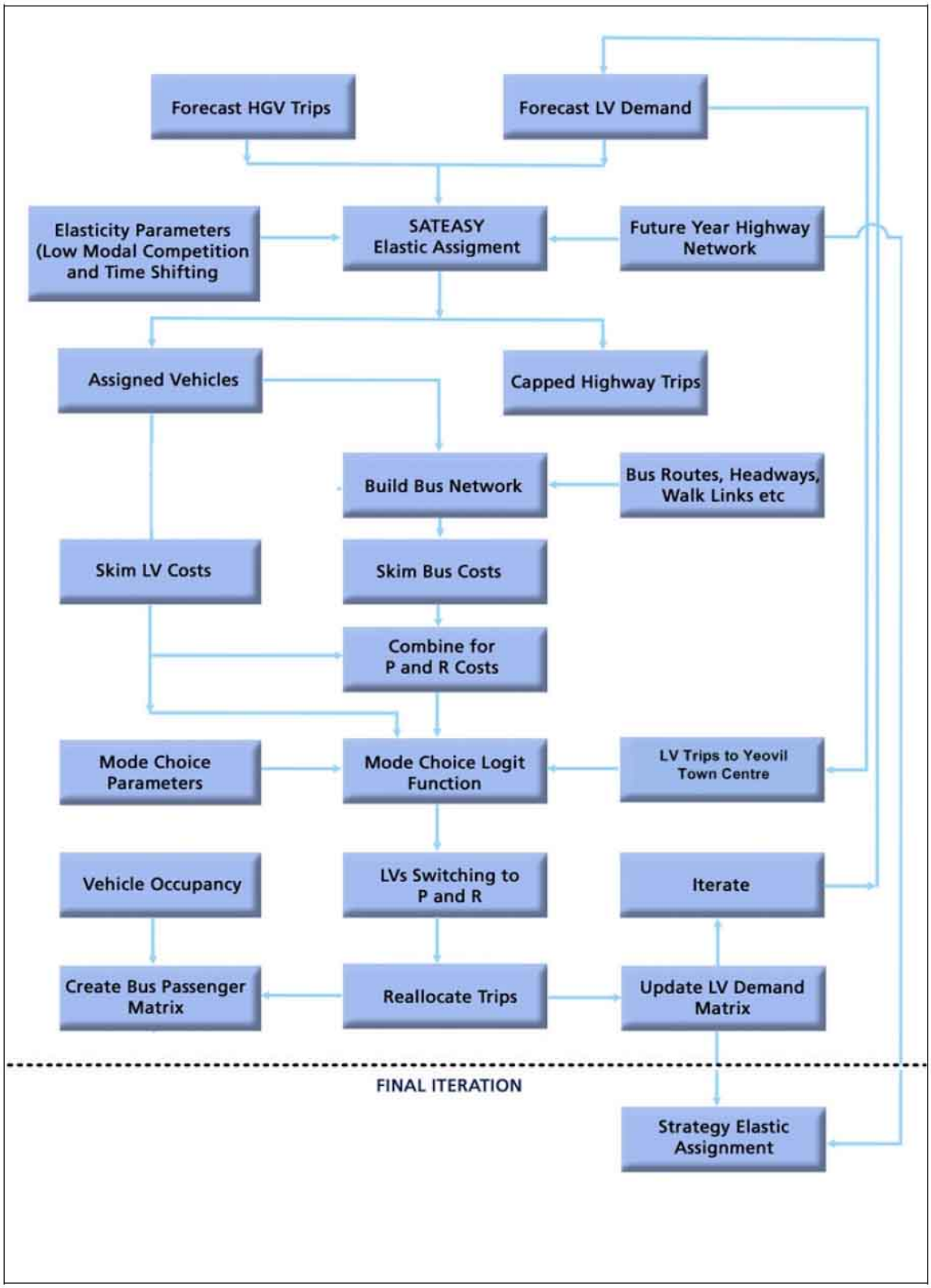
C.5 This note describes the operation of the model, the main assumptions, and the forecasts of park and ride patronage in the 2011 AM peak hour, assuming that both sites would be operational by then. It also reports a number of sensitivity tests of the key input parameters including the impacts of alternative parking charges, service headways and levels of bus priority.

OPERATION OF THE MODEL

C.6 The park and ride sub-model is summarised in Figure C.1. It has been built on the SATURN based Yeovil Traffic Model, which assigns matrices of light and heavy vehicles to a detailed network, and simulates the effects of this traffic on queues and delays at junctions.

C.7 An elastic assignment procedure is used to suppress the growth of traffic demand in response to increasing highway congestion. It employs simple elasticity parameters to reduce travel demand between zones based on modelled cost differences between the base (2002) and strategy (2011) years, thus representing the effects of these cost changes on more marginal road users. Elasticity parameters recommended by the Department for Transport (DfT) have been used, assuming that some time shifting would occur and that modal competition would be low. Modal transfer resulting from park and ride is modelled separately.

Figure C.1 - Park and Ride Model Forecasting Procedure



C.8 Speeds from the congested traffic assignments, after trip suppression has been taken into account, were extracted from SATURN and used to build the bus network that serves the park and ride sites. This ensures compatibility between the travel costs by alterative modes. The two networks are then skimmed to provide the costs for input to the mode choice model.

C.9 Park and ride travel costs are estimated for each zone to zone movement by combining car costs from the origin to each of the proposed park and ride sites with the subsequent costs of travel by bus to the town centre destination. The park and ride site which offers the least overall cost is then selected as the preferred parking location.

C.10 The mode choice model uses a standard binomial logit function to forecast the proportion of car drivers that would transfer to park and ride, on the basis of these costs. It compares the costs of travel by car (for the whole journey including parking charges and search times) with the equivalent costs of travel by car and bus.

C.11 The mathematical form of the model allows trips to use park and ride even if the cost is greater than travelling by car. Although this is not unrealistic it is unlikely to occur regularly therefore the model does not allow trips to transfer to park and ride if their costs are more than 10% greater than the equivalent car costs.

C.12 The trips which are forecast to use park and ride are still included in the car matrix but the destination for these trips is adjusted from a town centre zone to the appropriate park and ride site.

C.13 The adjusted light vehicle demand matrix is then assigned to the modelled road network and capped for trip suppression, the bus network is revised on the basis of the new traffic speeds (due to reduced car usage), and the costs are re-skimmed. This process has been iterated through 6 loops for each test.

KEY ASSUMPTIONS

C.14 It has been assumed that buses would operate on a single route running between the park and ride sites via the town centre. The route would have two stops, in the town centre at the bus station, and a second stop adjacent to Agusta Westland on the A3088 Lysander Road.

C.15 The route taken through the town centre was determined by examining the Yeovil Traffic Model to find the fastest route through the network. Figures C.2 and C.3 show the route and stop locations of the proposed park and ride service. The locations of the park and ride sites at Bunford and Babylon Hill are indicative and show the general area that a park and ride site could be located. No work has been undertaken assessing the optimum location for the sites.

C.16 Traffic speeds extracted from the SATURN model were factored by 1.10 to represent lower bus speeds and time lost at bus-stops. Walking times and waiting times (calculated at half the bus headway) were factored by 2, as recommended by DMRB, to represent peoples' aversion to these elements of journeys by public transport, and their misperception of the time involved.

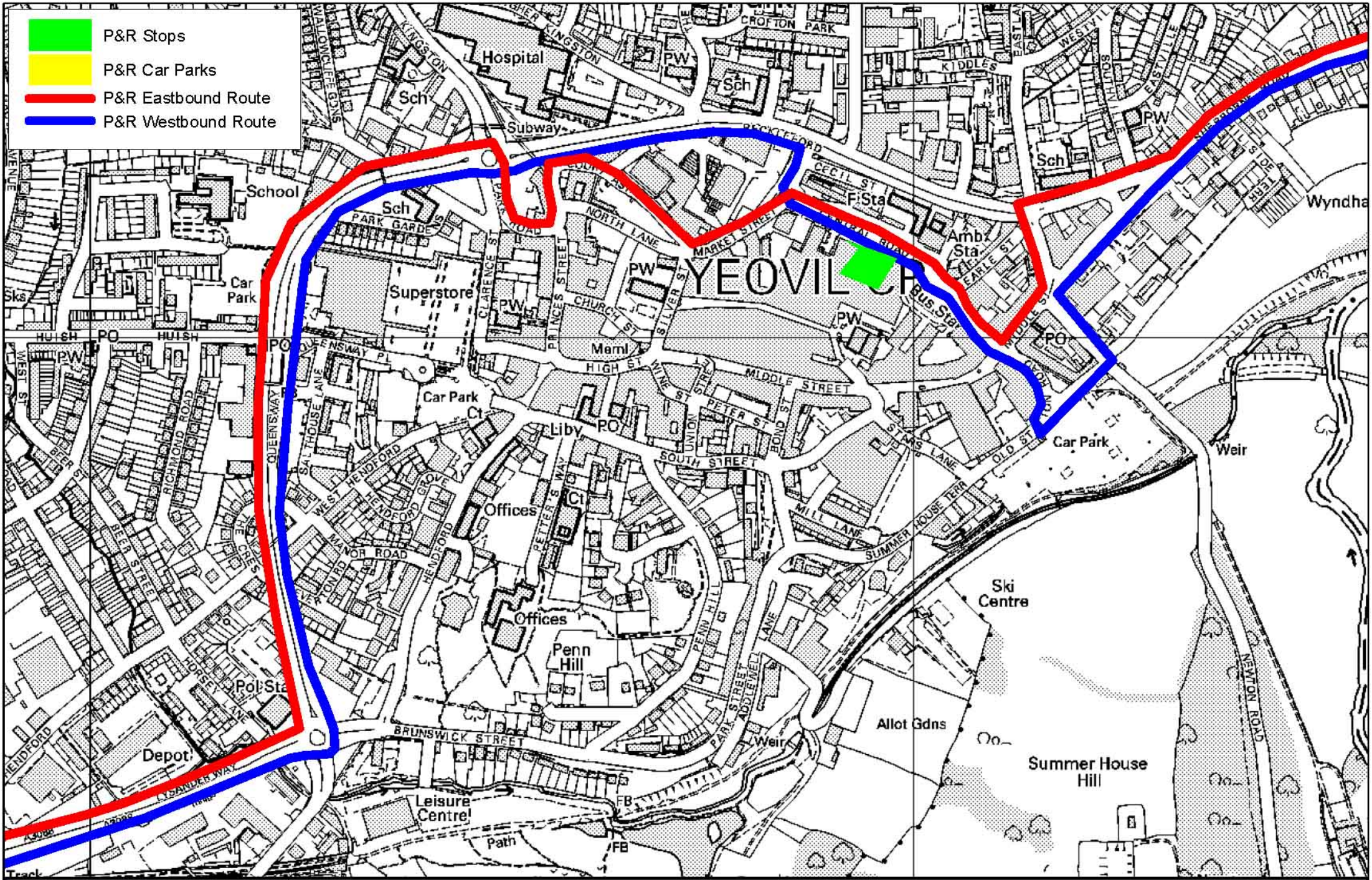


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Figure C.2 - Proposed Park and Ride Routes and Stops

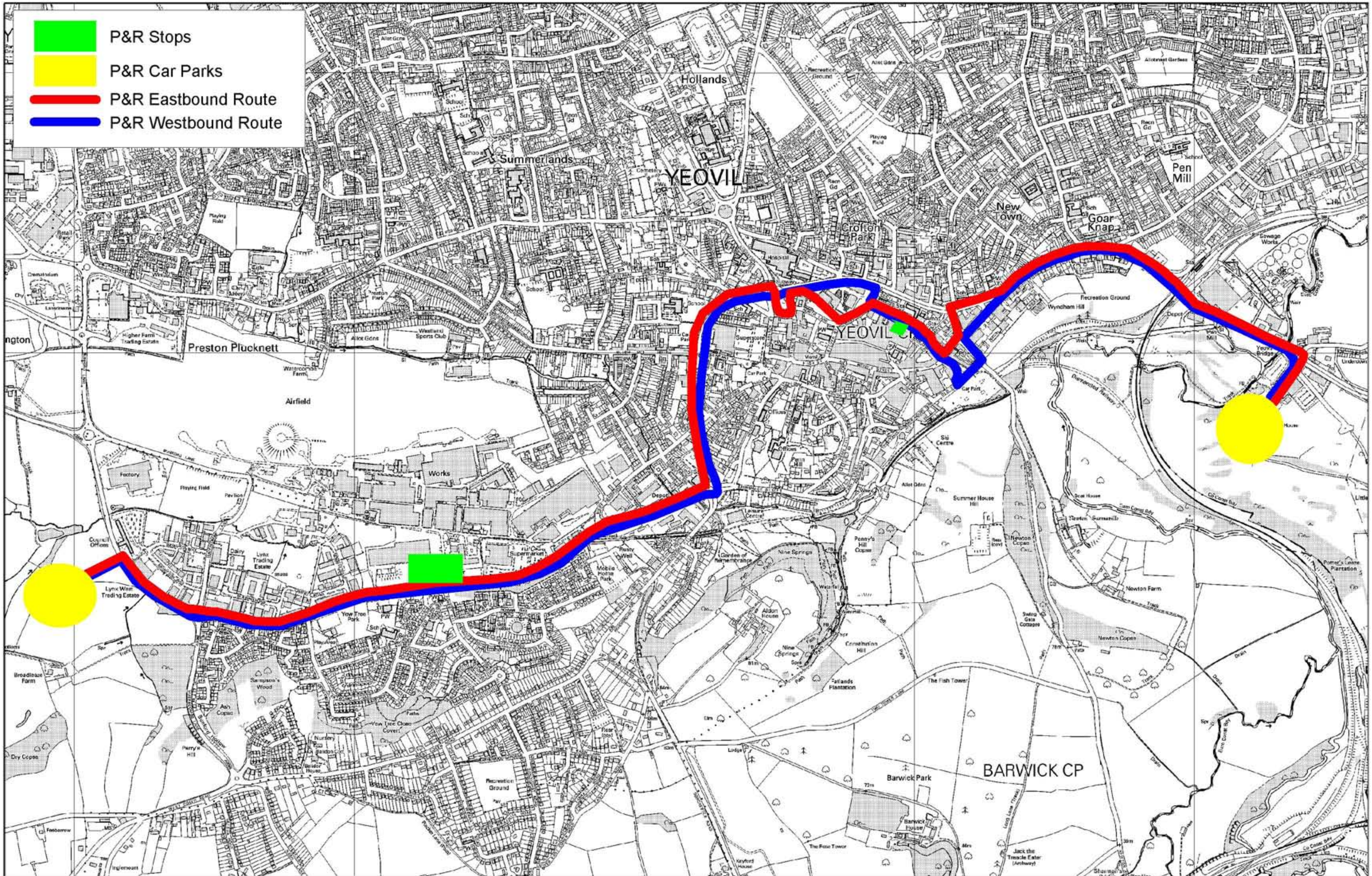

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Figure C.3 - Proposed Park and Ride Routes and Stops

C.17 Forecast traffic demand was based on the 2011 Local Plan allocations plus windfall sites identified in consultation with SSDC. Overall growth was controlled at district level to TEMPRO 4.2.3 forecasts. This process is described in detail in Appendix A of this report.

C.18 The model assumed that travel costs by car included:

- Journey time from origin to town centre destination, based on traffic conditions in 2011;
- Vehicle operating costs, at 9.3 pence per kilometre, based on the Transport Economics Note (TEN);
- Parking charges in the town centre of £1.50 per day (This is a weighted average of the cost of long stay car parking in Yeovil Town Centre and due to the compact town centre the same charge is applied to all zones. Sensitivity tests presented later in the report consider the impacts of increasing those charges);
- Parking search time of 4 minutes for trips going to town centre car parks and 2 minutes for trips going to Agusta Westland and adjacent zones; and
- The proportion of trips to the town centre that would consider switching to park and ride was assumed to be 50% and trips to Agusta Westland (where there is uncontrolled parking) was assumed to be 25%.

C.19 The travel costs by park and ride were assumed to include:

- Car journey times from origin to preferred park and ride site;
- Vehicle operating costs for this part of the journey;
- In-vehicle bus time from the park and ride site to the most convenient destination bus stop;
- Bus fares assumed at a fixed flat rate of £1.50 per person (consistent with other UK park and ride fares);
- Average waiting time, assumed to be half the headway (6 minutes) and factored by 2, as noted above; and
- Walking time, within the park and ride site, and from town centre bus station and Lysander Road bus stop to the final destination zone; also factored by 2.

C.20 The service headway was assumed to be 12 minutes or five buses per hour as it was unlikely that the forecast demand would warrant additional services. Further tests were also carried out looking at the sensitivity of the demand forecast to headway.

C.21 All costs were converted to generalised cost minutes assuming a 2011 AM peak hour value of time per vehicle of 15.4 pence per minute, based on TEN values. The value of time includes Light Goods Vehicles (LGV) as well as cars, and vehicles on working time, as well as those on non-working time (commuting), even though drivers of LGV's and those on business may be less likely to switch modes.

C.22 As such, the value of time used in the forecasts may be too high. However, since most of the monetary costs are incurred by car drivers, lower values of time would increase forecast car costs and thus tend to increase the proportion switching mode. A higher value of time would therefore provide a more conservative forecast.

C.23 The mode choice parameters are a key input to the model, and have therefore been carefully selected. A dispersion parameter of -0.048 was used which had been estimated by the Peter Davidson Consultancy from stated preference data collected in Taunton in 1994. This value is supplied by similar studies elsewhere and is considered to be typical. However, the modal constant of 6 minutes, estimated from the same data, was felt to be too low.

C.24 Instead a modal constant of 18 minutes was used which had been calibrated for a similar study of park and ride in Salisbury (based on a dispersion parameter of -0.0456) so that modelled base year demand for an existing site matched the observed demand. Other studies however have used higher modal constants of 30 minutes and above. Park and ride modelling for Taunton used the same values where to ensure the robustness of the forecasts a series of sensitivity were undertaken based on modal constants of 18 minutes ± 12 minutes (i.e. from 6 minutes to 30 minutes).

C.25 Ideally, the value of time used to convert monetary costs to generalised minutes should be consistent with the calibrated mode choice parameters. In this case, values of time estimated by Peter Davidson Consultancy; factored by average occupancy (1.21) to represent vehicles, and by the forecast growth of GDP per head (from TEN) to represent the 2011 AM peak hour would be about 3.5 pence per minute. This is much lower than the equivalent values based on TEN. However, as mentioned previously, the higher values of time used in the model are likely to provide a more conservative estimate of park and ride demand.

MODEL FORECASTS

C.26 Based on the assumptions outlined above, the model has been used to forecast the impact of the proposed park and ride sites in the 2011 AM peak hour. Table C.1 shows the Base Strategy Park and Ride Forecast which is the forecast patronage for the park and ride service with the other elements of the strategy in place.

C.27 The test assumes that parking charges have not been changed from the current £1.50, the bus fare is £1.50 per passenger and the service operates with a 12 minute headway. The table shows the number of vehicles that would transfer to each site, and the bus passengers that this would generate (based on an average occupancy of 1.21).

Table C.1 – Base Strategy Park and Ride Forecast, 2011 AM Peak

Park and Ride Site	Forecast Transfers – 2011 AM Peak Hour	
	Vehicles	Passengers
West (Bunford)	11	13
East (Babylon Hill)	18	22
Total	29	35

Source: Yeovil Park and Ride Model

C.28 It can be seen that there is minimal forecast patronage which is unsurprising as the park and ride service is not offering any advantage in cost over the car. To

understand how demand for park and ride would increase with higher car parking charges in the town centre a series of test were undertaken increasing the car paring charges in £1 increments.

C.29 Table C.2 below shows the results of the tests changing the car park charges. The headway of the park and ride service is maintained at 12 minutes.

Table C.2 – Park and Ride Forecasts, 2011 AM Peak – Increased Car Park Charges

Park and Ride Fare	Car Park Charge	Passengers using West (Bunford) Site	Passengers using East (Babylon Hill) Site
£1.50	£1.50	13	22
£1.50	£2.50	63	62
£1.50	£3.50	117	114
£1.50	£4.50	165	150
£1.50	£5.50	203	177

Source: Yeovil Park and Ride Model

C.30 The table shows that significant demand can be achieved if the car park charges in Yeovil are increased significantly and so increasing travel costs for car trips. In broad terms a £1.00 increase in parking charges represents an increase of 6.5 generalised cost minutes for car.

C.31 To see if a decrease in the fare for using the park and ride service would stimulate an increase in demand further sensitivity tests were carried out. These reduced the fares to £1.00 and £0.50 whilst keeping parking charges at current levels and maintaining a headway of 12 minutes. Table C.3 shows the results of these tests.

Table C.3 – Park and Ride Forecasts, 2011 AM Peak – Increased Car Park Charges

Park and Ride Fare	Car Park Charge	Passengers using West (Bunford) Site	Passengers using East (Babylon Hill) Site
£1.50	£1.50	13	22
£1.00	£1.50	35	45
£0.50	£1.50	73	72

Source: Yeovil Park and Ride Model

C.32 This analysis shows that a reduction in fares will result in a reasonably modest increase in patronage, especially when compared with the results of the increased car park charge tests. The largest reduction in fare that could be modelled was £1.50 per passenger (i.e. a free service) which can be compared to the increases in car parking per vehicle of up to £4.00. In addition a reduction in fares will result in lower revenue and make the service less likely to cover its costs.

FLEET REQUIREMENTS

C.33 Analysis of the journey times along each of the park and ride service routes showed that for a service running with a 12 minute headway it would just be possible to