Cuckoo Farm Park and Ride, Colchester

Park & Ride Feasibility Study

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Produced for:

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EXECUTIVE SUMMARY

Overview

This report has investigated the feasibility of providing a new Park and Ride (P&R) facility for Colchester on vacant land to the north of the A12 Trunk Road at Cuckoo Farm. Options for a facility with 1,000 and 2,000 car parking spaces as prescribed by ECC have been investigated with general access to the site from the proposed new dumb-bell roundabout junction on the A12(T). Two options for bus access have also been explored using either the proposed A12(T) dumb-bell junction or a bus only link to Boxted Road. The 2,000 space option assumes that the proposed sister P&R site at Eight Ash Green does not advance as planned.

The study has confirmed that a site immediately north and extending north west of the proposed new A12(T) Service Area is the most acceptable in planning terms. Layout options are therefore focused on Parcels A (3129) and B (5032) with some encroachment into Parcel C (8839) anticipated with 2,000 spaces. These land parcels are shown in Figure 1.1 of the main report.

Site Layout

A number of outline designs have been developed to include variations with a central bus terminus, an alternative focused towards the proposed A12(T) Service Area and the bus only link to Boxted Road access route. The designs have been developed to show general vehicular access to the P&R site from the proposed A12(T) dumb-bell roundabout and a combined access in the form of an internal roundabout further north to cater for both P&R and Service Station traffic. An assessment is provided to confirm that the internal roundabout will operate satisfactorily. The options for site layout are provided as drawings in Appendix B to the report.

A12(T) Junction Operation

The proposed A12(T) dumb-bell junction is assessed for an Opening Year of 2010 and a Design Year of 2025 both 'with' and 'without' the P&R site for 1,000 and 2,000 spaces. The outcome of submissions and discussions with the Highways Agency related to the impact of a site with 1,000 car parking spaces on the A12(T) is also included. An assessment of the 2,000 space options for 2025 has been undertaken, although not formally reviewed by the Highways Agency at this time. Evidence is presented to show some capacity issues at the proposed A12(T) dumb–bell in 2025, with an indication of how these could be addressed at a later time if required.

SERTS Principles

SERTS principles have been applied to the proposals with a case presented to indicate how the site is capable of applying with them.

Bus Route Choice

Routes via the A12(T), Boxted Road and the Community Stadium have been examined, with guide journey times provided based on journey time surveys carried out during the study. This has been supplemented by a further assessment of route options from

Colchester North Station, to include the potential to serve the Station forecourt and Colchester Hospital, to link with Colchester Town Centre.

Summary of Findings

The Site Feasibility Report indicates that:

- The Favoured location of the site is towards the west of the proposed A12(T) dumb-bell (The Western Site), just north of the planned service station;
- The Proposed A12(T) junction will function satisfactorily in the 2025 Design Year, although there may be a need to consider improvements to the southern NAR Phase 3 approach from south;
- The proposed P&R development for 1,000 spaces should not have a material impact on the Trunk Road network within the 15-year design life, particularly in relation to it being located adjacent to the proposed new A12(T) junction at Cuckoo Farm. This is likely to be acknowledged by the Highways Agency;
- Round trip timing for P&R buses is around 25 - 30 minutes, which may limit its attractiveness to customers;
- Overall it appears that there is little to separate various route choices in terms of round trip journey times. Boxted Road could avoid potential for unpredictable delays that may occur on A12(T) and community stadium/ NAR alternatives;
- Boxted Road - Community Stadium - NEB is probably the best route, subject to the route meeting the requirements of the highway authority in terms of operation and safety. The A12(T) Junction - Community Stadium - NEB route is the second choice that needs further investigation;
- Final optimum route choice needs to satisfy requirements for public acceptance, journey time reliability and demand for a P&R service that will stop at key destinations and also maximise town centre penetration;
- Can accommodate SERTS principles, particularly in relation to serving the Hospital, North Station and linkages with the Town Centre; and
- Best for rail passengers to have stops just south of the rail station.

The study has recommended that in order to obtain more robust results, the following additional work should be commissioned:

- A more detailed examination of bus journey times and network operations;
- Analysis of the potential impact of traffic growth or restraint measures over time to allow journey time comparison between general traffic and P&R bus journeys;
- Assessment of bus operations and potential for bus priority at North Station Gyratory;
- Detailed site assessment of bus stopping opportunities and pedestrian routes to and from the station immediately south of the railway Bridge at North Station; and

- A more detailed examination of access arrangements and junction designs for Boxted Road to include the need to determine traffic speeds and volumes and vertical road alignments.

The following has also been identified as needing further consideration and consultation when carrying out the above additional work:

- Whether to progress any option for buses routing via Boxted Road;
- The optimum layout option to be taken forward for more detailed design and presentation in association with any subsequent planning application;
- The merits of a more detailed route assessment and modelling exercise of the various options to determine the interaction between P&R bus journeys, the delay through junctions and the competing journey times likely to be experienced by the car;
- The need for a detailed assessment of anticipated P&R demand;
- The optimum route choice to link the site with the town centre bearing in mind SERTS principles; and
- The arrangements to cater for P&R buses and passengers that focus on Colchester North Station and any requirement to consider further bus priority and/ or pedestrian enhancements surrounding North Station roundabout.

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1 Introduction

1.1 Background

This study has been carried out on behalf of Essex County Council (ECC) to investigate the feasibility of providing a new 1,000 space Park and Ride (P&R) facility for Colchester on vacant land to the north of the A12 Trunk Road (A12(T)) and east of Straight Road at Cuckoo Farm. The land is currently under ownership of Colchester Borough Council. In the document 'Transport for Colchester[1]', the overall transport strategy aims at achieving three P&R facilities located North (Cuckoo Farm), West (Stanway) and East (A133) of Colchester to serve future demand and underpin a sustainable transport strategy for the Town. The proposed facility at Cuckoo Farm joins Stanway as one of two P&R facilities being actively developed at this time.

General highway access to the Cuckoo Farm site is envisaged from a proposed new junction on the A12(T). This junction, in the form of a dumb-bell roundabout arrangement, is to be funded through developer contributions associated with land to the south of the A12(T), situated between the Trunk Road and Mill Road. The land development is for primarily housing, with some ancillary commercial development and a new Community Stadium.

1.2 Original Appointment

To determine the impact of P&R at Cuckoo Farm, Essex County Council (ECC) originally appointed Mouchel Parkman (MP) in December 2005 to provide a Feasibility Study for the site, with access from the proposed new A12(T) junction. This original study was to be focussed on three main elements:

1. Initial design and costing of the site access and internal layout;

2. Investigation of the impact of the proposed P&R site on the proposed new A12(T) roundabout junction; and

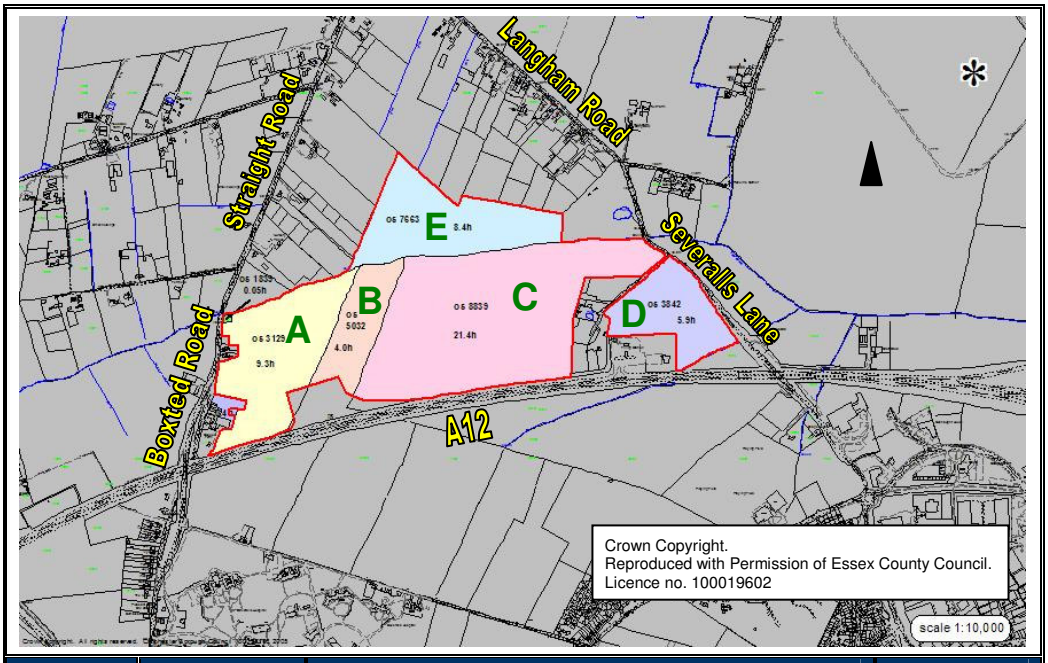
3. Investigation of possible bus priority and capacity improvements on the Northern Approach (Phase 3) and/ or Boxted Road/ Straight Road, Colchester, and the choice of the appropriate bus route for the P&R buses north of the railway.

[1] Transport for Colchester - Essex County Council & Colchester Borough Council

The study was based on an understanding that only one site option would be developed to the required level of detail, to include broad cost estimates in support of informed decisions as to the feasibility of P&R at Cuckoo Farm. A copy of this Brief is included in **Appendix A.**

1.3 Revised Study Brief

Following project inception, discussions with Colchester Borough Council (CBC) identified that the Borough Council owned five parcels of land to the north of the A12(T). It was confirmed that any of these could be used for P&R purposes. These are shown in Figure 1.1.



PARCEL	OS REF	LOCATION	AREA (HA)
A	3129	East of Boxted Road	9.3
B	5032	Adjacent to 3129	4.0
C	8839	Largest parcel to West of current Service Station	21.4
D	3842	East of current Service Station	5.9
E	7663	North of two central parcels	8.4
		TOTAL	**49.0**

Figure 1.1: Cuckoo Farm - General Location and Land Parcel Details

The parcels are broadly situated within a triangle of roads formed by the A12(T) Trunk Road to the south, Straight Road/ Boxted Road to the West and Langham Road/ Severalls Lane to the East. Direct access to the local road network for buses is potentially available via both Straight Road-Boxted Road and Severalls Lane for onward connections to Colchester Town.

During the progression of work on the original brief it was determined that the relative position of the various land parcels allowed consideration of other access and site layout arrangements, which would offer an expanded option choice. This matter was tabled at a progress meeting with ECC on 25 January 2006, where three main options for site development were identified. It was agreed that the route for general P&R traffic would remain focussed on the new A12(T) access junction; however the choice of routing arrangements for buses should include consideration of both:

a. The proposed A12(T) dumb-bell roundabouts and the Northern Approach Road (NAR) for onward linkages with the Town Centre; and

b. Boxted Road.

ECC later agreed to expand on the original scope of the project to assess these options in accordance with a revised study brief issued on 17 February 2006 which is attached in **Appendix A**. The final agreed options for testing are given in Table 1.1.

OPTION		BUS ACCESS	AREA	AREA (HA)
1	a	A12(T) Bridge	**Parcel A (3129)**	**9.3**
	b	Boxted Road		
2	a	A12(T) Bridge	**Parcels B and C (5032/ 8839)**	**25.4**
	b	Boxted Road		
3	a	A12(T) Bridge	**Parcels A and B (3129/ 5032)**	**13.3**
	b	Boxted Road		

Table 1.1: Agreed Options for Testing

ECC also confirmed that all these options should be taken forward at the same level of detail to accord with the original brief. This would ensure that a proper and informed choice could be made between them. Options 1 and 2 are to be assessed in support of a 1,000 car parking space facility. Option 3 examines the feasibility of a 2,000 space option.

Further discussion between ECC and CBC suggested that the principal options being considered would be those located to the west of the proposed A12(T) junction, i.e. focussed on parcel 3129. A 1,000 space option to the East of this junction has however been retained to maintain flexibility in the future choice of options.

Overall the key objectives of the Cuckoo Farm P&R project remain in accordance with those described above. The following objectives associated with the revised study brief have now been added:

1. To ensure that all feasible options are developed to the same level of detail;

2. Inclusion of consideration of the full priority route to Colchester Centre;

3. Incorporate into the project the potentials identified by the South Essex Rapid Transit Study (SERTS); and

4. Detailed consultations with the Highways Agency (HA) on appropriate options.

With respect to the Highways Agency (HA), ECC requested that consultation should only occur following the completion of the s106 Agreement for the development and that details of proposals issued to the HA should be agreed with ECC before being tabled for discussion with HA. This has been strictly adhered to and all meetings with the HA were held after the completion of the s106 Agreement documentation.

1.4 Feasibility Study Framework

The remaining part of this Feasibility Study is presented in the following sections:

- Section two follows this introduction to provide a general description of the site to include the existing access arrangements, the surrounding highway network and details of the NAR.

- Section three sets the framework for site access and internal layout options;

- Section four provides an assessment of maximum P&R demand, based on 1,000 and 2,000 car parking spaces, traffic generation and distribution on the adjoining network.

- Section five describes the impact of the site on the proposed A12(T) dumb bell roundabout;

- Section six provides an outline on the application of SERTS principles to the site;

- Section seven outlines the bus route assessment framework that include details of the various route choices available to the north of Colchester North Station;

- Section eight develops framework outlined in section seven to provide an assessment of further route choices to complete the link with Colchester town centre;
- Section nine provides the survey methodology and approach used to determine bus journey times as a guide to potential P&R route choice;
- Section ten gives a summary and conclusions to the overall study; and
- Section eleven concludes with the study recommendations.

For convenience, larger figures, supporting data and other relevant information referenced in the study are presented as **Appendices**.

2 Study Area

2.1 Overview

This section is an outline of the Study Area in relation to the local highway network and the overall road hierarchy.

2.2 Surrounding Highway Network

The study area is located to the north of Colchester within a triangle of roads formed by the A12(T) Trunk Road to the south, Straight Road/ Boxted Road to the West and Langham Road/ Severalls Lane to the East. Direct access to the local road network is potentially available via both Straight Road-Boxted Road to the west and Severalls Lane to the west for onward connections to Colchester Town. The use of Severalls Lane is not an option for consideration given the focus for general vehicular access to the site via the proposed new A12(T) dumb-bell roundabout junction, which provides a more suitable conduit for movement. The location of the site relative to the surrounding highway network is shown in Figure 2.1.

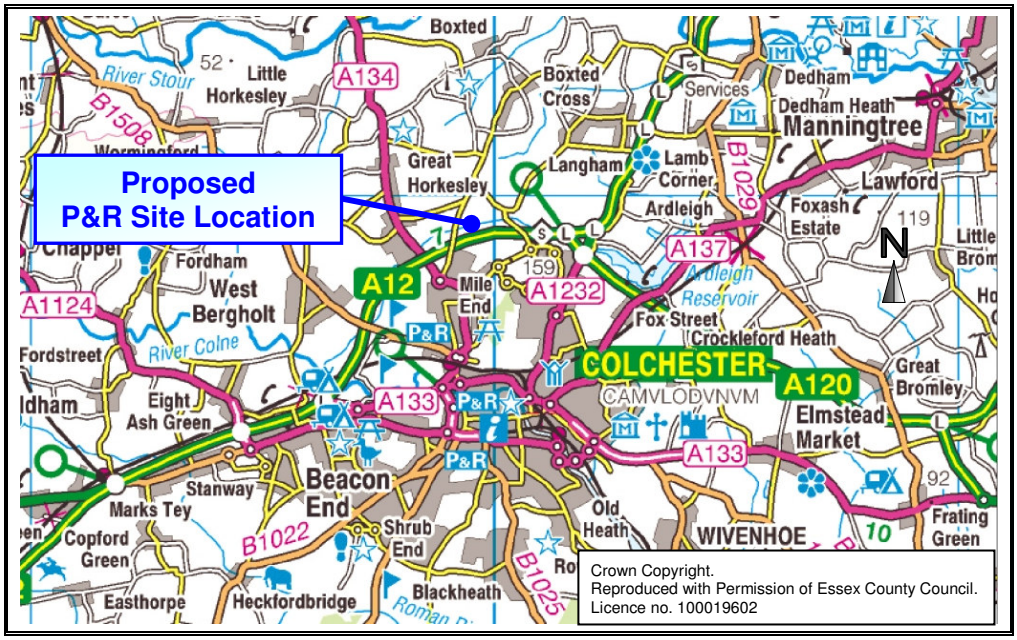


Figure 2.1: General Location

2.3 The Northern Approach Road

A significant amount of new development is currently evolving for land to the north of Colchester town centre. This includes the proposals associated with the new Community Stadium focussed on land to the south of the A12(T) and

Cuckoo Farm. To satisfy the traffic needs and to improve the road network generally in the area, developers have funded the construction of a new road, with new access roads identified at strategic points to serve various development sites. When the proposals are entirely complete the Northern Approach Road (NAR) will eventually link the proposed new dumb-bell junction at the A12(T) Cuckoo Farm with the area surrounding the junction of North Station.

A significant part of the route has already been constructed and provides a link between North Station Gyratory in the South and the A134 Nayland Road/ Boxted Road roundabout in the North. The main section from Colchester Station to Mill Road is referred to as NAR Phase 2, with the section from Mill Road to Nayland Road/ Boxted Road added to the additional plans to form NAR Phase 2a. Phase 2a was completed early in 2003, with this section of road formally opened in June 2003. In the future, Phase 2a will be amended so that Phase 3 continues directly from Phase 2, with Phase 2a entering through a new signalled arm from the Mill Road / NAR junction.

The proposals for NAR Phase 3 include an extension of the road to the north of Mill Road, which will connect via a series of roundabouts to the A12(T) at the proposed new dumb-bell roundabout junction located broadly north east of the proposed Community Stadium Development. The fundamental road arrangement surrounding the proposed P&R site to include the new local connections associated with the NAR Phase 3 is shown in Figure 2.2.

A4 Drawing Insert

Figure 2.2: Northern Approach Road – General Arrangement

3 Site Access and Internal Layout Options

3.1 General Access Arrangements

General highway access to the proposed site is envisaged from the proposed new dumb-bell junction on the A12(T). Two options for bus access have been considered using either the new A12(T) access junction, with buses mixing with general traffic or alternatively an exclusive bus only link from Boxted Road.

General access from the A12(T) requires consideration of an access strategy that accommodates both the proposed P&R traffic and suitable arrangements to serve the proposed Service Area that will be located immediately North West of the northern dumb-bell. Access to the proposed Service Area has been promoted by the developer on the basis of a route using a northern arm of the proposed northern dumb-bell.

3.2 General Layout Considerations

The design of the proposed P&R site has been developed based on careful consideration of a number of factors that relate to:

- Land availability, relative position and planning considerations;
- Accommodation of the required number of spaces;
- Alternative bus access strategies to include enforcement issues; and
- Compatibility with both the proposed A12(T) dumb bell roundabout design and the new Service Area.

Adequate land area to accommodate a design for either a 1,000 or 2,000 space options was established as an issue at an early stage, however it has been necessary to secure an 'in-principle' agreement from CBC on the most suitable location to satisfy planning considerations. Following a meeting with officers at CBC, ECC has confirmed that a site immediately north of the proposed Service Area is considered more acceptable in planning terms. This is considered to provide a better match with the proposed built environment that will evolve from provision of the Service Area and allow an element of connectivity between the two facilities such as the opportunity to provide convenient pedestrian linkages and the ability for drivers to readily access the proposed service station for fuel and other items.

This subsequently concentrated design efforts on layout options towards the west of the proposed dumb-bell roundabout to occupy predominantly Parcels A and B (Option 3 from Table 1.1). In an effort to maintain flexibility in the decision making process MP also determined an outline design using land to the north east of the service area, which is mainly set within the western flank of Parcel C to the east of the dumb-bell. Expansion to accommodate 2,000 car parking spaces is anticipated to require an element of all three parcels.

The evolving design process has subsequently altered the original option tests shown in Table 1.1 to concentrate on layout options based on the geographical location of a proposed site relative to the Proposed A12(T) dumb-bell roundabout, to give:

- **Option 1:** Western Options (1,000 Spaces – Parcels A & B);
- **Option 2:** Eastern Options (1,000 Spaces – Parcel C);
- **Option 3:** Western Options (2,000 Spaces – Parcels A, B & C); and
- **Option 4:** Central Terminus Options (Parcels A, B [1,000] & C [2,000]).

In all cases it has been recognised that it is desirable to provide a common access for both the P&R site and the Service Area, served by a roundabout at a suitable distance to the north of the dumb-bell. This access strategy will simplify the access arrangements to both sites and aid traffic management in the area.

3.3 The Western Options (1,000 Car Parking Spaces – Parcels A & B)

Two layout options have been developed for the 1,000 car parking space facility with the terminus located fairly adjacent to the proposed Service Areas to aid movement for non-motorised users between the two sites. These are confirmed by the corresponding drawings highlighted below and provided in **Appendix B**:

1. **Option 1A** - Bus and General Access via Proposed A12(T) Dumb-bell; and
2. **Option 1B** - Bus Access via Boxted Road.

The features of these options are:

Option 1A – Drawing No. 733049/OA/1A

This provides a bus terminus area for picking-up and setting down on the southern flank of the proposed P&R site, immediately adjacent to the Service Area boundary. This would enable closer integration for pedestrians between the bus terminus and the Service Area, and avoids buses mixing with general traffic within the site. Access to the wider network for all vehicles would be through the proposed A12(T) dumb-bell roundabout. The access roundabout junction to the site would be located at the north eastern corner of the proposed Service Area site, with a link road provided to connect with the A12(T) northern dumb-bell further south.

Buses would secure access to the site from a dedicated eastern arm of the proposed access roundabout junction, with all other P&R traffic directed towards a northern roundabout arm. Traffic seeking the Service Area would use the south western arm of the roundabout.

Option 1B – Drawing No. 733049/OA/1B

The arrangement is an adaptation of Option 1A to provide a dedicated link for buses through to Boxted Road in the west, where they would link to the main highway network using a simple T-junction. This option simplifies the access roundabout layout further east that will serve both the remaining P&R traffic and the Service Area, by removing one of the arms proposed by Option 1A. The total separation of the route for buses in this arrangement minimises the opportunities for general traffic to consider the route as a potential rat-run between the P&R site, A12(T) and Boxted Road, which would minimise potential enforcement issues.

3.4 The Eastern Option (1,000 Car Parking Spaces – Parcel C)

A layout to the north east of the proposed dumb-bell roundabout is not considered preferable in planning terms and would be relatively detached from the Service Area, offering less encouragement for interaction between the two sites except perhaps for less sustainable journeys by motorised travel. This option is not favoured by either CBC or ECC. A layout has however been provided to allow comparison and is shown in **Appendix B** as **Option 2A - Drawing No. 733049/OA/02A**.

3.5 The Western Options (2,000 Car Parking Spaces – Parcels A, B & C)

Two layout options have been developed for the 2,000 car parking space facility and with the terminus located fairly adjacent to the proposed Service Areas to aid movement for non-motorised users between the two sites. These are confirmed by the corresponding drawings highlighted below and provided in **Appendix B**:

1. **Option 3A** - Bus and General Access Via Proposed A12(T) Dumb-bell;

2. **Option 3B** - Bus Access Via Boxted Road; and

Generally the design expands the 1,000 space western option to the North, West and marginally East to accommodate the additional car parking requirements.

The features of the individual options are:

Option 3A – Drawing No. 733049/OA/3A

This presents an expanded Option 1A, with the bus terminus retained adjacent to the Service Area site. The extension of the car parking to accommodate additional vehicles increases walk distance for patrons at the furthest extremities, which could prove less attractive as it will add to 'park - bus – park' journey times for those required to park at the outer fringes of the proposed site. Inevitably with a surface area on this scale some additional walking distance will be required, unless the bus follows a circuit within the site to offer additional boarding and alighting opportunities, although this could lead to additional delays on the route.

Option 3B – Drawing No. 733049/OA/3B

Option 1B has been expanded to form this option to accommodate the exclusive bus link to Boxted Road. The comments above in relation to walk distances applies equally here although this presents an expanded Option 1A, with the bus terminus retained adjacent to the Service Area site. The expansion of the car parking to accommodate additional vehicles adds additional walk distances for patrons at the furthest extremities. Once again the provision of a physically separated and dedicated route for buses could address any potential enforcement issues.

3.6 The Central Bus Terminus Option (Parcels A, B [1,000] & C [2,000])

Over the course of the project ECC confirmed a requirement to consider a layout that focussed on a central bus terminus, with internal bus routing arrangements that would share carriageway space with other users as much as practicable. The aim is to reduce passenger walking distances, land take and minimise infra-structure costs. These are confirmed by the corresponding drawings highlighted below for the 1,000 space options and provided for reference in **Appendix B**:

1. **Option 4A** - Bus and General Access via Proposed A12(T) Dumb-bell; and

2. **Option 4B** - Bus Access via Boxted Road.

Generally these options modify the site layout to provide a central bus terminus as an alternative Option 1 in accordance where practicable with the design that has gradually emerged for the site at Eight Ash Green in Colchester[2]. This demands that bus routing arrangements share space with other traffic through the internal aisle arrangement wherever appropriate. Option 4 provides a consolidated car parking layout, with aisles serving car parking spaces on both sides wherever practicable.

The features of the individual options for 1,000 car parking spaces are:

Option 4A – Drawing No. 733049/OA/4A

This option provides a bus terminus area for picking-up and setting down at the centre of the site and slightly north east of the internal roundabout. Buses and all other traffic would secure access to the site from a northern arm of the proposed access roundabout junction. Traffic seeking the Service Area would use a south western arm of the roundabout.

Buses would continue to share their route through the site with general traffic, following the internal aisle system in a clockwise circulation on a route that passes the bus terminus.

Option 4B – Drawing No. 733049/OA/4B

[2] Drawing No. TM0024/P/006/01A and 2A - Eight Ash Green, Park and Ride, Colchester. Mouchel Parkman June 06

This modification of Option 4A provides a link to Boxted Road at the south western corner of the site. In common with Option 4A a clockwise circulation is proposed for bus routing through the site, using routes shared with other vehicles. The notable exception will be the bus only link from the site to Boxted Road itself.

The revised terminus arrangement focuses P&R bus interchange activity towards the centre of the site and as a consequence minimises the relative walk distances for the majority of the anticipated users. The arrangement requires buses to share a proportion of its route with general traffic, to include the proposed new access roundabout junction for Option 4A and through the car park for both 4A and 4B. By placing the terminus in the middle of the site, there is perhaps slightly less cohesion with the adjacent Service Area, however this could be offset by a direct pedestrian/ cycle link between the two. These more vulnerable users would however be required to cross the inbound access road that serves the P&R car park at some point.

To achieve a balance in terms of equalising walking distances, the site is relatively evenly distributed either side of the bus terminus. Expansion to accommodate 2,000 spaces, while seeking to maintain the balance in terms of relatively equal walking distances, is likely to promote a design that will see the site expand north, east and west in fairly equal proportions. As a consequence the site would tend to encroach into more land towards the east of the A12(T) dumb bell (Parcel C) than required under Option 1 above. No drawing has been provided for this 2,000 space option.

3.7 Safety Audit

A Stage One Road Safety Audit (RSA) has been undertaken on the layouts of options 1 and 2 to examine the safety implications for all road users, including pedestrians and cyclists. A copy of the audit document is available on request. Although the designs for the P&R site are only at a preliminary design stage, the audit process has raised some common issues for consideration at this feasibility stage:

- Need to provide car parking spaces with sufficient features between rows to break up flat surface and thereby prevent excessive speed when the car park is close to empty;
- A recommendation to discourage the movement of pedestrians between the service station and the site to avoid conflict with motorised vehicles;
- Recommendation for speed reduction on all car parking aisles to supplement those at crossing points to maintain appropriate vehicle speeds;

- The location, form and safe operation of a new access junction on Boxted Road and the ability to cater for bus movements;
- Slow moving buses turning across other traffic on Boxted Road, which is subject to the National Speed Limit of 60mph;
- Potential visibility constraints on Boxted Road due to location of A12(T) bridge and other features; and
- The need for deterrent measures to prevent private vehicular access on any link road between Boxted Road and the site;

The majority of the issues and recommendations raised would be resolved at detailed design stage. Those involving the access junction at Boxted Road require more detailed study and analysis to confirm traffic flows, approach speeds and visibility requirements to determine an acceptable junction arrangement.

3.8 Summary

In summary a site with focus on the western land parcels A and B is considered more compatible with the built environment associated with the proposed delivery of the Service Area. It would enable a stronger link to be established between the two sites and offer improved opportunities for more sustainable pedestrian / cycle transfer than the eastern alternative concentrated on Parcel C. This view is enhanced when considering any expansion further east to incorporate the 2,000 car parking space option.

A central bus terminus facility would minimise walk distances for passengers, which is likely to be an important consideration for many in terms of the attractiveness of the site and reducing transfer times for the car-bus-car journey. This consideration has added weight with the 2,000 car parking space option where the outer extremes of an enlarged site may be considered inconvenient by some users. The option for a central terminus with 1,000 car parking spaces would remain focused on parcels A and B. Encroachment into Parcel C is anticipated with an expansion of the site to cater for 2,000 spaces.

Exclusive bus access to Boxted Road is a practical option in engineering terms. It has advantages in that it would generally provide P&R buses with a dedicated route to join the highway network, avoiding other general traffic attracted to the P&R facility, Service Area and the network extending from the A12(T). It would however add an additional junction and buses to Boxted Road and public acceptance for such a routing arrangement would need to be secured. The potential for a link between Boxted Road and the proposed

A12(T) junction would open opportunities for a general traffic route in the area, which is unacceptable. An exclusive bus only route with physical separation would minimise this risk and ease potential enforcement issues.

4 Assessment of Maximum P&R Demand

4.1 Background

As part of the development proposals in the area a SATURN model was produced in 2001, covering the area of influence of the Mile End Transport and Development Strategy (METDS). It remains the principal tool for evaluating schemes in this area and was drawn upon by both Transport Assessment studies undertaken for the Community Stadium Development (CSD) and for their view of a Bus Based Park and Ride operating from the Stadium car park. Although the model included all known committed development when built, it explicitly excluded any specific generations for Park and Ride.

MP understands that the committed developments included were:

- North Colchester (incorporating Cuckoo Farm and Severalls areas);
- East Colchester (including Hythe, Colne Harbour and Greenstead areas);
- St Botolph's Quarter (including east town centre redevelopment); and
- The Garrison re-development.

The model was based on surveys undertaken in 1995. At the time METDS assumed a 2003 Opening Year for the new A12(T) junction and SATURN model flows were consequently produced for a Design Year of 2018.

4.2 Opening Year

Recent work on the CSD and its associated P&R site by the Development Consultants took a pessimistic view that the proposed new A12(T) dumb-bell Opening Year would be 2012. Current ECC advice however, is that the junction will open in 2010 and this has been assumed as the Opening Year.

4.3 P&R Traffic Generation

It is outside the scope of this report to determine actual demand forecasts to justify any predicted level of patronage that may be attracted to the proposed P&R site at Cuckoo Farm. In the absence of such forecasts it has been necessary to determine the likely traffic generation at the site based on a method that equates a level of car parking provision with the potential traffic generation. The evaluation of the highway network and operations that

follows is therefore based on levels of car parking at the site that have been prescribed by ECC, which assumes a facility with 1,000 and potentially 2,000 spaces.

To assess the trip generation associated with the proposed Cuckoo Farm P&R site, the methodology used by MP to determine trip generation for the Sandon P&R in Chelmsford has been largely replicated[3] to inform the assessment of proposals for both the 1,000 and 2,000 car parking space options. Modal split for trips attracted to the site has been based on *'Park and Ride in Oxford and York: Report of Surveys'*[4]. For clarity these are reproduced in Table 4.1.

CITY	OXFORD			YORK		
Day	**Fri**	**Sat**	**6-day**	**Fri**	**Sat**	**6-day**
Drove Self	75.4	62.9	72.7	58.4	70.3	60.7
Car Passenger	15.9	34.0	19.7	14.9	18.5	15.6
'Kiss & Ride'	2.0	1.3	1.9	4.3	1.3	3.7
Cycled	0.7	0.1	0.4	1.4	1.0	1.4
Walked	5.1	1.7	4.5	19.2	7.9	17.0
Other	0.9	0.0	0.8	1.8	1.0	1.6
All	**100**	**100**	**100**	**100**	**100**	**100**

Source: Table 6. Park and Ride in Oxford and York: Report of Surveys. G. Parkhurst and G. Stokes. (1994)

Table 4.1: Modes Used to Access P&R Sites Oxford and York

The data from Oxford and York has been used in the absence of any reliable sources of alternative data that offer an equivalent level of detail in terms of modal split and daily demand profiles; which is a fundamental part of determining the likely traffic generation in this case. It is outside the scope of this study to commission and review new surveys at alternative sites for the purposes of improving the currency of such data.

In view of the site location and intended purpose it is reasonable to assume that the majority of users attracted to the site will travel by car. From this the Oxford data for Friday has been applied in preference to York as it is considered to provide a more robust assessment of the likely trip profiles

[3] Maldon Road Park and Ride, Chelmsford Transport Assessment – Mouchel Parkman. June 2004

[4] Graham Parkhurst and Gordon Stokes. July 1994

associated with the proposal site, with 75.4% of all daily trips by 'car driver' and 2% for an element of 'Kiss and Ride'.

From the Oxford data the predicted daily users for a 1,000 and 2,000 space car park, assuming that all spaces are used, can be calculated as 1,326 and 2,653 people respectively (i.e. the number of spaces divided by 0.754). From the total number of daily users it is also assumed that 45% will be commuters arriving during the typical weekday AM peak hour, with a corresponding number leaving the site during the PM peak hour.

It has also been assumed that peak hour travel patterns will be predominantly tidal and that the travel habits of only a very small proportion of users of the P&R service would be in conflict with the majority i.e. they would be leaving the site during the AM peak and arriving in the PM peak. Based on data from the Oxford study, a robust assumption has been made that 5% of the daily users would depart from the P&R during a typical weekday AM peak hour with a corresponding figure arriving during the PM peak.

Following the calculation of the likely number of person trips attracted to the site during the typical weekday AM and PM peak hours, it is necessary to translate these to vehicular flows. This has been achieved by multiplying the calculated person trips from 0 by the sum of the car driver and 'kiss and ride' proportions from the Oxford study at 77%. The resultant peak hour vehicular flows are shown in Table 4.2 for a 1,000 space car park and Table 4.3 for the 2,000 space option.

		Spaces	Car Driver	Daily People	% Arrivals	% Departures	Peak Hour People	% Cars	Total Cars
AM	**ARR**	**1,000**	75.4%	1,326	45%	-	597	77%	**460**
	DEP				-	5%	66		**51**
PM	**ARR**	**1,000**	75.4%	1,326	5%	-	66	77%	**51**
	DEP				-	45%	597		**460**

Table 4.2: Assumed Peak Hour Car Trip Generation - 1,000 Spaces

		Spaces	Car Driver	Daily People	% Arrivals	% Departures	Peak Hour People	% Cars	Total Cars
AM	**ARR**	**2,000**	75.4%	2,653	45%	-	1,194	77%	**919**
	DEP				-	5%	133		**102**
PM	**ARR**	**2,000**	75.4%	2,653	5%	-	133	77%	**102**
	DEP				-	45%	1,194		**919**

Table 4.3: Peak Hour Trip Generation - 2,000 Spaces

4.4 Trip Types

To follow the calculation of total trips generated by the proposed P&R site it is necessary to consider actual trip type. For the purposes of this assessment these have been divided into three trip types:

1. Primary trips;
2. Secondary – Diverted trips; and
3. Secondary – Pass-by trips.

Primary Trips

These are defined as trips that are totally new to the local road network i.e. those which would not previously have been destined for Colchester prior to the existence of the P&R at Cuckoo Farm. It is unlikely that primary trips would make up a large proportion of the overall trips generated by the site during peak hours, as people are unlikely to transfer their place of work to Colchester as a consequence of a P&R facility at the site. It has therefore been assumed that only 10% of all peak hour trips will be primary.

The proposed P&R site lies to the north of both the A12(T) junction and the main urban area of Colchester itself. It is considered unlikely that many primary trips would originate from the West of the proposed site using the A12(T) as these trips would be intercepted either by the proposed P&R site at Eight Ash Green, or alternatively by drivers following a logical route to access

central and western Colchester using the A1124 London Road and the A133 Cymbeline Way. Likewise it is highly unlikely that trips would leave Colchester to access the A12(T) at Eight Ash Green and subsequently follow the trunk road eastbound, as this would involve travelling out of town by car simply to return by bus.

The main areas from which primary trips are likely to originate would therefore be from the East via the A12(T) and the North, approaching the junction from the south, using local road connections. The southern distribution at the proposed site therefore anticipates this demand from the north using the A134 Nayland Road and Boxted Road or Severalls Lane. The absence of any direct physical connection with the A12(T) for these journeys means that drivers have to cross the trunk road and subsequently approach the proposed P&R site from the South.

Secondary Trips – Diverted

Diverted trips are defined as those that currently exist on the local road network but which divert from their usual route to take advantage of the P&R. It is assumed that all secondary trips attracted to the site will be diverted trips, as users make the choice to use the express bus service as a direct replacement for journeys via congested roads into the town centre. These trips would mainly encompass travellers from the east of the site that currently travel to Colchester town centre through Crown Interchange. In particular those with origins and destinations focussed on the A12(T) Ipswich Road.

The balance of the total number of diverted trips is anticipated from the south of the proposed P&R site in response to the attraction of the P&R service and its potential use by commuters seeking an express link to Colchester Station and the town centre. The introduction of the site is likely to influence some journey choice from the new development and residential areas immediately south of the A12(T) arc as people elect to take advantage of the service.

Secondary Trips – Pass-by

Pass-by trips are defined as those that currently pass directly by the proposed P&R site access and then turn into the site as opposed to continuing their journey into Colchester town centre. In the circumstances it is reasonable to assume that there will not be any trips that fall into this category at the P&R site.

4.5 Trip Distribution

To follow the establishment of 'trip types', three possible distribution scenarios have been examined for the proposed new A12(T) dumb-bell roundabout:

1. **Distribution One (88% East, 12% South)** is considered to reflect the most 'reasonable' assumption in terms of the distribution pattern by anticipating that most of the trips will be attracted from the East of the proposed P&R site. It responds to the sites geographic relationship with the adjoining road network and emerging settlement pattern.

2. **Distribution Two (78% East, 22% South)** provides a sensitivity test in response to an increased local demand from the adjoining urban area and associated road network immediately South of the site. The altered flow balance would influence distribution at the proposed A12(T) dumb-bell roundabout.

3. **Distribution Three (No Eight Ash Green P&R)** responds to the event that the other proposed P&R site at Eight Ash Green is not progressed. It is still assumed that journeys from the East will prove slightly more dominant than from the West, due to the relatively shorter travel distance and potential attractiveness of the facility when related to journeys times associated with alternative traffic routes to the town centre. The distribution includes the same proportion as Distribution One in terms of the 10% attraction for trips from the South.

The distributions are illustrated diagrammatically in Figures 4.1-4.3 below. The proposed effect of the Park and Ride on the A12(T) junction has been modelled by distributing traffic for the 2025 design year.

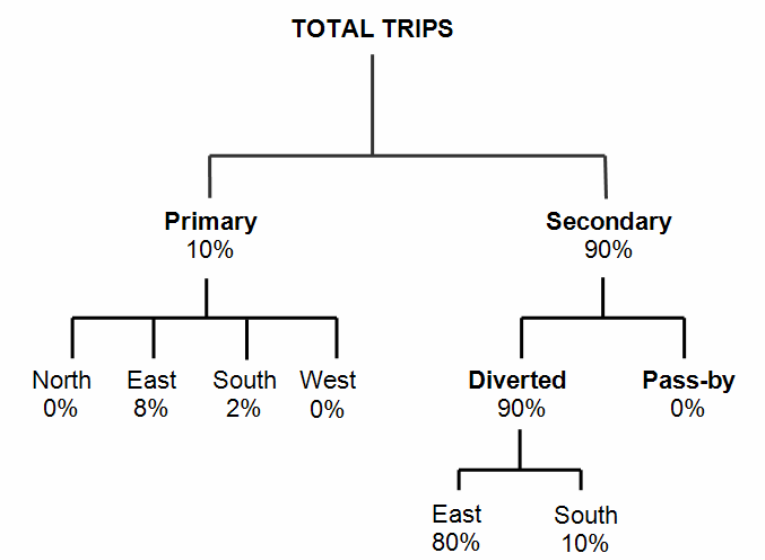


Figure 4.1: Distribution One - 88% East, 12% South

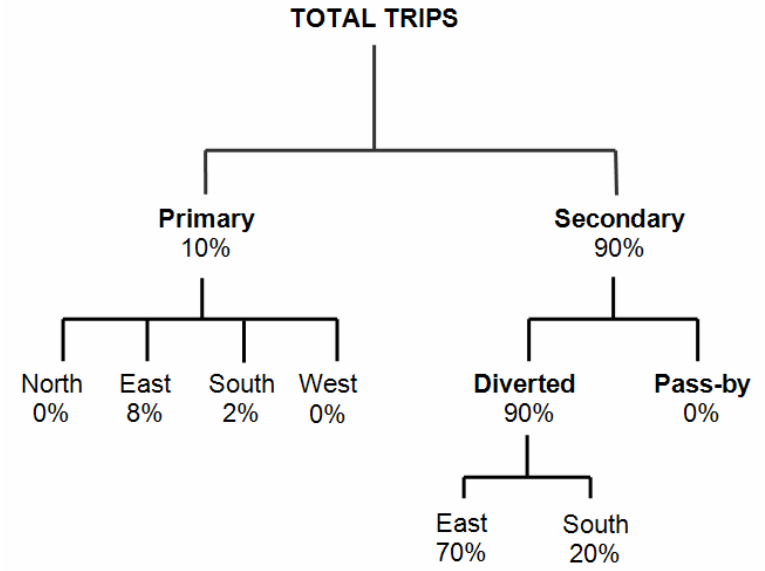


Figure 4.2: Distribution Two - 78% East, 22% South

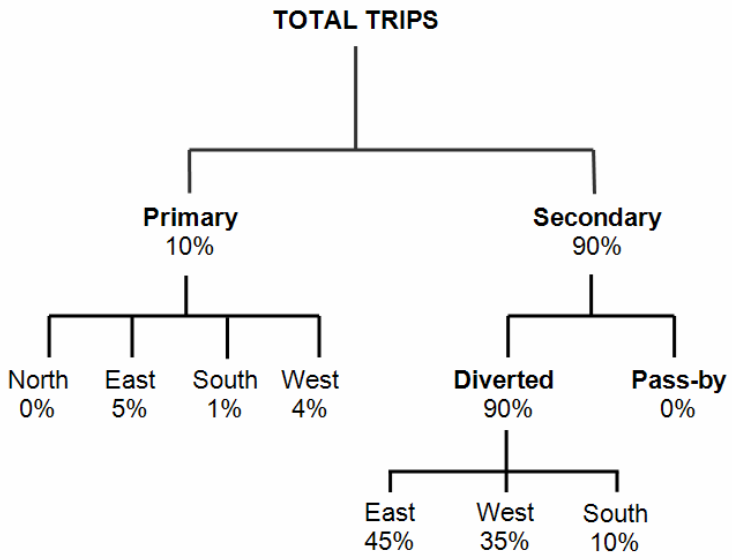


Figure 4.3: Distribution Three - No Eight Ash Green

4.6 Base Traffic Flows

The METDS SATURN model includes an assessment of all committed development in the area in 2011 and forms the foundation for base traffic flows in this assessment. For the purposes of this assessment and added robustness 2011 flows have therefore been assumed as the base for the Park & Ride Opening Year of 2010.

From all the modelling work associated with supporting the CSD application MP is aware that the only traffic through the new A12(T) junction is development traffic related to the known development at Cuckoo Farm and environs. In the METDS report the exact content of the development is listed.

An assessment of strategic and locally diverted traffic likely to be attracted to a new junction at the A12(T) Cuckoo farm has previously been undertaken by Denis Wilson Partnership (DWP) and reported in May 2001. The study acknowledged that the METDS SATURN model used to assess the traffic conditions in Northern Colchester considered only those trips with an origin or destination within the model cordon and existing external to external trips that pass through the modelled network. It acknowledged at that time that providing a new junction on the A12(T)(T) in the vicinity of the A134 would cause trips of a longer distance (given the title ‘strategic’ by the scheme consultants) nature, that were not previously using the modelled network, to reassign to use the A134 via the new junction.

It was also recognised that there were some trips both to and from the villages to the North of the modelled area that could use the new junction to access the A12(T)(T) instead of using current routes. As a result DWP estimated the numbers of these through and local trips that are likely to reassign to the new junction during the AM peak hour (08:00-09:00) and the PM peak hour (17:00-18:00). It was identified that these trips should be added to the flows forecast by the SATURN model to determine the total number of trips using the A12(T) junction. A network diagram to show the combined strategic and local diversion (2011 Flows) was provided as Figure 4 to that Appendix and is reproduced in this report as **Appendix C**.

The level of attracted traffic at 2011 has been determined from SBA's 'Cuckoo Farm West, Park and Ride, Transport Assessment' produced in June 2003. The 2018 traffic in that report was originally derived from METDS and contained the mix of both Local and Strategic Diversions (background traffic) and CSD traffic. METDS was subsequently factored by Savell Bird & Axon (SBA) to provide design year flows for 2018. The factoring process from 2011-2018 followed by SBA included the CSD traffic.

To reverse the process and hence determine the level of background traffic that is susceptible for growth between 2011 and 2025, MP has logically assumed that the attracted traffic only leaves or joins the A12(T) and heads either to or from Colchester at the A12(T) dumb-bell. Hence there are four specific movements and these have been identified at the junction as traffic on the junction slip roads. The background traffic flows for 2011 at the junction have therefore been extracted from Figure 4 of the DWP Appendix referred to above.

To determine and separate the component traffic elements for 2011, the 2018 flows that accompanied the SBA 2018 flows have been factored back by inverting the factor used by SBA. SBA originally used a factor of **1.079** derived using TEMPRO for Essex.

The known four attracted flows identified by DWP have then been directly subtracted to provide two sets of flows:

- Strategic and Local Attracted Trips; and
- CSD trips at 2011.

At this point MP concluded that there is no difference in growthed or non-growthed flows. MP has assumed that the development level was set at 2011.

The Park & Ride development traffic has been added to the 2011 Base + CSD Traffic to provide the assumed opening year traffic situation at the

proposed dumb bell junction in 2011 (2011 Base + CSD Traffic + Park & Ride Traffic).

4.7 Assessment Year and Traffic Growth

The assumed 2010 Opening Year for the proposed Cuckoo Farm P&R site initiates a revised Design Year of 2025, which is 15 years after opening in accordance with Highways Agency expectations for assessment.

Only the background flows have been growthed to 2025. As discussed above this is because both the CSD and P&R traffic are considered to be development traffic, which leaves no scope for the traffic flow associated with these developments to grow.

The Local and Strategic flows provided by the DWP report have been subsequently subtracted from the CSD Traffic, leaving Local and Strategic flows only. These flows have been growthed by a factor of **1.118** using NRTF weighed by TEMPRO for Essex to give the 2025 base traffic.

The 2025 base has been added to the CSD traffic, which has not been growthed to give the 2025 base plus stadium traffic. P&R traffic has been added to the 2025 Base + CSD Traffic to determine the situation at the proposed dumb bell junction in 2025 (2025 Base + CSD Traffic + P&R Traffic).

P&R traffic was not explicitly modelled in SATURN and an estimate of the trip generation has been made based on the number of car park spaces, using the method described earlier.

Flow diagrams for 2010 Base Year and 2025 Design Year both ‘with’ and ‘without’ the P&R development and the relevant distribution scenarios are included for reference in **Appendix D**.

5 A12(T) Junction Impact

5.1 Introduction

Junction capacity analyses have been undertaken at the proposed new junction on the A12(T) for a typical weekday AM and PM peak hour.

The Highways Agency set out its expectations for improvements at the first point of access to a Trunk Road in DfT Circular 04/2001 (Control of Development Affecting Trunk Roads and Agreements with Developers Under Section 278 of the Highways Act 1980). The Circular states that 'the works specified for the point where development-related traffic first accesses the trunk road network will be sufficient to accommodate all traffic fifteen years after the development opens'.

Junction assessments using TRL software ARCADY5 has been used to assess the operation of both the north and south roundabouts, which will combine to form the proposed A12(T) dumb-bell junction. The principal outputs from the model are the ratio of flow to capacity (RFC) and the maximum queue predicted for each approach arm that is in conflict with opposing traffic. If the RFC is below 1.00 then the junction is operating within capacity and little or no queuing will result. To allow for a performance margin however, an RFC value of 0.85 is considered the desirable maximum.

The assessments have been carried out for all three P&R development distributions discussed in Section 4.5 for both 1,000 and 2,000 car parking space options for the 2025 design year.

All ARCADY results are included in **Appendix E** for completeness.

5.2 Proposed New A12(T) Junction – Base 'Do Nothing' (2010 and 2025)

Initial ARCADY assessments were carried out for both the 2010 Opening Year and 2025 Design Year using the 'Committed Development' base distribution to determine the operation of the junction in the absence of any proposed P&R facility. The objective is to determine if highway improvements would be necessary to ensure that the 'with P&R' distribution would be no worse, in terms of queuing and delay, than in the 'without P&R' distribution.

Base flows from the SATURN model were used to model the proposed junction without predicted P&R traffic. Table 5.1 to Table 5.3 confirms that the junction as a whole runs satisfactorily during both the AM and PM peak periods for both the 2010 Opening and 2025 Design Years.

Base 2010 Northern Dumb-Bell Arm	AM Peak			PM Peak		
	RFC	Queue	Delay	RFC	Queue	Delay
A – From Southern RAB Arm	0.330	1	0.05	0.276	0	0.07
B – A12(T) (EB) Off-Slip	0.499	1	0.9	0.801	4	0.25
C - Services/ Site Access Arm	0.080	0	0.092	0.02	0	0.10
D – A12(T) (EB) On-Slip	-	-	-	-	-	-

Table 5.1: Summary of ARCADY – 2010 Base (North Roundabout)

Base 2010 Southern Dumb-Bell Arm	AM Peak			PM Peak		
	RFC	Queue	Delay	RFC	Queue	Delay
A – Northern Approach Road	0.80	4	0.19	0.861	5	0.27
B – South western Road	0	0	0	0.10	0	0.09
C - A12(T) (WB) On-Slip	-	-	-	-	-	-
D – To North Roundabout	0.353	1	0.06	0.601	2	0.10
E – A12(T) (WB) Off-Slip	0.213	0	0.06	0.276	0	0.08

Table 5.2: Summary of ARCADY – 2010 Base (South Roundabout)

Base 2025 Northern Dumb-Bell Arm	AM Peak			PM Peak		
	RFC	Queue	Delay	RFC	Queue	Delay
A – From Southern RAB Arm	0.336	1	0.07	0.279	0	0.07
B – A12(T) (EB) Off-Slip	0.496	1	0.10	0.817	4	0.27
C - Services/ Site Access Arm	0.081	0	0.08	0.094	0	0.11
D – A12(T) (EB) On-Slip	-	-	-	-	-	-

Table 5.3: Summary of ARCADY – 2025 Base (North Roundabout)

Base 2025 Southern Dumb-Bell Arm	AM Peak			PM Peak		
	RFC	Queue	Delay	RFC	Queue	Delay
A – Northern Approach Road	0.816	4	0.12	0.868	6	0.28
B – South western Road	0	0	0	0.010	0	0.09
C - A12(T) (WB) On-Slip	-	-	-	-	-	-
D – To North Roundabout	0.358	1	0.06	0.612	1	0.010
E – A12(T) (WB) Off-Slip	0.218	0	0.06	0.285	0	0.08

Table 5.4: Summary of ARCADY – 2025 Base (South Roundabout)

5.3 Distribution One (2025) - 1,000 P&R Spaces

Distribution One favours traffic coming from or returning to the East of the proposed A12(T) dumb-bell (88%) with the remaining 12% approaching the junction from the south. Tables 5.5 and 5.6 give a summary of the ARCADY results for this Distribution.

D1 (1,000 Spaces) 2025	**AM Peak**			**PM Peak**		
Northern Dumb-Bell Arm	RFC	Queue	Delay	RFC	Queue	Delay
A - From Southern RAB	0.740	3	0.18	0.324	1	0.07
B - A12(T) (EB) Off-Slip	0.684	2	0.23	0.841	4	0.32
C - Services/ Site Access Arm	0.149	0	0.09	0.912	6	0.88
D - A12(T) (EB) On-Slip	-	-	-	-	-	-

Table 5.5: Summary of ARCADY – 2025 Base + Distribution One (North Roundabout)

D1 (1,000 Spaces) 2025	**AM Peak**			**PM Peak**		
Southern Dumb-Bell Arm	RFC	Queue	Delay	RFC	Queue	Delay
A - Northern Approach Road	**1.038**	**26**	**1.72**	0.890	7	0.34
B - South western Road	0	0	0	0.010	0	0.10
C - A12(T) (WB) On-Slip	-	-	-	-	-	-
D - North Roundabout	0.362	1	0.06	0.651	2	0.11
E - A12(T) (WB) Off-Slip	0.549	1	0.10	0.342	1	0.09

Table 5.6: Summary of ARCADY – 2025 Base + Distribution One (South Roundabout)

The northern junction operates satisfactorily during both the AM peak and PM peak, with all approach arms within acceptable limits of capacity and minimal queues. This situation is paralleled for the southern roundabout during the PM peak; however it is notable that the Northern Approach Road (NAR) marginally exceeds an RFC of 1.00 during the AM peak with a predicted queue of 26. While the junction is operating marginally over capacity, the influence of this queue is unlikely to impact on the operation of the A12(T) trunk road, although it may have some bearing on perceptions of the relative attractiveness of the P&R facility for some drivers approaching the site from the south as it would inevitably add to morning journey times.

5.4 Distribution Two (2025) - 1,000 P&R Spaces

Distribution Two has been included as a sensitivity test to accommodate an increased demand from the southern junction approach. The main demand remains focussed on journeys attracted from the East (78%) with an

increased proportion for journeys approaching from the South (22%). Tables 5.7 and 5.8 provide the ARCADY results for Distribution Two.

D2 (1,000 Spaces) 2025 Northern Dumb-Bell Arm	AM Peak			PM Peak		
	RFC	Queue	Delay	RFC	Queue	Delay
A - From Southern RAB	0.740	3	0.18	0.324	1	0.07
B - A12(T) (EB) Off-Slip	0.684	2	0.23	0.841	4	0.32
C - Services/ Site Access Arm	0.149	0	0.09	0.912	6	0.88
D - A12(T) (EB) On-Slip	-	-	-	-	-	-

Table 5.7: Summary of ARCADY– 2025 Base + Distribution Two (North Roundabout)

D2 (1,000 Spaces) 2025 Southern Dumb-Bell Arm	AM Peak			PM Peak		
	RFC	Queue	Delay	RFC	Queue	Delay
A - Northern Approach Road	**1.052**	**30**	**1.93**	0.890	7	0.34
B – South western Road	0	0	0	0	0	0.10
C - A12(T) (WB) On-Slip	-	-	-	-	-	-
D - North Roundabout	0.366	1	0.06	0.683	2	0.12
E - A12(T) (WB) Off-Slip	0.513	1	0.09	0.345	1	0.09

Table 5.8: Summary of ARCADY– 2025 Base + Distribution Two (South Roundabout)

Although Distribution Two alters the balance of flows at the roundabout, the results generally match those found under Distribution One conditions. Once again the northern junction operates within acceptable limits during both the AM and PM peak with minimal queues predicted. The same is also true for the southern roundabout during the PM peak.

In common with the Distribution One scenario however, the NAR is predicted to experience a queue of, in this case, some 30 vehicles at the southern roundabout during the AM peak.

5.5 Distribution Three (2025)

Distribution Three tests the junction in response to the event that the proposed sister P&R site at Eight Ash Green does not progress as planned. Two scenarios have been tested that consider both a 1,000 and 2,000 car parking space option.

1,000 P&R Car Parking Spaces

Table 5.9 and Table 5.10 show the AM and PM peak hour ARCADY results for a 1,000 car parking space option.

D3 (1,000 Spaces) 2025 Northern Dumb-Bell	AM Peak			PM Peak		
	RFC	Queue	Delay	RFC	Queue	Delay
A - Southern RAB Arm	0.583	1	0.12	0.307	0	0.07
B - A12(T) (EB) Off-Slip	0.804	4	0.32	0.850	5	0.34
C - Services/ Site Access Arm	0.149	0	0.09	0.912	6	0.88
D - A12(T) (EB) On-Slip	-	-	-	-	-	-

Table 5.9: Summary of ARCADY– 2025 Base + Distribution Three (North Roundabout) 1,000 Spaces

D3 (1,000 Spaces) 2025 Southern Dumb-Bell Arm	AM Peak			PM Peak		
	RFC	Queue	Delay	RFC	Queue	Delay
A - Northern Approach Road	**0.959**	**12**	**0.71**	**0.983**	**16**	**0.93**
B - South western Road	0	0	0	0.13	0	0.12
C - A12(T) (WB) On-Slip	-	-	-	-	-	-
D - North Roundabout	0.381	1	0.06	0.811	4	0.20
E - A12(T) (WB) Off-Slip	0.412	1	0.08	0.381	1	0.11

Table 5.10: Summary of ARCADY– 2025 Base + Distribution Three (South Roundabout) 1,000 Spaces

The redistribution of traffic demand has little impact on the operation of the northern roundabout under this scenario, with results for both peak hours that parallel those found for Distribution One and Two above.

The ARCADY results for the southern roundabout are also broadly similar to that found with the other distribution scenarios, although the queues on the NAR are much reduced in both the AM and PM that are considered much more manageable and less likely to be considered unreasonable in terms of impacting on the attractiveness of the proposed P&R site or the operation of the junction as a whole.

2,000 P&R Car Parking Spaces

Table 5.11 and Table 5.12 show the AM and PM peak hour ARCADY results for a 2,000 car parking space option.

D3 (2,000 Spaces) 2025 Northern Dumb-Bell	AM Peak			PM Peak		
	RFC	Queue	Delay	RFC	Queue	Delay
A - Southern RAB Arm	0.831	5	0.28	0.331	1	0.07
B - A12(T) (EB) Off-Slip	**1.270**	**58**	**6.50**	0.869	6	0.39
C - Services/ Site Access Arm	0.202	0	0.09	**1.701**	**143**	**16.96**
D - A12(T) (EB) On-Slip	-	-	-	-	-	-

Table 5.11: Summary of ARCADY– 2025 Base + Distribution Three (North Roundabout) 2,000 Spaces

D3 (2,000 Spaces) 2025 Southern Dumb-Bell Arm	AM Peak			PM Peak		
	RFC	Queue	Delay	RFC	Queue	Delay
A - Northern Approach Road	**1.145**	**53**	**3.81**	**1.123**	**46**	**3.31**
B - South western Road	0	0	0	0.016	0	0.15
C - A12(T) (WB) On-Slip	-	-	-	-	-	-
D - North Roundabout	0.403	1	0.06	1.011	22	1.22
E - A12(T) (WB) Off-Slip	0.615	2	0.08	0.515	1	0.17

Table 5.12: Summary of ARCADY– 2025 Base + Distribution Three (South Roundabout) 2,000 Spaces

The impact of a 2,000 car parking space option with Distribution Three results in both junctions experiencing signs of stress on some approach arms. The ARCADY results for the northern roundabout predicts relatively large queues on the A12(T) eastbound off slip (58) during the AM peak and a long delays with 143 vehicles attempting to emerge from the proposed Service and P&R site during the PM peak.

The southern roundabout is predicted to experience capacity issues on the NAR in both peak hours, with a further increase in predicted queues when compared to all previous scenarios. While all other arms operate well within capacity the queues on the NAR is an issue that may require the delivery of suitable mitigation measures to ensure that this demand is managed effectively.

5.6 Proposed Junction Improvements

The ARCADY results above indicate some issues in the 2025 Design Year, based on the road layout and junction geometry currently proposed in association with scheduled development in the area. These are mainly focussed on the NAR approach at the southern roundabout for both the 1,000 and 2,000 space option, accompanied by the A12(T) eastbound off-slip approach (AM) and the proposed site access (PM) at the northern roundabout for the 2,000 space option.

To resolve these potential issues alterations have been tested to modify the design geometry of both the northern and southern dumb-bell roundabouts. In all cases suitable alterations to the arms under consideration can be achieved within the highway.

5.7 Northern Roundabout

The northern roundabout operates satisfactorily under all three distribution options associated with a proposed 1,000 space P&R car park. Conditions are predicted to deteriorate in association with Distribution Three and the 2,000 car parking space option, especially during the PM peak. To address this issue the 'worst case' PM situation for Distribution Three has been remodelled with appropriate changes to lane widths and flares on affected arms to accommodate the predicted traffic volumes.

The resultant ARCADY for the PM is shown in Table 5.13, which confirms that with relatively minor geometry alterations in place the Northern dumb-bell would operate satisfactorily even in the 'worst case' scenario.

D1 (2,000 Spaces) 2025 **Northern Dumb-Bell**	**PM Peak**		
	RFC	Queue	Delay
A - Southern RAB Arm	0.502	2	0.14
B - A12(T) (EB) Off-Slip	0.841	4	0.36
C - Services/ Site Access Arm	0.951	8	0.91
D - A12(T) (EB) On-Slip	-	-	-

Table 5.13: Summary of ARCADY– 2025 Base + Distribution Three (North Roundabout) 2,000 Spaces – Changed Geometry

5.8 Southern Roundabout

Two 'worst case' scenarios have been determined for the southern roundabout. Both occur during the AM peak and involve the 2025 base traffic plus Distribution One (1,000 spaces) and the 2025 base traffic plus Distribution Three (2,000 spaces) scenarios. In common with the Northern roundabout, the

junction has been remodelled for these 'worst cases' to determine appropriate changes to lane widths and flares on affected arms, which could be progressed in later years to accommodate future predicted traffic volumes.

The relevant AM peak ARCADY results for the revised roundabout layouts are given in Table 5.14 and Table 5.15 for the 1,000 and 2,000 car parking spaces options respectively. Both tables again confirm that with relatively minor geometry alterations in place the Southern dumb-bell could operate satisfactorily even under these 'worst case' conditions.

D1 (1,000 Spaces) 2025	**AM Peak**		
Southern Dumb-Bell Arm	RFC	Queue	Delay
A – Northern Approach Road	0.930	10	0.52
B – South western Road	0.0	0	0
C - A12(T) (WB) On-Slip	-	-	-
D – To North Roundabout	0.362	1	0.06
E – A12(T) (WB) Off-Slip	0.549	1	0.10

Table 5.14: Summary of ARCADY– 2025 Base + Distribution One (South Roundabout) 1,000 Spaces- Revised Geometry

D3 (2,000 Spaces) 2025	**AM Peak**		
Southern Dumb-Bell Arm	RFC	Queue	Delay
A – Northern Approach Road	0.901	8	0.34
B – South western Road	0.020	0	0.19
C - A12(T) (WB) On-Slip	-	-	-
D – To North Roundabout	0.373	1	0.06
E – A12(T) (WB) Off-Slip	0.530	1	0.10

Table 5.15: Summary of ARCADY– 2025 Base + Distribution One (South Roundabout) 2,000 Spaces- Revised Geometry

5.9 P&R Internal Roundabout Assessment

The assessment of the operational capabilities of the proposed new dumb-bell junction on the A12(T) has been followed by an evaluation of the new internal roundabout serving both the Service Area and the P&R site discussed earlier in Chapter 3.

In common with the assessment for the A12(T) dumb-bell, the junction capacity analyses has been undertaken for a typical weekday AM and PM peak hour using the ARCADY 5 computer program. The required roundabout geometry has been obtained from Drawing No. 733049/OA/4B shown in **Appendix B**. The junction assessment assumes that all P&R traffic, including

P&R buses, will mix with Service Area traffic while negotiating the proposed internal roundabout and presents a 'worst case' scenario.

The ARCADY assessments were carried out for 2025 using the 'Committed Development' base distribution and assuming 2,000 car parking spaces at the site. This is considered to represent the 'worst case' scenario. The Savell Bird & Axon report June 2003 provides the base traffic flows, which have not been growthed for reasons stated above. The committed development flows have been added to the base to test the roundabout for 2025.

The summary of the results set out in Table 5-16 confirms that the junction operates satisfactorily during both the AM and PM peak periods. The full ARCADY outputs are included in **Appendix F**.

ARM	AM Peak Period			PM Peak Period		
	RFC	Queue	Delay	RFC	Queue	Delay
A - From A12(T)(T)	0.400	1	0.07	0.291	0	0.06
B - Service Area	0.070	0	0.06	0.057	0	0.06
C – P&R	0.093	0	0.05	0.428	1	0.08

Table 5-16: Summary of ARCADY's - 2025 Internal Roundabout (Worst Case Scenario)

5.10 Highways Agency Response to Proposed Development

The Highways Agency (HA) has been made aware of the proposals for the P&R site to cater for 1,000 car parking spaces at Cuckoo Farm to foster understanding of the site selection benefits and seek agreement to the principle of access from the A12(T) dumb-bell roundabout. The objective has been to draw attention to the proposals and promote a traffic appraisal methodology in advance of any formal submission for outline planning permission to ensure that any potential concerns that the HA may have are addressed at an early stage.

A meeting was held between MP, ECC, the HA and its consultants Faber Maunsell (FM) at the offices of FM on 24 May 2006, which was followed by submission of a draft feasibility report on the impact of the P&R proposals on the proposed A12(T) junction.

The FM review of the draft feasibility report subsequently advised in Technical Note 48984/BX107 dated 30 June 2006 that:

> *"Whilst the proposed development will generate trips at this location, the sustainable nature and main objective of the proposed development, to remove trips from the wider network, has potential to influence travel behaviour and encourage the move from the car to*

alternative options. Due to the nature of the scheme the Highways Agency may be prepared to accept a slight material impact at this location on the network to facilitate the improvements over the wider network"

FM advised that the draft raised some points for clarification and confirmation, in particular the need to identify strategic and background traffic that was not part of the Community Stadium Development. In response MP submitted a technical note and supporting evidence by e-mail dated 28 July 2006, with a formal hard copy to follow. The technical note included the case for a revised modelling methodology to coincide with that now presented earlier in this report. FM has subsequently produced a second technical note dated 10 August 2006 (ref 48984/BN135) for the HA, which concludes that:

"The ARCADY results show that the dumb-bell roundabouts would work in 2025 without the park and ride traffic, however capacity would be exceeded with the development traffic on Arm A (NAR) for both distribution 1 and 2. MP state that for both cases, the storage capacity required to contain the queues exists. It should however be noted that the slip roads appear to be within capacity, and thus the proposed development should not impact on the A12(T)"

In the light of this work it is reasonable to conclude that the HA will accept that the proposed P&R development should not have a material impact on the Trunk Road network with a 15-year design life, particularly in relation to it being located adjacent to the proposed new A12(T) (T) junction at Cuckoo Farm.

6 SERTS Principles

6.1 Introduction

At the Progress Meeting on 25 January 2006 Mouchel Parkman provided a summary of the outline ideas arising from the South Essex Rapid Transit (SERTS) project, which is currently being progressed. One idea was the consideration of extension of the bus route through Colchester Centre to another key location on the other side of the town. SERTS has identified benefits to such route extensions. Another key consideration was the benefit to be gained in terms of patronage and performance, by using different vehicle styles. A possible linkage to the Essex Coach Study and its potential to provide extra trips using the Park and Ride service was also discussed. ECC requested that lessons being learned from SERTS be applied to the Cuckoo Farm P&R Project.

6.2 SERTS Principles

The target market for the proposed site for P&R at Cuckoo Farm is existing car users who would otherwise drive into the town centre. As a consequence the site is located on a radial route on the edge of the urban area to intercept inbound motorists. In terms of public transport the fundamental principle underpinning SERTS is to provide:

> *"A reliable service to link residential developments with employment sites and transform connectivity across the area".*[5]

When applied to the proposals for the site at Cuckoo Farm the key objectives from this statement would relate to the need for service reliability and the exploration of any potential to promote an extended service that would offer suitable linkages to enhance cross town connectivity. SERTS recognises that frequent and reliable bus services are crucial to the success of the scheme and a service frequency of broadly ten minutes off-peak and seven to eight minutes in peak times as suggested by 'Bus-Based Park and Ride: A Good Practice Guide, 2000' is likely to form the cornerstone of the service. It is also imperative that the P&R site is able to offer comparable journey times with, and preferably a distinct journey time advantage over, the private car.

[5] South Essex Rapid Transit – Final Report (Draft). Mouchel Parkman Nov 2005

Although the service should provide adequate capacity to accommodate the morning and afternoon peaks in demand, there is also a need to consider the key criticism of P&R, which can be the wasted capacity as patronage tends to focus on peak periods and primarily in one direction. Measures to combat this can include making the service attractive to off-peak markets such as tourists and shoppers, and serving some destinations along the route that will encourage additional patronage for the service throughout the day. SERTS principles do however highlight that it is important to consider the potential impacts on other local bus services, as abstraction of patronage from other services can reduce the capacity of the service.

In terms of attracting an off-peak demand the potential link with Severalls Hospital, town centre shopping trip promotion and leisure trips focussed at Colchester Station are among some of the initiatives that could tap into the off-peak market. The ability to improve cross-town journeys could also offer opportunities by considering onward services that can serve other major developments to the south of the town centre. The need to promote suitable public transport priority measures and routes is recognised by SERTS to assist the delivery of regular services along the route.

Overall it is important to ensure that the development of the P&R network and system is in response to a clearly defined set of problems and not as a means to an end in itself. MP in its report on SERTS[6] set out a number of objectives associated with the development of transportation associated with the evolution of the Thames Gateway South East (TGSE). These are considered relevant to the principles guiding the delivery of P&R at Cuckoo Farm. These principles have been adapted for the Colchester situation while retaining the fundamental principles that guide them:

- Improve containment within the Colchester Area through improved accessibility to facilities and opportunities;
- Provide additional transport capacity to enable the town to accommodate inward housing, jobs and infrastructure investment and thereby fulfil its local role;
- Develop a more sustainable travel culture by making public transport a more attractive mode, establishing more sustainable travel habits for new trips, supporting current public transport use and attracting mode shift from existing or aspiring car users;

[6] South Essex Rapid Transit – Final Report (Draft). Mouchel Parkman Nov 2005.

- Reduce relative journey times between key origins (edge of Town) and destinations (Town Centre) and improve journey time reliability in comparison with car journeys and thereby increase the overall capacity of key transport corridors;
- Serve key public transport termini and interchanges (both existing and proposed), where practicable;
- Feed into a developing sustainable transportation system for the town, exploring possibilities for further system expansion to link together future major development sites (housing and industry) with existing and proposed centres of population and activity; and
- Promote suitable public transport priority measures and routes while maximising the amount of segregation from general traffic whenever practicable.

The following chapters consider bus routing arrangements associated with the proposed P&R site at Cuckoo farm guided by these principles.

7 Bus Route Assessment

7.1 Introduction

This part of the assessment examines potential route choices available to secure suitable linkages between the proposed P&R site at Cuckoo Farm and the North Station Gyratory formed at the junction of the A134 Mile End Road/ Petrolea Close/ North Station Road and Berholt Road, which lies immediately east of and also serves road access to Colchester Station.

A function of the proposed P&R service is to not only provide a link with the town centre but also to offer a connection with both Colchester General Hospital and Colchester North Station. To accommodate the stop adjacent to the rear of the Hospital, which will also serve the new housing development at Severalls, a pedestrian crossing has already provided across the NAR to aid pedestrian movement. These two stopping opportunities along the route will further enhance the potential appeal of the service by providing a sustainable alternative for out-of-town journeys to both these facilities.

The route for general P&R traffic is to remain focussed on the new A12(T) dumb-bell access junction. The route choice for buses could however include consideration of either the dumb-bell or an alternative involving Boxted Road. These options are developed below.

7.2 Community Stadium and NAR (Phase 3)

Section 2.3 above has outlined the background and routing arrangements associated with the NAR. The opportunities for local movements that stem from delivery of NAR3 also extend to proposals for a Northern Express Busway (NEB). This will be a “bus only”, two-way road that will run parallel with the NAR, on its western side, from the Community Stadium in the north to connect with the newly constructed Bus Link Road at Bruff Close and the North Station Gyratory in the south. The route of the NEB has already been established in principle, with the necessary land required to deliver the facility safeguarded.

The original concept for P&R to the north of Colchester focussed on a facility linked with and adjacent to the Community Stadium, which will provide a bus interchange located immediately south west of the main complex with adjacent car parking opportunities further west. The bus interchange will connect directly and form the start of the NEB, which subsequently follows a route that parallels the southern flank of the Stadium site.

Other internal road connections serving the Stadium complex also allow general traffic connections to the east with NAR3 and significantly, in the context of this report, the A12(T) Dumb-bell roundabout. For reference the internal layout and road connections associated with the Community Stadium is shown in Figure 7.1.

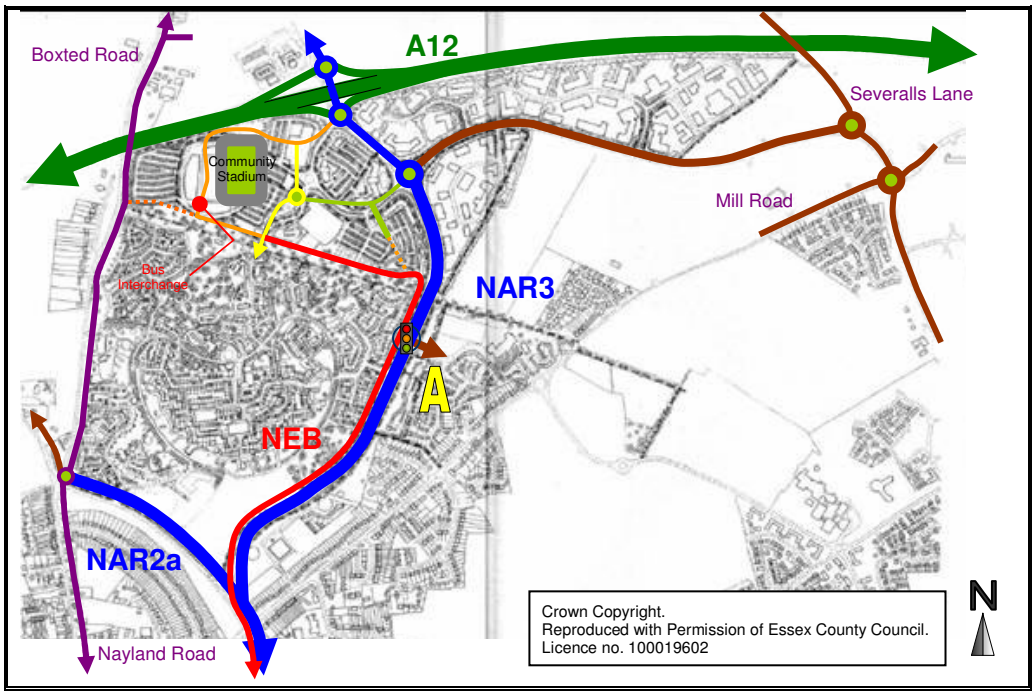


Figure 7.1: Local Road Connections Surrounding Community Stadium

Three route options have been identified assuming the P&R site is focused at the proposed new A12(T) junction, highlighted as Figure G1 in **Appendix G** and described below:

ROUTE 1: Community Stadium - Northern Express Busway (NEB)

In terms of the currently planned infrastructure surrounding the Community Stadium, access opportunities linking the proposed P&R site at Cuckoo Farm with the NEB exist via the internal access roads serving the stadium or alternatively by following the new link road connecting the A12(T) with the proposed signalised junction on the eastern side of NAR3 that will serve as access to residential development associated with the Severalls Hospital site and highlighted as Point A in Figure 7.1.

The former will require P&R buses to negotiate the A12(T) dumb-bell, entering the Community Stadium road network using the south western arm of the A12(T) southern roundabout. The route would then travel west and subsequently south to circulate the Stadium, passing via the bus interchange before connecting with the NEB for onward travel towards the town centre. The reverse would be the case for the return journey. This option would allow passengers to board and alight at the bus interchange facility.

ROUTE 2: NAR(3) - Northern Express Busway (NEB)

The alternative route would bypass the Community Stadium and as a consequence a section of the NEB, with buses exiting the southern dumb-bell and travelling along the route of NAR3 mixed with general traffic, passing through another new roundabout some 100 metres to the south of the A12(T), which provides a connection to the proposed East-West link road, before joining the NEB following negotiation of the proposed signalised junction at Point A highlighted above. From this point P&R buses would leave general traffic to take advantage of the NEB. Once again the reverse would be the case for the return journey. This option would not allow passengers to board and alight at the bus interchange facility associated with the Community Stadium.

ROUTE 3 (Additional Option): Alternative NEB Access - Northern Express Busway (NEB)

Drawing Number 9001/071/01 submitted with the planning application on behalf of the Community Stadium Developers by DLA Architecture, shows the proposed layout of development surrounding the Community Stadium.

Access to the development as a whole is to be provided by a connection with the A12(T) Southern dumb-bell roundabout, supplemented by the east-west link road roundabout some 100 metres south east. Access to the proposed development from the western arm of this roundabout leads to a T-junction, which serves access to a proposed Business Park, located south west of the roundabout and a Health and Fitness Centre opposite.

The side turning terminates at these two facilities but however it is practicable to consider a short extension to this cul-de-sac to provide a dedicated bus link that would connect directly with the NEB towards the south western corner of the Community Stadium Site. This would provide an alternative route for P&R buses to secure access to the NEB, avoiding the circulatory route around the Stadium Complex itself. A stop could be considered on the suggested link road to provide interaction with the surrounding Community Stadium site.

7.3 Boxted Road

Bus access to the P&R site focussed on Boxted Road would have two main choices using existing and proposed highway infrastructure to connect with the town centre. An alternative option is available for consideration and is discussed as option three below. The three route options for Boxted Road are shown in Figure G2 in **Appendix G**.

ROUTE 1: Boxted Road – Nayland Road - Mile End Road

The first would involve a journey taking advantage of the exclusive 'bus-only' link that prevents general through traffic gaining access to Nayland Road at the Ford Lane/ Boxted Road/ Nayland Road/ NAR junction. Subsequent routing would follow Mile End Road to join with North Station Gyratory and onwards to the town centre. Mile End Road has relatively light traffic levels, mainly through the influence of the restrictions associated with the bus gate and the offer of a viable alternative route presented by the construction of NAR(2a).

This option provides the most direct route between Boxted Road and North Station gyratory, however it would involve a journey shared with general traffic and as a consequence buses could be exposed to the variable highway events that can influence reliable journey times such as, interruptions from manoeuvring traffic, road works, inappropriate parking etc.

The stopping strategy for the P&R service would also be influenced by this choice as it would not be viable to serve Colchester General Hospital from this route option.

ROUTE 2: Boxted Road – NAR(2a) - Northern Express Busway (NEB)

The second choice would follow the route of NAR(2a) in preference to Mile Road, with P&R buses subsequently gaining access to the NEB at the traffic signals proposed to control the junction of NAR(2a)/ NAR(3).

ROUTE 3 (Additional Option): Boxted Road – Route of Emergency Link-Northern Express Busway (NEB)

The proposals for the Community Stadium include an emergency access route that will connect directly with Boxted Road. The eastern end of this emergency access route connects directly with the NEB and there is therefore potential to consider a dual-purpose facility over the length of the emergency access route that will serve both emergency vehicles and P&R buses. The connection would enable P&R buses leaving the proposed site from Boxted Road to access both the Community Stadium, possibly with a scheduled stop, and also to the NEB. A stopping opportunity at the Stadium could be published to coincide with major events at the Stadium to offer a sustainable alternative to parking at the complex itself or the surrounding area.

7.4 Route of the NEB

From the Community Stadium the NEB runs broadly southwards in parallel with the proposed NAR(3) to flank the eastern side of the Severalls Hospital

Site. It subsequently bisects the NAR(2a) to the north of Mill Road and continues as an Express Route alongside the existing route of NAR(2), south towards North Station Gyratory.

Although the route is segregated from the NAR and therefore buses do not share space with general traffic, it does interact with the remaining highway network on fairly regular occasions due to its path and interaction with a number of junctions that feature along its route. From North to South these are:

1. NAR/ Proposed Access Road - east side of NAR(3);
2. NAR/ Proposed Access Road - west side of NAR(3);
3. NAR/ Nayland Road;
4. NAR/ Mill Road;
5. NAR/ Dickenson Road (access road to new housing);
6. NAR/ Wallace Road (access road to new housing);
7. NAR/ Turner Road;
8. Eastern End of Bruff Close (Direct connection with NEB);
9. Mile End Road/ New Bus Link Road (Western End of Bruff Close); and
10. North Station Roundabout (Western Roundabout of Gyratory).

With the exception of the confirmed proposed direct access route to link the NEB with the eastern end of Bruff Close and access from Mile End Road onto North Station roundabout (west) it is assumed that the remaining junctions will be subject to a mix of signal control at main junctions with priority junctions serving smaller housing developments. At this stage it is not confirmed how buses will interact at these junctions in terms of securing a priority at each and as a consequence it is difficult to assess with any certainty how this will impact on P&R service journey time reliability. It should also be noted that the NEB would be shared with other bus services, operating in both directions. Even with a strategy for bus priority along the route it is likely that some delay will be experienced at various locations to achieve a suitable balance between competing demands.

It is proposed that the existing alignment of NAR(2a) will be locally revised to accommodate the new NAR(3) and NEB route, by providing the western arm

of a traffic signal controlled T-junction. This arm will maintain the Nayland link road across to the NAR(2a)/ Boxted Road/ Nayland Road roundabout further west.

7.5 Northern P&R Bus Traffic Signal linkage NAR to NEB

It can be noted that the option of Route 2 to the north of the Railway Station would involve a routing arrangement that would require a link between NAR(3) and the NEB. The objective is to establish this connection as soon as practicable to the south of the A12(T) Dumb-bell and as a consequence at the most northerly traffic signal junction referenced as No. 1 in the list of signal junctions provided above.

An assessment of the junction capabilities has been undertaken to check the capacity of the proposed Severalls access road junction to accommodate right turn bus manoeuvres from the Colchester Northern Approach Road (CNAR) to the Colchester Northern Express Busway (CNEB). In parallel a check has also been made on the need for an improvement to the proposed junction, to accommodate P&R bus manoeuvres, by providing a flare to CNAR (N) arm, for right turning vehicles and a bus advance area at the stop line.

The proposed junction has been modelled using LINSIG junction analysis software with five signal stages. It also includes pedestrian crossings, which will be provided at the CNAR and Severalls access road approaches. All vehicular traffic movements have been modelled as unopposed movements.

LINSIG is considered an appropriate tool to ascertain the capacity for right turn bus movements at the CNAR/ Severalls access road junction for this review. The proposed signal layout has been modelled on that referenced as Junction (I) in the CNAR Express Busway Report (EBR) discussed later in this report. As part of the junction proposal the CNAR Southbound traffic will have two approach lanes with the nearside lane carrying straight ahead traffic and the offside lane containing right turning traffic to include buses.

The LINSIG model information provided, is based on 2011 predicted traffic flows, which have been extracted from the Colchester Northern “Do Maximum Situation” SATURN model. According to the EBR, a bus frequency of 15 buses per peak hour in each direction has been assumed for the LINSIG assessment. The assessment was undertaken for AM & PM peak periods and two cycle times were tested; 90 seconds & 80 seconds respectively. The LINSIG analysis output is provided for reference in **Appendix H**.

The LINSIG results indicate that the proposed Junction (I) will operate with adequate Practical Reserve Capacity (PRC) for the two peak periods considered. A summary of the results is provided in Tables 7.1 and 7.2.

Peak Period	90 Sec Cycle Time		80 Sec Cycle Time	
	PRC %	Total Junction Delay (pcuh)	PRC %	Total Junction Delay (pcuh)
AM - Peak	17.2	11.5	11.9	11.8
PM - Peak	14.7	14.6	10.3	14.7

Table 7.1: Performance Statistics for CNAR/ Severalls Access Road Junction

The performance statistics for the CNAR (N) Right turn lane, which will be carrying the subject P&R bus movement, is shown in Table 7.2.

Peak Periods	Total Green Time (s)	Demand Flows (pcu)	Max Sat (pcu/hr)	Capacity (pcu)	Degree of Sat (%)	Total Delay (s/pcu)	Queue (pcu)
Cycle Time 90 Seconds							
AM - Peak	9	60	1,868	208	28.9	41.4	1.4
PM - Peak	21	343	1,868	457	75.1	43.7	7.4
Cycle Time 80 Seconds							
AM - Peak	9	60	1,868	234	25.7	35.1	1.2
PM - Peak	17	343	1,868	420	81.6	48	7.6

Table 7.2: Performance Statistics for CNAR (N) Right Turn Lane

The results show that in the AM peak period, with either 80 or 90 seconds of cycle time, there is significant spare capacity for vehicles, including buses, to make right turn manoeuvres into the CNEB or Severalls access road. This is indicated from the degree of saturation values; 28.7% (90s cycle time) and 25.7% (80s cycle time). The low degrees of saturation are mainly due to the predicted low flow of 60 right turning vehicles in the AM peak period.

During the PM peak, the volume of right turning vehicles increases to 343 and as a result the degree of saturation increases to 75.1% (90s) and 81.6% (80s). However, the link will still be operating within capacity.

The green time allocated for the AM peak CNAR right turning traffic, including the buses, will sufficiently accommodate the bus movement from CNAR (N) to the Colchester Northern Express Busway (CNEB). During the PM peak period, the green time allocated for the same traffic will also accommodate the bus movement from the CNAR (N) approach to the CNEB.

Although the assessment shows the availability of spare capacity in both the AM and PM peak periods, it may be necessary to consider the provision of a flare for right turning vehicles and also a stop line bus advance area at the CNAR (N) approach. This will ensure a separation of vehicles into appropriate lanes as the approach the CNAR (N) stop line. It will also result in an efficient discharge of vehicles within the allocated green time for the stage.

7.6 Access to Colchester North Station

A function of the proposed P&R service is to provide a connection with Colchester North Station. Direct access to the station forecourt would involve deviation from and subsequently returning to North Station Gyratory. Although the additional travel distance would be a relatively short, such an arrangement would add to the overall journey time.

For southbound service, P&R buses would be required to negotiate an additional traffic signal stop line to secure access to the station concourse via the western roundabout arm. A circuit of the station area would return the P&R bus back to the roundabout, where it would then be required to re-circulate part of the roundabout once again, negotiating further traffic signals, before rejoining its route to the town centre. In effect the overall journey would require the P&R bus to circulate the complete roundabout in competition with general traffic.

For the northbound service, the deviation is less marked as the P&R bus could enter the Station by making a left-turn via the southern signal controlled arm of the roundabout. The bus would subsequently return and follow its route north to Mile End Road and the NEB via Bruff Close.

In both cases the likely dwell time to deliver and collect passengers would be the same wherever the actual stop location. What is likely to impact on service delivery is the additional delay incurred, especially for southbound buses, as a direct result of any requirement to leave and re-circulate the signalised roundabout.

In the absence of any requirement to enter the Station concourse, the P&R service would face less potential disruption to its routing schedule, which is likely to offer a more reliable service. The obvious attraction of stopping within the station concourse is the ability to offer a direct interface for passengers. The trade-off would be the influence on service reliability during peak traffic periods and the need for buses to mix with traffic activity attracted to the Station access road itself.

The alternative would be to focus passengers at an alternative location within convenient walking distance of the Station. This would enable the P&R bus to avoid deviating from the most direct route. It would however require passengers to accept a walk as part of their journey experience. This is perhaps not unreasonable given that even when parking a car relatively close to station facilities, for example at the station car park, it is accepted that an element of walking is involved.

The bus stop on Mile End Road immediately south of Bruff Close would provide an alternative for the southbound service; this would however require passengers to negotiate the roundabout, which is unlikely to be seen as convenient by many. The most suitable alternative is considered to focus on the existing bus stops either side of the road immediately south of the railway bridge. The advantages of this strategy are:

- The P&R service could avoid deviation from a more direct route, thereby reducing journey times;
- The bus stops are within a convenient distance from the station, particularly for commuters seeking the London bound platform in the morning peak;
- Both the southbound and northbound leg of the service would be focussed on the same general location; and
- Passengers could use the existing 'puffin' crossing to facilitate pedestrian crossing manoeuvres;

7.7 North Station Gyratory

MP reported the physical practicality of the NEB back in February 2005[7]. The conclusions at that time highlighted that the North Station Gyratory would not have any specific bus priority features within it but that the use of Bruff Close would enable buses to avoid some parts of the gyratory. At that time the junction capacity analysis led to the conclusion that the inclusion of the Express Busway would not unduly affect the operation of the gyratory. This conclusion was based on earlier work[8] founded on previous SATURN modelling exercises using the Colchester Northern 2011 'Do Maximum' situation and predicted flows for 2011.

[7] CNAR Express Busway – Final Report. Mouchel Parkman (2005)

[8] Colchester Northern Approach Express Busway Study: Topic Paper 2 – CNAR Busway Technical Evaluation. Mouchel Parkman (2004).

During the course of a site visit associated with compiling this report it was however noted that buses emerging under signal control from Bruff Close onto Mile End Road are required to give way to the circulatory carriageway at North Station Roundabout, which can lead to delays. Once established on the carriageway southbound buses can experience a further halt when confronted with the stop line on the circulatory carriageway that controls movements for traffic emerging from the adjacent Petrolea Close/ Turner Road roundabout.

Although not examined in detail it appears that opportunities may exist to investigate a revised signal layout whereby a bus emerging from Bruff Close could be offered a priority route direct to this stop line by introducing further signal control and suitable coordination at the junction of Mile End Road with the circulatory carriageway of North Station Roundabout.

A further enhancement could be revisions to the bus stop lay-by at the southern end of Mile End Road to create an extended bus lane that would link directly with Bruff Close. Buses would exit Bruff Close to join this lane directly and experience an exclusive route down to the roundabout entry. It is accepted that on occasions this route may be occupied by a bus waiting at the stop, however this event is likely to be relatively infrequent.

The introduction of a new signal stop line on the circulatory carriageway to the west of Mile End Road may also open opportunities to consider a bus link directly through the centre of North Station roundabout that would provide a direct connection for northbound buses between the railway-bridge and Mile End Road.

These and other possibilities for bus priority enhancements at the North Station roundabout are at only a very preliminary stage, however it is considered that this junction warrants closer examination in terms of maintaining the attractiveness of future bus operations and in particular for the P&R service through this key junction on the network.

8 Park & Ride to Colchester Centre.

8.1 Introduction

ECC requested that the consideration of the bus routes be extended to include the full route to the Colchester Centre, drawing on the Steer Davies Gleave (SDG) Park and Ride Report (2003)[9], to include a review of this work in the event that its proposed route choice and priorities remain appropriate. ECC also instructed that the review should include an updated feasibility appraisal of the proposed routes.

The MP journey time surveys that are described in Chapter 9 include an assessment of critical routes from Colchester Station to the town centre. The assessment re-visits the routing choices made by SDG between the proposed P&R site and Colchester Town Centre.

8.2 New Bus Station Proposals

As part of the St. Botolph's Masterplan, the existing bus station at Queen Street is to move to a new location between Osborne St and Vineyard St at Vineyard Gate. This new purpose built station is scheduled for completion in time for Christmas trading in 2009 and will accommodate existing bus services while allowing for future increases. It will also include provision for short-stay layover bus spaces.

In preparation work has already begun on providing a temporary bus station, which marks the first in a number of phases of temporary arrangements to deliver the St. Botolph's Quarter Masterplan.

The Queen Street bus station site will become the location for a new Visual Arts Facility (VAF), in company with residential and commercial development. With excellent links to Colchester Town rail station, Vineyard Gate will provide a true 'transport hub' as it also includes provision for scheduled long distance coaches, a taxi rank, car parking and good car, cycling and pedestrian access. It will serve buses on the town centre circuit, allowing them to avoid route deviations that were a feature of some services using Queen Street. This should provide quicker and more convenient services for both bus operators and passengers to include the proposed P&R service at Cuckoo Farm.

[9] Cuckoo Farm Park and Ride – Final Report. Steer Davies Gleave. July 2003.

8.3 SDG Park and Ride Report

The SDG examination of routing choice for P&R services focussed at Cuckoo Farm assumed a facility operating from a terminus at the Community Stadium. Although the present study adds a further dimension by promoting an alternative proposal for a site to the north of the A12(T), much of the assessment work on route considerations undertaken by SDG is relevant in the context of the revised proposals. Alterations and amendments have been made where necessary to reflect the revised circumstances.

SDG examined the proposed routing at that time to include:

- **Community Stadium Terminus - Bruff Close** along a dedicated Busway, with two stops to serve the Severalls Hospital Development and Colchester General Hospital;
- **North Station Road - North Hill** using both proposed and existing bus priority measures, with one stop proposed adjacent to the rail station;

With three options for the Town Centre Circuit:

- **Town Centre Route 1:** Via High Street, Queen Street, Osborne Street and Head Street, with one stop on the High Street and at Osborne Street and Head Street.**;**
- **Town Centre Route 2:** South via a proposed contraflow bus lane in Head Street, with return journey via Crouch Street and Balkerne Hill; and
- **Town Centre Route 3:** To town centre via Balkerne Hill, stopping only at Head Street and onwards to Cuckoo Farm via North Hill.

The three Town Centre Circuit options are shown in Figure 8.1 overleaf.

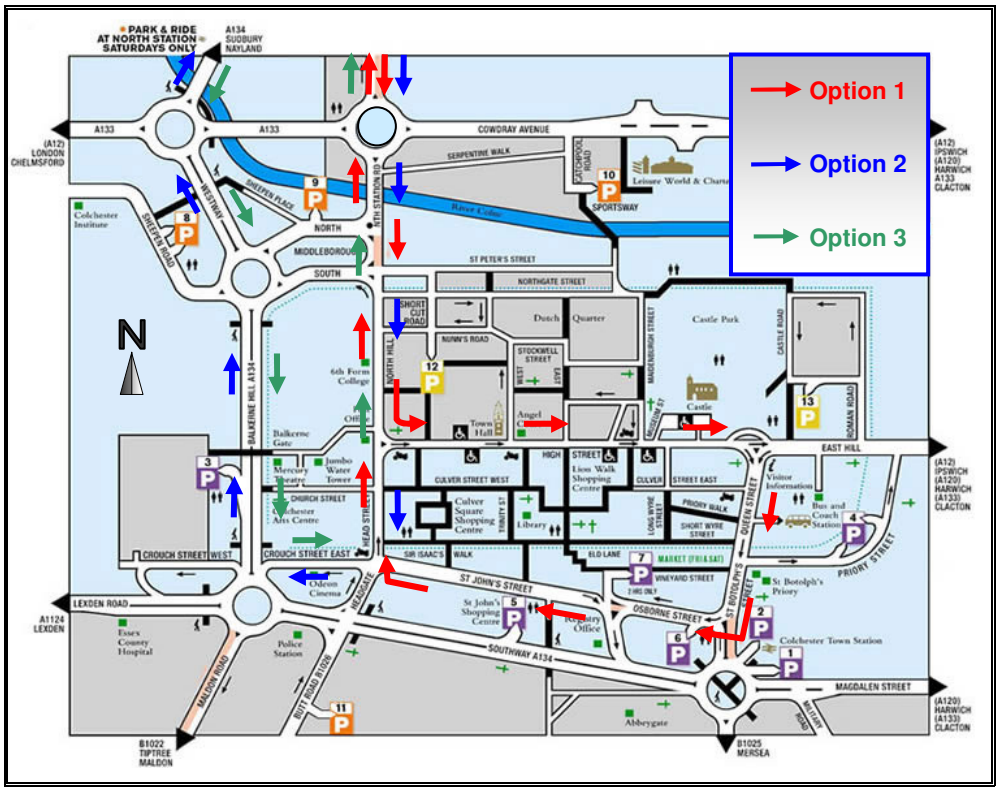


Figure 8.1: SDG Town Centre Cuckoo Farm P&R Service Routing Options

The stop adjacent to rather than on the rail station forecourt was considered by SDG, however it concluded that there would be no overall time-saving for passengers compared with stopping on-street in North Station Road. This conclusion is supported by MP given the likely deviation required to service the station forecourt and the inherent delay that is likely incur in terms of both access and egress.

Following a review of proposals for the historic core SDG also identified the potential for a new southbound bus lane along the section of North Station Road between Cowdray Way and St Peters Street. The need to relocate traffic and parking to the west side of the route to enable such a measure was highlighted.

MP has examined each route in terms of estimated average journey time, informed by the survey results for various route types outlined in Chapter 9.

9 Bus Journey Time Surveys

9.1 Introduction

To inform the route choice process MP has undertaken a series of journey time surveys to gauge link flow profiles. The surveys unique to this project were conducted during both peak and off-peak times on Wednesday 22, Thursday 23 and Friday 24 March 2006. Others have supplemented these surveys from 15 March 2006, which were compiled to inform the proposed P&R facilities at Halstead Road.

The surveys employed a variety of methods to include:

- Off peak car journeys on stretches of road that would parallel the express Busway;
- Timed route running on board scheduled bus services, which coincided with links that would be shared with the P&R service;
- A registration survey of buses at key locations with associated time stamping to enable subsequent vehicle matching and journey time estimation; and
- Timed follow checks of existing scheduled buses for shared key links.

The data has allowed a broad comparison of potential bus routeing arrangements between the proposed P&R site and the town centre to include an assessment of the relative merits of routing arrangements involving access from either the A12(T) or Boxted Road.

9.2 Methodology

The methods outlined above were used to carry out journey time surveys using the following procedures:

1. All timings include only one set of junction delays; and
2. Surveys include the time through upcoming junctions.

Off peak car journeys surveys were undertaken to estimate the speed of buses using the NEB. It is assumed that a bus will travel at about the same rate as a car following the general route of the parallel NAR in the off peak. AM and PM timings, both in a northbound and southbound direction, for the NEB are therefore approximated using the NAR(2) average northbound off

peak timings. At the same time, NAR(2a) and Boxted Road journey times were surveyed.

As the NEB terminates at the junction of Mill Road, northbound and southbound journey times were considered when estimating total trip lengths, with observations timed while travelling at the speed of general traffic. Timings included the delay at the junction of Mill Road/ NAR(2a) plus an additional 30 seconds to take account of the delay in rejoining general traffic from the NEB.

Surveys were conducted on board scheduled buses, which shared common links with the proposed P&R service and included First Service 61 and Network Colchester Service 2b. Timings were conducted during both the AM and PM peaks on Wednesday 22 March and during the AM peak on Friday 24 March 2006.

Town Centre bus surveys were undertaken:

- For all buses passing key points on the network (recording both the registration number and the time the vehicle passed a fixed point);.
- During the AM peak hour only inbound buses travelling to the town centre from the north of Colchester were surveyed;
- All buses passing Northgate Street were recorded at the corner of North Hill and High Street; the survey therefore excluded the Middleborough/ St Peters junction delay;.
- Bus details were again registered as the bus passed through the traffic signals at High Street/ Head Street;
- and subsequently at the Queen Street/ High Street Junction.

During the PM peak hour only outbound buses, travelling to the north of Colchester, were surveyed. Bus times and registration details were noted through the junction of High Street/ Head Street and while passing round the corner from St Botoloph's Roundabout and Osborne Street.

For the purpose of this assessment the overall route has been divided into two main areas of interest:

- North of Colchester North Station (Boxted Road and NAR routing options); and
- South of Colchester North Station (Town Centre routing options).

Each area incorporates a number of route options discussed below.

9.3 North of Colchester North Station

As previous described in Chapter 7 a total of six NAR and Boxted Road routing options have been highlighted for consideration within the area to the North of the Station:

A12(T) Dumb-bell, NAR and Community Stadium

Option 1: Community Stadium - NEB

Option 2: NAR(3) - NEB

Option 3: Alternative NEB Access - NEB

Boxted Road

Option 1: Boxted Road - Nayland Road - Mile End Road

Option 2: Boxted Road - NAR(2a) - NEB

Option 3: Boxted Road - Route of Emergency Link- NEB

These six options are considered together as they can be regarded as alternatives to one another.

9.4 South of Colchester North Station

As discussed previously in Chapter 8, there are three options initially suggested by SDG to serve the Town Centre:

Town Centre Route 1: High Street - Queen Street - Osborne Street - Head Street circuit.

Town Centre Route 2: South via a proposed contraflow bus lane in Head Street, with return journey via Crouch Street and Balkerne Hill.

Town Centre Route 3: via Balkerne Hill, stopping only at Head Street and onwards to Cuckoo Farm via North Hill.

For sections of planned but not yet constructed road and un-surveyed links, average speed information from corresponding links was applied to estimate the journey time. Table 9.1 illustrates this process:

Section of Un-built / Un-surveyed road	Proxy for Average Speed
NAR 3	NAR 2
NAR 3a	NAR 2
Roads within Stadium Development	15 mph
Mile End Rd (between Defoe Crescent and Boxted Rd)	Boxted Road
Balkerne Hill	North Station Road
Westway	North Station Road
Crouch Street	Av. Speed - Town Centre
Queen Street	Av. Speed - Town Centre

Table 9.1 Bus Journey Times - Data Extrapolation

The various assumptions and individual route sections identified for assessment to the north and south of Colchester North Station are shown diagrammatically in Figure G3 and Figure G4 respectively in **Appendix G**.

9.5 Journey Time Survey Results

Results of the Journey time surveys are illustrated in Tables 9.1 to 9.9. For clarity the various options are presented to distinguish the route choices for the A12(T) and Boxted Road, in conjunction with the corresponding town centre route alternatives, and provide an overall estimate of journey time to aid comparison. Figures G5 to G8 included with **Appendix G** are provided to aid presentation of the main results.

The results provide an estimate at this stage based on a ‘snap-shot’ of existing conditions and include various assumptions. They do however provide a guide during this preliminary assessment of the tabled route options.

A more detailed estimation of bus journey time could be secured by explicit modelling of each route to include a more thorough assessment of link and junction delay using a micro-simulation model such as PARAMICS. This could include analysis of the potential impact of traffic growth and altered travel behaviour and route patterns over time and enable direct comparison between journeys by general traffic set against P&R bus journeys. Such an exercise is outside the scope of this study at this time.

The tables below summarising the journey times are:

- Southbound (Table 9.2);
- Northbound (Table 9.3);
- Average of southbound and northbound (Table 9.4);
- Deviation of results (Table 9.5);
- Total round trip times (Table 9.6);
- Round trip rankings (Table 9.7);
- Times by common routes (Table 9.8); and
- Distances for each trip (Table 9.9).

Southbound Route Timing Matrix		Town Centre Routes		
		1	2	3
A12(T), NAR and Community Stadium				
Option 1	AM	18:12	**17:10**	26:14
	PM	15:01	14:19	**12:41**
Option 2	AM	17:14	**16:12**	25:16
	PM	14:03	13:21	**11:43**
Option 3	AM	18:31	**16:29**	25:33
	PM	14:20	13:38	**12:00**
Boxted Road				
Option 1	AM	18:36	**16:34**	25:38
	PM	12:57	12:15	**10:37**
Option 2	AM	17:12	**16:10**	25:44
	PM	14:01	13:19	**11:41**
Option 3	AM	18:23	**17:21**	26:25
	PM	15:12	14:30	**12:52**

Table 9.2 Southbound Journey Time Surveys [mm:ss]

Northbound Route Timing Matrix		Town Centre Routes		
		1	2	3
A12(T), NAR and Community Stadium				
Option 1	AM	15:15	15:37	**13:04**
	PM	15:34	**9:50**	12:46
Option 2	AM	14:41	15:03	**12:30**
	PM	14:30	**08:46**	12:42
Option 3	AM	14:32	14:54	**12:21**
	PM	13:51	**09:07**	12:03
Boxted Road				
Option 1	AM	13:39	14:01	**11:28**
	PM	12:16	**07:32**	11:28
Option 2	AM	13:45	14:07	**11:34**
	PM	13:04	**08:20**	11:16
Option 3	AM	15:15	15:37	**13:04**
	PM	15:34	**10:50**	12:46

Table 9.3: Northbound Journey Time Surveys [mm:ss]

Ave North and Southbound Route Timing Matrix		Town Centre Routes		
		1	2	3
A12(T), NAR and Community Stadium				
Option 1	AM	16:43	**16:23**	19:39
	PM	15:18	**12:04**	12:44
Option 2	AM	15:57	**15:37**	18:53
	PM	14:17	**11:04**	12:12
Option 3	AM	16:31	**15:42**	18:57
	PM	14:06	**11:22**	12:02
Boxted Road				
Option 1	AM	16:07	**15:18**	18:33
	PM	12:37	**09:53**	11:03
Option 2	AM	15:29	**15:09**	18:39
	PM	13:33	**10:50**	11:28
Option 3	AM	16:49	**16:29**	19:45
	PM	15:23	**12:40**	12:49

Table 9.4: Ave Northbound & Southbound Journey Time Surveys [mm:ss]

% Deviation	Town Centre Routes		
	1	2	3
A12(T), NAR and Community Stadium			
Option 1	-2.03%	58.81%	2.35%
Option 2	1.26%	71.67%	-1.57%
Option 3	4.93%	63.44%	2.49%
Boxted Road			
Option 1	11.28%	86.06%	0.00%
Option 2	5.23%	69.40%	2.66%
Option 3	-2.03%	44.15%	2.35%

Table 9.5: Deviation – % Deviation from PM Peak to AM Peak

Round Trip Times	Town Centre Routes		
	1	2	3
A12(T), NAR and Community Stadium			
Option 1	32:01	28:28	32:22
Option 2	30:14	**26:41**	31:05
Option 3	30:37	27:04	30:59
Boxted Road			
Option 1	28:44	**25:11**	29:36
Option 2	29:01	25:58	30:07
Option 3	32:12	29:09	32:34

Table 9.6: Total Round Trip Times (Sum of Averages NB + SB) [mm:ss]

Round Tip Ranking	Town Centre Routes		
	1	2	3
A12(T), NAR and Community Stadium			
Option 1	15	**5**	17
Option 2	11	**3**	14
Option 3	12	**4**	13
Boxted Road			
Option 1	6	**1**	9
Option 2	7	**2**	10
Option 3	16	8	18

Table 9.7: Total Round Trip Ranking Matrix

Average Round Trip	Town Centre Routes			Average
	1	2	3	
A12(T), NAR & Community Stadium Routes	30:57	**27:24**	31:29	**29:57**
Boxted Road Routes	29:59	**26:46**	30:46	**29:10**
Average	**30:28**	**27:05**	**31:07**	

Table 9.8: Ave Round Trip Times Grouped by Common Routes [mm:ss]

	Town Centre Routes		
	1	2	3
A12(T), NAR and Community Stadium			
Option 1	**11.1** (6.9)	**10.6** (6.6)	**10.6** (6.6)
Option 2	**10.3** (6.4)	**9.6** (6.0)	**9.6** (6.0)
Option 3	**10.4** (6.5)	**9.6** (6.0)	**9.6** (6.0)
Boxted Road			
Option 1	**10.3** (6.4)	**9.5** (5.9)	**9.5** (5.9)
Option 2	**10.0** (6.2)	**9.3** (5.8)	**9.3** (5.8)
Option 3	**10.7** (6.6)	**9.9** (6.2)	**9.9** (6.2)

Table 9.9: Total Round Trip Distances Kilometres and (Miles)

9.6 Route Analysis

Table 9.6 and the ranking matrix provided in Table 9.7 indicate that Boxted Road (Option 1) via Mile End Road has potential to provide the most favourable routing choice in terms of journey time when considering P&R bus routing to the North of Colchester North Station. For the route to the south of North Station a journey following SDGs suggested contraflow bus lane in Head Street returning via Crouch Street and Balkerne Hill (Option 2) was most favourable. The time saving is however mainly dependent on the PM journey time, which is significantly lower than all other times, whereas the AM journey time is not significantly different from the other options.

Combining these two routing choices produces an overall round-trip journey time of just over 25 minutes, although this is only 47 seconds quicker than the nearest rival. The combination of Town Centre (Option 3) with Boxted Road (Option 3) is the slowest with an estimated journey time at 32 minutes.

Table 9.8 illustrates that in general, the Boxted Road routes may deliver shorter journey times in comparison with the NAR and Community Stadium alternative. It also highlights that Town Centre (Option 3) is potentially the least efficient choice of the three town centre options. It is however important to acknowledge that these journey time assessments are based on current traffic conditions and existing bus operations.

In terms of Town Centre route choices, Options 2 and 3 provide a shorter travel distance than Option 1 as illustrated in Table 9.8, however they limit passenger choice to arrangements focussed exclusively towards the western side of the Town Centre. It may be more sustainable to consider routing the P&R bus by Option 1 to improve Town Centre penetration. Options 2 and 3 also face the potential for more exposure to the fluctuations of general traffic whereas this is reduced in the town centre by means of traffic management measures such as bus gates.

The town centre journey times were calculated to include existing dwell time at bus stops, making Options 2 and 3 appear quicker due to the fact that assumptions were required to estimate the journey time on non-surveyed links. Options 2 and 3 include the use of dual carriageway, which may not currently provide scope for bus stops. Moving the P&R route to follow these links would also remove opportunities for stopping points along North Station Road.

9.7 Overview

Generally the results indicate little difference in terms of average round trip journey times between the various options and in practise each route could vary on a day-to-day basis through the influence of general network conditions.

The NAR and Community Stadium options need to be considered carefully as P&R buses will be required to negotiate the new A12(T) dumb-bell junction and its adjoining network. Route choice via Boxted Road would avoid the need for P&R buses to compete at these and subsequent features before securing access to the NEB, and could also benefit from the shortest journey times. The surveys indicate that Boxted Road routes produce marginally improved journey times in comparison with the NAR and Community Stadium Routes, with average round-trip journey times of just over 29 minutes compared with 29 minutes and 57 seconds. These timings would however need to be confirmed with more detailed modelling that is outside the scope of this particular study.

In terms of comparing the individual NAR with Boxted Road route choices, Boxted Road (Option 1) produces the shortest time, however this route would be shared with general traffic along Mile End Road and as a consequence may face a degree of journey time variability. Use of the NEB for at least part of the journey could be more reliable, as it offers a dedicated route. A journey via NAR(2a) and the NEB (Boxted Road - Option 2) offers an attractive alternative as the overall journey times are second fastest and there is minimal variation between the AM and PM peak journey timings in comparison with the alternatives.

Subject to other considerations such as the desire to serve Colchester Hospital and public acceptance it is important to note that routes via Boxted Road could avoid unpredictable delays resulting from increasing competition over time with general traffic at the proposed new A12(T) junction and along the adjoining route to the NEB. The Boxted Road options could also provide operational benefit, as the trips are shorter when compared with all NAR and Community Stadium options. Boxted Road (Option 2) would provide additional benefits by using the NEB up to Mill Road and would also enable the service to support a stop at Colchester Hospital.

Although the overall round trip times suggest an optimum routing choice involving Mile End Road (Boxted Road - Option 1) combined with SDGs suggestion for a contra-flow bus lane in Head Street (Town Centre - Option 2), it is necessary to consider qualitative considerations in the final assessment. Both Town Centre Options 2 and 3 limit scope for access to the centre or east of the Town Centre and as a consequence may exclude a number of potential users. In addition a route focussed on Boxted Road and Mile End Road would remove the opportunity to satisfy one of the overall scheme objectives by avoiding Colchester Hospital.

On balance in terms of both maximising town centre penetration and serving key features such as Colchester Hospital the combination of Boxted Road (Option 2) and Town Centre (Option 1) could deliver a suitable compromise to achieve the overall scheme objectives. In the event that a route via Boxted Road is not favoured then a direct route between the A12(T), NAR and NEB is preferred, provided that serving access to the Community Stadium is not a requirement.

Based on the journey time assessment there appears little to separate the various route choices and in the absence of a more detailed assessment of individual link and junction capacities the surveys can only offer a guide towards optimum route choices, as they are based on existing conditions and include a number of assumptions. Generally Boxted Road could avoid a number of key junctions and links with their associated unpredictable delays,

while there is also a demand to provide an overall route that will serve important destinations and maximise town centre penetration.

A more accurate appraisal to determine the final route choice would improve the predictions of journey times to inform the final route choice. It would however demand a fairly extensive modelling exercise, which is outside the scope of this current study, to determine in more detail the various influences and interactions inherent with future network conditions. This would extend to the need to consider the interaction and impact associated with the proposed new roundabouts towards the east of the Community Stadium and the influence on network operations that will stem from the need for buses to cross a number of junctions when following the route of the NEB.

Further assessments should consider future network conditions in more detail for the route as a whole, which is likely to lend itself to consideration of the development of a micro-simulation model for the area, using programs such as PARAMICS, which can assist with the decision making process and help to visualise and appreciate the various interactions in more detail.

A suitable model would enable more reliable comparisons to be made between the relative merits of a car journey set against the P&R bus alternative and help to identify and test the need for any further network enhancement or restraint measures that may be required in future years to maintain conditions in favour of bus operations.

10 Summary and Conclusions

10.1 Overview

This report has investigated the feasibility of providing a new Park and Ride (P&R) facility for Colchester on vacant land to the north of the A12 Trunk Road at Cuckoo Farm. Options for a facility with 1,000 and 2,000 car parking spaces as prescribed by ECC have been investigated with general access to the site from the proposed new dumb-bell roundabout junction on the A12(T).

10.2 Site Layout

The study has confirmed that there is sufficient land area available from the land parcels under consideration to accommodate a site with either 1,000 or 2,000 car parking spaces. A site to the north and extending north west of the proposed new Service Area, which is anticipated adjacent to the A12(T), has been determined as the most acceptable in planning terms and the layout options therefore focus on Parcels A (3129) and B (5032). Further encroachment into Parcel C (8839) is anticipated to cater for 2,000 spaces.

Site access for general traffic is concentrated at the proposed A12(T) Dumb-bell roundabout junction, while an alternative route for buses via Boxted Road has also been considered. Traffic routing through the proposed A12(T) junction has raised the need to secure agreement from the Highways Agency that the access strategy is both feasible and effective.

10.3 Site Access and Internal Layout Options

To maintain flexibility in the decision making process outline designs on land both to the north and north west of the proposed service area and for one case east of the proposed A12(T) dumb-bell have been developed.

For general highway access a common access to serve the P&R site and the Service Area via a suitable roundabout to the north of the A12(T) dumb-bell is promoted. This has been tested for all viable options and traffic conditions and will cater for the predicted traffic demands for both the proposed opening year of 2010 and a design year of 2025.

Two options for bus access have been investigated using either the new A12(T) access or a dedicated bus only link from Boxted Road. The Boxted Road link requires additional study to confirm operational and safety matters, however in principle it would provide an exclusive bus route that avoids general traffic and unpredictable delays at the proposed A12(T) dumb-bell

roundabout. It would add an additional junction and buses to Boxted Road, which requires public scrutiny and debate before a decision on this option can be made.

In terms of the internal site layout a central bus terminus option has also been developed to supplement others adjacent to the Service Area. This would minimise walk distances and is therefore likely to be favoured by service users. A decision on the optimum option choice and specific form of the final internal site layout will be necessary to take the matter forward for planning permission.

10.4 Assessment of Park & Ride Demand

Demand forecasts to justify patronage at the site is outside the scope of this project. The likely traffic generation has therefore been based on a broad brush method previously used for the Sandon P&R site. Both the method of traffic generation and distribution of traffic on the network have been agreed with the Highways Agency.

In terms of car traffic, a 1,000 space car park could generate some 460 arrivals and 51 departures in the morning peak hour, while the 2,000 space option could generate some 919 arrivals and 102 departures. In both cases the numbers are reversed for the evening peak hour. These are robust estimates based on the number of parking spaces and not the actual demand for the sites, which may be significantly lower.

10.5 A12(T) Junction Impact

Junction capacity analyses for both the 2010 assumed Opening Year and 2025 Design Year using the 'Committed Development' base distribution confirms that the junction as a whole operates satisfactorily in the absence of any proposed P&R facility.

Three P&R development traffic distributions have been added to the committed development and tested for the 2025 Design Year. The first favours traffic from the East, the second accommodates an increased demand from the south, while the third assumes that the proposed sister P&R site at Eight Ash Green does not advance as planned.

The results indicate some issues in the 2025 Design Year, based on the road layout and junction geometry currently proposed for the A12(T) junction. These are found with all three traffic distributions tested and are mainly focussed on the NAR approach at the southern roundabout during the AM peak for the 1,000 space option. This queue worsens with the 2,000 space

option under Distribution Three and is experienced in both peak hours, while at the northern roundabout an unmanageable queue is predicted for the P&R exit during the PM peak. With 2,000 spaces the A12(T) eastbound off-slip approach to the northern roundabout is also over capacity. In all cases suitable improvements to the proposed A12(T) junction layout can be achieved within the highway to address these issues.

In the light of the assessment work submitted for review and agreed by the Highways Agency (1,000 spaces) it is reasonable to conclude that the proposed P&R development for 1,000 spaces should not have any material impact on the Trunk Road network with a 15-year design life. Some issues that may impact on the Trunk Road with Distribution Three and 2,000 spaces could be resolved at a later time by junction modifications on critical approach arms, within available highway land.

10.6 SERTS Principles

A P&R site at Cuckoo Farm should help the town to accommodate future growth and help to develop a more sustainable travel culture. The proposals satisfy SERT principles by:

- Enhancing cross town connectivity;
- Offering an effective and direct link to the town centre;
- Stopping at main attractions e.g. Colchester Hospital, North Station and the central bus station.

It is considered important that the P&R service can deliver a journey time advantage compared to the private car. This should be achievable, although at this time not rigorously tested, provided that suitable priority measures are in place.

The overall concept for P&R at Cuckoo Farm would underpin a developing sustainable transportation system for the town. The use of the Northern Express Busway (NEB) would demonstrate a firm commitment to sustainable transport by allowing P&R buses to avoid general traffic for a significant part of the link with the town centre.

Although the service should provide adequate capacity to accommodate the morning and afternoon peaks in demand, there is a need to consider patronage outside peak periods. The service should be made attractive to off-peak markets and proposals for stops at Colchester Hospital and Colchester North Station will aid this process.

10.7 Bus Route Choice

The NAR and routes through the Community Stadium need to be considered carefully as P&R buses must negotiate the new A12(T) dumb-bell junction and its adjoining network. A route via Boxted Road would avoid these features, and as a consequence could offer shorter journey times.

Guide journey time surveys suggest there is little to choose in terms of timing between the various route options with an overall round trip journey time varying between 25 to just over 30 minutes. In practise daily variations can be expected due to general network conditions. A route via Boxted Road and Mile End Road could provide the quickest journey to Colchester North Station, while onwards to the town centre a route following the contraflow bus lane in Head Street returning via Crouch Street and Balkerne Hill (Option 2) as suggested by Steer Davies Gleaves Consultancy, appears favourable. The slowest route involves a combination of the Town Centre loop (Option 3) and Boxted Road (Option 3).

Comparing the individual NAR and Boxted Road routes has shown Boxted Road (Option 1) via Mile End Road as the quickest although competition with other traffic could cause daily variations. Use of the NEB for at least part of the journey could improve reliability. A journey via NAR(2a) and the NEB (Boxted Road - Option 2) offers a reasonable alternative. A third option (Boxted Road - Option 3) has potential, which would link Boxted Road - Community Stadium Emergency Link - Northern Express Busway (NEB) to allow P&R buses to access the Community Stadium and the NEB.

Generally bus routing via Boxted Road would avoid other traffic at the proposed new A12(T) junction, while offering potential operational benefits, as the trips are shorter than all the NAR and Community Stadium alternatives. Boxted Road (Option 2) would provide additional benefits by using the NEB up to Mill Road to serve Colchester Hospital.

Overall there appears little to separate the various route choices in terms of round trip journey times. Generally Boxted Road could avoid a number of key junctions and links with their associated unpredictable delays, which may occur on occasion with routes using the A12(T) and community stadium/ NAR alternatives. The final choice will need to satisfy requirements of public acceptance, journey time reliability and the demand to provide an overall P&R service that will both stop at key destinations and maximise town centre penetration.

In the absence of a more detailed assessment the journey time surveys presented can only offer a guide towards optimum route choice. It is

understood that a Colchester Area Model is under consideration for development, and this would be extremely useful in providing a more rigorous assessment of the potential operation of the P&R bus service in the future.

10.8 Access to Colchester North Station

The proposed P&R service link with Colchester North Station is considered worthwhile although direct access to the station forecourt would add to the overall journey time due to the influence of the North Station Roundabout and is not recommended. A suitable alternative could be available using the existing bus stops either side of the road immediately south of the railway bridge, however further work is necessary to confirm this.

10.9 NEB and North Station Gyratory

With the exception of the proposed direct access route to link the NEB with the eastern end of Bruff Close and access from Mile End Road onto North Station roundabout (west), it is proposed that some of the remaining junctions will be subject to signal control. At this time it is not confirmed how buses will interact at the various signalised and other access junctions along the route of the NEB and as a consequence it is difficult to define how this will impact on P&R service journey time reliability. Even with a strategy for bus priority it is expected that some delay will be experienced at various locations to achieve a suitable balance between competing demands.

The use of Bruff Close allows buses to avoid some parts of the North Station gyratory however there are no scheduled bus priority measures at this junction and these may be required in future years. This junction warrants closer examination to investigate any opportunities to assist bus operations in future years.

10.10 Summary of Main Conclusions

Notwithstanding the fact that this has been a relatively high level assessment of the key issues relating to the Cuckoo Farm P&R, and that there are a number of areas where more detailed modelling would be required to come to a firm conclusion, the Site Feasibility Report indicates that:

- The Favoured location of the site is towards the west of the proposed A12(T) dumb-bell (The Western Site), just north of planned service station;

- The Proposed A12(T) junction will function satisfactorily in the 2025 Design Year, although there may be a need to consider improvements to the southern NAR Phase 3 approach from south;

- The proposed P&R development (1,000 spaces) should not have a material impact on the Trunk Road network within the 15-year design life, particularly in relation to it being located adjacent to the proposed new A12(T) junction at Cuckoo Farm. This is likely to be acknowledged by the Highways Agency

- Round trip timing for P&R buses is around 25 - 30 minutes, which may limit its attractiveness to customers;

- Overall it appears that there is little to separate various route choices in terms of round trip journey times. Boxted Road could avoid potential for unpredictable delays that may occur on A12(T) and community stadium/ NAR alternatives.

- Boxted Road-Community Stadium - NEB is probably the best route, however subject to the route meeting the requirements of the highway authority in terms of operation and safety. The A12(T) Junction - Community Stadium - NEB route is the second choice that needs further investigation;

- Final optimum route choice needs to satisfy requirements for public acceptance, journey time reliability and demand for a P&R service that will stop at key destinations and also maximise town centre penetration;

- Can accommodate SERTS principles, particularly in relation to serving the Hospital, North Station and linkages with the Town Centre; and

- Best for rail passengers to have stops just south of the rail station.

11 Recommendations

We have used our reasonable endeavours to provide information that is correct and accurate and have discussed above the reasonable conclusions that can be reached on the basis of the information available. We would recommend that in order to obtain more robust results, the following additional work should be commissioned.

- A more detailed examination of bus journey times and network operations through assessment of link and junction delay for the various route options is pursued;
- Analysis of the potential impact of traffic growth or restraint measures over time to enable direct comparison between journeys by general traffic set against P&R bus journeys;
- Assessment of bus operations and the potential for bus priority improvements at North Station Gyratory;
- Detailed site assessment of bus stopping opportunities and adequate pedestrian routes to and from the station immediately south of the railway Bridge at North Station as an alternative to using the station concourse for passenger boarding and alighting; and
- A more detailed examination of access arrangements and junction designs for Boxted Road to include the need to determine traffic speeds and volumes and vertical road alignments;

The following would also need further consideration and consultation when carrying out the above additional work:

- Whether to progress any option for buses routing via Boxted Road;
- The optimum layout option to be taken forward for more detailed design and presentation in association with any subsequent planning application;
- The merits of a more detailed route assessment and modelling exercise of the various options to determine the interaction between P&R bus journeys, the delay through junctions and the competing journey times likely to be experienced by the car;
- The need for a detailed assessment of anticipated P&R demand;
- The optimum route choice to link the site with the town centre bearing in mind SERTS principles; and

- The arrangements to cater for P&R buses and passengers that focus on Colchester North Station and any requirement to consider further bus priority and/ or pedestrian enhancements surrounding North Station roundabout.

Appendices

APPENDIX A

Project Study Briefs

APPENDIX B

Site Layout Options

APPENDIX C

DWP Appendices (Figure 4)
A12(T) Dumb Bell Roundabout
Combined Strategic & Local Diversions
Predicted Flows (2011)

APPENDIX D

Traffic Flow Diagrams

APPENDIX E

Proposed A12(T) Dumb-Bell ARCADY Results CD

APPENDIX F

Internal Roundabout ARCADY Results

APPENDIX G

Bus Route Assessment

APPENDIX H

NAR - NEB Interface
Indicative Traffic Signal Layout
& Testing Results