

# **THE EFFECTS OF PARK AND RIDE PARKING SUPPLY ON PUBLIC TRANSPORT DEMAND – ANALYSIS TO PROMOTE BEST PRACTICE**

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## **1. STUDY OUTLINE AND OBJECTIVES**

Arup, with Accent and the Institute for Transport Studies at the University of Leeds were appointed by Transport Scotland to explore the relationships between parking availability and the wider impacts on demand. The study seeks to fill a significant research gap, with the outputs intended to develop an overall framework to assess the opportunities for other park and ride sites. It is intended the research will provide evidence for a more consistent strategic approach. Future proposals must have a robust financial case and support the delivery of other objectives. The study considered both rail and bus based park and ride schemes.

The primary objective of the study was to assess the impacts of changes in parking supply, quality and pricing on the demand for public transport and how this varies depending on location and passenger behaviour. The identification of these characteristics will enable new sites to be identified using the emerging analysis.

The main research aims were:

- to investigate if the availability and cost of parking at bus and rail park and ride sites affects public transport patronage and what alternatives are used in the absence of formal parking facilities;
- if a relationship is found for the above, to assess the extent to which park and ride can influence modal shift to public transport, and to quantify the wider impacts including emissions and congestion;
- to assess the relative importance of factors which influence and drive the use of park and ride facilities (separately for rail and bus based sites);
- to establish whether and to what extent park and ride leads to undesirable outcomes, for example, an increase in car usage as passengers who previously walked, or made a journey entirely by public transport begin driving to a site, or drive further to make use of parking facilities;
- to develop metrics to inform guidance to appraise the impact on demand and revenue;
- to identify the optimum pricing policy to maximise rail station car parking revenue.

## 2. OVERVIEW OF THE STUDY METHODOLOGY

A methodology was developed to explore the issues by combining outputs from secondary research, with new primary research tailored to fulfil the study objectives. This approach was adopted for a number of reasons:

- There was some uncertainty whether analysis of secondary ticket data would be adequate to identify trends, hence the requirement for additional primary research;
- Results from the primary data collection were used to understand responses to a range of policy choices, with this data incorporated into the forecasting models;
- Secondary data was used to understand current behaviour;
- The combined datasets helped to generate a statistically robust dataset.

The primary case studies were carefully selected, to ensure the results and subsequent conclusions were sufficiently representative and could be applied to other parts of Scotland. Budgetary considerations determined the type and number of interviews collected at each location. Three types of case study have been examined:

- parking at railway stations is examined in section 3;
- bus based park and ride is examined in section 4;
- cross-Forth park and ride is reviewed in section 5.

## 3. PARKING AT RAILWAY STATIONS

### 3.1 Background

It is intended rail based park and ride helps to support a number of objectives:

- **Economic:** schemes can help to support additional city centre employment and help to control levels of congestion by providing faster, more reliable journey times compared with the alternative modes;
- **Environmental:** help to reduce carbon emissions. The total per passenger kilometre for rail can be around 50% lower compared with car (Source, Act on CO2 website);
- **Social:** some park and ride sites help to reduce the number of car trips to the urban centre and this can cut congestion, reduce the number of accidents and improve quality of life.

Strong rail patronage growth has been achieved in Scotland during the last 10 years and this has led to increased pressure on car parking availability at stations. Many car parks are now full before the end of the AM peak period, and there is a perception that off-peak demand may be suppressed. If parking is not available, some users may simply choose to make their entire journey by car or drive further to an alternative station. Previous studies have failed to fully explore this relationship. As part of this study stakeholder consultation, surveys with existing users and rail ticket data was analysed to examine the relationship between the variables.

### 3.2 Stakeholder Consultation

The relationship between car parking extensions and changes in rail demand was discussed with First ScotRail (FSR). These discussions explored the relationship between parking availability, the resulting impact on rail demand and the influence of other factors. This consultation highlighted several important issues. FSR is generally supportive of schemes to increase car parking availability, especially if they are able to help attract new rail revenue. However, the high capital costs and short duration of the remaining franchise means the scope for FSR to lead proposals is limited.

FSR noted that there are a number of factors influencing rail growth, including the attractiveness of the rail service and the extent of crowding problems. The interface between parking availability and the timetable is an influential factor. Car park extensions from stations with a competitive rail service operating parallel to congested roads have helped to attract new users. For example, the route between Edinburgh and Glasgow via Shotts was significantly improved from December 2009 with the introduction of limited stop trains. Passenger usage from selected stations has increased as a result of the more attractive service, placing pressure on the availability of parking.

The potential benefits of decking existing car parks were highlighted by FSR, particularly if the scope for surface level expansions is restricted. Decking existing facilities could reduce implementation timescales, particularly if land needs to be purchased. However, shorter timescales can be offset by the prohibitively expensive capital costs.

### 3.3 Attitudinal Surveys

Surveys were conducted in early September to understand user characteristics and attitudinal responses. These surveys were collected to understand the socio-economic characteristics of passengers using the railway stations surveyed, with some of the analysis carried forward to inform the development of the forecasting models. A total of 493 surveys were completed at six railway stations. Surveys were undertaken from mid afternoon to the early evening weekdays, and during daytime shifts at the weekend, in order to interview a cross-section of passengers.

**Table 1: Summary of the Car Parking Statistics**

Station	Number of Spaces		Timescales	Usage	Operator	Rail Services
	Before the Extension	After the Extension				
Kirkcaldy	320	594	Nov 2006	80%	Local authority	Regular services to Edinburgh, plus trains to Aberdeen / Inverness
Bridge of Allan	114	146	Dec 2005	100%	First ScotRail	Regular trains to Edinburgh and Glasgow Queen Street
East Kilbride	134	287	May 2007	97%	First ScotRail	Regular trains to Glasgow Central
Falkirk High	285	285	N/A	98%	First ScotRail	Regular trains to Edinburgh and Glasgow Queen Street
Stirling	276	276	N/A	100%	First ScotRail	Regular trains to Glasgow Queen Street, Edinburgh, Aberdeen and Perth
Perth	160	160	N/A	92%	First ScotRail	Regular trains to Glasgow Queen Street, Edinburgh, Aberdeen and Perth

Surveys were conducted at Bridge of Allan, Kirkcaldy and East Kilbride stations where the number of spaces had been increased. This provided a reasonable cross-

section based on geographic location, different characteristics (rural / urban) and the charging structure. Perth, Stirling and Falkirk High were used to understand the results for stations where the number of spaces available was unchanged. The following sections discuss the main results from the survey.

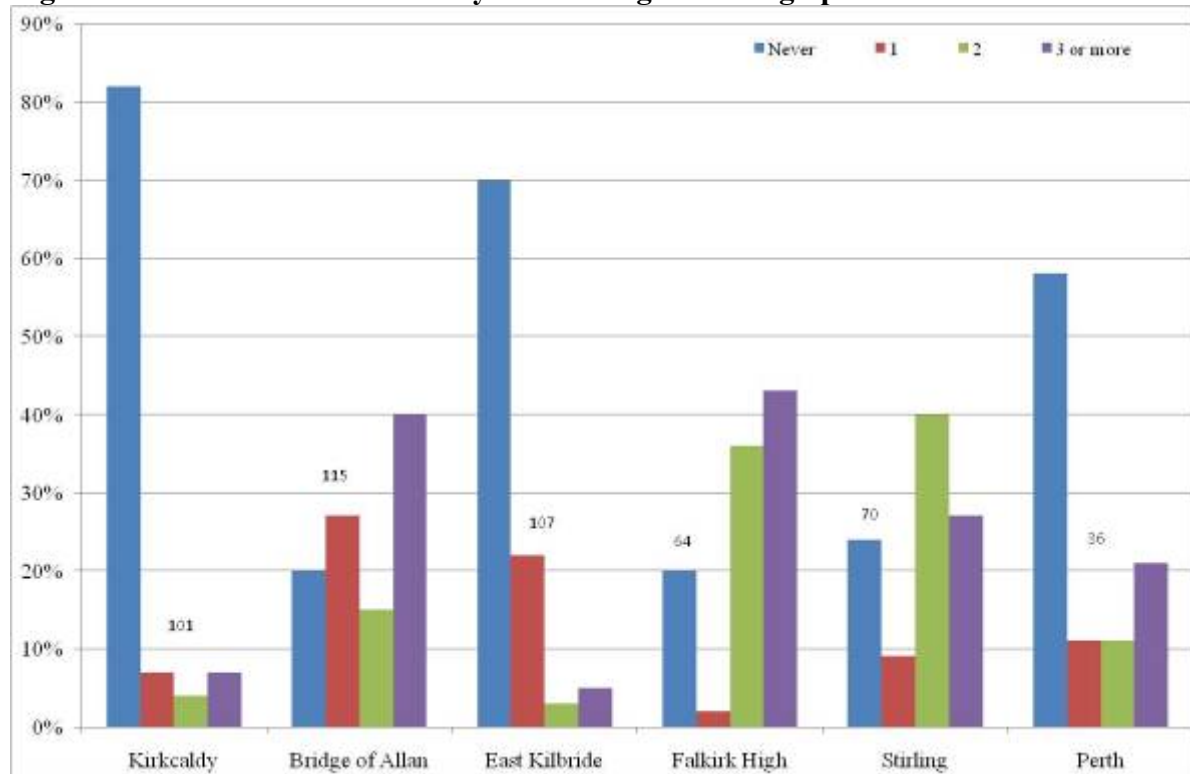
### *Parking Costs*

The data on parking costs shows several interesting trends. The railway stations with extended car parks are generally free, including Kirkcaldy and Bridge of Allan. Furthermore, over 90% parked free of charge at East Kilbride. Only 1% using Falkirk High and Stirling parked for free, but these have not benefitted from extensions.

### *Parking Availability*

Respondents were interviewed to explore their perceptions of parking availability. There are noticeable differences between the results, with at least 70% of respondents always finding a space at Kirkcaldy and East Kilbride, suggesting the previous constraints have been alleviated by extensions at these stations. In contrast, only 20% of users at Bridge of Allan, Falkirk High and Stirling always found a parking space. This highlights the popularity of the car park at Bridge of Allan, despite its recent expansion. About 40% of users at Bridge of Allan and Stirling had problems finding a space on at least 3 occasions every 10 visits. The results indicate a step change in parking availability is required with some spare capacity to materially influence the perception of users. Figure 3.1 presents the results.

**Figure 3.1: Likelihood of Difficulty in Securing a Parking Space**

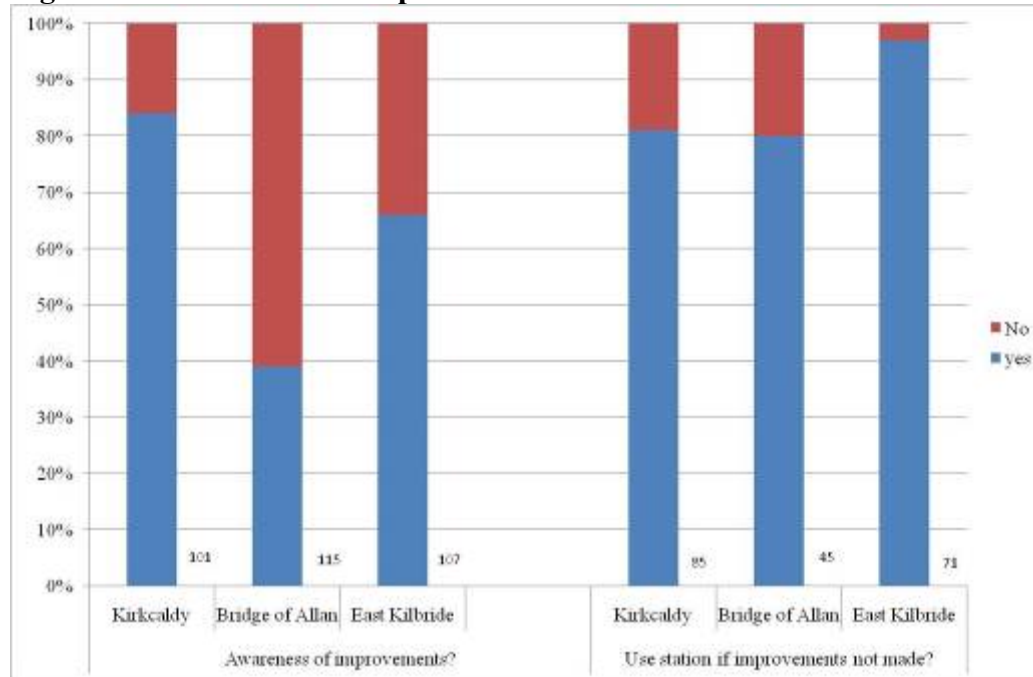


Source: Arup analysis of Accent data, sample size shown

### *Awareness and Response to Car Park Extensions*

The majority of respondents surveyed at Kirkcaldy (84%) and East Kilbride (66%) were aware of the improvements to these station car parks. Interestingly at Bridge of Allan, 61% of respondents were not aware of the improvements, and the continued high utilisation of spaces may be a contributory factor for this result. At least 80% of respondents stated they would have used their current station even if the additional parking spaces had not been delivered. This outcome highlights the apparent reluctance to modify travel behaviour even if the availability of parking at stations was limited. The survey results are shown in Figure 3.2.

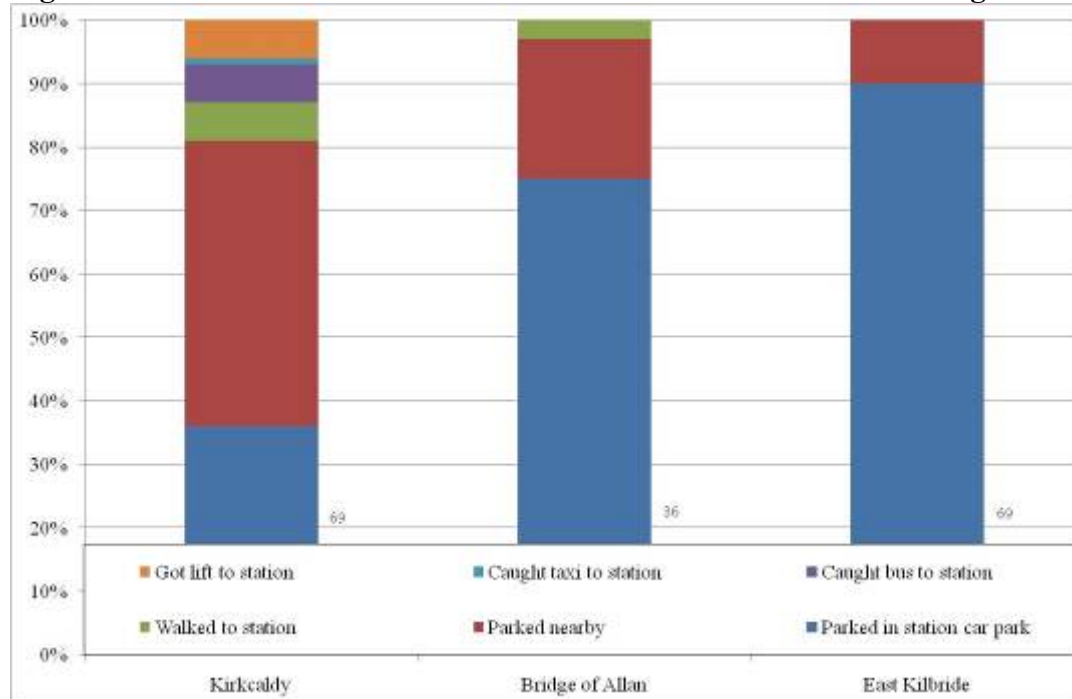
**Figure 3.2: Awareness of Improvements**



Source: Arup analysis of Accent data, sample size shown

Figure 3.3 illustrates the change in travel behaviour for respondents who used the station prior to the improvements, and their mode of access. Only one-third of respondents interviewed at Kirkcaldy previously drove, with about 45% parking elsewhere. The results suggest the majority of passengers would have continued to park at the station, regardless of whether improvements were delivered. With the exception of Kirkcaldy, the number of 'other' responses including walking, catching a bus or using taxis was very small.

**Figure 3.3: Travel Behaviour Before Car Park was Extended – Existing Users**



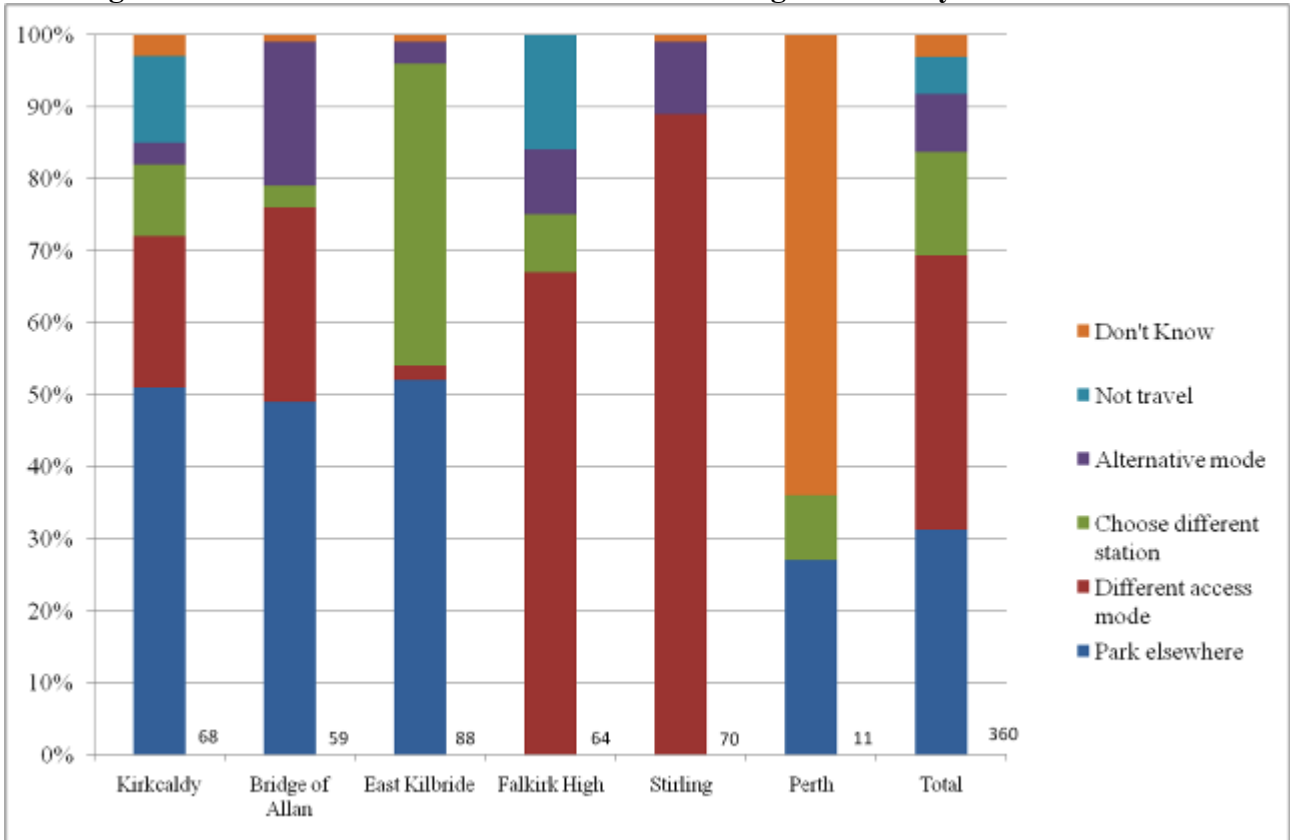
Source: Arup analysis of Accent data, sample size shown

The additional number of rail trips generated as a result of car park extensions can be taken into account in the appraisal. The sample size for new users is relatively small, so the conclusions need to be treated with some caution. Around 20-30% of users at Bridge of Allan and Kirkcaldy previously travelled by car, indicating some car trips have been removed from the network. Furthermore, 30-40% previously drove to a different station, so the extensions have reduced the length of some car trips to the station. However, the results also suggest that a small number of respondents who previously walked or cycled to the station are now driving, in response to the increased parking availability.

#### *Changes to Travel Behaviour*

About 50% of respondents at Kirkcaldy, Bridge of Allan and East Kilbride stated they would park elsewhere if the availability of spaces was restricted at these railway stations. Over 40% of users at East Kilbride would travel from a different station, and this conclusion reflects the close proximity of alternative stations. Passengers interviewed at Falkirk High and Stirling indicated they would use a different mode of access, but still use these stations. This reflects the improved journey opportunities available (higher frequencies and / or faster journey speeds) compared with adjacent stations. There was insufficient survey time to explore the alternative modes that they might use, but other data (for example, Department for Transport, WebTAG unit 3.13.2), indicates the most popular alternative modes of access are car either as a driver or passenger. The results are shown in Figure 3.4.

**Figure 3.4: Alternative Travel Behaviour if Parking Availability is Constrained**



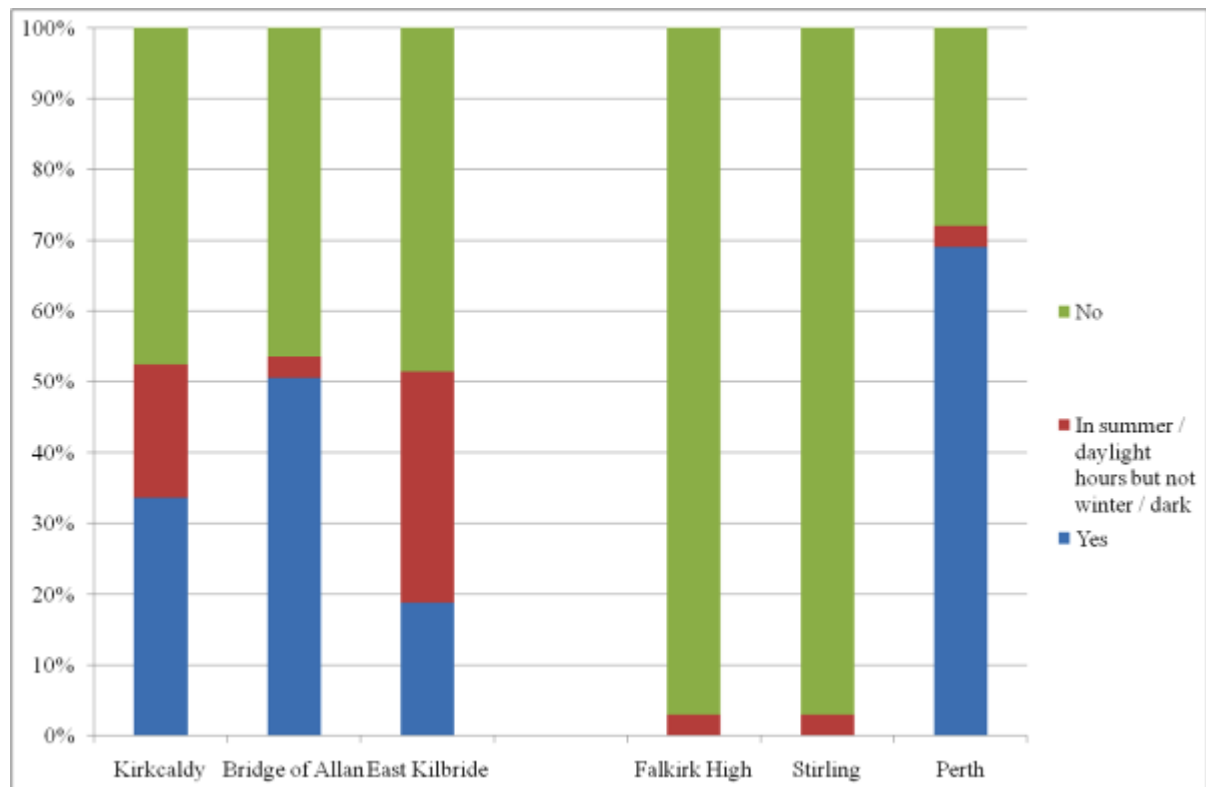
Source: Arup analysis of Accent data, sample size shown

#### *Station Facilities*

The importance of CCTV varies at the six stations (see Figure 3.5). In Kirkcaldy, Bridge of Allan, East Kilbride and Perth, the majority of respondents would still use the car park even if CCTV was not available. The availability of lighting is a greater concern compared with the availability of CCTV. At Falkirk High and Stirling, over 90% of respondents stated they would not use the car park at these stations if there was no lighting.

The results suggest a minimum level of facilities is required including lighting and a tarmac road to access to the station. The availability of CCTV is less important, although this conclusion varies depending on the specific location.

**Figure 3.5: Willingness to use the Car Park without CCTV, Lighting and an Untarmacked Road**



Source: Arup analysis of Accent data

### 3.4 Secondary Data Analysis and Development of the Forecasting Model

#### *The Model*

A forecasting model to estimate the relationship between the change in rail demand and car parking availability was developed. The models were populated using LENNON ticket data, change in city centre employment, GDP forecasts, change in population and the availability of parking spaces at the stations. The model was supplemented by the number of journeys from MOIRA if the requirement for patronage data pre-dated 2004.

The model was segmented to reflect the type of ticket being purchased and the length of trip (up to 20 miles, or longer). The station-to-station flows generating the largest number of journeys were included in the model and the inclusion of almost 15,500 records meant the survey size was robust. A number of attitudinal variables were also incorporated into the model using results from the respondent interviews. A more detailed description of the modelling methodology can be obtained from the authors if required.

Separate forecasting models were developed for the season and non-season travel markets, plus local trips up to 20 miles and inter-urban flows since the characteristics of these users could vary. The models examined the change in rail demand if the number of spaces was increased and also examined the impact of pricing. The results of the modelling work are discussed in Section 3.5.



### 3.5 Implications for the Analysis

**Modelling Results:** The outputs from the modelling analysis indicated a 10% increase in parking spaces could generate an additional 0.4% season ticket journeys, and 0.9% increase in trips by non-season ticket holders. The impacts are smaller for local journeys less than 20 miles. Based on the 600 space car park at Kirkcaldy, this equates to 2 wholly new trips per day for season ticket holders and 6 extra trips per day for non-season tickets.

A £1 increase in parking costs compared with current levels means 55% of drivers would choose to park elsewhere, with 5% diverting altogether from rail. This demonstrates the relative sensitivity to any changes in parking costs.

Parking charges had a lesser impact if ample free local parking was available, reflecting the increased availability of alternatives. A relationship between the availability of parking spaces and inter-urban season tickets was identified if spaces were reduced. A linkage was also found if there is ample local free parking for non-season tickets, implying commuters are less inclined to leave their cars 'off-site'. However, the increased availability of spaces earlier in the morning may be a contributory factor for this behaviour.

**Modal Choice:** The results indicate the scope to influence overall mode choice from increased station parking is relatively small. The extra parking has encouraged about 4% of respondents to divert from an alternative, less convenient railway station. About 3% of total respondents previously chose to complete their journey by car. However, the increased availability of parking has encouraged some users to drive rather than opting to walk. A higher number of passengers are able to park at the station, rather than choosing an adjacent location, for example, on-street. The overall change in car distance travelled using the network is broadly neutral. The reduction in car distance achieved if new rail users switch from car is broadly equal to the additional distance generated from extra car trips travelling to the station. As a result, the change in car kilometres resulting from the extensions is negligible.

**Role of Supplementary Factors:** Conclusions from stakeholder feedback, along with the survey results regarding the impact of 'softer' measures help to illustrate the relative importance of these factors, for example, CCTV, lighting and other measures to create a safe waiting environment.

**Change in Travel Behaviour:** There was limited evidence of new car trips being generated as a result of the extra parking spaces. The number of motorists switching from car was very small as demonstrated in the more detailed analysis.

**Financial Appraisal:** The capital cost to extend existing car parks is about £10,000 per space depending on the scheme complexity, although this could be higher if decking is required. Assuming a notional parking cost is introduced, plus the cost of a 'typical' return rail fare, the payback period would exceed the current duration of the franchise. This reinforces why car park extensions are unlikely to be viable in simple financial terms over a franchise term.

**Price Elasticity:** If the parking charge is increased by £1, demand would be reduced by 4.9% or 3.0% if there is ample free local parking.

## 4. BUS BASED PARK AND RIDE

### 4.1 Background Context

One of the main objectives of bus based park and ride is encouraging car users travelling to large urban centres to transfer onto buses for the last part of their journey. Similar to rail based park and ride, they help to support wider economic, environmental and social objectives and have been introduced at various locations across Scotland and other locations across the rest of the UK. Buses make more efficient use of road space compared with private cars, helping to boost the number of employees able to access employment opportunities in the major urban centres. Buses also generate carbon emissions that are 30% lower per kilometre compared with a private car (Source, Act on CO2 website). These outputs also help to support quality of life and safety objectives.

### 4.2 Comparison of Selected Park and Ride Sites

Initial comparisons suggest schemes in Scotland attract a lower number of trips per annum compared with some sites in England. For example, the four sites serving Edinburgh (population 480,000, plus 3.5m tourists annually ([www.visitScotland.com](http://www.visitScotland.com)) generate around 450,000 trips per annum, whereas five sites at York attract about 6m users (population 140,000, plus 7.1m visitors per annum). Several case studies have been reviewed to understand the contributory factors for successful park and ride sites. A number of themes emerged:

- **Size of potential catchment:** the most successful schemes serve an urban centre with a population of at least 100,000 people;
- **Location:** sites need to be conveniently located to their potential catchment, with minimal delays from congestion. Effective signing from the strategic highway network is also required;
- **Bus priority measures:** required to deliver competitive bus journey times versus other modes;
- **Service frequency:** buses need to depart every 10 minutes to provide a dedicated, frequent service. A service every 12-15 minutes is less attractive;
- **Role of Demand Management:** The most successful schemes are integrated into an overarching demand management strategy, especially in historic areas.
- **Costs:** cost of bus fares must be competitive compared with city centre parking charges;
- **Branding:** bus operators have a prominent role to publicise the availability of park and ride, through distinctive vehicle liveries, marketing and other material;
- **Sites:** good lighting, a staff presence and security is required.

### 4.3 Primary Research

#### Overview of User Behaviour

Sites at Bridge of Don, Aberdeen and Ingliston, Edinburgh were chosen as locations to conduct surveys of user behaviour, since they offered a reasonable sample size in

terms of the number of existing users, varied geographic coverage serving different catchments and alternative city centre parking strategies. The results from the bus user interviews are discussed below. A total of 250 surveys were completed at the two sites.

#### *Journey Times to the Park and Ride*

Almost 60% of respondents interviewed at Bridge of Don and Ingliston had a journey time to the site less than 20 minutes, with a further 15% taking less than 30 minutes. Over 20% of respondents travelled for more than 40 minutes, including 10% making trips of over an hour.

#### *Catchment Analysis –Trips to the Destination*

Nearly 65% of trips using Ingliston have a destination in Edinburgh city centre. The Gyle is also a popular location. Over 95% of trips from Bridge of Don had a destination in Aberdeen city centre.

#### *Journey Purpose*

The most popular journey purposes of park and ride users are commuting and shopping. Commuting accounts for almost 50% of the total, whilst shopping represents a further 25%. The relatively high percentage of shopping trips is interesting, particularly as 95% of spaces at Ingliston were occupied before 9am. The ‘other’ journey purposes account for a relatively small proportion of the total.

#### *Parking Availability*

Monitoring data provided by Aberdeen and Edinburgh suggests both sites are operating below capacity. Over 95% of users always found a space, and those reporting a problem only highlighted these difficulties infrequently.

#### *Ticket Types*

About 80% of passengers bought single or return tickets. The usage of alternative tickets is relatively small, with fewer than 40 passengers using other products.

#### *Change in Travel Behaviour*

Almost 25% of existing users would be unwilling to pay anything extra. This implies some users have free or low cost parking available, so are choosing to use park and ride for convenience reasons. About 50% would pay up to £1.00 extra to use the park and ride, implying the cost to park in Aberdeen is relatively cheap. Interestingly, about 7% of users in Edinburgh would be willing to pay over £3.00, indicating the cost of alternative parking in the city centre is very expensive. Over 60% of existing users would drive in the absence of sufficient parking, with a further 20% switching to a local bus service. A small number of respondents drove to Ingliston to take advantage of the more frequent and cheaper buses compared with the local routes originating from adjacent catchments.

#### *Passenger Safety Considerations*

Nearly 80% of respondents would continue to use the park and ride if CCTV was not available. The availability of lighting appears a more important issue. Less than 50% of respondents would use the park and ride if the site was poorly lit, although some users would be willing to use the site during the summer. The combination of poor

access to the site, no lighting and no CCTV has a major impact on user behaviour, with just 30% of respondents willing to use the sites.

### *Summary of Main Issues*

Many of the passengers using park and ride have a destination in the city centre, with commuting and shopping the most popular trip purposes. Relatively few passengers reported problems regarding the availability of spaces. The cost of other possible parking in Aberdeen is relatively low, although some users were willing to pay over £3 to park in Edinburgh, indicating the cost of alternatives is relatively high.

### **Overview of Non User Behaviour**

About 120 interviews with non-users were also completed to understand the factors that influenced their travel behaviour. Respondents were carefully screened to ensure the characteristics of their journey meant they could switch to park and ride.

### *Existing Car Journey Times to the City Centre*

Respondents were interviewed to understand journey times to central Aberdeen or Edinburgh. The sample made relatively long access trips compared with drivers already using the park and ride, with over 50% travelling between 40 and 50 minutes. No-one interviewed had an access time less than 10 minutes, although these timings include the total journey time to reach the city centre.

### *Competing Parking Charges*

One of the main factors affecting the choice between driving or using park and ride is the cost and availability of car parking in the city centre. About 55% of possible respondents have access to free parking and this influences travel choices. About 75% pay £2.50 or less to park in the city centre. These survey results help to inform the level of park and ride fares offered to ensure services are competitive.

## **4.6 Implications Resulting from the Analysis**

The detailed review of the existing case studies and other secondary data, plus the issues emerging from the primary research has highlighted some fundamental issues. The availability of adequate parking is a pre-requisite for a successful park and ride. Other performance indicators have been examined to understand their relative importance. These are presented in terms of ‘essential’ or ‘desirable’ factors.

**Table 4.1: Main Requirements**

Description	Essential	Desirable	Description	Essential	Desirable
Proximity to the strategic road network	√		Type of vehicles		√
Availability of parking throughout the day		√	Operating period	√	
Service frequency – departures every 10 minutes	√		Pricing mechanism	√	
Dedicated buses serving the site		√	Availability of facilities		√
Competitive journey times	√		Evidence of branding	√	

- **Availability of Parking:** this is absolutely fundamental to the success of bus based park and ride. In summary, the absence of parking availability means a high proportion of users would choose alternative modes, principally making the entire journey by car. The results from the primary research indicated over 60% of respondents would make their entire journey by car if there was insufficient parking available. This outcome clearly indicates the importance of ensuring adequate parking is available throughout the day, particularly for off-peak commuters.
- **Evidence of the Supplementary Impacts:** The benefits from park and ride significantly outweigh any modest dis-benefits resulting from drivers making extra trips by car. Our survey research demonstrated the number of car kilometres removed from the network is 2.5 to 3 times higher than the additional mileage generated from respondents driving to the park and ride to take advantage of the improved public transport journey opportunities;
- **Financial Appraisal:** based on assumptions from a number of existing schemes, the costs for services departing every 10 minutes range from £800,000 to £1m per site per annum, depending on the operating period. For a site to break even in financial terms, about 1,200 passengers per day need to be attracted. This number of passengers highlights the importance of locating sites in the optimum position to achieve a robust financial case. The capital costs to develop a new site range from £5-10m with societal benefits helping to offset these costs;
- **Catchment Analysis:** Based on previous consultancy studies, the percentage of drivers passing the site with a destination in the city centre ranges from 20-40%. It is estimated park and ride attracts between 10-40% of motorists depending on the characteristics of the schemes and the parking structure enforced in the urban centre. Car occupancies of about 1.37 persons could be assumed based on STAG guidance. This equates to about 20,000 vehicles per day using roads adjacent to the site. Scheme operating costs vary depending on specification offered and could range from £75,000 to £100,000 per annum. It is assumed the capital costs will be funded through Local Transport Plan investment, with these costs recouped from wider societal benefits including journey time savings, highway decongestion benefits;
- **Pricing Policy:** If prices were increased by around £2, the revenue lost as a result of motorists altering their travel behaviour would be greater than the extra income generated from the remaining users. This indicates the current price structure of about £3 is broadly correct, and indicates bus passengers are responsive to potential changes in travel choices.

## 5. CROSS FORTH TRAVEL

### 5.1 Background

This case study examined competition between bus based park and ride at Ferrytoll and rail from Inverkeithing, mainly for trips to Edinburgh. These sites are conveniently located to the strategic highway network to encourage motorists to switch to public transport prior to the congested Forth Road Bridge. This helps to control congestion levels, particularly for trips that could not easily divert to public transport for the entire journey.

- **Ferrytoll:** the site is open daily from early morning until after midnight. There is a high frequency bus service, with departures every 5 minutes towards Edinburgh at peak times, with other services to Edinburgh Airport, Gyle and Edinburgh Park. There is free parking for 1,040 spaces. Journey times to Edinburgh during the peak periods are about 40 minutes, with return daily fares of £4.70.
- **Inverkeithing:** there is rail based park and ride to Edinburgh. Access from the strategic road network is less convenient compared with Ferrytoll. There are at least 5 trains per hour towards Edinburgh, with journey times of about 25-30 minutes. Although the rail service is less frequent, journey times are faster, especially in the peak periods when buses are more readily affected by congestion. However, rail fares are more expensive.

## 5.2 Primary Research

Respondents using Inverkeithing or Ferrytoll were interviewed in the car parks. A brief interview was conducted about their current journey, with 159 interviews completed. The Stated Preference (SP) interviews explored the relative attractiveness of bus and rail based park and ride. The analysis presented a number of travel choices to current users.

## 5.3 Implication Resulting from the Analysis

The analysis of the cross-Forth travel market highlighted some important issues that will affect the opportunities to further develop park and ride.

- Changes to service frequency variable have a negligible impact on the results, although this may be influenced by the existing high frequency departures;
- Time spent getting to the final destination has a strong impact on the choice between rail and bus. This was an influential factor affecting the overall choice;
- The implied Value of Time is relatively low and may indicate park and ride users are less responsive to alternative travel choices. Respondents seem to be parking in Fife and using park and ride to avoid expensive parking costs in Edinburgh, even though journey times are longer. The bus and rail travel markets are relatively segmented, with just a small proportion switching.

The opportunities to improve cross-Forth park and ride services will be influenced by a number of factors, including future parking policies in central Edinburgh and the distribution of employment. The capacity constraints affecting the Forth Bridge may help to encourage other motorists to use park and ride, although the proposed new crossing may partially alleviate these constraints. Improvements to public transport need to be examined as part of wider solutions for the corridor.

## 6. CONCLUSIONS AND NEXT STEPS

The main impacts from the study are presented to inform the policy makers both in Transport Scotland and local authorities. This analysis formed the main deliverable of the study. The outputs will help to provide strategic guidance to decision makers to understand the benefits of providing additional car parking spaces and its impact on public transport demand.

Whilst there is evidence to suggest bus based park and ride can help to reduce the overall number of car trips, existing schemes in Scotland are relatively under-performing compared with other examples. The linkages with wider transport policy need to be strengthened to help attract a higher number of motorists to use the site and support wider objectives. Furthermore, the site selection process must be carefully developed to help ensure the financial case for the scheme is robust. The availability of parking forms a crucial overall factor contributing to a scheme's success, but several other factors must be fulfilled to maximise the commercial impacts.

In contrast, the relationship between parking availability and rail demand is less conclusive based on the research completed. If parking availability is increased, the level of new rail demand is relatively small and the subsequent change in car distances using the network is negligible. As a result, the case for delivering additional car parking spaces at stations must be linked to other objectives, for example, addressing specific car parking capacity constraints that may have arisen as a result of rail service improvements.

The requirement to improve bus or rail services for Cross-Forth journeys will be influenced by various factors, including future parking policy to be applied in central Edinburgh, the distribution of employment and the role of any demand management initiatives resulting from the proposed new Forth Crossing.