



**TRANSPORT
SCOTLAND**
CÒMHDHAIL ALBA

**Larkhall – Milngavie Railway
Project Evaluation Study
Final Report**



**LARKHALL – MILNGAVIE RAILWAY
PROJECT EVALUATION STUDY
FINAL REPORT**

SYSTRA Limited

Transport Scotland 2015

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Evaluation of Larkhall-Milngavie Rail Link



1 Opened



2 Cost
£35m

3 **4.7km** of track reinstated



1.6km of track extension



4 new stations

4 A return of **£2.77** for every **£1** spent on the project



5 Enhanced frequency on the Milngavie branch and the Newton to Hamilton line:
From 2 to 4 trains per hour



6 Actual Passenger Demand at new stations in 2012/13:

614,800 

26% higher than forecast.



7 Public transport journey times to Glasgow Central **reduced by 10 minutes**



for **60%** of Larkhall & Hamilton population



8 Up to **1800 new homes** in Larkhall & Ferniegair by 2020 – rail improvements a key factor



10 **49%** of commuters using the Larkhall area stations said that they would have to drive to work if these stations were unavailable.



9

64% of respondents used the line for commuting purposes



1. EXECUTIVE SUMMARY

- 1.1. SYSTRA were commissioned by Transport Scotland in March 2014 to undertake an evaluation of the Larkhall – Milngavie railway project and to provide recommendations for improvement of the draft Rail Evaluation Guidance.
- 1.2. The evaluation found that the project has been a success in terms of standard Transport Economic Efficiency (TEE) measures with the project's benefits outweighing its costs. This is primarily due to higher than expected demand. However, there is only limited evidence to support the success of the project's wider objectives.
- 1.3. To conduct the evaluation, data was gathered and analysed to provide an evidence base to establish the extent to which the project has met its original objectives and the five Scottish Transport Appraisal Guidance (STAG) criteria.
- 1.4. The six project objectives were:
 - Project Objective 1:** to reconnect Larkhall to the rail network to allow the introduction of a half-hourly service;
 - Project Objective 2:** to double the frequency of services between Hamilton and central Glasgow and between Milngavie and central Glasgow to four trains per hour;
 - Project Objective 3:** to remove an operational bottleneck on the North Suburban line;
 - Project Objective 4:** to increase the attractiveness of Larkhall and Kelvindale and the surrounding areas for inward investment and land development;
 - Project Objective 5:** to offer social inclusion benefits for residents; and
 - Project Objective 6:** to encourage a modal shift towards public transport.
- 1.5. To establish an evidence base, a variety of techniques were employed, using a combination of primary and secondary research including:
 - a User Survey of rail passengers to understand their characteristics and the impacts of the project on their travel behaviour;
 - a Business Survey to understand the impact of the project on local businesses;
 - accessibility analysis to assess how public transport journey times have changed since the completion of the project; and
 - secondary data sources to establish actual station demand and revenue, and examine trends in local socio-economic indicators such as population and employment.
- 1.6. The first three operational objectives have all been achieved. For the remaining three, in the absence of quantitative targets, it was more difficult judge the extent to which they have been achieved. There was evidence from the two surveys undertaken and the accessibility analysis that positive contributions have been made towards social inclusion benefits and a modal shift towards public transport (objectives 5 and 6), particularly in Larkhall.

- 1.7. For objective 4, whilst there was some evidence from the User Survey to suggest that Larkhall and Kelvindale have become more attractive places to live and work, there was limited evidence of inward investment, land development for commercial purposes and Wider Economic Benefits (WEBs) from the Business Survey. Examination of local socio-economic indicators also showed there was no conclusive evidence to suggest that the Larkhall – Milngavie project has had a significant or measurable wider economic or social impact, other than data to support an increase in home building in the Larkhall area. It is however acknowledged that these are long-term impacts and may yet still materialise.
- 1.8. In terms of utilisation, the project has been a success with actual passenger demand exceeding forecasts. For example, in 2012/13, actual passenger demand at the four new stations was 26% higher than forecast. Reasons for the difference were explored. It is thought that exogenous drivers of rail demand in general such as increasing employment in city centres and car dis-benefits such as congestion, parking constraints and high fuel prices, as well as population being higher than forecast have been key factors. Other factors may include not accounting for the inclusion of Park & Ride facilities and the method by which demand abstraction from other stations was modelled.
- 1.9. The project's original Benefit Cost Ratio (BCR) was 0.66, indicating that the project's monetised benefits would not outweigh its costs (although it was acknowledged that the project would bring other non-monetised benefits such as regeneration impacts which would make the project value for money). Owing to changes in appraisal methodology since the original BCR was calculated and the availability of actual values to replace some of the forecast values, the BCR was recalculated. The new value was calculated as 2.77 which is significantly higher than the original appraisal value and indicates that the project has delivered value for money. Even when reverting to the original appraisal assumptions, the project's benefits still outweigh its costs with a BCR of 1.83.
- 1.10. Drawing from the learning points encountered whilst undertaking this evaluation study, a number of recommendations for the improvement of the draft Rail Evaluation Guidance have been made. The key recommendations are to:
- develop 'SMART' project objectives which can be effectively and continuously monitored post-project completion;
 - conduct the Process Evaluation soon after project completion;
 - identify the data required to effectively appraise, monitor and evaluate the project including the use of surveys to better understand the characteristics and behaviour of users and potential users both before and after project completion;
 - ensure data collection is an on-going exercise rather than a task that is only considered as part of the Outcome Evaluation;
 - consider innovative survey design including the use of new technology and social media to ensure a more targeted yet cost-effective survey approach;
 - ensure all project documentation is comprehensively archived and safe-guarded to make sure the relevant and correct information is readily accessible which will aid the future monitoring of the project;
 - ensure all demand modelling assumptions made and outputs prepared at the appraisal stage are comprehensively documented; and

- undertake sensitivity tests using a range of economic conditions when preparing demand forecasts to reflect the inherent uncertainty in forecasting.

2. INTRODUCTION

Larkhall – Milngavie Railway Project Overview

Summary

2.1. The Larkhall – Milngavie railway project opened in December 2005 and comprised two engineering schemes:

- re-instatement of 4.7km of track from the junction near Hamilton to a new station at Larkhall with two additional stations at Merryton and Chatelherault; and
- a 1.6km extension of the Northern Suburban line from Maryhill to Annesland, with a new station at Kelvindale.

2.2. As well as the line re-instatements and station re-openings, two significant service enhancements to the Glasgow suburban rail network were implemented:

- enhanced service frequency on the Milngavie branch from 2 to 4 trains per hour; and
- enhanced service frequency on the Newton – Hamilton line from 2 to 4 trains per hour.

2.3. A map showing the route is shown below

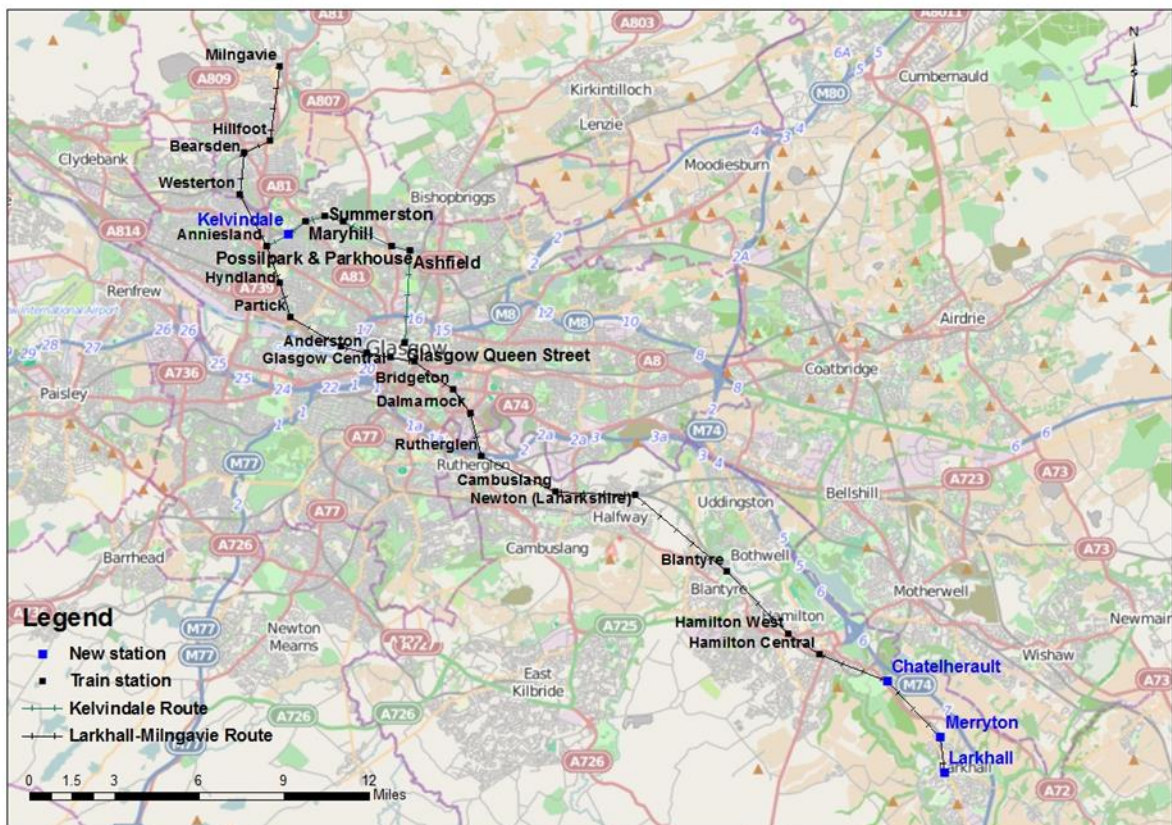


Figure 1 Larkhall – Milngavie Rail Project

Background

- 2.4. The original Larkhall station opened in the early 1900s and connected the South Lanarkshire town to the suburban Glasgow rail network. However, the line to Larkhall was withdrawn in 1965 on the recommendation of the Beeching Report.
- 2.5. The idea of re-opening the Larkhall line was first raised in the mid-1980s and in 1992, Strathclyde Regional Council (SRC) carried out a major review of its transport strategy. The outcome was a number of proposals to enhance local transport, one of which was the Larkhall – Milngavie railway project. This would involve the reconstruction of the Larkhall line, as well as the second stage of reconstruction on the Northern Suburban Line between Maryhill and Anniesland. These changes were complemented by a range of changes to the timetable (predominantly service frequency improvements) providing enhanced services to many areas, from Milngavie in the north and to Larkhall in the south.
- 2.6. In 1994, British Rail, on behalf of SRC, submitted and obtained the necessary Parliamentary powers to acquire land for the project. This was followed by a review in 1996 by the Strathclyde Passenger Transport Authority (now the Strathclyde Partnership for Transport, SPT) which confirmed the Larkhall – Milngavie project as a necessary and appropriate development of the heavy rail network to meet the public transport needs of the area.
- 2.7. Appraisal and analysis of the project by SPT between 1998 and 2000 included:
- the original Outline Business Case¹;
 - a reappraisal in line with the New Approach to Appraisal (NATA) framework²;
 - an appraisal of the wider economic and land-use impacts³; and
 - an economic cost-benefit analysis using the Strathclyde Integrated Transport Model (SITM)⁴.
- 2.8. The cost-benefit analysis indicated a BCR of 0.66, with the majority of benefits coming from journey time benefits. However, significant non-quantifiable benefits such as regeneration of Larkhall and increasing access to education and job opportunities were considered more than sufficient to offset the deficit in the appraisal which included only monetised benefits.
- 2.9. Work on the Larkhall – Milngavie project began in 2004 and was completed in 2005 at a cost of £35 million.

Project Objectives

- 2.10. Prior to the completion of the project in 2005, Larkhall, with a population of over 15,000⁵, was one of the largest settlements in the Glasgow conurbation that was not linked to the Strathclyde rail network.

¹ Larkhall to Milngavie PPP Project Outline Business Case 1998/99 – SPT, October 1998

² Larkhall to Milngavie PPP Project: Reappraisal of Investment Case 1999/00 – SPT, July 2000

³ Wider Impacts of the Larkhall – Milngavie Project – David Simmonds Consultancy, October 2000

⁴ Modelling Report: Larkhall/Milngavie Rail Project – SPT, November 2000

⁵ 2001 Census

2.11. Traditionally a mining and textiles area, many of Larkhall's industrial factories had closed in the 1980s resulting in high unemployment. The Larkhall – Milngavie project was therefore seen as a key catalyst in facilitating economic regeneration of Larkhall and other areas along the line, and link local communities to jobs, education and training opportunities.

2.12. Although the project targets were not explicitly defined at the outset, the implicit objectives can be summarised broadly as:

Project Objective 1: reconnect Larkhall to the rail network to allow the introduction of a half-hourly service;

Project Objective 2: double the frequency of services between Hamilton and central Glasgow and between Milngavie and central Glasgow to four trains per hour;

Project Objective 3: remove an operational bottleneck on the North Suburban line;

Project Objective 4: increase the attractiveness of Larkhall and Kelvindale and the surrounding areas for inward investment and land development;

Project Objective 5: offer social inclusion benefits for residents; and

Project Objective 6: encourage a modal shift towards public transport.

2.13. The first three can be considered as 'outputs' which enable the remaining 'outcome' objectives.

Evaluation of Project to Date

2.14. The following evaluations of the Larkhall – Milngavie project have been conducted to date:

- a 'Lessons Learned' or 'Process Evaluation'⁶ examined how well the project was implemented through interviews with key personnel involved in the project and concluded that the project had been a success but a number of improvements were identified;
- actual demand for three of the new stations (Larkhall, Chatelherault and Merryton) was examined to determine how different it was from the original forecasts and, if so, the potential reasons behind the differences⁷.

Evaluation Study Objectives

2.15. SYSTRA were commissioned by Transport Scotland in March 2014 to undertake an evaluation of the Larkhall – Milngavie railway project.

2.16. The main objectives of the evaluation were:

- to undertake a Stage 2 Outcome Evaluation of the Larkhall – Milngavie project; and

⁶ Strathclyde Partnership for Transport: Larkhall Milngavie Railway Project: Lessons Learned Report – The Nichols Group, November 2008

⁷ Station Usage and Demand Forecasts for Newly Opened Railway Lines and Stations – DfT/ Transport Scotland, September 2011 <http://www.transportscotland.gov.uk/report/new-stations-study-3677>

- to review the draft Rail Evaluation Guidance drawn up by Transport Scotland Analytical Services.

Outcome Evaluation

- 2.17. A Stage 2 Outcome Evaluation is conducted on a project that has been in existence for a sufficient period to enable a comprehensive examination to be undertaken of actual performance against identified targets. It differs from a Stage 1 Outcome Evaluation which is conducted at an early stage in the life of a project and provides a high-level, early indication of performance.
- 2.18. The Stage 2 Outcome Evaluation conducted as part of this evaluation study included:
- an assessment of the extent to which the project has met its objectives (section 2.12), the expected non-quantified benefits and the five Scottish Transport Appraisal Guidance (STAG) criteria;
 - an assessment of the Wider Economic Benefits (WEBs) generated by the project including agglomeration and productivity benefits, and improved labour supply; and
 - a comparison of outturn costs and benefits to determine whether the project has offered value for money through a recalculation of the project's Benefit to Cost Ratio (BCR).
- 2.19. Additionally, the information and findings that would have been useful from the Process Evaluation and Stage 1 Outcome Evaluation (had one been carried out) were considered.

Rail Evaluation Guidance

- 2.20. Transport Scotland Analytical Services have produced draft guidance on the evaluation of major rail projects in Scotland. As part of this evaluation study, the draft guidance was reviewed and recommendations for improvements proposed in light of the Outcome Evaluation.
- 2.21. The outputs from the evaluation will be used to inform how Transport Scotland plans, appraises, delivers and evaluates future rail projects.

Report Structure

- 2.22. The structure of the report is as follows:
- Chapter 3 presents the findings from the Process Evaluation;
 - Chapter 4 provides an overview of the Outcome Evaluation methodology;
 - Chapter 5 discusses the extent to which the project's objectives have been met;
 - Chapter 6 assesses the extent to which the project has satisfied the five STAG criteria;
 - Chapter 7 discusses the impacts of the project on the wider economy by examining a number of socio-economic indicators such as population and the housing market;
 - Chapter 8 discusses the extent to which the project has generated WEBs;
 - Chapter 9 reviews the actual station demand against what was forecast and provides potential reasons for any differences;

- Chapter 10 presents the recalculation of the project's BCR to assess whether the project has offered value for money; and
- Chapter 11 presents recommendations for the improvement and development of the draft Rail Evaluation Guidance in light of the findings of this evaluation study.

3. PROCESS EVALUATION

Overview

- 3.1. Under STAG guidelines, the Process Evaluation is concerned with how well a project was implemented. Its aim is to establish which aspects of the project went well and which could have been improved upon. The lessons learned from the Process Evaluation can then be used both to improve the current project to ensure it runs more successfully going forward and to inform the implementation of future projects.
- 3.2. For the Larkhall – Milngavie railway project, the current guidance was not in place at the time the Process Evaluation should have taken place. In 2008 however, a Lessons Learned exercise⁸, effectively a Process Evaluation, was conducted by the Nichols Group. This involved a review of the project's implementation and identified successes, issues and challenges. This was achieved through interviews with the key project personnel from the project delivery partners and stakeholders: Scottish Executive, SPT, Network Rail, Carillion Rail, ScotRail and South Lanarkshire Council.
- 3.3. The report noted that on the whole the implementation of the project was a success:
 - the project was delivered on time;
 - outturn cost was within 3% of the planned budget;
 - the adverse impacts on train performance during implementation was less than anticipated; and
 - passenger demand has exceeded forecasts.
- 3.4. However, a number of issues were identified which led to a set of comprehensive recommendations.
- 3.5. For this evaluation study, the objective was not to repeat these recommendations. Instead, the process involved a review of those findings and providing supplementary insight into the key project issues through further interviews with personnel involved in the project. Interviews were conducted with:
 - Network Rail;
 - SPT;
 - Transport Scotland; and
 - South Lanarkshire Council.
- 3.6. ScotRail were also contacted but decided there was no-one remaining within their team who had been sufficiently involved in the project to contribute (the Franchise Manager at the time of the project had since retired). It is noted however that ScotRail contributed to the 2008 Lessons Learned exercise.
- 3.7. Interviews were conducted in person, over the phone or by completion of a questionnaire, with the aim being to establish:
 - what had worked well during the project?;
 - what had worked less well?;

⁸ Larkhall Milngavie Railway Project – Lesson Learned Report, 24 November 2008

- what were the key project issues?;
 - if the project were to be repeated, how might the delivery process be improved or refined?; and
 - are any of the lessons learned from the Larkhall – Milngavie project already being put into practice?.
- 3.8. The findings from the first interview conducted with Network Rail generated a number key themes around which to structure subsequent interviews:
- Project Team & Project Management;
 - Project Objectives & Strategy;
 - Stakeholder Management;
 - Risk Management; and
 - Change Control.
- 3.9. In general, the themes discussed and issues raised were consistent with the previous Lessons Learned report. This chapter should be read in conjunction with that report.

Project Team & Project Management

- 3.10. Network Rail project managed the infrastructure works and appointed their own team to undertake this role. ScotRail project managed the operational elements. SPT had overall programme management responsibilities for the two workstreams.
- 3.11. Feedback from some respondents suggests there was a lack of clarity of project and programme management responsibilities, and that reporting lines were not sufficiently defined. It is also unclear whether Project Management Plans were prepared and maintained to ensure the project was well-executed, monitored and controlled.
- 3.12. During the implementation, no project office involving the three key organisations (SPT, ScotRail and Network Rail) from which to co-ordinate the project existed. Network Rail did have their own project office which provided the project manager and supporting staff. Feedback from interviews suggests that this separation of key personnel reduced the potential for collaborative working and led to slow resolution of issues.

At the outset, project and programme management responsibilities and reporting lines should be clearly defined. Consideration should be given as to which organisation is best placed to manage the delivery of the project, in particular in managing the risks associated in delivering rail projects.

Project Management Plans should be created and maintained to ensure that the project is well executed, monitored and controlled.

A multi-organisational project office should be established to house key personnel and facilitate collaborative working.

Project Objectives & Strategy

- 3.13. As noted in section 2.12, quantitative project objectives or success criteria were not defined at the outset, and little consideration was given to how the project's benefits would be monitored and reported.
- 3.14. Feedback suggests that efforts at a senior level were too focussed on time and budget rather than project outcomes, and that the focus on the outcomes was dominated by the engineering and infrastructure aspects, rather than on the desired train service and operational outputs. In effect, the engineering works 'took over' and the purpose of the project (i.e. the delivery of a robust and resilient train service was a secondary consideration).

The project strategy should be clearly defined at the outset, with quantitative project objectives and key success criteria set. As well as delivering the project on time and budget, there should be focus on ensuring that the desired project outcomes are achieved.

Project strategy and objectives should have the buy-in from all project stakeholders.

Stakeholder Management

- 3.15. Although no formal stakeholder management plan was developed, the main stakeholders were identified and legal agreements were put in place.
- 3.16. However, issues were encountered when the new stations were handed over from Network Rail to ScotRail and South Lanarkshire Council refused to accept the re-fettled road bridges from Network Rail.
- 3.17. Feedback suggests that this was caused by failure to meet stakeholders' expectations, rather than quality control issues. Neither ScotRail nor South Lanarkshire Council were sufficiently engaged at an early enough stage, so their sight of initial designs was limited. Furthermore, there was no representation from ScotRail and South Lanarkshire Council at a Project Board level and so there was no opportunity to influence the project outcomes.

A formal stakeholder management plan should be in place with stakeholders engaged in the process and their input sought from project inception onwards in order to minimise the acceptance risk at a later stage in the project.

Risk Management

- 3.18. A risk management plan was developed and was perceived as being generally well-managed. However, a key issue raised by Network Rail was that of risk ownership. It is widely agreed that too much risk was placed under Carillion's responsibility who were not in a position to effectively manage the risk when it materialised (e.g. relocation of key utilities). This was exacerbated by a lack of an implementation agreement between Network Rail and SPT which could have reduced the risk to Carillion prior to them being engaged.

Allocation of project risks should be carefully considered with a greater emphasis on risk-sharing and ensuring the party accepting the risk is best placed to manage it.

A more comprehensive risk assessment should be undertaken to better pre-empt risks in particular those relating to public utilities, ground condition and mining issues which can create major engineering problems.

Change Control

- 3.19. Although there were no major changes to the basic scope of the infrastructure project, it is evident that change requests could have been better managed and was one of the major issues throughout the project.
- 3.20. Feedback suggests that Network Rail were given little flexibility to vary the contract with Carillion. Any changes required SPT's prior agreement and often required the implications of the change to be comprehensively costed. This frequently caused delays and impacted the smooth delivery of the project.

To avoid project delays, a less onerous and restrictive change control process should be considered with a higher change threshold set so that only changes having major cost and time implications require detailed scrutiny.

Conclusions

- 3.21. The evidence gathered from the Lessons Learned exercise conducted in 2008 and the supplementary interviews carried out for this evaluation suggests that on the whole the delivery of the Larkhall – Milngavie project was a success.
- 3.22. It is also noted that the Larkhall-Milngavie project was the largest rail infrastructure implemented in Scotland for over 30 years and so few of the personnel involved had experience of delivering such a large-scale project. Taking this into account, the success of the project is even more commendable.
- 3.23. From the interviews conducted during this evaluation, there were however a number of learning points which should be borne in mind on future rail investment projects including:

- **project and programme management responsibilities, and reporting lines should be more clearly defined;**
- **collaborative working should be promoted, perhaps facilitated by a multi-organisational central project office;**
- **project strategy, objectives and success criteria should be better defined with the buy-in of all stakeholders;**
- **formal engagement with stakeholders from the project outset;**
- **major risks should be more carefully considered and risk-sharing mechanisms adopted; and**
- **a less onerous change control process should be established to ensure the delivery of the scheme is not unnecessarily delayed.**

3.24. It was also noted that several of these learning points are already being put into practice. For example:

- on the Borders rail project, Network Rail are now adopting a more transparent and shared approach to risk assessment which has ensured better price certainty; and
- in direct response to the issues experienced on the Larkhall – Milngavie project, there was greater expenditure on mining remediation works on the Stirling – Alloa – Kincardine, Airdrie to Bathgate and Borders rail projects. Whilst this meant greater upfront costs, it mitigated the risk of higher costs and project delays at a later stage in the project.

3.25. A further recommendation relates to the timing of the Process Evaluation. The current guidance was not in place at the time of the Larkhall – Milngavie project was conducted on completion in 2005 so no Process Evaluation was conducted following project completion. By the time the 2008 Lessons Learned exercise was conducted, it was inevitable that some project personnel had moved organisations and were unavailable to participate. Additionally, much of the project documentation had been archived and was difficult to obtain. This highlights the need for the Process Evaluation to be conducted soon after project completion. This will ensure that the key individuals involved in delivering the project are still available to provide their input and that all issues encountered can be easily recalled and recorded.

To ensure all evidence is captured and that the relevant personnel and still available to participate, the Process Evaluation should be conducted as soon as possible after project completion and ideally within six months.

4. OUTCOME EVALUATION

Overview

- 4.1. Transport Scotland's guidance explains that 'an Outcome Evaluation should be conducted once the project has been in existence for a sufficient period to enable an examination to be undertaken of actual performance against identified targets'.
- 4.2. To conduct the Outcome Evaluation, the project objectives (section 2.12) were considered in turn and an assessment made as to the extent they have been achieved (see chapter 5). Performance against STAG criteria was also assessed (see chapter 6).
- 4.3. Additionally, the project was assessed in terms of the extent to which it generated additional wider benefits including the impact on the local economy and WEBs. These non-quantifiable benefits were considered, in SPT's view, to be more than sufficient to offset the deficit in the monetised appraisal. These are discussed in chapters 7 and 8.
- 4.4. The Outcome Evaluation methodology is discussed below.

Data Sources

- 4.5. To conduct the Outcome Evaluation, data was gathered and analysed to provide an evidence base to establish:
 - before and after service levels at all affected stations (not just newly opened stations);
 - impacts on the improved attractiveness of Larkhall and Kelvindale, including newly-attracted investment and development;
 - improvements in accessibility, particularly for areas with low social inclusion;
 - rail users' travel behaviour before and after;
 - observed modal shift (e.g. whether rail users are now making fewer car journeys and, if so, the outturn reduction in vehicle kilometres and accidents).
- 4.6. To achieve this, a variety of techniques were employed, using a combination of primary and secondary research.

Primary Data – User Survey

- 4.7. It was felt that the most effective way to determine change in travel behaviour was to carry out an online survey with passengers to understand their travel patterns before and after the rail project's opening.
- 4.8. The User Survey is discussed in detail in Appendix A.

Primary Data – Business Survey

- 4.9. To understand how the station re-openings and service frequency improvements impacted the performance of local businesses by improving accessibility and access to the labour market, an online survey of local businesses was undertaken.

4.10. The Business Survey is discussed in detail in Appendix B.

Secondary Data

4.11. Several secondary data sources were used to inform the evaluation as shown in Table 1.

Table 1 Secondary Data Sources

Data	Source	Evaluation Application
Station Demand	Office for Rail Regulation (ORR) National Rail portal	Establish actual station demand (see Chapter 9 and 10)
Station Revenue	LENNON rail ticket database	Establish actual station revenue (see Chapter 10)
Population	General Register Office for Scotland	Assess impact of project on local socio-economic indicators (Chapter 7)
Key Benefits Claimants	Scottish Neighbourhood Statistics	
Jobseeker's Allowance Claimants		
House Prices		
House Sales		
House Building		

Accessibility Analysis

4.12. TRACC – a multi-modal transport accessibility tool – was used to assess how public transport journey times have changed since the completion of the project. The outputs from this assessment are presented in chapter 5.

Determining Attribution

4.13. As noted in the draft Rail Evaluation Guidance, it is imperative that any evaluation is able to attribute any change to the transport intervention. In doing so for this evaluation, the following areas were considered.

Counterfactual

4.14. The counterfactual is what would have happened in the absence of the project and can assist in determining the extent to which the project was responsible for any change in behaviour.

4.15. Establishing the counter-factual for this project was challenging given no baseline information was gathered such as user surveys to establish travel behaviour before the project was completed. Instead, in the User Survey (Appendix A) conducted for this evaluation, to deduce how respondents would have travelled before 2005:

- users of the four new stations (Larkhall, Merryton, Chatelherault and Kelvindale) were asked how they would travel in the future if rail was not available from their nearest station; and
- users of other stations which benefited from a frequency improvement were asked how they would travel in the future if the current train service frequency was reduced.

4.16. This information was then used to deduce the level of generated demand and the level of demand abstraction from other modes.

Control Group

- 4.17. For station demand, to isolate the net impact of the project, the counterfactual was established by assuming that growth at impacted stations would have been as per actual growth at stations within a control group. The control group selected was a group of stations that were not impacted by the project, but are within the same locality such that economic factors that influence rail demand are otherwise similar. This is discussed in more detail in chapter 9.
- 4.18. For the impact on the wider economy (chapter 7), data for the project study area was again compared against various control groups to help understand whether any impacts that have occurred locally within the project area have been directly due to the station re-openings and frequency improvements. As data for such impacts is typically at a more aggregate level (usually by unitary authority), it was more challenging to select control groups against which the only key differentiating factor has been the Larkhall-Milngavie project. While the approach in this context is not perfect, it is regarded as reasonable within the principle of proportionality emphasised in STAG.

Spatial Assessment

- 4.19. Due to the localised impacts of the Larkhall – Milngavie project, results of the Outcome Evaluation are typically presented by the different areas affected by the project. For example, the results of the User Survey are presented according to the four separate project components (section 13.17) to evaluate the localised impacts of the scheme and the impacts of the new station openings. For the impact on the wider economy (chapter 7), results are typically presented at a unitary authority level (South Lanarkshire, East Dunbartonshire and Glasgow) or, if the data were sufficiently disaggregated, at a settlement level (Larkhall, Hamilton, Milngavie).
- 4.20. Although the focus is on local or intra-area impacts, where possible, inter-area or ‘two-way street’ effects are also assessed to evaluate the success of the project in opening up scope for new economic interactions *between* different regions. For example, the re-opening of Larkhall station may have benefited local residents by increasing their access to employment opportunities but it may also have benefited businesses beyond Larkhall as people are increasingly spending their money in non-local locations due to the improved transport links.

5. ASSESSEMENT AGAINST PROJECT OBJECTIVES

Overview

- 5.1. One of the key evaluation study objectives is to provide a comprehensive assessment of the extent to which the project has met its objectives.
- 5.2. This chapter assesses each objective in turn. For project objectives 1 to 3, assessment was based simply on the current service specification. For project objectives 4 to 6, assessment was achieved primarily through analysis of the User Survey and Business Survey results. Additionally, project objective 5 was informed through the TRACC accessibility analysis.

Project Objective 1

- 5.3. Project objective 1 was **‘to reconnect Larkhall to the rail network to allow the introduction of a half hourly service’**.
- 5.4. Passenger services began serving Larkhall again from 12th December 2005, as well as the two new stations at Merryton and Chatelherault. Trains now run every 30 minutes to Glasgow Central throughout the day from Monday to Saturday. An hourly service operates on Sunday.

The objective to reconnect Larkhall to the rail network has been fully achieved with a half-hourly service now running from the town to central Glasgow throughout the day.

Project Objective 2

- 5.5. Project objective 2 was **‘to double the frequency of services between Milngavie and central Glasgow and between Hamilton and central Glasgow’**.
- 5.6. Since the re-opening of the Larkhall line in December 2005, there has been a doubling in the frequency of services from typically two to four trains per hour between Hamilton and central Glasgow throughout the day from Monday to Saturday. The Sunday service frequency is typically three trains per hour.
- 5.7. Similarly, there has been a doubling in the frequency of services from typically two to four trains per hour between Milngavie and central Glasgow throughout the day from Monday to Saturday. A half-hourly service runs on Sunday.

The objective to double the frequency of services between Hamilton and central Glasgow and between Milngavie and central Glasgow has been fully achieved with at least a four trains per hour service operating on each branch throughout the day.

Project Objective 3

- 5.8. Project objective 3 was **‘to remove an operational bottleneck on the North Suburban Line’**.

- 5.9. Before the extension of the North Suburban line from Maryhill to Anniesland, Maryhill Line services had to run empty to Knightswood North Junction (near Westerton) to reverse before returning to Queen Street.
- 5.10. Since the reinstatement of the line, this bottleneck has been removed; Maryhill line services now run into Anniesland (via the new station at Kelvindale) before returning to Queen Street. The extension has also freed up capacity for the extra trains serving the new line to Larkhall to run through Westerton and onwards to Milngavie.

The objective to remove an operational bottleneck on the North Suburban Line has been fully achieved.

Project Objective 4

- 5.11. Project objective 4 was **‘to increase the attractiveness of Larkhall and Kelvindale and the surrounding areas for inward investment and land development’**.
- 5.12. To assess the extent to which this objective has been met, information on land development for residential or business purposes was obtained. The responses from the User Survey were also analysed to determine whether the rail improvements have influenced respondents’ decisions to move home and/or change jobs, as well as impacted on local spending habits. The Business Survey responses were used to assess whether the rail project had been a factor in a firm’s decision to relocate to or open a new branch in the area.

Land Development Evidence

- 5.13. Regarding land development for residential purposes, information from South Lanarkshire Council suggests that the reopening of the three Larkhall stations has led to an increase in house building and has contributed to the area being classed a Community Growth Area – this is discussed in more detail in Chapter 7. In total, 1,800 new homes in the Larkhall area are expected to be built, representing a significant investment in housing infrastructure in the area.
- 5.14. There is little evidence of land development for business or industrial purposes in Larkhall or Kelvindale. Data from South Lanarkshire Council suggests that there has been no significant industrial developments in Larkhall since 2005, with the exception of a new NHS distribution warehouse.

User and Business Survey Results

- 5.15. The User Survey results are presented for Scheme 1 (Hamilton – Larkhall Re-opening) and Scheme 2 (Maryhill – Anniesland Re-opening) in Table 49 and Table 50 respectively in Appendix C.
- 5.16. There is evidence from the survey to suggest that reconnecting the stretch of line from Larkhall to Hamilton to the rail network has had an impact on making the Larkhall area a more attractive place to live (Table 49). For example, the survey data indicates that the rail improvements have influenced residents’

decisions to move to Larkhall and that there is a perception that property prices have increased as a result of the new stations.

- 5.17. The impact of reopening Kelvindale station has also been beneficial (Table 50) but it has been more limited compared to Larkhall, perhaps because this involved just the re-opening of just one station rather than re-connecting an entire branch. Nevertheless, the survey evidence suggests that the scheme has made some contribution to retaining/attracting residents to the area.
- 5.18. There appears to have been limited impact of increased spending in local businesses. Although over half of respondents living in the Larkhall area and a third of respondents living in the Kelvindale area claim to spend more money as a result of the rail project, the majority stated this was in non-local locations such as central Glasgow. These residents have therefore benefitted by having a greater choice of leisure and shopping locations. Non-local businesses will also have benefitted through increase in trade (although local businesses may have seen some loss). This is an example of an inter-area or 'two-way street' impact in which the rail project has enhanced economic interactions between two areas.
- 5.19. In the Business Survey, businesses that had opened a new branch or relocated to either Larkhall or Kelvindale since the completion of the Larkhall – Milngavie project were asked whether the rail improvements had influenced their decision. Only one of the two survey respondents who had moved to Larkhall since 2005 (there were none to Kelvindale) stated the rail project as a factor in their decision. This is in line with the data from South Lanarkshire Council and suggests that there is insufficient evidence to conclude whether the project has increased inward investment and land development for business purposes.

In the Larkhall area, there is evidence that the rail project has led to land being developed for residential purposes and it is thought to have been a factor in the area being classed as a Community Growth Area which will in time lead to a significant increase in new housing in the area.

The User Survey results suggests that the project has made some contribution to the objective by making these places more attractive places to live.

Although there is no evidence of significant new business investments in the areas impacted by the rail project, these are long-term decisions and could take many years to materialise and so the full benefits of the rail project may yet to be realised.

Project Objective 5

- 5.20. Project objective 5 was **'to offer social inclusion benefits for residents'**.
- 5.21. To assess whether this objective has been met, the extent to which the rail improvements have promoted social inclusion by connecting people to employment opportunities, social networks, education and leisure activities, thus allowing disadvantaged people access to opportunities that most people take for granted was assessed.

User Survey Results – Journey Purpose

- 5.22. User Survey respondents' journey purpose and destination were analysed to assess whether the Larkhall – Milngavie project has provided a valuable link to employment, education and leisure opportunities.
- 5.23. Weighted according to frequency of travel information, respondents' journey purpose by origin station is shown Table 2. Of all journeys (n=309), 64% were for commuting (including access to higher/further education), 26% for leisure and 10% for business. As shown in Table 2 below, these proportions are broadly similar to the national average pattern of travel demand purposes.

Table 2 Analysis of weighted Journey Purpose by Origin Station

Scheme	Commuter	Business	Leisure
1: Hamilton – Larkhall reopening (n=182)	61%	9%	31%
2: Maryhill – Anniesland reopening (n=36)	52%	16%	32%
3: Enhanced frequency Newton – Hamilton (n=64)	80%	6%	14%
4: Enhanced frequency Milngavie branch (n=27)	55%	16%	29%
All respondents (n=309)	64%	10%	26%
Scotland average⁹	59%	11%	30%

- 5.24. The distribution of purposes shows that passengers on the Larkhall – Milngavie line use it to access a range of opportunities and facilities in the surrounding areas. In particular, the new stations have provided a valuable link to employment and education with 61% of those surveyed on the reopened Larkhall section and 52% on the reopened Maryhill – Anniesland section using it for commuter purposes including access to education and training.

User Survey Results – Availability of Public Transport

- 5.25. One of the key criteria in achieving social inclusion is improving the *availability* of public transport, ensuring that is within easy reach of where people live and preferably within walking distance so that those who do not drive and/or who are infirm are not disadvantaged.
- 5.26. The User Survey data was assessed to determine how the reopening of Larkhall, Merryton, Chatelherault and Kelvindale stations has made public transport more available by calculating how much nearer the new stations are 'as the crow flies' to a respondent's home address than the nearest station before 2005. It is important to note that actual distances travelled by walking or driving will be slightly higher than the 'crow fly' distances reported here.
- 5.27. Prior to the reopening of Scheme 1 (Hamilton – Larkhall), the nearest station for those residents now using Larkhall, Merryton or Chatelherault would most likely have been Hamilton Central. The median¹⁰ 'crow fly' distance from

⁹ National Rail Travel Survey – Overview Report, December 2010

¹⁰ The median was used rather than mean to avoid distortion by outlying values

respondents' homes to Hamilton Central is 6.4km (n=77). The home location of these 77 respondents is illustrated in Figure 2.

- 5.28. The median distance from respondents' homes to their nearest station is now just 0.7km (see Figure 2 for details) and hence these stations are now within easy walking distance for the majority of respondents living in these area.
- 5.29. As a result, walking is the station access mode for 63% of journeys made from these three stations, with just 23% of trips driving to the station and a further 4% travelling to the station as a car passenger.

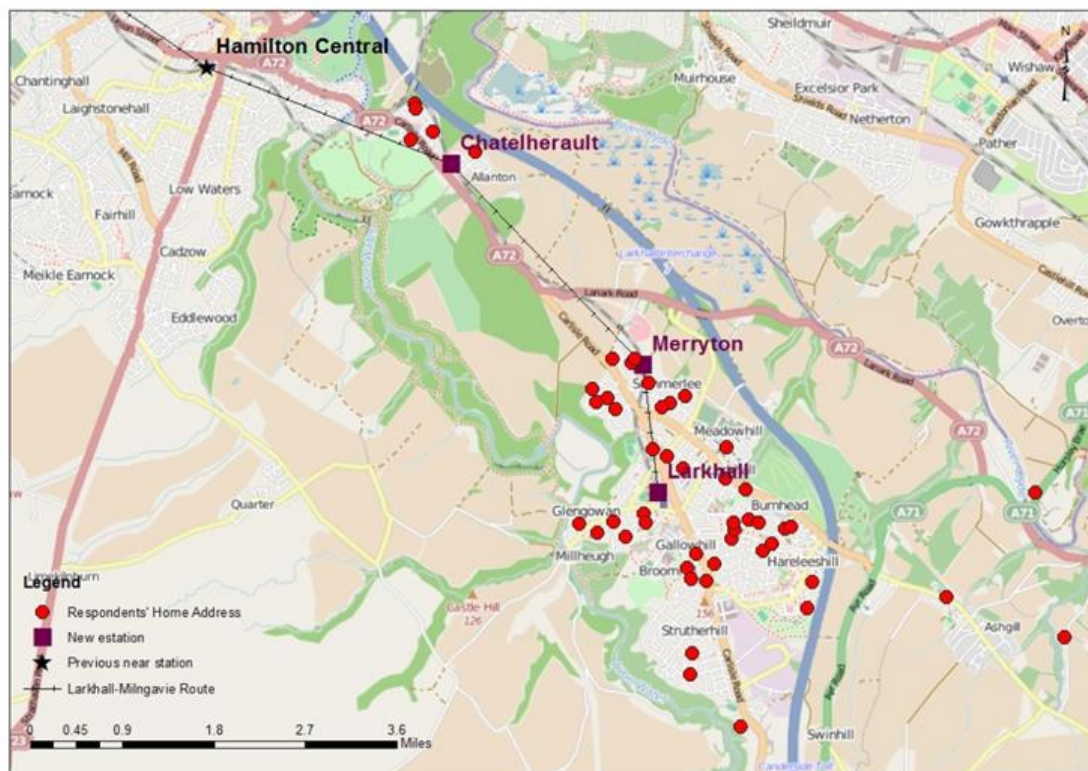


Figure 2 Previous vs Current Nearest Station Locations – Larkhall Residents

- 5.30. For Scheme 2 (Maryhill – Anniesland reopening), the nearest pre-2005 station for Kelvindale residents would most likely have been either Maryhill or Anniesland. The pre-2005 median¹⁰ 'crow fly' distance from respondents' homes to their closest station (either Maryhill or Anniesland) is 0.64km (n=10). The median distance from respondents' homes to Kelvindale is now just 0.36km (see Figure 3 for details). Whilst this is less than the step-change seen in the Larkhall area, the reopening of the station has still nearly halved the median distance from the Kelvindale respondents' homes to their nearest railway station, with the improvement in actual rather than "crow fly" distances likely to be greater given the canal and road layout.



Figure 3 Previous vs Current Nearest Station Locations – Kelvindale Residents

Accessibility Analysis

- 5.31. To demonstrate how public transport journey times have changed as a result of the Larkhall – Milngavie project, accessibility analysis was undertaken to assess the impact on journey times between the Larkhall and Hamilton areas and Glasgow Central Station.
- 5.32. The analysis was undertaken using TRACC, a multi-modal transport accessibility software tool. This is designed to generate travel times by public transport and highway modes to give accurate journey times from many origins to many destinations in one calculation.
- 5.33. Table 3 lists the input data sources that were used in the analysis.

Table 3 Accessibility Analysis Data Sources

Data	Description	Source
Origins	Postcode centroids	OS Code Point Open
Destination	Glasgow Central Station	Geo-coded manually
Public Transport Network	National Public Transport Data Repository (NPTDR) data	November 2014 NPTDR download
Population	2011 Census Population	2011 Census day estimates of usually resident population by postcode

- 5.34. The public transport (rail, bus and coach) journey time from each postcode centroid within the Larkhall and Hamilton areas¹¹ to Glasgow Central station was calculated. Glasgow Central station was chosen as a proxy for access to central Glasgow employment, education and leisure opportunities.
- 5.35. Two calculations were performed during the morning peak period (07:00-10:00). The first produced the minimum journey time from each postcode centroid to Glasgow Central Station with the Larkhall-Milngavie extension in place, while the second performed the same calculation without it.
- 5.36. For each calculation, the minimum journey times produced consist of in-vehicle time and walk times to, from and between stations and stops. In addition, time penalties¹² were applied in order to reflect the change in frequency of services as a result of the Larkhall-Milngavie extension.
- 5.37. The differences between the two estimated journey times to central Glasgow calculations were used to estimate the change in public transport journey times (see Figure 4 for details).

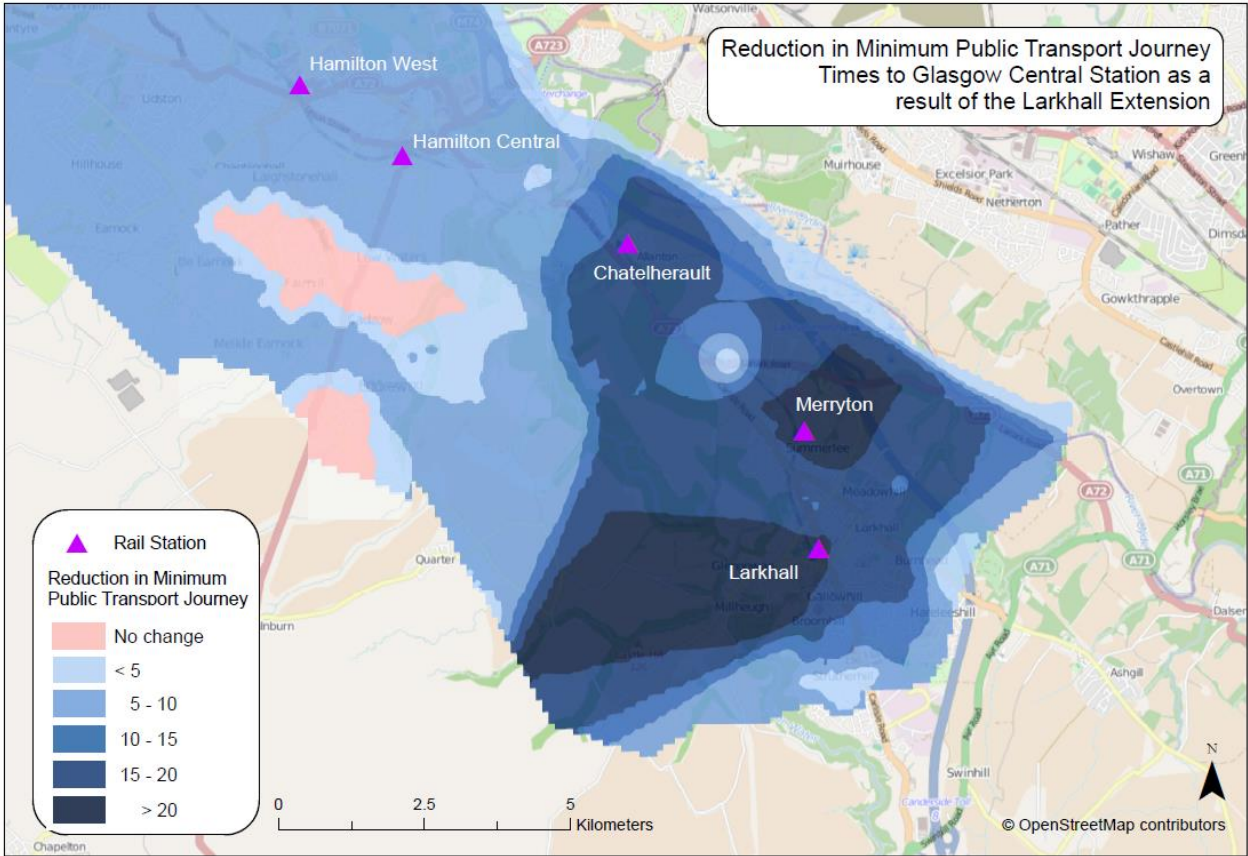


Figure 4 Reduction in Minimum Public Transport Journey Times

- 5.38. As expected, the largest reductions are in the Larkhall area which benefited from the three new stations and removed the need for passengers to travel to Hamilton to access rail. Here, the journey times to Glasgow Central by public transport have reduced typically by between 10 and 20 minutes. For postcodes within the immediate vicinity of Merryton and Larkhall stations, the reduction is in excess of 20 minutes. Unsurprisingly, the reduction in the Hamilton area is less (typically between 0 and 10 minutes) as the two Hamilton stations benefited merely from the service frequency enhancements.

¹¹ Postcodes beginning ML3 and ML9
¹² Time penalties based on Non-London Urban PDFH v5.1 frequency penalties

5.39. Table 4 shows the impact of the reduced public transport journey times by proportion of population in the areas assessed. This shows that for 60% of the population in this area, public transport journey times to Glasgow Central have reduced by at least 10 minutes.

Table 4 Reduction in Public Transport Journey Times by Larkhall/Hamilton Population

PT Journey Time to Glasgow Central Reduction	0	< 5	5 - 10	10 - 15	15 - 20	> 20
Population	27,822	1,819	4,229	41,308	5,580	2,153
Percentage	34%	2%	5%	50%	7%	3%

5.40. The rail project has therefore reduced public transport journey times to Glasgow Central for the majority of the Larkhall and Hamilton population. This will have promoted social inclusion for local residents, particularly those without a car, and made employment, education and leisure opportunities more accessible.

5.41. A separate accessibility was not undertaken for Kelvindale as it is likely the impact will have been less considering the proximity of the existing stations (Anniesland and Maryhill) before the new station was opened. It is expected though that public transport journey times from Kelvindale will also have been reduced, but to a lesser extent than from Larkhall and Hamilton.

The survey data suggests that the project has contributed to the objective ‘Offer social inclusion benefits to residents’ by:

- **promoting access to a range of opportunities and facilities in the surrounding areas, in particular employment and education opportunities with 64% of respondents using the line for commuting purposes;**
- **improving the availability of public transport through the re-opening of stations. This is particularly true for Larkhall residents where the nearest station is now within walking distance for the majority of residents, whereas previously their nearest station was over 6km away on average and therefore only accessible by car or bus; and**
- **providing a reduction in public transport journey times therefore promoting accessibility to employment, education and leisure opportunities and promoting social inclusion.**

Project Objective 6

5.42. Project objective 6 was **‘to encourage a modal shift towards public transport’**.

5.43. To assess whether this objective has been met, User Survey respondents were asked questions to understand how changes to rail services since completion of the Larkhall-Milngavie rail project have affected their travel behaviour. Respondents were also asked whether the rail improvements have influenced their car ownership.

User Survey Results – Use of Rail

5.44. In general, the Larkhall – Milngavie project appears to have increased users' frequency of rail use over the last 5 years, with 50% of respondents using rail much more than in 2009 (Table 5). Unsurprisingly, the greatest change has been on the Hamilton-Larkhall line which was reconnected to the network; here 66% of respondents reported using rail 'much more' than in 2009. There has also been an increase in rail usage from the stations where there has been a frequency improvement (schemes 3 and 4).

Table 5 Rail Usage compared to 2009 by Scheme

Scheme	Rail Usage Compared to 2009				
	Much More	Little More	Same	Little Less	Much Less
1: Hamilton – Larkhall reopening (n=82)	66%	11%	12%	5%	6%
2: Maryhill – Anniesland reopening (n=15)	39%	31%	31%	-	-
3: Enhanced frequency Newton – Hamilton (n=34)	27%	12%	52%	6%	3%
4: Enhanced frequency Milngavie branch (n=12)	25%	8%	25%	8%	33%
All respondents (n=143)	50%	14%	25%	4%	6%

5.45. For the two schemes involving the reopening of new stations (Scheme 1 and 2), nearly all respondents who have travelled to or from these stations stated that the station re-openings have affected their travel plans (94% for those whose home station is Larkhall, Merryton or Chatelherault, and 91% for those whose home station is Kelvindale).

5.46. Respondents were also asked how many more rail trips they make as a result of the new stations. The responses are summarised in Table 6. For those travelling to/from Larkhall, Merryton and Chatelherault, 28% reported using the new station(s) 5 or more times a week, with a further 26% using them at least once a week. At Kelvindale, half of those travelling to/from the station reported using it at least 5 times a week. This indicates the new stations are being used on regular basis (e.g. for commuting).

Table 6 Number of Additional Rail Trips by Scheme

Scheme	Number of Additional Trips				
	5 or 5+ /Week	3 – 4 / week	1 -2 / week	Less than 1/week	None
1: Hamilton – Larkhall reopening (n=82)	28%	13%	13%	42%	3%
2: Maryhill – Anniesland reopening (n=15)	50%	25%	17%	8%	0%

5.47. Whilst a proportion of these trips will have been generated (i.e. the trip would not previously have been made), it is likely that some of these trips have been abstracted from car. The level of car abstraction is analysed below.

User Survey Results – Level of Abstraction from Other Modes

5.48. To deduce how the User Survey respondents would have travelled in the absence of the project (i.e. the counterfactual), they were asked how they

would travel for their most frequent journeys under the following circumstances:

- users of the four new stations (Larkhall, Merryton, Chatelherault and Kelvindale) were asked how they would travel in the future if rail was not available from their nearest station; and
- users of other stations which benefitted from a frequency improvement were asked how they would travel in the future if the current train service frequency was reduced.

5.49. In general, the project appears to have encouraged greater use of public transport, with the most significant impact being from the re-opening of the Hamilton – Larkhall railway line (Scheme 1).

5.50. For those journeys by rail to or from the three re-opened stations (n=201) relating to Scheme 1 (Larkhall, Merryton and Chatelherault), 43% of journeys would be made by car if the three new stations were unavailable. A further 26% would be made by bus and 5% as a car passenger. The remaining journeys would either not be made at all (13%), the respondent would travel to a different location to board the train (e.g. Hamilton (8%)) or the respondent was not sure how they would travel (4%).

5.51. Figure 5 below shows the breakdown of these journeys by Commuting (n=65) and Other (n=136). This suggests that the proportion switching to car (driver and passenger) would be higher for commuting journeys than for other journey purposes (55% for commuting compared to 44% for other), though sample sizes are small and this difference is not statistically significant at the 95% confidence level.

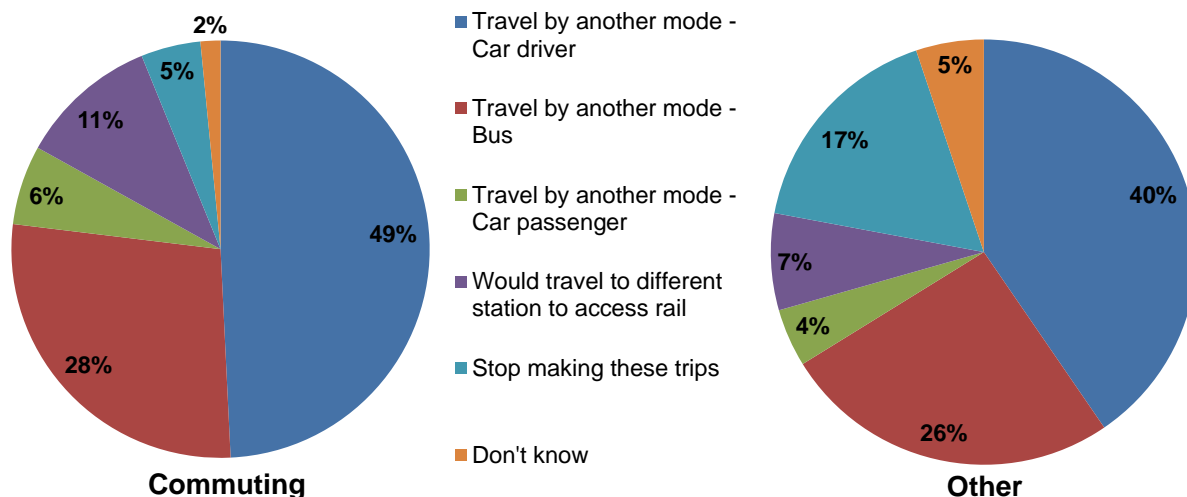


Figure 5 Journey Mode without Larkhall – Milngavie Railway Project (Scheme 1: Larkhall – Hamilton)

5.52. For the other scheme involving the re-opening of a station (Scheme 2: Reopening of the Maryhill – Anniesland railway line; n=36), nearly two-thirds of journeys would be made by other modes if the station was not available (Figure 6). 36% would be made by bus perhaps reflecting the good bus network in the area¹³ and/or lower levels of local car ownership. Due to the

¹³ Analysis of bus services in Kelvindale suggests that the bus offers a more direct service into Glasgow than rail which is via Maryhill which may explain the high bus abstraction.

small sample size for this scheme, results are presented combined for all journey purposes.

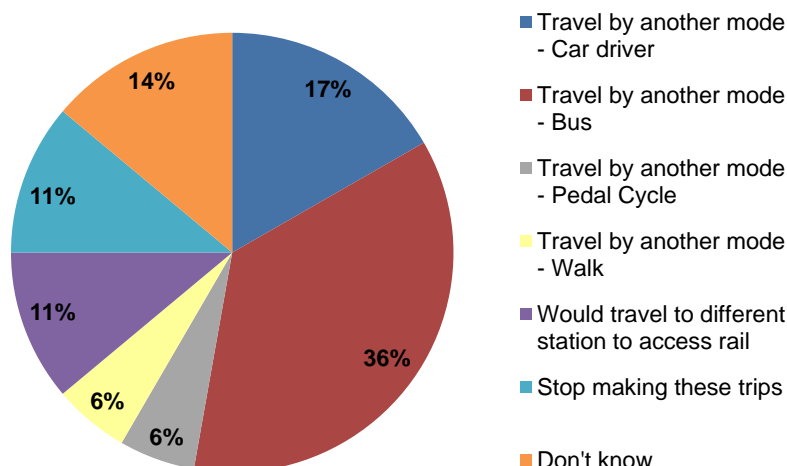


Figure 6 Journey Mode without Larkhall – Milngavie Railway Project (Scheme 2: Maryhill – Anniesland)

5.53. For the schemes involving a frequency enhancement rather than station re-opening, the shift to other modes would unsurprisingly be a lot lower:

- Scheme 3 – Enhanced frequency of service on the Newton – Hamilton line; n=74 (Figure 7):
 - over two-thirds of journeys made by rail to/from Hamilton Central, Hamilton West and Blantyre would still be made by rail if the frequency was lower, although 20% would be made by rail less frequently;
 - 9% of journeys would be made by other modes (split between car and bus).

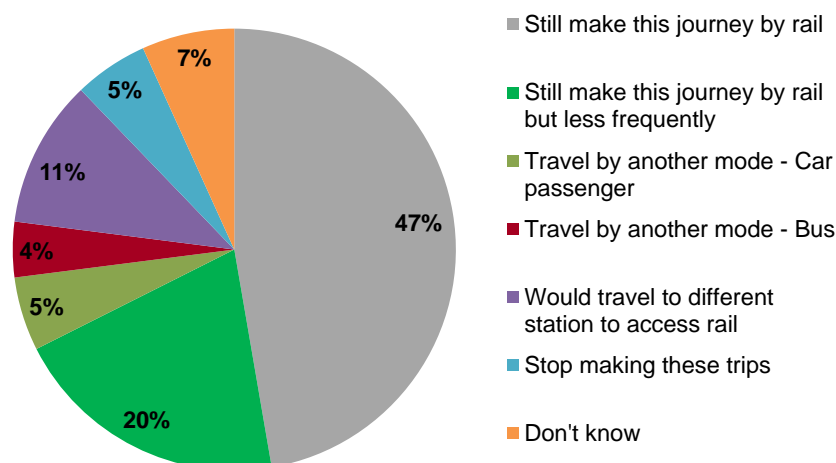


Figure 7 Journey Mode if Reduced Rail Frequency (Scheme 3: Newton – Hamilton)

- Scheme 4 – Enhanced frequency of service on the Milngavie branch; n=34 (Figure 8)
 - over 60% of journeys made by rail to/from Milngavie, Hillfoot, Bearsden and Westerton would still be made by rail if the frequency was lower;
 - 24% of journeys would be made by other modes (split between car and bus).

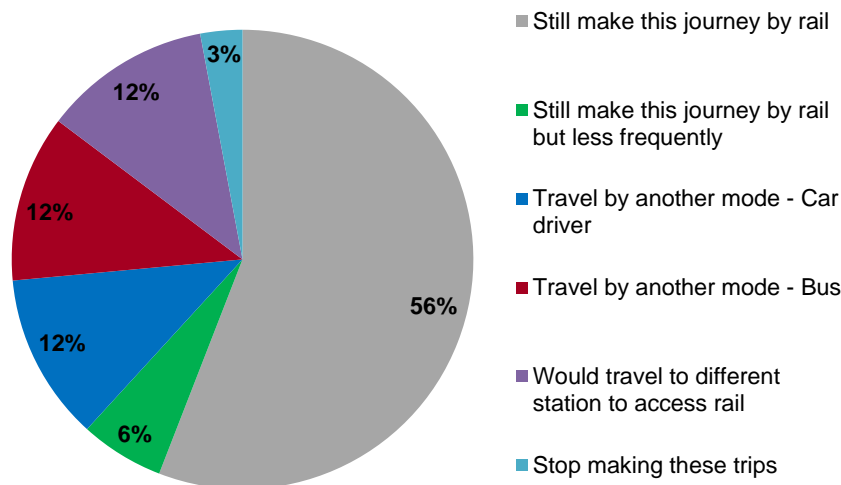


Figure 8 Journey Mode if Reduced Rail Frequency (Scheme 4: Milngavie Branch)

5.54. The results presented above indicate stated preference (i.e. what respondents would do in the future), rather than revealed preference (i.e. what they actually did when the rail improvements were implemented in 2005). However, for the purposes of this exercise, it was reasonable to assume that they are equivalent. The results were therefore used to deduce the levels of abstraction from other modes so for example, for Scheme 1 a 75% abstraction rate is implied (43% car driver, 27% bus and 5% car passenger).

Impact on Car Ownership

5.55. User Survey respondents were also asked whether the changes to local rail services have impacted the number of vehicles owned in their household as a result of the rail improvements (Table 7). Overall, the majority (87%, n=143) stated that there had been no impact. There is some variation by scheme (with respondents allocated to scheme according to their home station), perhaps reflecting the different nature of the four scheme components.

5.56. The number of respondents reporting a reduction in household vehicles consistently outweighs those reporting an increase so, from the User Survey results, it appears that there has been a small net decrease in household car ownership as a result of the rail improvements.

Table 7 Impact on Car Ownership by Scheme

Scheme	Reduction in Household Cars/Vans	Increase in Household Car/Vans	No Change in Household Cars/Vans
1: Re-opening of the Hamilton – Larkhall railway line (n=82)	11%	4%	82%
2: Re-opening of the Maryhill – Anniesland railway line (n=15)	13%	7%	80%

3: Enhanced frequency of service on the Newton – Hamilton line (n=34)	12%	-	88%
4: Enhanced frequency of service on the Milngavie branch (n=12)	9%	-	91%
All respondents	10%	2%	87%

The survey data suggests that the project has contributed to the objective ‘encourage a mode shift towards public transport’:

- **evidence suggests that there has been an abstraction of trips from car and bus, with the impact most pronounced in the Larkhall area where approximately half of journeys made to or from the three re-opened stations would be made by car if it were no longer possible to access rail at the three new stations; and**
- **there is also evidence of a small net decrease in car ownership as a result of the rail improvements.**

Conclusions

- 5.57. In the absence of ‘SMART’ objectives¹⁴ or any quantified targets, it is difficult to conclude whether the project as a whole has been a success in terms of boosting public transport patronage or alleviating local transport issues. Nevertheless, the results from the User Survey and Business Survey indicate that the project has made a positive contribution to five of its objectives.
- 5.58. The findings from the User Survey show that respondents believe that the re-opening of the four stations at Larkhall, Chatelherault, Merryton and Kelvindale has made these areas more attractive as places to live and improved access to employment opportunities. In the long term, this may attract inward investment through the creation of new homes and jobs. Although there was no evidence from the Business Survey of sustained inward investment and land development, these are long-term decisions and could take many years to materialise and so the full benefits of the rail project may yet to be realised.
- 5.59. The User Survey data also suggests that the re-opening of the four stations and the frequency improvements on the rest of the line have improved the availability of public transport which can promote social inclusion by connecting people to employment opportunities, social networks, education and leisure activities. This is most evident for Larkhall residents where the nearest station is now within walking distance for the majority of residents, whereas previously their nearest station was over 6km away on average and therefore only accessible by car or bus.
- 5.60. Finally, there is evidence from the survey findings that the rail improvements have encouraged a mode shift towards public transport which has likely resulted in abstraction of trips from road vehicles as well as a small net decrease in car ownership.

¹⁴ ‘SMART’ objectives are discussed in section 11.4

6. ASSESSMENT AGAINST STAG CRITERIA

Overview

- 6.1. This chapter assesses whether the Larkhall – Milngavie railway project satisfies the five STAG criteria:
 - Environment;
 - Safety;
 - Economy;
 - Integration; and
 - Accessibility and Social Inclusion.
- 6.2. The ‘Economy’ criterion has already been assessed through the project-specific objective ‘to increase the attractiveness of Larkhall and Kelvindale and the surrounding areas for inward investment and land development’ (chapter 5). It is also assessed further through the extent to which the project has impacted the wider economy (chapter 7) and created WEBs (chapter 8) as well as the recalculation of the BCR (chapter 10). No further analysis was therefore undertaken.
- 6.3. Similarly, the ‘Accessibility and Social Inclusion’ criterion has already been assessed through the project specific objective ‘to offer social inclusion benefits for residents’ (chapter 5) so no further analysis was undertaken.
- 6.4. The remaining three criteria are discussed below.

Environment

- 6.5. As discussed in chapter 5, there is evidence from the User Survey of a modal shift from car to rail, as well as a minor net decrease in car ownership resulting from the Larkhall – Milngavie rail improvements. This is likely to have led to a decrease in the number of car trips and therefore a reduction in greenhouse gas emissions.
- 6.6. Based on the National Transport Model’s assumption that each additional rail passenger kilometre travelled results in a 0.26km reduction in car vehicle kilometres (as trips previously made by car switch to rail)¹⁵, this will have resulted in a decrease in carbon dioxide (CO₂) emissions from road traffic of approximately 750 tonnes per annum¹⁶. Additionally, there will have been an unquantified reduction in the emission of the main traffic-related air quality pollutants (NO_x and small particulate matter).
- 6.7. However, this will have been offset by the emissions related to the increase in rail kilometres operated due to the service frequency improvements and the new stations served.
- 6.8. The increase in rail kilometres operated is estimated to be approximately 360,000 km per annum¹⁷ which will have generated nearly 1,000 tonnes of additional CO₂ per annum¹⁸.

¹⁵ Change in car km calculated as per Table 53

¹⁶ Based on 129g CO₂ equivalent emissions per passenger km for the average petrol car in 2013 (Carbon Account for Transport No. 5: 2013/14 Edition, Transport Scotland)

¹⁷ Based on analysis of the 2004 and current Larkhall – Milngavie timetables

- 6.9. There has therefore been a small net increase in carbon dioxide emissions (approximately 250 tonnes CO₂ per annum). This is because the increase in emissions from the extra rail services is not sufficiently compensated by the reduction in car emissions, even though rail is more efficient than car in terms of CO₂ emissions per passenger kilometre travelled. This estimation excludes the impact of any changes to bus services resulting from the rail scheme.
- 6.10. There is also likely to have been a slight increase in rail-related noise for those living next to the reopened railway line. This will not have been offset by a significant reduction in road traffic noise, since the change in total car traffic will have been too small to create a perceptible reduction in traffic-related noise.
- 6.11. The negative impacts on the landscape and existing habitats as a result of constructing the new line and stations would have been minimal, since the line follows an existing, abandoned route.

Overall, there is likely to have been a small net negative environmental impact due to the Larkhall – Milngavie railway project, due to a minor net increase in carbon emissions and additional rail-related noise close to the reopened sections of track. These will have been partially offset by a slight reduction in the emission of the main traffic-related air quality pollutants in the relevant road corridors.

Safety

- 6.12. The mode switch from car to rail as a result of the Larkhall – Milngavie project may have led to a reduction in traffic on local roads within the area. This may have led to a reduction in road-related accidents. However, fewer cars on the road may have led to increased road speeds which could in turn have meant more severe and/or an increased frequency of accidents.
- 6.13. To assess whether there has been a net reduction in accidents as a result of the rail project, Transport Scotland road accident statistics were assessed before (2000 to 2004) and after (2005 to 2009 and 2010 to 2013) project completion for roads that run close to the Larkhall – Milngavie railway line¹⁹ and therefore those that are most likely to have experienced a reduction in traffic volumes as a result of rail abstraction.
- 6.14. The statistics show that there was a 14% reduction in the total number of accidents on roads close to the Larkhall – Milngavie railway line between 2000/04 and 2005/09, and a 35% reduction between 2000/04 and 2010/13. However, similar rates of accident reduction were also observed on roads in the Glasgow City Council area (17% and 41% respectively) and the differences between the two were not found to be statistically significant^[1]. The decrease in accidents seen for the roads examined therefore cannot be attributed directly to the Larkhall – Milngavie project. Instead, there are likely

¹⁸ Based on an average electricity consumption of 8.0kWh per unit km for Class 318 (3-car) and Class 320 (3-car) trains and 0.3406kg CO₂ emissions per kWh for an electric train in 2013 (STAG Technical Database, Section 7)

¹⁹ Selected roads: M74 (J1 to J8); B7078 Larkhall – M74 (J8); A72 Larkhall – Hamilton; A724 Hamilton – Rutherglen; A81 Milngavie – Glasgow; A82 Anniesland – Glasgow; A739 Bearsden – Glasgow.

[1] At the 95% confidence level

to be other factors involved such as improved road engineering, speed reduction measures, weather and random variation. However, it should be noted that although the figures presented are 4 or 5-year averages, as they are relatively small numbers there will still be a degree of variation which can be subject to relatively large fluctuations between periods just by chance.

Whilst there has been a reduction in casualties on the roads parallel to the Larkhall – Milngavie railway line since project completion, a similar reduction has also been observed at a regional level. The reduction cannot be conclusively attributed to the project itself and instead is more likely to be due to other factors.

Integration

Transport Integration

- 6.15. The re-opening of the Larkhall line has reconnected Larkhall to the suburban rail network allowing direct services to central Glasgow without the need for interchange.
- 6.16. (Table 8). To determine whether any reduction was directly attributable to the rail project or just a general downward trend in road casualties, the statistics were compared to a control group, namely the full Glasgow City Council area.

Table 8 Road Accident Statistics Before and After Project Completion

Area	Accident Type	2000-04 average [#]	2005-09 average [#]	2010-13 average [*]	00/04 – 05/09 Difference		00/04 – 10/13 Difference	
					#	%	#	%
Selected Project Area Roads ¹⁹	Fatal	2	2	3	0	0%	1	50%
	Serious	30	26	16	-4	-13%	-14	-47%
	Slight	184	158	122	-26	-14%	-62	-34%
	Total	217	187	140	-30	-14%	-77	-35%
Glasgow City Council	Fatal	18	18	9	0	0%	-9	-50%
	Serious	327	254	175	-73	-22%	-152	-46%
	Slight	1,777	1,482	1,071	-295	-17%	-706	-40%
	Total	2,121	1,755	1,254	-366	-17%	-867	-41%

[#]5-year average; ^{*}4-year average

- 6.17. The statistics show that there was a 14% reduction in the total number of accidents on roads close to the Larkhall – Milngavie railway line between 2000/04 and 2005/09, and a 35% reduction between 2000/04 and 2010/13. However, similar rates of accident reduction were also observed on roads in the Glasgow City Council area (17% and 41% respectively) and the differences between the two were not found to be statistically significant²⁰. The decrease in accidents seen for the roads examined therefore cannot be attributed directly to the Larkhall – Milngavie project. Instead, there are likely to be other factors involved such as improved road engineering, speed reduction measures, weather and random variation. However, it should be noted that although the figures presented are 4 or 5-year averages, as they are relatively small numbers there will still be a degree of variation which can be subject to relatively large fluctuations between periods just by chance.

²⁰ At the 95% confidence level

Whilst there has been a reduction in casualties on the roads parallel to the Larkhall – Milngavie railway line since project completion, a similar reduction has also been observed at a regional level. The reduction cannot be conclusively attributed to the project itself and instead is more likely to be due to other factors.

Integration

Transport Integration

6.18. The re-opening of the Larkhall line has reconnected Larkhall to the suburban rail network allowing direct services to central Glasgow without the need for interchange.

Land-Use Integration

6.19. There is so far little evidence that the Larkhall – Milngavie project has resulted in significant land-use changes. This is discussed in more detail in chapter 8.

Policy Integration

6.20. The Larkhall – Milngavie project is consistent with wider Scottish policy, in particular that of social inclusion as discussed in chapter 5.

On the basis of transport and policy integration, the Larkhall – Milngavie railway project is consistent with the Integration criterion.

Conclusions

6.21. The evidence available suggests that Larkhall – Milngavie project has made a positive contribution to the Integration criterion and, as discussed in chapter 5, the Economy and Accessibility and Social Inclusion criteria. The evidence is inconclusive as to whether there has been an impact on the Safety and the Environment criteria.

7. IMPACT ON WIDER ECONOMY

Overview

- 7.1. This chapter assesses the impact of the Larkhall – Milngavie railway project on the wider economy. It considers a number of local socio-economic indicators:
 - population;
 - key benefits and Jobseeker’s Allowance claimants;
 - house prices and house sales; and
 - housing completions.
- 7.2. Identifying and isolating the impacts of a new transport scheme is a challenging task as these indicators are typically influenced by a number of factors simultaneously.
- 7.3. To assess whether the project has had an impact, it was therefore important to understand the counterfactual as discussed in Chapter 4 (i.e. what would these socio-economic indicators in the local area have been had the project not been implemented).
- 7.4. A control group was therefore defined against which the areas impacted by the Larkhall – Milngavie project were compared. Assuming economic conditions are similar in the control group and the areas impacted by the project, the rail project is then the key differentiating factor and may therefore explain any differences between the indicators in the control group and the project area. While the approach applied in this context is not perfect, it is regarded as reasonable and within the principle of proportionality emphasised by STAG.
- 7.5. Due to the large geographical coverage of the Larkhall – Milngavie project (it extends over three unitary authorities: Glasgow, East Dunbartonshire and South Lanarkshire), the national average (i.e. Scotland as a whole) was selected as the most appropriate control group.
- 7.6. Socio-economic data was sourced from the General Register Office for Scotland and Scottish Neighbourhood Statistics. Data was taken from the years immediately prior to the completion of the project in 2005 as well as from 2006 to the present to establish whether post-2005 trends were simply a continuation of the pre-2005 trend or were impacted by the rail project.

Population

- 7.7. It is reasonable to assume a new railway line or improved rail frequency will, over time, lead to an increase in the local population due to improved accessibility (although this may take many years to materialise). There was some evidence from the User Survey that people’s decision to move home had been influenced by the rail improvements (see Table 49 and Table 50, Appendix C). To assess this, the population since 2002 to the present from the General Register Office for Scotland was analysed to identify whether there has been any change in trends.
- 7.8. Figure 9 shows the indexed population in the three authorities impacted by the rail project and the Scotland average. The total population change between 2002 and 2013 was lower in the three authorities impacted by the rail project than the national average: -1.4% in East Dunbartonshire; 3.3% in Glasgow and 4.2% in South Lanarkshire, compared to 5.4% in Scotland as a whole.

The population in South Lanarkshire grew faster than the national average in 2003 and 2004 but this was prior to the new stations being built. In East Dunbartonshire, the population declined each year until growing in 2012.

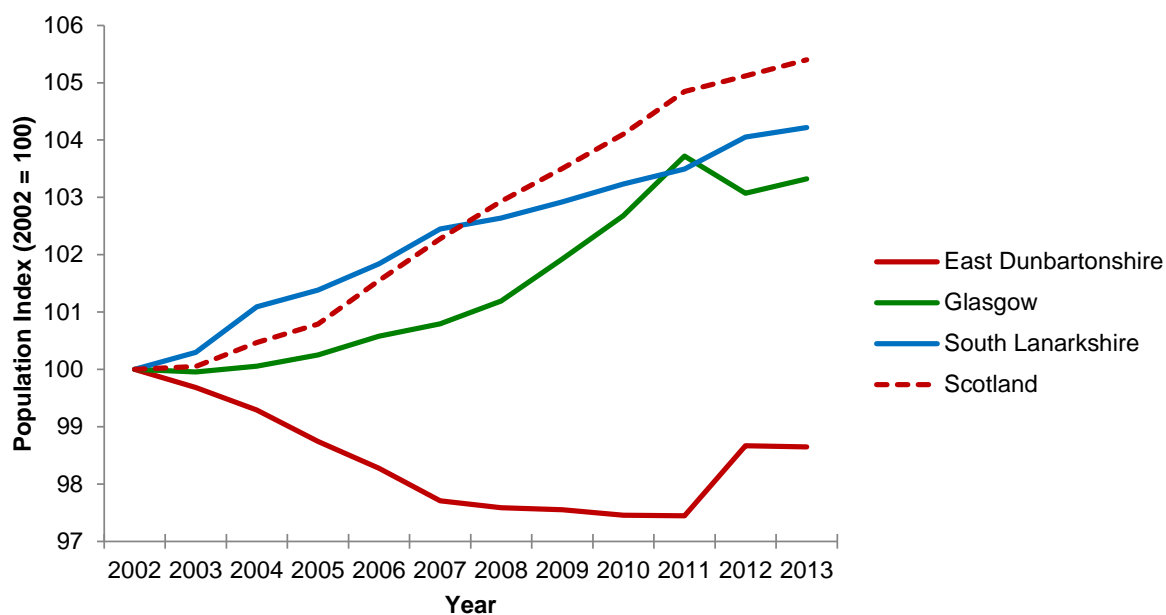


Figure 9 Population Index (Unitary Authority Level), 2002 – 2013

7.9. Comparing the population change before (2002 to 2005) and after (2005 to 2013) the project was completed shows whilst there was a higher growth post-completion in all three unitary authorities, this was also true of the control group (i.e. Scotland as a whole) and so growth was likely due to other factors rather than the rail project (Table 9).

Table 9 Population Change, 2002 - 2013

Region	Population Change		
	2002 – 2005	2005 – 2013	2002 - 2013
East Dunbartonshire	-1.3%	-0.1%	-1.4%
Glasgow	0.2%	3.1%	3.3%
South Lanarkshire	1.4%	2.8%	4.2%
Scotland	0.8%	4.6%	5.4%

7.10. Assessing the population of the individual settlements (data only available from 2003 to 2012) impacted by the rail project reveals that despite South Lanarkshire displaying sustained population growth from 2003 onwards, Hamilton and Larkhall do not follow this trend (Figure 10). The population of Hamilton increased slowly from 2003 until 2008, after which it grew substantially, at a rate twice the national average. By 2012 its population was 10% higher than in 2003. In contrast, Larkhall, which benefited from the two new stations in 2005 (Larkhall and Merryton), has shown a continuous population decline since 2007; its population in 2012 was 4% lower than it was in 2003.

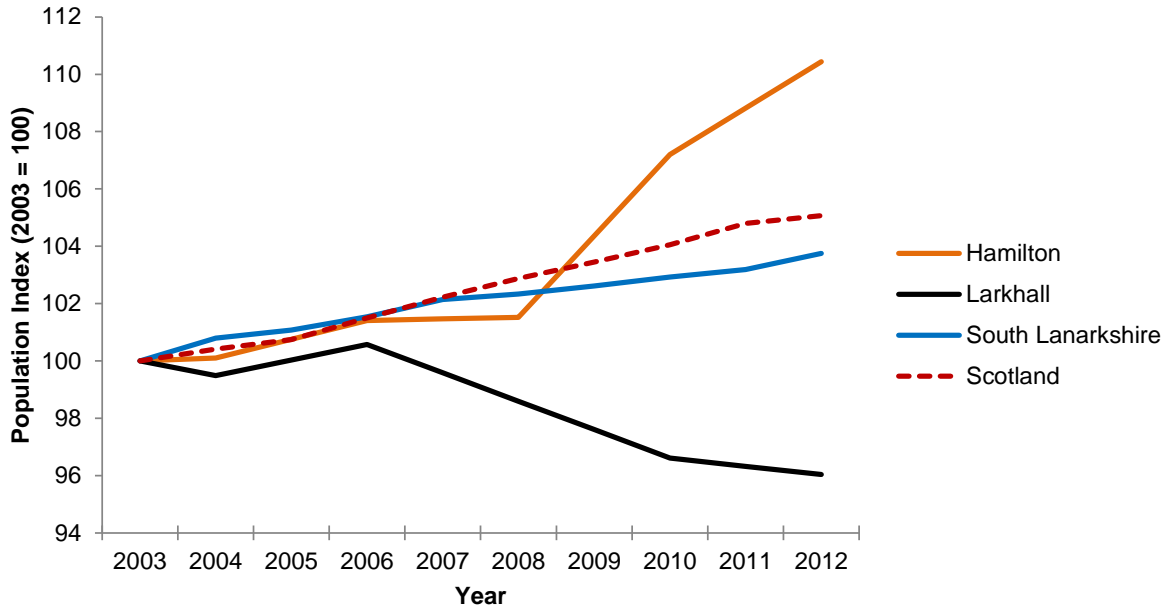


Figure 10 Population Index (Settlement Level – Hamilton & Larkhall), 2003 – 2012

7.11. In East Dunbartonshire, whilst at the unitary authority level, the population declined from 2003 to 2011, the population in Milngavie showed a marked increase in 2007 and 2008 (Figure 11), which may have been partly in response to the service frequency improvements.

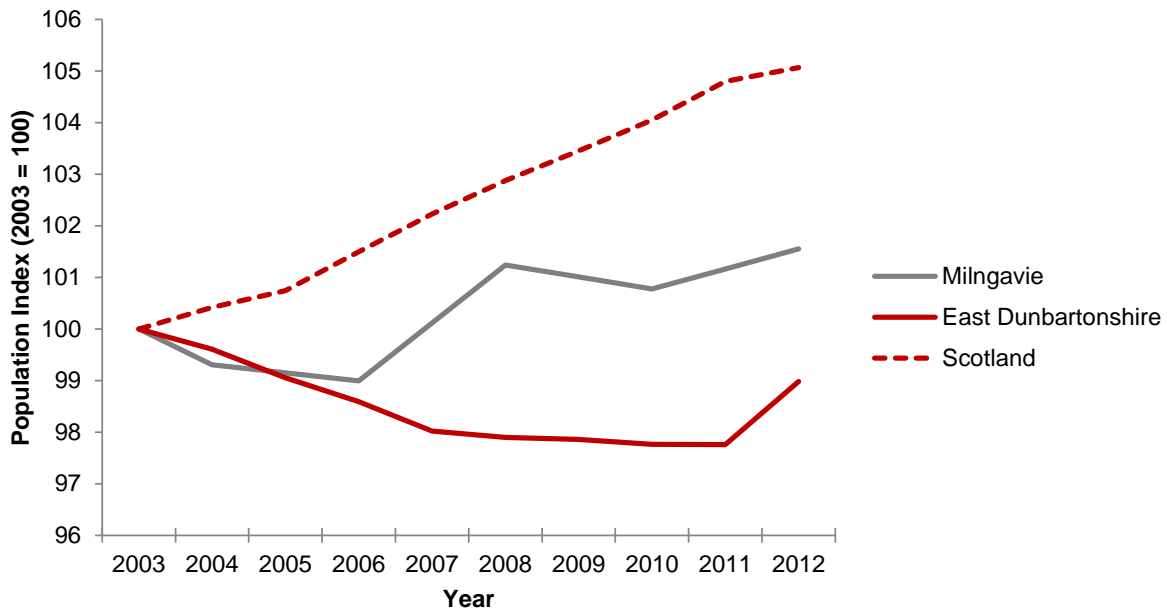


Figure 11 Population Index (Settlement Level – Milngavie), 2003 – 2012

The evidence to link population growth to the Larkhall – Milngavie railway project is inconclusive. The population change between 2005 and 2013 in the three unitary authorities impacted by the project has actually been lower than the national average since 2002.

In Larkhall, the main beneficiary of the project with two new stations, the population has shown a consistent decline from 2007 onwards. However, as evidenced in the User Survey the rail project may have contributed to retaining or attracting residents to the area and therefore mitigated some of the population decline.

Key Benefits & Jobseeker's Allowance Claimants

- 7.12. Evidence from chapter 5 suggests the Larkhall – Milngavie project has improved accessibility and increased employment opportunities. Additionally, the impact of the new stations in Larkhall may have helped to promote more local economic activity with the creation of new job opportunities.
- 7.13. To assess whether the rail project has had an impact on local employment opportunities, the percentage of the working population claiming key benefits and Jobseeker's Allowance since 2002 to the present from the Scottish Neighbourhood Statistics was assessed to identify whether there has been any change in trends.
- 7.14. Figure 12 shows the index of the percentage of working age population claiming key benefits from 2002 to 2013 for the areas impacted by the rail project and the control group. All areas show broadly the same trend in the rate of decrease of claimants from 2003 to 2007 in line with the economic growth experienced during this period. This was followed by an increase in 2008 and 2009 presumably as a result of the recession. Since 2010 there has been a gradual decrease in line with the economic recovery.
- 7.15. As the 2006 to 2008 trend appears to be a continuation of the pre-2006 trend, there does not appear to be any clear evidence that the Larkhall – Milngavie project has had an impact on the number of key benefits claimants.

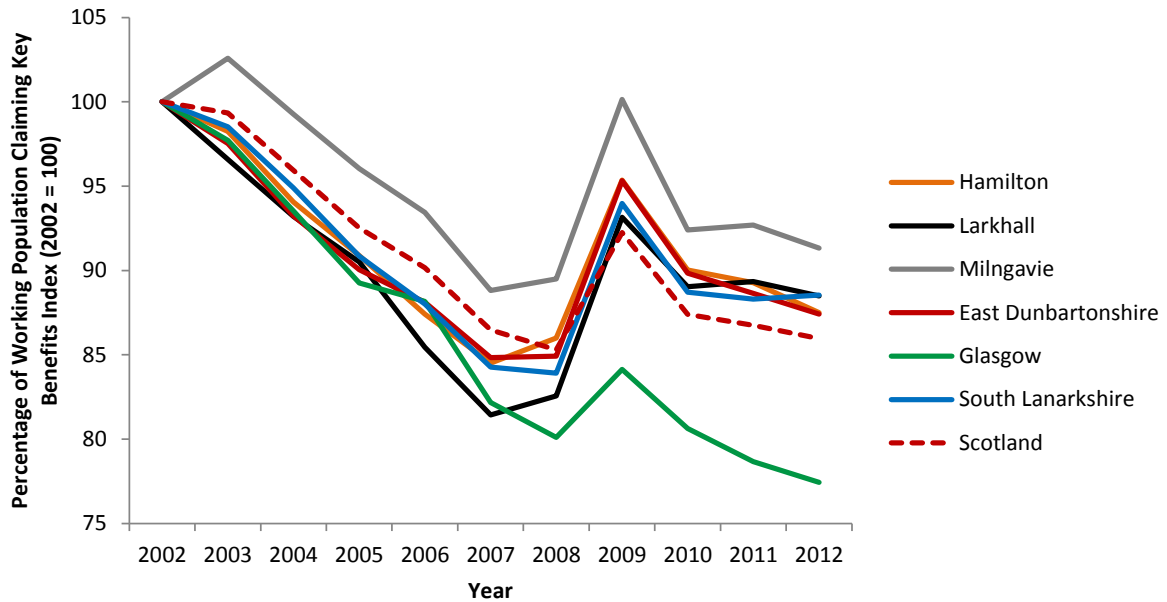


Figure 12 Percentage of Working Population Claiming Key Benefits Index, 2002 – 2012

7.16. The index of the percentage of working age population claiming Jobseeker’s Allowance is shown in Figure 13. Although more volatile than the key benefits claimants, there was an overall decrease in the percentage claiming Jobseeker’s Allowance between 2002 and 2007 across all areas after which there was a marked increase in 2008 and 2009. Since 2009 there has been little change in the percentage of claimants.

7.17. As per the key benefit claimants, the trends in Jobseeker’s Allowance observed appear to be in line with the macro-economic conditions rather than the impact of the Larkhall – Milngavie project, with no noticeable difference between the areas impacted by the improvements and the control group from 2006 onwards.

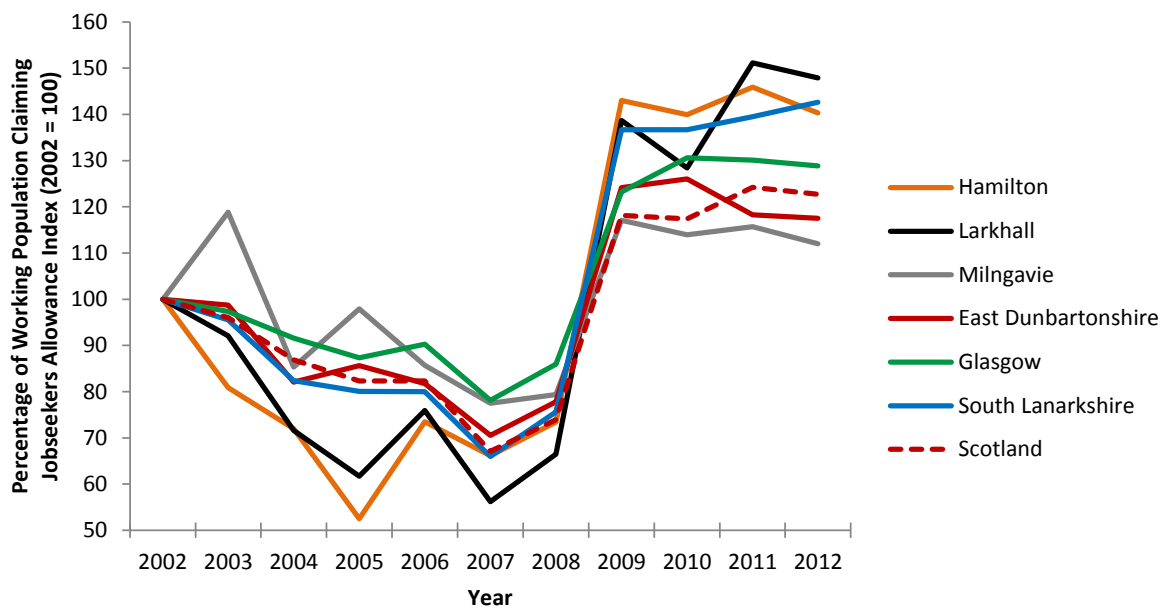


Figure 13 Percentage of Working Population Claiming Jobseeker’s Allowance Index, 2002- 2012

There is no conclusive evidence to link the percentage of benefit claimants to the Larkhall – Milngavie railway project. The changes observed since 2005

are most likely as a result of the economic recession and subsequent recovery rather than the impact of the rail improvements.

House Prices & House Sales

- 7.18. The User Survey suggested there was anecdotal evidence that residents close to the new stations believed the Larkhall – Milngavie project had helped raise house prices and influenced people’s decision to move (see Table 49 and Table 50, Appendix C).
- 7.19. To assess whether the rail project has had an impact on house prices and the number of house sales, data from 2002 to the present from the Scottish Neighbourhood Statistics was analysed to determine whether there has been any change in trends.
- 7.20. Figure 14 shows the index of median house prices from 2002 to 2012 for the unitary authorities and settlements impacted by the rail project and the control group. Across all areas including the control group, a similar trend is observed. Between 2002 and 2007 a substantial increase was observed with median prices increasing by a least 70% in all areas; in Glasgow and Scotland as a whole, prices almost doubled. There was a notable increase of 22% in Milngavie in 2006 which could perhaps be an immediate response to the rail improvements. From 2008 however median prices have decreased, with notable falls in Milngavie and Hamilton. In Larkhall, which has seen the biggest improvement in connectivity, the decrease has been less and more in line with the national trend.
- 7.21. The trend in median house prices is in line with the macro-economic environment with prices falling in 2008 and 2009 in response to the recession. Whilst there may have been some short-term localised impacts (e.g. in Milngavie), the house price data in the areas impacted by the rail project broadly follow the same trend as the control group. There is therefore no firm evidence that the rail project has had an impact on house prices.

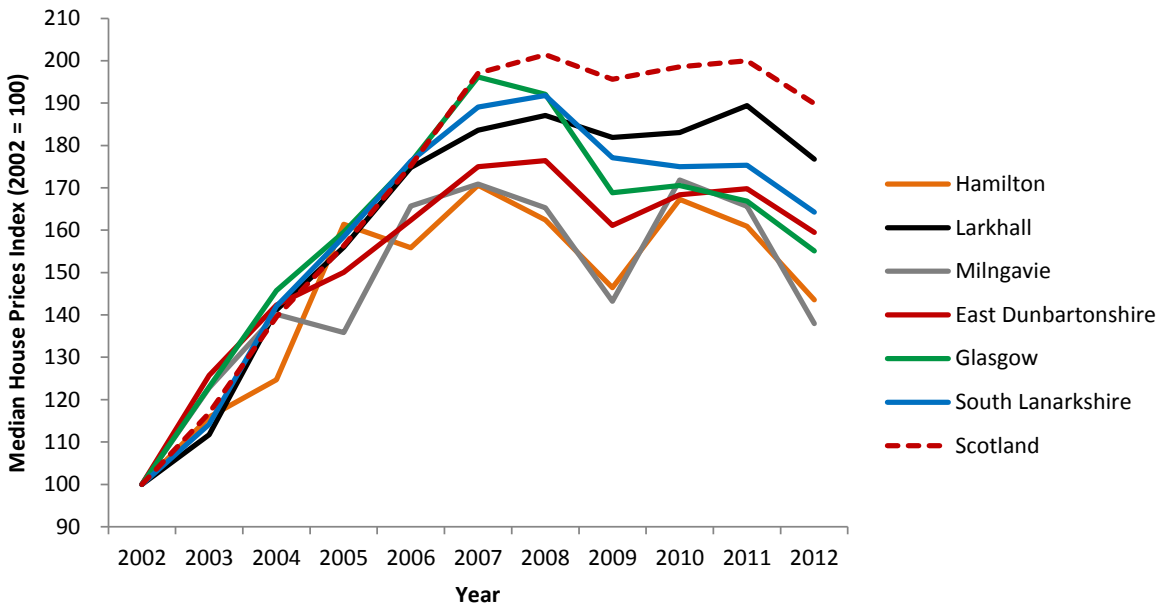


Figure 14 Median House Prices Index, 2002- 2012

- 7.22. Figure 15 shows the index of number of house sales from 2002 to 2012. The areas impacted by the rail project typically follow the control group trend with an increase up to 2007 (in line with house prices) followed by a significant fall in 2008 and 2009. Since 2010, there has been a small recovery. There are however some local variations, notably in Hamilton and Larkhall which had a decrease in the number of home sales at the start of the period.
- 7.23. Given there are no significant differences with the control group, as per house prices, there is no conclusive evidence that the rail project has had an impact on the number of house sales. The changes observed are more likely in response to the macro-economic conditions rather than local factors.

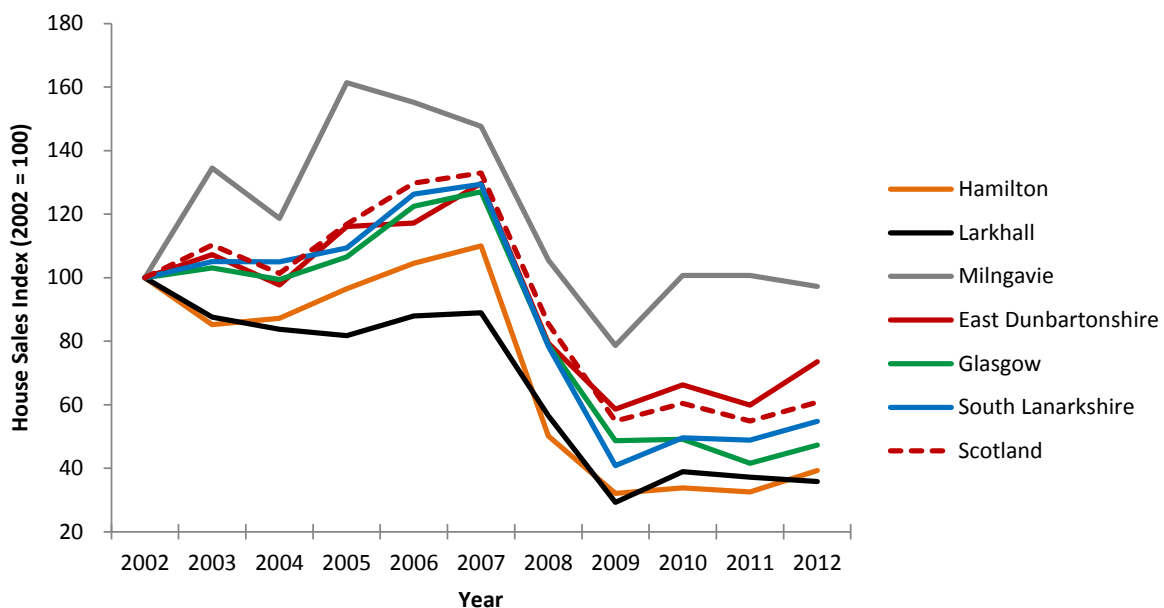


Figure 15 Number of House Sales Index, 2002- 2012

The data does not provide a firm link between house prices or the number of houses sold and the Larkhall – Milngavie railway project. The variations in the housing market since 2005 are most likely in response to the period of strong economic growth to 2007 followed by the recession in 2008 and 2009.

However, evidence from the User Survey suggests the rail project may have had a small beneficial impact on the housing market with the perception that the improvements have boosted house prices.

Housing Completions and New Developments

- 7.24. To assess whether the rail project has led to more housing being built, housing completion data since 2003/4 to the present from the Scottish Neighbourhood Statistics was assessed to determine whether there has been any change in trends.
- 7.25. Figure 16 shows the index of housing completions from 2003/04 to 2013/14. This shows that the number of completions in East Dunbartonshire has been most volatile compared to South Lanarkshire, Glasgow and the national average and in particular has shown a strong recovery since 2009/10. However, given the relatively small number of homes built (typically between 100 and 300 per annum), this is unsurprising. In South Lanarkshire there was an increase of over 300 completions between 2005/06 and 2006/07 which

may have been in response to the opening of the new stations in the Larkhall area. However, since 2006/07 there has been a broadly declining trend in completions in South Lanarkshire and Glasgow, in line with the national average.

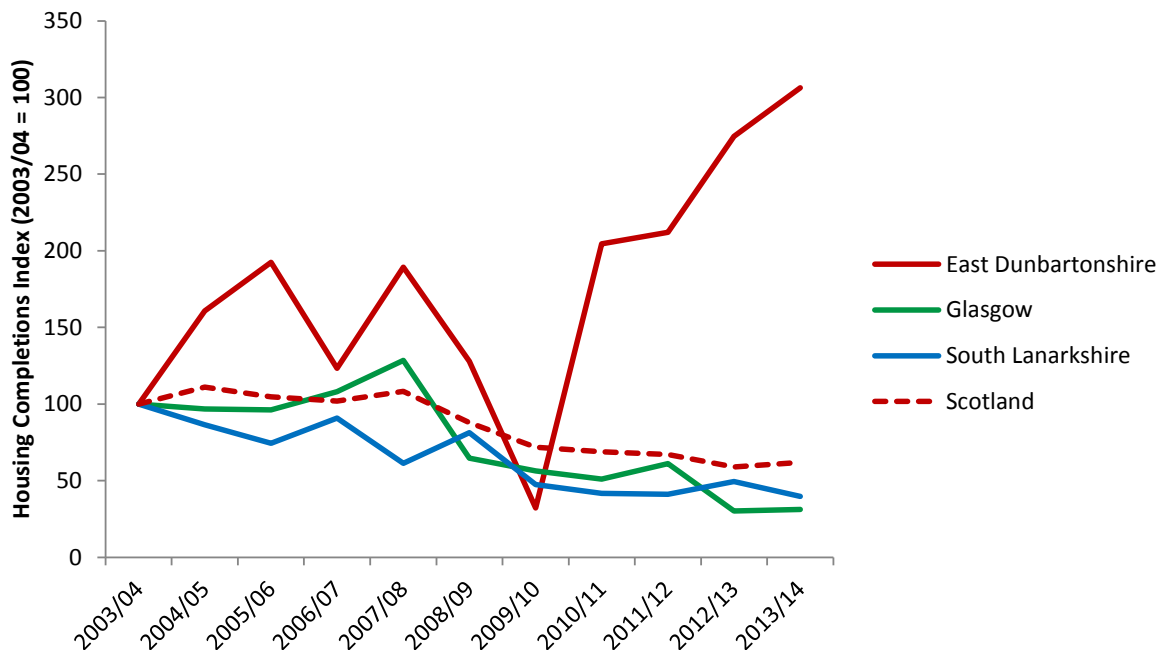


Figure 16 Number of Housing Completions Index, 2003/04 – 2013/14

7.26. To assess whether there was an impact on housing completions at a more local level, data from South Lanarkshire Council was obtained regarding private sector housing completions since 2005 in Larkhall and Ferniegair (the settlement served by Chatelherault station) as shown in Figure 17. This shows that the highest level of completions in Larkhall were in 2005 (63) and 2006 (45). This may in part have been in response to the opening of Larkhall and Merryton stations in 2005. Since 2006, there has been a lower level of activity in Larkhall but in Ferniegair there were nearly 150 completions between 2008 and 2012; again the rail improvements may have been a factor.

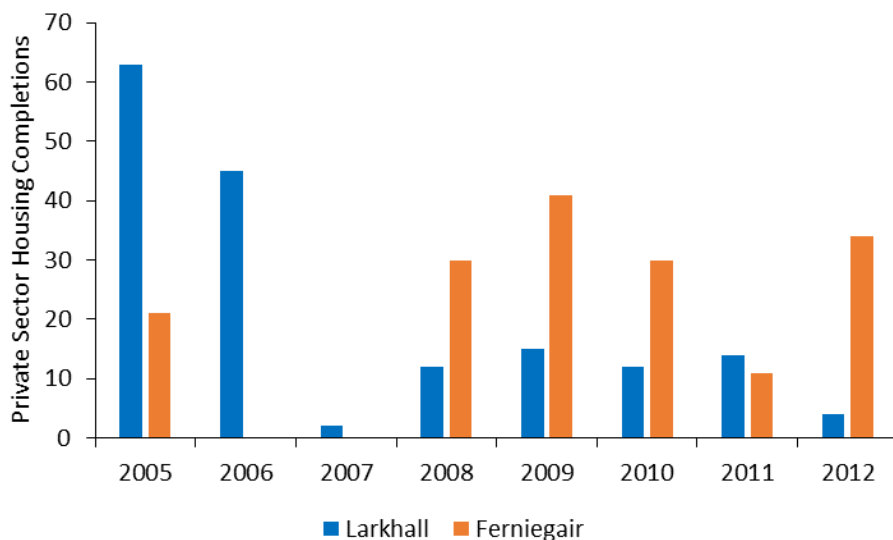


Figure 17 Number of Housing Completions in Larkhall and Ferniegair, 2005 – 2012

7.27. Further housing developments in Larkhall and Ferniegair are due with construction work already started or planning consent given. This is primarily

a result of the local area being classed as a Community Growth Area²¹. In Larkhall, this is expected to deliver 1,500 new homes and in Ferniegair, 300 new homes are expected with 150 of these completed by 2020. South Lanarkshire Council believe that the rail improvements were a key factor in securing the growth area status and boosting the level of housing investment in the area. The sites for new developments are considered as more sustainable as a result of the new rail link and developers are more prepared to invest as a result; it is unlikely the same scale of building would have been seen without the existence of the rail link. In the long term, therefore, the station re-openings have contributed to the building of new homes in Larkhall and Ferniegair.

Conclusions

- 7.28. For most of the local economic indicators examined (population, benefit claimants, house prices and house sales), there is no clear evidence to suggest that the Larkhall – Milngavie project has had a significant or measurable wider economic or social impact.
- 7.29. Comparing the indicators in the areas impacted by the rail project against the control group showed that there was no significant variation between the two suggesting that the impact of the rail improvements was minimal. In addition, some of the positive trends observed such as population tend to have been continuations of what was being experienced prior to the completion of the rail project in 2005.
- 7.30. In the indicators where volatility was observed (e.g. the labour and housing markets), the trends were in line with the economic growth experienced up to 2007 followed by the subsequent recession of 2008 and 2009 and finally recovery from 2010 onwards. Although there may have been localised and small-scale impacts due to the rail project, it is likely that, considering the granularity of the data available, these have been masked by the prevailing macro-economic conditions.
- 7.31. Housing completions is the one indicator examined where there is evidence to support the positive impact of the rail improvements. The station re-openings is thought to have been fundamental to the designation of the Larkhall area as a Community Growth Area. In the long term, this will deliver 1,800 new homes in Larkhall and Ferniegair. In time, these new developments may deliver wider positive social and economic impacts.

²¹ Community Growth Areas are places that can accommodate large-scale, urban growth as identified in the Glasgow and Clyde Valley Structure Plan

8. WIDER ECONOMIC BENEFITS

Overview

- 8.1. In addition to the conventional user and non-user benefits such as journey time savings, reliability improvements and environmental impacts, new transport infrastructure can also impact the local economy. An improved transport network can lead to greater efficiency within the economy through improved links between firms, and between firms and their employees. New stations in particular can also lead to increased investment and regenerate an area. These economic impacts are known as Wider Economic Benefits (WEBs).
- 8.2. STAG identifies four possible types of WEB:
 - agglomeration impacts;
 - wider benefits arising from improved labour supply;
 - increased competition as a result of better transport; and
 - increased output in imperfectly competitive markets²².
- 8.3. WEBs are harder to quantify than conventional transport benefits and are a relatively new feature of economic appraisal within the transport sector; they were not formally assessed at the time the Larkhall – Milngavie railway project appraisal was undertaken in 2000. It was however acknowledged that there would likely be additional effects beyond those captured by conventional appraisal including effects on the economy of the area.
- 8.4. The extent to which WEBs have been generated by the Larkhall-Milngavie rail project and their impact on local economies, communities and businesses was therefore assessed.
- 8.5. Of the WEBs listed above, the following two areas were assessed:
 - agglomeration impacts; and
 - wider benefits arising from improved labour supply.
- 8.6. The two other types of WEB listed above were not considered: STAG considers the ‘increased competition as a result of better transport’ as neutral and ‘increased output in imperfectly competitive markets’ is accounted for as an uplift in the cost-benefit analysis.
- 8.7. In addition to the WEBs analysis (which assumes a fixed land use in applying conventional transport appraisal cost benefit analysis), changes in land use were also investigated as a result of the project (e.g. the conversion of previously vacant or derelict land) to industrial or commercial use resulting in new businesses opening in the area.
- 8.8. As acknowledged by STAG, WEBs are difficult to identify and quantify. The aim of the analysis was therefore to provide an indicative exploration of the existence and scale of the WEBs generated as a direct result of the rail project, rather than attempt to provide a precise monetary value of the impacts. The findings will inform the extent to which WEBs should be investigated in future appraisal and evaluations of similar schemes.

²² Imperfect competition occurs when a firm has at least some control over the price of their outputs i.e. they exercise market power.

Methodology

- 8.9. Given the limited impact of the Larkhall-Milngavie rail project, a proportionate assessment was carried out in line with STAG.
- 8.10. The main source used to provide the required data for the WEBs analysis was the Business Survey discussed in chapter 14.
- 8.11. Additionally, the User Survey results and accessibility analysis undertaken to calculate the impact of the rail project on public transport journey times to key business destinations across Glasgow (chapter 5) were drawn upon.

Agglomeration Impacts

- 8.12. Agglomeration benefits can arise from improved transport links because businesses derive productivity benefits from being close to one another and from being located closer to larger labour markets. If transport investment brings businesses closer together and close to their workforce this may generate an increase in labour productivity above and beyond that which would be expected from the conventional user benefits alone (e.g. journey time savings).
- 8.13. To address whether the Larkhall-Milngavie rail project has created agglomeration impacts, the responses from the Business Survey in relation to how the project has impacted businesses' performance by improving the accessibility / proximity to other firms and labour markets were analysed. Additionally, the results from the accessibility analysis undertaken (chapter 5) were used.
- 8.14. Businesses that have been operating in the area since before the completion of the Larkhall-Milngavie rail project (n=19) were asked a series of questions to determine how the project has impacted their business.

General Business Performance

- 8.15. At a general level, nearly half (47%, n=9) of the businesses operating in the area since before the Larkhall-Milngavie rail project was completed stated that the project had a positive impact on the performance of their business. The remainder stated there had been neither a positive nor a negative impact.
- 8.16. Over half of businesses (53%, n=10) felt that there would be a strongly or slightly negative impact on their business if there was no railway.

Accessibility Analysis

- 8.17. As demonstrated in chapter 5, the Larkhall – Milngavie project has led to reduced public transport journey times. This may therefore have improved accessibility to a business's suppliers, customers and other branches.
- 8.18. This is evidenced through almost half of business survey respondents (47%, n=9) indicating the rail project has improved access to key services (suppliers, markets and other business functions). Slightly fewer (37%, n=7) thought it has improved access to their existing and potentially new customer base (Figure 18).

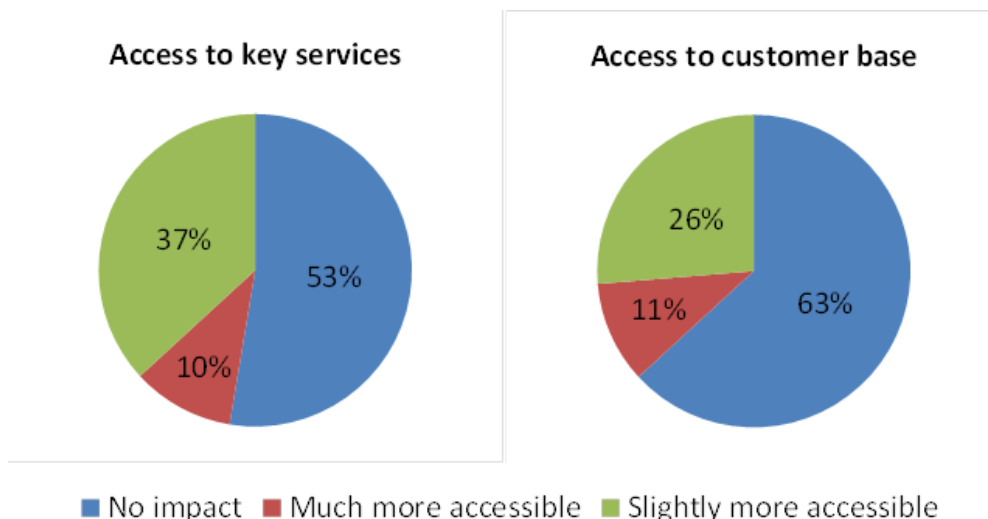


Figure 18 Impact on Accessibility

8.19. The belief that the rail project has improved accessibility is reinforced by the increased use of rail (Table 10), particularly for commuting with nearly two-thirds (63%, n=12) of businesses stating their staff are more likely to travel by rail to/from work. Businesses are also now more likely to use rail to meet with customers and/or suppliers (48%, n=9) and for travelling to other branches (37%, n=7).

Table 10 Impact of Larkhall-Milngavie Rail Project on Rail Travel

Number of Full-time Employees	Staff Commuting to/from Work	Meeting with Customers and/or Suppliers	Travelling to Other Branches
Much more likely to travel by rail	37%	32%	16%
Slightly more likely to travel by rail	26%	16%	21%
Neither more nor less likely to travel by rail / Don't know	37%	52%	63%
Slightly less likely to travel by rail	0%	0%	0%
Much less likely to travel by rail	0%	0%	0%

Competition

8.20. A key product of agglomeration is a more efficient labour market interaction which can lead to increased competition between businesses and reduce inefficiencies.

8.21. However, the impact on competition between businesses as a result of the Larkhall-Milngavie rail project appears to be minimal with nearly all businesses (89%, n=17) saying the rail project had had no impact in this respect.

Business Costs

8.22. Agglomeration benefits can lead to reduced business costs through more efficient input and output markets.

8.23. However, as with competition, the impact of the rail project on reducing business costs has been minimal with 79% (n=15) stating there has been no impact. For those businesses that stated there had been an impact, savings have been modest (maximum of £5k per annum).

Improved Labour Supply

8.24. Transport costs can affect the overall costs and benefits to an individual:

- more people can choose to work if the costs of commuting (time and/or fare) are reduced;
- people may choose to work more hours if their commuting time falls; and
- improved transport links can open up new opportunities and lead to better matching of labour supply with demand, resulting in higher productivity.

8.25. To assess whether the Larkhall-Milngavie rail project has improved the labour supply, the responses from the Business Survey in relation to whether it is now easier to retain and/or recruit staff were analysed.

8.26. Additionally, the responses from the User Survey were analysed to determine whether the changes to rail services due to the Larkhall-Milngavie rail project have reduced commuting journey times or influenced respondents' decisions to change jobs.

Business Survey Analysis

8.27. Businesses that have been operating in the area since before the completion of the Larkhall-Milngavie rail project (n=19) were asked a series of questions to determine how the project has impacted the ability of their business to recruit and/or retain staff, and if so, the main reasons for this.

8.28. Nearly half (47%, n=9) of respondents stated that the Larkhall-Milngavie rail project has had a positive impact on their ability to retain staff and recruit new and/or more highly-skilled staff. The reasons given for this were:

- reduced commuting times (67%, n=6);
- providing a viable alternative to car or bus travel (56%, n=5); and
- making the location more accessible (44%, n=4).

User Survey Analysis

8.29. In the User Survey, respondents whose nearest stations were one of the four newly opened stations (Larkhall, Merryton, Chatelherault and Kelvindale) were asked whether the changes to rail services due to the Larkhall-Milngavie rail project have reduced their travel time to/from work and/or influenced their decision to change jobs.

8.30. Nearly half of respondents whose nearest station is Larkhall, Merryton, Chatelherault (48%, n=40) said the new stations have reduced the time they spend travelling to/from work. Of the respondents who had changed jobs in the last 5 years, 38% (n=12) stated that the improvements influenced their decision to move to their current job.

8.31. Residents for whom Kelvindale is the nearest station (n=12), 83% (n=10) say the new station has reduced the time they spend travelling to/from work. Of the 47% (n=7) of Kelvindale residents who have changed jobs in the last 5 years, just one (17%) stated that the improvements influenced their decision to move to their current job.

8.32. This evidence is supported by the accessibility analysis which has shown that the rail project has reduced public transport journey times.

Changes in Land Use

- 8.33. In addition to WEBs (which assume a fixed land use), major transport projects can result in changes to land use. For example, businesses may relocate as a result of improved connectivity resulting in the conversion of previously vacant or derelict land to industrial or commercial use.
- 8.34. Productivity benefits can arise through businesses relocating to a more convenient location due to:
- an increase in turnover/profitability through reduced costs e.g. lower rents and other operational costs;
 - reduced time spent travelling to/from work; and
 - better access to labour market, suppliers and customers.
- 8.35. To assess whether the Larkhall-Milngavie rail project has resulted in land use changes, information was obtained from South Lanarkshire Council as to whether there have been any new business developments in the area since 2005. Additionally, the responses from the Business Survey in relation to whether the rail improvements influenced a business's relocation decision were analysed.

New Business Developments

- 8.36. As discussed in chapter 5, based on the information received from South Lanarkshire Council, there have been no significant industrial developments in the Larkhall area since 2005. The exception is the opening of the NHS distribution warehouse in Canderside, south of Larkhall.

Business Survey Analysis

- 8.37. The Business Survey respondents who had opened a new branch or relocated to the area since the completion of the Larkhall-Milngavie rail project (i.e. since the end of 2005 (n=17)) were asked whether the rail improvements had influenced their decision.
- 8.38. Only three respondents stated that the Larkhall-Milngavie rail project had influenced their decision to open a new branch or relocate and just one of those stated that it was the main factor (the other two said it was an important factor amongst others). The reasons given were that the rail improvements have made it easier:
- for staff to commute to/from work (n=2);
 - to meet customers and/or suppliers (n=2); and
 - to travel to other branches of the business (n=1).
- 8.39. Although the rail project does not appear to have been a factor in the majority of businesses' decision to open a new branch or relocate, nearly half (n=8) stated there would be a negative impact if there was no rail service.

Conclusions

- 8.40. Although there are limits to the conclusions that can be drawn from a small business survey, the analysis carried out above suggests that the rail project has been overall beneficial to businesses, with nearly half of those surveyed

stating it has had a positive impact on their performance. However, evidence of sustained and significant WEBs is limited.

Agglomeration Benefits

- 8.41. The accessibility analysis has demonstrated that connectivity and public transport journey times to key destinations from locations along the Larkhall-Milngavie route have been improved. There is some evidence that this has created opportunities for agglomeration benefits to materialise through, for example, increased use of rail for better access to markets, suppliers and customers.
- 8.42. However, quantifiable evidence is more limited with few businesses able to demonstrate any substantial reduction in business costs as a direct result of the rail improvements.

Improved Labour Supply

- 8.43. There is evidence that the rail project has improved the labour supply to local businesses with nearly half of the Business Survey respondents stating that the rail improvements have made it easier to retain and/or recruit staff.
- 8.44. This is reinforced by rail users stating that the rail improvements have reduced their commuting times and, particularly in the Larkhall area, influenced their decision to move jobs.

Land Use Changes

- 8.45. There is little evidence that the rail improvements have influenced businesses' decisions to open new branches or relocate. In the Larkhall area, there has so far been no significant change in land use for new business developments.

Reasons for limitations to WEBs

- 8.46. There are several reasons why WEBs arising from the Larkhall-Milngavie rail project may have been limited:
- i. Main benefits are restricted to service improvements along one corridor*
- 8.47. The main change to the majority of users of the Larkhall-Milngavie rail project has been the doubling in frequency of services on large sections of the line. Whilst this will have reduced waiting times, it will not have significantly altered connectivity or accessibility, or opened up new destinations and markets in a way that would have a tangible impact on a business's individual performance.
- 8.48. A more valuable project from businesses' perspective may have been a rail link to Glasgow airport; several of the Business Survey responses commented on this and stated that this would make a real difference to their business's accessibility.
- 8.49. When transport improvements are restricted to one corridor within a city, WEBs are always likely to be localised and small-scale. Agglomeration and other WEBs tend only to be significant where transport infrastructure improvements facilitate step change improvements in connectivity and journey times *between* major economic centres.
- ii. Larkhall was already well-connected and primarily a residential area*

- 8.50. The main step change improvements of the Larkhall-Milngavie rail project have been focused in the Larkhall area with the re-opening of the line and Larkhall, Merryton and Chatelherault stations.
- 8.51. Although this has improved accessibility to Larkhall, access to Larkhall even before the completion of the project was not considered a problem because of its location adjacent to the M74 motorway. Considering car was and remains the dominant mode for commuting and business travel, the presence of the railway in the area is unlikely to have had a significant impact on existing businesses' performances or played a key role in attracting businesses to the area.
- 8.52. Furthermore, since the closure of Larkhall's traditional industries such as the iron and steel works, the town is now predominantly residential and may not fit with a new business's aspirations, even with the rail improvements. Larkhall may therefore find it difficult to attract significant new business investment. This is compounded by the fact that there are better-connected locations such as Hamilton and Motherwell in close proximity which have a larger 'white collar' business presence.
- 8.53. However, this situation may change in the future should road congestion worsen which may lead to the introduction of policies to discourage car use (e.g. road-user charging). The presence of a good rail link may become a more important factor for a business considering new locations and encourage investment in the town.
- iii. Business investment due to rail improvements may take many years to materialise*
- 8.54. Although the Larkhall-Milngavie rail project was completed nearly a decade ago, WEBs and land use changes can take many years to materialise, particularly regarding a business's decision to open a new branch or relocate. Furthermore, the recession of 2008-09 may have stalled any plans for expansion plans and new business investment in locations such as Larkhall.
- 8.55. As the economy recovers, areas along the line such as Larkhall may become more successful at attracting new investment. One large investment decision alone could create several hundred new jobs and precipitate a steady stream of new businesses and investment.

9. REVIEW OF PASSENGER FORECASTS

Overview

- 9.1. This chapter compares actual passenger demand at the four stations on the line that were re-opened in 2005 against the forecasts as set out in the original Business Case. Where there are differences, possible reasons are discussed, for example by reviewing the methodology used to forecast demand.
- 9.2. Actual demand at the stations on the Larkhall – Milngavie line that benefited from service frequency improvements in 2005 was also reviewed. Demand forecasts for these stations were not explicitly documented in the original Business Case. Actual demand was therefore assessed against a set of control stations not impacted by the project to determine whether the improvements generated new demand above and beyond underlying growth in Scottish rail travel (which in effect is a proxy for the counterfactual i.e. what would have happened had the project not been implemented).

Actual Vs Forecast Demand – New Stations

- 9.3. This section compares the actual demand data against the forecast demand data from 2006/07 (the first full year in which the stations were open) to 2012/13 (the last year for which demand data is available) for the four newly opened stations in 2005:
 - Larkhall;
 - Merryton;
 - Chatelherault; and
 - Kelvindale.

Methodology

- 9.4. The actual demand data is based on the entries and exits total from the Office for Rail Regulation's (ORR) estimates of station usage^{23,24}.
- 9.5. The forecast demand data was taken from section 7.3.17 of the Modelling Report for the Larkhall/Milngavie Rail Project prepared by Strathclyde Passenger Transport (SPT) in November 2000 (hereafter referred to as the 'SPT Modelling Report'). The SPT Modelling Report only provided disaggregated daily demand forecasts for the four stations in 2001, the date the stations were originally due to open (Table 11).

²³ <http://orr.gov.uk/statistics/published-stats/station-usage-estimates> - these are estimates of the total numbers of people entering, exiting and changing at each station in Great Britain based on ticket sales data recorded in rail industry systems

²⁴ Since 2013/14, the ORR have used a more sophisticated methodology to determine demand at SPT stations (http://orr.gov.uk/data/assets/pdf_file/0017/15362/station-usage-2013-14.pdf). This has had the impact of reducing demand at some stations from 2013/14 onwards. The previous method which had been used since 2008/09 did not use the zone card survey data for example. It is therefore acknowledged that the pre-2013/14 demand figures presented in this report are potentially overstated.

Table 11 Forecast Demand at New Stations (2001)

Station	2001 Daily Boarders	2001 Daily Alighters	2001 Total Daily Demand
Larkhall	406	338	744
Merryton	226	352	578
Chatelherault	73	57	130
Kelvindale	66	84	150

Source: Table 7.3.17, SPT Modelling Report

9.6. In the SPT Modelling Report, the 2001 demand was grown by applying forecast planning data (i.e. population, number of households, employment etc) for each of the 599 Strathclyde Integrated Transport Model (SITM) model zones. This provided the demand for the two forecast years (2016 and 2031) at an aggregate level (i.e. total rail boardings) for the entire SPT network which covers all Strathclyde suburban rail services (Table 12).

Table 12 Forecast Annual Rail Boardings with Larkhall/Milngavie Project (full STP network)

Forecast year	Annual Rail Boardings	Growth since 2001
2001	57,064,229	-
2016	63,141,578	10.7%
2031	73,029,911	28.0%

Source: Figure 3, SPT Modelling Report

9.7. For this evaluation, the demand in Table 12 was used to derive an average annual rail growth rate between 2001 and 2016 (0.7% per annum) which then was applied to the 2001 demand at the four stations to calculate the forecast daily demand for each year from 2006/07 to 2012/13. This was converted to annual demand by applying an annualisation factor of 283²⁵ (less than 365 as typically users do not use the network everyday e.g. most rail commuters do not travel at the weekend).

9.8. All annual demand figures presented below are rounded to the nearest 100 passengers.

Larkhall

9.9. Table 13 shows the actual versus forecast demand at Larkhall station from 2006/07 to 2012/13 and is represented graphically in Figure 19. These show that for every year from 2006/07 – 2012/13, actual demand at Larkhall station has been greater than forecast demand. Even in the first full year of opening, the actual demand was over 50,000 (23%) higher than forecast. Despite demand falling in 2009/10 and 2010/11 (presumably due to the recession), demand in 2012/13 was 116,000 or over 50% higher than the forecast.

²⁵ Derived from the SPT Modelling Report which reports a total annual SPT rail demand in 2001 the 'do-something' scenario of 57,064,229 boardings and a 24hr rail demand of 201,698 boardings

Table 13 Actual vs Forecast Demand – Larkhall, 2006/07 to 2012/13

	06/07	07/08	08/09	09/10	10/11	11/12	12/13
Actual demand	268,700	307,900	334,300	323,100	317,500	327,100	342,700
Actual annual growth rate	-	14.6%	8.6%	-3.4%	-1.7%	3.0%	4.8%
Forecast demand	217,700	219,200	220,700	222,200	223,700	225,200	226,700
Forecast annual growth rate	-	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
Demand Difference (absolute)	51,000	88,700	113,600	100,900	93,800	101,900	116,000
Demand Difference (%)	23.4%	40.5%	51.5%	45.4%	41.9%	45.2%	51.2%

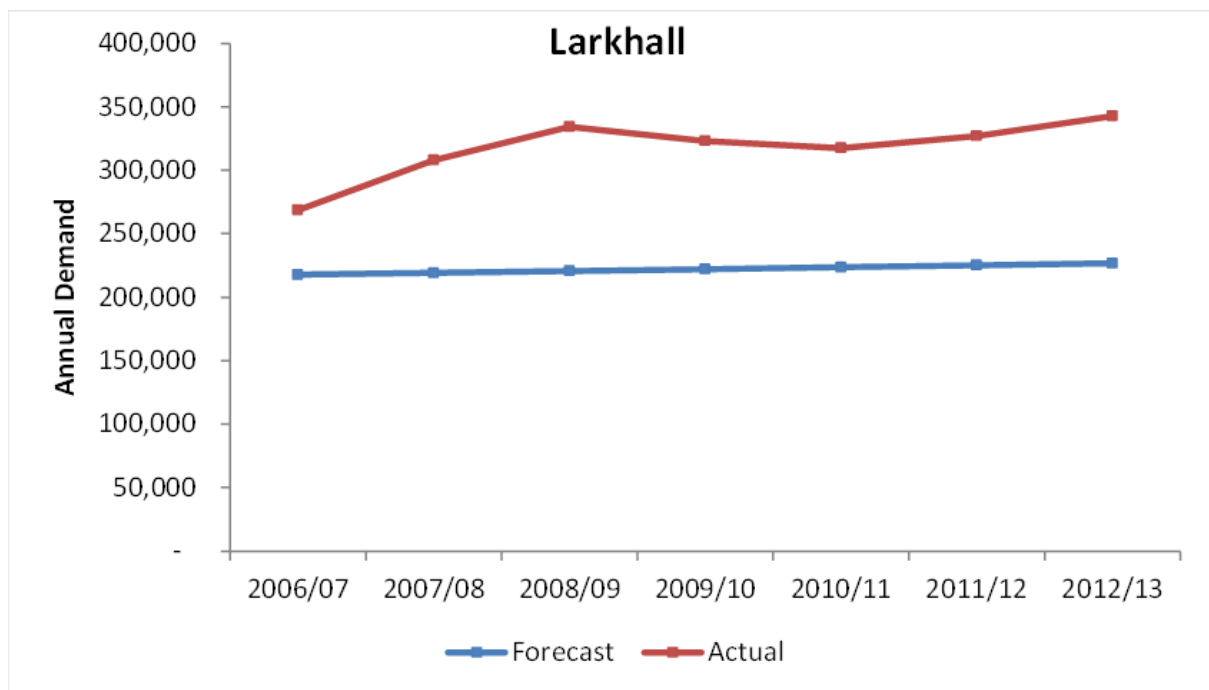


Figure 19 Actual vs Forecast Demand – Larkhall, 2006/07 to 2012/13

Merryton

9.10. The actual versus forecast demand at Merryton station from 2006/07 to 2012/13 is shown in Table 14 and is represented graphically in Figure 20. In contrast to Larkhall, the actual demand at Merryton has been consistently lower than the forecast. Even though the actual demand growth rate has been higher than the implied forecast growth rate (with the exception of 2010/11) by 2012/13 demand was still 63,000 (36%) lower than forecast.

Table 14 Actual vs Forecast Demand – Merryton, 2006/07 to 2012/13

	06/07	07/08	08/09	09/10	10/11	11/12	12/13
Actual demand	81,100	97,600	99,500	104,000	102,700	106,300	113,100
Actual annual growth rate		20.3%	1.9%	4.5%	-1.3%	3.5%	6.4%
Forecast demand	169,100	170,300	171,400	172,600	173,800	174,900	176,100
Forecast annual growth rate		0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
Demand Difference (absolute)	-88,000	-72,700	-71,900	-68,600	-71,100	-68,600	-63,000
Demand Difference (%)	-52.0%	-42.7%	-41.9%	-39.7%	-40.9%	-39.2%	-35.8%

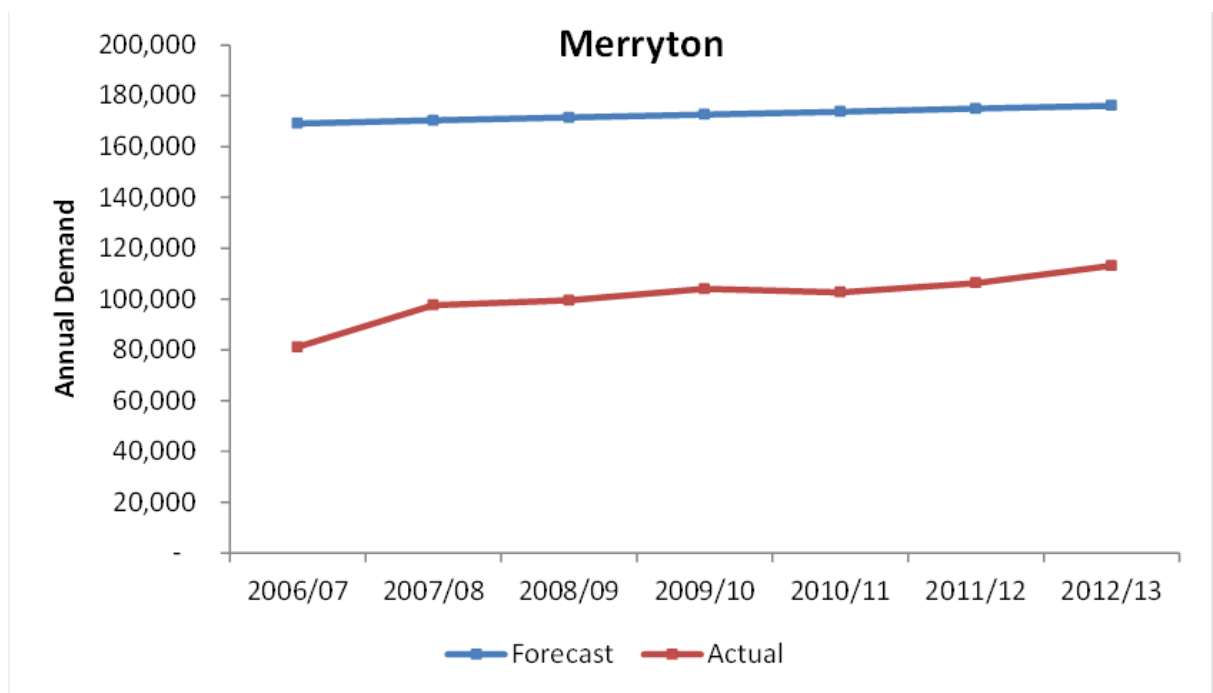


Figure 20 Actual vs Forecast Demand – Merryton, 2006/07 to 2012/13

Chatelherault

9.11. Table 15 shows the actual versus forecast demand at Chatelherault station from 2006/07 to 2012/13. This is represented graphically in Figure 21. The 2006/07 actual demand for Chatelherault was less than half the forecast. However, demand at Chatelherault is now outperforming the forecast and in 2012/13 was 23,000 (58%) higher.

Table 15 Actual vs Forecast Demand – Chatelherault, 2006/07 to 2012/13

	06/07	07/08	08/09	09/10	10/11	11/12	12/13
Actual demand	17,300	23,500	41,000	49,800	57,100	59,500	62,500
Actual annual growth rate		35.8%	74.5%	21.5%	14.7%	4.2%	5.0%
Forecast demand	38,000	38,300	38,600	38,800	39,100	39,300	39,600
Forecast annual growth rate		0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
Demand Difference (absolute)	-20,700	-14,800	2,400	11,000	18,000	20,200	22,900
Demand Difference (%)	-54.5%	-38.6%	6.2%	28.4%	46.0%	51.4%	57.8%

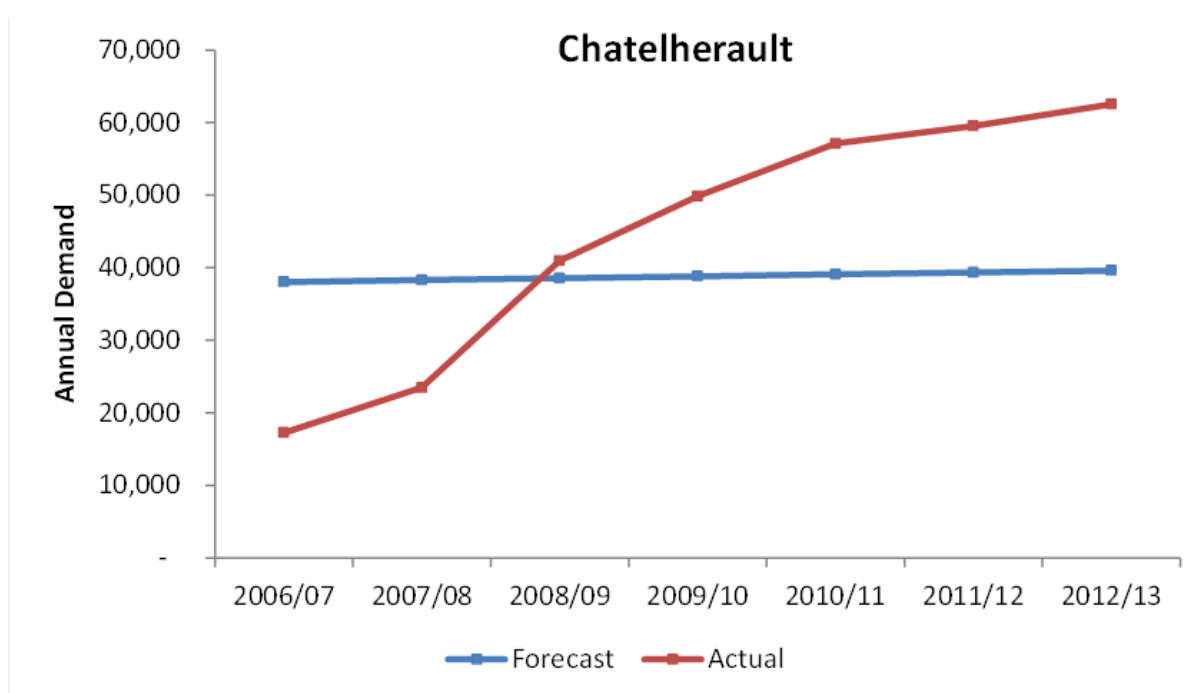


Figure 21 Actual vs Forecast Demand – Chatelherault, 2006/07 to 2012/13

Kelvindale

9.12. The actual versus forecast demand at Kelvindale station from 2006/07 to 2012/13 is shown in Table 16 . This is represented graphically in Figure 22. The 2006/07 actual demand for Kelvindale was more than double the forecast. Despite actual demand falling by 18% in 2010/11 (possibly due to the recessional impact), demand in 2012/13 was still 51,000 or 111% higher than the forecast.

Table 16 Actual vs Forecast Demand – Kelvindale, 2006/07 to 2012/13

	06/07	07/08	08/09	09/10	10/11	11/12	12/13
Actual demand	95,000	107,700	109,500	109,700	90,500	94,400	96,500
Actual annual growth rate		13.4%	1.7%	0.2%	-17.5%	4.3%	2.2%
Forecast demand	43,900	44,200	44,500	44,800	45,100	45,400	45,700
Forecast annual		0.7%	0.7%	0.7%	0.7%	0.7%	0.7%

growth rate							
Demand Difference (absolute)	51,100	63,500	65,000	64,900	45,400	49,000	50,800
Demand Difference (%)	116.4%	143.7%	146.1%	144.9%	100.7%	107.9%	111.2%

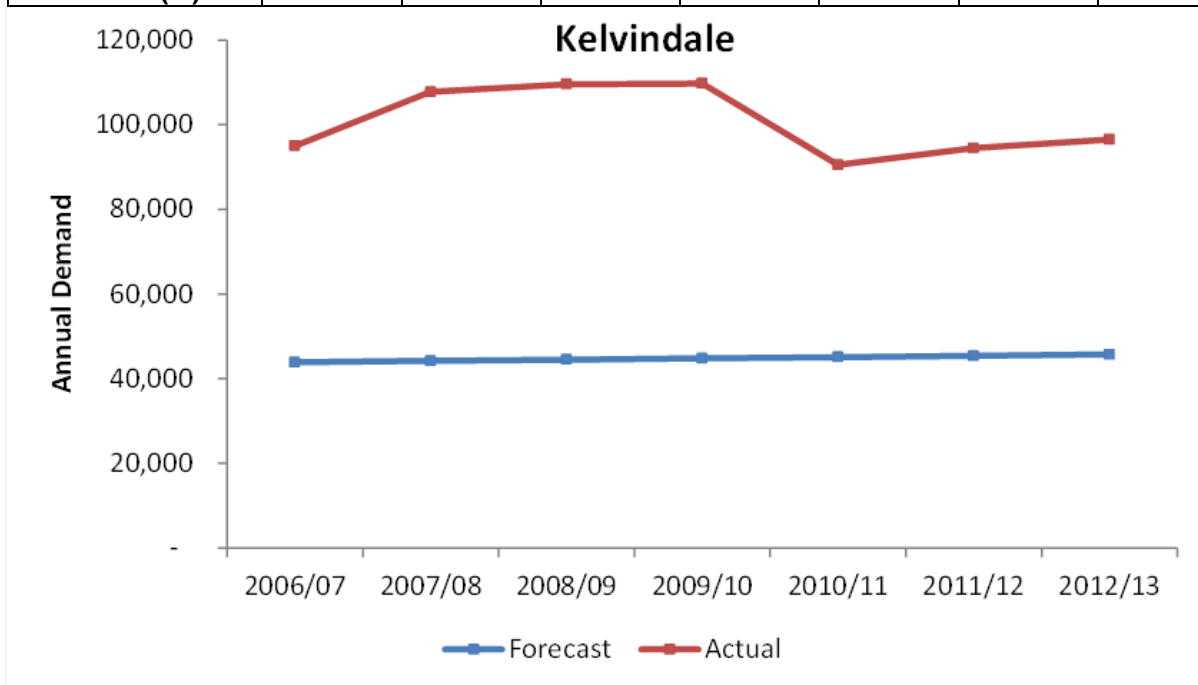


Figure 22 Actual vs Forecast Demand – Kelvindale, 2006/07 to 2012/13

Summary – All new stations

9.13. Analysis of 2012/13 actual against forecast demand at the four new stations shows there are some large differences with actual demand being at least 50% higher than forecast at three stations (Larkhall, Chatelherault and Kelvindale). Table 17 shows the actual versus forecast demand at all four stations from 2006/07 to 2012/13. This is represented graphically in Figure 23. Whilst actual demand in 2006/07 was very close to forecast (1% difference), a noticeable difference is observed from 2008/09 onwards. Although the recession dampened demand in 2009/10 and 2011/12, the divergence between actual and forecast has continued in the last couple of years with actual demand 26% higher than forecast in 2012/13.

Table 17 Actual vs Forecast Demand – All New Stations, 2006/07 to 2012/13

	06/07	07/08	08/09	09/10	10/11	11/12	12/13
Actual demand	462,100	536,700	584,300	586,600	567,700	587,400	614,800
Actual annual growth rate		16.1%	8.9%	0.4%	-3.2%	3.5%	4.7%
Forecast demand	468,800	472,000	475,200	478,400	481,600	484,900	488,200
Forecast annual growth rate		0.7%	0.7%	0.7%	0.7%	0.7%	0.7%
Demand Difference (absolute)	-6,700	64,700	109,100	108,200	86,100	102,500	126,600
Demand Difference (%)	-1.4%	13.7%	23.0%	22.6%	17.9%	21.1%	25.9%

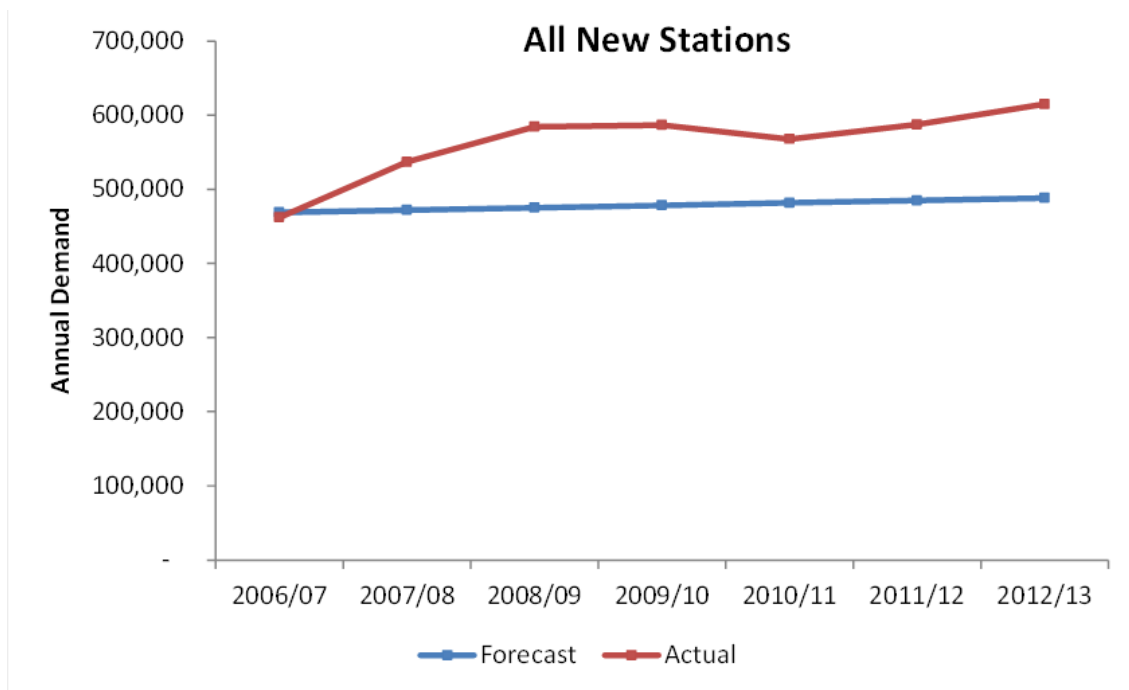


Figure 23 Actual vs Forecast Demand – All New Stations, 2006/07 to 2012/13

9.14. Potential reasons for the differences between actual and forecast demand are discussed at the end of this chapter.

Actual Vs Forecast Demand – Service Frequency Improvements

9.15. This section assesses the actual demand at stations that benefited from a service frequency improvement from 2005 onwards as a result of the Larkhall – Milngavie project. These stations are divided into two sections:

- Hamilton – Glasgow section (Hamilton Central, Hamilton West, Blantyre, Newton, Cambuslang, Rutherglen, Dalmarnock and Bridgeton); and
- Milngavie – Glasgow section (Milngavie, Hillfoot, Bearsden, Westerton and Anniesland).

Methodology

9.16. The SPT Modelling Report does not provide any demand forecasts for the stations that benefited from service frequency improvements in 2005.

9.17. As an alternative to using demand forecasts, the actual demand is therefore compared against:

- average demand growth at the ten stations on the Cathcart Circle section²⁶ of the network linking Glasgow to Cathcart in south Glasgow. This section of the network was not impacted by the Larkhall – Milngavie project and

²⁶ Pollokshields East, Pollokshields West, Maxwell Park, Shawlands, Pollokshaws East, Langside, Cathcart, Mount Florida, Crosshill and Queens Park

demand from 2006/07 onwards is relatively stable. This section therefore acts as a good control and it is reasonable to assume growth at stations that did receive a service improvement would have been similar to the growth observed on the Cathcart section of the network had there been no service improvements since exogenous demand drivers (i.e. population, employment) are likely to have been similar for the two rail lines; and

- the implied overall SPT rail demand growth between 2001 and 2016 as per the Modelling Report (as discussed in section 9.6).

Hamilton – Glasgow stations

9.18. Using estimates of station usage data from the ORR, Table 18 and Table 19 show the actual demand and annual growth rate respectively at the eight stations on the Hamilton to Glasgow section of the network and at a total level. This is also illustrated graphically in Figure 24.

Table 18 Hamilton - Glasgow Stations Actual Demand, 2005/06 to 2012/13

Station	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	Total Growth 05/06 – 12/13
Hamilton Central	671,803	705,089	746,393	815,296	803,932	845,704	873,182	892,228	32.8%
Hamilton West	593,672	575,226	617,736	739,282	756,516	798,816	846,130	885,286	49.1%
Blantyre	340,118	382,883	410,401	460,462	459,820	490,204	527,100	560,532	64.8%
Newton	336,806	367,045	384,594	425,634	440,916	481,146	515,754	523,554	55.4%
Cambuslang	557,494	579,420	604,899	660,234	655,394	689,836	757,572	777,400	39.4%
Rutherglen	526,357	579,169	613,983	711,480	734,704	796,568	894,432	977,418	85.7%
Dalmarnock	58,081	61,109	61,209	70,162	77,290	76,982	79,558	21,506	-63.0%
Bridgeton	240,092	286,177	308,699	390,860	393,962	409,236	489,326	617,186	157.1%
All stations	3,324,422	3,536,118	3,747,914	4,273,410	4,322,534	4,588,492	4,983,054	5,255,110	58.1%

Source: ORR

Table 19 Hamilton - Glasgow Stations Actual Annual Demand Change, 2006/07 to 2012/13

Station	06/07	07/08	08/09	09/10	10/11	11/12	12/13
Hamilton Central	5.0%	5.9%	9.2%	-1.4%	5.2%	3.2%	2.2%
Hamilton West	-3.1%	7.4%	19.7%	2.3%	5.6%	5.9%	4.6%
Blantyre	12.6%	7.2%	12.2%	-0.1%	6.6%	7.5%	6.3%
Newton	9.0%	4.8%	10.7%	3.6%	9.1%	7.2%	1.5%
Cambuslang	3.9%	4.4%	9.1%	-0.7%	5.3%	9.8%	2.6%
Rutherglen	10.0%	6.0%	15.9%	3.3%	8.4%	12.3%	9.3%
Dalmarnock	5.2%	0.2%	14.6%	10.2%	-0.4%	3.3%	-73.0% ²⁷
Bridgeton	19.2%	7.9%	26.6%	0.8%	3.9%	19.6%	26.1%
All stations	6.4%	6.0%	14.0%	1.1%	6.2%	8.6%	5.5%

²⁷ the large decrease in demand at Dalmarnock in 2012/13 is in response to disruption due to station refurbishment works

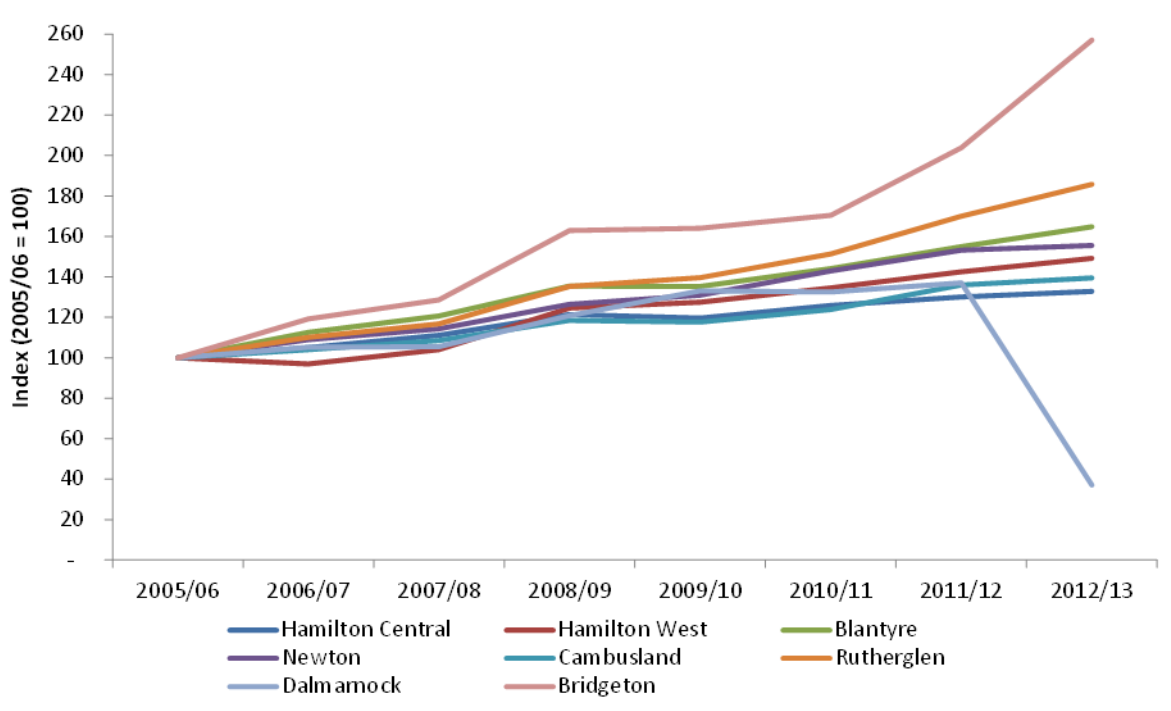


Figure 24 Hamilton – Glasgow Stations Indexed Actual Demand, 2005/06 to 2012/13

9.19. The majority of the stations on the Hamilton – Glasgow section exhibited strong growth over the period, averaging at 58% total growth over the seven years (an average growth of 7% per annum). In particular:

- growth was notably strong in 2006/07 and 2007/08 perhaps in immediate response to the frequency improvements;
- in 2006/07, demand decreased at Hamilton West and growth at Hamilton Central was less than that seen at other stations on the branch; this may be in part due to abstraction as passengers that previously used these stations switched to use the three new stations at Larkhall, Chatelherault and Merryton (this is supported by the evidence from the User Survey as discussed in Chapter 5);
- the high growth observed in 2008/09 was most likely to be in response to the introduction of more stringent revenue protection regimes by ScotRail on the Glasgow suburban rail network – this increase is therefore not necessarily new demand but instead represents the more accurate recording of existing demand;
- these stations were resilient during the recession period (2009/10 and 2010/11) with continued growth at most stations; this is in contrast to the national trend where rail demand growth was weaker (total ScotRail demand increased 0.7% in 2009/10 and 1.8% in 2010/11²⁸).

9.20. Table 20 shows the demand-weighted average²⁹ actual annual demand growth for the eight Hamilton – Glasgow stations along with the demand-

²⁸ Scottish Transport Statistics No 32 2013 Edition

²⁹ In the weighted average, stations with higher demand contribute more to the average than stations with lower demand

weighted average actual growth for the ten control Cathcart Circle stations and the implied forecast growth taken from the SPT Modelling Report. This is illustrated graphically in Figure 25.

Table 20 Hamilton - Glasgow Stations Actual Demand Growth compared to Forecast Growth and Growth at Control Stations, 2006/07 to 2012/13

Annual Demand Growth	06/07	07/08	08/09	09/10	10/11	11/12	12/13	Total Growth 05/06 – 12/13
Actual – Hamilton – Glasgow stations	6.4%	6.0%	14.0%	1.1%	6.2%	8.6%	5.5%	58.1%
Actual – Cathcart Circle control stations	4.7%	3.8%	5.6%	12.2%	1.6%	8.2%	2.9%	45.5%
SPT Assumed Growth (implied)	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	4.8%

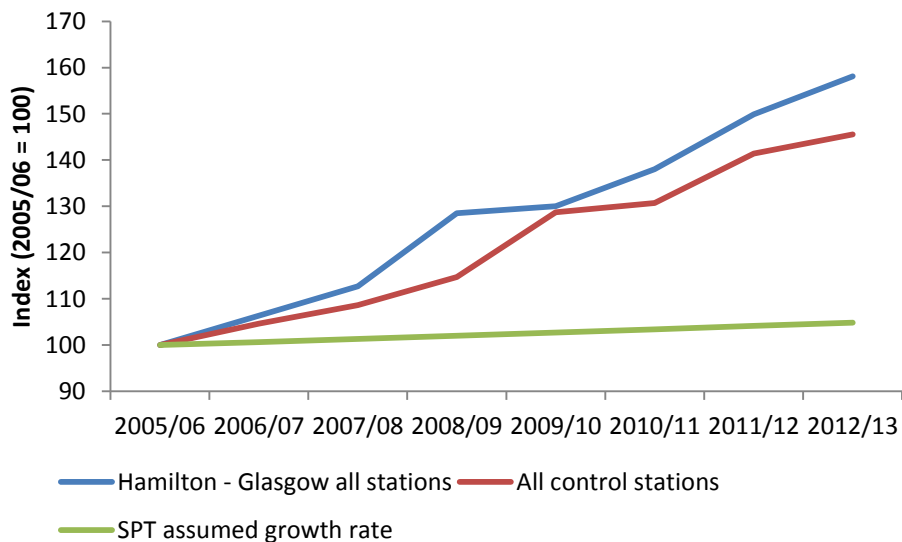


Figure 25 Hamilton – Glasgow Stations Indexed Growth Comparison, 2005/06 to 2012/13

9.21. Figure 25 shows that average growth across the eight Hamilton – Glasgow stations has consistently outperformed that across the ten control Cathcart Circle stations. If it assumed that exogenous growth factors were broadly the same across both areas, then it can be inferred with reasonable confidence that the difference is largely attributable to endogenous factors, including the service frequency improvements.

Milngavie – Glasgow stations

9.22. Table 21 and Table 22 show the actual demand and annual growth rate respectively for the five stations on the Milngavie to Glasgow section of the network and at a total level from 2005/06 to 2012/13. This is illustrated graphically in Figure 26.

9.23. Table 21 and Table 22 show the actual demand and annual growth rate respectively for the five stations on the Milngavie to Glasgow section of the

network and at a total level from 2005/06 to 2012/13. This is illustrated graphically in Figure 26.

Table 21 Milngavie - Glasgow Stations Actual Demand, 2005/06 to 2012/13

Station	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	Total Growth 05/06 – 12/13
Milngavie	717,154	754,346	781,321	845,146	823,618	861,082	905,468	927,382	29.3%
Hillfoot	200,259	218,733	241,921	280,494	278,596	288,000	308,696	318,386	59.0%
Bearsden	378,360	419,891	446,277	497,514	486,600	495,454	534,454	570,742	50.8%
Westerton	597,777	615,382	633,364	689,592	658,378	683,484	735,430	775,164	29.7%
Anniesland	775,049	808,956	848,987	962,696	998,824	1,047,958	1,103,308	1,145,740	47.8%
All stations	2,668,599	2,817,308	2,951,870	3,275,442	3,246,016	3,375,978	3,587,356	3,737,414	40.1%

Table 22 Milngavie - Glasgow Stations Actual Demand Change, 2005/06 to 2012/13

Station	06/07	07/08	08/09	09/10	10/11	11/12	12/13
Milngavie	5.2%	3.6%	8.2%	-2.5%	4.5%	5.2%	2.4%
Hillfoot	9.2%	10.6%	15.9%	-0.7%	3.4%	7.2%	3.1%
Bearsden	11.0%	6.3%	11.5%	-2.2%	1.8%	7.9%	6.8%
Westerton	2.9%	2.9%	8.9%	-4.5%	3.8%	7.6%	5.4%
Anniesland	4.4%	4.9%	13.4%	3.8%	4.9%	5.3%	3.8%
All stations	5.6%	4.8%	11.0%	-0.9%	4.0%	6.3%	4.2%

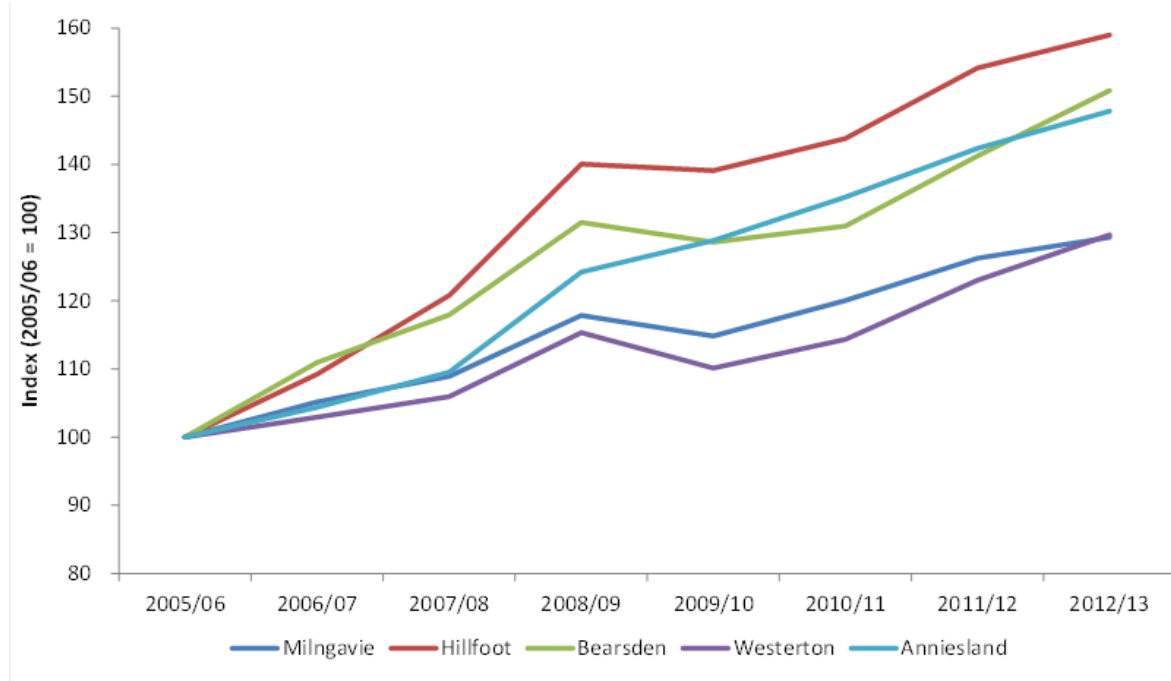


Figure 26 Milngavie – Glasgow Stations Indexed Actual Demand, 2005/06 to 2012/13

9.24. All stations on the Milngavie – Glasgow section exhibited strong growth over the period, averaging at 40% total growth over the seven years (an average growth of 5% per annum). Growth was particularly high at Hillfoot, Bearsden and Anniesland. In particular:

- growth was notably strong at Bearsden and Hillfoot in 2006/07 and 2007/08 perhaps in immediate response to the frequency improvements;
- whilst it would be reasonable to have expected demand at Anniesland fall in 2006/07 due to abstraction at Kelvindale, in fact demand continued to rise in 2006/07 and 2007/08;
- as per stations on the Hamilton – Glasgow section, the high growth observed in 2008/09 was most likely to be in response to the introduction of the more stringent revenue protection regimes introduced by ScotRail and therefore the increase is not necessarily new demand but represents instead the more accurate recording of existing demand;
- with the exception of Anniesland, all stations suffered a drop in demand in 2009/10 which is likely to be due to recession.

9.25. Table 23 shows the demand-weighted average actual annual demand growth for the five Milngavie – Glasgow stations, along with the demand-weighted average actual growth for the ten control Cathcart stations and the implied forecast growth taken from the SPT Modelling Report. This is illustrated graphically in Figure 27.

Table 23 Milngavie – Glasgow Stations Actual Demand Growth compared to Forecast Growth and Growth at Control Stations, 2006/07 to 2012/13

Annual Demand Growth	06/07	07/08	08/09	09/10	10/11	11/12	12/13	Total Growth 05/06 – 12/13
Actual – Milngavie – Glasgow stations	5.6%	4.8%	11.0%	-0.9%	4.0%	6.3%	4.2%	40.1%
Actual – Cathcart control stations	4.7%	3.8%	5.6%	12.2%	1.6%	8.2%	2.9%	45.5%
Forecast (implied)	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	4.8%

9.26. Figure 27 shows that average growth across the five Milngavie – Glasgow stations outperformed that across the ten control Cathcart stations initially from 2006/07 to 2008/09, which was perhaps in response to the service frequency improvements. However, in 2009/10 onwards, average growth across the ten control Cathcart stations then outperforms that across the five Milngavie – Glasgow stations owing to a demand decrease in 2009/10 across the Milngavie – Glasgow stations. This trend is in contrast to the Hamilton – Glasgow stations which did not suffer a downturn in demand during the recession.

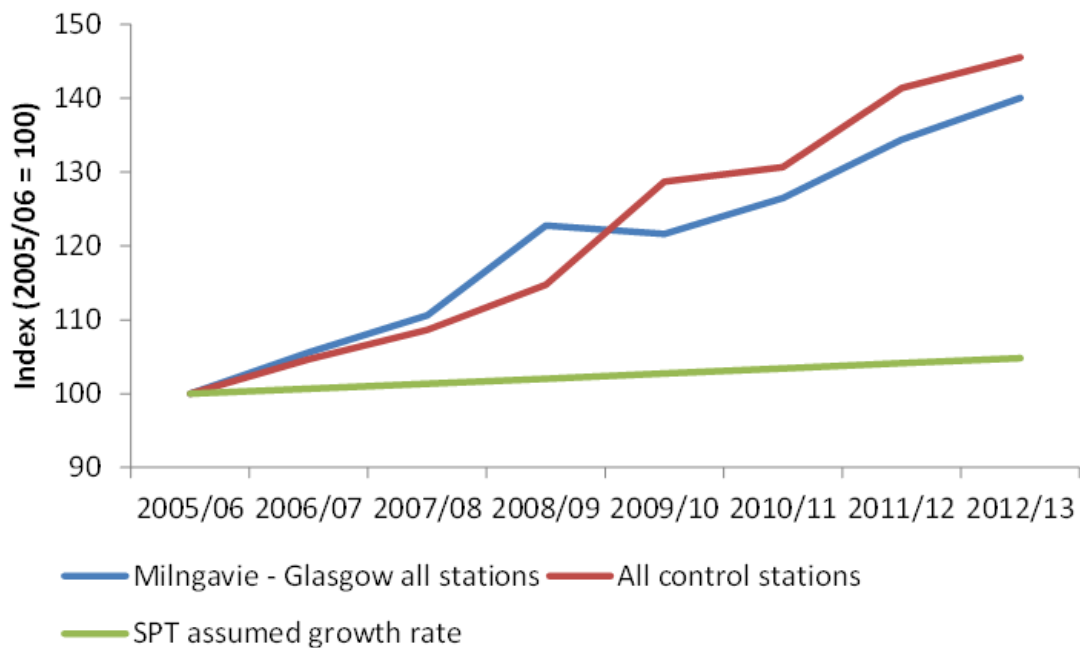


Figure 27 Milngavie – Glasgow stations indexed growth comparison, 2005/06 to 2012/13

Review of Forecasting Methodology

- 9.27. Section 9.13 showed there were some significant differences between the demand forecasts and actual demand for the four new stations.
- 9.28. This section investigates why differences between the forecasts and actual demand may have materialised through a critique of:
- modelling technique;
 - forecasting assumptions; and
 - service specification.

Modelling Technique

i. Choice of Model

- 9.29. Demand forecasts for the Larkhall – Milngavie project were undertaken using SPT’s Strathclyde Integrated Transport Model (SITM), a comprehensive four-stage transport model used for transport planning in conjunction with varying land use or roads and passenger transport network development scenarios.
- 9.30. A full modal split run of the SITM model was carried out for years 2001, 2016 and 2031 for both the base and scenario networks. Travel demand forecasts were prepared to cover a 30 year period from the likely year of opening, as required by the economic assessment and appraisal guidance at the time.
- 9.31. It is noted that the SPT Report did not include any discussion of the justification for adopting the four stage modelling approach, nor whether

alternatives were considered e.g. a direct demand (trip rate) model. However, under Passenger Demand Forecasting Handbook (PDFH) guidance, a four-stage model is considered ideal for considering major rail changes in an urban context. It has the advantage of being able to incorporate complex interactions between different modes within the wider transport network and this is perhaps the reason why a four-stage model was considered most appropriate.

9.32. However, one particular weakness of a four-stage model is if the change in transport provision proposed is small in the context of the overall provision, the model may not be sufficiently sensitive and the zoning may not be fine enough to deal with the impact of a specific station. This may have been the case with the Larkhall – Milngavie project and potentially an alternative modelling approach could have been more appropriate.

ii. Model Zoning

9.33. The zoning structure of the SITM was reviewed to determine whether this was likely to be the reason why the Merryton station demand was over forecast whereas the adjacent station Larkhall was under forecast. As shown in Figure 28, a disaggregated zoning structure was applied with Merryton station in a separate zone from Larkhall station. It is unlikely therefore that the zoning structure is the cause of the difference. Indeed section 6.1.6 of the SPT Modelling Report discusses how the original single zone representing Larkhall was split into four to create a finer zone structure to allow the three new stations to be modelled more accurately.

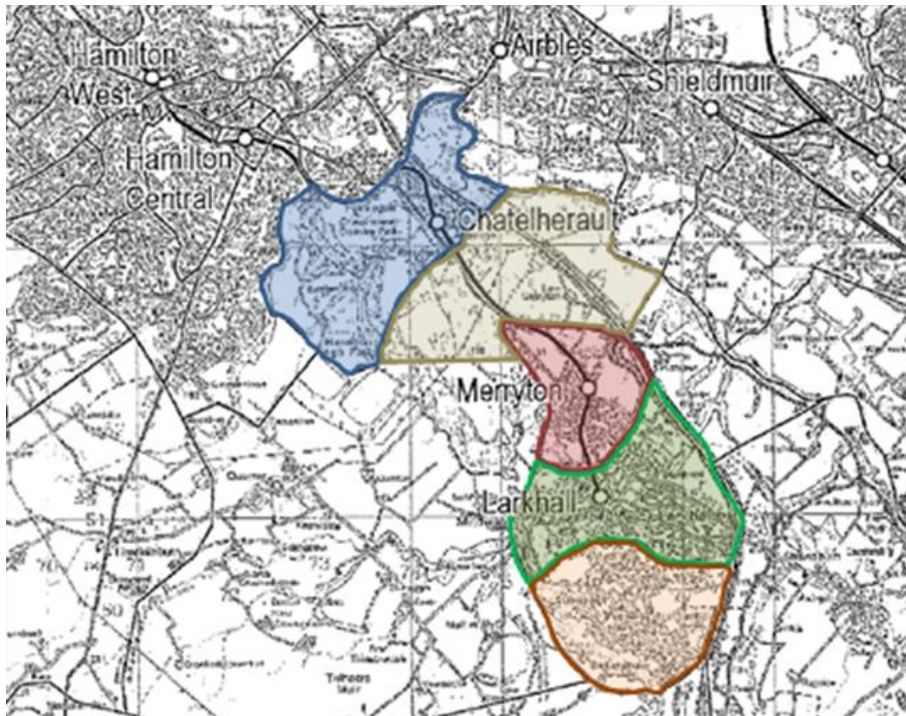


Figure 28 STIM Model Zoning – Larkhall

iii. Demand Abstraction

- 9.34. Demand for new stations is typically from three sources: generated demand (i.e. the trip would not previously have been made); mode switching (i.e. the trip would have been previously made by another mode such as car or bus); and abstraction of demand from existing stations (i.e. the trip would have been previously made from an existing station).
- 9.35. Abstraction of demand from existing stations is a key consideration when considering demand at new stations, particularly when the new stations are within the vicinity of existing stations as was the case for all four new stations on the Larkhall – Milngavie line³⁰. However, whilst the SPT Modelling Report explicitly documented the extent of mode switching as a source of new station demand, there was no reference to demand abstraction from existing stations so it is not clear whether this was considered or not.
- 9.36. If demand abstraction from existing stations was not explicitly considered, then this may be one reason why the forecasts at the four new stations were typically lower than actual demand.

Forecasting Assumptions

i. Exogenous Growth

- 9.37. Little information was provided in the SPT Modelling Report regarding the key exogenous growth assumptions applied (i.e. factors that cannot be controlled by the train operator such as population and employment growth) other than:
- planning data was sourced from the Central Scotland Transport Model³¹; and
 - the economic growth rate selected was the mid-point of the Government's low and high forecasts.
- 9.38. However, as discussed in section 9.6, the implied forecast average annual growth rate between 2001 and 2016 is 0.7% which can presumably be attributed wholly to exogenous growth drivers (assuming that other endogenous drivers such as timetable changes, marketing and fares initiatives are small enough to be ignored).
- 9.39. To verify this implied exogenous growth rate, key actual economic drivers over the period 2001 to 2013 were obtained specifically for the Glasgow area (Table 24).

Table 24 Glasgow region growth drivers, 2001 – 2013 Source: Experian

Exogenous Driver	Total Growth 2001 to 2013	Average Annual Growth Rate
GVA per capita	41.4%	2.9%
Full Time Employment	4.8%	0.4%
Population	4.4%	0.4%

³⁰ Assessing the Potential Performance of New Local Railway Stations, University of Southampton – 2009

³¹ this was an older version of the Central Scotland Transport Model (CSTM12) in current use

9.40. These growth drivers have been applied to the STP Modelling Report 2001 demand forecasts (as per Table 12) in line with PDFH methodology to grow demand from 2001 to 2012/13:

- commuting demand is grown in line with the total full-time employment growth i.e. 4.8% with an elasticity³² of 1.3³³;
- other demand (business and leisure) is grown in line with total GVA per capita growth (i.e. 41.4%) with an elasticity of 1.2³⁴ and total population growth (i.e. 4.4%) with an elasticity of 1.0³⁵; and
- commuting and other demand are weighted 59:41 as per Scotland's average journey purpose split³⁶.

9.41. Under this growth scenario, the 2012/13 forecast demand would compare to actual as shown in Table 25. For Larkhall, Chatelherault and Kelvindale, the forecasts are now closer to the actual demand and at a total level, the actual is only 6% higher than forecast. The overestimate of demand at Merryton is however even more pronounced.

Table 25 2012/13 Forecast and Actual Demand – Alternative Exogenous Growth Scenario

Station	2012/13 Forecast (Alternative Exogenous Growth Scenario)	2012/13 Actual	Difference
Larkhall	268,518	342,700	27.6%
Merryton	208,607	113,100	-45.8%
Chatelherault	46,918	62,500	33.2%
Kelvindale	54,137	96,500	78.3%
All stations	578,180	614,800	6.3%

9.42. This high-level analysis indicates that the actual exogenous drivers have outperformed the exogenous forecasts applied in the SITM and may be one of the reasons why the actual total demand is typically higher (although it is noted that the actual exogenous drivers applied for this evaluation were at the Glasgow level whereas in the SITM they were at the local i.e. SITM zone level and therefore not necessarily the same). Indeed, this is referenced in 'Station Usage and Demand Forecasts for Newly Opened Railway Lines and Stations' report³⁷; in the absence of explicit exogenous growth factors in the SPT Modelling Report, a 4% per annum growth rate was assumed in the Station Usage report.

9.43. Further evidence that exogenous drivers may have been higher than forecast is provided by comparison of land-use supply in the Larkhall area between

³² in this context elasticity refers to how responsive rail demand is to change in exogenous drivers such as employment and population e.g. an employment elasticity of 1.3 means that if employment increases by 1%, rail demand will increase by 1.3%

³³ PDFH employment elasticity for Non-London to/from core cities (Glasgow is defined as core city)

³⁴ PDFH GDP per capita elasticity for Non-London to/from core cities

³⁵ PDFH population elasticity for Non-London to/from core cities

³⁶ National Rail Travel Survey – Overview Report, December 2010

³⁷ Station Usage and Demand Forecasts for Newly Opened Railway Lines and Stations – Steer Davies Gleave, August 2010

2005 and 2013 which shows a large amount of land being released for industrial and housing development since the new stations have opened (Figure 29). As a result, population and employment growth may have been higher than the year 2000 forecasts and the catchment areas of the stations may now be larger than originally expected. However, whereas this may explain the higher than forecast growth at Larkhall and Chatelherault stations, it makes the overestimate of demand at Merryton even more surprising given a lot of the new developments appear to be within the vicinity of this station.

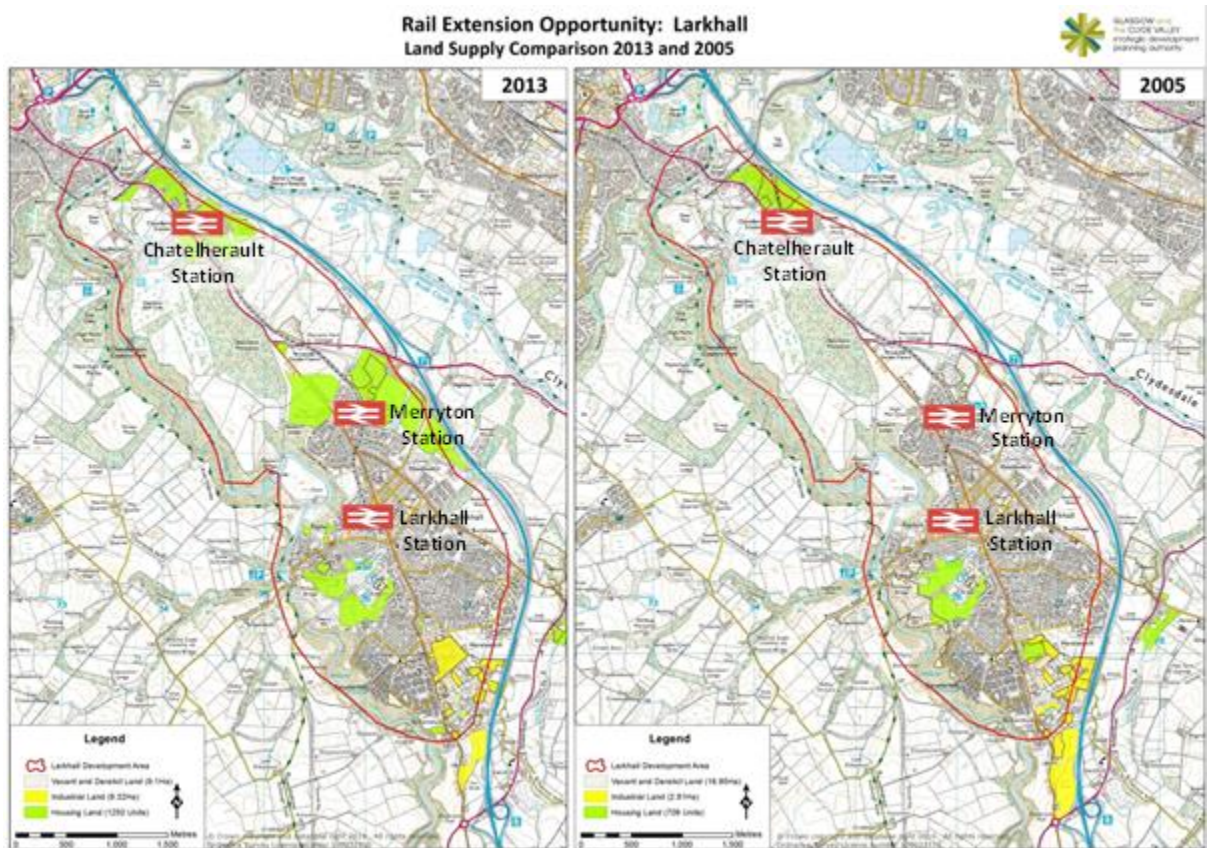


Figure 29 Larkhall Land Use Supply Comparison, 2013 and 2005

9.44. One of the reasons for the over forecast of demand at Merryton may be due to the station's location. It is not on the main Larkhall to Hamilton main road (A72) so it may actually it is quicker for some Merryton residents to drive to Chatelherault station which is directly off the main road and which has the advantage of a larger car park and is in a cheaper fare zone³⁸. A further reason could be that whilst there has been new housing development in Merryton, the level is still lower than what was predicted in 2000, perhaps as a result of the recession.

ii. Park and Ride Schemes

9.45. Three out of the four new stations have Park and Ride facilities:

- Chatelherault – 100 spaces;

³⁸ An off-peak return to Glasgow Central is currently £5.50 from Merryton and £4.80 from Chatelherault

- Merryton – 80 spaces; and
 - Larkhall – 200 spaces.
- 9.46. Park and Ride facilities are designed to provide easy access to city centres; people tend to make the majority of their journey by car before transferring to rail to avoid inner-city congestion and parking charges. They are therefore attractive to those living further away as well as local residents and, as a result, increase the catchment area of the station.
- 9.47. There was no evidence in the SPT Modelling Report that Park and Ride was part of the scheme specification during the appraisal process and consequently that the potential demand impacts of Park and Ride provision were factored into the assessment. Demand may have been underestimated at these stations during the appraisal which could explain the underestimate at Larkhall and Chatelherault but not the overestimate at Merryton.
- 9.48. However, research³⁹ suggests that, except in specific circumstances, there is no conclusive link between car parking provision and rail demand (as people generally switch from on-street parking). Any additional demand generated by the Park and Ride facilities may well therefore have been relatively small.

iii. Annualisation Factors

- 9.49. The SITM provided station demand on a daily basis. This was converted into annual demand by applying an annualisation factor.
- 9.50. The SPT Modelling Report did not detail the annualisation factors which were used in the demand forecasting. However, as per section 9.5, an annualisation factor of 283 is implied.
- 9.51. As set out in the Department for Transport's Transport Users Benefit Appraisal (TUBA)⁴⁰, recommended annualisation factors for Commute/Business and Leisure are 253 and 353. Weighting these factors as per the Scotland average journey purpose³⁶ (70% Commute/Business and 30% Leisure) would result in an annualisation factor of 283 which is identical to that used in the SITM. The annualisation factor applied is therefore unlikely to be a key reason why there is a difference between the forecast and actual demand.

iv. Demand Ramp-up

- 9.52. Under PDFH guidance, it is standard practice to apply demand ramp-up factors to reflect that improvements take time to occur and for passengers to be aware of the service changes. For example, PDFH suggests a 70% factor be applied to the full single year demand estimate in year 1, 85% in year 2 and 95% in year 3 with all lags complete i.e. 100% of demand evident by the end of year 4.

³⁹ <http://www.transportscotland.gov.uk/research/j253322-00.htm>

⁴⁰ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/319119/tuba-user-manual.pdf

9.53. It would have been appropriate to apply such factors to the demand forecasts prepared for the four new stations. However, it is not clear from the SPT Modelling Report whether this was done or not.

Service Specification

9.54. The forecasting in the appraisal made a number of assumptions about the service specifications which would be implemented when the scheme was constructed. These are defined in the SPT Modelling Report as:

- introduction of a half-hourly passenger service between Milngavie and Larkhall;
- extension of the Northern Suburban line to Anniesland to allow a full Northern service timetable to be introduced;
- removal of operational restrictions at Westerton to enable a 15 minute service frequency to be operated on the Milngavie section;
- improvement from 6 trains per hour to 8 trains per hour at Westerton and Anniesland, due in part to the extension of the Northern Suburban to Anniesland and the removal of operational restrictions mentioned above;
- an increase in frequency from 10 trains to 12 trains an hour between Hyndland and Partick;
- an increase in frequency from 4 trains to 6 trains an hour between Rutherglen and Partick on the Argyle Line in the off-peak; and
- a 15 minute service frequency at Blantyre and both Hamilton stations.

9.55. Comparison of this planned service specification and the actual service specification implemented shows that they are closely matched suggesting that there is little, if any, variation between what was forecast in 2000 and what materialised in reality. There have also been no significant changes to this service pattern since 2005. Therefore, variations in the service specification are unlikely to have been responsible for the differences between the forecast and actual demand.

Conclusions

9.56. It is difficult to single out any one key reason why there are differences between the forecast and actual demand for the four new stations. This is further complicated by the lack of documentation in the SPT Modelling Report to verify key modelling assumptions or to determine whether impacts such as demand abstraction and demand build-up factors were applied.

9.57. Exogenous factors however are the dominant drivers of rail demand and evidence suggests that actual economic and population growth have been higher than what was forecast in 2000, particularly in the strong period of growth between 2000 and 2007 before the recession. This difference is therefore likely to be one of the most important reasons why actual demand has been higher than forecast at three of the four stations.

9.58. Other more minor reasons for the difference may include not accounting for:

- Park and Ride facilities; and

- demand abstraction from existing stations.

It should also be noted that there is no 'right' way of modelling demand at new stations, and that every new station will have its own unique set of circumstances that may lend itself to a particular modelling approach or set of assumptions. Furthermore, influences on long-term rail demand are multi-faceted, including potentially volatile drivers such as economic growth. This makes it almost impossible to achieve an exact match between forecast and actual station demand.

10. RE-CALCULATION OF THE BENEFIT-COST RATIO

Overview

- 10.1. Cost-benefit analysis undertaken at the economic appraisal stage of the Larkhall-Milngavie rail project in 2000 indicated a BCR of 0.66 for the project. The majority of the benefits were expected to come from journey time savings for existing and new public transport users.
- 10.2. However, it was expected that the project would bring other benefits that could not be easily monetised and captured within the formal cost-benefit appraisal including:
 - assisting economic development and encouraging local investment;
 - increasing social mobility;
 - creating further opportunities for further public transport orientated land-use development; and
 - reducing the local environmental impact.
- 10.3. These non-quantifiable benefits were considered by the main project sponsor, SPT, to be more than sufficient to offset the predicted deficit in the monetised appraisal.
- 10.4. Since the original economic appraisal of the Larkhall – Milngavie project, there have been methodological developments to economic appraisal (e.g. extension of the appraisal period from 30 to 60 years and changes to the discount rate applied to future year costs and benefits). Additionally, as the project was completed in 2005, outturn values to replace some of the forecast values are now available, as well as evidence to inform certain elements of the appraisal (e.g. the level of abstraction from car).
- 10.5. The economic appraisal was therefore repeated to provide a quantitative breakdown of the benefits and costs associated with the Larkhall – Milngavie project and allow the BCR to be recalculated to determine whether the project has offered value for money.
- 10.6. The recalculation of the BCR also provides an important insight and ‘lessons learned’ for future transport appraisals and will inform the recommendations for the Rail Evaluation Guidance.

Economic Appraisal

- 10.7. An economic appraisal assesses the cost of the scheme against the resulting benefits to determine whether the project offers value for money.
- 10.8. Comparing the total cost against the total benefits is not sufficient since costs tend to ‘front loaded’ towards the construction phase of the project, whereas the benefits will accrue over the full appraisal period.

10.9. The basis of the economic appraisal process is to assess the long term worth of a scheme. Costs and benefits are expressed in monetary terms, and are adjusted for the time value of money, so that all flows of benefits and project costs over time are expressed in a common basis in terms of their Net Present Value (NPV).

Impacts on Wider Society – Present Value of Benefits

10.10. The project’s Present Value of Benefits (PVB) is the net value of benefits and dis-benefits that impact wider society. These include: increase in public transport revenue through generation of rail demand; user and non-user benefits such as travel time savings and reduced road congestion; and impacts on wider government finances such as indirect tax.

10.11. The benefits associated with the project are discussed in more detail below.

Impacts on Government – Present Value of Costs

10.12. The project’s Present Value of Costs (PVC) is the cost of the scheme to government. The PVC includes only the costs that specifically to fund the project. These costs include: capital costs; maintenance costs; operational costs; and renewal costs.

10.13. The costs associated with the project are discussed in more detail below.

Benefit Cost Ratio

10.14. The BCR is given by the ratio PVB/PVC. This indicates how much benefit is given per unit of cost and is used to inform value for money assessment of transport schemes. A BCR greater than 1 indicates that the benefits outweigh the costs.

Economic Appraisal Methodology

i. Appraisal Assumptions

10.15. The economic appraisal was conducted by applying the assumptions shown in Table 26 in line with STAG.

Table 26 Economic Appraisal Assumptions

Appraisal Principle	Assumption
Appraisal period	60 years As the project was completed in December 2005, the appraisal period runs from 2006 (first full year of opening) to 2065.
Price base year	2010 All revenues streams converted to 2010 prices using the Treasury’s GDP deflator
Discount rate	All revenues discounted to 2010 base year: 3.5% for first 30 years 3.0% thereafter
Demand cap	Demand is capped at 2032 levels No rail demand growth from 2033 onwards.

10.16. In the original appraisal conducted in 2000, different assumptions were applied:

- the appraisal period was 30 years;
- the price base year was 1994; and
- a 6% per annum discount rate was applied.

10.17. However, it was preferable to recalculate the BCR using current STAG guidance, to eliminate the methodological discrepancy between the two BCR estimates and to facilitate comparison of the Larkhall – Milngavie project with recent/future appraisals of other transport schemes.

ii. Do-Something and Do-Minimum

10.18. To isolate the incremental benefit of the Larkhall-Milngavie rail project, it was necessary to forecast two scenarios, one with the project, the ‘Do-Something’ (DS), and one without, the ‘Do-Minimum’ (DM).

10.19. In the DM, it was assumed the project was not implemented (i.e. no new stations, and no change in service frequency).

10.20. The benefit applied in the BCR calculation was then the incremental benefit of the DS against the DM (i.e. DS – DM).

iii. Evaluation Scope

10.21. A proportionate, high-level approach was taken throughout the evaluation, with focus on the main benefits and costs and retaining consistency with the original appraisal where possible.

10.22. The evaluation covered all stations on the Larkhall to Milngavie (Table 27) with the exception of the central Glasgow stations (Partick, Exhibition Centre, Glasgow Central, Glasgow Queen Street and Argyle Street). They were excluded as the frequency improvements at these stations were relatively minor. Furthermore, it would have been difficult to isolate the impact of the Larkhall – Milngavie project due to other network improvements implemented during the relevant period (e.g. the Airdrie to Bathgate link which will also have influenced demand at some of the central Glasgow stations).

Table 27 Stations Included in Evaluation

Larkhall – Milngavie Line Stations	
Included in evaluation	Milngavie, Hillfoot, Bearsden, Westerton, Anniesland, Kelvindale, Hyndland, Bridgeton, Dalmarnock, Rutherglen, Cambuslang, Newton, Blantyre, Hamilton West, Hamilton Central, Chatelherault, Merryton, Larkhall

Project Benefits

10.23. The main project benefits and dis-benefits are:

- change in public transport revenue (rail, bus);

- rail user (both existing and new) benefits, predominantly journey time savings;
- non-user benefits due to fewer car trips (e.g. external costs of car use such as decongestion);
- lower indirect tax revenue as increased spending on rail means less spending elsewhere.

10.24. Each of these are discussed below including, where applicable, the STAG guidance applied to monetise each one.

Public Transport Revenue

10.25. The rail improvements delivered by the scheme (either new stations or service frequency improvements) have generated additional rail demand and therefore additional rail revenue.

10.26. However, evidence from the User Survey (see Chapter 5) suggests part of this additional demand has been abstracted from bus. Therefore, there will have been a fall in bus demand and revenue resulting from the project which will have offset the increase in rail revenue.

10.27. To determine the incremental rail revenue generated by the project, the DS and DM revenue streams were calculated as documented in Table 51 in Appendix C.

10.28. The DM and DS rail demand over the 60 year appraisal period is shown in Figure 30.

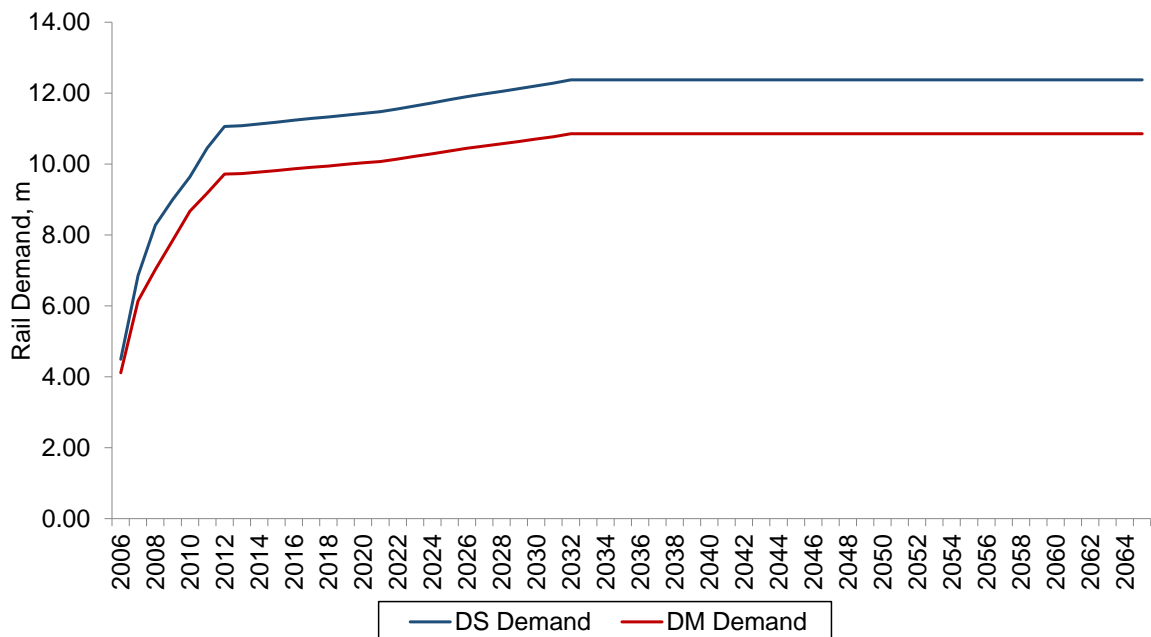


Figure 30 DS and DM Rail Demand, 2006 – 2065

10.29. The total 60 year rail revenue (in 2010 prices and values) in the DS is £516.5m and in the DM £446.6m. The total incremental rail revenue (DS – DM) is therefore £69.8m.

10.30. The small level of abstraction from bus to rail (based on the User Survey results) will reduce bus revenue by £2.5m over 60 years (in 2010 prices and values). Levels of abstraction from bus were determined from the User Survey and an average fare of £1.50 (2014 prices) was applied.

10.31. The incremental public transport revenue impact due to the Larkhall – Milngavie project over 60 years (in 2010 prices, discounted) is therefore £67.4m, as shown in Table 28.

Table 28 Present Value Public Transport Revenue Impact

Revenue	Value £m
Rail	69.8
Bus	-2.5
Total	67.4

Values are 60 year totals discounted to 2010 prices and values

User Benefits

i. Journey Time Savings

10.32. The Larkhall – Milngavie project has delivered significant time saving benefits for existing and new rail users.

10.33. For existing rail users:

- station waiting times have been reduced at stations where service frequencies have improved; and
- station access/egress times have been reduced for rail users that now use the new stations but previously had to travel further to reach existing stations.

10.34. The rail improvements have also improved the convenience of journey-making and/or reduced journey times and therefore generated new rail users who either previously had longer bus-based journeys or who previously did not make the relevant trips at all.

10.35. New users derive half of the time saving benefit ('Rule of a Half'⁴¹) compared to existing users, in line with transport economic theory.

10.36. The calculation of the value of the journey time savings is documented in Table 52 in Appendix C. The time saving benefits were monetised using Values of Time (VoT) as shown in Table 29.

⁴¹ Economic theory suggests that when users change their travel in response to a change in cost (from C_0 to C_1), the benefit derived (or net consumer surplus) averages half the change in cost (the 'rule of a half'). This is because some users will shift with only the smallest change in cost (so small the cost can still be assumed to be C_0) whereas others will only shift when the cost is C_1 . The average benefit across all users is therefore $\frac{1}{2} \times (C_1 - C_0)$.

Table 29 Values of Time by Journey Purpose

Journey Purpose	Value of Time (£ per hour, 2010 prices)
Commute	6.81
Business	26.86
Leisure	6.04

Source: STAG

10.37. The value of the journey time savings over 60 years (in 2010 prices and values) is £390.4m as shown in Table 30.

Table 30 Present Value of Journey Time Savings

Journey Time Savings	Value £m
Existing User	361.2
New User	
Abstracted from bus	11.8
Previously did not travel	17.4
Total	390.4

Values are 60 year totals discounted to 2010 prices and values

ii. Crowding and other Benefits

10.38. Other potential user benefits such as crowding relief were not considered. Whilst there may be some localised crowding on peak services to Glasgow, the impact on crowding of the Larkhall – Milngavie project is likely to have been minimal and was therefore not included in either the original appraisal or that being reported here.

Indirect Tax Revenue

10.39. Schemes such as the Larkhall – Milngavie that generate rail demand shifts consumer consumption from alternative goods and services to rail. This impacts indirect taxation revenues because:

- diesel rail fuel duties are considerably lower than road fuel duties and many trains now run on electricity; and
- rail fares are zero-rated for VAT.

10.40. STAG guidance was applied to calculate the indirect tax impacts due to the generation of rail demand resulting from the Larkhall – Milngavie project. This involved calculating the difference between the DS and DM rail revenue (as per Table 51) and applying the indirect tax rate of 19%.

10.41. The value of the indirect tax impacts over the 60 year appraisal period (in 2010 prices, discounted) is -£13.9m as shown in Table 31.

Table 31 Present Value Indirect Tax Impacts

Indirect Tax impacts	Value £m
Commuting	-11.1
Business	0.0
Leisure	-2.8
Total	-13.9

Values are 60 year totals discounted to 2010 prices and values

Non-User Benefits

10.42. User Survey evidence indicated that there has been a mode switch from car to rail as a result of the Larkhall – Milngavie project which will have led to a (slight) reduction in traffic congestion and other traffic-related non-user benefits. At the *appraisal* stage, it is typical to monetise these non-user benefits (i.e. benefits to travellers who are not the primary users of the enhanced rail services).

10.43. Given the Larkhall – Milngavie project is now at the *evaluation* stage, it was decided not to include these non-user benefits in the core BCR calculation as the assumptions applied would be appraisal-based. However, to retain consistency with the appraisal BCR, the non-user benefits were still calculated and in the BCR calculation presented below, as well as the core BCR (i.e. excluding non-user benefits), the calculation is repeated but including non-user benefits.

10.44. The primary method for estimating non-user benefits is based on Marginal External Costs (MECs). The use of road vehicles incurs both private costs borne by the individual traveller (i.e. fuel costs, travel time and external costs borne by other). For cars, these external costs include congestion, air pollution, noise, infrastructure and accident costs.

10.45. A mode shift to rail therefore brings the following benefits:

- congestion relief due to fewer cars on the road;
- infrastructure relief as fewer cars means less requirements for road works;
- accident relief due to fewer cars on the road;
- air quality improvement as per person transported, emissions from rail are lower than from car;
- noise reduction as per person transported, noise from rail is lower than from car; and
- greenhouse gas reduction, since the per-passenger-kilometre emissions from travel rail are lower than from car.

10.46. However, there is also a dis-benefit to government as fewer car trips results in lower spending on car fuel and so the government collects less indirect tax.

10.47. STAG guidance was applied to calculate the change in these external costs arising from the reduction in car trips resulting from the Larkhall – Milngavie rail project, as documented in Table 53 in Appendix C.

10.48. The value of these benefits over the 60 year appraisal period (in 2010 prices and values) is £11.8m as shown in Table 32.

Table 32 Present Value Marginal External Costs

Marginal External Costs	Value £m
Congestion	13.4
Infrastructure	0.2
Accident	2.5
Local Air Quality	0.0
Noise	0.2
Greenhouse Gases	1.2
Indirect Tax	-5.7
Total	11.8

Values are 60 year totals discounted to 2010 prices and values

User Charges

10.49. There may have been some change in rail user charges as some passengers may now be paying higher fares such as those who previously boarded trains at Hamilton Central but can now board at Larkhall (which is in a higher-fare zone).

10.50. However, this impact is likely to have been small⁴² and any increase in fare has likely been offset by a reduction in access time and costs.

10.51. This impact is therefore not included in the calculation of the PVB.

Wider Economic Benefits

10.52. The original appraisal anticipated that the project would bring other benefits that could not be easily monetised such as Wider Economic Benefits (WEBs).

10.53. This impact was assessed in Chapter 8 and concluded that whilst there is some evidence of small-scale localised impacts, in general the WEBs generated by the Larkhall-Milngavie rail project have been limited.

10.54. WEBs are therefore not included in the recalculation of the PVB being reported here.

PVB Summary

10.55. The total PVB over 60 years is £443.9m as shown in Table 33.

⁴² For example an off-peak return from Larkhall to Glasgow Central is £1.20 more than that from Hamilton Central

Table 33 Present Value of Benefits

Benefit	Value £m
Public Transport Revenue	67.4
User Benefits	390.4
Indirect Tax Impacts	-13.9
Total	443.9

Values are 60 year totals discounted to 2010 prices and values

10.56. If the marginal external costs (£11.8m) are included, then the PVB increases to £455.6m.

Project Costs

10.57. The costs of the Larkhall – Milngavie rail project can be broken down as follows:

- capital costs;
- operational costs;
- maintenance costs; and
- renewal costs.

Capital Costs

10.58. The project capital cost covered the construction costs of building the new track and stations. The total outturn capital cost was £34.5m, with funding as shown in Table 34.

Table 34 Outturn Capital Cost Funding Contributions

Source	Value £m
Scottish Government	25.0
Strathclyde Passenger Transport	9.1
South Lanarkshire Council	0.4
Total	34.5

Source: Transport Scotland

10.59. For the purpose of this exercise, it was assumed that the capital cost was spread equally over the two years of construction, 2004 and 2005.

Operational Costs

10.60. The operational costs associated with the project include the cost for leasing extra trains, staff and fuel costs, and track and station access charges.

10.61. The operational costs were agreed by Transport Scotland under the franchise agreement with First ScotRail awarded in 2004. As part of their bid, operational costs were proposed for the project under a priced option. These are broken down between variable operational costs (Table 35) and track and station access charges (Table 36) for the life of the 10 year franchise.

10.62. It was assumed that these are the outturn costs (although they were 2004 forecasts). The 2014/15 values were assumed to apply each year until the end of the appraisal period with no real increases applied.

Table 35 Outturn Variable Operational Costs, 2005/06 – 2014/15

Variable Operational Costs (£)	2005/06	2006/07	2007/08	2008/09	2009/10
	655,583	1,920,582	2,115,003	2,146,569	2,169,777
	2010/11	2011/12	2012/13	2013/14	2014/15
	2,199,390	2,217,414	2,291,701	2,266,726	2,298,030

Source: ScotRail Franchise Agreement, Section 3

Table 36 Outturn Track and Station Access Costs, 2005/06 – 2014/15

Track Station Access Costs (£)	2005/06	2006/07	2007/08	2008/09	2009/10
	127,420	739,043	1,121,289	1,117,013	1,144,709
	2010/11	2011/12	2012/13	2013/14	2014/15
	1,135,770	1,127,336	1,185,381	1,118,420	1,105,008

Source: ScotRail Franchise Agreement, Section 3

Maintenance Costs

10.63. Maintenance costs of the new assets were covered by SPT until added to the railway Regulatory Asset Base⁴³ at the start of Control Period 4 in April 2009 (Table 37). The cost is a fixed cost charged by Network Rail under terms agreed by the Rail Regulator.

Table 37 Maintenance Costs, 2005/06 – 2008/09

Maintenance costs (£)	2005/06	2006/07	2007/08	2008/09
	85	214	229	245

Source: Transport Scotland

10.64. From 2009/10 onwards, any maintenance costs are covered by the Regulatory Asset Base and so it was not possible to extract the precise maintenance cost attributable to the Larkhall – Milngavie rail project. The 2008/09 maintenance cost (£245k) were therefore assumed to continue to apply each year until the end of the appraisal period with no real increases or decreases applied.

Renewal Costs

10.65. It was assumed that renewals to the new stations and tracks will be undertaken to continue to provide an acceptable environment for rail passengers and to ensure public safety.

10.66. These costs were assumed to be 10% of the capital cost, spent every 10 years, with the first renewal due in 2016.

⁴³ Regulatory Asset Base (RAB) is the value of a privatised asset equal to what investors paid when the assets were originally privatised plus any subsequent capital expenditure adjusted for depreciation.

PVC Summary

10.67. The total PVC over 60 years is £160.4m as shown in Table 38.

Table 38 Present Value of Costs

Cost	Value £m
Capital Costs	39.9
Operational Costs	104.6
Maintenance Costs	7.5
Renewal Costs	8.4
Total	160.4

Values are 60 year totals discounted to 2010 prices and values

Calculation of Benefit Cost Ratio

BCR Analysis

10.68. Table 39 shows the PVB, PVC, NPV (calculated as PVB – PVC) and BCR (PVB/PVC) as recalculated on the basis of the analysis described above.

Table 39 Benefit Cost Ratio

Item	Value
PVB (£m)	443.9
PVC (£m)	160.4
NPV (£m)	283.5
BCR	2.77

PVB, PVC and NPV are 60 year totals discounted to 2010 prices and values

10.69. The BCR is therefore recalculated as 2.77. If the PVB includes marginal external costs (£11.8m), then the BCR increases to 2.84.

10.70. With a BCR greater than 1, this indicates the benefits outweigh the costs.

Comparison against Original BCR

10.71. The original project BCR calculated at the appraisal stage was 0.66. The recalculated BCR therefore represents a significant improvement over the original BCR.

10.72. However, as discussed in section 10.16, due to changes in appraisal methodology, a direct like-for-like comparison is not possible.

10.73. To overcome this, two sensitivity tests have been run as shown in Table 40:

- as per current STAG guidance but assuming a 30 year appraisal period;
- as per current STAG guidance but assuming a 30 year appraisal period, a 1994 price base year and a discount rate of 6%.

10.74. Note however that even when implementing the above, inconsistencies remain between the two appraisal methodologies (e.g. appraisal values such as values of time which will have been updated since 2000 as a result of new research).

Table 40 Benefit Cost Ratio Sensitivity Tests

Sensitivity Test	Assumption	BCR
1	30 year appraisal period; 2010 price base year; 3.5%/3.0% discount rate	2.35
2	As per Test 1 but with 1994 price base year and 6% discount rate	1.83

10.75. The sensitivity tests show that, even with a shorter appraisal period and higher discounting of future year benefits, the project's benefits still outweigh its costs.

It can therefore be concluded that the outturn benefit cost ratio of the Larkhall – Milngavie rail project is significantly higher than that reported in the original appraisal and indicates that the project's benefits outweigh the costs.

11. RECOMMENDATIONS FOR RAIL EVALUATION

Overview

- 11.1. This chapter sets out the recommendations to be considered for inclusion in Transport Scotland's Rail Evaluation Guidance. The basis for these recommendations has been primarily SYSTRA's experience in conducting this evaluation study and in particular the challenges experienced undertaking the different aspects of the study including the Outcome and Process Evaluations, conducting surveys and reviewing passenger forecasts.
- 11.2. A number of the recommendations are already included in the current draft guidance but are repeated here, either to highlight their importance or to refine the relevant guidance text. Others are potential new guidance which are not covered in the current version of the draft guidance.

Recommendations

Project Objectives

- 11.3. The current draft guidance states that projects should be assessed against their original objectives and against the five STAG criteria. One of the issues with the Larkhall – Milngavie evaluation was that only general project objectives were set (e.g. 'to offer social inclusion benefits for residents'). In the absence of quantitative or measurable objectives, it was difficult to assess the extent to which each objective had been met.
- 11.4. It is therefore recommended that 'SMART' project objectives are established prior to the initial appraisal and that these objectives are then used in the subsequent evaluation:
- **Specific** – objective should specify exactly what the project will achieve in unambiguous terms;
 - **Measurable** – objective should be quantitative and measurable, against which the project can be evaluated in the future;
 - **Achievable** – objective should have a realistic chance of success;
 - **Realistic** – objective should have a clear purpose and benefit;
 - **Time-bound** – objective should specify the timescales for accomplishment.
- 11.5. Objective-setting should involve all project stakeholders' agreement. Consideration must also be given to the information and data that will be required to effectively measure the project against each objective. This should include details of the method and frequency of the data collection.
- 11.6. Establishing achievable 'SMART' objectives is a fine balance. Whilst objectives should be challenging and stimulating, they should also be realistic and take into account forecasting uncertainties. Failure to meet objectives by a large margin could potentially be politically embarrassing and damage public confidence in future transport projects.

Control Groups

- 11.7. Due to the wide geographical coverage of the Larkhall – Milngavie rail project it was difficult to establish a reliable control group that was close enough to the project area to have been subject to the same economic conditions but not affected by the project's impacts.
- 11.8. The project control group should be identified at the project outset and measures put in place so that any data collection is carried out in the control group area, as well as the main project area, to allow a subsequent comparison between the two.

Baseline

- 11.9. As noted in the draft guidance, establishing the baseline is essential to be able to understand the behaviour of users before the project intervention.
- 11.10. A challenge for the Larkhall – Milngavie Outcome Evaluation was that no baseline was established. The User Survey tried to recreate the baseline by asking respondents what they would do if there was no station or if the rail frequency was reduced. However, how passengers would travel in the future is not necessarily the same as how they used to travel before the project was completed and so approach may not reproduce the 'Before' behaviour accurately.
- 11.11. It is recommended that the baseline is established at the initial appraisal stage, for example through surveys of the users of existing stations within the study area and non-users who currently use other modes. Users and non-users could be asked about their current travel patterns and how they are likely to react to the improvements, in particular whether they would switch to rail.
- 11.12. The data from these surveys would give a better understanding of likely demand abstraction and mode shifting that can be modelled and lead to more accurate and more evidence-based demand forecasts.

Secondary Data

- 11.13. The draft guidance highlights the importance of secondary data sources that could be used to inform evaluations of rail projects.
- 11.14. It is recommended that these data sources, the frequency of collection and the stakeholder responsible for collection and analysis are identified at the project outset or as part of the STAG appraisal process. How this data will be used to inform whether a particular objective is being met should also be clearly established.
- 11.15. For certain localised impacts (e.g. the opening of a new station), data on socio-economic indicators such as population and employment may not be at a sufficiently disaggregate level to accurately assess the impact of the project. In such instances, alternative data sources should be considered and a process established to gather it.

Primary Data

i. Survey Method

- 11.16. On-board and at station surveys are referred to in the draft guidance. Whilst these are an effective technique for collecting information, they can be time-consuming and expensive.
- 11.17. An alternative is the use of online surveys, as demonstrated with the User Survey undertaken for this evaluation study. These can be a more cost-effective alternative to on-board or at station surveys. Although it excludes people who do not have internet access, this is becoming increasingly less of an issue, as more people get access to the internet, through a combination of home computers and smartphones.
- 11.18. However, one of the issues encountered on the Larkhall-Milngavie evaluation was the low response rate to the online survey. To increase the response rate for future online surveys, it is recommended that alternative channels for promoting surveys should be explored alongside traditional advertising. In particular, advertising on social media such as Facebook and Twitter is likely to generate a higher response rate from those who use the relevant social media. Such channels have the advantage of users been able to access the survey immediately by clicking on the link as opposed to users seeing the advert and then accessing the survey later.
- 11.19. The main disadvantages of using social media to recruit respondents are:
- it is a less targeted approach and could generate a significant number of irrelevant responses from respondents living or working outside the study area; and/or
 - it may annoy some members of the relevant social media networks who receive the request to participate but who have little or no interest in the rail scheme or the survey.
- 11.20. To avoid these problems, it is recommended adding QR codes⁴⁴ to the flyers and posters being used to advertise the survey in the study area. These can then be used to enable the members of the travelling public who have the relevant smartphone/tablet technology to quickly access the relevant online survey webpage, while ensuring that the set of respondents remains within the targeted study area.

ii. Survey Content

- 11.21. Regardless of the survey method used, it is recommended that rather than bespoke surveys being developed for each rail project, a standard 'best practice' survey template is developed that could be used each time an appraisal or evaluation study is undertaken. Surveys could contain a

⁴⁴ QR (Quick Response) code is the trademark for a matrix barcode that can be read by a device such as a smartphone or tablet and then opens information about the item to which it is attached in the device's web browser

common core set of questions, supplemented by further questions tailored to the individual scheme.

- 11.22. It is also recommended that surveys maximise the information gathered by asking information about multiple frequent journeys (e.g. the Larkhall-Milngavie User Survey asked respondents about up to three of their most frequent journeys). This is useful because many passengers use rail on a regular basis for more than one purpose (e.g. commuting and leisure), but their behaviour following an intervention may differ according to their journey purpose. It is therefore useful to collect information on more than one journey.
- 11.23. Transport Scotland could use the format of the travel purpose questions used in this evaluation study as the starting point for an (electronic) survey template which could be provided with the evaluation guidance. However, it is likely some modifications may be needed to this questionnaire, to ensure that it adequately covers the generic needs of a typical rail scheme evaluation.

iii. Timing of Surveys

- 11.24. In addition to a survey to establish the baseline (see section 11.11), it is recommended that information on users' travel behaviour is collected following project completion, typically between six and twelve months from the project opening. This will help establish the extent to which travel behaviour of existing residents/employees of the area changes as a result of scheme, including the level of abstraction from other modes and stations.
- 11.25. However, this 'just after opening' survey would not capture lifestyle changes as a result of transport improvements (e.g. moving house, changing job). A further survey should therefore be undertaken between 3 and 5 years after the scheme's opening, to pick up these medium/long-term impacts.
- 11.26. This recommendation will obviously have cost implications for the evaluation process, so it may be desirable to exclude this follow-up survey for any small/local schemes deemed 'unlikely' to generate significant land-use changes. These smaller schemes are likely to be appraised using simple fixed-demand matrices, with no WEBs included within their appraisal, so there will be a corresponding reduction in the need to evaluate these WEBs within the evaluation process.

Process Evaluation

- 11.27. In the Larkhall-Milngavie 'Lessons Learned' exercise undertaken in 2008, it was noted that as three years had passed since the project's completion, many of the personnel involved in the project had moved organisations and so were not available to participate. Additionally, much of the project documentation had been archived and was difficult to obtain. This limited the findings from the exercise.
- 11.28. This highlights the need for the Process Evaluation to be conducted soon after project completion. This will ensure that most of the key individuals

involved in delivering the project are still available to provide their input and that all issues encountered can be easily recalled and recorded.

11.29. It is therefore recommended that the Process Evaluation is conducted within six months of project completion.

Project Documentation

11.30. When conducting the Larkhall-Milngavie evaluation it was at times difficult to gain access to key project documentation. Furthermore, given the change in personnel since the project was completed, it was sometimes unclear whether the information provided was comprehensive or the latest version.

11.31. It is therefore recommended that on project completion, all key project documentation is archived and transferred to the stewardship of one organisation (probably Transport Scotland).

Demand Modelling

i. Choice of Demand Forecasting Methodology

11.32. For the Larkhall-Milngavie demand modelling, no rationale was given in the SPT Modelling Report for the modelling approach chosen.

11.33. It is recommended that before any modelling begins, an evaluation of the various modelling approaches available and the pros and cons of each one is undertaken. Clear justification for one approach over alternatives should be documented. Best practice guidance as to which approach is likely to be the most suitable for a given set of circumstances is provided in PDFH.

ii. Documentation of Forecasts and Assumptions Applied

11.34. Little information regarding exogenous assumptions used was given in the SPT Modelling Report. Furthermore, demand forecasts were only provided for the four new stations, and for the predicted opening year (2001).

11.35. It is therefore recommended that a modelling Record of Assumptions is produced. This should include:

- a detailed description of the modelling methodology;
- all exogenous factors assumed including their source;
- the levels of demand abstraction and mode switching assumed, including justification and/or evidence for the assumptions made;
- all key modelling parameters including annualisation and ramp-up factors;
- a clear description of the rail service pattern (frequency and journey times) and fares assumed; and
- any assumptions made about the Reference Case and Do Something changes affecting the competing modes (e.g. journey time, frequency and/or fares).

11.36. Additionally, a full suite of model outputs (ideally in a simple comma-separated variable or equivalent 'flat' format) should be prepared. This should include comprehensive annual demand forecasts for all stations impacted by any change i.e. all stations in the study area, and for an extended time period e.g. for 15 years post-implementation. This will facilitate a future comparison of the forecasts against actual demand.

iii. Sensitivity and Risk Analysis

11.37. To account for the impact of potentially volatile drivers such as economic growth on demand forecasts, it is best practice to prepare a range of forecasts to reflect the inherent risk in using a particular set of exogenous drivers. In addition to the 'Central' forecast (based on the most likely or mid-range scenario), typically two sensitivity tests should be performed: 'Low' and 'High'.

11.38. The 'Low' sensitivity test would for example take the more pessimistic forecasts available for GDP, employment and population growth; the 'High' would take the more optimistic forecasts. These could be either drawn from different forecasters e.g. Experian, Oxford Economics or CEBR, or by adjusting the 'Central' forecasts e.g. +0.5% and -0.5% per annum for the 'High' and 'Low' scenarios respectively.

11.39. In addition to sensitivity testing the main exogenous drivers, tests should also be conducted around other factors that may influence the demand predicted for the scheme. For example:

- with and without park and ride facilities;
- the inclusion of a significant competitor response (from bus/coach operators);
- if the forecast demand at a particular station is significantly influenced by additional local housing or commercial development, what would be the impact if this development does not occur or is on a smaller scale than assumed in the core forecast?

12. EVALUATION STUDY CONCLUSIONS

Overview

12.1. This chapter summarises the main findings and conclusions with respect to the two main study objectives:

- an assessment of the extent to which the project has met its objectives and the five STAG criteria, and whether the project has offered value for money;
- provide recommendations for improvement of the draft Rail Evaluation Guidance.

Conclusions

12.2. The evaluation found that the project has been a success in terms of standard Transport Economic Efficiency (TEE) measures with the project's benefits outweighing its costs which is primarily due to higher than expected demand. However, there is only limited evidence to support the success of the project's wider objectives.

Achievement of Objectives

12.3. The six project objectives were:

- Project Objective 1: reconnect Larkhall to the rail network to allow the introduction of a half-hourly service;
- Project Objective 2: double the frequency of services between Hamilton and central Glasgow and between Milngavie and central Glasgow to four trains per hour;
- Project Objective 3: remove an operational bottleneck on the North Suburban line;
- Project Objective 4: increase the attractiveness of Larkhall and Kelvindale and the surrounding areas for inward investment and land development;
- Project Objective 5: offer social inclusion benefits for residents; and
- Project Objective 6: encourage a modal shift towards public transport.

12.4. The first three operational objectives have all been achieved. For the remaining three, in the absence of quantitative targets, it was more difficult judge the extent to which they have been achieved. There was certainly evidence from the two surveys undertaken and the accessibility analysis that positive contributions have been made for objectives 5 and 6, particularly in Larkhall:

- the rail improvements have led to reductions in public transport journey times to key destinations across the project area, improving accessibility and promoting social inclusion;

- there is evidence from the survey findings that the rail improvements have encouraged a mode shift towards public transport which has likely resulted in abstraction of car trips as well as a small net decrease in car ownership.
- 12.5. For objective 4, although there was some evidence from both the User and Business Surveys that the project had increased the attractiveness of Larkhall and Kelvindale, this was not supported by examination of local economic indicators; this suggested that overall the rail project has not had a significant or measurable wider economic or social impact. There is some evidence however of the rail project being a factor in the increased levels of homes being built in the Larkhall area in particular. It is also acknowledged that the full benefits of the rail improvements could take many years for to materialise.
- 12.6. The analysis of WEBs generated by the project also suggested that these too had been limited to localised, small-scale impacts.
- 12.7. Nevertheless, overall the project can be considered a success in terms of utilisation, with actual passenger demand exceeding forecasts and the recalculation of the BCR showed this was significantly higher than that reported in the original appraisal and indicates that project has delivered 'value for money'.

Recommendations for Rail Evaluation Guidance

- 12.8. The recommendations listed in chapter 11 were developed through encountering a number of issues when conducting this evaluation study.
- 12.9. The main recommendations are to:
- develop 'SMART' project objectives which can be effectively and continuously monitored post-project completion;
 - conduct the Process Evaluation soon after project completion;
 - identify the data required to effectively appraise, monitor and evaluate the project including the use of surveys to better understand the characteristics and behaviour of users and potential users both before and after project completion;
 - ensure data collection is an ongoing exercise rather than a task that is only considered as part of the Outcome Evaluation;
 - consider innovative survey design including use of new technology and social media to ensure a more targeted yet cost-effective survey approach;
 - ensure all project documentation is comprehensively archived and safeguarded to make sure the relevant and correct information is readily accessible which will aid the future monitoring of the project;
 - ensure all demand modelling assumptions made and outputs prepared at the appraisal stage are comprehensively documented; and
 - undertake sensitivity tests using a range of economic conditions when preparing demand forecasts to reflect the inherent uncertainty in forecasting.

12.10. Inclusion of these recommendations will promote a more robust, evidence-based evaluation of rail projects. This will enhance the ability to demonstrate that the observed project outcomes and impacts have been caused by the intervention rather than external influences.

13. APPENDIX A: USER SURVEY

Overview

- 13.1. For this evaluation, it was decided that the most effective way to determine change in travel behaviour since the project was implemented was to ask rail passengers using services on the line directly to build up an accurate picture of behaviour 'before' and 'after'.
- 13.2. An online survey was developed as this was judged to be the most effective method of gathering the necessary information considering the geographical spread of respondents (see figure 1).

Respondent Recruitment and Survey Response Rate

- 13.3. SYSTRA originally proposed to advertise the survey using a combination of flyering and posters at stations that received new services and service improvements, advertisements in the local press, and social media (for example through Transport Scotland, Network Rail and First ScotRail's Twitter and Facebook feeds).
- 13.4. However, due to concerns from Transport Scotland that the blanket nature of social media would not allow users of the Larkhall-Milngavie service to be specifically targeted, it was decided not to use this approach. In addition, it was not possible to use posters as a means of advertising the survey as First ScotRail were not able to facilitate this.
- 13.5. Awareness of the survey was therefore generated through a targeted approach. An initial week-long flyering exercise was undertaken at key stations (the four new stations⁴⁵ on the line plus Glasgow Queen Street and Glasgow Central) across the network. This was followed by placing an advert in the local press⁴⁶ for 2 weeks. The initial promotion resulted in a total of 116 survey responses, 35% of the target sample of 336⁴⁷.
- 13.6. A further week-long flyering exercise⁴⁸ was subsequently undertaken to further boost responses, but with limited effect. Following all promotion activity, a total of 164 survey responses were received, representing half of the target sample.

⁴⁵The four new stations created as a result of the Larkhall-Milngavie railway project were Larkhall, Merryton, Chatelherault and Kelvindale.

⁴⁶ A quarter-page advert was placed in two editions of the weekly The Hamilton Advertiser.

⁴⁷ The target sample of 336 was based on a 30% sample of daily entries/exits from the four new stations in 2012/13.

⁴⁸ Here, the four new stations (Chatelherault, Merryton, Larkhall, Kelvindale) as well as those stations on the line with the highest patronage which received service improvements as a result of the Larkhall-Milngavie Railway project were targeted. The additional stations targeted were: Glasgow Central Low Level, Glasgow Queen Street Low Level, Hamilton Central, Hamilton West, Exhibition Centre, Partick, Hyndland, Anniesland, Argyle Street, Rutherglen and Milngavie.

13.7. In total, the online survey was live over a six-week period between Tuesday 6th May and Friday 20th June 2014.

Survey Content

13.8. To gather the information required to evaluate the scheme against the objectives and STAG criteria, the survey focused on the issues listed below. The following information was provided for up to three of the respondents most frequent journeys:

- journey origin / destination;
- journey purpose;
- journey frequency;
- time of journey; and
- the transport mode(s) used to access the stations.

13.9. Additionally, respondents were asked:

- whether travel behaviour has changed as a result of service improvements;
- whether respondent has moved home / job as a result of service improvements;
- whether respondent has changed their spending habits as a result of service improvements; and
- demographic information (age, gender, marital status, household income etc).

13.10. The main aim of the survey questions was therefore to build up an accurate picture of 'before' and 'after' travel behaviour.

Sample Size and Limitations of Analysis

13.11. A total of 164 survey responses were received over the six-week online survey period and information was provided for 309 journeys⁴⁹.

13.12. The number of journeys recorded was scaled up to provide the total number of annual journeys made by respondents based on frequency of travel information e.g. for a journey made 'about once per week', a scaling factor of 52 was applied and then a factor of 2 (to account for the station entry and exit). This gave a total of 66,410 annual station entries/exits. This compares against the Office for Rail Regulation (ORR) estimate of annual station entries/exits in 2012/13 (the last year for which data is available) of 6.77m across all stations covered by survey. The sample size therefore represents 1.0% of total station entries/exits in 2012/13.

13.13. Based on this sample size, the margin of error is $\pm 7.65\%$ with a confidence interval of 95% and on the assumption of maximum uncertainty. This should

⁴⁹The number of journeys is greater than the number of respondents as the survey asked about multiple journeys (information was provided for up to three of the respondent's most frequent trips in the past year).

be taken into account when considering the results presented in subsequent sections.

Overview of Respondents

13.14. The distribution of the respondents' home postcodes (n = 15150) is shown in the map in Figure 31 and summarised in Table 41. The distribution of respondents reflects the targeting of key stations, with over 60% living in Larkhall or Hamilton. The remainder were predominantly from the Greater Glasgow area, particularly the Kelvindale and Bearsden areas.

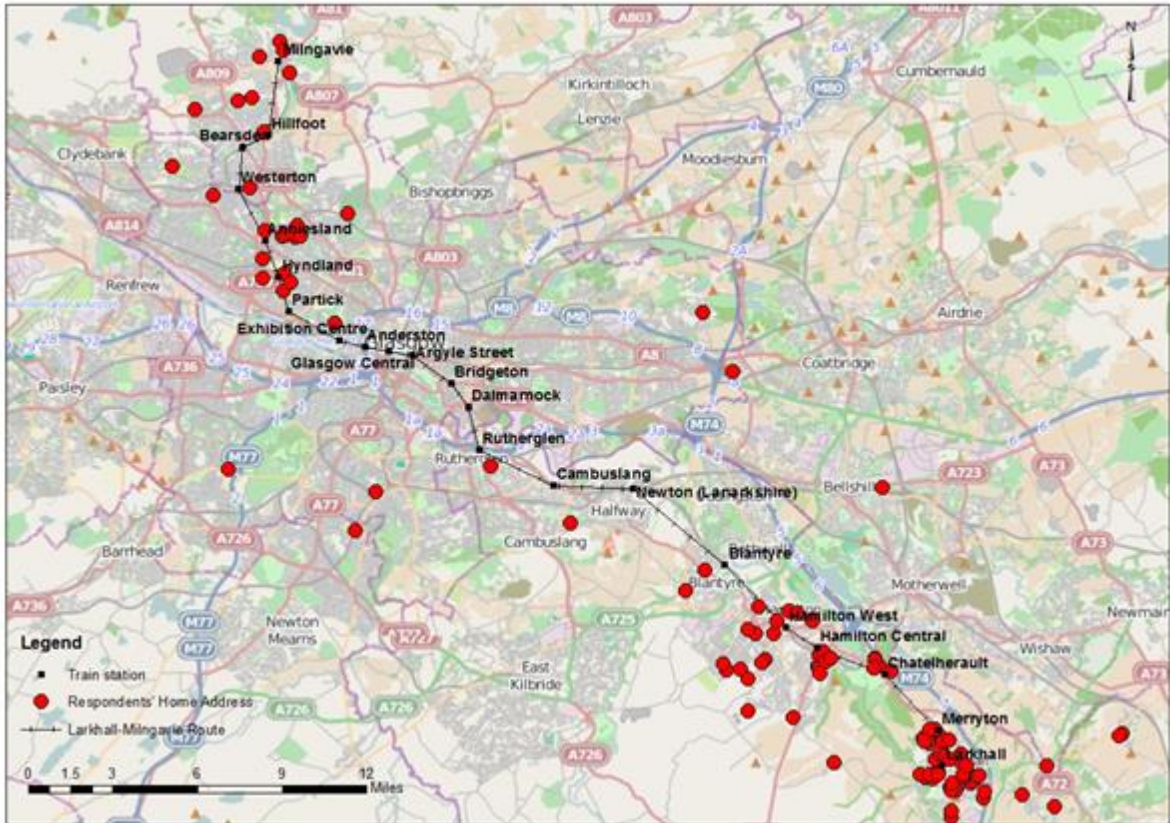


Figure 31 Survey Respondents' Home Address Locations

Table 41 Postcode Distribution of User Survey Respondents

Postcode / Area	Number of Respondents
ML9 (Larkhall)	61
ML3 (Hamilton)	34
G12 (Glasgow City incl. Kelvindale)	9
ML11 (Lanark)	6
G61 (Bearsden)	5
Other G or ML postcodes	35
Other Scotland postcodes	1
Total	151

⁵⁰13 respondents declined to provide their home postcode.

13.15. The age and gender distribution of the respondents is summarised in Table 42. This indicates the survey sample was representative of gender but that the under 45s were under-represented and the over 45s over-represented when compared to the gender and age profile of rail passengers at a national (GB) level.

Table 42 User Survey Respondents by Age and Gender

Gender	16-24	25-44	45-64	65+	Total	GB Average ⁵¹
Male	6%	17%	26%	4%	53%	54%
Female	4%	18%	21%	4%	47%	46%
Total	10%	35%	46%	9%	100%	
GB Average⁵¹	19%	46%	30%	5%	100%	

Analysis of Survey Responses

13.16. The survey responses were predominantly analysed to address the extent to which project objectives (referenced in section 2.12) have been met. This analysis is presented in Chapter 5.

13.17. Where applicable, the analysis focusses on the four key scheme components of the Larkhall – Milngavie railway project (Table 43). Where analysis is by scheme, respondents have been allocated to each scheme according to their home station i.e. the nearest to their home address (which for nearly all respondents is the station that they use the most). This covers 145 respondents (96% of the total sample).

Table 43 Larkhall – Milngavie Railway Project Schemes

Scheme	Home Station
1: Hamilton – Larkhall reopening (n=84)	Larkhall, Merryton and Chatelherault
2: Maryhill – Anniesland reopening (n=15)	Kelvindale, Anniesland, Maryhill
3: Enhanced frequency Newton – Hamilton (n=34)	Hamilton Central, Hamilton West, Blantyre
4: Enhanced frequency Milngavie branch (n=12)	Milngavie, Hillfoot, Bearsden, Westerton

13.18. Table 44 compares the number of scaled annual journeys (as discussed in section 13.12), against the number of station entries in 2012/13 from the ORR by scheme. This shows that the sample size was highest for the Hamilton – Larkhall reopening scheme and reflects the targeting of respondents. Clearly the larger the sample size %, the smaller the margin of error. Results relating to schemes 2 to 4 should therefore be treated with more caution owing to their low sample sizes.

Table 44 Sample Size by Scheme

Scheme	Survey Respondents Annual Journeys	2012/13 ORR Annual Station Exits ⁵²	Sample Size %
1: Hamilton – Larkhall	31,474	518,318	6.1%

⁵¹ National Rail Travel Survey – Overview Report, December 2010

⁵² Covering all stations shown in Table 43

reopening			
2: Maryhill – Anniesland reopening	12,418	1,325,518	0.9%
3: Enhanced frequency Newton – Hamilton	16,974	2,338,046	0.7%
4: Enhanced frequency Milngavie branch	5,544	2,591,674	0.2%

14. APPENDIX B: BUSINESS SURVEY

Overview

- 14.1. To understand how the station re-openings and service frequency improvements impacted the performance of local businesses by improving accessibility and access to the labour market, an online survey of local businesses was undertaken.
- 14.2. Originally a telephone-based survey was proposed. However, this generated a low response rate and so a web-based survey was developed.
- 14.3. The survey was piloted internally at SYSTRA to enable cognitive testing of survey responses, ensuring questions were unambiguous and easy to understand, and to check survey routings were correct.
- 14.4. A market research company was commissioned to contact businesses through one of their panels. Businesses located within close proximity to the Larkhall-Milngavie line were selected⁵³.
- 14.5. Although the survey covered businesses along the whole Larkhall-Milngavie line, those located in the Larkhall area were specifically targeted. This is because the station openings at Larkhall, Merryton and Chatelherault are likely to have had the largest impact on Wider Economic Benefits (WEBs) compared to the service frequency enhancements on the rest of the line.

Survey Content

- 14.6. Surveys were completed by a senior member of the business, typically the business owner, manager or director.
- 14.7. The survey questions differed according to the length of time the business had been operating in the area for.
- 14.8. Businesses that have been in the area for more than 9 years (i.e. before the completion of the rail project in 2005) were asked questions concerning the impact the Larkhall-Milngavie rail project has had on the following areas:
 - business performance;
 - turnover and profitability;
 - access to suppliers, customers and key services;
 - staff recruitment and retention;
 - business travel; and
 - supply chain linkages.

⁵³ Only businesses located in these Glasgow/Motherwell postcodes were invited to participate in the survey: G11, G12, G13, G20, G61, G62, G63, G72, ML1, ML3 and ML9.

14.9. Businesses that have opened or relocated to the area since 2005 were asked the extent to which the rail project had influenced this decision.

Overview of Respondents

14.10. The distribution of survey respondents (n=36) is shown in Figure 32 and summarised in Table 45. The distribution of respondents reflects the targeting of businesses, with nearly a third (31%, n=11) of businesses located in Larkhall or Hamilton.

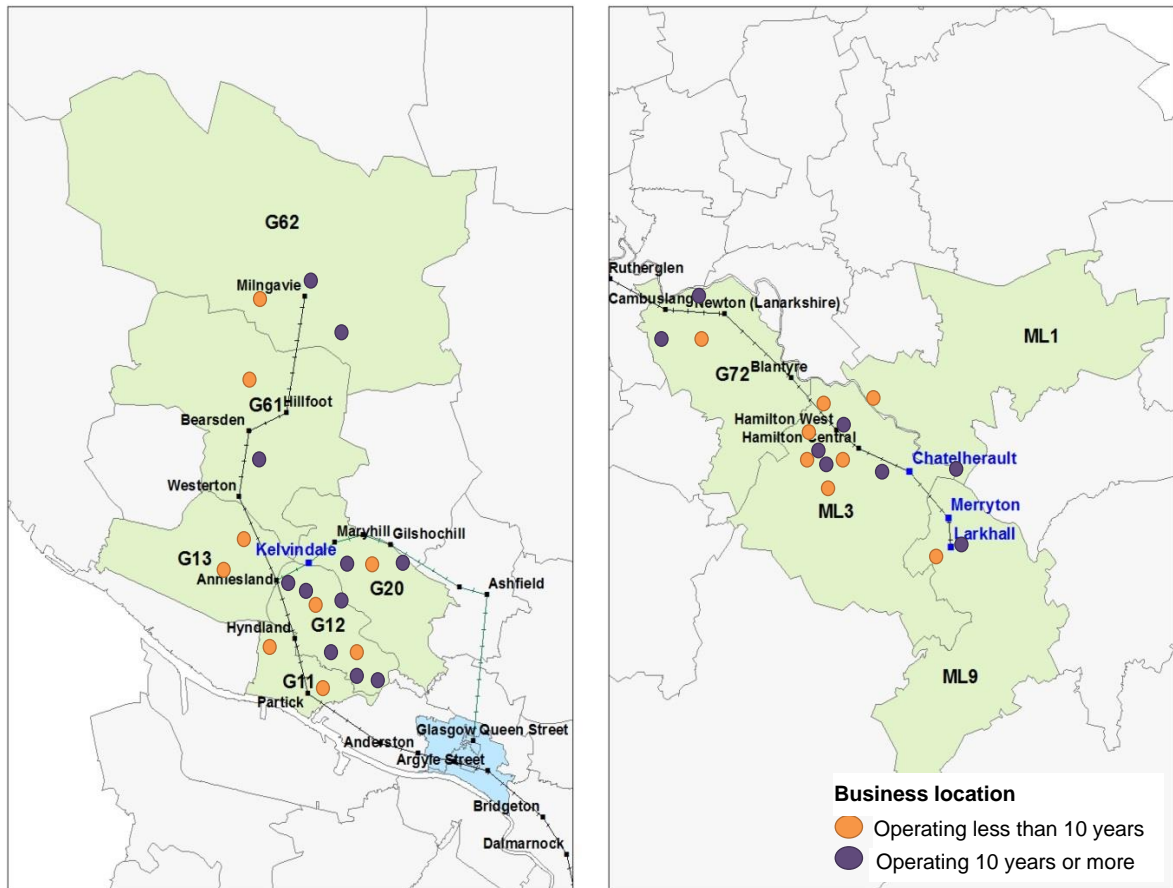


Figure 32 Business Survey Respondents' Locations

Table 45 Breakdown of Business Survey Respondents by Postcode

Post code / Area	Number of Respondents	%
G11 (Broomhill, Partick)	2	6%
G12 (West End, Kelvindale)	8	22%
G13 (Annesland, Knightswood)	2	6%
G20 (Maryhill, North Kelvinside)	3	8%
G61 (Bearsden)	2	6%
G62 (Milngavie, Baldernock)	3	8%
G72 (Blantyre, Cambuslang)	3	8%

ML1 (Motherwell)	2	6%
ML3 (Hamilton)	9	25%
ML9 (Larkhall)	2	6%
Total	36	100%

14.11. The breakdown of businesses by industry sector, number of full-time employees and turnover are shown in Table 46, Table 47 and Table 48 respectively. It was beyond the scope of this exercise to weight the survey results to correct for bias of particular types of industry sector or size (by comparing against data of all Glasgow businesses for example). However, the results indicate a good cross section of industry sector and business size.

14.12. It is important to note that the conclusions that can be drawn from a sample size of just 36 are limited and this should be taken into account when considering the results presented in subsequent sections.

Table 46 Breakdown of Business Survey Respondents by Industry Sector

Industry Sector	Number of Respondents	%
Construction	2	6%
Wholesale and retail trade	5	14%
Transportation and storage	4	11%
Information and communication	3	8%
Financial and insurance	4	11%
Professional, scientific and technical	5	14%
Education	1	3%
Human health and social work	4	11%
Arts, entertainment and recreation	5	14%
Other service activities	1	3%
Other	2	6%
Total	36	100%

Table 47 Breakdown of Business Survey Respondents by Number of Full-Time Employees

Number of Full-Time Employees	Number of Respondents	%
0 (sole-trader)	6	17%
1 - 49 employees	16	44%
50 - 249 employees	3	8%
250+ employees	11	31%
Total	36	100%

Table 48 Breakdown of Business Survey Respondents by Annual Turnover

Annual Turnover	Number of Respondents	%
Under £100k	10	28%
£100 k up to £500 k	5	14%
£500 k up to £1m	4	11%
£1 m up to £5m	4	11%
£5 m up to £10m	3	8%
£10 m up to £25m	2	6%
£25 m up to £50m	1	3%
Greater than £50m	7	19%
Total	36	100%

15. APPENDIX C: USER & BUSINESS SURVEY ANALYSIS

Table 49 Assessment of Impact of the Re-Opening of the Hamilton – Larkhall Railway Line (Scheme 1)

Measure	Impact	User Survey ⁵⁴ & Business Survey Evidence
Retain and attract residents	Strong beneficial ✓✓✓	User Survey: Of the 29% (n=29) of Larkhall rail users who have moved in the last 5 years, 71% (n=24) stated that improvement in local rail services had influenced their decision to move home.
Make area more attractive as a place of employment or leisure	Neutral	User Survey: Few non-residents (n=10) appear to travel to Larkhall by rail for work or leisure on a frequent basis so the impact on the new stations in boosting the area's attractiveness as a place of employment or leisure has been limited. This perhaps reflects the fact that Larkhall is predominantly a residential rather commercial centre and is therefore a trip generator rather than attractor.
Increase property values	Moderate Beneficial ✓✓	User Survey: Nearly half of Larkhall rail users (n=38) believe that the value of their property has gone up as a result of the new stations, as opposed to 5% (n=4) who believe that the value of their property has gone down.
Encourage spending by residents	Moderate Beneficial ✓✓	User Survey: 52% of Larkhall residents (n=41) state that they now spend a greater proportion of their money due to changes in rail services. Of these, the majority (83%, n=34) are doing so in non-local locations; analysis of the survey origin-destination data suggests this is mostly in central Glasgow. An increase in spending locally is more limited. This analysis refers to spending at an individual level rather than the overall level of spending in a particular area e.g. due to more people coming into the area. Larkhall rail users have therefore benefitted by having a greater choice of leisure and shopping locations. Non-local businesses will also have benefitted through increase in trade (although local businesses may have seen some loss). This is an example of an inter-area or 'two-way street' impact in which the rail project has enhanced economic interactions between two areas.
Encourage inward investment and land development	Neutral	Business Survey: Only one of the two businesses that had moved into the area since the rail project was completed cited the rail improvements as a factor influencing their decision

⁵⁴ The User Survey results relate respondents who stated that their home station is Larkhall, Merryton or Chatelherault (n=82); and non-residents who make frequent trips to any of these three stations (n=10).

Table 50 Assessment of Impact of the Re-Opening of the Anniesland – Maryhill Railway Line (Scheme 2)

Measure	Impact	User Survey ⁵⁵ & Business Survey Evidence
Retain and attract residents	Strong beneficial ✓✓✓	User Survey: Of the 60% (n=9) of Kelvindale rail users who have moved into the area in last 5 years, nearly all (n=8) stated that improvement in local rail services had influenced their decision to move home (although the sample size is small).
Make area more attractive as a place of employment or leisure	Neutral	User Survey: As per Larkhall, analysis of non-residents' destinations show almost no trips are made to the Kelvindale area for employment or leisure on a frequent basis (n=2). This perhaps reflects the fact that Kelvindale is predominantly a residential rather commercial centre and is therefore a trip generator rather than attractor.
Increase property values	Neutral	User Survey: For those rail users for whom Kelvindale is the nearest station (n=12), just 17% (n=2) believe that the value of their property has gone up as a result of the new station (although none thought it had decreased as a result).
Encourage spending by residents	Slight beneficial ✓	User Survey: No respondents indicated that their spending habits have changed locally. One-third (n=4) however now spend a greater proportion of their income in other non-local places, predominantly in central Glasgow. Again, this analysis refers to spending at an individual level rather than the overall level of spending in a particular area.
Encourage inward investment and land development	Neutral	Business Survey: No businesses surveyed had moved into the area since the rail project was completed

⁵⁵ The User Survey results relate only residents of Kelvindale and the surrounding area (n=15) i.e. those who stated that their home station is Kelvindale, Anniesland or Maryhill; and non-residents who make frequent trips to any of these three stations (n=2)

16. APPENDIX D: BENEFIT COST RATIO CALCULATIONS

Table 51 Calculation of Rail Revenue in DM and DS

Appraisal Period	Method
2006 – 2013	
Do-Something	LENNON outturn revenue
Do-Minimum	<p><i>Stations with service frequency improvement:</i></p> <ul style="list-style-type: none"> ▪ 2005 demand⁵⁶ grown in line with average annual growth at the ten Cathcart Circle stations (the control group – see section 9.17) to generate DM demand for 2006 to 2013. It is reasonable to assume that had there been no service frequency improvements then growth would have been in line with that observed on the Cathcart Circle since exogenous demand drivers are likely to have been similar for the two lines ▪ Converted to revenue by using LENNON average yield data <p><i>New stations:</i></p> <ul style="list-style-type: none"> ▪ Zero demand and revenue at the four new stations but abstraction from existing stations determined using User Survey data to determine % of demand at new stations that previously accessed existing stations
2014 – 2033	
Do-Something & Do-Minimum	<p>2013⁵⁶ demand disaggregated by ticket type grown in line with the following drivers using an elasticity based approach as per PDFH⁵⁷ methodology:</p> <ul style="list-style-type: none"> ▪ Employment⁵⁸: applied to Seasons only ▪ Population⁵⁸: applied to Full and Reduced only ▪ GVA per capita⁵⁸: applied to Full and Reduced only ▪ No real fares increases assumed (assumed to grow in line with RPI from 2014 onwards) ▪ Converted to revenue using 2013 LENNON average yields
2034 – 2065	
Do-Something & Do-Minimum	No demand or real revenue growth from 2033 onwards (in line with STAG which recommends a cap on growth beyond 2032)

⁵⁶ Rail demand by ticket type sourced from Office for Rail Regulation (ORR) estimates of station usage

⁵⁷ Elasticities sourced from PDFH

⁵⁸ Employment, population and GVApc forecasts for the Glasgow region sourced from TEMPRO v6.2

Table 52 Calculation of Journey Time Savings

User Type	Method
Existing rail users	<p><i>Stations with service frequency improvement:</i></p> <ul style="list-style-type: none"> ▪ Change in GJT in DS compared to DM calculated by applying change in service frequency penalty^{59,60,61} <p><i>New stations:</i></p> <ul style="list-style-type: none"> ▪ Change in GJT in DS compared to DM calculated by applying change in service frequency penalty and change in assumed access time^{59,60,61} e.g. in DM a Larkhall resident would have accessed Hamilton Central by car or bus but in DS they can board directly at Larkhall
New rail users	<p><i>Those abstracted from bus / car:</i></p> <ul style="list-style-type: none"> ▪ Change in GJT in DS compared to DM calculated by comparing current rail journey time to previous mode journey time⁶² ▪ Rule of a half applied⁴¹Error! Bookmark not defined. <p><i>Those who previously didn't travel:</i></p> <ul style="list-style-type: none"> ▪ Assumed same journey time benefit as existing rail users ▪ Rule of a half applied⁴¹

⁵⁹ Service frequency penalties sourced from PDFH

⁶⁰ DS rail journey times and frequencies by station obtained from First ScotRail timetables; DM rail journey times assumed to as per DS; DM frequencies obtained from scheme documentation

⁶¹ All journey times and frequencies based on from station to central Glasgow (Central or Queen Street) as User Survey indicated this was the typical journey destination, and in off-peak

⁶² Bus journey times and frequencies by station taken from operator websites; car journey times taken from AA Route Planner

Table 53 Calculation of Marginal External Costs

Stage		Description
1.	Estimate change in car km	<ul style="list-style-type: none"> ▪ The difference between DS and DM demand by station calculated as per Table 51 was converted to passenger km by applying average trip length in km (assumed to be from station to Glasgow Central as user survey indicated this was the predominant destination) ▪ Change in passenger km converted to change in car km by applying change in car km as % of change in rail factor (26% as per TAG guidance, Unit A5.4 Table 1)
2.	Analyse characteristics of car journeys	<ul style="list-style-type: none"> ▪ webTAG provides the proportions of traffic by different road types and levels of congestion for Scotland (TAG Databook, Table A5.4.1) ▪ Proportions for intervening years obtained by interpolation ▪ 2006 to 2009 assumed to take 2010 values ▪ 2036 onwards assumed to take 2035 values
3.	Marginal external costs results	<ul style="list-style-type: none"> ▪ webTAG provides the marginal external costs in pence per km by road type and congestion band for each impact in 2010 prices (congestion, infrastructure, accident, local air quality, noise, greenhouse gases and indirect taxation) ▪ These values were applied to the change in car km by road type and congestion level for each year from 2006 to 2065
4.	Calculation of discounted external costs	<ul style="list-style-type: none"> ▪ The total undiscounted external costs of changes in car use over the 60 year appraisal period were discounted

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اس دستاویز کی مزید کاپیاں آڈیو کیسٹ پر اور بڑے حروف کی چھپائی میں اور کمیونٹی کی زبانوں میں طلب کیے جانے پر دستیاب ہیں، برائے مہربانی اس پتے پر رابطہ کریں:

এই ডকুমেন্ট-এর (দলিল) অতিরিক্ত কপি, অডিও এবং বড়ো ছাপার অনুর আকারে এবং সম্প্রদায়ের ভাষায় অনুরোধের মাধ্যমে পাওয়া যাবে, অনুগ্রহ করে যোগাযোগ করুন:

Gheibhear lethbhreacan a bharrachd ann an cruth ris an èistear, ann an clò mòr agus ann an cànan coimhearsnachd. Cuir fios gu:

इस दस्तावेज़/कागज़ात की और प्रतियाँ, माँगे जाने पर, ऑडियो टेप पर और बड़े अक्षरों में तथा कम्प्यूनिटी भाषाओं में मिल सकती हैं, कृपया संपर्क करें:

ਇਸ ਦਸਤਾਵੇਜ਼/ਕਾਗਜ਼ਾਤ ਦੀਆਂ ਹੋਰ ਕਾਪੀਆਂ, ਮੰਗੇ ਜਾਣ 'ਤੇ, ਆਡਿਓ ਟੇਪ ਉੱਪਰ ਅਤੇ ਵੱਡੇ ਅੱਖਰਾਂ ਵਿਚ ਅਤੇ ਕੰਮਿਊਨਿਟੀ ਭਾਸ਼ਾਵਾਂ ਦੇ ਵਿਚ ਮਿਲ ਸਕਦੀਆਂ ਹਨ, ਕ੍ਰਿਪਾ ਕਰਕੇ ਸੰਪਰਕ ਕਰੋ:

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