DEVELOPMENT OF AN ALTERNATIVE TRANSPORT APPRAISAL TECHNIQUE: THE TRANSPORT QUALITY OF LIFE MODEL

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ABSTRACT

This thesis justifies, designs and tests a new transport appraisal technique – the Transport Quality of Life (TQoL) model. In the United Kingdom the New Approach to Transport Appraisal (NATA) is presently used to appraise the economic, environmental and social impacts of transport projects. Although recently updated, NATA still does not include the assessment of individual's travel experience – and yet, to make fully informed decisions on the impact of future schemes, it is important to understand more about passenger's current journey quality in order to make informed judgement on the impact of future schemes. This thesis thus explores the potential of Quality of life (QoL) techniques as one means of addressing this gap in appraisal methods and scope.

For the purposes of this thesis, TQoL is defined as the passenger experience of travel. Through the thesis a TQoL model was progressively refined and developed –from an initial Mark I model to a more evolved and developed Mark III model - to produce an appraisal tool that highlights differences in journey experience.

To develop the model and to determine whether a TQoL approach was a valuable addition to transport appraisal, QoL techniques were applied to the transport networks of Glasgow and Manchester to determine if this is a valuable alternative in transport appraisal. In each city three modes of public transport were analysed to highlight identify the mode providing the best highest TQoL.

A two-part household survey was used to gather the data. The first survey was city-wide to gain the weightings for the TQoL indicators. The second was collected from pre-determinedselected transport corridors to evaluate TQoL. The results were quantified and presented in spider diagrams. T-tests were then used to calculatedidentify the significant differences in TQoL.

Throughout the thesis the TQoL model is redefined to produce an accurate appraisal tool that can identify differences in journey experience. Factor analysis on the data from both Glasgow and Manchester confirmed showed that the a TQoL model should can be based on five factors - access and availability, sustainable transit, environment, personal safety and transport costs. This structure was found in both Glasgow and Manchester. TheApplying the final TQoL models showed that in both locations fixed modes - particularly Light Rapid Transport - are provideing a significantly higher TQoL compared to the bus TQoL. By evaluating transport from the passenger's viewpoint, the TQoL model This tool can help validate existing techniques to make transport appraisal more co-ordinatedcomprehensive by evaluating transport from the passenger's viewpoint. The thesis therefore concludes that the TQoL modelThe technique should be used in addition toto supplement existing techniques to enable the policy makers and practitioners make an better informed judgement decisions on how toabout improvinge the quality of transport.

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ACKNOWLEDGEMENTS

This thesis is dedicated to my wife, Shona. Without the continuous support, love and encouragement it would not have been possible to complete this PhD. It is also dedicated to Noah Thomas born on 3rd December 2009. This proves to you that anything is possible in this world, and hope you are able to enjoy the same opportunities as myself.

A special mention must also be made to all my family and friends who have been there for me throughout my university career, especially my mum and dad who provided the best possible start in life.

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Chapter One

INTRODUCTION

In the UK various transport problems - increased congestion, unsustainable transport policies, a lack of investment in public transport, etc - have both placed more pressure on public transport modes and have reduced the quality of their service. The European Commission (2001) describe the ills besetting transport in urban areas as impacting negatively on the quality of life. This is significant because public transport is a crucial part of town and cities and relied upon by millions of passengers every day. Despite the recognised problems there is no definitive method to appraise their travel experience, with transport appraisal being dominated by techniques that determine the cost or benefit of infrastructure and systems (HM Treasury 2003) and relatively little is known about the passenger experience. There is therefore a pressing need for a technique that can assess the passenger experience a factor in transport appraisal and decision-making.

This thesis is based on the premise that the principles of quality of life (QoL) research have potential as a means to evaluate journey experiences on public transport and, in turn, for their inclusion with transport appraisal and decision-making. By adapting research conducted on QoL in the UK in the late 1980s (Rogerson et al., 1989c), this thesis introduces, develops and tests the concept of Transport Quality of Life (TQoL) as a measure of passenger experience on public transport.

TQoL assesses the quality of passengers' travel experience and thus the TQoL appraisal model presented here aims to consider all the major aspects and issues that concern an individual on any given journey. In particular, as a practical model and test, it compares TQoL on three methods of public transport - LRT, fixed rail and bus - to illustrate which provides a better experience for the passenger.

QoL research can be applied in transport because the purpose and evaluation is suited for appraisal of journey experience. Rather than focusing on individual components in isolation, it evaluates many different elements within a single model. Previous QoL research quantified results in a single overall score so that urban areas could be compared together. In the approach adopted here, TQoL is assessed in one single model to illustrate pictorially whether a mode of transport provides a high QoL. This would, inter alia, allow policy makers and practitioners to evaluate where increased investment will lead to an improved QoL.

TQoL is not a new concept. It was first discussed as a means of assessing, appraising and informing decision-making about transport schemes, policies and programmes in the early 1980s (Buchan, 1992). Buchan's ideas, however, were regarded as too forward thinking at the time and there has been no development since by either private operators or local and central government.

Five paradigms have shaped transport research over the last fifty years: vehicle-based, trip-based, activity-based, dynamics-based and, attitude-based. Jones (2009) argues that there is only very limited development of appraisal under the attitude-based paradigm. This thesis contributes to this paradigm by providing detailed understanding of passenger experience to improve decision-making in transport policy and practice.

RESEARCH CONTEXT

The Labour government elected in 1997 attempted to introduce more radical policies (DETR 1998) but, as Goodwin (2008) observes, a government that "…started off with such a clear aim has frittered away goodwill and time by taking its eye off the ball." On gaining office, the then secretary of state for transport (John Prescott) promised that: "I will have failed if in five years time there are not many more people using public transport and far fewer journeys by car" (Prescott, 1997). Since then, car traffic has grown by 10%, from 365.8

billion vehicle-kilometres to 402.4 billion vehicle-kilometres (Table 1.1). More people were travelling by car than ever before and Prescott had been unable to keep his promise.

The then new government acknowledged a transport problem in the first overarching transport White Paper for thirty years. During this time there have been mode specific white papers such as Roads for Prosperity (Department of Transport 1989). Despite this, commentators have argued that the government was not wholly committed to tackling the root of the transport problem (Docherty, 2003; Goodwin, 2008; Docherty and Shaw, 2008). Pucher and Lefèvre (1996) described this problem as an urban transport crisis dominated by six issues: Congestion, Environment, Energy, Safety, Financing and Equity. These problems are driven by two factors - increase in car ownership and the decline in public transport service.

The precise extent of a current urban transport crisis can be debated because while the traffic growth has continued to rise, the distance travelled by public transport has also increased in the past ten years (Table 1.2). Despite bus and rail journeys only accounting for 6 and 7 percent of all passenger transport, passenger kilometres have increased steadily since 1998. The recent economic conditions and increase in congestion are impacting on public transport patronage. Although people now travel greater distances by public transport, car use is still dominant in urban areas. But, while 67.5% of all trips are still made by car, in large urban areas the number of households without a car, is down 6 percent since 1998 (DfT 2007a).

Congestion, the environment and equity are three major transport crisis factors impacting on QoL in urban areas. When congestion increases it puts more pressure on public transport as journeys become less reliable. The environmental problem influences passengers' QoL because some harmful emissions from vehicles impact on air quality. Road transport is the only sector with predicted growth in emissions over the next twenty years (DTI 2004). Equity is also a serious issue that affects QoL. In a society where household car

Table 1.1 Road traffic by type of vehicle: 1949-2006, by billion vehicle-kilometres

Source: (DfT 2007e)

Year	Cars and taxis	Motorcycles	Larger buses & coaches	Light vans	Goods vehicles	All motor vehicles	Pedal cycles
1955	42.3	7.5	4.2	9.8	13.2	77.0	18.2
1960	68.0	10.0	3.9	15.0	15.3	112.3	12.0
1965	115.8	6.7	3.9	19.0	17.3	162.7	7.0
1970	155.0	4.0	3.6	20.3	17.6	200.5	4.4
1975	181.6	5.1	3.2	23.5	18.3	231.7	4.4
1980	215.0	7.7	3.5	26.1	19.7	271.9	5.1
1985	250.5	7.4	3.7	28.6	19.6	309.7	6.1
1990	335.9	5.6	4.6	39.9	24.9	410.8	5.3
1995	351.1	3.7	4.9	44.5	25.4	429.7	4.1
1996	359.9	3.8	5.0	46.2	26.2	441.1	4.1
1997	365.8	4.0	5.2	48.6	26.9	450.3	4.1
1998	370.6	4.1	5.2	50.8	27.7	458.5	4.0
1999	377.4	4.5	5.3	51.6	28.1	467.0	4.1
2000	376.8	4.6	5.2	52.3	28.2	467.1	4.2
2001	382.8	4.8	5.2	53.7	28.1	474.4	4.2
2002	392.9	5.1	5.2	55.0	28.3	486.5	4.4
2003	393.1	5.6	5.4	57.9	28.5	490.4	4.5
2004	398.1	5.2	5.2	60.8	29.4	498.6	4.2
2005	397.2	5.4	5.2	62.6	29.0	499.4	4.4
2006	402.4	5.2	5.4	64.3	29.1	506.4	4.6

Table 1.2 Passenger transport: by mode: 1952-2006, by Billion passenger kilometres/percentage

Source: (DfT 2007e)

Year	Road								Rail[1]	%	Air (UK)	%
	Buses and coaches	%	Cars, vans and taxis	%	Motor cycles	%	Pedal cycles	%				
1955	91	38	83	35	8	3	18	8	38	16	0.3	0.1
1960	79	28	139	49	11	4	12	4	40	14	0.8	0.3
1965	67	19	231	66	7	2	7	2	35	10	1.7	0.5
1970	60	15	297	74	4	1	4	1	36	9	2.0	0.5
1975	60	14	331	76	6	1	4	1	36	8	2.1	0.5
1980	52	11	388	79	8	2	5	1	35	7	3.0	0.6
1985	49	9	441	81	8	1	6	1	36	7	3.6	0.7
1990	46	7	588	85	6	1	5	1	40	6	5.2	0.8
1995	43	6	618	87	4	1	4	1	37	5	5.9	0.8
1996	43	6	622	87	4	1	4	1	39	5	6.3	0.9
1997	44	6	632	86	4	1	4	1	42	6	6.8	0.9
1998	45	6	636	86	4	1	4	1	44	6	7.0	1.0
1999	46	6	642	86	5	1	4	1	46	6	7.3	1.0
2000	47	6	640	85	5	1	4	1	47	6	7.6	1.0
2001	47	6	654	85	5	1	4	1	47	6	7.7	1.0
2002	47	6	677	86	5	1	4	1	48	6	8.5	1.1
2003	47	6	673	85	6	1	5	1	49	6	9.1	1.2
2004	48	6	678	85	6	1	4	0	50	6	9.8	1.2
2005	49	6	674	85	6	1	4	1	52	7	9.9	1.2
2006	50	6	686	85	6	1	5	1	55	7	9.9	1.2

1 National Rail, urban metros and modern trams.

2 Excluding travel by water.

ownership is the norm, households without a car are socially excluded since they cannot are unable to fully participate (DETR, 2000b).

Current transport problems have no single cause. Rietveld and Nijkamp (2003) explain that growth in car ownership is dependent on several background factors, such as the rise in income and welfare, the rise in leisure time, and demographic developments. Katz (1999) argues that there is a special symbolism attached to owning a car. A person's sensual feeling is embodied in the mobility of the car, adjusting itself to a position that is tailored to his dimensions and sense of comfort.

Under these circumstances QoL on transport can be affected in two ways: it can be enhanced through the personal private mobility of the car, or devalued by continued presence of the urban transport crisis affecting public transport. Understanding more about current travel behaviour and how it can be affected by the transport problems is an objective of this thesis. Identifying which systems are providing a better experience is not only important for transport appraisal but also for helping the government meet its long-term goals.

In October 2007, the Department for Transport (DfT) produced a new long-term transport strategy to meet the recommendations set out in the Eddington and Stern reports (Eddington, 2006a; Stern Review 2006). Five broad objectives were identified:

- Maximising the overall competitiveness and productivity of the national economy, so as to achieve a sustained high level of GDP growth.
- Reducing transport's emissions of CO2 and other greenhouse gases, with the desired outcome of avoiding dangerous climate change.
- Contributing to better health and longer life-expectancy through reducing the risk of death, injury or illness arising from transport, and promoting travel modes that are beneficial to health.
- Improving quality of life for transport users and non-transport users, including through a healthy natural environment, with the desired outcome of improved well-being for all.

- Promoting greater equality of transport opportunity for all citizens, with the desired outcome of achieving a fairer society (DfT 2007d).

To help understand the effect of transport on QoL – the fourth objective - DfT commissioned social research by the University of the West of England (UWE) and a 600 person citizen's panel.

The UWE research (Lyons et al., 2008) found three ways people feel transport affects their QoL: first, it provides the means to participate in the whole range of economic and social activities outside the home; second, the conditions of the travel itself can be enjoyable or unpleasant, and mostly a mixture of the two; and third it impacts on the safety and pleasantness of the local environment, especially residential streets.

The research's main conclusion related to the practical difficulty of collating evidence, mainly because the language is general and overlaps with all the other policy goals. This concurs with the citizens' panel, where stakeholders endorsed the importance of recognising QoL issues but concluded there was difficulty increasing progress due to the inability to define many of the key concepts (DfT 2008b). The panel recommended that improving QoL would strengthen the UK public transport system infrastructure and assist it to become more environmentally friendly (GfK NOP 2008).

This latest research and reports show QoL to be a key part of transport in the UK. Both reports commissioned by the government suggested that enhancing QoL could be achieved through the improvements in transport systems. There are many ways transport systems can be improved, including new transport policies, direct intervention (e.g. road-user charging), and investment. Improvements to current appraisal techniques can also help improve systems.

Transport appraisal in the UK currently operates under the guidelines of the Treasury's *Green Book*. The main appraisal technique is cost-benefit analysis (CBA), which quantifies in monetary terms as many as possible of the costs and benefits of a proposal (HM Treasury 2003). For those issues that cannot be quantified fully in monetary terms, other techniques are used to infer a price, through either a revealed preference (RP) or a stated preference (SP) approach (HM Treasury 2003). There are however associated problems with SP due to the inconsistencies between stated intention and actual behaviour (Fuji and Gärling, 2003; Bates, 1988; Ben-Akiva et al., 1989; Ben-Akiva et al., 1992; Wardman, 1988; Sugden, 2005). Alternative transport appraisal techniques are needed not only because the passenger experience is unmeasured but also because these techniques fail to capture fully network-wide benefits that may result (Eddington, 2006a). DfT's (2009) revision of the New Approach to Appraisal (NATA) following the criticisms by the Eddington Study and the Stern Review that the New Approach to Appraisal (NATA) still does not fully evaluate non-market impacts, particularly passengers experience. Although there are improvements to the process to align the Appraisal Summary Table (AST) with the DfT's transport strategy, it does not go far enough to evaluate the journey experience. This thesis therefore will explore an alternative appraisal technique that, in principle, can enable better decision-making for planners, practitioners and transport operators, and which, ultimately, can deliver a better QoL.

RESEARCH AGENDA AND STRUCTURE

As current methods do not incorporate passenger experience into the evaluation of current and future transport systems, this thesis aims to explore and develop an alternative transport appraisal technique. The thesis thus constitutes a design process intended to develop and refine a tool to appraise individual experiences on public transport – this tool will be referred to as the TQoL model. It will test the feasibility of assessing passenger journey experience through QoL techniques. Note that it is not the intention to assess whether one mode of transport is better than another; if this initial research enquiry proves successful, then it would be possible to conduct further research to appraise specific public transport modes relative to one another.

The TQoL model was developed, evaluated and refined through the process of the research; this development is explained in this thesis. TQoL is assessed in three separate transport corridors in two cities - Glasgow and Manchester. Each corridor has high patronage on one particular mode of public transport. Glasgow and Manchester were selected for the study locations as they have similar transport, economic, social and developmental characteristics. This was important to evaluate the reliability and robustness of the TQoL model.

The research was conducted through a two-part household survey. The first survey was city-wide to gain the weightings for the TQoL indicators. The second was sent to addresses located within the pre-determined transport corridors to assess TQoL. The results from the weighted survey were multiplied together to produce a perpetual TQoL score for each indicator. These scores were then presented as TQoL spider diagrams, which compare all three modes of transport. The differences in TQoL for each indicator were calculated through t-tests to show the significant differences for bus, train and light-rail passenger's. Household surveys were chosen to be implemented rather than surveying on-board because it was essential to obtain data from habitual passengers. If the questionnaires were conducted on-board it could have included passenger's who do not regularly travel on that mode or that route. Therefore it was specified at the start of the questionnaire that only passengers by that particular mode under investigation should complete the survey. If it was not their main mode of transport for the longest part of the journey the questionnaire was not included in the dataset.

A flow diagram of the development, exploration and testing of the TQoL model and the chapter structure of this thesis are shown in Figure 1.1. As the development of the model is an iterative process, the chapter structure is not directly congruent with the flow diagram. Through the research the TQoL model is was developed and redefined to produce the final TQoL model – for simplicity and clarity of exposition, this development is presented as occurring through three key revisions of the model. These are referred to as Mark I, Mark II and Mark III.

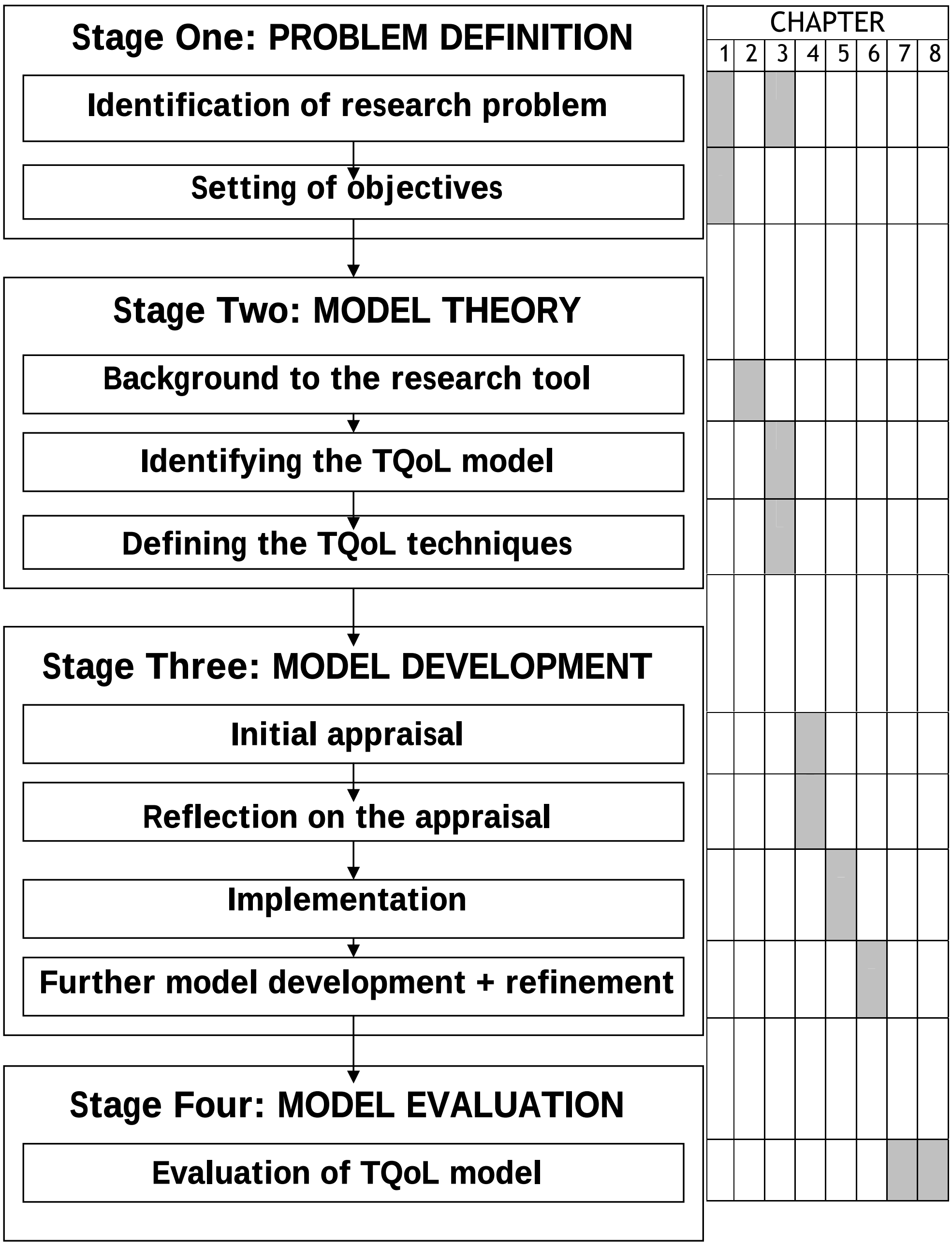

Figure 1.1 TQoL Model Development Flow chart

The development of the TQoL model(s) consisted of four main parts stages:

I. Problem Definition,
II. Model Searching,
III. Model Development and
IV. Model Evaluation.

(I) Problem Definition

Identification of the research problem and objective setting is presented in the present chapter. More detail on this stage is also provided in chapter 3. The main research problem is the inability of current transport appraisal techniques to evaluate the experience of individuals on public transport. The main research objective of the research is thus to develop a new method that can be applied to supplement current appraisal techniques to further enhance and broaden the appraisal process.

(II) Model Theory

Chapters 2 and 3 introduce, explain and develop the theory for the model.

Chapter 2 introduces and discusses QoL research theory. As this is the methodological approach applied for the model, the chapter reviews recent development in the field. It starts with social indicator research in the 1930s and ends with the latest research projects focusing on issues that are affected by QoL. In describing the theory of the tool the Rogerson et al. (1987) study is identified as the most appropriate technique to adapt.

Chapter 3 designs the initial TQoL model and defines the techniques to be used. It explains the theoretical background and evaluates possible indicators. The TQoL Model Mark I is then presented in this chapter. This initial methodology is constructed to evaluate TQoL in the same way as Rogerson et al assessed QoL.

(III) Model development

Chapters 4, 5, and 6 define the TQoL model.

Chapter 4 is the methodological chapter and explains techniques used in the initial appraisal. It explores whether QoL techniques can be transferred and whether they need modification to suit the field of transport. The initial appraisal was tested in a single transport corridor in Glasgow. Following the appraisal, reflection was made on TQoL Model Mark I and modifications were made to improve it as an appraisal technique. The final part of chapter 4 describes TQoL Model Mark II used in the assessment of TQoL in Glasgow and Manchester.

By revealing the differences in modal TQoL, Chapter 5 assesses the success of the implementation stage. This section of the chapter contains the results using the traditional QoL techniques. Spider diagrams and t-tests compare the significant differences between the modes within an individual city and across the cities.

Chapter 6 presents the final stage of model development. Factor analysis is used to test the validity of the TQoL indicators to measure passenger journey experience. There are two stages to the analysis, testing the conceptualisation of TQoL model mark II and investigating the possibility of a new TQoL model. Following the analysis the TQoL Model Mark III is presented and final TQoL models for Glasgow and Manchester are produced.

(IV) Model Evaluation

The final stage of the thesis and the research evaluates the merits of the TQoL model as an appraisal technique and debates the implications for policy and practice. Chapters 7 and 8 present the final stages of the development process.

Chapter 7 discusses how successful the TQoL model has been to evaluate journey experience, the contribution gained through factor analysis and what the results mean in the UK transport context. It concludes by assessing the caveats of when applying this appraisal technique, what improvements are needed and what changes could have improved the quality of this research project.

Chapter 8 examines the research's potential impact on current and future policy and practice. It highlights how the TQoL approach can contribute to the debate on transport appraisal and illustrates how the TQoL model can be used in future appraisals. To further demonstrate this, a practical example is presented of how it could have contributed to the decision made on Manchester's future public transport network. The final section outlines an agenda for further research.

Chapter Two

BACKGROUND THEORY:
QUALITY OF LIFE RESEARCH

2.0 INTRODUCTION

As explained in the previous chapter this thesis aims to develop a transport appraisal technique to assess passenger experience on public transport. After stating the research problem and setting the objectives, the next stage – Model Theory - consists of chapters two and three, which introduce and explain the background theory for the development of the TQoL model (Figure 2.1). The background theory is drawn from Quality of Life (QoL) research and it is argued that QoL theory and techniques can be usefully extended into transport research. Accordingly, this chapter reviews the development of the QoL field, starting with the social indicator movement in the US in the 1930s and progressing to the most recent research that evaluates QoL in specific contexts. It then defines and identifies appropriate techniques to evaluate Transport Quality of Life (TQoL).

2.1 WHY QUALITY OF LIFE?

Quality of Life (QoL) research is designed to measure the social condition of an individual. Rather than evaluating one or two components, it evaluates many different elements in one holistic model. A number of factors combine together to explain QoL. As many factors contribute to explain a person's experience on public transport this is also true for TQoL. A passenger will not value their experience on only the cost of a journey or how safe they feel, a much wider range of issues need to be considered (Hine and Mitchell, 2001; Urry, 2007; Wardman et al., 2001). Thus, QoL research can be applied in transport as the purpose and evaluation is well suited to TQoL appraisal.

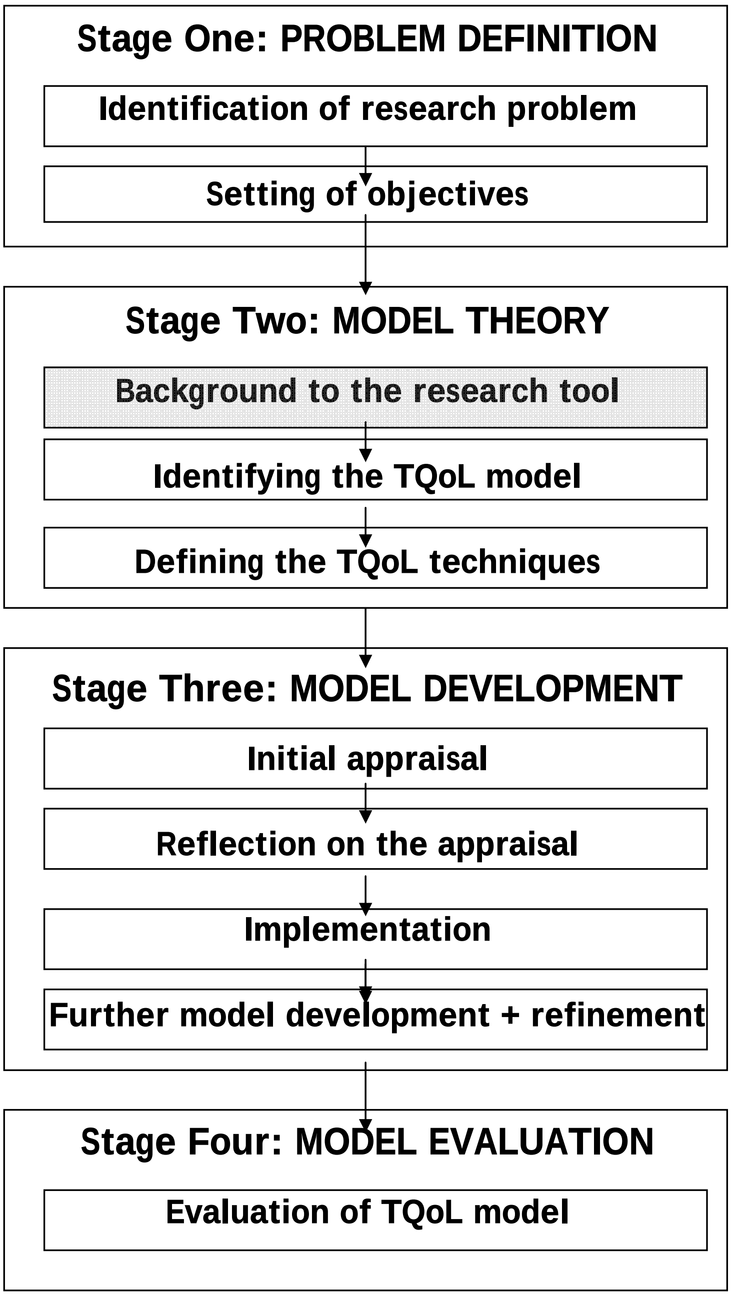

Figure 2.1 TQoL model development in relation to chapter 2

While other methods could be applied to appraise public transport use, QoL research can focus on a wide range of factors affecting societal differences. Definition of QoL however, has proved quite difficult in the past. It is commonly agreed to be a vague and ethereal entity, something that many people talk about, but which nobody knows very clearly how to define it (Campbell et al., 1976). It is used frequently because it is applicable to many different issues. Current literature and research on QoL studies, including this thesis, shows, as yet, that no conclusive agreement has been reached, even among specialists, about the exact definition and place of QoL in social studies.

In addition to social sciences, QoL research is conducted in medical intervention, health management, housing programmes and economic and community development. The largest development is found in the field of health-related QoL. Following the social indicator movement, an individual topic area was created to understand more about patients and medical practices. The methodology used in this field is advanced. With many health-related QoL studies conducted on an international scale (Bergner, 1989; Bland and Altman, 1995; Coates et al., 1993; DeBoer et al., 1995; Tarlov, 1992).

The core method to measure QoL uses sets of indicators. Organisations, publications and governments commonly also use sets of indicators to monitor their performance. The UK government for example, monitors performance of schools and hospitals using indicators and quantifies the results in league tables. Newspapers do the same for university league tables (Lipsett, 2009; O'Leary, 2009). Many other conditions are monitored, including places (Savageau, 2007), companies (Fortune, 2009) and countries (Economist Intelligence Unit 2008). These provide only basic evaluation and with no strong methodological content can be criticised for weaknesses in focus, development and bias.

The frequency with which QoL is used in policy can be illustrated by a brief analysis of UK government policy documents (Table 2.1). A search of the websites of governmental departments indicates that QoL is a prominent term in policy and strategic direction. The number of hits found on each website is high, which shows the relationship and applicability of QoL. Inclusion in the overarching strategic aims of five departments and ten department strategies indicates its topicality in current policy. It is also used because of its innate

Table 2.1 – Occurrence of Quality of Life in public policy
(Websites accessed 18.07.08)

Government Department	Number of Hits on 'Quality of Life' in Departmental Search Engine	Use in Departmental Main Strategic Aim	Use in Principal Department Strategy
Cabinet Office	22 Hits	No	No
Department for Business, Enterprise & Regulatory Reform (BERR)	Over 100 Hits	No	No
Department for Children, Schools and Families (DCSF)	Over 100 Hits	No	Yes- DCSF Ten Year Youth Strategy
Department of Communities and Local Government (DCLG)	191 Hits	Yes – Part of explanation of what the department does	No
Department for Culture, Media & Sport (DCMS)	169 hits	Yes – Main Strategic Aim	Yes – DCMS Annual Report 2008
Department for Environment, Food and Rural Affairs (DEFRA)	2,679 hits	Yes – DEFRA's Strategic Priorities and Outcomes	Yes – 2008 DEFRA Department report
Department of Health (DH)	308 hits	No	Yes – DH Departmental Report 2008
Department For Innovation, Universities & Skills (DIUS)	-	Yes- Mission Statement and Departmental objectives	Yes – DUIS Departmental Report 2008
Department for International Development (DFID)	344 hits	No	Yes- DFID Annual Report 2008: Making it Happen
Department for Transport (DfT)	11 hits	No	Yes – DfT Transport Strategy: Towards a Sustainable Transport System
Department for Work & Pensions (DWP)	144 hits	No	Yes – DWP Opportunity for all – Indicators update 2007
Home Office	463 hits	No	No
Ministry of Justice	39 hits	No	No
Northern Ireland Assembly	284 hits	-	-
Scottish Government	5,461	Yes – Strategic objectives	Yes- Economic Strategy
Welsh Government	Over 100 hits	No	Yes – One Wales: A progressive agenda for the government of Wales

vagueness. Despite, no clear definition for the term it is still important to improve the QoL for an individual.

In this thesis, QoL research techniques are used because the aim is to present the level of experience or 'happiness' found on different modes of public transport. As this cannot be assessed in a single measurement, it is necessary to combine different factors to explain TQoL. Before explanation of how QoL research was adapted to the specific area of transport, it is necessary to review the key debates in the development of QoL methods.

2.2 THE SOCIAL INDICATOR MOVEMENT

The origins of QoL can be traced to the 'social indicator movement' of the 1960s and 1970s. The earliest social indicator research undertaken was in 1933 when President Hoover's Committee on Social Trends proposed a regular series of national reports entitled *Recent Social Trends in the United States*. This is recognised as the first attempt to analyse social factors, which would have an impact on public policy in the same way economic issues were evaluated (Bauer, 1966).

The social indicator movement developed following the publication of two reports and a series of key debates. The first report was published in 1962, following a National Aeronautical and Space Administration (NASA) study on the possible effects of the Space Programme on American Society. Those involved in the project found the space programme's social consequences to be both substantial and often unexpected. At the same time they were unable to find the necessary data for a detailed quantitative analysis. The desire to understand 'second degree' consequences of major technical innovations required identification of suitable methods to measure social consequences (Bauer, 1966).

The second report, by the National Commission on Technology, Automation, and Economic Progress, drew similar conclusions to the NASA study. It recommended creating a system of ‘social accounts’ to provide a balance sheet of the social and economic progress movement in four areas:

- Measurement of social costs and net returns of economic innovations
- Measurement of social ills (e.g. crime, family disruption)
- Creation of ‘performance budgets’ in areas of defined social needs (e.g. housing, education)
- Indicators of economic opportunity and social mobility (National Commission on Technology Automation and Economic Progress 1966)

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Following these reports a number of key commentators argued for social indicators to become part of the political process (Bauer, 1966; Gross, 1967; Sheldon and Moore, 1966; Sheldon and Moore, 1968). Their discussions led to the US government addressing social issues with the same weighting as economic indicators. It set up a panel for social indicators consisting of 41 social scientists and an equal number of statisticians and administration experts. Although the Department of Health, Education and Welfare (HEW) previously produced a set of indicators and studies of trends between 1959 and 1966, these were only a small set of measures. The panel advanced this work in *Toward a Social Report* in 1969. This represented the first genuine attempt to produce a social equivalent to the annual economic report, delivering a broad review of the state of the nation on a wide range of social conditions (Cazes, 1973).

Outside the United States, the social indicator movement was less advanced, with only small projects using social indicators in the UK, France and European Commission. In the UK, the Central Statistical Office (CSO) published the first series of *Social Trends* in 1970. This was a collection of quantitative indicators deemed significant in the detection of social condition and enhancement of social policy. In France, indicators of social significance were compiled and analysed by the Office of the Commissioner-General for the Plan from 1967. The first main report, *Recherche sur les Indicateurs Sociaux* was published in 1971. The chief economic advisors of the United Nations Economic Commission for Europe also launched a programme of research into the long-term validity of social science methodologies in 1969. Their aim was to identify social factors, such as living conditions of elderly people, housing, working conditions and mobility, which could be used to monitor and forecast future social conditions (Cazes, 1973).

A social indicator may be defined as a statistic of direct normative interest which facilitated concise, comprehensive and balanced judgement about the condition of major aspects of a society (U.S. Department of Health Education and Welfare 1969). It is in all cases a direct measure of welfare and is subject to the interpretation that, if it changes in the 'right' direction, while other things remain equal, things have gotten better, or people are 'better off'.

The social indicators were quantitative so they could be analysed in the same way as economic data. There were a number of social problems emerging at the time that led to the social indicator movement. These included: growth and urbanization of the population, general upgrading in standards of living, the spread and increasingly higher attainment in levels of education, and the heightened self-awareness and rise of minority groups which created serious social strains (Sheldon and Moore, 1968).

As social problems became increasingly detectable the basic objective of social policy was to evaluate the problems not only in monetary terms but also with regard to the state of the social system. Social indicators were able to (i) measure the state of and changes over time in (ii) major aspects or dimension of (iii) social conditions that can be judged normatively, as (iv) part of a comprehensive and interrelated set of such measures embedded in a social model, and (v) their compilation and use should be related to public policy goals (Smith, 1973).

The social indicator movement split in two directions in the 1970s. The first introduced the concept of social system models (Fox, 1974; Land, 1977; Land and Spilerman, 1975; Warren, 1980). The second involved an attempt to understand the condition of well-being; which eventually grew into quality of life research.

2.3 QUALITY OF LIFE RESEARCH

Measuring individual well-being involves two quite distinctive types of social indicators – objective measures and subjective measures. The general progression over time has been from initial reliance on objective indicators to increased use of subjective indicators. Objective conditions are generally measured by counting the occurrences of a given phenomenon; subjective evaluations are usually based on asking individuals about their perceptions, feelings and responses (Carley, 1981).

In early QoL research it was common practice to use objective indicators because quantitative time-series analysis was prevalent in social statistics. Studies of QoL in US metropolitan areas during the 1970s typify the objective indicator evaluation (Liu, 1975b; Liu, 1975a; Liu, 1976). Liu modelled quality of life as QOL = F(PH, PS), where physical (PH) and psychological (PS) are the key factor inputs. The physical inputs consisted of bundles of quantifiable measures deemed to account for the basic needs of human beings, which were grouped into economic, political and welfare, health and education and social input factors. The psychological inputs include subjective spiritual factors, such as community belongingness, love, affection, esteem and self-actualization (Liu, 1975b). Although the research claimed to be a subjective measurement of QoL, the psychological measures were not evaluated and were simply given a constant value against the 125 physical input indicators.

QoL research using only objective variables was rejected as inadequate because subjective variables are equally important in evaluating QoL (Schneider, 1975; Kuz, 1978). Schneider's research examined the relationship between thirty objective and subjective indicators in US urban areas. His work revealed no discernable relationship between the level of well-being measured by a wide range of objective indicators and the QoL subjectively experienced by individuals in that city.

Kuz's study in Manitoba, Canada, identified twenty-one objective indicators and thirteen subjective indicators. He concluded that QoL research using only objective variables was 'highly suspect' because it explored only one aspect of a multidimensional problem and subjective realities are equally important in the assessment of QoL (Kuz, 1978).

Many other QoL studies have highlighted the significance of subjective indicators. In 1976 a large scale project examined the argument that 'psychological wellbeing' - was important in the assessment of the QoL. Two thousand-one hundred respondents were asked for their personal evaluation of happiness and life situations. The overarching conclusion revealed that satisfaction with life was related to the fulfilment of the basic needs for individuals and groups in society (Campbell et al., 1976).

At the same time Andrews and Withey conducted the largest ever study of QoL. Over 5,000 US citizens were interviewed to develop both measures of well-being and appropriate techniques of scaling to compare the individual responses (Andrews and Withey, 1976). There are two key outcomes of the research - the subjective measurement and model development. They developed the 'delighted-terrible' (D-T) scale, where respondents were asked to rate their level of satisfaction on a number of variables from delighted to terrible. The second outcome is the relationship of subjective and objective measures in the Andrews-Withey model. The conceptual model proposes that a person's sense of QoL is understandable as a combination of affective responses to life domains (Andrews and Withey, 1976).

These research projects produce similar conclusions regarding the theoretical conception of QoL. Subjective indicator assessment is an essential part of QoL and should be included in any assessment. The studies were not the earliest seeking to portray social and individual subjective feelings of life. Maslow and Cantril both attempted to measure self-perpetual subjectivity. Maslow's hierarchical classification of human needs is built on the argument that higher order needs will only be achieved if psychological requirements are satisfied (Maslow, 1954). Cantril's *Self Anchoring Striving Scale* was used to evaluate what aspects of life were seen to be important, ranging from positive and negative points of view. Over a number of subjects, respondents were asked to assess their actual conditions (0-10) against an ideal situation (10) (Cantril, 1967).

Research of QoL based only on subjective measures has not produced reliable quantified states of mind and mood (Abrams, 1973). QoL should incorporate both objective and subjective indicators across a range of different dimensions in one 'conceptual model' (Cutter, 1985). The dimensions of Cutter's model are three fold: factors of the physical environment, social variables and perceptual indicators. This research confirmed it was possible to measure objective and subjective aspects of QoL in one model. Despite this, the model was criticised for not addressing the question of how perceptual evaluation of objective indicators is to be incorporated within the study of QoL (Rogerson et al., 1989b). This debate progressed into the development of weighting QoL indicators.

2.4 THE EMERGENCE OF SUBJECTIVE WEIGHTING OF QoL

Until the 1980s the results from studies of QoL were presented as unaggregated scores, in a single formula or in a large-scale database. This created a need for a weighting system that could attach importance to specific characteristics of physical, social and economic characteristics of human well-being (Smith, 1981). Three methods of weighting indicators were developed - by politicians, experts or the public. Value-weighting by each method affects the outcome of the results in different ways, with the first two having a marked impact on the definition of QoL.

Rogerson (1989b) criticised research projects based on political and expert opinion value weighting. He argues that weighting QoL indicators in this way can become biased, as their personal opinion will be reflected in the valuation of indicators. Even research based on the investigation of popular perceptions of life quality do not completely avoid this problem as researcher-respondent interactions also influence the measurement of perceptions (Rogerson et al., 1989b).

In the then most advanced QoL study Rogerson and associates addressed the methodological question of subjective weighting (Rogerson et al., 1987). Their work was the first large-scale project to use the general public to weight objective indicators of QoL. A nationwide study determined which dimensions should be used to assess QoL. These were separated into economic, social and environmental dimensions. A stratified national survey of twelve-hundred respondents then rated twenty dimensions of QoL in terms of importance in influencing the choice of where to live. The responses were scored on a scale from 1 (minimal significance) to 5 (variable very important). The contributions were then compared with a unitary or unweighted index (%.00%) (Rogerson et al., 1987). Values of QoL were calculated by multiplying the objective measure on each dimension with the scores from national opinion survey. This was done for data from UK towns and cities to produce a national index of QoL in large and intermediate metropolitan areas (Findlay et al., 1988; Rogerson et al., 1989a; Rogerson, 1997; Rogerson et al., 1987).

This method of weighting variables by importance has the advantage of avoiding distinguishing between real and perceived images of individual cities for homogenous groups. It also limits the impact of professional and political bias that can be caused in the other forms of weighting. Rogerson et al. highlight that the problems of using the general public to weight the indicators are selecting the correct QoL dimensions, interpreting the scaling results and the use of objective indicators (Rogerson et al., 1989b). These issues need to be considered in the construction of a TQoL model.

The Rogerson et al. method of QoL research will be applied in the conceptualisation of TQoL and appraisal of TQoL. Although twenty years old it was used in the TQoL model conceptualisation because there has been no further successful development of the perpetual weighting of QoL. The method's relevance is strengthened by its application in a recent assessment of QoL in the UK by the Work Foundation (Lee, 2006). Three points underline the appropriateness of the weighting system:

I. Because individual dimensions are given different scores by individuals and groups of the populations, the survey results indicate that unitary weightings do not adequately reflect the importance of different dimensions of QoL in Britain. It is therefore important that weightings are included. Although they may not produce vastly different rankings, their inclusion does help to legitimise the method as reflecting the views of the public rather than those of academic researchers.

II. The use of the weighting system allows recognition that each group in the population values QoL dimensions differently. The existence of a weighting system therefore refutes the generalised notion that there is, at any one point in time, one given set of quality-of-life rankings for British cities.

III. Weightings permit a ranking of dimensions of quality of life, so that more selective studies of a smaller number of indicators can be undertaken. The weightings provide a clear guide regarding those dimensions that are most critical to the public and, therefore, should be included in such exercises (Rogerson et al., 1989b).

2.5 DEVELOPMENT OF QOL RESEARCH IN POLICY AND ACADEMIC RESEARCH

The success of Rogerson et al.'s research led to an increased importance of QoL in public policy. The ability to quantify QoL for local areas on a mass scale made it a key feature of policy around the world. **Box 2.1** gives examples in Australia, New Zealand and Canada.

In the UK, government interest can be traced to concern for sustainable development following the Rio Summit in 1992. In 1996, the Department of the Environment Transport and the Regions (DETR) produced its first indicators for sustainable development. In a subsequent report (DETR, 1999) these were aligned to QoL. Indicators were used to measure a better QoL for everyone, now and for generations to come.

BOX 2.1 Selected examples of QoL research by international governments

Australia - The National Citizenship Project in Victoria, Australia, was created to develop a set of national benchmarks and indicators as a policy tool around the theme of citizenship and social well-being (Salvaris et al., 2000).

New Zealand - In New Zealand the Quality of Life Project began in individual cities and progressed to assess the largest cities in the country. It is a multi-council initiative that emerged in response to the growing pressure on urban communities, concerned about the impact of urbanization and the effects on the wellbeing of urban residents (Auckland City Council et al., 2007). The project started with six cities in 1999 and has expanded to include 12 local authorities. The indicators are designed under 11 domains to monitor urban issues and trends. A combination of citizen surveys and objective measures assess QoL. The latest project reported that the vast majority of residents in the 12 cities have a positive QoL, with QoL improving along with increases in life expectancy, median and household income and improvements in safety (Auckland City Council et al., 2007).

Canada - In Canada the Ontario Social Development Council designed a QoL index for community development to monitor key indicators of social, health, environmental and economic quality of life (Ontario Social Development Council & Social Planning Network of Ontario 2000). There has also been various other attempts to design survey instruments that can compare QoL, health and well-being in various housing environments (Ezzet-Lofstrom, 2004). The Quality of Life Reporting System (QOLRS) was also created by the Federation of Canadian Municipalities (FCM) to bring a community-based perspective to the development of public policy and to monitor the consequences of changing demographics (FCM, 1999). It is a similar programme to New Zealand's quality of life project, assessing objective measures in eight sets of QoL indicators. In the first report in 1999 16 municipalities were studied, which grew to 18 in 2001 and 20 in 2004 (FCM, 1999; FCM, 2001; FCM, 2004a). The most recent report in 2004 found that QoL was at risk and had deteriorated for a significant number of people between 1991 and 2001. The FCM then produced more specialised studies on QoL in *Income, Shelter and Necessities*, *Dynamic societies and social change*, *Growth, the economy and the Urban Environment* and *Trends & Issues in Affordable Housing & Homelessness* (FCM, 2004b; FCM, 2005a; FCM, 2005b; FCM, 2008). These reports provide more detail on a narrower set of trends that can affect QoL.

The UK QoL project was implemented to examine the social condition of individuals (DEFRA 2002b). The first stage was a trial benchmarking exercise to test the applicability of QoL research in a nationwide survey of over 3,700 people. Respondents were asked to score their QoL on a five-point Likert scale.

Five out of six people regarded their QoL as fairly or very good, almost two thirds were fairly or very optimistic about their QoL in the future and half said they were fairly or very optimistic about the future in their part of the country. Health was regarded as the most important factor affecting QoL, followed by money and crime (DEFRA 2002b).

The next stage in the government's development of QoL research was to produce a set of QoL indicators for use at the national and local level to assess sustainable development. The Audit Commission published a series of reports on QoL indicators. Its final report (The Audit Commission 2005) identified a set of indicators to be used in the UK sustainable development strategy. Sixty-Eight objective and subjective indicators of QoL were produced in the sustainable development strategy, which continue to monitor sustainable development on a yearly basis.

The UK government's application of QoL studies is not as advanced as New Zealand and Canada. There is no specific project to investigate QoL in large cities and is only used to monitor sustainable development. New Zealand and Canada have focused attention on QoL studies to ensure its residents QoL improves. It is however only a means of measuring improvement and the methods used to examine QoL are not as advanced as academic studies.

With the International Society for Quality of Life Studies (ISQOLS) formed to promote and encourage research in the field of quality-of-life studies, QoL research is now an established field. *Applied Research on the Quality of Life* is QoL's official journal. Recent development of QoL studies include investigation on cultural participation (Galloway, 2006; Lau et al., 2005), social mobility (Palomar-Lever, 2007), urban competitiveness (Lambiri et al., 2007; Rogerson, 1999), university life (Chow, 2005; Sirgy et al., 2007; Yu and Kim, 2008), community and recreation participation (Baker and Palmer, 2006), living conditions in rural areas (D'Agostini and Fantini, 2008), a review of national governments and public policy institutes' QoL indexes (Hagerty et al., 2001), the effect of population density (Cramer et al., 2004), and assessing residents' satisfaction with community based services (Sirgy et al., 2000).

The most recent development of QoL in the social sciences field has been involvement of the community in the research process. The Community-University Institute for Social Research (CUISR) based in Saskatchewan, Canada has pioneered this approach and has conducted many QoL studies in Saskatoon involving the community. This process has led to it being involved in setting priorities for action in these areas (Kitchen and Muhajarine, 2008). QoL surveys in 2004 found a drop from 2001 in the proportion of respondents reporting excellent QoL. The 2007 QoL study used quantitative (telephone surveys) and qualitative (interviews) research in a mixed method approach to QoL research. Seven benefits of using the mixed methods approach were identified:

I. Identifying possible questions to be added in future iterations of the survey;
II. Revealing variation in how participants in surveys and interviews respond to questions;
III. Revealing variation in definition of a neighbourhood condition
IV. Necessitating awareness of other data sources;
V. Operationalizing confirmation and comprehension;
VI. Revealing variation in how people define neighbourhood; and
VII. Revealing variation in how people define friendly (Kitchen and Muhajarine, 2008)

QoL research is expanding in more contexts to examine many different phenomena. The significant point from this review is how this study should be conducted. Mixed methodology in QoL research is still very new, and there needs to be more investigation into the validity of the method before it could be applied in TQoL. Objective and subjective measurement is the central methodological debate that will continue in the conceptualisation of TQoL. Because obtaining a proper understanding of the quality of urban life involves considering both the city on the ground and the city in the mind (Pacione 2003), this thesis will use objective and subjective measurement in the TQoL model.

Research on QoL in urban areas has focused on the inclusion of both objective and subjective measures. The Saskatoon QoL model used objective and subjective indicators to measure the social and physical environments, and included perceptual indicators to assess the contribution of quality of life over time (Randall and Morton, 2003). The result is a layered and multi-textured analysis, derived from a carefully constructed holistic QoL model integrating objective, subjective, and perceptual indicators. Rogerson et al.'s (1987) method to form perpetual measures of objective and subjective TQoL will be applied in this research project.

2.6 CONCLUSION

This chapter has explained the background theory for this research and has related it to the field of transport, arguing that QoL is an appropriate technique to evaluate passenger experience on public transport because it allows multiple issues to be measured by objective and subjective indicators. As with QoL, no dependent variable - or single variable - can fully explain or adequately represent TQoL.

QoL research can evaluate individual life quality. In the past ten years QoL research has been used in many different contexts. Focus has turned to measure aspects that can be affected by QoL and another aspect is public transport. Whilst the application of QoL approaches into specific fields is a positive development, the methods and indicators need to be made appropriate for and applicable to those specific fields. As has been found in the case of health-related QoL, they also need to become more statistically reliable. By developing the indicators in the TQoL Model, this thesis thereby advances the field.

Having reviewed QoL research in this chapter, the next chapter focuses on defining the TQoL techniques in more detail. The next chapter is thus the first stage of model design and explains how Rogerson et al's techniques are adapted for a TQoL appraisal model.

Chapter Three

TRANSPORT QUALITY OF LIFE CONCEPTUALISATION: DESIGNING A TOOL TO ASSESS TQoL

3.0 INTRODUCTION

As explained in chapter one, this research aims to design a new tool to measure transport quality of life (TQoL). The previous chapter set out the background theory by outlining recent developments in the quality of life (QoL) field. Following this, and in accordance with the model development diagram (Figure 3.1), this chapter discusses in more detail the methods used to assess TQoL. It adapts the Rogerson et al (1987) method (outlined in chapter two), presents an initial TQoL conceptual model (Mark I) and sets out an initial set of TQoL indicators, which will subsequently be used to assess TQoL in three modal corridors in two cities (chapters five and six).

The chapter is organised in five sections, each relating to a design stage of the TQoL Model. The first section identifies the performance criteria required for the tool to be an effective appraisal technique. The second reviews current debates in transport appraisal to demonstrate why there is a need for TQoL conceptualisation in transport research. It also explains why revealed preference research is a more suited compared to stated preference. The third reviews previous indicator research in transport to describe which indicators will be used in the TQoL model. The fourth briefly introduces how the results of the surveys will be analysed, while the fifth section considers spider diagrams as a means to represent TQoL results.

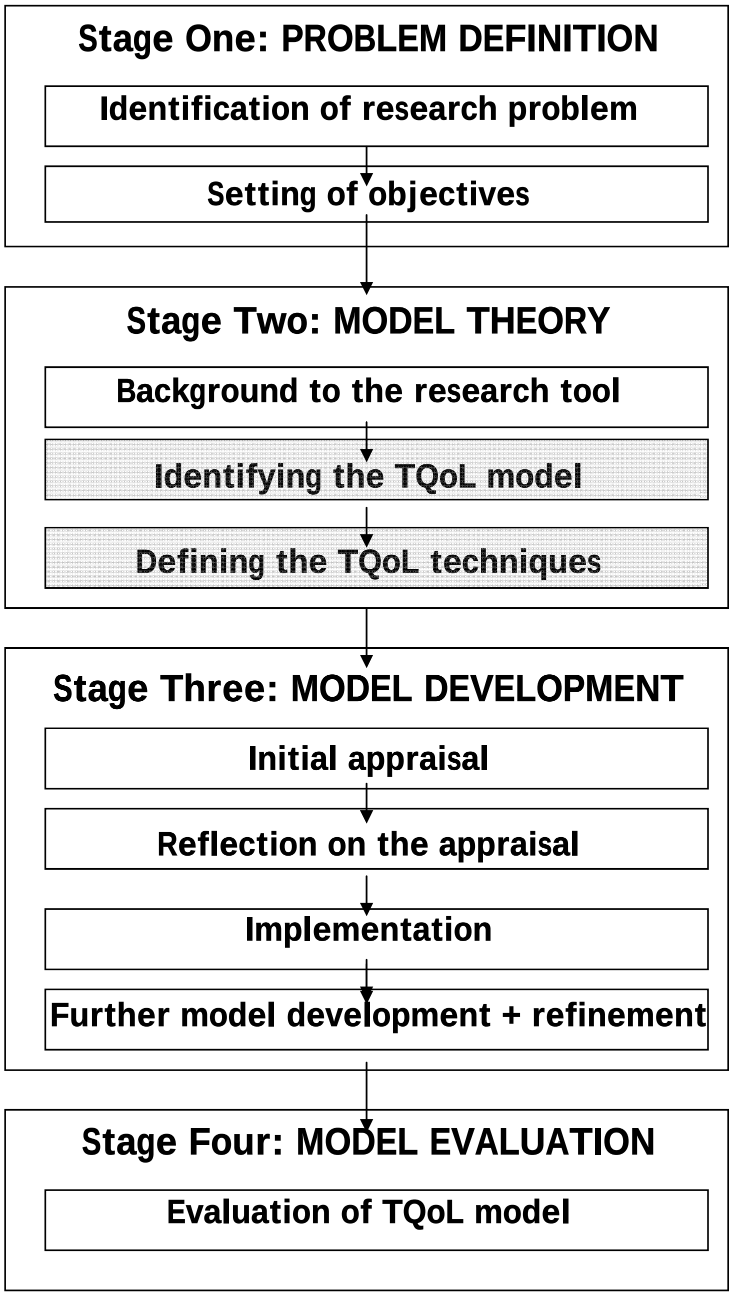

Figure 3.1 TQoL model development in relation to chapter 3

3.1 PERFORMANCE CRITERIA

To be an effective and useful policy tool, the TQoL model is measured against predetermined performance criteria. These guidelines are created to ensure the technique is able to measure TQoL:

- *Robustness* - the methodology must be resilient enough to measure TQoL on all forms of public transport. The model must also be reliable to be repeated in further studies and different locations. If the model produces QoL that is very similar on all modes it will be clear that the model is not robust enough to assess the differences in TQoL.
- *Precise* - the measurement used to assess TQoL must be precise to avoid incorrect results that can skew the outcome. QoL scales must be consistent and appropriate in their application. The indicators should also be wide ranging to cover all issues of travel experience. Consideration must be taken to ensure the model does not include too many indicators. This could lead to an over complex assessment that cannot be effectively presented to practitioners and policy makers.
- *Relevance* – the model must take account of current day behaviour and evaluation must specify the results are dependent upon the time and place. If there is no accurate secondary data for any indicators other sources must be considered. The model should not be based on data from different scales and timeframes because the TQoL model will be ineffectual if inaccurate data is included. Precise evaluation is an essential part of the model development and must always include relevant data.
- *Complexity* – the model must be reflective of current travel patterns but not too data hungry and over-complex so TQoL becomes misinterpreted. A key dimension of the TQoL model is that more than one mode of transport can be compared. Involving too much information may not enable effective comparison. The way the model performs is more significant. It must be developed in a way that is simplistic yet statistically reliable. Policy makers, practitioners and transport operators must be able to adapt this methodology and understand how it works. They need to identify the

Formatted: Indent: Left: 0 pt, Bulleted + Level: 1 + Aligned at: 18 pt + Tab after: 36 pt + Indent at: 36 pt, Tabs: 18 pt, List associated benefits of using the tool and if the TQoL model is too complicated the contribution to transport appraisal may be lost.

- *Adding Value* – the TQoL model is not the complete picture of public transport and should not be considered on its own. The purpose of developing this tool is to provide an alternative form of appraisal to help practitioners and policy makers make informed judgements on the success of public transport. It must be a valid tool that adds value to transport appraisal or the technique will be just another survey. The TQoL model must appraise current journey quality on one mode of transport and be able to compare this to other modes of transport.
- *Easily understood* – the results presented must be clearly understood so that all audiences can distinguish the difference in TQoL. This is a very important component in the design process. The output from the assessment must be represented in a way the policy maker or transport operator can understand the appraisal's results. They should be able to observe how well each mode of transport is performing and learn why one mode of transport is providing a better QoL compared to another. While previous QoL studies have used league tables or formulas to represent the overall score of performance, this model must produce an outcome that provides an accurate description of all TQoL issues.

Each of these dimensions must be considered when defining the TQoL model. This will ensure the technique is able to effectively assess TQoL in Glasgow and Manchester. As this is the first stage of design these elements will be assessed at the end of the chapter and the thesis to confirm that the TQoL model is meeting the aims of the performance criteria.

3.2 TQoL CONCEPTUALISATION

TQoL is the experience encountered by passengers when they travel by public transport. For this to be successfully measured the model must consider all aspects that concern an individual on any given journey. It is commonly recognised that a single measure is unlikely to encompass all aspects of *quality of service (Pullen, 1993), so indicators will measure different attributes of TQoL.*

At the ninth World Conference on Transport Research (WCTR), 2001, a special panel session was held to address the question of increasing the relevance and utility of transportation research. It was organized as a tribute to the late Professor Manheim, whose research career was based on developing analytical tools to support and enhance managerial decision-making (Ben-Akiva and Bonsall, 2004). Debating the idea how researchers can have more impact on public policy, the planning process, the transport product and, perhaps, the behaviour of individual travellers and shippers, they recommended four ways for new research to achieve this:

I. Increasing relevance, making sure the topic is pertinent to current policy and based on an understanding of the present and future needs of decision-makers;
II. Improving the interface, through involving practitioners in the research process;
III. Strengthening credibility, by producing models that are attractive for decision makers and not over complex, and;
IV. Effective dissemination, making sure that the results are communicated to practitioners in non-technical language (Ben-Akiva and Bonsall, 2004).

This discussion effectively provides the setting for the idea of the TQoL model. While there are still problems with urban transport in the UK, there is also a need to make transport research more accessible for policy makers and practitioners. The recommendations made in the panel session in 2001 will be considered in the development of the TQoL model.

One way to improve transfer of knowledge into practice is through improvement to current transport appraisal techniques. Although, appraisal by UK central government evaluates transport projects, programmes or policies, it is largely restricted to assessing potential of new transport infrastructure. The guidelines of appraisal are presented in the UK Treasury's *Green Book*. The method principally used in appraisal is cost-benefit analysis (CBA), which quantifies in monetary terms as many of the costs and benefits of a proposal that are feasible, including items for which the market does not provide a satisfactory measure of economic value (HM Treasury 2003).

For transport, CBA evaluates new transport infrastructure in a benefit:cost ratio (BCR). Using the example of the Edinburgh tram network, CBA concluded that the BCR for Phase 1a of the network was 1.77:1. This is a return of £1.77 in economic benefit for every £1 spent. The BCR for Phase 1 including both Phases 1a and 1b is 2.31:1, indicating a strong economic case for Phase 1b (TIE, 2007). BCR is part of the government's New Approach to Transport Appraisal (NATA). This is the analytical framework to appraise the economic, environmental and social impacts of all transport proposals (DfT 2007c). NATA was introduced to be a more comprehensive appraisal system to consider both qualitative and quantitative data of equal importance. This was updated following criticisms that NATA BCR did not include a number of GDP impacts and did not put a monetary valuation on environmental benefits (Eddington, 2006a). As part of the DfT's refresh of NATA, the Appraisal Summary Table (AST) was improved to align the process and the results with the objectives of DfT's transport strategy (DfT 2009). Table 3.1 illustrates how the new transport strategy goals relate to NATA objectives. Each of these objectives are measured by sub-objectives which are presented in the AST to provide the value for money of a proposal. Some of these impacts can be given a BCR, but for more than half of the impacts no monetary value can be placed to determine the cost or benefit. In this case an approximate value is placed on the impact in order for it to be compared to the BCR in an overall judgement.

Although NATA has been improved to include more non-monetised impacts and one of these is journey ambience to meet the goal of improving quality of life, this whole process can be seen to be invalid because it ultimately will evaluate the impact in a cost-benefit. When there is approximate values placed on these impacts it brings into question the validity of how 'journey ambience' can be evaluated. Therefore more sophisticated appraisal techniques are needed to capture all the economic, environmental and social impacts.

Table 3.1 The contribution of NATA objectives to DfT's strategy goals
Source: (DfT 2009)

Goal	Challenge		NATA subobjective	NATA objective
Tackle climate change	Reduce carbon emissions	◄	Greenhouse gases	Environment
Support economic growth	Improve reliability	◄	Reliability	Economy
	Improve connectivity	◄	Transport user benefits	Economy
	Support the delivery of housing	◄	Land-use policy	Integration
	Enhance resilience	◄	New analysis	
	Wider economic impacts	◄	New analysis	
Promote equality of opportunity	Improve accessibility	◄	New analysis	Accessibility to the Transport System
	Enhance regeneration	◄	Regeneration	Economy
	Reduce regional imbalance	◄	New analysis	
Improve quality of life	Reduce exposure to noise	◄	Noise	Environment
	Minimise impact on the natural environment, heritage and landscape	◄	Biodiversity	Environment
	Minimise impact on the natural environment, heritage and landscape	◄	Water environment	Environment
	Minimise impact on the natural environment, heritage and landscape	◄	Landscape	Environment
	Minimise impact on the natural environment, heritage and landscape	◄	Heritage	Environment
	Improve experience of travel	◄	Journey ambience	Environment
	Improve experience of travel	◄	Option values	Accessibility
	Improve experience of travel	◄	Transport interchange	Integration
	Improve the urban environment	◄	Townscape	Environment
	Creating opportunities for social contact and leisure	◄	Transport user benefits	Economy
	Creating opportunities for social contact and leisure	◄	Reliability	Economy
	Creating opportunities for social contract and leisure	◄	Severance	Accessibility
Better safety, security and health	Reduce the risk of death or injury	◄	Accidents	Safety
	Improve health through physical activity	◄	Physical fitness	Environment
	Reduce air quality health costs	◄	Local air quality	Environment
	Reduce vulnerability to terrorism	◄	New analysis	
	Reduce crime	◄	Security	Safety

The preferred method is to simulate the market value of an impact is by estimating the 'willingness to pay' (WTP) or 'willingness to accept' (WTA) project's outputs or outcomes (HM Treasury 2003). For a new transport project respondents will be asked how much they are WTP or WTA for a new road to reduce congestion, for example. This technique is designed to infer economic values for an increment of service. The green book states that the quantification of potential social, health or environmental impacts normally requires an alternative approach to valuation. Techniques that establish monetary values for this type of non-market impact generally involve the inference of a price, through either a revealed preference or stated preference approach (HM Treasury 2003). Revealed preference (RP) and stated preference (SP) are two techniques principally used in transport appraisal research. RP techniques infer an implicit price indirectly in examining consumers' behaviour in a similar or related market. SP are normally obtained by specially constructed questionnaires and interviews designed to elicit estimates of the willingness to pay (WTP) for, or willingness to accept (WTA), a particular outcome (HM Treasury 2003).

Research using SP methods originated in mathematical psychology in the early 1970s, and was developed through marketing research in late 1970s. The first studies of note in transport were conducted in the early 1980s (Sheldon and Steer, 1982; Steer and Willumsen, 1981; Hensher, 1982; Louviere and Hensher, 1982). The introduction of stated choice modelling using the set of established discrete-choice modelling tools widened the interest in SP-methods. For the first time travel behaviour researchers could see the benefit of stated-preference data in enhancing their travel choice methods (Hensher, 1994). There are two categories of research in transport: stated preference (SP) and stated choice (SC) - the difference being the method used in assessment. Stated preference asks respondents to indicate their preference to a set of combinations of attributes toward a particular transport service on a rating scale. Stated choice asks respondents to choose one of a combination of attributes of a transport service.

Stated preference and stated choice modes are used frequently in research because they use statistical techniques to infer the potential travel behaviour of a new transport project. A seminal paper by Kroes and Sheldon in 1988 highlighted a number of limitations of RP research to strengthen the case of SP. These are as follows:

I. It can be difficult to obtain sufficient variation in the revealed preference data to examine all variables of interest
II. There are often strong correlations between explanatory variables of interest (particularly travel time and cost). These make it difficult to estimate model parameters reflecting the proper trade-off ratios.
III. Revealed preference methods cannot be used in a direct way to evaluate demand under conditions that do not yet exist.
IV. Revealed preference methods require that the explanatory variables can be expressed in “objective” or “engineering” units; therefore there are normally restricted to primary service variable (such as journey time and cost) and can in practice rarely be used to evaluate the impact of changes in secondary travel variables (such as seat design and station facilities) (Kroes and Sheldon, 1988)

These points were valid at the time they were made, but this research is designed to challenge each one and strengthen the argument that revealed preference data is the best way to understand travel behaviour:

I. The TQoL model is developed to measure a number of different attributes affecting passenger behaviour, which disputes the first point. The model will evaluate more than one mode of transport at the same time across a wide variation of indicators.
II. The second point will be challenged in the way the model is constructed and analysed. There will be indicators for travel time and cost on separate factors to reduce correlation. Despite this, correlation may still occur between the two variables because the cost to travel can have an impact on journey time. To analyse the level of correlation, factor analysis is applied in chapter six.

III. Whilst the third point is true, this is not the goal of the research. SP techniques are used to evaluate potential developments, but before this is understood it is important to learn more about present travel behaviour.

IV. The last point is insignificant in the application of this research because subjective measures are used in addition to objective measures. It is possible to evaluate both primary and secondary travel variables.

This project is not intended to discredit SP and SC methods because they are valid techniques that continue to be used in the field of transport research. They are however not the appropriate methods that should be used to evaluate passenger behaviour when they travel by public transport. The main reason is due to the inconsistencies that have become associated with stated intention and actual behaviour (Fuji and Gärling, 2003; Bates, 1988; Ben-Akiva et al., 1989; Ben-Akiva et al., 1992; Wardman, 1988; Sugden, 2005). There are a number of factors that have been hypothesized which affect intention-behaviour consistency. These are split into errors of omission and errors of commission. A respondent may state that he will choose an alternative but then fail to actually do so (an error of commission), or he may not state that he will choose an alternative but actually do so (an error of omission) (Fuji and Gärling, 2003).

Three types of anomalies have proved particularly problematic – (i) the disparities between willingness to pay (WTP) and willingness to accept (WTA); (ii) scale insensitivity; and (iii) the influence of irrelevant cues (Sugden, 2005). Despite these problems there continues to be redevelopment of SP and SC methods. An increasing number of studies are combining sources of RP and SP data. It is said that SP data gives a depth of information which is missing in RP data, especially where applications involve alternatives that are currently not available or require the evaluation of the impact of attribute levels associated with existing alternatives outside of a plausible variation centred around current experience (Hensher and Bradley, 1993). Combination of data is reported to eliminate inconsistencies in both methods and has been used regularly to investigate travel behaviour in urban areas (Ahern and Tapley, 2008; Espino et al., 2007; Hensher et al., 2005; Liu, 2007).

In addition to SP and SC methods, the theory of planned behaviour also has been applied to transport to determine travel intentions (Ahern, 2001; Heath and Gifford, 2002; Manstead and Parker, 1995; Anable, 2005). This was introduced from psychology research as it was widely acknowledged that new methods were needed to accurately forecast travel behaviour (Gärling et al., 1998). However as with SP techniques the same problems have emerged, whereby the travel patterns do not always follow the planned behaviour (Bamberg et al., 2003; Bamberg and Schmidt, 1999; Yang-Wallentin et al., 2004).

Recently stated choice methods have been used to measure service quality on bus journeys and operators in Australia (Hensher et al., 2003; Hensher and Prioni, 2002). Service Quality Index (SQI) measures passenger's perceptions of service by asking individuals to choose between their current journey and two other designed journeys by a package of predetermined attributes. The score for the current trip is multiplied together with importance weights to produce the SQI for each individual passenger. These scores are averaged across all passengers to provide SQI for each corridor, which are then compared against other areas of the metropolitan area. There were 13 attributes of service quality identified, and graphs were produced to highlight how each attribute contributed to the SQI (Hensher et al., 2003).

While the philosophy behind the SQI approach is very similar to this project, there are important methodological differences. The SQI model uses both RP and SP data - a process that is commonly used in transport research. This may not be the most effective way of measuring an individual's experience on public transport. Although, SP and SC methods add richness to research by providing alternative specific attributes not currently available, this should not always be the goal of research and is not the aim of the current project. TQoL is not about learning whether people would prefer to travel by public transport. Before that is evaluated it is important to measure characteristics of current travel behaviour between different modes of transport. TQoL could help understand why people prefer to travel by other modes of transport through the illustration of variation in QoL on different modes of transport. This would be the first step. If results show LRT TQoL or Train TQoL to be significantly better compared to Bus TQoL, then clear grounds for modal shift become apparent. If the bus provides equally good QoL compared to fixed modes the government will have evidence to support current policy of no further investment in LRT. A more in-depth SP study should take place preceding examination of TQoL, not together in the model, because this could jeopardise the outcome of the result.

The TQoL model proposed here should illustrate how each mode of public transport is providing a better experience for passengers. The result will not be quantified into one overall score, as this will make interpretation very difficult. Whilst Rogerson et al. produced league tables of QoL so urban areas could be compared against each other, this is not appropriate in this research. Their approach identifies which areas have a better QoL, but does not highlight differences in each attribute. A model comparing TQoL on a wide range of issues is more suitable because it will show how the mode of transport is providing a good QoL. This will allow policy makers and practitioners to evaluate where increased investment could lead to an improvement in TQoL.

The concept of TQoL is not new. It was first discussed as a means of assessing, appraising and informing decision-making about transport schemes, policies and programmes (Buchan, 1992). Buchan proposed that transport planning and evaluation be identified in quality-of-life goals. Eight quality-of-life objectives for transport were promoted in a qualitative assessment to replace the previous appraisal process described as ‘technically complicated, incomplete and difficult to understand’. There was no development of Buchan’s ideas because the policies promoted in the book were seen to be too strong an inclination towards Labour philosophies to attract cross-party interest (Hart, 1993).

There has been more recent discussion on the relationship between transport and QoL (Steg and Gifford, 2005). QoL studies have also examined the impacts of transport pricing and transport policy (de Groot and Steg, 2006a; de Groot and Steg, 2006b). Respondents were asked to rate the effects of the policy on 22 QoL aspects (de Groot and Steg, 2006a). The QoL indicators were taken from previous work on the role of values in the field of household energy use (Poortinga et al., 2004). Despite this recent interest, TQoL still remains largely under researched and it is acknowledged that the methods used for assessing sustainable transport need to be further developed (Steg and Gifford, 2005).

This project will provide the methodology required to measure QoL on transport, in accordance with Ben-Akiva and Bonsall's recommendations:

I. Increase relevance – this will be achieved by researching one of the most important issues of transportation, passenger experiences of public transport.
II. Improving the interface – by making the process transparent so practitioners could be involved in the research process.
III. Strengthening credibility – through producing models that are attractive for decision makers and not over complex.
IV. Effective dissemination – ensuring the results are communicated to practitioners in non-technical language.

3.3 SELECTION OF INDICATORS

Quality of public transport can be measured in two ways, 'internal', which is quality based on hard performance targets and 'true', which relies on customer perceptions of the performance (Thompson and Schofield, 2007). These two separate forms of measurement can be combined together in one model of TQoL using objective and subjective indicators. Objective data provide internal quality and household surveys provide true measures of quality.

Selection of TQoL indicators is important because they represent the issues concerning an individual when they travel by public transport. If there are aspects not addressed TQoL will be not correctly understood. The indicators are selected from literature on sustainable transport indicator research due to the issues measured being very closely related to passengers' QoL. This review of sustainable transport indicator research will identify which sets of indicators are most applicable to the TQoL model.

The most appropriate method to select TQoL indicators would be to conduct a detailed research project to find out exactly what TQoL means to individuals. This is not possible within the timeframe and capabilities of the project as an in-depth qualitative research would require its own research study. The research is designed to test the capabilities of the method to appraise travel experiences. If this is successful it would then be appropriate to conduct a qualitative research study.

The review of sustainable indicators can be separated into three categories North-American government, European commission, and research papers. This field has developed quite rapidly over the past twenty years as government's are seeking to evaluate if their transport systems are becoming more sustainable. Sustainable transport is not simply about the environment as there are also economic aspects (e.g. the need for reinvestment in transport infrastructure) and social aspects (e.g. the need for equal accessibility) (Gudmundsson, 2001). Like QoL and TQoL, sustainable transport cannot be represented through a single measurement or assessment. It is a holistic concept involving a combination of a range of factors. This is why indicators can be useful to characterise TQoL to help the public policy decision-making process.

3.3.1 NORTH-AMERICAN GOVERNMENT

In the United States, the *Performance and Results Act* (GPRA), requires all major departments and agencies in the federal administration to define their goals, establish measurable indicators for those goals, and annually measure and report on performance in relation to the goals and indicators (OMB, 1993). The Department of Transportation (DOT) is one of the 24 departments required to publish indicators as part of their five year plans, annual performance plan and annual performance report (OMB, 2000).

The US DOT published its first strategic plan in 1997, followed by plans in 2000, 2003, and 2006. The strategic objectives are:

- *Safety:* To enhance public health and safety by working toward the elimination of transportation-related deaths and injuries.
- *Reduced Congestion:* Reduce congestion and other impediments to using the Nation's transportation system.
- *Global Connectivity:* Facilitate an international transportation system that promotes economic growth and development.
- *Environmental Stewardship:* Promote transportation solutions that enhance communities and protect the natural and built environment.
- *Security, Preparedness and Response:* Balance transportation security requirements with the safety, mobility and economic needs of the Nation and be prepared to respond to emergencies that affect the transportation sector
- *Organizational Excellence:* Advance the Department's ability to manage for results and achieve the goals of the President's Management Agenda. (U.S. Department of Transportation 2006)

For each strategic goal there are individual performance measures to assess whether the overall strategic aim is achieved. There are currently nine performance measures for Safety; 23 for Reduced Congestion; sixteen for Global Connectivity; six for Environmental Stewardship; nine for Security, Preparedness and Response; and five for Organizational Excellence. All measures are monitored through quantitative indicators.

Although this practice is regarded as important for being one of the first sustainable indicator applications, they do not reflect wider understandings of sustainability and the DOT does not regard sustainable transport as one of its main objectives. Performance measures are included in the department's policy because it is required by law and there is no genuine attempt to impose a sustainable transport agenda.

By contrast, the Canadian transport department's performance measures are more sustainable as they are produced without mandatory regulations. Transport Canada's (TC) sustainable development strategy provides transport performance indicators designed to meet the country's underlying goals of sustainable development. The strategy is structured around seven strategic challenges. Under each challenge there are specified commitments given by the government to meet the strategic challenges (Table 3.2). To meet the commitments quantitative and qualitative performance indicators are assessed. Most indicators refer to the actions TC needs to undertake in order to monitor the sustainability performance of transport. This ranges from the amount of new funding dedicated to climate change measures to use of the cost-benefit model.

The number of sustainable performance indictors is large which requires considerable time and resources to compile, quantify and analyse. With a total of 173 indicators, it is questionable whether the outcome actually contributes to understanding whether transport in Canada is (or has become) more sustainable. Despite this, detailed annual strategy progress reports are compiled each year to monitor sustainable development.

A number of issues should be raised by TC's strategy. It does not contain detailed examination of actual transport systems in operation. Although, there are commitments to reducing emissions from rail, air and marine transportation and promoting the use of cleaner vehicles, little reference is given to road transport. It is questionable to what extent sustainable development can be achieved when road transport remains the country's dominant mode. The indicators are qualitatively rich, with many projects carried out by various stakeholders and there is a grave risk of the performance planning and sustainability strategies remaining merely bureaucratic exercises (Gudmundsson, 2001).

Table 3.2 Transport Canada's sustainable transport commitments
Source: (Transport Canada 2004)

CHALLENGES	TC COMMITMENTS
1. Encourage Canadians to make more sustainable transportation choices	(1.1) Education and Communications on Sustainable Transportation Program (1.2) Promote active transportation options (1.3) Extend Green Commute program (1.4) Explore Use of Economic Measures
2. Enhance innovation and skills development	(2.1) Skills Development in the Transportation Sector (2.2) Climate change Impacts and Adaptation (2.3) Encourage Stimulating Adoption of E-Commerce Technology
3. Increase system efficiency And optimize modal choices.	(3.1) Intelligent Transportation systems (ITS) (3.2) Ensure Reasonable Access by Remote Communities to the National Transportation System (3.3) Monitor Climate Change Impacts and Adaptation (3.4) Invest in Transit and Sustainable Transportation Planning (3.5) Support Shortsea Shipping (3.6) Develop and Deploy Efficient Transportation Systems
4. Enhance efficiency of Vehicles, fuels and fuelling Infrastructure	(4.1) Implement Climate Change Commitments on Fuel Efficiency and Alternative Fuels (4.2) Reduce Air Emissions from Rail, Air and Marine Transportation (4.3) Promote Advanced Technology Vehicles (4.4) Promote Vehicle Emission Inspections (4.5) Research Motor Vehicle Speed Control for Safety and Sustainability (4.6) Support the development of Lightweight Materials and Low-Emission Vehicle Research
5. Improve performance of carriers and operators	(5.1) Promote Best Practices for Environmental Management in the Transport Sector (5.2) Develop new ICAO Standards (5.3) IMO Standards on Marine Pollution
6. Improve decision-making by governments and the transportation sector	(6.1) Transportation Data Initiative (6.2) Understand Economic, Social and Environmental Costs of Transport (6.3) Improve the Conduct of Strategic Environmental Assessments (6.4) Develop a Sustainable Transportation Lens
7. Improve management of and Transport Canada operations Lands	(7.1) Implement Transport Canada Environmental Management System (7.2) Implement Environmental Monitoring Program for National Airports System (NAS) (7.3) Churchill Airport Solar Wall/Supplemental Heating Trial (7.4) Prepare Pickering Green Space Lands plan (7.5): Modify Environmental Assessment (7.6) Conduct Natural Resource Inventories

3.3.2 EUROPEAN COMMISSION

The European Commission and the Organisation for Economic Cooperation and Development (OECD) have attempted to introduce sustainability indicators. In 2001, OECD commissioned a research programme to look at the environmental concerns of transport. This programme developed a set of Environmental Sustainable Transport (EST) guidelines to enable economic development and individual welfare without causing undue health and environmental impacts (OECD 2001). Six indicators were recommended to characterise wide-ranging health and environmental impacts from transport:

- **Climate change** - *CO2* – target to reduce carbon dioxide so that atmospheric concentrations are stabilised below their 1990 levels. The total emissions of *CO2* from transport should not exceed 20% to 50% of such emissions in 1990.
- **Regional air quality** - *NOX* and *VOC* – Total emissions of *NOX* and VOCs from transport should not exceed 10% of such emissions in 1990
- **Local air quality** – *Particulate matter (PM)* – Harmful ambient air levels are avoided by reducing emissions of fine particulates. Depending on local and regional conditions, this may entail a reduction of 55% to 99% of PM10 emissions from transport
- **Quietness** – (Noise) – Noise from transport no longer results in outdoor noise. Depending on local and regional conditions, this may entail a reduction of transport noise to no more than a maximum of 55 dB(A) during the day and 45 dB(A) at night and outdoors.
- **Land use/take criterion** - Land use and infrastructure for the movement, maintenance and storage of all transport vehicles is developed in such a way that local and regional objectives for air, water, eco-system and biodiversity protection are met. Compared to 1990 levels, this will likely entail the restoration and expansion of green spaces in built-up areas (OECD 2001).

The report specified that in order for these targets to be made the following EST guidelines should be accommodated in government policy:

Guideline 1. Develop a long-term vision of a desirable transport future
Guideline 2. Assess long-term transport trends, considering all aspects of transport
Guideline 3. Define health and environmental quality objectives

Guideline 4. Set quantified, sector-specific targets

Guideline 5. Identify strategies to achieve EST

Guideline 6. Assess the social and economic implications of the vision

Guideline 7. Construct packages of measures and instruments

Guideline 8. Develop an implementation plan

Guideline 9. Set provisions for monitoring implementation and for public reporting on the EST strategy

Guideline 10. Build broad support and co-operation for implementing EST

(OECD 2001)

More recently OECD has produced several different environmental indicators to correspond to a specific purpose and framework. The Core set of Environmental Indicators (CEI) are designed to track environmental progress and analyse environmental policies; Key Environmental Indicators (KEI) inform the public of the environmental progress; Sectoral Environmental Indicators (SEI) help integrate environmental concerns into sectoral policies; and Decoupling Environmental Indicators (DEI) monitor the progress towards sustainable development (OECD 2003). Transport is monitored through SEI because it is classified as a specific sector. The indicators are organised into a framework of: Sectoral trends and patterns of environmental significance; Interactions with the environment; and Economic and policy aspects.

The indicators are not restricted to environmental indicators per se but also concern linkages between the environment and the economy (OECD 2003). These cannot help member governments monitor sustainable development if there is no consideration of the social context. EST was set up to monitor sustainability of transport and the project did not provide a reputable format that could be adapted by individual countries. While the environmental indicators are a positive step in the right direction, they will not report progress towards sustainable development unless economic, environmental and social indicators are all included.

The European Commission's projects on sustainable transport are more useful than OECD. Two key projects have led to the introduction of sustainable transport indicators. The first was the Transport and Environmental Reporting Mechanism (TERM) programme, commissioned by the European Union and undertaken by the European Environmental Agency (EEA). TERM should enable policy-makers to gauge the process of their integration policies (European Environment Agency 2001). TERM's indicator system is designed to enable effective monitoring of transport and environment strategies. The indicators are based on seven qualitative policy objectives, each containing a number of performance measures (Table 3.3).

Policy makers of European Union members are encouraged to use TERM in their transport and environmental policies because it is reported that transport is becoming less rather than more environmentally sustainable (EEA, 2001).

Decisions to integrate are reserved for individual countries. Herein lies the problem - the document is not statutorily binding on policy makers. It is a useful application for monitoring environmental sustainability of transport but is (as most EU documents are) merely rhetoric that does not translate into action. In the UK, implementation of TERM has not occurred. The indicators intrinsic sustainability can also be questioned for a primary focus on environmental factors and limited inclusion of social factors.

The European Commission followed up this programme with the *Sustainable Mobility Measures and Assessment* (*SUMMA*) project. This was initiated following the White Paper for transport that highlighted the need to achieve *"… a modern transport system which is sustainable from an economic and social as well as an environmental viewpoint"* (European Commission 2001). To achieve this goal, SUMMA identified four primary objectives:

- To define and operationalise sustainable mobility and transport.
- To develop a system of indicators for monitoring sustainable transport and mobility.
- To assess the scale and scope of the problems of sustainability in the transport sector.

Table 3.3 - TERM INDICATORS

Source: (European Environment Agency 2001)

GROUP	INDICATORS	
TRANSPORT & ENVIRONMENT PERFORMANCE		
Environmental consequences of Transport	Transport final energy consumption and primary energy consumption and share in total (fossil, nuclear, renewable) by mode.	
	Transport emissions and share in total emissions for CO2, Ox, NM, VOCs, PM10, SOx, by mode.	
	Exceedances of air quality objectives.	
	Exposure to and annoyance by traffic noise.	
	Infrastructure influence on ecosystems and habitats (“fragmentation”) and proximity of transport infrastructure to designated sites.	
	Land take by transport infrastructures.	
	Number of transport accidents, fatalities, injured, polluting accidents (land, air and maritime).	
Transport volume & Intensity	Passenger transport (by mode and purpose): total passengers total passenger-kilometers passenger-kilometers per capita passenger-kilometers per GDP	Freight transport (by mode and group of goods): total tonnes total tonne-kilometers tonne-kilometers per capita tonne-kilometers per GDP
DETERMINANTS OF TRANSPORT/ENVIRONMENT SYSTEM		
Spatial planning and Accessibility	Average passenger journey time and length per mode, purpose (commuting, shopping, leisure) and territory (urban/rural).	
	Access to transport services e.g.: motor vehicles per household, portion of households located within 500m of public transport.	
	portion of households located	
Transport supply	Capacity of transport infrastructure networks, by mode and by type of infrastructure (e.g. motorway, national road, municipal road etc.).	
	Investments in transport infrastructure/capita & by mode.	
Price signals	Real passenger & freight transport price by mode.	
	Fuel price.	
	Taxes.	
	Subsidies.	
	Expenditure for personal mobility per person by income group.	
	Proportion of infrastructure & environmental costs (including congestion costs) covered by price.	
Technology & Utilization efficiency	Energy efficiency for passenger & freight transport (per pass-km and per tonne-km and by mode).	
	Emissions per pass-km & emissions per tonne-km for CO2, NOx, NM, VOCs, PM10, SOx by mode.	
	Occupancy rates of passenger vehicles.	
	Load factors for road freight transport (LDV, HDV).	
	Uptake of cleaner (unleaded petrol, electric, alternative fuels) & alternative fuelled vehicles.	
	Vehicle fleet size & average age.	
Management Integration	Proportion of vehicle fleet meeting certain air & noise emission standards (by mode).	
	Number of Member States that implement an integrated transport strategy.	
	Number of Member States with national transport & environment monitoring system.	
	Uptake of strategic environmental assessment in the transport sector.	
	Uptake of environmental management systems by transport companies.	
	Public awareness & behaviour.	

- To assess policy measures in the transport White Paper, as well as policy measures that can be used to promote sustainable transport and mobility in regions and cities. (Rahman and van Grol, 2005)

Following a lengthy investigation, the project presented a long list of indicators for sustainable transport and mobility. These were separated into the three sustainable development categories and each objective is monitored by quantitative measures. These indicators are the missing link in sustainable transport literature that can be used to monitor the social, economic and environmental conditions of transport. Despite this, as with TERM, the key problem is effective implementation. SUMMA is designed to be used by EU member states but it is not compulsory. This means that what is a consistent framework for policymakers to monitor sustainable development may never be used.

3.3.3 RESEARCH PAPERS

Several organisations have produced more advanced sustainable transport indicators. The (Canadian) Centre for Sustainable Transportation's (CST) Sustainable Transportation Performance Indicators (STPI) project was to provide a means of assessing the progress of sustainable transportation in Canada. This scheme is similar to TERM. The framework developed broad topic areas that are measured by seven topics (Gilbert et al., 2002). These topics are measured by 14 STPIs – each has between one and four secondary indicators. To meet each of the STPIs short and long term improvements are recommended.

STPI is a framework that can monitor sustainable transport. The only concern is the lack of recognition of social factors. Sustainable development is supposed to meet the needs of the current and future generations and is only possible when there is a holistic focus including environmental, economic and social factors. With little social framework, monitoring sustainable transport will be ineffective.

Table 3.4 LYON SUSTAINABLE MOBILITY INDICATORS

Source: (Nicolas et al., 2003)

DIMENSION OF SUSTAINABILITY	INDICATOR	LEVEL OF ANALYSIS
MOBILITY		
Service provided	Daily number of trips Trip purposes Average daily travel time	Overall and by geographic Location
Organization of urban Mobility	Mode split Daily average distance travelled Average travel speed	Overall and by travel mode
ECONOMIC		
Cost for the community	Annual transportation costs (total, per resident and per passenger-km) • Households • Businesses • Local government	Overall and per mode
SOCIAL		
	Household vehicle ownership Personal travel distance Household transportation expenditures (total and as a portion of income)	Overall, by income and geographic location
ENVIRONMENTAL		
Air pollution - global	Annual energy consumption and CO_2 emissions (total and per resident)	Overall, by mode, by location of emission, and location of resident.
Air pollution - local	CO, NO_x, hydrocarbons and particulates(total and per resident)	Overall, by mode, by location of emission, and location of resident.
Space consumption	Daily individual consumption of public space for transport and parking. Space required for transport infrastructure.	Overall, by mode and place of residence.
Other	Noise Accident risk	Overall, by mode and place of residence.

Recent research conducted in Lyon is the most advanced sustainable approach to transport indicators in the urban setting (Nicolas et al., 2003). The objective of the study was to closely analyse the factors related to the sustainability of an urban travel system. The research devised an analytical indictor technique based on understanding mobility phenomena and their economic, environmental and social impacts (Table 3.4).

Nicolas et al. were able to measure sustainable development on transport. The number of indicators is small – indicators were selected because they are readily available through the household survey. Using a small number of factors because they are convenient or available rather than being the most appropriate can devalue the project especially compared to the large sets included in the SUMMA and STPI projects. Nonetheless, it is important to consider practical considerations, such as data availability and research capabilities, when evaluating a research project.

The Victoria Transport Policy Institute have recently developed indicators for comprehensive and sustainable transport planning (Litman, 2005). The paper provided guidance on the selection of indicators that can be used to measure sustainable transport. The project also presented more detailed examples of economic, social and environmental indicators that can monitor sustainable transportation (Table 3.5). The recommended set of indicators is very comprehensive, containing all the important issues that concern sustainable transport. Data collection for these indicators would require a combination of objective and subjective measures. As these are the most inclusive indicators that are applicable to QoL principles this will be the main source for the TQoL indicators.

Increased attention by governments recognising a sustainable transport agenda, highlights the importance of research in this area. The difficulty of developing sustainable indicators is that their introduction will merely serve to confirm no movement towards sustainable development. Underlying all the rhetoric is the suspicion that sustainable development is not really the focus of policy, but a 'side show' (Banister, 2002). This is because all governments in the world value growth over everything else, especially economic growth. Social welfare is considered to be of next importance, followed by the environmental issues. Banister argues that unless this balance is redressed sustainable development is impossible.

Despite this acknowledgment, the review of sustainable transport indicators highlights two key points. First, is that sustainable transport indicators are the closest mechanism to TQoL indicators. Second, is the close link between sustainable development and QoL. The most recent QoL research in the social sciences is based on sustainable development principles, where indicators are constructed on economic, environmental and social dimensions.

Table 3.5 – INDICATORS OF SUSTAINABLE TRANSPORTATION

Source: (Litman, 2005)

Indicator	Description
ECONOMIC INDICATORS OF SUSTAINABLE TRANSPORTATION	
User rating	Overall satisfaction rating of transport system by users.
Commute Time	Average door-to-door commute travel time.
Employment Accessibility	Number of job opportunities and commercial services within 30- minute travel distance of residents.
Land Use Mix	Average number of basic services (schools, shops and government offices) within walking distance of homes.
Vehicle Travel	Per capita motor vehicle-mileage, particularly in urban-peak conditions.
Transport diversity	Variety and quality of transport options available in a community
Mode Split	Portion of travel made by non-automobile modes: walking, cycling, rideshare, public transit and telework.
Congestion delay	Per capita traffic congestion delay.
Travel costs	Portion of household expenditures devoted to transport.
Transport cost efficiency	Transportation costs as a portion of total economic activity, and per unit of GDP
Cost Efficiency	Portion of road and parking costs borne directly by users.
Freight efficiency	Speed and affordability of freight and commercial transport.
Delivery services	Quantity and quality of delivery services (international/intercity courier, and stores that offer delivery).
Commercial Transport	Quality of transport services for commercial users (businesses, public agencies, tourists, convention attendees).
Crash costs	Per capita crash costs
Mobility management	Implementation of mobility management programs to address problems and increase transport system efficiency.
Pricing reforms	Implementation of pricing reforms such as congestion pricing, Parking Cash Out, tax reforms, etc.
Land use planning	Applies smart growth land use planning practices, resulting in more accessible, multi-modal communities
SOCIAL INDICATORS OF SUSTAINABLE TRANSPORTATION	
User rating	Overall satisfaction of transport system by disadvantaged users.
Safety	Per capita crash disabilities and fatalities.
Fitness	Portion of population that regularly walks and cycles.
Community livability	Degree to which transport activities support community livability objectives (local environmental quality).
Non-drivers	Quality of transport services and access for non-drivers.
Affordability	Portion of budgets spent on transport by lower income households.
Disabilities	Quality of transport facilities and services for disabled people.
NMT transport	Quality of walking and cycling conditions.
Children's Travel	Portion of children's travel to school and other local destinations by walking and cycling.
Inclusive Planning	Substantial involvement of affected people, with special efforts to insure that disadvantaged and vulnerable groups are involved
ENVIRONMENTAL INDICATORS OF SUSTAINABLE TRANSPORTATION	
Climate change emissions	Per capita fossil fuel consumption, and emissions of CO2 and other climate change emissions.
Other air pollution	Per capita emissions of "conventional" air pollutants (CO, VOC, NOx, particulates, etc.)
Air pollution	Frequency of air pollution standard violations.
Noise pollution	Portion of population exposed to high levels of traffic noise.
Water pollution	Per capita vehicle fluid losses.
Land use impacts	Per capita land devoted to transportation facilities.
Habitat protection	Preservation of high-quality wildlife habitat (wetlands, old-growth forests, etc.)

The difference between sustainable transport indicator research and QoL research is that sustainable transport assessment has largely been conducted as theoretical evaluation that is not incorporated into public policy. QoL, however, is an important means of understanding how people's lives are affected and can lead to more positive policy outcomes. This thesis will show how the indicators developed in sustainable transport research can be applied to appraise TQoL as part of a new transport appraisal technique.

3.3.4 TRANSPORT QUALITY OF LIFE INDICATORS

> *"Methods need to be developed to measure quality of life, social impacts, and the environmental-ecological costs of transport. This change in societal priorities should mark a move away from the necessity to quantify everything and to ignore or devalue those factors which cannot be quantified."* (Banister, 2002)

In recognition of Banister's comment, and consideration of projects conducted previously, an opportunity exists to combine transport research with QoL research in the TQoL model. This can benefit both fields - by advancing the methodology of QoL and by developing a new technique for transport policy makers.

As previously discussed, the indicators assessing TQoL are adapted from the literature on sustainable transport indicators, the majority of the indicators in the model are adapted from Litman's sustainable transport indictors. This is primarily due to project limitations, which prevent a comprehensive project on the meaning of TQoL. The validity of the indicators will however be tested in the initial appraisal. This will thoroughly evaluate whether all the indicators are necessary and will detect whether there are any other issues not covered. The indicators are organised by the three dimensions of sustainable development. This is done for two reasons. The first is due to the clear link with sustainable development and QoL. Both concepts measure similar issues, designed to understand citizen's experience. The second is that this is the method used by Rogerson et al. in their studies of QoL and Littman's indicators of sustainable transportation (Table 3.5). The three groups of TQoL indicators are supplemented by personal indicators, which are intended to generate a deeper understanding of TQoL. At the heart of sustainable transport, this group of indicators fits into a new sphere of sustainable development as these specific indicators are designed to measure more accurately passenger experience (Figure 3.2). In the process of developing the TQoL model, the indicators are designed to measure journey experience rather than sustainable transportation because this will benefit transport appraisal. Littman's indicators of sustainable transportation would not contribute to this as they only provide a database of objective data, whereas the TQoL model will provide an objective and subjective understanding of passenger experience.

Figure 3.2 presents the headline indicators of the TQoL model mark I that will measure concerns facing passengers when travelling by public transport. There are 24 headline indicators assessed through 43 measures. More detail on each indicator is shown in Table 3.6. While there could have been an ever-lasting list of indicators to assess TQoL, this would have defeated the purpose of providing an accessible model that is easily understood. The indicators are a combination of objective and subjective measures because in order to obtain a proper understanding of the quality of urban life space we must consider both the city on the ground and the city in the mind (Pacione, 2003). It is also still regarded as the most appropriate approach in QoL research. To the best of the author's knowledge, this is the first investigation of TQoL and therefore it is correct to include objective data as well as the experience from the passenger.

Diener and Suh (1997) maintain that disadvantages exist with both objective and subjective measures of QoL. Objective indicators are relatively easy to define, collect and compare, and also represent issues of society that are not easily obtained through subjective measures. The weaknesses of these measures are that they can misrepresent the true fact through underreporting or missing datum. There is also uncertainty over correct definition of terms, collection of data, and if the measure will actually represent what is important to public transport passengers.

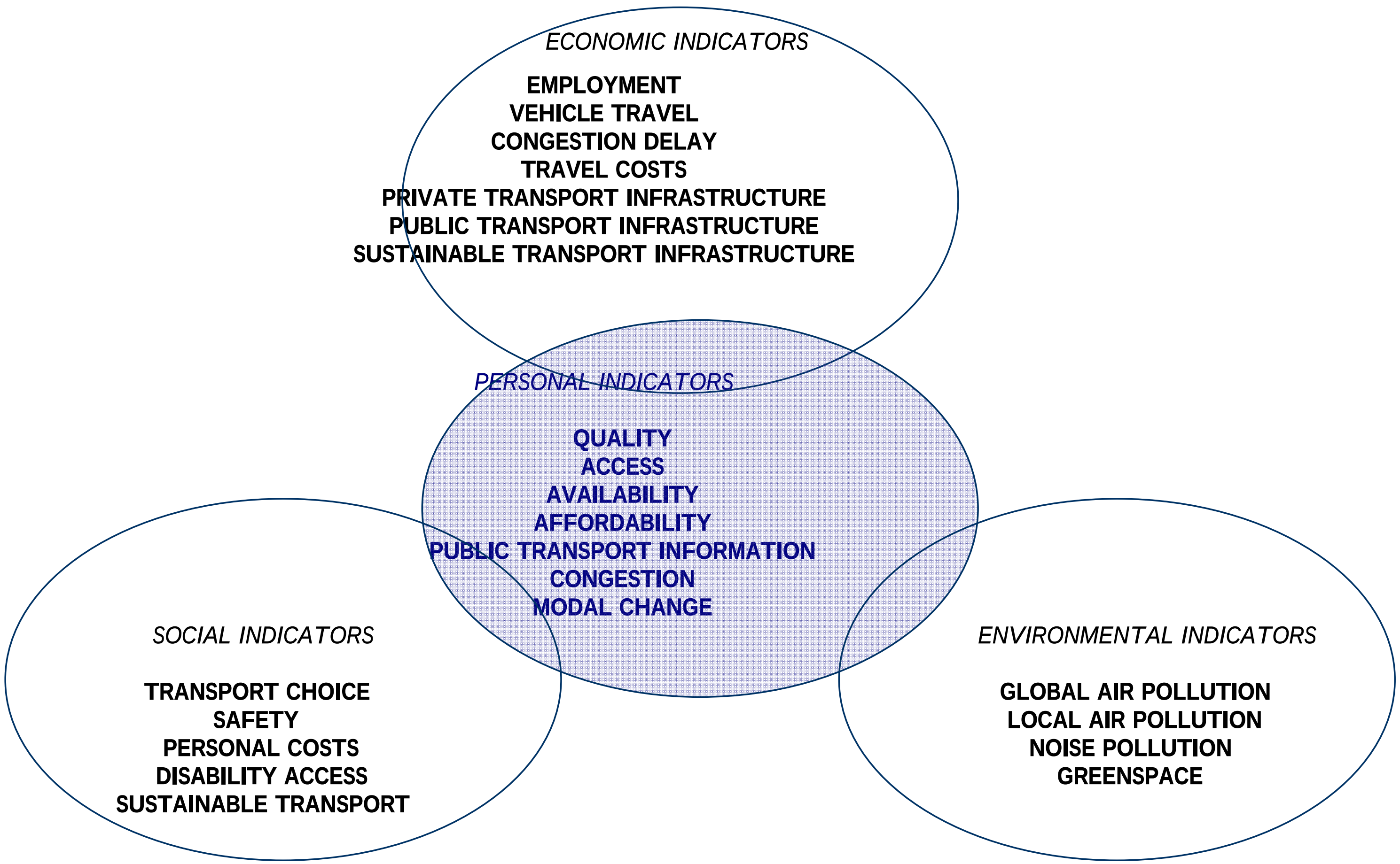

Figure 3.2 Sustainable development principles of the indicators in the TQoL Model Mark I

Table 3.6 – INDICATORS FOR TQoL MODEL MARK I

HEADLINE INDICATOR	INDICATOR DESCRIPTION	INDICATOR MEASURE	ACTION	SOURCE

ECONOMIC INDICATORS OF TRANSPORT QUALITY OF LIFE				
EMPLOYMENT	EC1: Number of job opportunities within 30 minute travel distance of residents	Rating of 1(worse) to 5 (best) for number of job opportunities from isochrones	PO	Littman (2(
VEHICLE TRAVEL	EC2: Time taken to travel for most common journey	Taken from second household survey – respondents choosing from time categories	S	Littman (2(
CONGESTION	EC3: Traffic levels	Using data from DFT - Million vehicle kilometres	D	Common us Measure
TRAVEL COSTS	EC4: Increase in fares for bus, train, and metro	Retail prices index 1987=100 – from DfT Transport Statistics	D	Littman (2(
PRIVATE TRANSPORT INFRASTRUCTURE	EC5: Annual expenditures on roads and parking services	£000	D	Littman (2(
PUBLIC TRANSPORT INFRASTRUCTURE	EC6: Annual expenditure on rail, bus and all metro systems	£000	D	Adapted fr Littman (2(
SUSTAINABLE TRANSPORT INFRASTRUCTURE	EC7: Annual expenditure on encouraging sustainable transit including cycle routes/lanes and walking provision	£000	D	Adapted fr Littman (2(
SOCIAL INDICATORS OF TRANSPORT QUALITY OF LIFE				
HEADLINE INDICATOR	**INDICATOR DESCRIPTION**	**INDICATOR MEASURE**	**ACTION**	**SOURCE**
TRANSPORT CHOICE	SO1: Number of different transport modal options within local area	Participant Observation - Rate the number of transport options - 1(low) to 5(High)	PO	Littman (2(
	SO2: Percentage of Households without a car	Data taken at ward level fro census data and standardized using national average	D	Common us Measure
SAFETY	SO3: Number of crash fatalities	Data taken from DFT and Scot exec. at city level - Using All KSI	D	Littman (2(
	SO4: Level of safety on public transport	Taken from second household survey - rated 1(v. unsafe) to 5(v.safe)	S	New
	SO5: Level of safety in private transport	Taken from second household survey - rated 1(v. unsafe) to 5(v.safe)	S	New
SUSTAINABLE TRANSPORT	SO6: Quality of transport services and access for non-drivers	Taken from second household survey - rated 1(v. poor quality) to 5(v.good quality)	S	Littman (2(
	SO7: Proportion of travel made by non-automobile modes: walking, cycling, car-sharing, and public transit	Data taken at city level - From Scot Exec. and Manchester city council – Percentage	D	Adapted fr Littman (2(

	SO8: Quality of walking and cycling conditions	Participant Observation - Rate the quality of walking and cycling condition in the transport corridor - 1(v.poor) to 5(v.good)	PO	New
	SO9: Proportion of population that regularly walks and cycles	Percentage of population that regularly walks at city level - taken from Scot Exec. and Manchester city council compared to UK average - 1(low) to 5(high)	PO/D	New
PERSONAL COSTS	SO10: Percentage of household budget income spent on transport	Taken from Family Spending – ONS	D	Common us Measure
DISABILITY ACCESS	SO11: Quality of transport facilities and services for disabled people	Participant Observation - Rate the quality of the services for disabled members of society in transport corridor - 1(v.poor) to 5(v.good)	PO	Littman (2(
	SO12: Proportion of rail stations which are fully accessible to wheelchair users	Participant Observation - rate the number of train stations in the transport corridor that are accessible by wheelchair - 1(low) to 5(high)	PO	Common us measure
	SO13: Proportion of buses which are fully accessible to less able members of society	Participant Observation - rate the number buses serving the transport corridor that are accessible by wheelchair - 1(low) to 5(high)	PO	Common us measure
ENVIRONMENTAL INDICATORS OF TRANSPORT QUALITY OF LIFE				
HEADLINE INDICATOR	**INDICATOR DESCRIPTION**	**INDICATOR MEASURE**	**ACTION**	**SOURCE**
GLOBAL AIR POLLUTION	EN1: CO2 emissions (calculated per resident)	Data taken from DEFRA (2004) figures for CO2 emissions by local authority - calculated per resident - Road transport per capita CO2 (tones)	D	Littman (2(
LOCAL AIR POLLUTION	EN2: Level of “conventional” air pollutants CO, NOx and PM_{10}	Data taken from National Atmospheric Emissions Inventory by local authority - Sum of each pollutant per resident – CO	D	Littman (2(
		NOx	D	
		PM10	D	
NOISE POLLUTION	EN3: Basic Noise Level in decibels for corridor area	Data collected from English and Scottish noise maps on road and rail pollution	D	New
GREENSPACE	EN4: Average size of road-less green areas within 500metres of household	Participant observation calculating the number of green areas within 500 metres from the isochrones - 1(None) to 5(A lot)	PO	UK Quality life counts (2004)
PERSONAL INDICATORS OF TRANSPORT QUALITY OF LIFE				
HEADLINE INDICATOR	**INDICATOR MEASURE**	**METHOD**		**SOURCE**

QUALITY	P1: Quality of the public transport service	Taken from the Second Household survey - with respondents rating the quality of their public transport service - 1(v.poor) to 5(v.good)	S	Common u measure
	P2: Satisfaction of public travel	Taken from the Second Household survey - respondents rating how satisfied they are with public transport - 1(v.unsatisfied) to 5(v.satisfied)	S	Common u measure
ACCESS	P3: Proportion of households within 400 m of a bus stop	Using data from private bus companies to calculate the number of households in isochrones within 400m from bus stop - 1(None) to 5(A lot)	D	Common us measure
	P4: Proportion of households within 800 m of a railway station	Using data from rail companies to calculate the number of households in isochrones within 800m from train station - 1(None) to 5(A lot)	D	Common us measure
	P5: Proportion of households within 800 m of a LRT/Subway station	Using data from rail companies to calculate the number of households in isochrones within 800m from LRT/Subway station - 1(None) to 5(A lot)	D	Common us measure
	P6: Number of major service facilities (including hospital, doctor surgeries, shopping centres and recreation amenities) within the isochrones and direct-link of local bus stop or rail/metro station	Using map from transportdirect rate the number 1(None) to 5(A lot)	D	Common us measure
AVAILABILITY	P7: Number of transport services operating every hour	Using data from bus, train and metro companies rate the number of transport services in the transport corridor - 1(low) to 5(high)	D	Common us Measure
	P8: Average journey time relative to automobile transit	Taken from the second household survey asking respondents to rate how much longer travel to work/study is by public transport - in time intervals	S	EU TERM (2002)
AFFORDABILITY	P9: Average cost of travel	Taken from the second household survey - asking respondents how much on average they spend on transport per week - £ brackets	S	Common us Measure
	P10: Willingness to pay extra for improved public transport service	Taken from the second household survey - asking respondents how much on they would be willing to pay extra for improved public transport - £ brackets	S	New
PUBLIC TRANSPORT INFORMATION	P11: Number of stops with all relevant transport timetables and information	Participant observation - find out how many of the transport stops have the relevant information - rate 1(none) to 5(all)	PO	New
CONGESTION DELAY	P12: Average time added on to journey	Taken from the second household survey - asking respondents how much longer they feel congestion adds to their journey - rated 1(a lot) to 5(none)	S	New

	P13: Belief that P.T is to blame for congestion	Taken from the second household survey - asking respondents if they agree public transport is to blame for congestion - 1(Strongly Disagree) to 5(Strongly Agree)	S	New
	P14: Belief that Car Traffic is to blame for congestion	Taken from the second household survey - asking respondents if they agree car traffic is to blame for congestion - 1(Strongly Disagree) to 5(Strongly Agree)	S	New
MODAL CHANGE	P15: Desire to travel by car	Taken from the second household survey - asking respondents if they wish to travel by or more car	S	New

The advantage of using subjective indicators is that it will measure individual's experience. Respondents will be able to make their own judgements on what is important to their QoL. This assessment is not attainable through objective indicators. The disadvantage of subjective measurement is that it is impossible to ensure the evidence given is reliable and reflective of all passengers. The data may also not fully represent TQoL because there may be some dependent or independent issues that could affect a passenger's experience.

There are strengths and weaknesses in both forms of indicators and whilst this may make them unworkable together it clear that these measures are methodologically and conceptually complementary (Diener and Suh, 1997). They need to be used in unison to understand human QoL, and to make informed policy decisions. QoL is a complex, multifaceted construct that requires multiple approaches from different theoretical angles. For this reason it is important to use both objective and subjective indicators to understand TQoL.

The most effective method to decide which indicators should be used to assess TQoL is to ensure that they meet the SMART objectives. In the following section each indicator will be defined in terms of the following criteria:

- **S**pecific
- **M**easurable
- **A**chievable
- **R**elevant, and,
- **T**ime-bound

Economic Indicators of TQoL

The current economic climate highlights just how vital the economy is for the development of a nation. Whilst this is an important factor there should be a more balanced approach with social and economic consideration. There are seven economic indicators that are important to TQoL. Each is described by the SMART objectives:

- **S**pecific to the economic condition;
- **M**easurable through secondary data, participant observation and the household survey;
- **A**chievable within the constraints of this research project;
- **R**elevant to the economic condition of passenger journey quality and;
- **T**ime-bound to the day the assessment of TQoL is conducted.

These headline indicators are adapted from Litman's (2005) economic sustainable transportation indicators because they are relevant to issues that can affect an individual's QoL on public transport.

Employment was measured by the number of job opportunities within a 30 minute travel distance from the residence (EC1). This is specific to the economic condition of TQoL because employment is a major part of most people's livelihood. It is measured by visiting the transport corridor and travelling by public transport to locations with major employment opportunities to assess on a scale from 1 to 5 the opportunity. Initially it was thought that data from jobcentres could be used for this indicator, however this was not available. To complete this participant observation may take some time but is easily achievable within the project. Not having good access to employment could be perceived as a major negative influence on a passenger's TQoL. The measure was time-bound by the date that the research is conducted. Participant observation will be conducted at different times of the day to gather experience for peak and off peak commuters.

Vehicle Travel (EC2) is specific to the economic condition of TQoL because the time taken to travel can have a major impact on QoL. If it takes someone over an hour to travel to the shops or work, then this could severely affect their experience of public transport. This indicator was measured in the second household survey, with respondents asked to select the time it takes for their most common journey. This task is achievable by respondents answering the questionnaire and is dependent on the individual's own journey, at that specific time. These values were standardised through the collection of multiple surveys. Consideration was made when the research is conduced so that no external factors could affect the results.

Congestion is a headline economic indicator for being one of the most important issues in transport. Almost all passengers are affected by congestion on the road. It is a problem that has specific economic effects on TQoL that can cause a loss of time. This indicator was measured by objective data on traffic levels in each city (EC3). This is achievable through the DfT's data produced on road traffic. This indicator is relevant, because as discussed, congestion can have a positive and negative effect on TQoL. The only concern is the timing of the data because it will be for the previous year.

Travel Costs (EC4) are specific to economic TQoL as this concerns the increase of fares of public transport. The cost to travel can have a major impact upon journey experience. This was measured using secondary data from the retail prices index published by DfT. This data is the only available that can be used to measure changes in travel costs. It was converted into the same values gathered from the household survey. The only minor issue is that the scale covers the whole of the UK. Although a more suited format would be data from individual cities, this data is not available. The indicator is relevant to the examination of TQoL because increases in fares can have a negative influence on QoL.

Transport infrastructure indicators (EC5, EC6 and EC7) represent the influence of investment in transport on TQoL. While these measures are not directly influential on the experience, investment can indirectly affect TQoL. Each indicator is specific to the economic condition of TQoL because they contain the annual expenditure on roads and parking services, public transport systems and cycle and walking provision. The indicators were measured using secondary data on local council's expenditure. This data is standardised to the same scale as the household surveys. Collection of the data is achievable by examining local transport expenditure plans. The influence of investment in transport must be included as it can lead to better or worse travel conditions. Investment on roads or cycle lanes could remove spending on public transport infrastructure, or decreasing investment in roads could impact bus travel. The data is time-bound by the latest local authority public accounts. A more effective way to understand these measures would be to find out exactly how much has been spent on public, private and sustainable transport infrastructure in the transport corridor. This data however is not accessible. It is also very important to make sure the indicators used provide a genuine representation of TQoL within the constraints of this project.

Social Indicators of TQoL

Social indicators represent issues affecting the social condition of public transport passengers. These are equally important as economic, environmental and personal indicators. There is no preferential treatment for one group of indicators over another and there are more social indicators only due to more social concerns. The data for these indicators was collected from secondary sources, participant observation and the second household survey. Fourteen indicators measured the five headline indicators according to the following guidelines:

- **S**pecific measures of social condition and TQoL;
- **M**easurable through secondary data, participant observation and the household survey;
- **A**chievable within the constraints of this research project;
- **R**elevant to the social aspects of passenger journey quality and;
- **T**ime-bound to the day of TQoL assessment.

Transport Choice (SO1, SO2) is one of the most important issues of TQoL. Residents with more transport options available will encounter a better QoL. For this indicator to be specific there needs to be two measures. Using only one would not give a true representation of choice. SO1 was measured by visiting the transport corridor and rating the number of transport options on a scale of 1 to 5. This was achievable, but took some time to assess. The indicator is relevant for highlighting how much choice there is within the corridor. It will be time-bound by the date of research. SO2 provides a specific measure of transport choice by revealing how many households have access to a car. If there are a high percentage of households without a car - diversity must be good. It was measured by taking the data for the transport corridor and standardising it against the UK national average. The only concern is the timeframe of the data, as it is from the 2001 census, which will be out of data at the time of assessment. Therefore consideration was needed when interpreting the output.

Safety is one of the greatest influences on individual travel experience. There are three measures for safety (SO3, SO4, SO5) to obtain the number of crash fatalities and perceived level of safety. Gathering this data was achievable through governmental transport statistics and the second household survey. These indicators are relevant to the social aspects of passenger quality because they all contribute to safety. Rather than including one quantitative measure, the subjective feeling of safety adds validity to the indicator. Data collected will be time-bound by the date recorded.

Sustainable Transport is now an important component of transport assessment. Whilst it may not be directly influential on TQoL these indicators are vital to measure the condition of travel without the car. These indicators measure the quality of transport services for non-drivers (SO6), the proportion of travel made by non-automobile modes (SO7), the quality of walking and cycling conditions (SO8) and the proportion of the population that regularly walks and cycles (SO9). They were measured through a combination of the household survey data, secondary data and participant observation. All indicators provide an accurate description of sustainable transport. The data was from different time ranges, which was noted in the interpretation of sustainable transport.

Personal Costs are very important to TQoL. This indicator is different to EC4 because it relates to the social cost of transport, whereas the economic indicator conveys the change in travel costs. The measure is the percentage of household budget spent on transport (SO10), which is gathered from secondary data on family spending. This indicator directly relates to P9. SO10 is the objective representation of social costs and the personal indicator reveals the actual cost to passengers. Data is accessed from the Office of National Statistics (ONS). The indicator available measures average family spending on transport to indicate the social cost of transport. Data was time-bound by the year that it is published which is different from the household survey, and consideration again will be made in the interpretation.

The final social headline indicator is **Disability Access**. This may not be specific to social TQoL for most people because they do not encounter any problem. For passengers registered disabled travel can be very difficult. TQoL therefore needs to measure this issue through the quality of transport facilities for disabled people (SO11), the proportion of rail stations that are fully accessible to wheelchair users (SO12) and the proportion of buses that are fully accessible to wheelchair users (SO13). Whilst these indicators only measured the condition for passengers with identified disabilities it also presents the accessibility for a wider range of people. The indicators are assessed through participant observation. The corridor sites were visited and given a rating for the provision provided. Each indicator has relevance towards appraising the disability provision and the social condition of TQoL.

Environmental Indicators of TQoL

The environmental indicators are important as the environment can have a major effect on QoL. Pollution from transport cannot only affect journey quality but individual health. The four headline indicators are standard measures used by local authorities and governments to monitor environmental performance. These are objective and taken from secondary sources. These indicators will meet the SMART goals:

- **S**pecific to the environmental problem;
- **M**easurable through secondary data, and participant observation;
- **A**chievable within the constraints of this research project;
- **R**elevant to the environmental condition and how it affects individual TQoL and;

- **T**ime-bound to the day the assessment of TQoL is conducted.

Air and noise pollution is the main factor that can affect environmental TQoL. Air pollution is measured through two separate headline indicators. The first assesses *Global Air Pollution,* through CO2 emissions per resident (EN1). This can influence QoL because CO2 can lead to changes in climatic conditions. Data was taken from emission figures for the local authority. This data is accessible to the public on DEFRA's website. The indicator is relevant to TQoL for representing the environmental problem each passenger faces. The data is published for 2004, so the figures are not as up-to-date as they should be, but there are no other sources available.

In addition to global air pollution, *Local Air Pollution* is a concern for QoL. The difference between the two indicators is that EN1 represents the wider damage caused to climate change and EN2 relates to damaging effects on health. Three pollutants that are commonly used are measured: Carbon Monoxide (CO), which can affect people with heart disease and the nervous system; Nitrogen Oxides (NOx), which can cause respiratory problems and; Particular Matter (PM10), which can lead to decreased lung function, aggravated asthma, and heart problems (DEFRA 2002a). Data for the indicators is gathered from the national atmospheric emissions inventory. It is calculated per resident in the corridor (EN2). The combination of local air pollutants is relevant to TQoL, because it indicates possible health problems each individual face when they travel. The indicators are time-bound by the data production.

Noise Pollution from traffic and railways can affect QoL. It can disturb our health and behaviour through stress and lack of sleep. Resident's experience of noise pollution is assessed by the government recommended level (EN3). There are currently no enforced limits of noise from transport in the UK so there is no way to make sure the noise pollution is above the UK average. It is possible to measure the level of noise from road and rail sources using strategic noise maps. The maps were produced in Lden and Lnight for each household that returns the second household survey. This data will be averaged for the corridor. The maps are presented on the DEFRA and Scottish government websites. This indicator is relevant to assessment of TQoL because it shows how noise affects QoL for each passenger.

The final indicator of environmental quality is *Greenspace*. Although this may not appear to be a major contributor to TQoL, if you live in an area where road-space is dominant then it can be important. It is specific to the environmental problem because residing in a location with no parkland can have negative impact on your QoL. It was measured by visiting the corridor and observing the green areas within 500 metres from all households returning the survey (EN4). This indicator was adapted for being relevant to how individuals feel when they travel by public transport (DEFRA 2004). If roads surround them, this can have a negative impact. The results are time-bound from when assessment is made.

Personal Indicators of TQoL

Personal indicators are designed to provide a deeper understanding of individual's journey experience. They are placed in the centre of the sustainable development diagram as each indicator incorporate aspects of economic, social and environmental condition. These are the most influential mobility issues affecting individual TQoL and therefore include more measures. They will also be SMART in their application:

- **S**pecific to the personal mobility experience of passengers;
- **M**easurable through the household survey, secondary data and participant observation;
- **A**chievable within the constraints of this research project;
- **R**elevant to the condition of passenger journey quality and;
- **T**ime-bound to the day that assessment of TQoL is conducted.

Quality is a main contributor to personal TQoL. There needs to be some level of quality for the individual to use that mode of transport. It was measured by two subjective questions in the second household survey - How they rate the quality of the service (P1) and; How satisfied they are with the service (P2).

The indicator is very relevant to TQoL for providing the quality, of QoL. The level is time-bound by the date of collection.

Access is another key component to a successful TQoL. To experience good journey quality, there must be good access to public transport services. It was measurable through four secondary data measures: the number of households within 400m from the bus stop (P3), 800m to the train station (P4), 800m from the LRT station (P5) and the number of major service facilities within the corridor (P6). The data was transformed into a scale from 1 to 5 by a simple equation. The distance of 400m from a bus a bus stop is used because this represents a comfortable walk for most people under normal conditions (Murray et al., 1998). The distance from train and LRT stations is also applied as it is the standard value for examining rail service (Smith and Taylor, 1994). Data was collected from transport operators and Internet resource websites. They can be gathered to provide an accurate assessment of access within each transport corridor. To understand about access it is necessary to know how many households are close to bus, rail and LRT interchanges and how easy it is for people to get to the hospital, shopping centres and recreation amenities.

Availability is part of the personal mobility experience as often inadequate transport options can limit opportunities for individuals. There are two measures of availability - the number of transport services per hour (P7) and the average journey time relative to travel by car (P8). Data from transport operators measure P7 and respondents will rate how much longer the journey takes in the second household survey. They are relevant to availability and TQoL for presenting how regular transport services operate and how this compares to the time lost or gained by not travelling by car. The data is time-bound at the date of research collection.

Affordability is one of the most significant aspects of TQoL because to discover that someone is paying more on transport each week (P9) but is willing to pay extra for an improved transport service (P10), delivers a good policy argument that the mode is providing poor TQoL. Although these indicators provide only one headline indicator, the analysis can lead to important conclusions on TQoL. These indicators were measured in the second household survey. They are both relevant to TQoL because they show much people are paying and how much they are prepared to pay for an improvement. Learning how much people are willing to pay for an improvement illustrates if public transport is providing a good TQoL. People may want to pay if they are experiencing a poor service. There also needs to be consideration of capabilities to pay. Many individuals may want an improvement to public transport but cannot afford extra costs or feel they contribute enough in taxes. These feelings will be considered in the conclusion of the results. As data is from the household surveys it was time-bound at the date of collection.

Personal TQoL is not only dependent on service and quality. Provision of information on public transport services is also significant. It is therefore necessary to include an indicator on **Public Transport Information**. Good advertisement and provision of relevant timetables can lead to passengers knowing all the various options available, which improves their QoL. The data was collected by visiting the transport corridors and examining the number of stops with updated transport information (P11). This task was achievable within the period of the project at the same time as other participant observation.

Congestion is included because it can affect personal QoL. This is different to the economic indicator (EC3) as it accounts for personal opinions on how congestion affects an individual's journey and their QoL. The economic indicator is designed to value the economic cost of congestion. Almost all passengers are affected by congestion on the road, rail network or LRT system. Too many cars on the road, too many passengers on board or too many trains waiting for a platform at a station all make a journey uncomfortable which has a direct impact on TQoL. There are three measures to indicate how people think congestion adds to their journey - the average time added to their journey from congestion (P12); the belief public transport is to blame for congestion (P13) and; the belief car traffic is to blame for congestion (P14). Respondents of the second household survey provide data for each of these indicators. Whilst the indicators are not a direct measurement of congestion, they do reveal how it affects their journey. It also contributes to the responsibility argument for congestion, showing if people feel it is not just car drivers who are to blame. There are no problems with the timing of this indicator as it will be bound by the date of the research.

The final indicator of personal TQoL is **Modal Change**. This is specific to the experience of passengers as it delivers an understanding of how satisfied people are with their mode. If they do not have a desire to travel by car (P15) their TQoL must be good. It was measured in the second household survey. Although it may not appear to have a direct link to journey quality, it is very important to learn how TQoL compares between public transport and the car. This data will also be time bound to the date of TQoL assessment.

All of the indicators included in the TQoL model mark I contain issues that are important to an individual when they travel by public transport. The theme of sustainable development was adopted for the factors because it is the most appropriate method to understand QoL. Personal indicators were also included to address the specific issues of personal mobility - which are the most important for TQoL. The indicators are selected from sustainable transport literature as they can explain the experience of journey quality and measure direct and indirect influences on QoL. Objective and subjective measures are used in the model, which is necessary for a thorough understanding of subjective well-being (Diener and Suh, 1997). This is the first study of TQoL so there needs to be inclusion of as many issues as possible. It is also important that the method is flexible with the relevance of each indicator confirmed in the research. This could mean not all remain in the final TQoL model. The changes to the TQoL model structure will be made after the initial appraisal. At present the only concern of the current model is the time frame of the data. The objective and subjective measures will not be for exactly the same time period, which could affect the outcome of TQoL. Having identified the indicators in the TQoL model mark I it is now necessary to present a brief introduction of how they will measure TQoL.

3.4 MEASURING TQoL

This section explains how the indicators are used to assess TQoL. It is a brief overview because more detail on the research methods is provided in the following chapter. Rogerson et al.'s (1987, 1988, 1989) method to evaluate QoL in the UK is applied as the basis for this project. In their study of QoL a nationwide survey was implemented to produce the weightings of their QoL indicators. These were then multiplied against objective measurements of QoL to produce a weighted score for each indicator (Rogerson et al., 1989c).

The perpetual weighting of indicators is still a crucial part of QoL assessment. It is the individual who experiences QoL and they should decide what aspects are most important to their QoL. This is true for TQoL as it is the passengers who experience public transport, so they state what is important to their TQoL, not the author or any other expert. This is in accordance with the weighting guidelines set out in Rogerson et al. QoL studies (Rogerson, 1997; Rogerson et al., 1989b; Rogerson et al., 1987; Rogerson et al., 1989c).

City-wide surveys are used to produce the weightings of TQoL. Respondents will be asked, on a scale from 1 (of very little importance) to 5 (of great importance), how important each indicator is to their QoL when they travel by public transport. The scores for each indicator will be averaged to give a weighting for each indicator. To make sure all the indicators are contributing to TQoL two methods are applied. If any indicators have a score below 2 these will be removed from the model. Focus group sessions and telephone interviews will also be used to gain a qualitative perspective on the issues that are important to passengers.

Data for each indicator is gathered through three different formats: secondary data, participant observation and a household survey in the transport corridor. Whilst results from the participant observation and household survey will be in the scale from 1 to 5, secondary data is not. This will be converted using the following equation:

(x1-xmin) x ((5-1) / (xmax-xmin)) + 1.

where,
x1 = the indicator score
xmin = the minimum value of the indicator data
xmax = the maximum value of the indicator data

Data from the travel costs indicator (C3) can be corrected as an example. The increase in fares for bus and train for 2007 is 248.1, the minimum value is 100, and the maximum value is 248.1.

(x1-xmin) x ((5-1) / (xmax-xmin)) + 1

(248.1-100) x ((5-1) / (248-100)) + 1

= 5

The next phase is to quantify the data on each indicator with the weightings gained from the city-wide survey. This is conducted in the following equation:

((Tscore / 1) x (Wscore / 5))

where,
Tscore = indicator score
Wscore = weighted score

If the second household survey reported travel costs to be of 3.5 importance to TQoL, the overall TQoL score would be calculated as follows:

((Tscore / 1) x (Wscore / 5))

((5 / 1) x (3.5 / 5))

= 3.5

The TQoL score for travel costs is 3.5, but these values do not represent much in isolation. To say the travel costs for a city is 3.5 is meaningless without the rest of the indicators. In the TQoL model, no one single measure will be considered on its own and they are all valued in the understanding of a passenger's journey quality (Figure 3.3). The indicator scores will not be added together to produce one overall TQoL score, as is done by Rogerson et al. and

SP techniques, because each issue needs to be considered and the value created by the model would be lost in quantification.

In SP and SC techniques, the methods combine the scores into an overall evaluation or preference (Kroes and Sheldon, 1988). This approach is an inappropriate format for the evaluation of TQoL. It is widely accepted that QoL is a complex subject, with many different issues, so why should they be minimised into one score. If the TQoL score was 59.6, this does not represent how passengers encounter environmental problems, how the costs to travel affect their QoL or even if they have good access to local services. It is very important to interpret individual indicators together on one model. This model is presented on spider diagrams. Further detail on the advantages and disadvantages of this method are discussed in the next section.

3.5 PRESENTATION OF THE TQoL MODEL

The aim this research is to provide a new form of appraisal that is accessible and easily understood by practitioners. Previous QoL studies have presented results in regression analysis, exploratory and confirmatory factor analysis, plots and ranking tables. QoL research output needs to be transparent and comprehended by everyone. In social science, ranking lists have predominately been used. Rogerson et al. applied rankings to show which urban areas had the best QoL. Whilst all audiences understood these, the overall QoL score does not allow effective comparison and it is not possible to discern how a city performs on each indicator.

The representation of data output is a crucial part of any public policy tool and a better communication of QoL studies is through spider diagrams graphs. These provide an immediate illustration of the findings. For the TQoL model it is necessary to portray the QoL on a particular mode of transport. This needs to be compared with the other modes of transport in that city. The spider diagram allows all indicators of TQoL on three modes of transport to be presented on a single chart. The policy maker or the transport operator is then

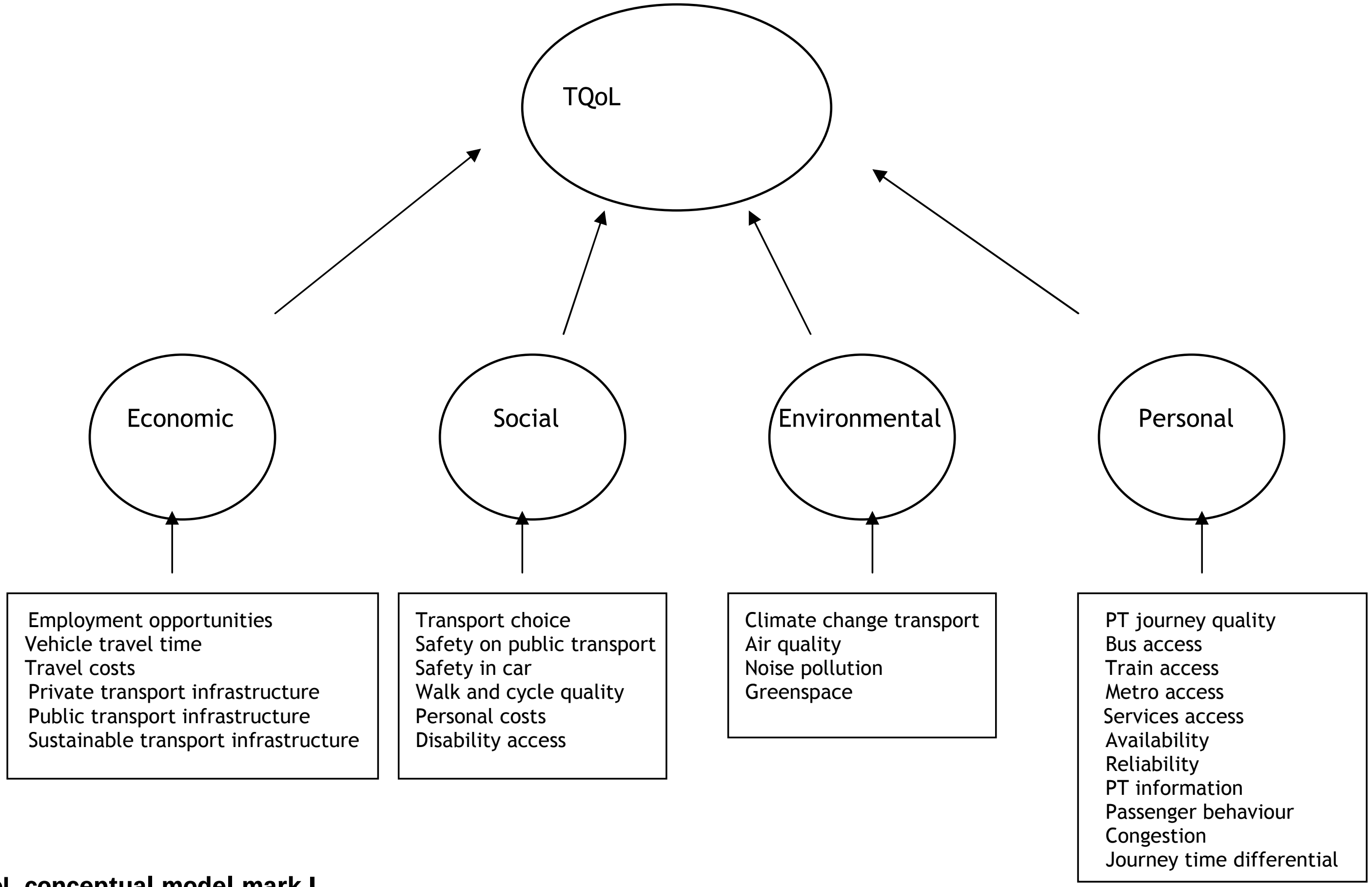

Figure 3.3 TQoL conceptual model mark I

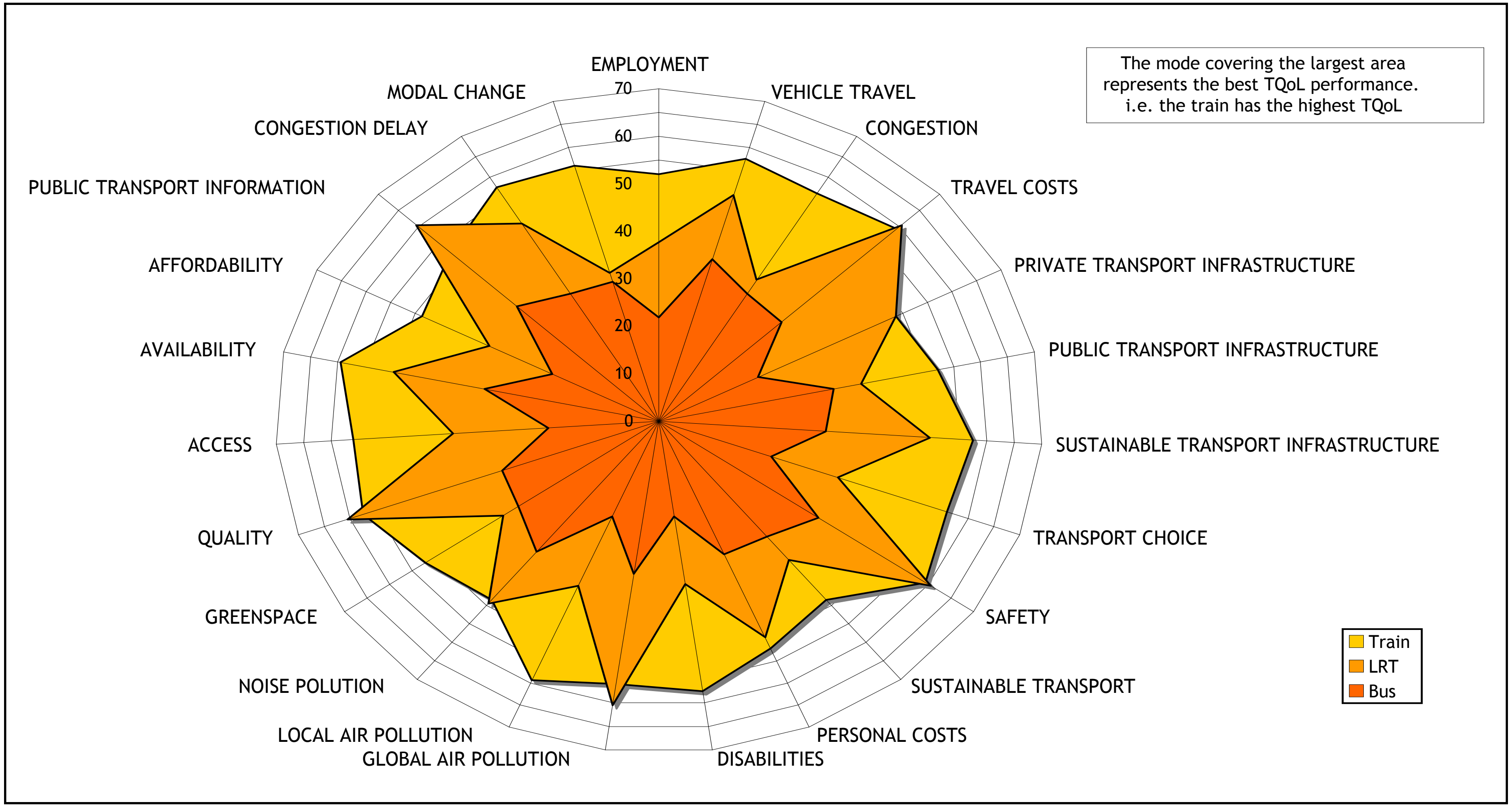

Figure 3.4 Example TQoL Spider diagram

able to immediately observe which mode provides the superior TQoL. A fictitious example of TQoL is presented in Figure 3.4. The method allows two types of conclusion to be made - modal comparisons and evaluation of individual modes. On this model the train provides the best TQoL, followed by LRT, and bus. At an individual level, the bus performs poorly overall but there is better QoL for global air pollution, personal costs, safety, vehicle travel and public transport information. LRT has a good QoL, especially for global air pollution, safety, public transport information and quality. TQoL is good for all indicators on the train most notably for disability provision, travel costs and quality. Spider diagrams provide an immediate representation of the journey experience. The models can thus then be compared against other cities.

The main advantage of using this approach is that different modes of transport can be compared in a single graph. This method is not unique or the most scientific, as other more sophisticated techniques could have been used and the following criticisms could be made against this approach:

I. It is not as advanced as should be used in transport appraisal.
II. The placement of the indicators affects the output of the model
III. The degrees at which the indicators are separated affects the output of the model
IV. Is this technique an addition to quality of life research, or would the traditional ranking system be more appropriate

Each of these criticisms can be answered. The TQoL model is designed to help policy makers and transport operators understand more clearly how public transport is affecting passengers. Rather than a substitute for CBA or SP techniques, it is an alternative method to compare modes of transport. The value of this tool will be tested in this research. If the results are positive further development can be made. Within the available resources design of a new presentation technique is not possible, thus issues regarding the structure of the spider diagrams cannot be addressed in the present thesis. The sequence of the indicators is produced by the economic, social, environmental and personal factors. Any order that is made could affect the output as one indicator may be drastically different to the next. This is a consequence of

TQoL in a corridor not an issue of design. The introduction of spider diagrams will be a positive development for QoL research, because ranking overall TQoL is unsuitable for the context of TQoL. Aggregation of the data involves a loss of information, which makes comparison unambiguous and less clear. It is not possible to make precise evaluations based on a single score so all indicators need to be considered in the TQoL model.

3.6 CONCLUSION: FINAL EVALUATION OF TQoL MODEL MARK I

This chapter has introduced and explained a new TQoL model by identifying the set of indicators to be used to appraise passenger experience on public transport. This is the first stage of the design process. In the development of this model specific performance criteria were considered. These needed to be robust, precise and relevant, not over complex, but easily understood and had to add value to transport appraisal:

- *Robustness* – Reviewing the literature on sustainable transport indicators ensured the indicators selected were sufficiently robust to measure TQoL. Testing of the model's robustness can only happen within the initial appraisal and implementation stages. These will ascertain whether the model is methodologically reliable enough for repeated studies.

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- *Precise* - The indicators are measured through a combination of methods that are the most precise available. Data will be converted so that scores will remain one format. Measurement of TQoL is adapted from Rogerson et al.'s study of QoL in the United Kingdom.
- *Relevance* – Each indicator is selected because it covers issues directly and indirectly relevant to a passenger of public transport. The applicability of the indicators will be tested in the initial appraisal to ensure all issues are covered and those indicators judged not relevant will be excluded.
- *Complexity* – The methodology is a transparent and easily understood technique. There are many different aspects involved that affect a passengers' journey and they all are considered in one straightforward

model. There is not parsimony of indicators because too much information is difficult to interpret and would not allow effective modal comparison.

- *Adding Value* – This TQoL model is not the final expression of public transport performance, nor should it be. Transport appraisal needs to be more inclusive and this technique is another format for understanding public transport behaviour. It should not be interpreted in isolation, but rather in combination with SP and CBA methods.
- *Easily understood* – Presentation of QoL data should be a key construct of research. This is how people first come in contact with the results. Spider diagrams introduce a new concept to the field, which is a readily communicable impression of the performance of public transport modes.

This chapter has argued that TQoL is both under-researched and is not currently considered a central concept in transportation research methodology. This research is designed to explore whether QoL methods can be applied as an alternative – or supplementary - technique in transport appraisal. The premise is the importance of learning more about individuals' current journey experiences before it is revealed how they would prefer to travel. Indications of future intended behaviour may not be sufficiently reliable to form a basis for the formulation of transport policy. When evaluation is made on the performance of public transport, little is researched on passenger experience. Because it encapsulates many different issues, QoL can be considered an appropriate concept to use and the development of QoL appraisal tools can, in principle, increase relevance, improve interface, strengthen credibility and provide effective dissemination. These are necessary features if researchers and research is to have an impact on public policy, the planning process and transport operators (Ben-Akiva and Bonsall, 2004).

Having designed an initial TQoL conceptual model (Mark I) and identified an initial set of TQoL indicators, the next stage of the model development is initial appraisal and implementation. Initial appraisal is undertaken to test whether the method works successfully in one transport corridor in Glasgow. The next chapter thus explains the methods used to evaluate TQoL and presents the findings from the initial appraisal. Following this assessment, modifications were made to the model, producing the TQoL Model Mark II, which was used in the implementation stage of appraisal in three corridors in Glasgow and Manchester (chapters five and six).

Chapter Four

DEFINING THE RESEARCH TECHNIQUE

4.0 INTRODUCTION

By presenting the initial appraisal and reflecting on the appraisal stages, this chapter introduces the third stage of the model development (see Figure 4.1). Introducing and explaining the research indicators used to evaluate TQoL, the chapter is organised in four main sections. The first explains the research technique, by describing how Rogerson et al's method is adapted in the Transport Quality of Life (TQoL) model. It describes how the initial version of the TQoL Model (Mark I) was tested in the initial appraisal stage. This appraisal took place in a single corridor in Glasgow to test the TQoL model. The second justifies the study locations of Glasgow and Manchester. The third discusses the findings of the initial appraisal. The fourth reflects upon the TQoL model mark I appraisal technique and presents a revised TQoL Model (Mark II). This is the version used to appraise TQoL in the implementation stage.

As this thesis is a design process, the model is flexible and changes made to the method are explained throughout the chapter. The final version of the TQoL Model (Mark III) is presented in chapter six but this will only confirm the validity of the TQoL concept. So that the TQoL model can provide an accurate appraisal of passenger TQoL, the model must ensure that all the most relevant issues can be measured appropriately.

4.1 DEFINING THE TQoL MODEL

In the context of the model development this section defines the proposed TQoL model and explains how it adapts Rogerson et al.'s technique (see Chapters two and three). The introduction of perpetual weighting into QoL research has not advanced since the time of publication. The method of

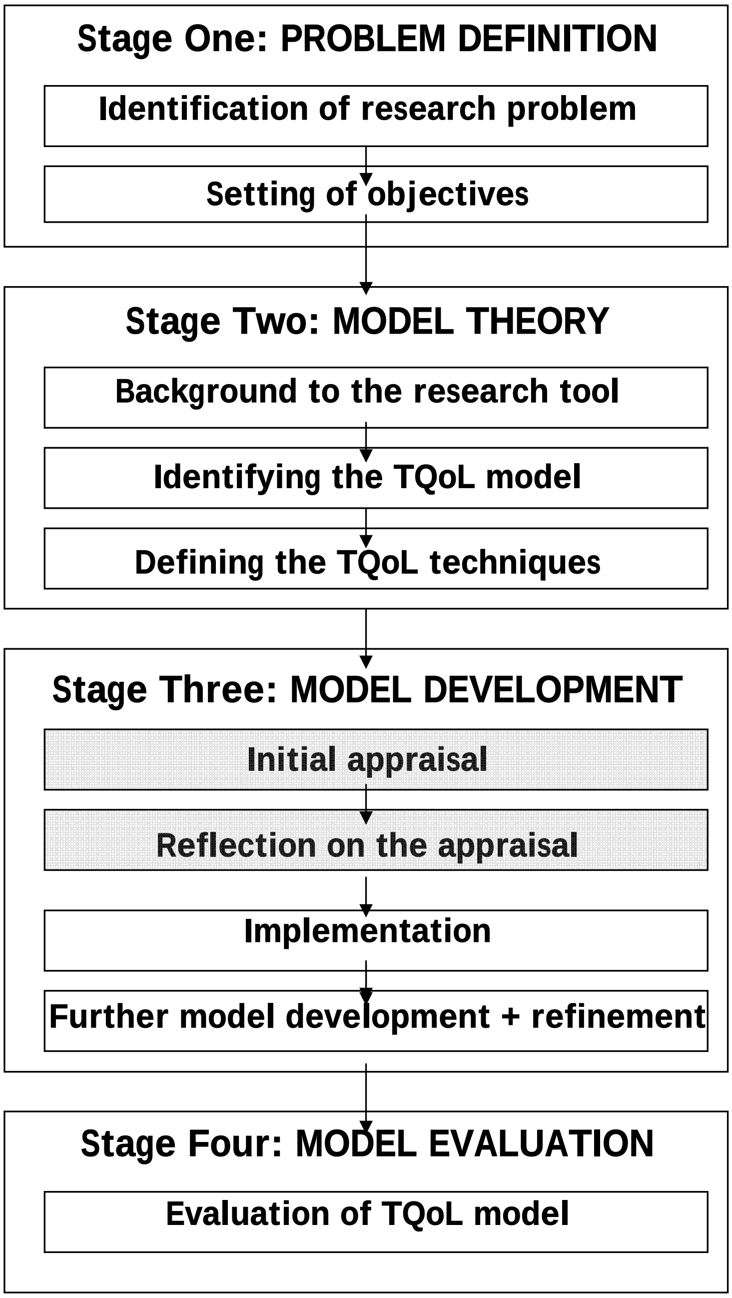

Figure 4.1 TQoL model development in relation to chapter 4

obtaining a measure of the relative importance of dimensions of QoL without reference to a specific location has the advantage of avoiding the problem of distinguishing between real and perceived images of individual cities for apparently homogenous groups (Rogerson et al., 1989b). Despite reoccurring arguments criticizing value judgements of weighting process (Hagerty et al., 2001; Knox, 1976; Seidman, 1977) their approach to evaluating QoL is still highly regarded. A more detailed explanation of Rogerson et al. methodology is necessary to understand how it can be applied.

Rogerson et al. conducted studies of QoL in many different locations in the UK, but the method applied remained the same. There are three main elements to the method: (i) identification and use of local labour market areas to represent city regions; (ii) identification of the relative importance attached to each dimension of QoL by the public via a national opinion survey; and (iii) selection of 47 indicators that represent the social, economic and environmental dimensions identified by the national survey (Rogerson et al., 1989c). The research combined subjective data collected from the national opinion survey with secondary data. In the study of QoL in Britain's intermediate cities 1200 respondents in the national survey were asked to rate twenty dimensions of QoL in terms of importance in influencing their choice of where to live scored on a scale from 5 (very important) to 1 (of minimal influence) although each respondent had the option of rating the dimension as zero (not considered by the respondent) (Rogerson et al., 1989b). The dimensions of QoL were identified as important if the averaged score was above 0. These survey results formed the 'weightings' for the indicators used to measure QoL. They then selected data to represent each indicator of QoL. In total 47 indicators were used to measure the 19 social, economic and environmental dimensions of QoL. These objective measures were obtained from secondary sources. The QoL scores were calculated by multiplying the scores on each of the dimensions of QoL by the weightings from the opinion survey to form a single weighted score (Rogerson et al., 1989c). The scores were combined and overall scores were ranked by the best city providing the best QoL.

Rogerson et al.'s QoL method can be applied in the transport context. While the basics of the approach do not need to be changed, some adjustments are needed to allow TQoL to be measured in an individual city. Aspects of Rogerson et al.'s technique that can be changed to improve the model include the validity of a national survey to gather the weightings of the indicators; the strength of using only objective data to assess QoL; and the value of using ranking systems to display the QoL for an area. These issues will be addressed in testing TQoL model mark I. This model used in the initial appraisal is designed as closely as possible to Rogerson et al.'s method to explore whether this approach is possible within the field of transport research. This will meet the main objective of the thesis - to evaluate how successful QoL techniques can represent individuals' experiences on public transport. As discussed previously in chapter three, no other appraisal technique can evaluate journey experience from the passenger's viewpoint. This needs appraised so that planners, operators and governmental officials understand how different modes of transport perform.

TQoL model mark I will be conducted through two household surveys as applied by Rogerson et al. The first gathers data to calculate the weightings of the indicators and the second collects data to evaluate quality of life on public transport. Household surveys are used in this research rather than on-board user surveys as it was the intention to evaluate the TQoL for specific modes. Conducting surveys of users on-board could have included non-habitual/regular travellers. These are passengers who are using that mode of transport but it is not their regular mode or route of travel. Therefore it was essential to identify households within close proximity to the corridor. At the top of each questionnaire it was made clear that the survey should only be completed if the passenger travelled by that particular mode of transport for the longest part of the journey. These are known as users. If the respondent identified that they did not travel by that particular mode they were deemed a non-user and the response was not included in the dataset.

4.1.1 WEIGHTING SURVEY

The first survey was designed to find out how important each of the TQoL indicators is to an individual when they travel by public transport. Whilst Rogerson et al. conducted a large-scale national survey to produce the weightings for their indicators, this is not feasible and necessary in this project. A nationwide survey to gather what is important to public transport passengers will be invalid for some areas as they will have a much different experience to others. The indicator weightings should only apply to that one certain area, therefore the survey will be compiled at the city level not the nationwide level. How can a bus passenger's experience of QoL in rural Aberdeenshire be compiled together with an underground passenger in central London? They may have similar problems, like congestion or travel cost, but there are so many different factors to consider in one location. Weightings in such a widespread geographical area would not match. There is also the issue of culture to consider. Many countries consist of quite distinct cultures within the same national border while the one culture is not necessarily constrained by national borders (de Vaus, 2008).

There is an argument that even at the city-level perception of QoL would be very different. Whilst this is true, it is a much better medium to evaluate perpetual QoL, than nationwide. A weighting survey at the corridor level would be the most appropriate population to use for the weighting of the survey, however there are number of possible issues. The dataset could be too narrow to gain an effective perception of TQoL and it would require a larger dataset because there would need to be three separate weighting surveys in each city. This larger research cost could not be supported within the research budget. A solution to this would be to allow the respondent of the survey assessment to complete the weighting survey. This should not be done as it could bring into question the validity of both surveys. It is essential to gain separate perceptions of the importance of the TQoL indicators and their TQoL. Their judgement of what indicators are important when they travel could affect their experience and it is important to gain an overview of the city's perception of TQoL rather than a narrow focus in specific areas. Two separate city-wide surveys will be collected for Glasgow and Manchester. There are three important components in the weighting survey design process: 1. boundary definition and selection of addresses; 2. sample sizes and; 3. questionnaire design and scale development.

Boundary Definition and the Sampling Frame

The boundary for the weighting survey is 8 km radius from the city centre (Figure 4.2 and 4.3). In Glasgow this almost equates to the Glasgow city council boundary and in Manchester it is approximately the area within the M60

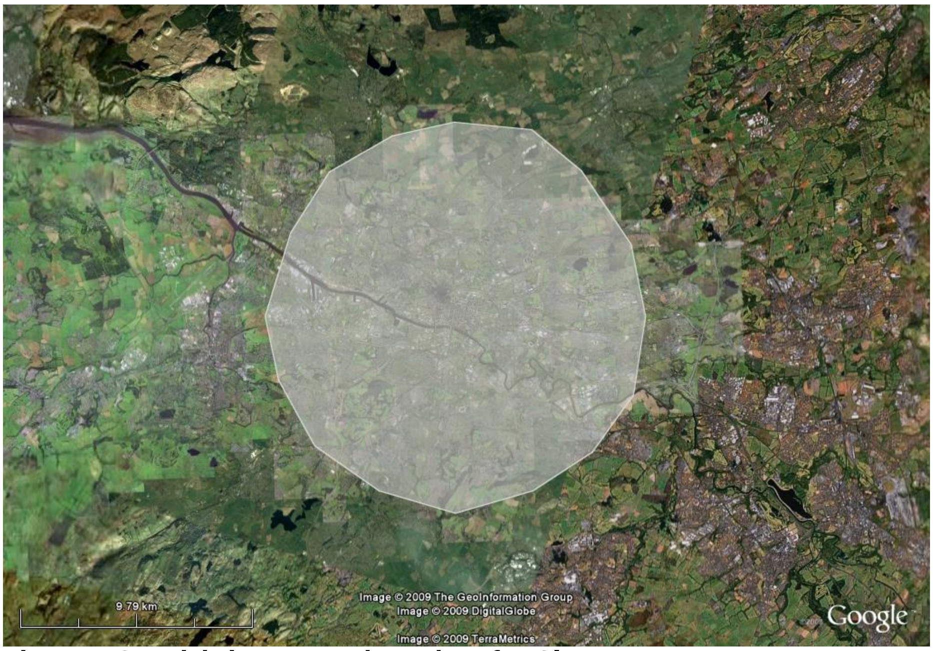

Figure 4.2 Weighting survey boundary for Glasgow

Figure 4.3 Weighting survey for Manchester

motorway. By identifying a boundary area of 8 km it provides an equal distance from the city centre that is more valid than using the city boundary or the M60 motorway. Only addresses within the boundary area will be selected.

After identifying the boundaries for the catchment area it is important to define the sampling frame. The sampling frame is the group or aggregation of elements that we wish to study, the group to which we want to generalize the results of our study (Czaja and Blair, 2005). The sample for the weighting survey is designed to be a representative sample of public transport users. This means that the profile of the sampling frame is all people within the boundary area who use public transport. Although this may seem to be an advantage to other surveys that have a pre-determined audience, it is very difficult to get access to an address database for public transport users for the whole of Glasgow and Greater Manchester. Without money or important contacts it is not possible. The obvious resource to apply is the telephone directory. Using the Glasgow and Manchester BT telephone directories it is possible to randomly select addresses within the boundary area. The problem associated with the telephone directory is that it will not mirror exactly the population it is designed to represent. Every adult does not own a telephone, and many are not listed in the telephone directory, but a perfect frame does not exist. Using the directory could make the sample biased and this will be assessed following the initial appraisal. The other issue is that not everybody travels to work by public transport, which will result in a lot of responses that may need to be rejected.

There are four main types of samples: simple random sampling; systematic sampling; stratified sampling; and multistage cluster sampling. The choice depends on the nature of the research problem, the availability of good sampling frames, money, the desired level of accuracy in the sample and the method by which data are to be collected (de Vaus, 2002). For the most effective representation of the population in the weighting survey a simple random sampling process is appropriate. This is conducted by using the random number feature in Microsoft Excel. This function allows the start and end number to be entered followed by the number of responses required. For the phone book this process will be completed three times, for the page number, column number and entry number. The page numbers and the column numbers can be worked out easily and the number of insertions requires a little more time. All the number of entries will be identified and averaged in the first twenty, middle twenty and last twenty pages. This will provide the average number of entries in each column. This figure, together with the pages and column numbers was then processed in the random number generator to produce the addresses that were to be selected. It then requires some time to go through the phone book and extract addresses. If the number selected did not exist at that very point in the phone book then the entry was excluded.

Once all the addresses had been identified they were checked against the boundary. If the address is more than 8 km away from the city centre it was excluded from the database. It was important to include more addresses at this point as some chosen from the telephone directory may not be within the pre-determined boundary. The distances were then calculated using Google Earth.

Questionnaire design and scale development

A major difficulty of mail surveys is obtaining a sufficient response. Calculations determined how many responses are needed to provide a sample that is representative of public transport users in Manchester and Glasgow. Obtaining those level of responses can be difficult and non-response is a factor of research. For a variety of reasons people selected in a sample may not respond. Some may refuse, others will be uncontactable and the rest may be incompatible with the survey (de Vaus, 2002). The response rate is an indication of the survey quality and the higher the rate the better the quality. There are many aspects that can determine the response rate including interest in the survey subject, incentives, time required to complete the survey and the overall design of the questionnaire. The last two factors are issues that can be controlled by the researcher, which increases the first point. The survey was designed and planned effectively to grab the attention of the participant immediately. There are many design techniques that have been promoted, but one of the most effective approaches in recent years has been Dillman's Total Design Method (TDM) (Dillman, 1987).

This method was introduced to help researchers get good results that could be comparable to those which could be obtained through face-to-face interviews at a much lower cost. TDM is a two-part process to increase the quality of the responses and design of the survey. Early projects that were conducted according to the TDM achieved very high response rates. The average response rate for 48 surveys was 74% (Dillman, 1987). Those surveys implementing TDM in full rose to over 90% for specialized groups. Research has also proven it to successful outside of North-America with rates of 84% in Spain (de Rada, 2001) and 68% in the Netherlands (de Leeuw et al., 1996).

Strict design guidelines are specified for the survey to accompany implementation of four separate mailings (Dillman, 1987). The success of a high response rate depends on the implementation of all four mailings, but all stages cannot be completed without a large research budget. This is lacking in this current project, as two surveys are being conducted in two cities. This restricts the ability to implement all stages of TDM and could only be completed in part. Results from previous TDM surveys suggests that after only a second wave of mailing you can achieve a return of over 50% (de Rada, 2001). This could be accompanied with findings that the best choice of a follow-up technique is a postcard when the budget is tight and the priority is to save money (Erdogan and Baker, 2002). For this project therefore it was more appropriate to conduct only 2 mailings for the weighting survey. The first was completed as specified in stage one of TDM and the second was a reminder letter sent 2 weeks after the initial mail shot. This allows separation of respondents that have already replied so they do not receive a follow-up letter after they have just completed the survey. The design process of the TDM survey was followed so that the maximum number of responses could be completed.

The design of the survey was to appeal to the respondent through consistency. This depends on convincing people that first, a problem exists that is of importance to a group with which they identify, and second, that their help was needed to find a solution. TDM also stresses that personalisation is important to make clear to the respondent the critical message that the study is important and participation is important to its success. This personalisation is not through individual techniques but the overall presentation of the survey. The first mailout included the cover letter, questionnaire and a returnable envelope.

The covering letter is intended to be the first part of the mailout examined by the respondent. It introduces the survey with the intention to motivate the respondent to fill in the questionnaire and return it immediately. The template described by Dillman was used for the weighting survey. A sample of the cover letter used in the Glasgow weighting survey is shown in Appendix A.

The first paragraph explained the aims of the study to persuade the respondent that the study is useful. It was the first, and in many cases, only part of the letter that the respondent will read so it is important to grab the attention of reader immediately. The social usefulness argument directed for this survey was based on persuading the respondent that it is important to gather information on individual's QoL when they travel by transport. The preceding paragraph sought to further persuade the respondent that his or her response was important and that no one else's can be substituted. It was necessary to have an equal sample of male and females. As the sample was selected from the telephone directory it was not clear if the person specified in the address is the individual that needs to complete the questionnaire. This meant that it was necessary to specify that an adult male or female should complete the survey. The third paragraph assures the respondent that confidentiality will be upheld. The remaining sections of the letter: reemphasize the social usefulness of the study, describe how they can receive a copy of results and indicate the willingness to answer any questions that may arise. Copies of the results were offered as a reward to the respondent for completing the survey and to provide evidence of the importance of the survey. Included in the mailout package was the cover letter, copy of results form, returnable envelope and questionnaire. The design layout of the questionnaire also was according to the TDM (Appendix A).

One of the first issues to consider in planning the questionnaire was ordering the questions. There are a number of principles that were followed under TDM. The first was that they are ordered along a descending gradient of social usefulness (or importance), second that similar questions are grouped together, third was ensuring a flow and continuity through building on cognitive ties, and finally positioning questions that are mostly likely to be objectionable after less objectionable ones (Dillman, 1987). There were no objectionable questions in this survey so this issue does not need to be addressed. The questionnaire began with two simple questions on their travel behaviour. This was because the first question is more likely than any other to determine whether the questionnaire will be completed. It is recommended that it should only take a few seconds to respond, should convey a sense of neutrality and be applicable to everyone.

The most appropriate ordering technique in this survey was to group all questions of the four factors together to allow a consistent flow. The questions relating to economic TQoL were ordered together and led onto the social, environmental and personal questions of TQoL. The questions were all composed very similarly to relate more easily to the respondent. Each question asked how important each indicator is to their quality of life when they travel by public transport. The first question followed the introductory questions by asking how important was the ability to access different job opportunities to your quality of life. This was the first economic indicator relating to job opportunities. Each of the other questions were posed in the same way. The decision to start with this question was because it is just as important as any other questions. Questions relating to demographic information were placed at the end of the questionnaire as recommended.

The design layout of the questionnaire was also arranged according to the TDM. These principles have been successful in boosting response rates. The final issue to consider in the questionnaire was the scaling of the answers. The Likert scale from 1 to 5 was applied as it proved to be a successful measure of QoL in Rogerson et al.'s research. While different measurement scales could have been applied, it was necessary to test the validity of Rogerson et al.'s method for public transport appraisal. The same scale was used for all the weighting questions to ensure consistency for the respondent.

Sample Sizes

Sample size is an important part of the design process. The required sample size depends on two key factors: the degree of accuracy required for the sample; and the extent to which there is variation in the population in regard to the key characteristics of the study (de Vaus, 2002). To identify the degree of accuracy two key statistical concepts can be used - sampling error and the confidence interval.

Calculations of samples sizes can be made considering these two factors of accuracy. Determination of sample size is a function of a number of things: the research being used; the variability of the key variable(s), if we are trying to estimate a population value; or, if we are testing a hypothesis, the size of the differences between two variables and the standard error of their difference (Czaja and Blair, 2005). In this research the appropriate approach was determining the sample size through an estimation of a population percentage. The aim of this survey to gain an understanding of which indicators are most important to public transport passengers. This meant that the percentage of people that travel to work by public transport was used as the population percentage. The classic formula (Cochran, 1977) was applied to determine the sample size for a variable expressed as a percentage:

$$n = \left(1 - \frac{n}{N}\right) \times \frac{t^2\left(p \times q\right)}{d^2} = \textit{finite population correlatio } n \times \frac{\textit{probabilit y level} \times \text{var} \textit{iance}}{\textit{confidence } \text{int} \textit{erval}}$$

where

n = The sample size or the number of completed interviews with eligible elements

N = The size of the eligible population

t^2 = The squared value of the standard deviation score that refers to the area under a normal distribution of values

p = The percentage category for which we are computing the sample size

q = 1-*p*

d^2 = The squared value of one-half the precision interval around the sample estimate

This formula was calculated using the information on public transport users. Travel-to-work data in Glasgow indicates that 30% of the total economically active population travel to work by public transport. In the Manchester it was 20% (ONS, 2001b). The 95% confidence interval and values - Glasgow *p* = 0.30, and q is 1-0.30 = 0.70, and Manchester p = 0.20 and q is 1-0.20 = 0.80 - were added into the equation as follows:

Glasgow

$$n = \frac{(1.96)^2(0.30)(0.70)}{(0.05)^2} = \frac{.8067}{.0025} = 323$$

Manchester

$$n = \frac{(1.96)^2(0.20)(0.80)}{(0.05)^2} = \frac{.6147}{.0025} = 246$$

The number of questionnaires needed to represent the population of public transport passengers to the 95% confidence level in Glasgow was 323 and in Manchester it was 246. This formula is only a guide to sample size requirements because few samples are truly simple random samples. The formula thus only applies to a variable percentage and not a more reliable metric constant variable, such as income. The percentage of public transport users in the cities will not be the same, especially as the percentages used are taken from the 2001 census. It is commonly accepted that the sample must be a certain percentage of the population to accurately reflect the population (Czaja and Blair, 2005) and another standard equation was calculated (Cochran, 1977) to determine the sample size of public transport users in relation to the total population:

$$n = \frac{n}{1 + \left(\frac{n - 1}{N}\right)}$$

The total working age population in employment is 255,481 in Glasgow and 142,449 in Manchester, and with the already calculated sample sizes, these values were substituted in following equations:

Glasgow

$$n = \frac{323}{1 + \left(\frac{322}{255{,}481}\right)} = \frac{323}{1.00126} = 322.6$$

Manchester

$$n = \frac{246}{1 + \left(\frac{245}{142{,}449}\right)} = \frac{246}{1.00172} = 245.6$$

In both equations the difference is less than 1. This means the size of the population does not have an impact upon the sample size. The only case where it may impact on the sample size is if the population is small and the sample size is less than 5% of the population (Czaja and Blair, 2005). This may be the case for the modal corridors. Compared with the degrees of accuracy if the samples reached the identified sample size it would have been within 10% of the mean in both cities, with almost 5% sampling error in Glasgow and 6.5 error in Manchester (Alreck and Settle, 1995; de Vaus, 2002). These levels are respectable within social science research.

The final problem with survey design is gathering sufficient responses to meet the identified sample sizes. Questionnaire design can improve the number of responses but the expected number of completed questionnaires had to be estimated. This is best done from previous surveys or a pre-test. As this was the first survey to gain the weightings of TQoL, the percentage of responses that could be returned was estimated. If the average success rate using TDM were applied (74%), 436 questionnaires would have been sent out in Glasgow and 332 in Manchester. All stages of the TDM are not being incorporated so applying the 50% success rate (de Rada, 2001) found applying only one follow-up stage was appropriate. This means 646 questionnaires were required in Glasgow and 492 in Manchester. These numbers were subsequently reviewed following the initial appraisal.

4.1.2 TQOL ASSESSMENT SURVEY

Assessment of TQoL is conducted in three corridors in each city. There were three main methods of data collection: secondary data, participant observation and a household survey. The combination of objective and subjective data is recommended to be essential to understand human QoL (Diener and Suh, 1997). Secondary data was collected for 18 of the TQoL indicators and this objective measurement presents the experience faced by all passengers in the modal corridors. Most of this data was online so there were no difficulties with access. The only significant issues were timeframe and the data scales. Not all data was the same year so consideration needed to be made when interpreting the output from the model. The data was also in different scales and was transformed into the scale of 1-5 using the equation shown in chapter 3, section 3.4. Participant observation was used to elicit the experiences encountered by passengers that cannot easily be quantified in secondary data or the household survey. In this project the role of research-participant is adopted (Gans, 1999), with areas visited and scores given for the relevant TQoL. The second survey is different to the weighting questionnaire. It was sent to addresses within the pre-determined corridor to assess passengers experience in relation to a number of TQoL indicators.

The principles of Dillman's TDM were once more applied in the design of the second household survey. Three components were considered in the survey deign process: boundary definition and selection of addresses, questionnaire design and scale development and sample sizes.

Boundary Definition and the Sampling Frame

The boundaries for corridors were calculated for the distance from the modal interchange station or stop (Figures 4.4-4.9). Households needed to be within 400m from a bus stop on the transport corridor, or 800m from a local train or LRT station. The distances are selected because 400m from a bus stop represents a comfortable walk for most people under normal conditions (Murray et al., 1998) and 800m is the standard value used for examining access to rail services (Smith and Taylor, 1994). Only houses that are within the boundaries were examined. The grey areas represent the boundary areas, with some corridors containing more circles because there are more transport interchanges. For example, there are three stations within the Glasgow train and LRT corridors, but only one train station within the Manchester train corridor. This expanded the area where the sample can be collected from but did not affect the outcome of the results. It simply meant there was a wider

Figure 4.4 **Assessment survey boundary for Glasgow Train Corridor**

Figure 4.5 **Assessment survey boundary for Glasgow LRT Corridor**

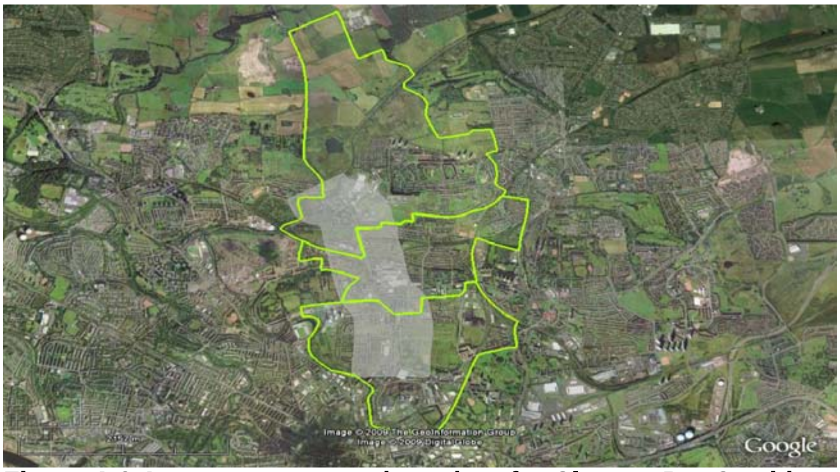

Figure 4.6 **Assessment survey boundary for Glasgow Bus Corridor**

Figure 4.7 Assessment survey boundary for Manchester Train Corridor

Figure 4.8 Assessment survey boundary for Manchester LRT Corridor

Figure 4.9 Assessment survey boundary for Manchester Bus Corridor

area from which households could be selected. The conditions experienced at each modal station should be the same and should not affect their TQoL.

The sampling frame for the assessment survey was similar to the weighting survey. Instead of including all public transport users, each modal corridor frame will only represent passengers of that particular mode. For example, only passengers who travel by bus for their most common journey will be included in the assessment of TQoL in the bus corridor. This is the same for train and LRT passengers. Due to the inability to gain access to addresses that travel by one particular mode the telephone directory was used to select addresses. Despite the previous mentioned problems it remains one of the few options to randomly select a sample. The same simple random sampling strategy was applied to gain the addresses. The random number generator was used to produce a list of page, column and entry numbers. Addresses were then selected and checked using Google Earth to make sure they were within the corridor boundary. If they were not within 400m or 800m from the relevant modal stop the entry was excluded.

Questionnaire Design and Scale development

The assessment survey was also designed according to Dillman's guidelines. The strict design and implementation procedures were followed to improve the response rate. As was implemented in the weighting survey only 2 mailings were sent out, the initial posting and a follow-up letter. Focus was made in the design of the cover letter and the questionnaire.

The cover letter for the assessment survey was almost identical to the weighting survey cover letter (Appendix A). The only difference is the usefulness of the study paragraph. It was stated that these results would be used to understand the experience of quality of life on transport. The first paragraph explained the social usefulness of the study, the second paragraph aimed to convince the respondent their response was important, the third paragraph promised confidentiality, the fourth reemphasized the usefulness of the study and the final section explained what to do if questions arise. The mailout package was the same as the weighting survey with the cover letter, copy of results form, returnable envelope and questionnaire all included.

The design layout of the questionnaire was constructed according to the TDM principles (Appendix A). Although the layout was very similar to the weighting survey the content is different. The questionnaire began with the same introductory questions on purpose and method of travel. The questions were not bulked together according to the groupings, but ordered in common sense according to aspects of travel. For example question 4 on how much quicker it would be if travelling by car was followed by the question on how long the journey takes. This was done throughout the questionnaire to make more logical sense to the respondent instead of placing all the economic questions together. The majority of the questions related directly to TQoL so were worded differently, and presenting them in this way helped ensure a logical flow. Questions 4 – 14 directly relate to TQoL, which provided the data that examine the subjective aspects of TQoL. Questions 15 – 23 were demographic questions used to examine the data further. The Likert scale from 1 to 5 was also adopted throughout the questionnaire to test Rogerson et al.'s measurement and ensure consistency for the respondent and evaluation.

Sample Sizes

The required sample sizes were calculated the same way as the weighting samples, through an estimation of a population percentage. In the weighting survey the percentage of all public transport passengers was used. For the corridor samples the percentage of people travelling by the mode of transport was applied in Cochran's classic formula. In the respective Glasgow corridors 34% of commuters travel to work or study by bus, 15% travel by train and 16% travel by LRT (Scrol, 2001f). In the Manchester corridors 27% travel by bus, 4% travel by train and 11% travel by LRT (ONS, 2001b). This data was used to calculate the required sample sizes:

Glasgow Bus

$$n = \frac{(1.96)^2(0.34)(0.66)}{(0.05)^2} = \frac{.8621}{.0025} = 345$$

Glasgow Train

$$n = \frac{(1.96)^2(0.15)(0.85)}{(0.05)^2} = \frac{.4898}{.0025} = 196$$

Glasgow LRT

$$n = \frac{(1.96)^2(0.16)(0.84)}{(0.05)^2} = \frac{.5163}{.0025} = 207$$

Manchester Bus

$$n = \frac{(1.96)^2(0.27)(0.73)}{(0.05)^2} = \frac{.7572}{.0025} = 303$$

Manchester Train

$$n = \frac{(1.96)^2(0.04)(0.96)}{(0.05)^2} = \frac{.1475}{.0025} = 59$$

Manchester LRT

$$n = \frac{(1.96)^2(0.11)(0.89)}{(0.05)^2} = \frac{.3761}{.0025} = 150$$

In Glasgow, the number of questionnaires required to represent 95% of travellers by bus is 345, by train 196 and by LRT 207. In Manchester, 303 questionnaires are required to represent bus passengers, 59 for train passengers and 150 for LRT passengers. The second of Cochran's formulas was calculated to determine the sample size of modal transport users in relation to the total population. The total population in each ward and the figures calculated in the previous formulas were substituted in the following equations:

Glasgow Bus

$$n = \frac{345}{1+\left(\frac{344}{6,544}\right)} = \frac{345}{1.05256} = 327.8$$

Glasgow Train

$$n = \frac{196}{1+\left(\frac{195}{11,576}\right)} = \frac{1966}{1.01685} = 192.7$$

Glasgow LRT

$$n = \frac{207}{1 + \left(\frac{206}{13{,}218} \right)} = \frac{207}{1.01558} = 203.8$$

Manchester Bus

$$n = \frac{303}{1 + \left(\frac{302}{11{,}860} \right)} = \frac{303}{1.02546} = 295.5$$

Manchester Train

$$n = \frac{59}{1 + \left(\frac{58}{14{,}338} \right)} = \frac{59}{1.00404} = 58.8$$

Manchester LRT

$$n = \frac{150}{1 + \left(\frac{149}{9{,}124} \right)} = \frac{150}{1.01633} = 147.6$$

Output from all the equations, with the exception of Manchester's train corridor, provides only a slight difference in the required sample size. In Glasgow, there are minor reductions of 4.9% in the bus corridor, 1.5% in the train corridor and 1.4% in the LRT corridor. In Manchester there are minor reductions of 2.3% in the bus corridor and 1.6% in the LRT corridor. This confirms that the size of population does not affect the sample size. While either calculation could have been used, the more appropriate values were the percentage of modal passengers as it provides greater validity for the sample. Although the smaller samples contain a greater degree of sampling error they were still an accurate representation of the modal passengers. The number of surveys that needed to be sent out to gather enough responses was calculated estimating 50% response. In Glasgow, 690 were for the bus corridor, 392 for the train corridor and 414 for the LRT corridor. In Manchester 606 were required for the bus corridor, 118 for the train corridor and 300 for the LRT corridor. These numbers were also reviewed following the initial appraisal.

4.1.3 TESTING THE TQOL INDICATORS

The TQoL indicators used to assess public transport passengers' were also evaluated in the initial appraisal stage. Although they were selected from literature for meeting each aspect of journey quality they may not all be important and some issues may not be included. The indicators were to be tested in two separate ways. The first was to check the validity through the survey response. In Rogerson et al.'s study of QoL, indicators were only included if they scored above 0 in the national weighting survey. This principle was adopted and if any indicator from the citywide weighting survey scored less than 2 it was to be removed from the assessment. This was to ensure only indicators that are important to individuals TQoL are included. The second form of testing is using a qualitative research phase to confirm if there are any issues not covered by the TQoL indicators. The qualitative research included focus group sessions and telephone interviews. Whilst a more detailed qualitative research project would have been more appropriate for this task, this was not possible within the project capabilities. Ideally in-depth interviews and more focus groups session would test the validation of the indicators more accurately. This was scaled down to a smaller stage of investigation to allow successful completion of wider research objectives. This stage of research was conducted immediately after the initial appraisal.

4.2 STUDY LOCATIONS - GLASGOW AND MANCHESTER

The key criterion for selecting the case study locations was that they had to have similar development, demographic and transport characteristics. Two cities were required to test the reliability of the TQoL model. The intention of this project is to develop and test a method that can evaluate TQoL. This needs to be carried out in real locations with real problems and challenges. The goal is to not discover which mode of transport, or city is providing a better TQoL. If using only one city the viability of the method cannot be fully understood and application as an alternative transport appraisal technique is not guaranteed without repeated testing. The cities needed to have three principal public transport modes in operation – bus, train and metro or light-rail – and contain key transport corridors served by one or more of these modes. The main function of the method is to compare three different modes of transport at one time. In practice, this reduced the search to a small number of cities: Glasgow, Sheffield, Manchester, Nottingham, Birmingham, Croydon and Dublin (Ireland).

Glasgow was chosen for the first city, as it is an important city in public transport terms, with a strong history of public transport patronage and relatively low car dependency. The local authority has the highest percentage of households without a car outside London. Public transport is central to the daily activities of Glasgow's residents. Understanding TQoL on three different modes of transport includes the performance of Light-Rail Transit (LRT). There is no LRT system in Glasgow, but it does have the subway. This is a small underground network where fifteen stations serve the centre and west-end of the city. Under DfT's classification – it is a metro, with passenger statistics measured together with LRT networks.

Following the selection of Glasgow, comparisons were made to locate a second city with similar characteristics. This city was selected after examination of transport, demographic, housing, other, employment and benefit statistics. Appendix B provides full detail on the selection process of the cities and the transport corridors. A summary of the comparison findings is presented in Table 4.1. Whilst each city contains similar characteristics to Glasgow, the two most comparable are Manchester and Nottingham. Of the 26 different issues compared Manchester and Nottingham each contain 16 similar levels. Manchester was identified as the second city as there are three modes of transport in operation where corridors could be selected and it has a more similar urban structure. While it is not possible to select identical cities, implementation in Glasgow and Manchester will test if the model is able to effectively appraise TQoL. The results from this assessment may not vary in the two cities because they have similar characteristics, however this is not the objective of the research. It is to test if the method can effectively measure TQoL. Box 4.1 provides a summary of the two cities.

BOX 4.1 GLASGOW AND MANCHESTER - A COMPARISON

Public transport plays a crucial role for individuals in Manchester as it does in Glasgow. In the city of Manchester there are a high percentage of households without a car together with reliability on the extensive LRT and bus systems. There are two train terminus' operating substantial services in the city and Greater Manchester. The two cities have a similar history - developing from strong manufacturing centres in the early and mid 20th century, to encounter massive decline and now enjoying a period of growth. The political structures are similar with strong commuting towns outside both city centres. Glasgow has a stronger city centre than Manchester but this has enjoyed a major economic resurgence in the past ten years.

DEMOGRAPHY

Glasgow's total population is much larger. However this is not a problem, because the research is not dependent on the size of the population. There are more important aspects that were needed rather than simply the size of the city. Population in Glasgow has been in decline since a high of over 1 million residents in the 1950s. This was in part due to the economic decline - caused by people seeking new employment further away from Glasgow and policy encouraging migration to new town developments. In recent times economic growth and a new policy of in-migration, particularly from asylum seekers, has led to population increase. Manchester also experienced a sharp decline in population from a high of over 700,000 in the 1930s. This also was been revered due to increased economic growth and in-migration.

SOCIAL CONDITION

Glasgow and Manchester have a similar social condition with both cities containing areas of deep deprivation. Both cities also contain a number of wards defined as areas of deprivation. Almost 70 per cent of the 5% most deprived areas; 50 per cent of the 10% most deprived areas; and 38 per cent of the 15% most deprived areas are found in Glasgow (Scottish Executive 2005). In Manchester there are 21 wards in the top 100 most deprived in England according to the Index of Multiple Deprivation (IMD) (Manchester City Council 2004). In Manchester 46 Super Output Area's (SOA) also fall into the worst 1% and No SOA in Manchester is in the best 80% in England. There are poverty stricken areas in each of the cities, which may not seem to be an important factor for this research, but public transport is very important to lower income groups of society. Dependence on public transport is almost guaranteed in these wards and therefore it is essential to learn the quality of life experienced on the different transport modes.

ECONOMIC DEVELOPMENT

Glasgow and Manchester have seen major economic growth in recent years. Real GDP growth in the past ten years has seen them grow towards some of Europe's elite metropolitan areas. Annual growth rate in GDP in Glasgow was very similar to Manchester at around 2.7%. In 2004 GDP per capita reached $24,000 in Greater Glasgow and $22,500 in Greater Manchester (BAK Basel Economics 2005). In Glasgow, GDP growth is due to increasing employment and redeveloping the city centre, especially along the River Clyde. The same programme was conducted in Manchester together with regeneration for the 2002 commonwealth games.

Both cities have also experienced large growth in Gross Value Added (GVA) from 1995-2005. Total GVA increased 68.9% in Glasgow and 72.8% for Manchester South (ONS, 2006). There was also similar development in the two cities for employment. Detailed analysis of employment statistics presented in Appendix B confirmed no significant differences for all but one of the 7 variables tested.

Table 4.1 Summary of comparison findings

		GLA-BIRM	GLA-SHEF	GLA-MAN	GLA-NEW	GLA-NOTT
TRANSPORT	LRT		x		x	
	Train	x				
	Bus			x		x
	Driving by car			**x**	x	x
	% households no car			**x**	x	x
DEMOGRAPHY	Pop. Size		x			
	DDI			x		x
	Pop. Change		x			
	Pop. Density					x
HOUSING	Ave. house price		x			x
	Prop. Social housing			x		
	Prop. lone parent				x	x
OTHER	Tot. recorded crime			x		x
	Prop. work pop. level 5-6	x	x	x	x	x
	Annual ave. PM10	x	x	x	x	x
DETAILED EMPLOYMENT	Employ. Rate	x		x	x	x
	Unemploy. Rate	x		x	x	x
	Econ act. Rate			x		x
	Econ inact. Rate			x	x	x
	% FTE			x	x	
	% PTE			x	x	
	% Self-employ					x
DETAILED BENEFIT PAYMENT	IB					
	IB Long					
	IS	x		x		
	JSA	x		x	x	x
TOTAL		7	6	16	12	16

In each city, three transport corridors were identified. The main criterion for the corridors was they had to be areas where there was high patronage on bus, train and LRT. The same modal corridors in each city needed to display similar characteristics. This was once more to test the reliability of the TQoL model. The bus corridor in Glasgow contained similar characteristics as the bus corridor in Manchester and the same was true for the train and LRT corridors. Further detail on the comparisons is contained in Appendix B.

The bus corridor in Glasgow was to the north of the city in the wards of Milton, Ashfield and Keppochhill. This is a poor area, with high public transport use, poor educational attainment, high economic inactivity and a higher majority of social rented properties. The closest related corridor in Manchester is to south-southwest of the city including Old Moat and Chorlton Park. This area has the biggest percentage of people travelling to work or study by bus, and the lowest number of commuters travelling by car. It also has the lowest economic inactivity, the highest number of households that are flats and social rented and the highest number of households with no cars.

The Glasgow train corridor is the south of the city on the eastern Cathcart circle line incorporating the wards Battlefield, Mount Florida and Cathcart. It was selected because it has a higher average percentage of people travelling by train to work or study, and a higher total number of train passengers. The Manchester train corridor is located at the top of the Stockport Border incorporating Heatons North and Heatons South. This corridor was selected as it is closer to the city, had better transport statistics and a more regular service.

The Glasgow LRT corridor is to the west of the city centre running directly through the wards of Partick, Hillhead and Hayburn. Whilst the LRT corridor in Manchester would not be the same as it is a different type of metro system, a corridor to the south-west of city in the Priory and Longford wards was identified. This area had a similar reliance upon public transport and a large working age population, with a relatively high number of households that are flats and without a car.

4.3 INITIAL APPRAISAL

The initial appraisal was a shortened assessment of TQoL in a single transport corridor in Glasgow. The purpose of this stage was to test the TQoL model mark I. This was designed to observe how successfully Rogerson et al.'s methodology can measure passenger experience on public transport. Changes have been made to their method but the principles of QoL research remain. The method as described in section 4.1, was implemented in the Glasgow train corridor. Assessment took place on a smaller scale, with only 300 questionnaires distributed for the city-wide survey and 200 for the assessment survey. Secondary data was collected and the corridor was visited to conduct the participant observation. Initial appraisal was conducted only in one corridor in Glasgow due to project limitations, which meant that it was not possible to compare different modes of transport. As the aim was to lead to development of the TQoL model it is crucial to test the techniques before the implementation stage. This allows for a period of reflection where modifications can be made to the TQoL model.

4.3.1 DATA COLLECTION AND RESULTS

The surveys were distributed to randomly selected households in August 2006 and a follow-up letter was sent two weeks after the initial mailshot. Following the 2nd mailshot the response rate increased from 22% to 29% for the weighting survey and from 38% to 44% for the assessment survey. Whilst the response rates for both surveys were below the expected level of 50% they are still respectable. Secondary data was collected for almost all the indicators and transformed. The only indicator where data could not be attained was noise pollution. The majority of the secondary data is only available at the city level, and in some cases it was national level. This causes concern for the model performance. Three corridors in one city cannot be effectively compared if the data is the same for the whole city or the whole country, as is the case for the increase in fares (EC4). There was also a problem with participant observation. Although an estimated value can be given for the experience of some indicators, the validity of this result can be questioned. This approach may not be the most appropriate way to measure aspects of QoL especially considering the associated problems that are commonly accepted with data collection (Jackson, 1983; LeCompte and Goetz, 1982; Schwartz and Schwartz, 1955; Becker, 1999). These issues are considered with respect to the appraisal technique in the next section of this chapter.

The results from the weighting survey were ranked in terms of importance according to the response from the respondents (Table 4.2). The most important indicator considered by passengers was *safety*. This is followed by the *quality of journey by public transport* and *overall quality of transport* indicators. The issue of least importance was access to job opportunities. This was surprising considering it is the main purpose for the majority of journeys. It is important to note that all of the scores are above 2, which means that at this stage all of the issues are important to TQoL. The open question at the

Table 4.2 Importance scores from Initial appraisal weighting survey

How important to your quality of life on transport is?	Score
1. Safety	4.61
2. Quality of journey by public transport	4.38
3. Overall quality of transport	4.34
4. Having a bus stop within 5 minutes walk	4.31
5. Having the choice of transport modes	4.29
6. Having information about local transport services	4.20
7. Having a number of different transport options	4.18
8. Quality of journey by car	4.15
9. Walking and Cycling quality	4.08
10. Cost to travel by car	4.04
11. Access to parkland	4.02
12a. Cost to travel by public transport	4.00
12b. Having a train station within 10 minutes walk	4.00
14. The time spent in traffic jams	3.85
15. Local air pollution considered	3.74
16. Climate change considered	3.47
17. The time it takes to travel to work	3.46
18. The effect of Noise	3.41
19. The cost of parking	3.19
20. Disabled access	2.85
21. Having access to job opportunities	2.73

Table 4.3 Importance scores and TQoL indicators

INDICATOR	WHERE IT COMES FROM	WEIGHTING SCORE
Economic indicators		
Employment	Variable 21	2.73
Vehicle Travel	Variable 17	3.46
Congestion	Variable 14	3.85
Travel Costs	Sum of Variable 10 & 12a	4.02
Private Transport Infrastructure	Sum of Variable 8, 10 & 19	3.79
Public Transport Infrastructure	Variable 2 and 12a	4.19
Sustainable Transport Infrastructure	Variable 9	4.08
Social Indicators		
Transport Choice -	Variable 7	4.18
Safety -	Variable 1	4.61
Sustainable Transport -	Sum of Variable 9 & 2	4.23
Personal costs -	Sum of Variable 10 & 12a	4.02
Disabilities -	Variable 20	2.85
Environmental Indicators		
Global Air Pollution -	Variable 16	3.47
Local Air pollution -	Variable 15	3.74
Noise Pollution -	Variable 18	0.00
Greenspace -	Variable 10	4.02
Personal Indicators		
Quality -	Variable 3	4.34
Access -	Sum of Variable 4 & 12b	4.16
Availability -	Sum of Variable 5 & 17	3.88
Affordability -	Sum of Variable 10 & 12a	4.02
Public Transport Information	Variable 6	4.20
Congestion -	Variable 14	3.85
Modal Change -	Variable 5	4.29

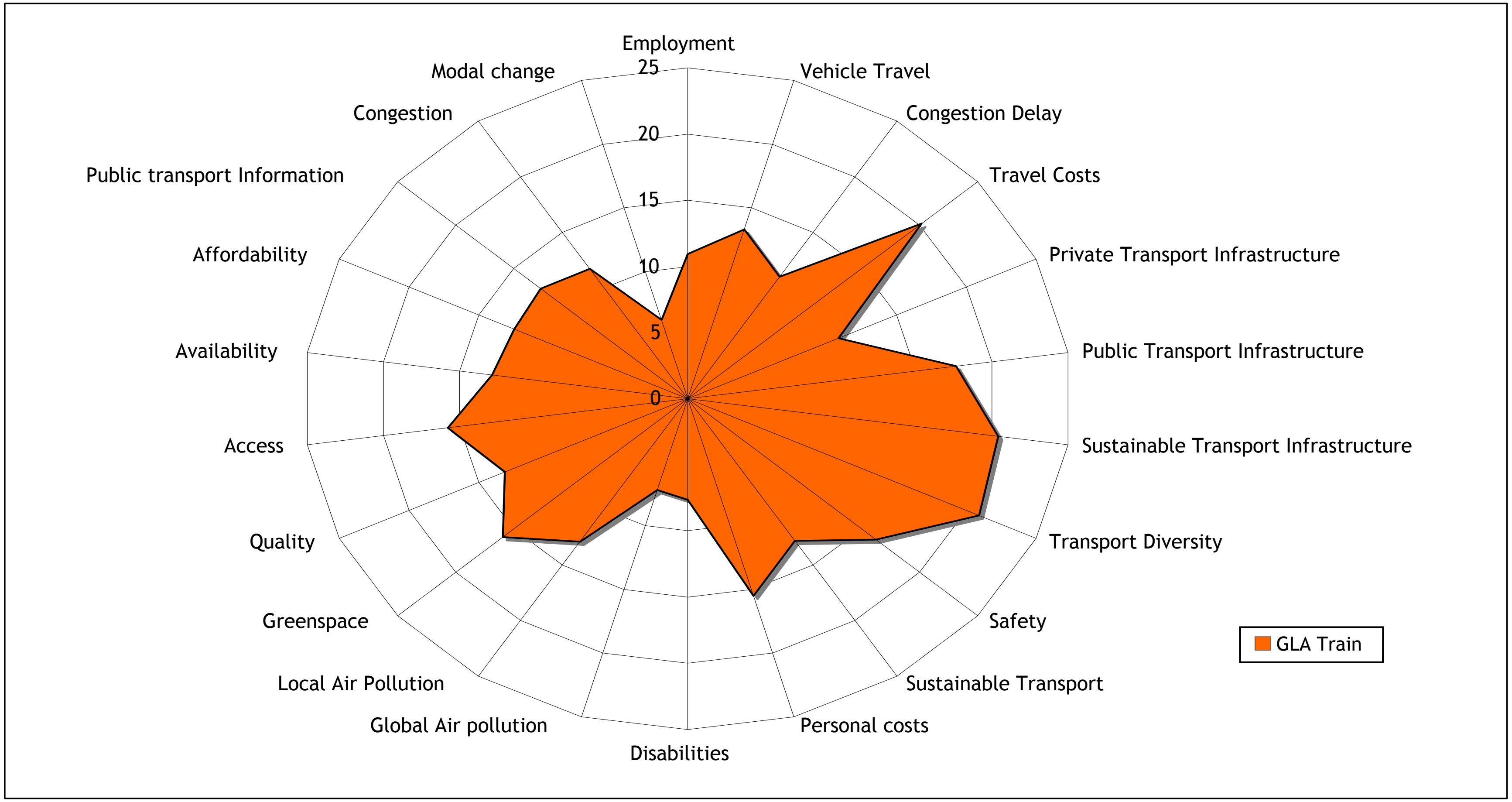

Figure 4.10 Initial Glasgow Train TQoL

end of the survey regarding any other indicators that were not included found passenger behaviour and reliability to be important for individual TQoL. These were to be included in the TQoL model mark II. How the scores relate to the indicators is shown in Table 4.3. The variable numbers relate to where it was ranked from the weighting survey. This approach indicates a problem for the model's robustness. As more than one measure were used for some of the indicators the validity of the indicator scores can be questioned.

The weighting scores and the data collected from the survey, secondary data and participant observation were multiplied together to produce the final TQoL scores for each indicator. The scores on their own indicate that transport choice, sustainable transport infrastructure investment and travel costs were high in the train corridor. Using Rogerson's et al.'s method these scores can be added together to provide an overall score of 298.93 for Glasgow's Train TQoL. This score could then be compared to the rest of the corridors in Glasgow and other cities. This would demonstrate how TQoL ranks on a national or even international scale. The problem with this approach is that the value from the research is lost in the quantification. Presentation of the data on spider diagrams provides a more accurate and easily understood output. The spider diagram for the Glasgow train corridor is shown in Figure 4.10. The advantage of this approach lies in illustrating how well the mode of transport performs on all the TQoL indicators. When three different modes of transport are presented on a single diagram it will be more effective. In this chart it is still possible to observe differences in the Train TQoL. The area where it was performing best is the last two economic indicators and first two social indicators. It is important to note that the noise pollution indicator has been excluded from the chart as no data was found. This is an issue that was be addressed in the next stage of model development. It was found that subjective data is more effective for this measure.

General judgements can be made but there is a need for more statistical interpretation of the results. Simply stating that TQoL on the train is better on a number of indicators is not robust enough. There needs to be more explanation of why and how. Using t-tests to compare the different modes of transport is one method that can be applied.

4.3.2 REFLECTIONS ON THE INITIAL APPRAISAL

The initial appraisal was conducted in one transport corridor in Glasgow to evaluate if the methodology is able to successfully measure TQoL. The research showed that the method needs some modification if the appraisal technique is to be successful. Rogerson et al.'s technique is well-suited to the investigation of journey experiences, but the methods applied need to be updated. The main change that needs to be made is the theoretical underpinning of the technique. Whilst commentators continue to argue that that QoL should be assessed by a combination of objective and subjective measurement in this context the value added from the objective data is not robust and precise enough. Many of the data sources are for different years and cover different scales, which produces an unreliable result. Under the performance criteria specified in chapter three it would mean that the TQoL model could not be accepted as an alternative appraisal technique.

Other modifications to the method are development to the surveys. These changes include the scaling technique used, sampling frame and sample sizes. Rogerson et al's Likert scale does not allow for variation in QoL and a broader range would be more appropriate. Using the telephone directory as the sampling frame is not an effective method to gain the samples, because it delivers a biased sample. The size of the samples may also need to be rethought considering the research budget available to complete both phases of research in both cities. This could mean that a lower number of surveys will be mailed. Despite the improved presentation brought by spider diagrams to observe differences in TQoL on all indicators there needs to be more statistical analysis to interpret the results. These changes are described in more detail in the preceding section. This stage will present the TQoL model mark II that was used in the implementation phase.

4.4 MODIFICATION TO THE TQoL METHODOLOGY

This section contributes to the model development by reflecting upon the appraisal technique and the qualitative research and modifying the methodology accordingly to gather a more reliable assessment of TQoL. The principles of Rogerson et al.'s methodology are applicable to transport research, but changes were required to improve the accuracy of the model. There were four main areas of improvement: theory of the method, survey design, sampling frame and model analysis.

4.4.1 TQoL Theory

In the TQoL model mark I there are three main weaknesses in terms of the theory of TQoL: (I) validity of the output, (II) objective data and (III) inconsistencies with TQoL indicators. These are modified to ensure the model can measure TQoL more accurately.

(I) Validity of the output is the main concern following the initial appraisal. The objective of the thesis is to develop a methodological tool that can appraise individuals experience on public transport. The results produced by the model need to be precise, robust, relevant and add value to transport appraisal. This was not found in TQoL model mark I. It does not provide an accurate evaluation of the journey experience because the data used is incompatible and unreliable. There was not enough quality data available that can be used to represent the objective perspective of the passenger. This was a major concern for the development of a QoL technique, due to the central argument that a combination of both subjective and objective data is needed for a true reflection of QoL (Beesley and Russwurm, 1989; Diener and Suh, 1997; Pacione, 2003; Randall and Morton, 2003; Rogerson, 1995). Objective and subjective indicators have been found to constitute independently useful estimates of the QoL construct (Cummins, 2000). The relationship between objective and subjective variables is complex, but it is generally fairly independent. The ability to use both measures in one model therefore is very difficult to achieve with a high level of reliability. This is despite Rogerson et al. using only objective measures. The TQoL model mark I was to supplement objective data with the subjective perspective of individual's experiences. This is because perceptions and experiences are subjective. A model measuring TQoL using only objective data would be irrelevant. It is not possible to

understand the experience of the passenger without asking them about their journey.

(II) *Objective data* in this model does not provide an accurate representation of TQoL and there was not enough reputable data at the local level. Even if there was, it may not have been effective enough for the aims of this technique. The TQoL model needs to meet specific performance criteria to compare different modes of transport and contribute to transport appraisal. Upon reflection of the TQoL concept a stronger case was made for a total subjective assessment. The TQoL model is designed to measure the experience of the passenger. The only correct way this should be measured is by asking the passenger about their experience. Whilst this approach is different from traditional QoL research it is the most appropriate method to examine TQoL. It provides a much better representation of their QoL, as only their experience will be used in the assessment. QoL is subjective, shaped by the surrounding environment, and it links our internally held goals and values with the world around us (Randall and Williams, 2002). The two household surveys should be used to observe the subjective TQoL but objective data and participant observations are not needed, as the quality provided is not satisfactory. The TQoL indicators and the surveys were modified so all the issues could be answered in the second household survey.

(III) *Inconsistencies* is the third key problem through the over complication of using more than one indicator to represent a headline indicator. In some cases the mean score was taken for up to four different measures to produce the weighting for a single TQoL indicator. This lacked quality and reliability. It is more appropriate to use only one single measure for one headline indicator.

In the TQoL model mark II the same headline indicators are used and the two new indicators were also included because they all were significant in relating to individuals experience. This produces a new set of TQoL indicators, with only one measure for each headline indicator (Table 4.4). This reduced the number of indicators from 39 to 29. Six of the indicators are economic, six are social, four are environmental and twelve personal indicators. Littman's sustainable development format remained for the factor groups.

Table 4.4 TQoL indicators following Initial appraisal

ECONOMIC INDICATORS OF TRANSPORT QUALITY OF LIFE	
EC1: EMPLOYMENT	Access to employment?
EC2: VEHICLE TRAVEL	Time taken to travel to work?
EC3: TRAVEL COSTS	How much does each journey cost you?
EC4: PRIVATE TRANSPORT INFRASTRUCTURE	How effectively is money spent on roads and parking services?
EC5: PUBLIC TRANSPORT INFRASTRUCTURE	How effectively is money spent on public transport services?
EC6: SUSTAINABLE TRANSPORT INFRASTRUCTURE	How effectively is money spent on walkways and cycle paths?
SOCIAL INDICATORS OF TRANSPORT QUALITY OF LIFE	
SO1: TRANSPORT CHOICE	How would you describe the number of different transport options in your area?
SO2: SAFETY ON PUBLIC TRANSPORT	How safe do you feel when traveling on public transport?
SO3: SAFETY IN CAR	How safe do you feel when traveling by car?
SO4: SUSTAINABLE TRANSPORT	How do you rate the quality of walkways and cycle paths in your local area?
SO5: PERSONAL COSTS	How much of your weekly budget is taken up by transport costs?
SO6: DISABILITIES	How do you rate the overall quality of provision for transport services for people with disabilities?
ENVIRONMENTAL INDICATORS OF TRANSPORT QUALITY OF LIFE	
EN1: CLIMATE CHANGE TRANSPORT	How much pollution in local area due to transport?
EN2: AIR QUALITY	How do you feel the level of air quality is in your local area?
EN3: NOISE POLLUTION	How badly do you consider the noise from transport to be in your local area?
EN4: GREENSPACE	How much parkland is there within 500m from your home?
PERSONAL INDICATORS OF TRANSPORT QUALITY OF LIFE	
P1: QUALITY	How is the overall quality of the public transport service in your area?
P2: SATISFACTION	How satisfied are you with the public transport serviced?
P3: BUS ACCESS	How close is your nearest bus stop?
P4: TRAIN ACCESS	How close is your nearest train station?
P5: SUBWAY ACCESS	How close is your nearest subway station?
P6: SERVICES ACCESS	How easy is the access to major services i.e. hospital, shops and recreation services?
P7: AVAILABILITY	How often is there a regular public transport service in your local area?
P8: PUBLIC TRANSPORT INFORMATION	What level of knowledge do you know about the public transport services in your local area?
P9: CONGESTION	How much does congestion add to your journey?
P10: CONGESTION BLAME PUBLIC TRANSPORT	Agree that public transport is to blame for congestion?
P11: CONGESTION BLAME PRIVATE TRANSPORT	Agree that car traffic is to blame for congestion?
P12: JOURNEY TIME DIFFERENTIAL	How much longer is it to travel by public transport?
P13: PASSENGER BEHAVIOUR	Behaviour of other passengers enhance or detract travel experience

A number of headline indicators were removed and some added. In the economic indicators, the only change was the exclusion of the congestion indicator. This was because there is already a congestion indicator in the personal indicators. Instead of using objective data, respondents will be asked how much congestion affects their journey. The number of social measures was reduced so each issue could be answered in only one question. Safety was been split into the two to observe how safe passengers feel when they travel by public transport and by car. These answers provided information on passenger's perceptions of safety. The personal costs indicator was still part of the model to represent how much of the weekly budget is spent on transport. This is a different issue to the amount spent on each journey.

Four indicators measure the environmental conditions with more quality instead of averaging multiple measures for each indicator. The personal indicators were also redefined for more simplicity and reliability. Passengers revealed their experience of quality, access, availability, reliability, information, congestion, journey time and passenger behaviour. The two new indicators were included in this group because they closely relate to personal travel. Access to model interchanges and services have been separated into the different indicators instead of averaging the scores together. Journey time differential, which was previously measured as part of availability, was introduced as a separate indicator. There are also now three indicators to evaluate the impact of congestion. The two indicators that were removed are affordability and modal change. Affordability is covered by the two travel cost indicators. Modal change was removed as there was no real contribution to the model. It was in fact a stated preference question that would contradict what the TQoL model is trying to measure. This question was still included in the survey to evaluate differences in TQoL. Correct wording in the questionnaires is vital to make sure the respondent understands each issue and is able to answer appropriately.

Measuring TQoL subjectively provides a much greater understanding of passenger experience. Although objective data is considered a valuable part of QoL assessment the value added in this context does not merit inclusion. The model can now fully understand the passengers experience on each TQoL indicators. It will become a measurement technique that directly appraises individuals current travel behaviour. Critics may argue that it is not possible to understand travel behaviour only through subjective data. Whilst this is true to a certain point, unless you have the correct data, objective measurement does not add any value and detracts from the output of the model. The worse case scenario for this project was developing a tool that can be disregarded for not providing a quality appraisal of passenger experience. There was specific performance criteria set out in chapter three and including this would not lead to an effective appraisal of TQoL. QoL is a very complex concept to assess and using data that detracts from output would make TQoL insignificant. Appraisal of TQoL is therefore much better served by examining the subjective experience of public transport.

Having identified these indicators it was necessary to test once more if they were contributing to passengers TQoL. A qualitative research phase was conducted to understand on a one-to-one level how passengers feel about TQoL and determine if there were any issues not covered by the indicators.

4.4.2 QUALITATIVE ASSESSMENT OF TQoL INDICATORS

A wide scale project using multiple focus group sessions and one-to-one interviews would be the most appropriate way to confirm the applicability of the TQoL indicators. Project time and cost restrictions meant this stage was limited to one focus group session and ten telephone interviews.

The focus group session permits the researcher to observe a large amount of interaction on a specific topic in a short time (Smithson, 2008). In terms of this research it was particularly helpful for model development. The design of the focus group ensured the audience present represented views from males and females, older and younger adults and passengers from all modes of transport. While focus group research guides recommend groups are single sex groups or similar characteristics to permit cross-group comparability for this stage, it was important to bring together a diverse group that represented a small sample of an urban population. Five people attended the focus group, selected to provide a range of transport passengers. Appendix C provides more detail on the focus group structure and content.

The outcome of the focus group confirmed the validity of the TQoL indicators. As the group was small it was easier to manage and conversation was free flowing. When conversation moved off topic discussion was directed back to the subject so all the indicators were discussed. The difficulties in attracting participants meant telephone interviews were needed to further confirm views from wider groups of society.

Telephone interviews provided an opportunity to verify the TQoL indicators on a one-to-one basis without the higher costs found in conducting personal interviews. Respondents were also selected from the citywide survey. The addresses were organised according to different characteristics and individuals were randomly identified. This enabled an equal amount of male and females, employed and unemployed, and varied age groups. Ten interviews were conducted. The number of interviews is drawn from literature relating to theoretical saturation, which is described as the key to excellent qualitative research (Morse, 1995). Saturation can be described as the point at which no new information or themes are observed in the data. Research has found that saturation can occur after six-to-twelve interviews (Guest et al., 2006; Morse, 1994; Nielsen and Landauer, 1993), although others have calculated that extremely accurate information can be achieved with a small sample of four individuals (Romney et al., 1986).

The outcome of the interviews was positive with each person contacted taking part. The validity of the TQoL indicators were once more reassured as each respondent thought all of the indicators were significant. In some cases indicators were explained in more detail to clarify their role. When they were all listed at the beginning of the interview it did cause some confusion, however once they were repeated and explained one by one the contribution was understood. In four of the interviews only the list of indicators could be explained. While it would have been better to go into more detail their contribution was still important. There were also three interviews that lasted over half an hour and all of the indicators were discussed in more detail. In both the short and long interviews respondents agreed that all the indicators were important. The only issue that needed further confirmation was congestion blame. In two interviews people thought it was valuable but in the others the validity in measuring their experience was disputed.

This small qualitative research stage was critical to the model's development. A larger project might have been more helpful, but this was not possible within the constraints of this project. More focus groups would also have been better, but the response was low and there was problems arranging suitable times and location. It was positive to learn that all of the indicators are contributing to individual's experience on public transport. Despite the qualitative research being small it was sufficient to test the indicators. Considering the results from both stages more research would have probably confirm the findings, not contradict it. The validity of the indicators will be further tested in the implementation and model development stages. This was the last point that any new issues could be introduced and it was surprising that no new issues were brought up. This could be due to people feeling the list is already quite long and there must not be any more. It could even be due to them not wanting to say the wrong thing. Despite these issues both the focus groups and the interviews were conducted in an informal atmosphere and people were encouraged to express their feelings.

4.4.3 SURVEY RE-DESIGNS AND SCALE DEVELOPMENT

The final set of TQoL indicators was redefined to measure subjective experiences (Table 4.5). Incorporating all the indicators into the survey made the questionnaire longer so layout and format became an important part of the design process. The questionnaires were once more constructed according to Dillman's TDM. Since the initial appraisal, Dillman produced an updated version of TDM, known as the 'Tailored Design Method' (Dillman, 2007). The principles of the survey design are very similar to the previous edition.

Many of these recommendations could not be implemented due to financial costs. This included layout and aspects of design. A booklet is preferred for the questionnaire layout printed on single pages only and the cost to print over

Table 4.5 Indicators for the TQoL model mark II

ECONOMIC INDICATORS OF TRANSPORT QUALITY OF LIFE	
EC1: EMPLOYMENT	How would you describe the access to employment?
EC2: VEHICLE TRAVEL	Time taken to travel?
EC3: TRAVEL COSTS	How much does each journey cost you?
EC4: PRIVATE TRANSPORT INFRASTRUCTURE	How effectively is money spent on roads and parking services?
EC5: PUBLIC TRANSPORT INFRASTRUCTURE	How effectively is money spent on public transport services?
EC6: SUSTAINABLE TRANSPORT INFRASTRUCTURE	How effectively is money spent on walkways and cycle paths?
SOCIAL INDICATORS OF TRANSPORT QUALITY OF LIFE	
SO1: TRANSPORT CHOICE	How would you describe the range of different transport options in your area?
SO2: SAFETY ON PUBLIC TRANSPORT	How safe do you feel when traveling on public transport?
SO3: SAFETY IN CAR	How safe do you feel when traveling by car?
SO4: SUSTAINABLE TRANSPORT	How do you rate the quality of walkways and cycle paths in your local area?
SO5: PERSONAL COSTS	How much of your weekly budget is taken up by transport costs?
SO6: DISABILITIES	How do you describe the access of transport services for people with disabilities?
ENVIRONMENTAL INDICATORS OF TRANSPORT QUALITY OF LIFE	
EN1: CLIMATE CHANGE TRANSPORT	How much pollution in local area due to transport?
EN2: AIR QUALITY	How do you feel the level of air quality is in your local area?
EN3: NOISE POLLUTION	How badly do you relate the level of noise from transport to be in your local area?
EN4: GREENSPACE	How much parkland is there within 500m from your home?
PERSONAL INDICATORS OF TRANSPORT QUALITY OF LIFE	
P1: QUALITY	Overall, how do you describe the quality of the public transport service in your area?
P2: BUS ACCESS	How close is your nearest bus stop?
P3: TRAIN ACCESS	How close is your nearest train station?
P4: SUBWAY ACCESS	How close is your nearest subway station?
P5: SERVICES ACCESS	How easy is the access to major services i.e. hospital, shops and recreation services?
P6: AVAILABILITY	How often is there a regular public transport service in your local area?
P7: RELIABILITY	How reliable is the public transport services in your area?
P8: PUBLIC TRANSPORT INFORMATION	What level of knowledge do you know about the public transport services in your local area?
P9: CONGESTION	How does congestion add to your journey?
P10: JOURNEY TIME DIFFERENTIAL	How much longer is it to travel by public transport?
P11: PASSENGER BEHAVIOUR	Behaviour of other passengers enhance or detract travel experience

1500 questionnaires on single pages was not possible within the project budget. There is also the environmental concern to consider. The questionnaires were printed on both sides and stapled at the upper left hand corner.

The first criterion of the layout is ordering of the questions. As described in the initial methodology the questions should not be disconnected. They need to be ordered together to allow logical flow of conversation. Deciding on the first question is very important because no single question is more crucial than the first one (Dillman, 2007). In both the weighting and the assessment questionnaires it was decided that the same first questions should be applied (Appendix A). These were questions that related to their most common journey. Respondents were asked the purpose, how long it took them to travel, how often they make this journey, what method they used, how much it cost, what alternative modes are available and how they would prefer to travel. This may appear to be a lengthy introduction but it was designed to make the respondent feel that the survey applies to them and grab their attention. The rest of the questions were ordered in topical groups, not according to the indicator groups. In the weighting survey, the issues relating to indicators were placed in an item-in-a-series format. The issues are grouped together starting with access, then money, journey time, journey experience, safety and the environment. This flow makes sure the people do not lose concentration by jumping from one topic to another and back again. The matrix is broken up by asking respondents if they own a car. The final part of the questionnaire is demographic questions.

The flow of the assessment survey was very similar. At the top of the questionnaire it was made clear that only passengers of that particular mode should complete the survey. The survey was then ordered in component parts according to access, money, journey experience, safety, the environment and miscellaneous questions. The format is different from the weighting survey because questions on journey time and cost are answered in the introductory section. Questions 26 and 28-31 are included for analytical purposes. The demographic questions are also located at the end of the questionnaire. Although vertical alignment of answers is recommended this is not possible due to the change in scaling. Answers were placed in a vertical direction when it was possible.

The tailored-design process consists of five elements to significantly improve response: (I) a respondent-friendly questionnaire, (II) up to five contacts with the questionnaire recipient, (III) inclusion of stamped return envelopes, (IV) personalized correspondence, and (V) a token financial incentive sent with the survey request (Dillman, 2007). Not all of the stages were possible within this project. As discussed in the initial methodology it was only possible to design the survey according the TDM principles and send out two mailings: the main questionnaire and an additional follow-up letter two weeks later. Despite criticism over the success of a token incentive (Moses and Clark, 2004; Warriner et al., 1996), a prize draw was included to adhere with TDM.

The cover letter accompanying the questionnaire in the first mailout was constructed in a similar format to Dillman's recommendations (Appendix A). It was decided that a brief letter and a detailed information sheet on the survey was more suitable for this study. The cover letter is a straightforward explanation of what the study is, why it is useful and why they were selected. Whilst the essential components of the TDM cover letter are included detail is deliberately concise so the respondent is able to read the letter in its entirety and understand what is asked of them. The separate sheet on the survey information explains the research aims, how the data will be presented and who to contact to verify credentials (Appendix A).

Scale development was updated following concerns of reliability. Using only five possible options does not allow effective representation of passenger experience. Cummins and Gullone (2000) found that subjective QoL data can become negatively skewed as most people respond only to a restricted portion of the conventional scale. This confirms previous research in social psychology of unreliability when using the Likert 5-point scale (Heine et al., 2002; Russell and Bobko, 1992). An 11-point end-defined scale is recommended to be superior to 5- or 7-point scales for the purpose of measuring life satisfaction. This allows the respondent to record their satisfaction with a degree of precision that matches their ability to reliably discriminate between changing levels of satisfaction (Cummins, 2003). The 11-point scale provides 5 levels of satisfaction above the point of scale neutrality. This scale did have an impact on the layout of the questionnaire, as many questions relating to TQoL could not be presented in a vertical flow. For some questions, such as how much the journey cost or the travel time it may have been more appropriate to use an open-ended answer. Using this approach however would not have delivered the answer in the same scale. As the values had to be converted into the 11-point scale, it was more effective to use this scale for the responses.

4.4.4 SAMPLING FRAME AND SIZES

In the initial appraisal the telephone directory was used for the sampling frame in both surveys. The validity of this source can be questioned due to the bias that is caused. The use of telephone directory as a sampling frame results in three major sources of bias: exclusion of non-telephone households, exclusion of telephone numbers that are issued after the publication of the telephone directory, and exclusion of unlisted numbers (Esslemont et al., 1992). It is estimated that about ten per cent of the general population do not have a telephone in their home and about a quarter of those who do have telephones have ex-directory (unlisted) numbers. The proportion of homes without telephones is slowly falling, but the proportion of ex-directory numbers is rising (Thomas and Purdon, 1994). The result is that many groups will not be represented in the research.

The electoral register is a more comprehensive sampling frame. This contains a closer reflection of the total population. Commonwealth, British, European residents are required by law to be registered on the electoral roll. Although it does not include all residents in the UK the sampling frame becomes more valid, personal communication can be increased and the addresses should be more up-to-date. It also saves time in the selection process as the samples can be taken from the registers at the ward level. Dillman (2007) emphasises that personal communication can increase the quality of the survey which will lead to a better response rate. This was not possible using the telephone directory as usually only one person from the household is in the directory. In the electoral register all persons over 18 are included with both names presented.

This meant surveys could be addressed directly to the individual rather than asking for an adult male or female to complete the questionnaire. The electoral register also has the advantage by being more updated compared to the telephone directory as local election offices now operate under a rolling registration.

Addresses were selected by visiting the local election offices in Glasgow and Manchester. A simple random sample was collected for both surveys using the random number feature in Microsoft Excel. For both surveys an equal number of addresses from each ward/borough were selected in Glasgow and Manchester. A matrix was set up for the ward/borough number, the polling district, the page number and the electoral roll number. The relevant addresses were selected and checked to make sure they were within relevant boundaries.

The sample sizes were adjusted following concerns on the reliability of the results. Although the output of the TQoL model is not an essential part of this project the values do need to be reliable and it was decided that there should be equal respondents in each corridor. The project budget also restricted the number of total surveys to 5,000. If the previous criteria of sample sizes is used together with the response rates from the pre-test almost 6,000 surveys were required. The implications of this, was that the samples would be less likely to be representative to 95% of the population.

Based upon the response rates from the initial appraisal, 600 questionnaires were sent for the weighting and 350 for the assessment survey. If as in the initial appraisal, 22% and 38% were returned are returned after the first wave, 2136 will need to be sent in the weighting survey and 3402 for all assessment surveys. This is less than the previous calculations and just over the maximum number. Whilst the response rates will not be exactly received, the range should be very similar. If they are the same 174 surveys should be returned for the weighting survey and 154 for the assessment survey. Using the 90% confidence levels this will be a 23% reduction in confidence but an increase of 0.1% in Manchester weighting survey. For the assessment surveys in Glasgow it will be a 37% reduction on the bus sample, 12% increase on the train sample and 6% increase on the LRT sample. In Manchester it will be a 27% reduction for the bus samples, and an increase of 324% on the train sample and 46% on the LRT sample. In most cases the sample will be an accurate representation of the population.

4.4.5 TQoL ANALYSIS

The results from the initial appraisal lacked analytical confirmation because of the problems with the data that were collected. The spider diagrams are a valuable addition to QoL research, but needed to be reinforced with statistical analysis to add viability to the method and the outcome of the results. T-tests and factor analysis will verify the model development and increase reliability in the results. TQoL scores for each indicator on one mode need to be compared against the others. T-tests are an effective method to report significant differences between two samples. Although the most appropriate method would be to use a technique that can compare three samples, software for this technique is not available. The t-test calculations were conducted in SPSS.

Factor analysis was the second part of the analysis introduced to develop the TQoL model. Factor analysis is a multivariate statistical technique that can summarize the information from a large number of variables into a much smaller number of variables or factors. By identifying latent (not easily identifiable) relationships and combining variables into a few factors, factor analysis simplifies our understanding of the data. When you use factor analysis, the variables are not divided into dependent and independent categories. Instead, all variables are analyzed together to identify underlying patterns or factors (Hair et al., 2003). The advantage of using this technique in QoL research is that all of the indicators are considered in the model. There is no one dependent variable as all indicators are important. It measures the contribution of each indicator and assesses the amount of variance it contributes to the concept of TQoL. Factor analysis has been used regularly in health-related QoL, but adoption into the social sciences has been relatively slow. Using factor analysis in this research will verify the significance of the TQoL indicators. It will confirm the relationships in the data to reveal indicators that are contributing to TQoL and those that are not. This is the final stage of model development that will provide the TQoL model mark III.

4.5 CONCLUSION: THE TQoL MODEL MARK II

This chapter has contributed significantly to the overall research aim of developing a new appraisal tool for transport research. As a design process the development of the TQoL model does not end with this chapter, but continues through the analysis of the results (Chapter five) and through a further model development stage (Chapter six). The intention of this chapter was to introduce the revised TQoL Model (Mark II), test this methodology in the initial appraisal and reflect upon the technique. The appraisal found a number of problems that were modified for the implementation stage to be a successful appraisal of TQoL.

Rogerson et al's method was found to be unsuitable for assessing passenger experiences on public transport for three main reasons:

- First, QoL measurement does not provide a reliable enough value to appraise journey experiences. Using objective data does not allow the TQoL model to meet the specific performance criteria because the information is either out dated or not comparable at an inter-city level. The model would not be robust, precise and relevant. It would also mean the technique cannot add value to transport appraisal. Subjective TQoL assessment is more effective as it presents the experience on public transport from the passenger's viewpoint. Weighting TQoL indicators from a nationwide survey would also produce an invalid appreciation of people's feelings toward what is important to their TQoL. There are many different factors that can affect a national perspective, including culture, social characteristics and travel behaviour. There were also specific aspects of the methodology that were modified, especially in the scale development and survey design.

- Second, although verification of the indicators is also an essential part of QoL development, this was lacking in Rogerson et al's development. There needs to be more confirmation other than the respondent scores on the weighting survey. Qualitative research and factor analysis strengthen the TQoL model. These are crucial parts in the model development considering this is the first investigation of TQoL.

- Third, quantification of the indicator scores into a single TQoL score (as in the Rogerson et al method) represents a loss of quality and a lack of precision. While it is understandable why Rogerson et al used league tables to compare different locations, this method results in a loss of information. The multiple dimensions of QoL and TQoL cannot be adequately represented by a single score. There is also the issue of parsimony of indicators as a single score is not sufficient yet a million indicators would present problems of information overload in terms of data collection and analysis. Therefore the indicators selected in the TQoL model mark II are sufficient to appraise TQoL. Spider diagrams are a new form of pictorial communication, which, inter alia, allow modal corridors to be readily compared, while t-tests provide statistical rigour, allowing precise observation of which transport mode provides superior TQoL.

Despite these criticisms, essential principles of Rogerson et al's method remain in the TQoL Model. A city-wide survey has been used to provide the weightings for the TQoL indicators and these scores are multiplied against assessment scores gathered in a second household survey. Following the review of the initial results in chapter five, the model will be redeveloped using factor analysis in chapter six. This provides the final stage of development and the final version of the TQoL Model (Mark III), where only those indicators contributing to an individual's experience are included.

The following chapter will present the initial TQoL results from the implementation stage. These results will confirm the ability of the TQoL model to contribute to transport appraisal. If the TQoL models are able to identify individuals experience then the tool can be used in the appraisal process. The research has been deliberately flexible to adapt to changes that have occurred to the methodology and this process continues in the next two chapters.

Chapter Five

TRANSPORT QUALITY OF LIFE IMPLEMENTATION: RESULTS

5.0 INTRODUCTION

Using the methods outlined in Chapter Four, transport quality of life (TQoL) was appraised in Glasgow and Manchester. This chapter presents the initial findings from this appraisal and contributes to the implementation part of model development (**Figure 5.1**). This is the first stage of analysis applying Rogerson et al's traditional quality of life (QoL) techniques (Findlay et al., 1988; Rogerson et al., 1987). Although an important stage in model development, it is not the final stage because Chapter Six tests the model's reliability.

The chapter is organised in four main sections. The first section documents the data characteristics. The second and third sections present the results from TQoL appraisals in Glasgow and Manchester respectively. The final section presents the modal comparison in the two cities.

5.1 DATA COLLECTION REPORT, CHARACTERISTICS AND ANALYSIS

All postal surveys raise concerns regarding response rates because there must be sufficient data to conduct analysis. Reliable analysis needs relatively high response rates. In this project Dillman's *Tailored Design Method* (2007) was used to obtain a target sample to describe TQoL. It was also important to collect enough responses to complete factor analysis. It is generally agreed that there should be four or five times as many observations as there are variables to be analyzed (Hair et al., 1992). In each transport corridor 154 cases were required as there are twenty-seven TQoL indicators. Despite the

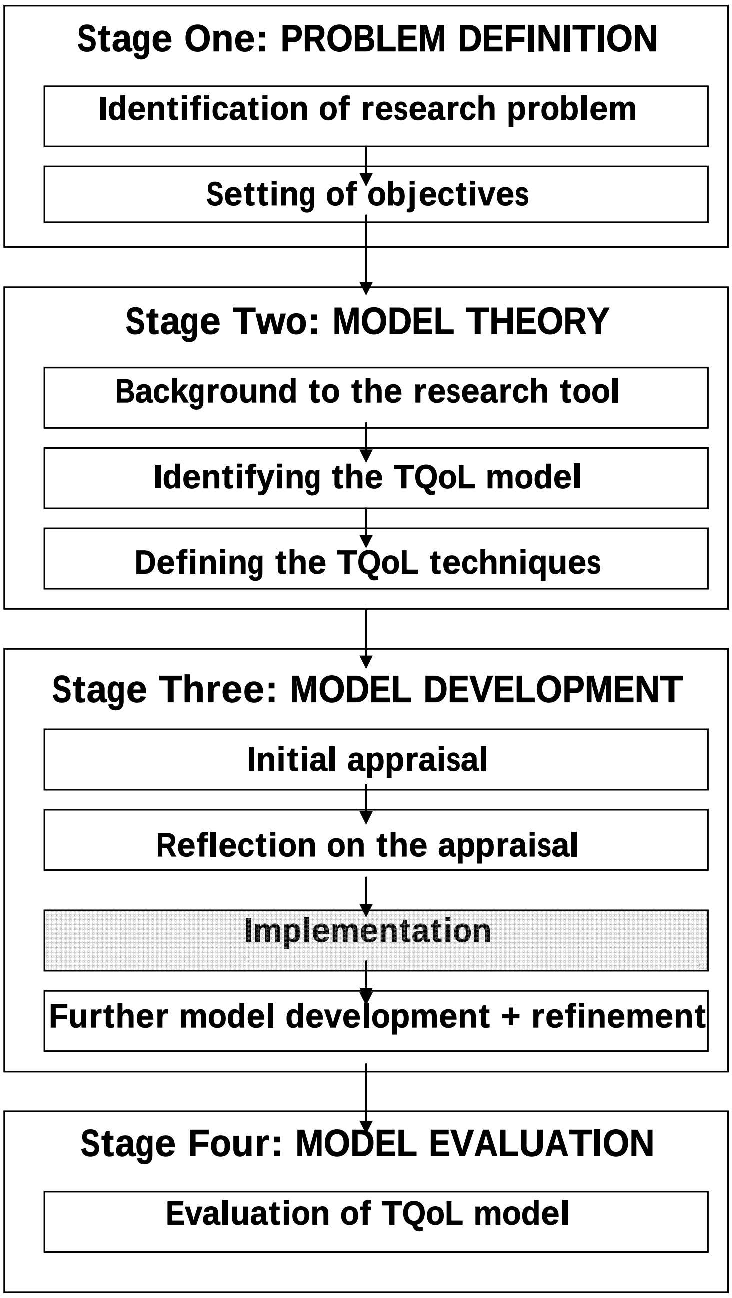

Figure 5.1 TQoL model development in relation to chapter 5

inability to implement Dillman's five elements of TDM, questionnaire design and interest in the subject delivered respectable response rates (**Table 5.1**).

Table 5.1 Survey response rates

	Number distributed	Valid Response	Non-Valid Response	Total	% Total Response	% Valid Response
MAN Survey 1	600	256	18	274	46	**43**
GLA Survey 1	600	226	21	247	41	**38**
MAN LRT	350	133	23	156	45	**38**
MAN Bus	350	130	26	156	45	**37**
MAN Train	350	136	32	168	48	**39**
GLA LRT	350	158	24	182	52	**45**
GLA Bus	350	147	16	163	47	**42**
GLA Train	350	183	36	219	63	**52**

Total response rates for both surveys range from 41% to 63%. Not all of the responses are applicable and valid responses varied from 37% to 52%. These figures are not as high as previous surveys implementing Dillman's TDM technique, but are large enough to test TQoL and conduct factor analysis. For the second survey there was a higher response rate in Glasgow compared to Manchester. The highest response received was from the train ward in Glasgow, which is similar to the rate gathered from the initial appraisal. The characteristics or a genuine interest in public transport in this area may account for the greater response. There is no concern regarding the response rates and the difference in sample sizes will not affect the results of TQoL. In some corridors the number of people travelling by the public transport mode is not that high. For example in the Manchester train corridor only 323 people travel to work by train (ONS, 2001a), so to receive responses from 39% is significant. If more resources were available to implement the five stages of TDM larger samples could have been collected.

Although these response rates are positive the accuracy of the population assessed is not as reliable. Using the sample size calculations made in the initial methodology only two samples were reflective of 95% of the population - Manchester's train corridor and the citywide sample. In Glasgow there is a reduction in responses required of 30% for the citywide sample, 57% in the bus corridor, 7% in the train corridor and 9% in the LRT corridor. In Manchester there is a reduction of 57% for the bus corridor and 11% for the LRT corridor. This was caused by changing the criteria of selecting samples. Despite not reflecting 95% of all passengers in each respective corridor appraisal based on similar sized samples is more effective. Questions could have been raised on the reliability of the output if Bus TQoL for over 300 respondents was compared against only 50 train passengers.

To further check the data's representativeness, population tests were conducted on each of the samples and across the two cities. This is because if the data is not an accurate representation of the population the result of TQoL could be biased to a particular group. While the characteristics will not be an exact replication of the residents there should be similar characteristics if the results are to be reputable. Two forms of observation were conducted. The first was a brief summary of how the data collected in the second survey compares to the same variables for the total population. The second was a more detailed assessment of the modal corridors. Demographic, social and transport characteristics were assessed using t-tests. These verified if the corridors had similar characteristics to support effective comparison of TQoL across both cities. The results of the tests are presented in Appendix D. Summary of demographic and social characteristics found all the corridors were similar to the total population. Detailed comparisons using t-tests also identified similar demographic and transport characteristics. The differences found in housing type, travel patterns and car use were expected. Whilst the areas in Glasgow and Manchester will never be exactly the same, the corridors selected do provide the best opportunities of modal comparison in the UK.

Each questionnaire was then checked to ensure it was correctly completed before being entered into SPSS. All questionnaires from survey one were inputted into the weighting dataset. For survey two it was important to include only questionnaires from respondents whose main journey method was being appraised. Thus only respondents travelling by bus in the bus corridor were included in the bus dataset. The same was repeated in each corridor in both cities.

This is one reason for the number of non-valid responses. Other explanations are that questionnaires were not fully completed or it was returned back unopened because they no longer lived at the address. This was a common problem, which was unusual considering the addresses were selected from 2006's electoral register. The main reason for changing to the electoral register was to give a more accurate representation of the population and prevent this very problem that occurred in the initial appraisal. The electoral register may not be as accurate as it could be because not everyone updates their residency status with the local election office.

To enter the data into SPSS efficiently some variables were coded appropriately. The datasets were then scanned to clear up any mistakes made whilst inputting. These mistakes were corrected so all the data collected was entered into SPSS accurately.

Analysis of the data to produce TQoL for each corridor is a relatively straightforward process following the practice taken by Rogerson et al. (1987) in their studies of QoL in the UK. The first survey is used as the weighting of the TQoL indicators, with the questions directly relating to questions of TQoL in the second survey. The score from each indicator in both surveys are averaged and then multiplied together to give the weighted TQoL score. The main differences from previous QoL research and recent work on Service Quality Index (SQI) (Hensher and Prioni, 2002; Hensher et al., 2003), is that scores are not aggregated together into one single TQoL score. The recently developed SQI's apply the principles of Stated Preference (SP) techniques. The SP linear equation is the same as used by Rogerson et al. and can easily be applied to TQoL (Kroes and Sheldon, 1988):

SP Equation

$$U = \alpha 1 \chi 1 + \alpha 2 \chi 2 + \ldots \alpha n \chi n$$

where

U	= total utility
$\chi 1$ to χn	= value of factors 1 to n
$\alpha 1$ to αn	= utility weights for factors 1 to n

TQoL Equation

$$TQoL = \alpha 1 \chi 1 + \alpha 2 \chi 2 + \ldots \alpha n \chi n$$

where

TQoL = total TQoL

$\chi 1$ to χn = value of TQoL indicators from 2nd survey, variables 1 to n

$\alpha 1$ to αn = weights of indicators from 1st survey, weights 1 to n

If the outcome of the model was to produce total scores the following results could be presented (**Table 5.2**). But what do these scores really tell us about the QoL experienced by passengers of public transport in Glasgow and Manchester? It shows a better fixed modal TQoL compared to Bus TQoL. In Manchester, Bus TQoL is lower by 65.38 compared to LRT TQoL. In Glasgow, Bus TQoL is lower compared to LRT TQoL by 70.18. But what makes the fixed modes in both cities better than the bus and how significant are the differences between the modes? Do these scores really demonstrate something useful so that practitioners and transport experts can say, yes, we want to invest in a new LRT system because the bus provides an inferior TQoL to LRT in Manchester by 65.38. The argument for or against investment of a new transport system is, and should be based on more than one single score. QoL on transport is more than just a single score i.e. the distribution is important hence the value of the spider diagram. There are many different dimensions of a persons experience when they travel by public transport. The spider diagrams act both pictorially and analytically as the true representation of TQoL.

Table 5.2 Total TQoL

	TRAIN	METRO	BUS
MANCHESTER	538.51	558.32	492.94
GLASGOW	557.17	557.99	487.81

5.2 TQoL APPRAISAL IN GLASGOW

5.2.1 OVERALL TQoL

TQoL for Glasgow was assessed using the traditional QoL techniques. The results were produced in SPSS and processed into spider diagrams in Microsoft Excel to compare TQoL by mode and different characteristics. **Figure 5.2** illustrates TQoL for Glasgow. This graph compares TQoL for the train, LRT and bus. It is possible to immediately observe differences between the modes of transport. The more area the chart covers the better the TQoL. Thus, passengers travelling on the train and LRT encounter a better experience compared to the bus. Although simple conclusions could be made on the charts, t-tests provide a comprehensive evaluation of the differences between the modes. T-tests report if there are significant differences for each indicator of TQoL. If there are differences in TQoL accurate interpretation can be made on journey quality.

The null hypothesis of the t-tests is that there are significant differences in TQoL between the samples. The more t-tests where the hypothesis can be accepted the greater the difference in TQoL. Levene's Test for Equality of Variance was conducted prior to the t-tests to determine whether the t-test for equal variance not assumed or equal variance assumed should be used. The appropriate test was then carried out with the t-statistic and 2-tailed significance produced in the table. If the significance level is ≥ 0.05 then it is possible to reject the null hypothesis that there are significant differences between the samples. Indicators with no significant differences are highlighted in red. The indicators have been abbreviated in each table, for a list of the full indicator names see Appendix E.

T-tests comparing the modes of transport from Glasgow are shown in **Table 5.3**. There are only two modes of transport compared, because t-tests can only test for equality of means from two different samples. In the comparison between LRT TQoL and Bus TQoL indicators with no significant difference in TQoL are the cost of transport (significant at 0.080), public transport infrastructure investment (significant at 0.191), sustainable infrastructure investment (significant at 0.231), car safety (significant at 0.654), transport budget (significant at 0.900), disabilities provision (significant at 0.047), climate change (significant at 0.132), air quality (significant at 0.176), and noise pollution (significant at 0.169). This means the cost to travel, how money is spent on transport, disability provision and environmental quality are very similar in these areas.

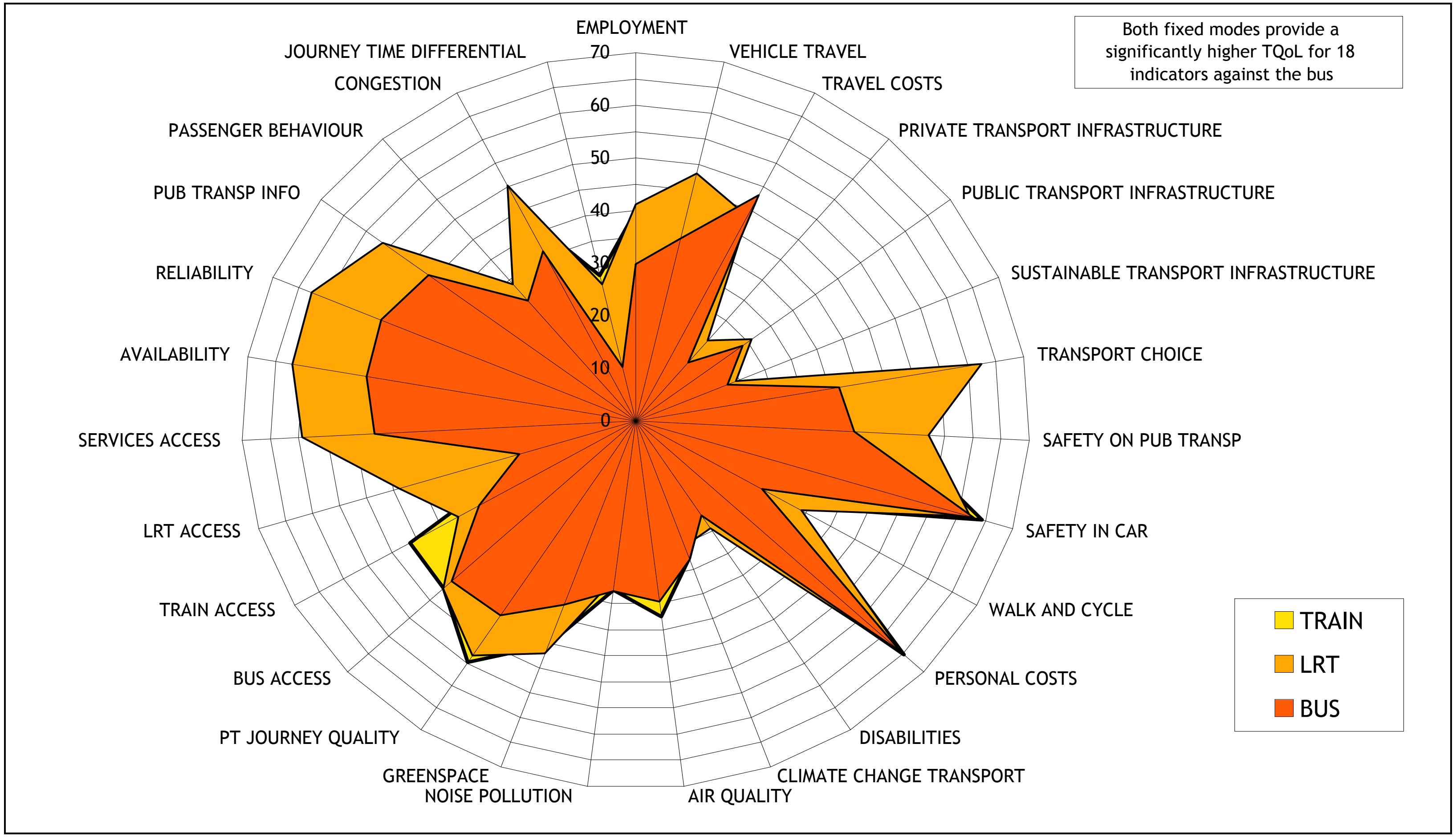

Figure 5.2 GLA TQoL all variables, by mode

Table 5.3 t-Tests comparing the means of Glasgow TQoL

t-Tests comparing LRT TQoL and Bus TQoL	t-test for Equality of Means t-Stat	Sig. (2-tailed)	t-Tests comparing Bus TQoL and Train TQoL	t-test for Equality of Means t-Stat	Sig. (2-tailed)	t-Tests comparing LRT TQoL and Train TQoL	t-test for Equality of Means t-Stat	Sig. (2-tailed)
EMPLOY	6.975	**0.000**	EMPLOY	-6.411	**0.000**	**EMPLOY**	1.018	**0.310**
VEHTRAV	10.653	**0.000**	VEHTRAV	-7.819	**0.000**	VEHTRAV	2.285	**0.023**
TRAVCOST	-1.755	**0.080**	**TRAVCOST**	2.008	**0.045**	**TRAVCOST**	0.221	**0.825**
PRVINFRAS	4.570	**0.000**	**PRVINFRAS**	-1.107	**0.269**	PRVINFRAS	3.778	**0.000**
PUBINFRAS	1.310	**0.191**	**PUBINFRAS**	1.416	**0.158**	PUBINFRAS	2.813	**0.005**
SUSINFRAS	1.200	**0.231**	**SUSINFRAS**	-0.234	**0.815**	**SUSINFRAS**	1.037	**0.301**
TRANCHC	11.459	**0.000**	TRANCHC	-7.854	**0.000**	TRANCHC	4.784	**0.000**
PUBSAF	5.962	**0.000**	PUBSAF	-3.421	**0.001**	PUBSAF	3.237	**0.001**
CARSAF	-0.448	**0.654**	**CARSAF**	-0.765	**0.445**	**CARSAF**	-1.328	**0.185**
WALK	4.460	**0.000**	WALK	-3.727	**0.000**	**WALK**	0.690	**0.491**
BUDG	0.126	**0.900**	**BUDG**	-0.526	**0.599**	**BUDG**	-0.494	**0.622**
DISAB	1.991	**0.047**	**DISAB**	0.176	**0.861**	DISAB	2.374	**0.018**
CLIMCHNG	-1.509	**0.132**	**CLIMCHNG**	0.169	**0.866**	**CLIMCHNG**	-1.390	**0.166**
AIRQUAL2	-1.357	**0.176**	AIRQUAL2	-2.074	**0.039**	AIRQUAL	-3.353	**0.001**
NOISEPOLL	-1.379	**0.169**	**NOISEPOLL**	0.083	**0.934**	**NOISEPOLL**	-1.409	**0.160**
GREENSPC	4.255	**0.000**	GREENSPC	-3.727	**0.000**	**GREENSPC**	0.775	**0.439**
JRNQUAL	5.154	**0.000**	JRNQUAL	-6.276	**0.000**	**JRNQUAL**	-1.078	**0.282**
BUSACC	4.305	**0.000**	BUSACC	-3.849	**0.000**	**BUSACC**	0.612	**0.541**
TRNACC	4.266	**0.000**	TRNACC	-16.557	**0.000**	TRNACC	-16.027	**0.000**
LRTACC	27.859	**0.000**	LRTACC	3.457	**0.001**	LRTACC	36.468	**0.000**
SERVACC	8.139	**0.000**	SERVACC	-3.530	**0.000**	SERVACC	5.484	**0.000**
AVAIL	6.949	**0.000**	AVAIL	-5.363	**0.000**	AVAIL	2.276	**0.023**
RELIAB	6.582	**0.000**	RELIAB	-5.148	**0.000**	**RELIAB**	1.800	**0.073**
TRANINFO	4.698	**0.000**	TRANINFO	-4.198	**0.000**	**TRANINFO**	0.907	**0.365**
BEHAV	2.017	**0.045**	**BEHAV**	-0.885	**0.377**	**BEHAV**	1.329	**0.185**
CONG	5.991	**0.000**	CONG	-3.725	**0.000**	CONG	2.598	**0.010**
JRNDIFF	12.073	**0.000**	JRNDIFF	-13.178	**0.000**	**JRNDIFF**	-1.165	**0.245**

There are significant differences for 18 of the 27 indicators of TQoL. There is a difference in employment (significant at 0.000) because the employment opportunities are much higher for those travelling on LRT (41.198) compared to the bus (29.847). This is the same for vehicle travel, private infrastructure investment, transport choice, public transport safety, walking and cycling quality, greenspace, journey quality, bus access, train access, LRT access, services access, availability, reliability, transport information, congestion and journey differential (all significant at 0.000) and behaviour of other passengers (significant at 0.045). LRT TQoL is higher for all indicators compared to Bus TQoL. The TQoL spider chart illustrates a difference between the modes of transport and t-tests confirm statistical variation in passenger experience.

The indicators with no significant difference are those issues not directly influential on TQoL, with the exception of travel costs and transport budget. Investment in transport infrastructure is determined at a city level, not within local areas, so there will be no major difference in the two corridors. The environmental factor reveals a low TQoL score for both corridors. This reflects a wider problem, that climate change and increased environmental awareness is not just a local concern, but one in which everyone is affected. Similar levels of TQoL for transport costs means that whilst there is concerns over increasing prices, there is no real difference in travelling by LRT compared to the bus. Although fixed modes of transport are perceived to be more expensive to use, the reality is that LRT in Glasgow does not cover a large area so the prices remain competitive.

In the comparison between Train TQoL and Bus TQoL, t-tests report significant differences for 18 of the 27 indicators. The indicators with significant differences are very similar to those for LRT. This is why fixed modes of transport are performing better compared to the bus. These indicators are employment opportunities, vehicle travel, transport choice, walking and cycling quality, greenspace, journey quality, bus access, train access, services access, availability, reliability, transport information, congestion and journey differential (all significant at 0.000), public transport safety and LRT access (significant at 0.001), air quality (significant at 0.039) and car safety (significant at 0.044). The differences are a result of higher TQoL scores for the train compared to the bus. The only indicator where the bus is providing a significantly better TQoL is LRT access due to the corridor being located closer to the LRT network.

Indicators with no significant differences are travel cost (significant at 0.045), private transport infrastructure investment (significant at 0.269), public transport infrastructure investment (significant at 0.158), sustainable infrastructure investment (significant at 0.815), transport budget (significant at 0.599), disabilities provision (significant at 0.861), climate change (significant at 0.866), noise pollution (significant at 0.039) and transport behaviour (significant at 0.366). These are similar results to the comparison of LRT TQoL and Bus TQoL. The only difference is that there are no significant differences for the private transport infrastructure investment and transport behaviour and there are significant differences in air quality. This means fixed modes of transport are providing a similar level of TQoL that is significantly better than the bus. This enhanced TQoL is on personal indicators of TQoL and some social and economic indicators.

TQoL scores with a positive difference in favour of the train are not as high compared to the differences between LRT and the bus. This difference may have been expected but it is an important finding nonetheless. The difference in mean scores between the two modes for employment is 10.070 compared to 11.351 for LRT, and for vehicle travel it is 10.095 compared to 12.728. This pattern is repeated for all the indicators, with the exception of journey quality and train access, where the mean difference for the train is 10.951 and 14.167 compared to 9.084 and 4.227 for LRT. Train access is expected to be higher, however the difference in journey quality is not. T-tests comparing the two fixed modes of transport will provide further detail on the difference in TQoL.

The spider diagram for Glasgow's TQoL illustrates little difference between the train and LRT, which should mean fewer indicators with significant differences. Results from the t-tests confirm 15 indicators with no significant difference between the samples. These are employment opportunities (significant at 0.310), travel cost (significant at 0.825), sustainable infrastructure investment (significant at 0.301), car safety (significant at 0.185), walking and cycling quality (significant at 0.491), transport budget (significant at 0.627), climate change (significant at 0.166), noise pollution (significant at 0.160), greenspace (significant at 0.439), journey quality (significant at 0.282), bus access (significant at 0.541), reliability (significant at 0.073), transport information (significant at 0.365), transport behaviour (significant at 0.185) and journey differential (significant at 0.245).

Environmental indicators, sustainable infrastructure investment, travel cost, travel budget and car safety were also issues of no significant difference in the comparison with the bus. These issues represent broader environmental and political concerns. Decisions on transport investment are taken at the city level and the environmental condition appears to be the same for all people within Glasgow. The cost to travel and weekly budget indicators is a more interesting point considering the influence costs has on journey quality. It is generally perceived that a better experience on public transport will cost considerably more and research has shown that cost to travel is a major factor is determining modal choice (Hanna and Drea, 1998; Hovell et al., 1975; Kittleson and Associates et al., 2003). Despite this, results demonstrate that the cost to travel is not an influential issue in the difference between TQoL in Glasgow. The remaining indicators with no significant difference are mainly from the personal indicators group.

The indicators with significant differences are vehicle travel (significant at 0.025), private transport infrastructure investment (significant at 0.000), public transport infrastructure investment (significant at 0.005), transport choice (significant at 0.000), public transport safety (significant at 0.001), disabilities provision (significant at 0.018), air quality (significant at 0.001), train access, LRT access, services access (all significant at 0.000), availability (significant at 0.023) and congestion (significant at 0.010). LRT TQoL is higher for each of these indicators, with the exception of air quality and train access. LRT provides a quicker journey time, more transport choice, better disability provision, superior access to LRT and services, more availability and less congestion. The only indicator with a surprising result is disability provision because there is currently no wheelchair access on LRT.

Overall there are many similarities in TQoL provided by fixed modes of transport in Glasgow. Passengers on both modes have a higher TQoL compared to the bus. The importance of these differences can be analysed by the weightings from the citywide survey. In this survey each respondent rated on a scale of 0-10 how important each indicator was to their QoL when they travel by public transport. These results have been ranked in order of importance to illustrate the most important aspects of TQoL (Table 5.4). The indicators with no significant differences between the two samples are shown in red. The first column on the left is the comparison between LRT and the bus, the middle column is the comparison between the train and the bus and the column on the right is the comparison between LRT and the bus.

There is a clear difference in the comparison between the fixed modes and the bus and the comparison of the two fixed modes. In the comparison of LRT and the train six of the top ten indicators and four of the top five provide similar levels of TQoL. For the most important aspects of TQoL there is little difference between the fixed modes. In the comparison between LRT and the bus there are only one indicator is in the top ten most important with no significant difference - safety when travelling by car. For the train and the bus there is only two indicators in the top ten of importance - safety when travelling by car and behaviour of other passengers. The majority of the indicators with no significant differences between the fixed modes and the bus are found in the lower half of the table, whereas between the two fixed modes there is more equal distribution towards the top half of the table. This means that the indicators with significant differences are more important (higher in table 5.4) between the fixed modes and the bus. This is the opposite for the comparison of the two fixed modes with the most important issues for TQoL reporting no significant differences.

5.2.2 GLASGOW TQoL BY DEMOGRAPHIC & TRANSPORT CHARACTERISTICS

The next stage of the analysis is to examine differences in TQoL within each mode of transport. TQoL is assessed by two demographic and two transport characteristics - gender, age, if the respondent is able to transport by car and if they want to travel more by car. There are two reasons for these

Table 5.4 Importance of TQoL indicators in Glasgow, highlighting the significant differences between the corridors

LRT AND BUS		TRAIN AND BUS		LRT AND TRAIN	
TQoL INDICATOR	SCORE OF IMPORTANCE	TQoL INDICATOR	SCORE OF IMPORTANCE	TQoL INDICATOR	SCORE OF IMPORTANCE
RELIABILITY	8.168	RELIABILITY	8.168	RELIABILITY	8.168
SAFETY ON PUB TRANSP	8.018	SAFETY ON PUB TRANSP	8.018	SAFETY ON PUB TRANSP	8.018
PASSENGER BEHAVIOUR	7.898	PASSENGER BEHAVIOUR	7.898	PASSENGER BEHAVIOUR	7.898
PUB TRANSP INFO	7.730	PUB TRANSP INFO	7.730	PUB TRANSP INFO	7.730
PT JOURNEY QUALITY	7.681	PT JOURNEY QUALITY	7.681	PT JOURNEY QUALITY	7.681
TRANSPORT CHOICE	7.553	TRANSPORT CHOICE	7.553	TRANSPORT CHOICE	7.553
AVAILABILITY	7.531	AVAILABILITY	7.531	AVAILABILITY	7.531
SAFETY IN CAR	7.482	SAFETY IN CAR	7.482	SAFETY IN CAR	7.482
VEHICLE TRAVEL	7.416	VEHICLE TRAVEL	7.416	VEHICLE TRAVEL	7.416
CONGESTION	7.358	CONGESTION	7.358	CONGESTION	7.358
GREENSPACE	7.279	GREENSPACE	7.279	GREENSPACE	7.279
WALK AND CYCLE	7.270	WALK AND CYCLE	7.270	WALK AND CYCLE	7.270
TRAVEL COSTS	6.986	TRAVEL COSTS	6.986	TRAVEL COSTS	6.986
PERSONAL COSTS	6.986	PERSONAL COSTS	6.986	PERSONAL COSTS	6.986
BUS ACCESS	6.916	BUS ACCESS	6.916	BUS ACCESS	6.916
AIR QUALITY	6.898	AIR QUALITY	6.898	AIR QUALITY	6.898
SERVICES ACCESS	6.876	SERVICES ACCESS	6.876	SERVICES ACCESS	6.876
TRAIN ACCESS	6.854	TRAIN ACCESS	6.854	TRAIN ACCESS	6.854
NOISE POLLUTION	6.708	NOISE POLLUTION	6.708	NOISE POLLUTION	6.708
LRT ACCESS	6.566	LRT ACCESS	6.566	LRT ACCESS	6.566
CLIMATE CHANGE	6.292	CLIMATE CHANGE	6.292	CLIMATE CHANGE	6.292
PUBLIC TRANSPORT INFRASTRUCTURE	6.018	PUBLIC TRANSPORT INFRASTRUCTURE	6.018	PUBLIC TRANSPORT INFRASTRUCTURE	6.018
EMPLOYMENT	5.765	EMPLOYMENT	5.765	EMPLOYMENT	5.765
DISABILITIES	5.699	DISABILITIES	5.699	DISABILITIES	5.699
SUSTAINABLE TRANSPORT INFRASTRUCTURE	5.115	SUSTAINABLE TRANSPORT INFRASTRUCTURE	5.115	SUSTAINABLE TRANSPORT INFRASTRUCTURE	5.115
JOURNEY TIME DIFFERENTIAL	4.956	JOURNEY TIME DIFFERENTIAL	4.956	JOURNEY TIME DIFFERENTIAL	4.956
PRIVATE TRANSPORT INFRASTRUCTURE	4.659	PRIVATE TRANSPORT INFRASTRUCTURE	4.659	PRIVATE TRANSPORT INFRASTRUCTURE	4.659

comparisons. The first is to observe if both groups experience similar levels of TQoL, and the second is to assess if the results have produced any bias in the data. The spider diagrams are presented here and the results of the t-tests are shown in Appendix E. TQoL by gender for all three modes are shown in Figures 5.3, 5.4, 5.5. For Train TQoL there appears to be minimal differences in experience for male and female passengers. T-tests report only three indicators with significant difference in TQoL - travel costs, personal costs and climate change. For all other indicators the significance of the t-statistic is above 0.05. The reason for these differences cannot be easily explained without further research. Although some general conclusions could be made for why there are differences in TQoL for the passengers it would not be accurate to do so as these need to be confirmed by further research. If there is theory that can justify the differences it will be included.

Overall, there is no real difference in Train TQoL for males and females. It was initially thought there would be a difference in safety as research indicates women generally feel more unsafe than men, both when travelling on and waiting for public transport and over the 'whole journey' (DfT 2004a). This is not a concern for train passengers in Glasgow, as females report a higher score for safety on public transport than males.

LRT TQoL by gender also shows little significant differences between the samples. Only two indicators have significant differences - safety on public transport and public transport behaviour. For both indicators the TQoL score is higher for males compared to females. This confirms previous research findings that females encounter a different safety experience compared to males (DfT 2004a). It is an issue the LRT provider may need to address. DfT's research found that the most effective measures to increase personal safety when waiting for light rail are bright lighting of the station, the presence of CCTV camera surveillance, a help point and real-time information.

There is greater variation for Bus TQoL by gender with significant differences for travel costs, public infrastructure investment, personal costs, air quality and noise pollution. The difference in transport costs could be related to the concessionary travel as there were a higher number of female respondents

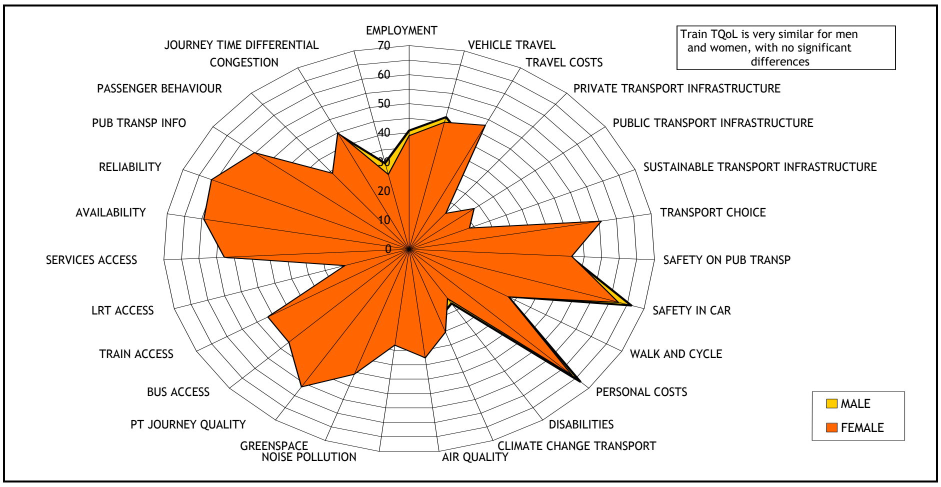

Figure 5.3 GLASGOW Train TQoL, by gender

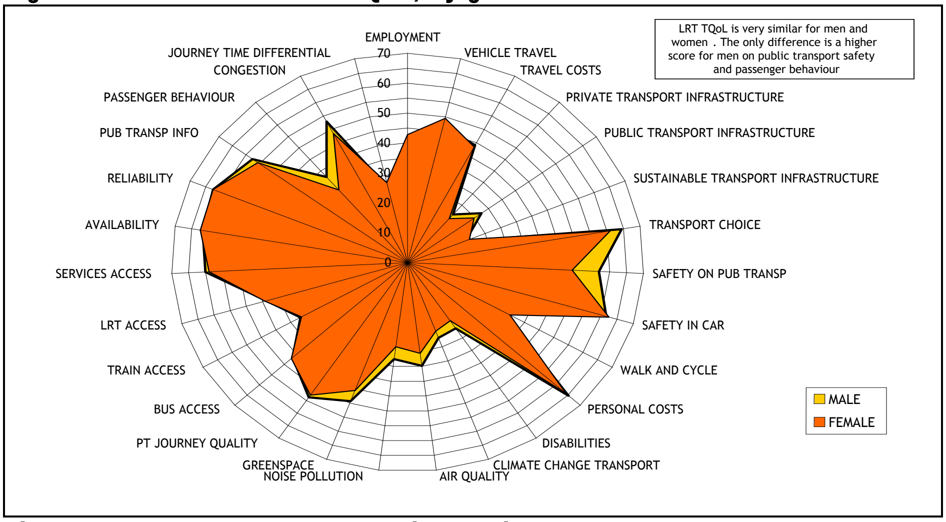

Figure 5.4 GLASGOW LRT TQoL, by gender

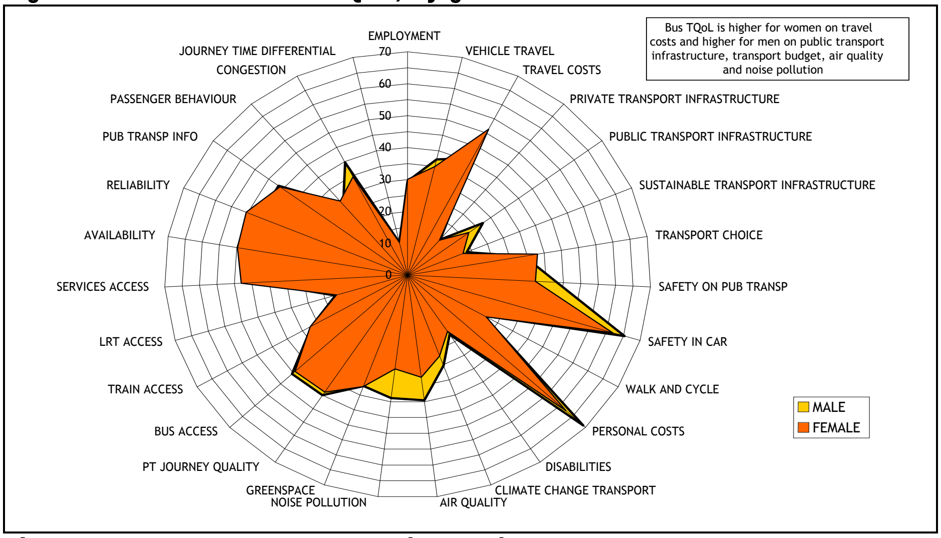

Figure 5.5 GLASGOW Bus TQoL, by gender

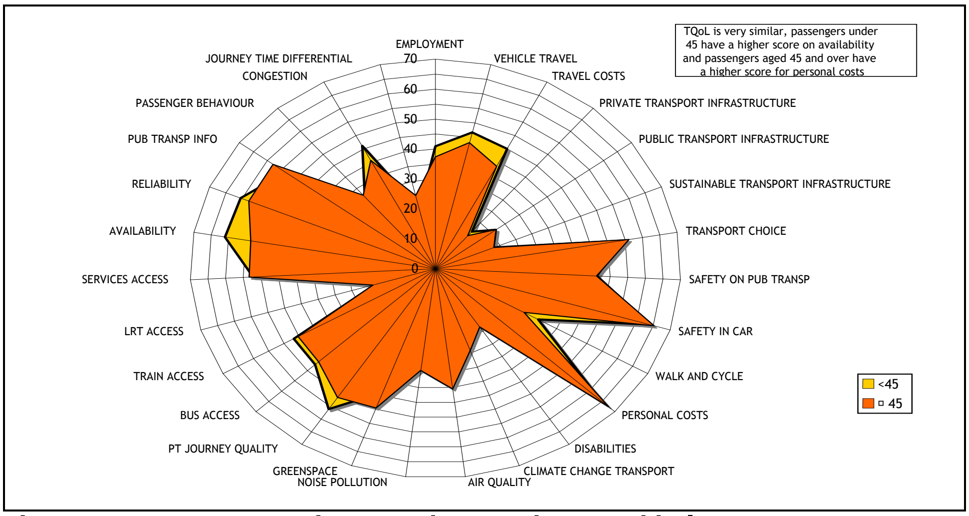

Figure 5.6 GLASGOW Train TQoL, by age above and below 45

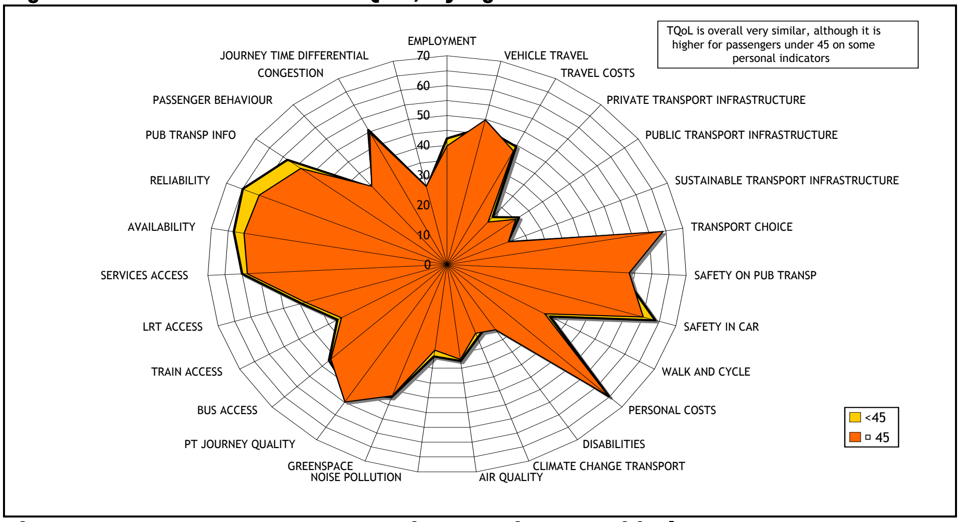

Figure 5.7 GLASGOW LRT TQoL, by age above and below 45

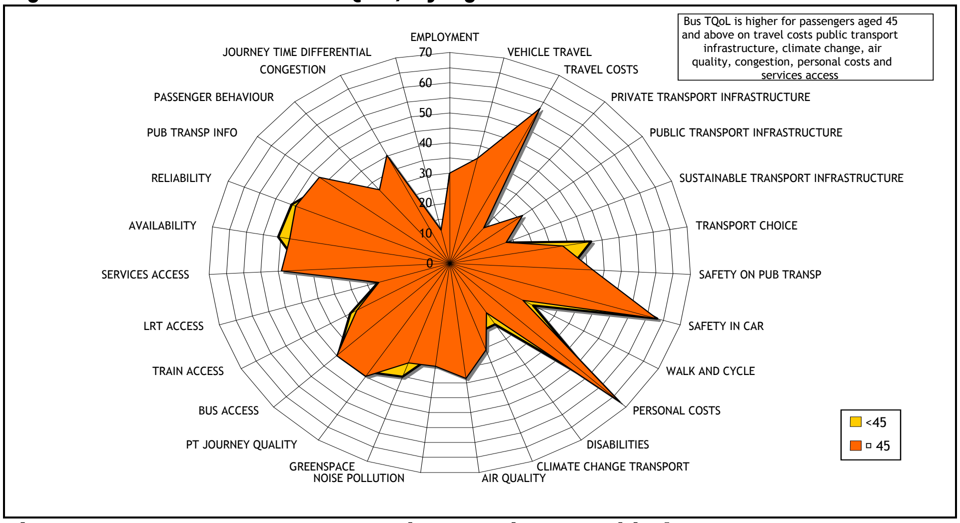

Figure 5.8 GLASGOW Bus TQoL, by age above and below 45

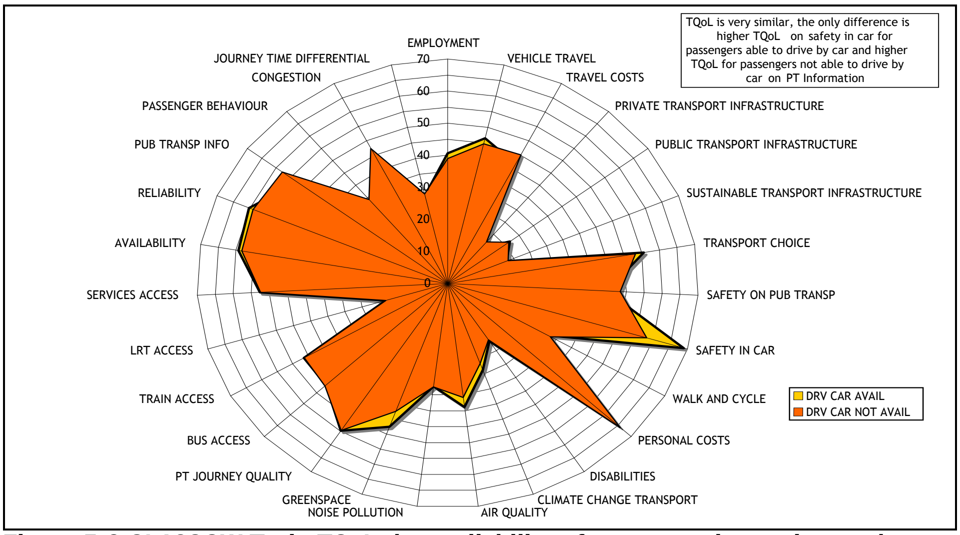

Figure 5.9 GLASGOW Train TQoL, by availability of car as an alternative mode

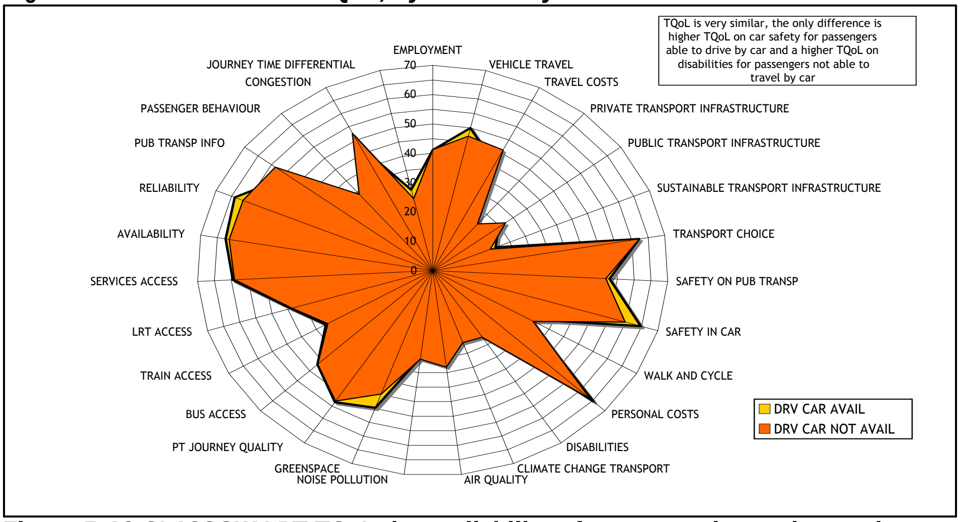

Figure 5.10 GLASGOW LRT TQoL, by availability of car as an alternative mode

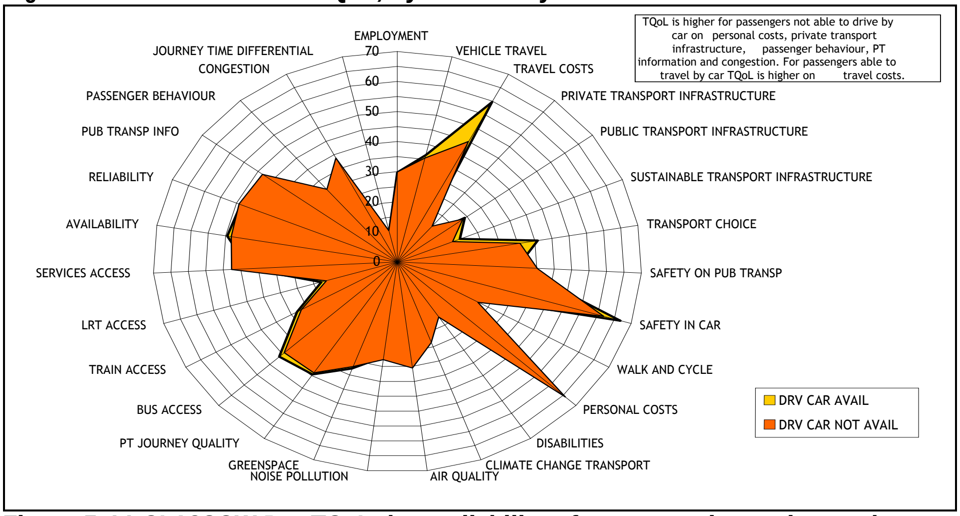

Figure 5.11 GLASGOW Bus TQoL, by availability of car as an alternative mode

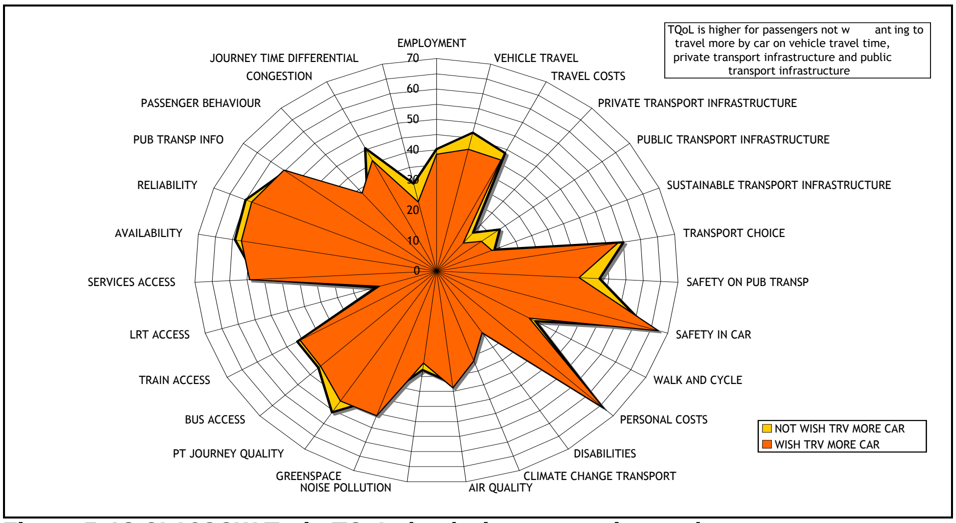

Figure 5.12 GLASGOW Train TQoL, by desire to travel more by car

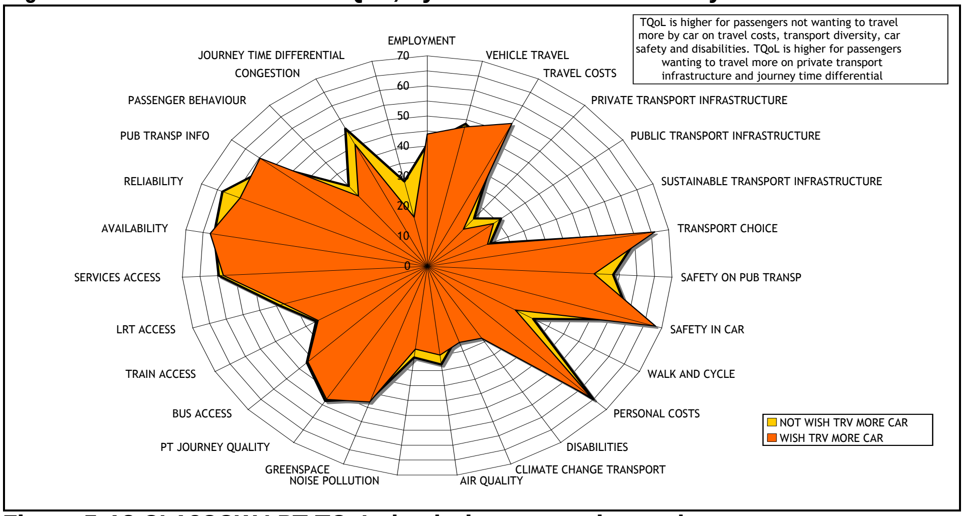

Figure 5.13 GLASGOW LRT TQoL, by desire to travel more by car

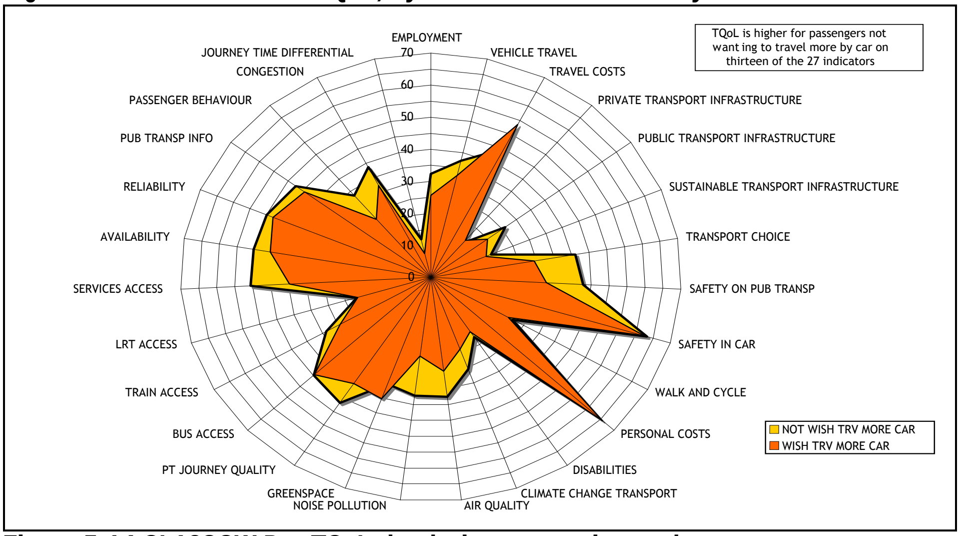

Figure 5.14 GLASGOW Bus TQoL, by desire to travel more by car

aged 55 and over (64.5%). Rye and Mykura (2009) have found that the free concession has stimulated bus use (and possibly some mode shift from car) amongst the mobile younger car-owning elderly. The other differences can not be easily explained without qualitative research.

For comparison of TQoL by age, the groups above and below 45 were used for the mid point in the range. These groupings were used because they provided two similar size samples, and are a good point to show the differences for older and younger adults. Whilst comparing each age group would have been more useful and interesting the samples would not have been large enough to guarantee reliability and only two samples can be compared in t-tests.

There are only two indicators with significant differences on both fixed modes. For Train TQoL it is personal costs and availability. The indicators with significant differences for LRT are LRT access and reliability. These results show that overall TQoL for both fixed modes is very closely related for both age groups, as illustrated by the spider diagrams (Figure 5.6 and 5.7).

There are more indicators with significant differences for bus TQoL by age. The spider diagram shows that respondents over 45 years are experiencing a higher TQoL for a number of issues (Figure 5.8). T-tests confirm significant differences in travel costs, public transport infrastructure, transport choice, climate change, air quality, congestion, personal costs and services access. The only indicator with a higher TQoL for passengers under 45 is transport choice. Travel cost and personal cost are higher for respondents over 45 because a large portion of this sample travels free on the bus. Overall, these results demonstrate that older adults are experiencing a significantly higher TQoL.

The first transport characteristic compared was differences for if passengers were able to travel by car. There is marginal difference for the fixed modes, but more variance on the bus (Figures 5.9, 5.10, 5.11). For Train TQoL there are two indicators with significant differences - safety in car and transport information. On LRT, two indicators have significant differences - car safety and disability provision.

For Bus TQoL there are significant differences on travel costs, private infrastructure, personal costs, bus access, transport information, passenger behaviour and congestion. For all but one of these indicators – travel cost – there is a higher TQoL for passengers not able to travel by car. These results display a marked difference in TQoL for those who have access to a car. When the bus passengers travel by car they experience a better QoL, which means there perception changes when they travel by bus. Research has shown that car availability can have an impact on experience (Stradling et al., 2005; Stradling et al., 2007) and psychological benefits (Ellaway et al., 2003) (i.e. those with access to a car gain more mastery, self esteem, and feelings of autonomy, protection, and prestige compared to public transport passengers). This is only applicable to bus passengers in this research as significant differences is not found for fixed modal passengers with car availability. To learn more about the effect of the car it would important to conduct further research comparing differences in TQoL between car users and public transport passengers.

The influence of the car is further analysed by passengers wanting to travel more by car. There appears little difference for the fixed modes, but a much higher TQoL for bus passengers not wishing to travel more by car (Figures 5.12, 5.13 and 5.14). For Train TQoL there are significant differences for vehicle travel time, private transport infrastructure investment and public transport infrastructure investment. On each indicator there is a higher TQoL score for passengers not wishing to travel more by car. Thus individuals experiencing longer journey time wish to travel more by car. These people also feel investment in private and public transport infrastructure is not effective. Overall, TQoL is the same for both groups and there is no strong argument suggesting the impact of TQoL is causing passengers to want to travel more by car.

For LRT TQoL there are significant differences in travel costs, private transport infrastructure, transport choice, car safety, disability provision and journey time differential. On all indicators, except private infrastructure investment and journey time differential the TQoL score is higher for passengers wishing to travel more by car. Although they are experiencing a higher TQoL on these indicators passengers still wish to travel more by car. It must be noted only 29 respondents wish to travel more by car, so the generalisation is not widely accepted. The majority of people are experiencing a good TQoL and do not wish to travel more by car.

For Bus TQoL there is a different outcome with significant differences on fourteen indicators. This includes employment opportunities, vehicle travel time, travel cost, public transport infrastructure investment, transport choice, public safety, climate change, air quality, noise pollution, journey quality, train access, services access, passenger behaviour and journey time differential. Respondents not wanting to travel more by car have a higher TQoL score for thirteen of these indicators. This means passengers experiencing a poorer TQoL want to travel more by car. These findings confirm previous research of how car use can affect bus experience (Anderson and Stradling, 2004; Stradling et al., 2005; Stradling et al., 2007).

5.2.3 GLASGOW TQoL REFLECTIONS

Examinations of TQoL by the four characteristics provide interesting conclusions. Whilst there were no major differences in TQoL by the demographic characteristics, the influence of the car did have an impact on TQoL. In fixed modal corridors the availability of and desire to travel more by car had little bearing on TQoL because passengers experience a good TQoL. The opposite result is found for Bus TQoL. These passengers who are able to travel by car report a lower TQoL score because they can compare the experience to travelling by bus. If passengers experience a lower TQoL they want to travel more by car. Recent research has found that improving public transport provision, would encourage people to choose it over car travel (GfK NOP 2008). This project has shown that if passengers experience a good level of TQoL they will not want to travel by car, however if they are not then the desire to travel by car increases.

In summary, assessment of TQoL in Glasgow was successful and allowed for a greater understanding of the differences in people's experience on public transport. Spider diagrams present an effective representation of TQoL with t-tests reporting significant differences between the modes. TQoL in Glasgow is significantly higher for passengers of fixed modes of public transport compared to the bus. TQoL is different for personal indicators and a number of economic and social indicators. These issues are most important to individual QoL when they travel by public transport. Indicators reporting no significant differences were environmental issues, infrastructure investment and transport costs. Both environmental and infrastructure investment indicators are issues that can be considered non-local. This means investment decisions taken at the city-level, were not found to have an impact on TQoL in local areas. The environment is a factor with wider implications because everyone was experiencing the same condition. No significant difference in transport costs means that the cost to travel does not have an influence on TQoL. TQoL appraisal on each mode by different characteristics also provides useful conclusions. Whilst there was no difference by gender or age, the influence of the car does impact TQoL. Appraisal of TQoL in Manchester is now very important to learn if the results provide similar outcomes.

5.3 TQoL APPRAISAL IN MANCHESTER

5.3.1 TOTAL TQoL

Assessment of the Manchester data was conducted as applied on the Glasgow data. The spider diagram for Manchester's TQoL is shown in Figure 5.15. Although there is an apparent difference in TQoL for the different modes the contrast between fixed modes and the bus is not as great as in Glasgow. T-tests comparing TQoL is presented in Table 5.5.

In the comparison between LRT TQoL and Bus TQoL there are eleven indicators with no significant differences. These are travel costs, private infrastructure investment, public transport infrastructure investment, sustainable transport infrastructure, public transport safety, car safety, personal costs, greenspace, bus access, transport information and passenger behaviour. These results are similar to Glasgow's comparison of LRT and bus. Infrastructure investment and transport costs were also key issues that reported no significant differences in that comparison. The difference here, is no significant difference in safety and

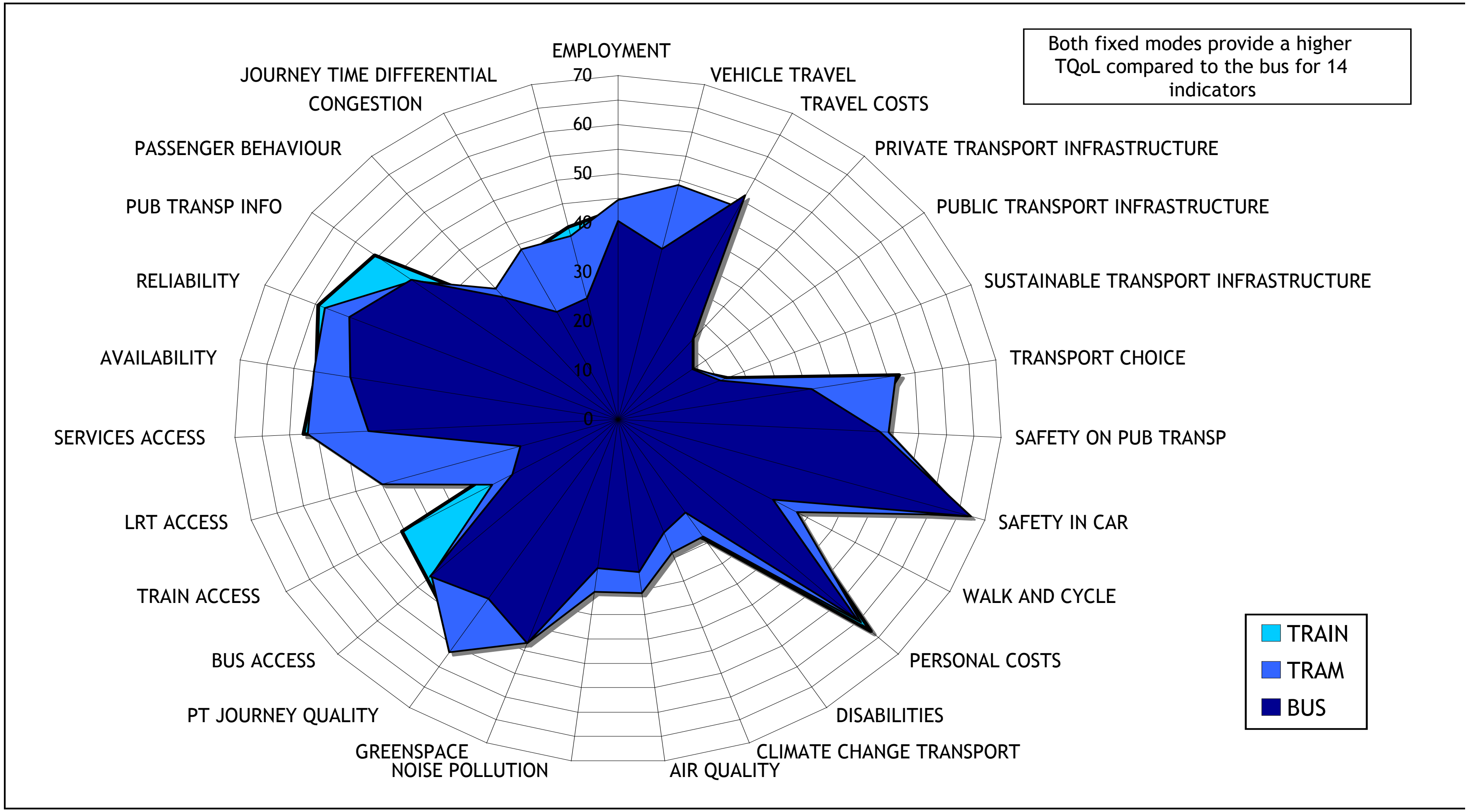

Figure 5.15 MANCHESTER TQoL all variables, by mode

Table 5.5 t-Tests comparing the means of Manchester TQoL

t-Tests comparing LRT TQoL and Bus TQoL	t-test for Equality of Means		t-Tests comparing Bus TQoL and Train TQoL	t-test for Equality of Means		t-Tests comparing LRT TQoL and Train TQoL	t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
EMPLOY	2.801	**0.005**	**EMPLOY**	-1.711	**0.088**	**EMPLOY**	1.258	**0.209**
VEHTRV	8.786	**0.000**	VEHTRV	-2.907	**0.004**	VEHTRV	4.439	**0.000**
TRVCOST	-1.089	**0.277**	**TRVCOST**	1.573	**0.117**	**TRVCOST**	0.578	**0.564**
PRVINFRS	0.204	**0.838**	**PRVINFRS**	1.083	**0.280**	**PRVINFRS**	1.330	**0.185**
PUBINFRS	0.231	**0.817**	**PUBINFRS**	0.211	**0.833**	**PUBINFRS**	0.459	**0.646**
SUSINFRS	0.719	**0.473**	**SUSINFRS**	-0.891	**0.374**	**SUSINFRS**	-0.270	**0.787**
TRANCHC	7.407	**0.000**	TRANCHC	-7.485	**0.000**	**TRANCHC**	-0.297	**0.767**
PUBSAF	0.694	**0.488**	**PUBSAF**	1.140	**0.255**	**PUBSAF**	1.815	**0.071**
CARSAF	-0.482	**0.630**	**CARSAF**	0.384	**0.701**	**CARSAF**	-0.129	**0.898**
WALK	2.457	**0.015**	**WALK**	-1.259	**0.209**	**WALK**	1.086	**0.278**
BUDG	0.837	**0.404**	BUDG	-2.417	**0.016**	**BUDG**	-1.944	**0.053**
DISAB	3.860	**0.000**	DISAB	-3.893	**0.000**	**DISAB**	-0.417	**0.677**
CLIMCHNG	2.561	**0.011**	**CLIMCHNG**	1.344	**0.180**	CLIMCHNG	3.994	**0.000**
AIRQUAL	2.448	**0.015**	**AIRQUAL**	-1.027	**0.306**	**AIRQUAL**	1.471	**0.142**
NOISEPOLL	2.566	**0.011**	**NOISEPOLL**	-0.016	**0.987**	NOISEPOLL	2.727	**0.007**
GREENSPCE	-0.016	**0.987**	GREENSPCE	6.795	**0.000**	GREENSPCE	6.536	**0.000**
JRNQUAL	7.344	**0.000**	JRNQUAL	-5.621	**0.000**	**JRNQUAL**	1.904	**0.058**
BUSACC	-0.637	**0.525**	**BUSACC**	-1.495	**0.136**	**BUSACC**	-2.000	**0.047**
TRNACC	3.207	**0.002**	TRNACC	-21.628	**0.000**	TRNACC	-16.848	**0.000**
LRTACC	26.082	**0.000**	**LRTACC**	3.691	**0.000**	LRTACC	33.609	**0.000**
SERVACC	5.573	**0.000**	SERVACC	-6.248	**0.000**	**SERVACC**	-0.471	**0.638**
AVAIL	3.157	**0.002**	AVAIL	-2.839	**0.005**	**AVAIL**	0.241	**0.810**
RELI	2.039	**0.043**	RELI	-2.578	**0.011**	**RELI**	-0.656	**0.512**
INFO	-0.156	**0.876**	INFO	-4.132	**0.000**	INFO	-4.401	**0.000**
BEHAV	1.019	**0.309**	**BEHAV**	1.806	**0.072**	BEHAV	2.826	**0.005**
CONG	6.282	**0.000**	CONG	-5.269	**0.000**	**CONG**	0.666	**0.506**
JRNDIFF	5.746	**0.000**	JRNDIFF	-6.351	**0.000**	**JRNDIFF**	-0.810	**0.419**

bus access. While LRT was found to be safer in Glasgow this is not the case in Manchester as both modes provide a good level of safety.

Indicators reporting significant differences are employment, vehicle travel time, transport choice, walking and cycling quality, disability provision, climate change, air quality, noise pollution, journey quality, train access, LRT access, services access, availability, reliability, congestion and journey time differential. LRT is providing a significantly higher TQoL for 14 of these indicators compared to the bus. The only indicators where the bus has a higher score are travel costs and safety in the car and these are not significant. Once more these differences are not easily explainable without qualitative research. In general, LRT TQoL is significantly higher than Bus TQoL.

In the comparison of Train TQoL and Bus TQoL there are significant differences for 14 of the 27 TQoL indicators. These are vehicle travel time, transport choice, personal costs, disability provision, greenspace, journey quality, train access, LRT access, service access, availability, reliability, transport information, congestion and journey time differential. The train is providing a better TQoL for all these indicators, except greenspace and LRT access. The issues with significant differences are similar to results comparing LRT and the bus. These indicators are mainly from personal indicators, but also include journey time from the economic indicators and transport choice from the social indicators. As there are differences in the two comparisons it is not possible to make comprehensive conclusions on why the fixed modes provide a better QoL compared to the bus. Despite this, fixed modes of transport are providing a significantly higher TQoL.

Indicators with no significant differences between Train TQoL and Bus TQoL are employment opportunities, travel cost, private infrastructure investment, public transport infrastructure investment, sustainable transport infrastructure investment, public transport safety, car safety, walking and cycling quality, climate change, air quality, noise pollution, bus access and passenger behaviour. The same indicators continue to reveal no significant differences. This includes the infrastructure investment indicators, environmental indicators and transport costs. Investment decisions and environmental quality once more have no impact on the local level. As was found in Glasgow, the cost to travel is not an important factor affecting TQoL.

Comparing Train TQoL and LRT TQoL, there are 19 indicators with no significant difference. These are employment opportunities, travel cost, private infrastructure investment, public transport infrastructure investment, sustainable transport infrastructure investment, transport choice, public transport safety, car safety, walking and cycling, personal costs, disability provision, air quality, journey quality, bus access, services access, availability, reliability, congestion and journey time differential. This is more indicators than the fixed modal comparison in Glasgow, which means the experience encountered on the train and LRT is very similar.

Indicators with significant differences are vehicle travel, climate change, noise pollution, greenspace, train access, LRT access and transport information and passenger behaviour. LRT TQoL has a higher score on all indicators except train access and transport information. Overall, the two fixed modes of transport provide a similarly good TQoL. Comparing these results to the importance of each of the indicators will confirm how valuable the differences are between the modes of transport. Results of the t-tests compared with the importance of TQoL indicators are presented in Table 5.6. Once more the indicators with no significant differences are coloured in red.

The importance of the differences in TQoL between the modes is not as significant as it was for LRT and the bus in Glasgow. In the comparison of LRT TQoL and Bus TQoL there are five indicators in the top ten and four in the top five with no significant differences. This means that despite there being a major difference between LRT TQoL and Bus TQoL these issues are not as important to an individual's TQoL.

In the comparison of Bus TQoL and Train TQoL only three indicators with no significant difference are in the top ten. This means the difference between these modes has more importance compared to the LRT and bus comparison. The relationship between the two fixed modes is also confirmed. In addition to

Table 5.6 Importance of TQoL indicators in Manchester, highlighting the significant differences between the corridors

LRT AND BUS		TRAIN AND BUS		LRT AND TRAIN	
TQoL INDICATOR	SCORE OF IMPORTANCE	TQoL INDICATOR	SCORE OF IMPORTANCE	TQoL INDICATOR	SCORE OF IMPORTANCE
RELIABILITY	8.805	RELIABILITY	8.805	RELIABILITY	8.805
PASSENGER BEHAVIOUR	8.566	PASSENGER BEHAVIOUR	8.566	PASSENGER BEHAVIOUR	8.566
SAFETY ON PUB TRANSP	8.344	SAFETY ON PUB TRANSP	8.344	SAFETY ON PUB TRANSP	8.344
SAFETY IN CAR	8.215	SAFETY IN CAR	8.215	SAFETY IN CAR	8.215
PUB TRANSP INFO	8.105	PUB TRANSP INFO	8.105	PUB TRANSP INFO	8.105
PT JOURNEY QUALITY	8.035	PT JOURNEY QUALITY	8.035	PT JOURNEY QUALITY	8.035
VEHICLE TRAVEL	7.824	VEHICLE TRAVEL	7.824	VEHICLE TRAVEL	7.824
GREENSPACE	7.770	GREENSPACE	7.770	GREENSPACE	7.770
AVAILABILITY	7.617	AVAILABILITY	7.617	AVAILABILITY	7.617
JOURNEY TIME DIFFERENTIAL	7.484	JOURNEY TIME DIFFERENTIAL	7.484	JOURNEY TIME DIFFERENTIAL	7.484
SERVICES ACCESS	7.430	SERVICES ACCESS	7.430	SERVICES ACCESS	7.430
TRANSPORT CHOICE	7.422	TRANSPORT CHOICE	7.422	TRANSPORT CHOICE	7.422
BUS ACCESS	7.258	BUS ACCESS	7.258	BUS ACCESS	7.258
WALK AND CYCLE	7.238	WALK AND CYCLE	7.238	WALK AND CYCLE	7.238
AIR QUALITY	7.180	AIR QUALITY	7.180	AIR QUALITY	7.180
TRAIN ACCESS	7.141	TRAIN ACCESS	7.141	TRAIN ACCESS	7.141
TRAVEL COSTS	7.112	TRAVEL COSTS	7.112	TRAVEL COSTS	7.112
LRT ACCESS	7.026	LRT ACCESS	7.026	LRT ACCESS	7.026
CONGESTION	6.988	CONGESTION	6.988	CONGESTION	6.988
NOISE POLLUTION	6.934	NOISE POLLUTION	6.934	NOISE POLLUTION	6.934
PERSONAL COSTS	6.813	PERSONAL COSTS	6.813	PERSONAL COSTS	6.813
CLIMATE CHANGE	6.297	CLIMATE CHANGE	6.297	CLIMATE CHANGE	6.297
EMPLOYMENT	6.074	EMPLOYMENT	6.074	EMPLOYMENT	6.074
DISABILITIES	5.898	DISABILITIES	5.898	DISABILITIES	5.898
PRIVATE TRANSPORT INFRASTRUCTURE	5.516	PRIVATE TRANSPORT INFRASTRUCTURE	5.516	PRIVATE TRANSPORT INFRASTRUCTURE	5.516
SUSTAINABLE TRANSPORT INFRASTRUCTURE	5.484	SUSTAINABLE TRANSPORT INFRASTRUCTURE	5.484	SUSTAINABLE TRANSPORT INFRASTRUCTURE	5.484
PUBLIC TRANSPORT INFRASTRUCTURE	5.277	PUBLIC TRANSPORT INFRASTRUCTURE	5.277	PUBLIC TRANSPORT INFRASTRUCTURE	5.277

having closely related TQoL the value of differences is strong – six of the top ten indicators have no significant difference.

Results from the t-tests confirm that LRT and the train are providing a higher TQoL compared to the bus. Despite this, the value of these differences is quite different. LRT contains fewer important indicators with no significant differences, whilst the train has more indicators that are important to TQoL.

5.3.2 TQoL BY DEMOGRAPHIC & TRANSPORT CHARACTERISTICS

The next stage of the appraisal is to examine TQoL on each mode by demographic and transport characteristics. Once more the results of the tests are presented in Appendix E. Train TQoL by gender represents little difference between the two groups (Figure 5.16). T-tests confirm significant differences for only four indicators - public safety, disability provision, LRT access and passenger behaviour. TQoL is higher for males on safety by public transport, disability provision and passenger behaviour. This confirms previous findings of the insecurity females feel when they travel on public transport (DfT 2004a).

LRT TQoL by gender is shown in Figure 5.17. T-tests report only three indicators of significant difference - safety in car, journey quality and availability. For all indicators TQoL is higher for males. This result therefore means that female passengers feel less safe travelling by car, the journey quality is not as good and consider there to be less availability. Without further qualitative research it is not possible to confirm why there is a different experience for men and women. Research has found that women do feel less safe when travelling by public transport (DfT 2004a) which could result in a poorer perception of journey quality.

Figure 5.18 illustrates the difference in Bus TQoL by gender, with the graph showing that men have a better TQoL compared to women on a number of indicators. The indicators with significant differences are private transport infrastructure investment, sustainable transport infrastructure investment, safety on public transport, walking and cycling quality, disability provision, air quality, journey quality, train access, services access, reliability and

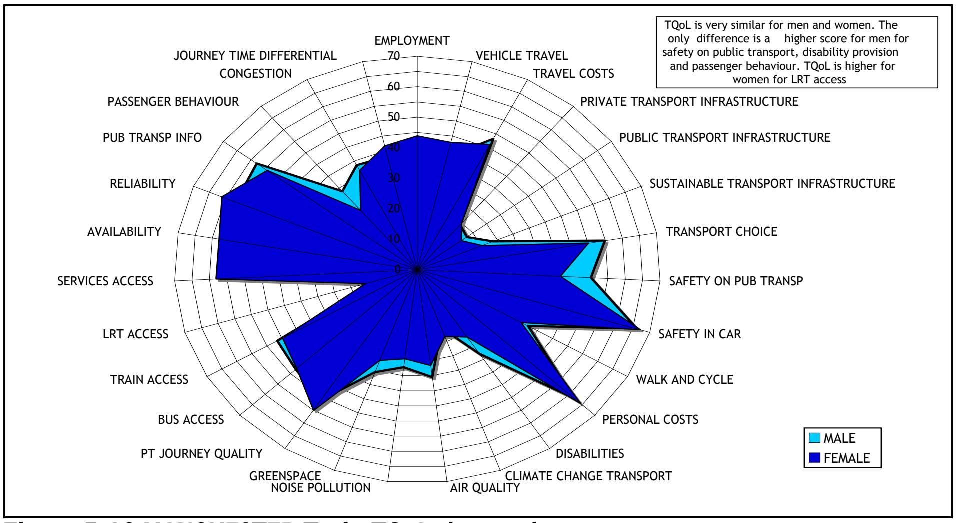

Figure 5.16 MANCHESTER Train TQoL, by gender

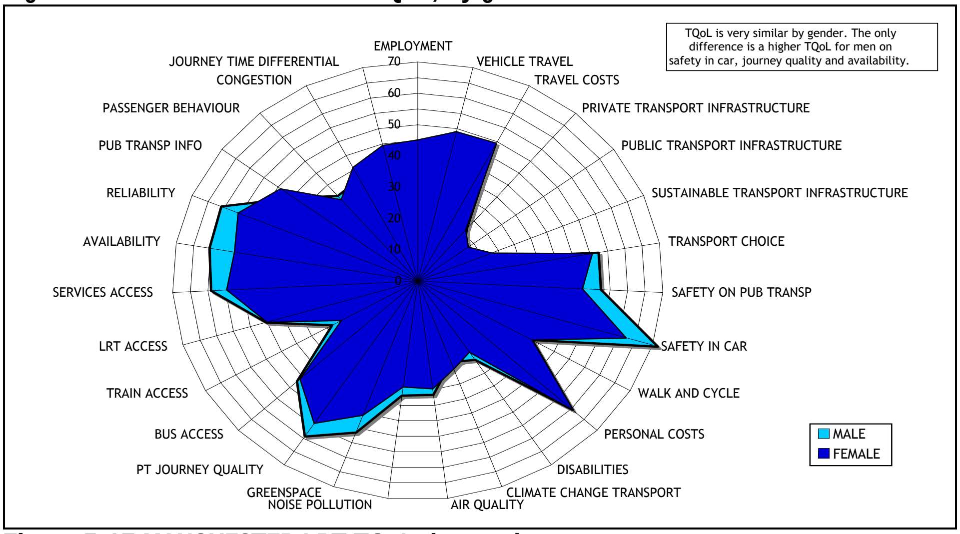

Figure 5.17 MANCHESTER LRT TQoL, by gender

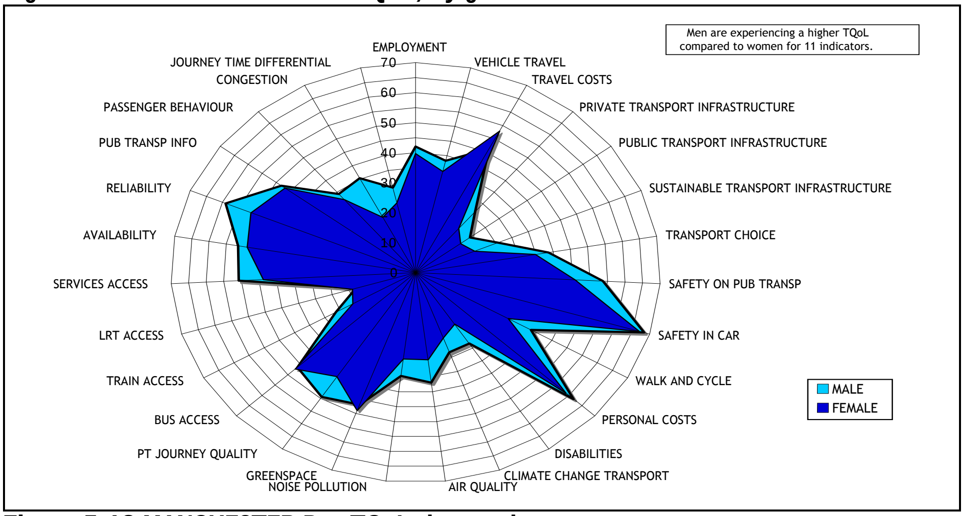

Figure 5.18 MANCHESTER Bus TQoL, by gender

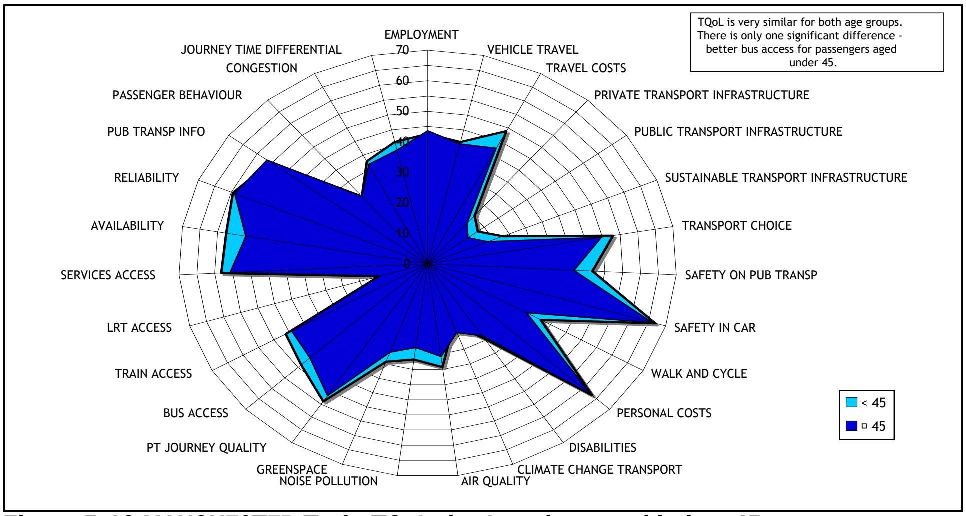

Figure 5.19 MANCHESTER Train TQoL, by Age above and below 45

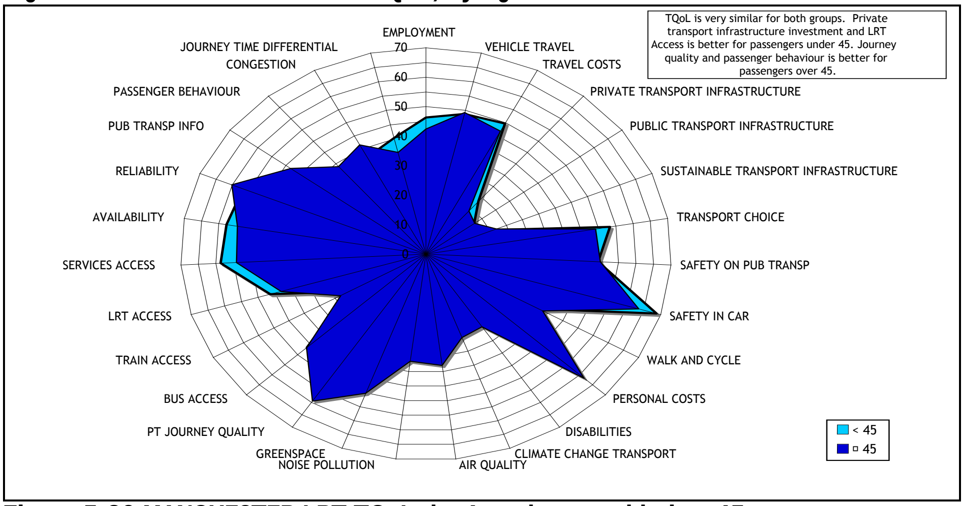

Figure 5.20 MANCHESTER LRT TQoL, by Age above and below 45

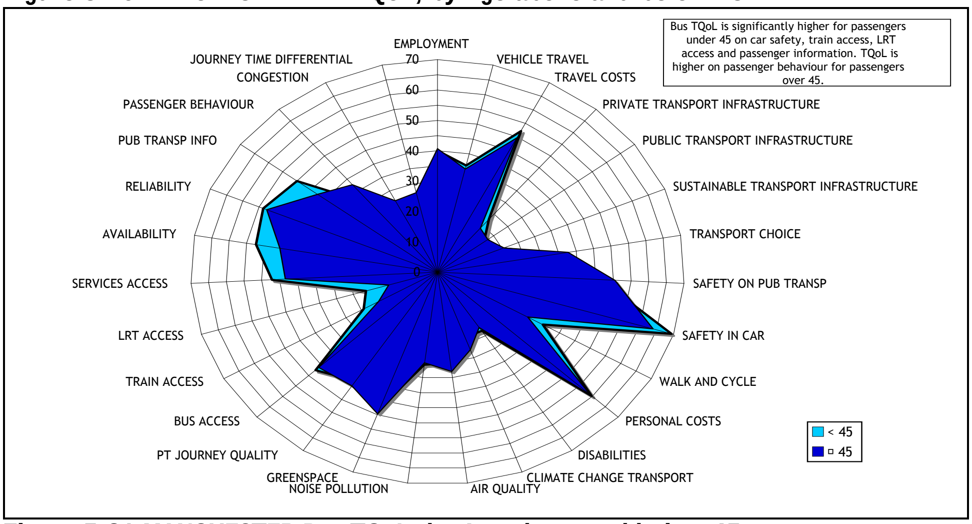

Figure 5.21 MANCHESTER Bus TQoL, by Age above and below 45

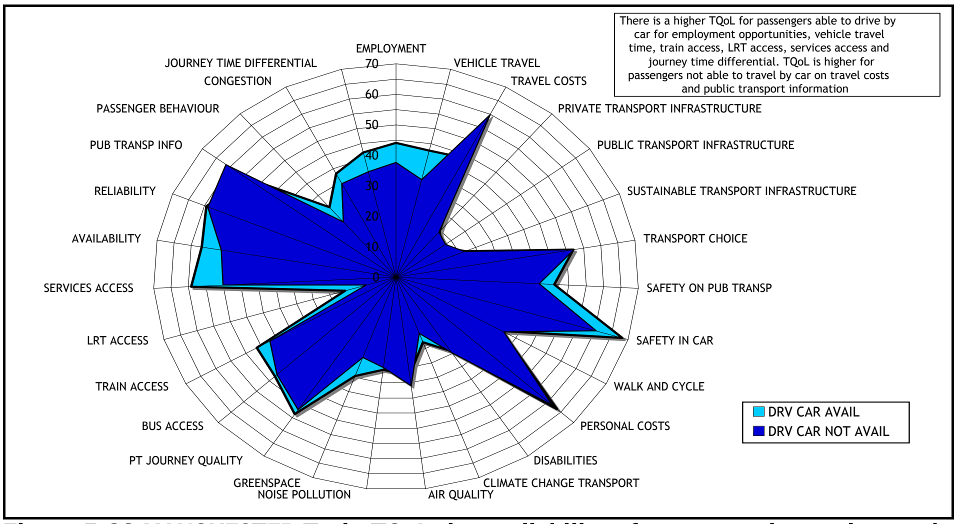

Figure 5.22 MANCHESTER Train TQoL, by availability of car as an alternative mode

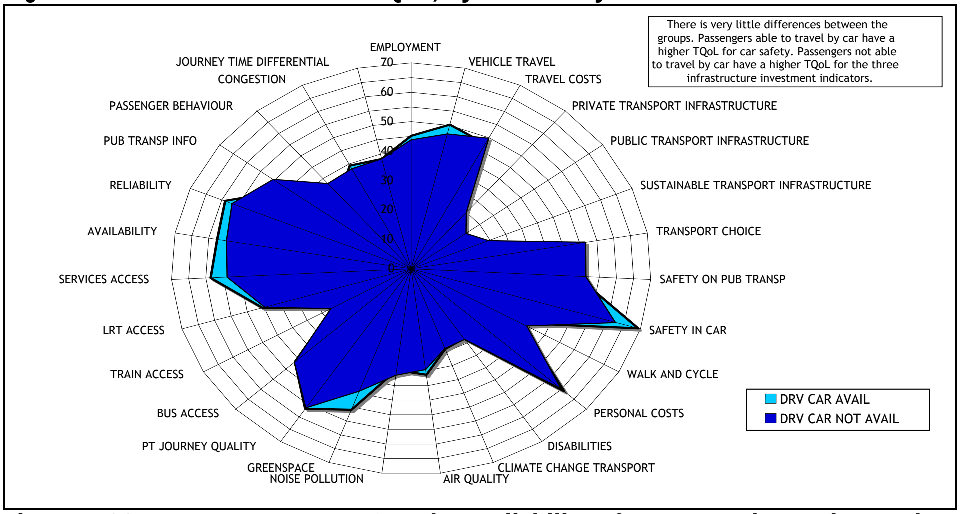

Figure 5.23 MANCHESTER LRT TQoL, by availability of car as an alternative mode

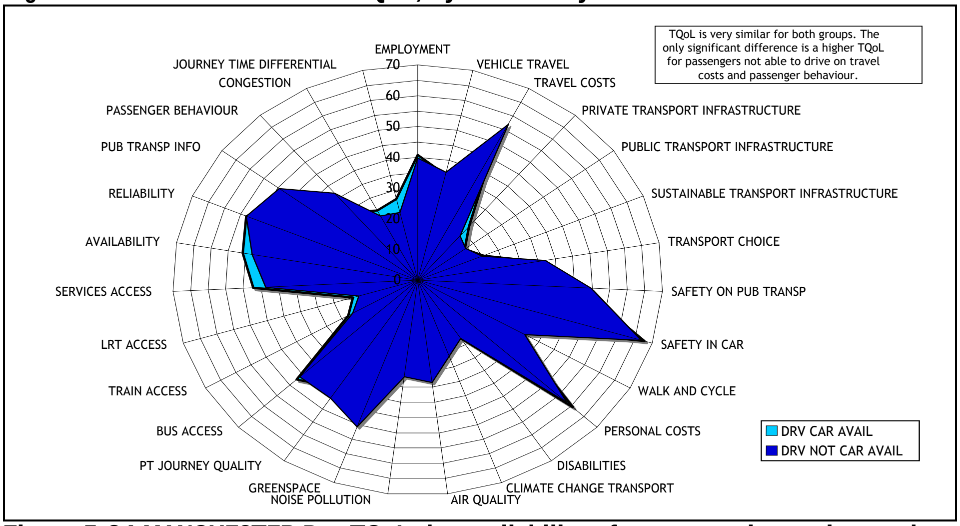

Figure 5.24 MANCHESTER Bus TQoL, by availability of car as an alternative mode

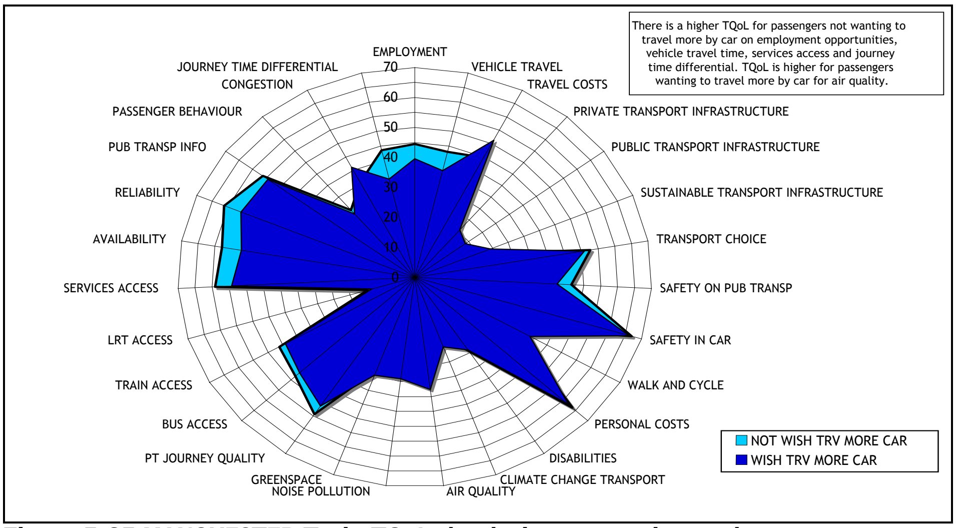

Figure 5.25 MANCHESTER Train TQoL, by desire to travel more by car

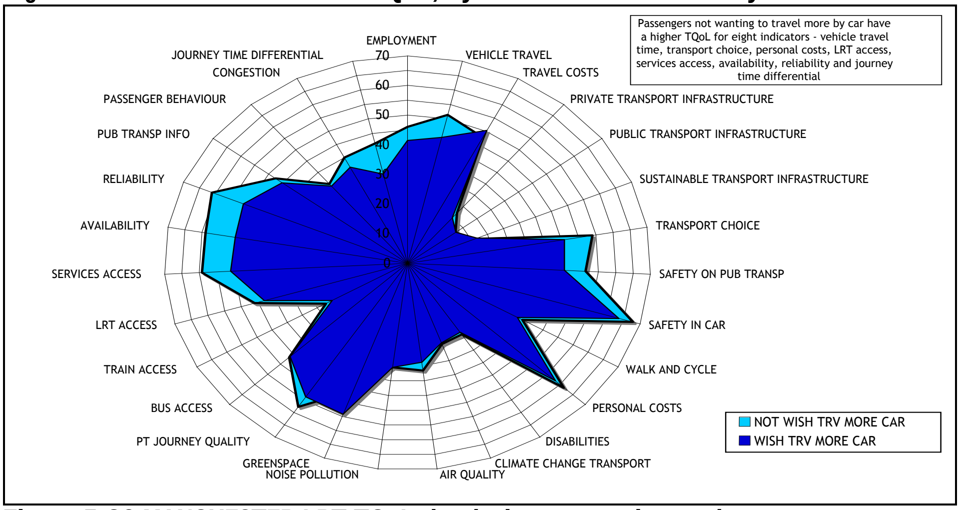

Figure 5.26 MANCHESTER LRT TQoL, by desire to travel more by car

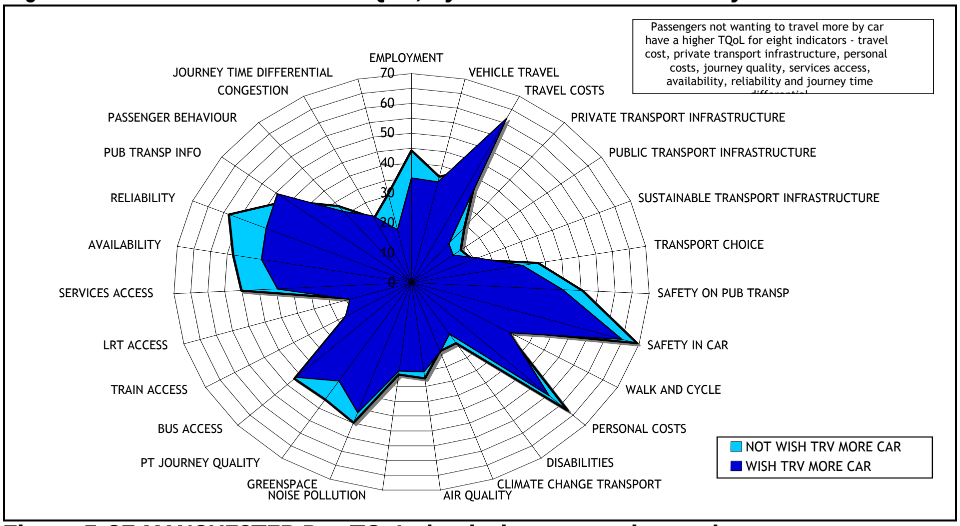

Figure 5.27 MANCHESTER Bus TQoL, by desire to travel more by car

congestion. Men have a higher TQoL score for all of these indicators. This is the same finding found in Manchester's other corridors, with males experiencing a higher TQoL.

The difference in TQoL by age for each mode is presented in Figures 5.19, 5.20 and 5.21. On all modes there appears to be very little difference in TQoL for passengers above and below 45 years. The shapes of the spider diagrams are close together which should mean less indicators with significant differences. T-tests for Train TQoL show only one indicator with significant difference - bus access. This could be caused by mobility problems some older adults may face. Research has shown that 14 percent of people aged over 65 had difficulty in walking down the road (Walker et al., 2002).

Although this comparison includes the age groups 45-54 and 55-64, 11.6% of all respondents are over 65. As this is the only indicator with no significant difference Train TQoL is not affected by age.

T-tests for LRT TQoL show four indicators with significant differences - private transport infrastructure investment, journey quality, LRT access and passenger behaviour. There is no clear separation between the groups, as private transport investment infrastructure and LRT access is better for passengers under 45 years, whilst journey quality and passenger behaviour is better for passengers over 45.

For Bus TQoL there are five indicators with significant differences - car safety, train access, LRT access, public transport information and passenger behaviour. Each indicator has a higher TQoL score for passengers under 45 years, except passenger behaviour. This means passengers under the age of 45 feel safer when travelling by car, have better access to LRT and more information on the public transport services, while passengers older than 45 have a better experience with other passengers.

Figures 5.22, 5.23 and 5.24 illustrate the differences in TQoL, by passengers able to drive by car as an alternative mode of transport. For Train TQoL there are significant differences in employment opportunities, vehicle travel time, travel costs, train access, LRT access, services access, public transport information and journey time differential. Passengers able to drive by car experience a better TQoL for employment opportunities, vehicle travel time, train access, LRT access and services access. Passengers unable to travel by car spend less to travel compared to passengers with a car and have a better knowledge of public transport information.

For LRT TQoL there are significant differences on four indicators - private transport infrastructure investment, public transport infrastructure investment, sustainable transport infrastructure investment and car safety. Passengers able to travel by car have a higher TQoL for car safety. Passengers not able to travel by car have a higher TQoL for public, private and sustainable transport infrastructure investment.

There are only two indicators of significant difference between passengers on Bus TQoL - travel costs and passenger behaviour. Passengers not able to drive by car have a better experience with other passengers and spend less on each journey. Overall, being able to drive by car does not affect the TQoL in the bus corridor. This is different to the results from Glasgow, where passengers unable to travel by car were experiencing a higher TQoL.

The second transport characteristic compares TQoL by if people want to travel more by car (Figures 5.25, 5.26 and 5.27). On each spider diagrams there appears better TQoL for passengers not wishing to travel more by car. T-tests for Train TQoL show five indicators with significant differences - employment opportunities, vehicle travel time, air quality, services access and journey time differential. For each indicator, except air quality, there is a higher TQoL for passengers not wishing to travel more by car. As passengers are encountering a poor journey experience on these specific issues they want to travel more by car.

T-tests for LRT TQoL identify nine indicators with significant differences - vehicle travel time, transport choice, personal costs, greenspace, LRT access, services access, availability, reliability and journey time differential. Passengers wanting to travel more by car experience a higher TQoL for only one of these indicators - greenspace. On the remaining eight indicators passengers not wanting to travel more by car experience a better journey quality.

For Bus TQoL there are nine indicators with significant differences - travel cost, private transport infrastructure investment, personal costs, journey quality, services access, availability, reliability and journey time differential. Passengers want to travel more by car as they encounter a lower TQoL on all these indicators, except travel costs.

5.3.3 MANCHESTER TQoL REFLECTIONS

Results from Manchester provide interesting conclusions. Overall there are significant differences between the modes of transport in favour of fixed modes. The significance of these differences are not as closely related to the importance of TQoL as was found in Glasgow. The train produced a more compelling argument of superior TQoL compared to the bus because it contained more issues important to TQoL in Manchester. Despite this, journey experience is still substantially better on LRT and the train compared to the bus.

In Manchester and Glasgow there are similar significantly different indicators when the same two modes of transport were compared. In the comparison between Train TQoL and Bus TQoL the same eleven indicators are identified - vehicle travel time, transport choice, greenspace, journey quality, train access, services access, availability, reliability, transport information, congestion and journey time differential. Eight of these are in the personal indicators group. The comparison between LRT TQoL and Bus TQoL produced very similar results. The only difference to the Train TQoL and Bus TQoL comparison is that employment opportunities, walking and cycling quality and LRT access were significant and greenspace and public transport information were not significant. This means that in both cities fixed modes of transport are providing a very similar TQoL.

There are also similar indicators with no significant difference. These include issues relating to infrastructure investment, the environment and transport costs. Indicators of investment were included in the model because it was conceived that there would be differences in the location of the city. As the results report no significant differences for these indicators in both cities it confirms the finding decisions taken at a city-level have no influence in each corridor. Environmental indicators were also considered to be an important component of TQoL because the environmental condition experienced by passengers can seriously affect individual's QoL. In general, there was no difference in condition encountered on all three modes. While Steer Davies Gleave (2005) argue that Light-rail is a more energy and environmentally efficient option, this research found no statistical difference between light rail and the bus. Although transport costs are regarded to be an influential factor determining modal choice, surprisingly the influence on TQoL is no different for train, LRT and bus passengers.

Assessment of TQoL by the demographic characteristics in Manchester showed little difference in experience and there was also only a small variation for passengers able to travel by car. The major difference in TQoL was found for passengers wanting to travel more by car. This confirmed findings from Glasgow of a relationship with TQoL encountered. If a passenger has poor TQoL on their mode they want to travel more by car. This was seen most clearly in the bus corridor.

The reasons for differences in TQoL are not easily understood in this type of research. Quantitative research is designed to observe answers but they do not provide thorough detail of why. While it could have been possible to suggest a rationale for why a group encounters a better TQoL based on literature and characteristics of the data a more detailed qualitative project would deliver an improved understanding of differences in TQoL.

TQoL represented by spider diagrams and t-tests is an efficient complementary measure to understand journey experiences. The t-tests confirm where the mode of transport is providing a higher TQoL. This method can be applied to compare modes of transport in both cities to discover if the same modes are providing a similar experience. If both cities are producing similar level of experience then substantial conclusions can be made regarding which method of transport is providing a better TQoL.

5.4 TQoL APPRAISAL OF MODAL COMPARISON

5.4.1 TQoL MODAL COMPARISON

The train, LRT and bus corridors in both cities can be compared, with the level of TQoL for all three modes appearing to be quite similar (Figures 5.28, 5.29 and 5.30). In the train corridor comparison there are fourteen indicators with significant differences - employment opportunities, vehicle travel time, private transport infrastructure investment, public transport infrastructure investment, sustainable transport infrastructure investment, disability provision, climate change, air quality, greenspace, bus access, LRT access, services access, congestion and journey time differential (Table 5.7). No one city is providing a better TQoL compared to the other. Train TQoL is higher for a number of indicators in Glasgow and higher for others in Manchester. Manchester's Train TQoL is better for employment opportunities, private transport investment, sustainable transport investment, disability provision, bus access, services access and journey time differential. Glasgow's Train TQoL is higher for climate change transport, air quality, green space, vehicle travel time, public transport infrastructure investment, LRT access and congestion.

There are thirteen indicators with no significant difference between the two cities. These are mainly found on social and personal issues. It would be very surprising if the Train TQoL in both cities were identical because there are a number of conditions to consider. These differences include characteristics of the passengers, transport operators and transport systems. Despite this, there are similarities in journey experience in both cities. In Manchester and Glasgow there is a good level of personal and social Train TQoL, with excellent journey quality, availability, reliability, transport information, diversity and safety. Another important point to make - considering they are two different train operators - is no significant difference in the cost to travel. Train passengers in

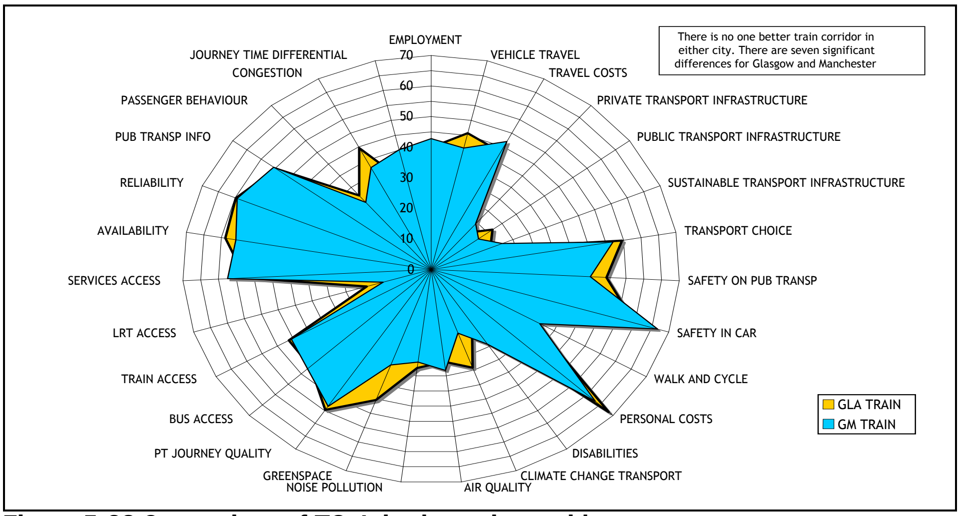

Figure 5.28 Comparison of TQoL in the train corridors

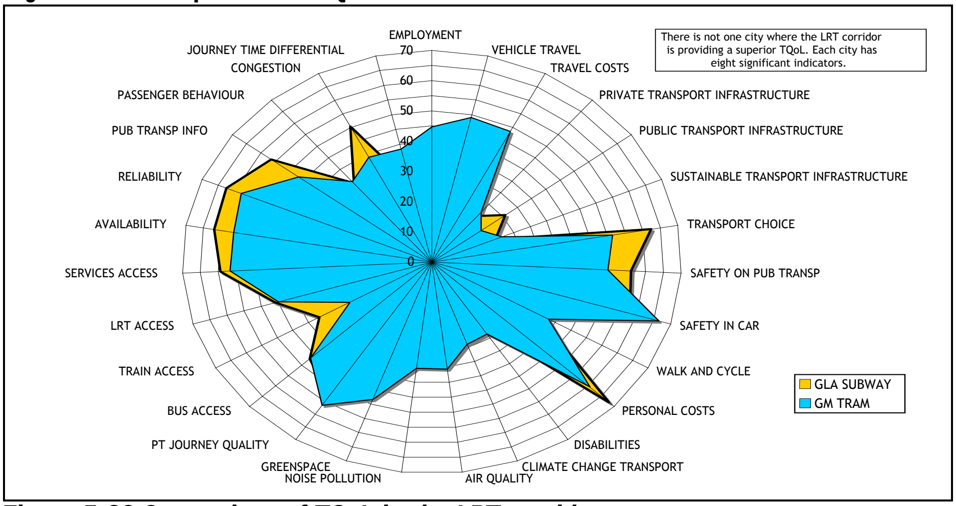

Figure 5.29 Comparison of TQoL in the LRT corridors

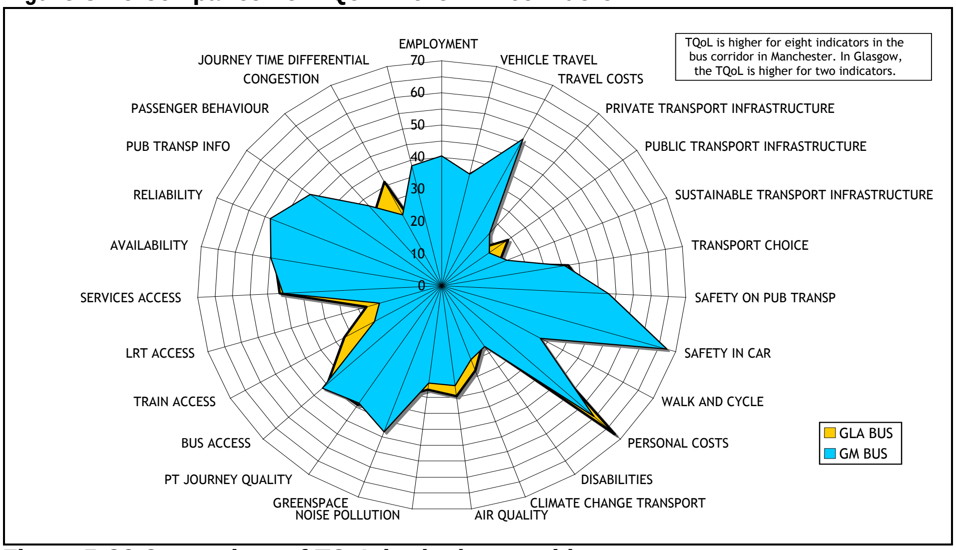

Figure 5.30 Comparison of TQoL in the bus corridors

Table 5.7 t-Tests comparing TQoL in the modal corridors

t-Tests comparing TQoL in the Train corridors			t-Tests comparing TQoL in the LRT corridors			t-Tests comparing TQoL in the Bus corridor		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
EMPLOY	2.287	**0.023**	EMPLOY	2.426	**0.016**	EMPLOY	5.961	**0.0**
VEHTRV	-2.882	**0.004**	VEHTRV	0.450	**0.653**	VEHTRV	-0.033	**0.9**
TRVCOST	1.456	**0.147**	TRVCOST	1.971	**0.050**	TRVCOST	1.139	**0.2**
PRVINFRS	3.284	**0.001**	PRVINFRS	1.178	**0.240**	PRVINFRS	4.871	**0.0**
PUBINFRS	-3.397	**0.001**	PUBINFRS	-5.832	**0.000**	PUBINFRS	-4.317	**0.0**
SUSINFRS	2.463	**0.014**	SUSINFRS	1.488	**0.138**	SUSINFRS	1.737	**0.0**
TRANCHC	-1.443	**0.150**	TRANCHC	-6.510	**0.000**	TRANCHC	-0.366	**0.7**
PUBSAF	-0.554	**0.580**	PUBSAF	-1.263	**0.208**	PUBSAF	3.665	**0.0**
CARSAF	1.454	**0.147**	CARSAF	2.459	**0.015**	CARSAF	2.463	**0.0**
WALK	1.346	**0.179**	WALK	1.986	**0.048**	WALK	3.349	**0.0**
BUDG	-1.421	**0.157**	BUDG	-4.464	**0.000**	BUDG	-3.847	**0.0**
DISAB	5.179	**0.000**	DISAB	2.993	**0.003**	DISAB	0.674	**0.5**
CLIMCHNG	-3.225	**0.001**	CLIMCHNG	2.076	**0.039**	CLIMCHNG	-1.962	**0.0**
AIRQUAL	-2.822	**0.005**	AIRQUAL	1.987	**0.048**	AIRQUAL	-1.855	**0.0**
NOISEPOLL	-1.123	**0.262**	NOISEPOLL	2.984	**0.003**	NOISEPOLL	-1.072	**0.2**
GREENSPCE	-5.777	**0.000**	GREENSPCE	0.540	**0.590**	GREENSPCE	4.703	**0.0**
JRNQUAL	-0.950	**0.343**	JRNQUAL	2.071	**0.039**	JRNQUAL	-0.335	**0.7**
BUSACC	2.030	**0.043**	BUSACC	-0.804	**0.422**	BUSACC	3.788	**0.0**
TRNACC	-1.234	**0.219**	TRNACC	-8.755	**0.000**	TRNACC	-8.106	**0.0**
LRTACC	-3.862	**0.000**	LRTACC	2.067	**0.040**	LRTACC	-2.525	**0.0**
SERVACC	3.371	**0.001**	SERVACC	-1.880	**0.061**	SERVACC	-0.456	**0.6**
AVAIL	-1.766	**0.079**	AVAIL	-3.573	**0.000**	AVAIL	0.443	**0.6**
RELI	-0.199	**0.843**	RELI	-2.542	**0.012**	RELI	1.628	**0.1**
INFO	0.466	**0.641**	INFO	-4.880	**0.000**	INFO	0.419	**0.6**
BEHAV	-1.554	**0.121**	BEHAV	0.353	**0.724**	BEHAV	1.175	**0.2**
CONG	-3.175	**0.002**	CONG	-5.060	**0.000**	CONG	-4.802	**0.0**
JRNDIFF	8.013	**0.000**	JRNDIFF	8.423	**0.000**	JRNDIFF	7.309	**0.0**

both cities face the same cost to travel and spend the same amount of their weekly budget on transport.

The indicators with significant differences on LRT TQoL are employment opportunities, public transport infrastructure investment, transport choice, car safety significant, personal costs, disability provision, climate change, noise pollution, journey quality, train access, LRT access, availability, reliability, public transport information, congestion and journey time differential. These results show that neither city is providing a better TQoL because the TQoL is higher for some indicators in Manchester and higher for others in Glasgow. In Manchester, LRT TQoL is higher for employment opportunities, car safety, disability provision, climate change, noise pollution, journey quality, LRT access and journey time differential. In Glasgow, LRT TQoL is higher for public transport investment, transport choice, personal costs, train access, availability, reliability, transport information and congestion.

It must be noted that these are two different LRT modes, in the underground and tram. Although there were the closet modes available for the context of this project they will not provide identical TQoL models. Despite this, there are eleven indicators with no significant differences, which means that LRT does provide a comparable travel experience in both cities.

For the bus corridors there are significant differences on thirteen TQoL indicators - employment opportunities, private transport infrastructure investment, safety on public transport, safety in car, walking and cycling quality, personal costs, greenspace, bus access, train access, LRT access, congestion and journey time differential. Bus TQoL in Manchester is higher than Glasgow on eight indicators - employment opportunities, private transport infrastructure investment, safety in public transport, safety in car, walking and cycling quality, greenspace, bus access and journey time differential. The bus is not overwhelmingly better in Manchester because there are fourteen indicators with no significant difference and two indicators with significant difference favouring Glasgow's Bus TQoL. Although Bus TQoL in Manchester is significantly higher for a number of issues there is not enough significant indicators to promote it as a complete improved experience.

5.4.2 MODAL TQoL REFLECTIONS

These comparisons of TQoL between the two cities highlight some important points. First are the common significant differences between the cities. There are four indicators in all three comparisons reporting the same significant differences - employment opportunities, private transport infrastructure investment, congestion and journey time differential. In all three comparisons Manchester has higher TQoL for employment opportunities and journey time differential, and Glasgow has a higher score for public transport infrastructure investment and congestion. Secondly, there is a relationship between the train and bus corridors. In Manchester there is higher TQoL for both private transport infrastructure investment and congestion. Between the fixed modes there was better TQoL in Manchester on disability provision. For LRT and bus there is improved safety in car in Manchester and better personal costs and train access in Glasgow.

In Glasgow, all modes of transport benefit from improved public transport investment and less congestion. There are closer train stations and less weekly budget spent on transport in LRT and bus corridors. On all modes in Manchester there is increased employment opportunities and a quicker journey time by car. There is better disability provision in the train and LRT corridors and safer travel by car in LRT and bus corridors.

The modal comparisons highlight a number of differences between the two cities. These do not prove that one city is providing a better TQoL compared to the other city. Modes of transport are providing a higher TQoL on a number of indicators but the variance is not strong enough to confirm that the mode in one city is significantly different to the other city. In Manchester, Bus TQoL is higher for eight indicators compared to Glasgow, but considering all TQoL indicators this is not an overall superior difference.

When preparing to conduct the research it was important to select corridors in both cities that were as closely related as possible. This was to test the reliability of the TQoL model. Despite this, these areas were never going to be exactly the same. Factors such as transport operators, local government, local external issues, the passengers themselves do affect the TQoL output.

5.5 CONCLUSION

This chapter has demonstrated that the TQoL model can successfully appraise public transport experience in Glasgow and Manchester, with the techniques applied enabling an effective comparison of the modes of transport. Spider diagrams present a readily comprehensible account of how well each mode of transport performs against other modes. This pictorial analysis is extended by t-tests, which indicate where each mode provides significant difference in TQoL.

In Glasgow, fixed modes provide a significantly better journey experience compared to the bus on the most important indicators of TQoL. For each mode of transport there were no major differences by demographic characteristics, but the influence of the car had an impact on TQoL in the bus corridor.

In Manchester, there was also a significant difference between fixed modal TQoL and Bus TQoL. This difference is not as closely related to the importance scores from the weighting surveys. Assessment of TQoL by transport characteristics also highlighted that the public transport experience can make people want to travel more by car.

Comparing TQoL across the two cities enhanced the understanding of journey experience, demonstrating that, while there are differences between the two cities, the same modes of transport provide similar levels of TQoL. Further detailed qualitative research project would be required to fully understand the reasons for the differences in TQoL.

This chapter has presented the implementation stage of model development. By confirming that the appraisal technique can reliably identify significant differences in TQoL between the modes of public transport, it has proved to be an important stage in the model development. Nonetheless, whilst appraisal using the TQoL model has been successful, it is not the final stage of development and the next chapter presents a further stage of model development, which is the final stage in the definition of the TQoL model. Exploratory Factor Analysis (EFA) is used to strengthen the model by exploring the underlying factor structure of TQoL.

Chapter Six

MODEL REFINEMENT

6.0 INTRODUCTION

This chapter tests the structure of the TQoL model. Identifying whether the model structure needs to be modified is an essential part to the model development. This will strengthen the appraisal process by only evaluating issues that relate to TQoL. The chapter is organised in four main sections. The first section introduces the factor analysis methods used in this research. The second tests the TQoL conceptual model (Mark II) to establish whether a new conceptual model needs to be developed. The third section tests the TQoL Model Mark III. The fourth section presents the final TQoL models for Glasgow and Manchester according to the factor analysis results. This chapter is the final part in the model design process and the last stage of the model development (**Figure 6.1**).

The TQoL model considers all the indicators together in the appraisal process as passengers' experiences cannot be simplified into a single score. Not all of these indicators will be appropriate in the measurement of TQoL. Factor analysis is applied to identify which factors and indicators identified through the literature are appropriate to measure TQoL.

6.1 FACTOR ANALYSIS

Factor analysis is an interdependence technique where all variables are simultaneously considered. Each of the observed (original) variables is considered as a dependent variable that is a function of some underlying, latent, and hypothetical set of factors (dimensions) (Hair et al., 2003). Factor analysis reveals the indicators that relate together in a single factor. These factors display how much variance the model explains. The total variance

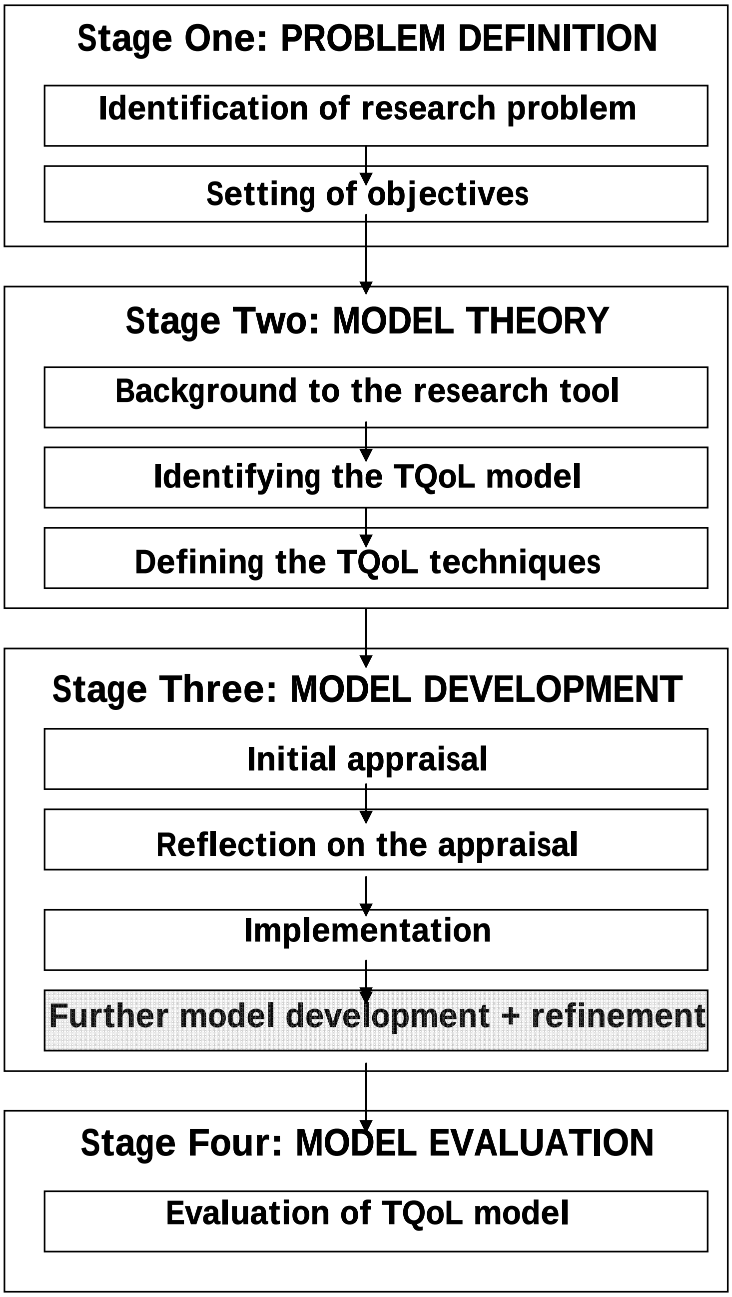

Figure 6.1 TQoL model development in relation to chapter 6

explained is how much variance all of the indicators together explain the concept of TQoL. This method is applied because it is not always possible to identify those factors that relate together.

Four factors are initially conceived to be important in explaining TQoL through literature and the pilot study (Figure 6.2). In the initial appraisal of TQoL all of these issues were important (Chapter 5). Factor analysis distinguishes between those indicators that are significant in explaining TQoL and those that are not. This process can lead to a new conceptual model of TQoL. This analysis will omit indicators that cause a lot of interference in the model. This TQoL model mark III will therefore be a more simplified and parsimonious model. There are two stages to testing the model: (i) to identify if the factors and indicators are appropriate to measure TQoL and (ii) to confirm if there should be a new conceptual model of TQoL.

Two basic factor models exist- principal component analysis (PCA) and common factor analysis. Principal components analysis uses all of the variance in the data set, while common factor analysis is based only on the common variance. The most commonly applied method is PCA, which is used when the objective is to summarize most of the original information (variance) in a minimum number of factors for prediction purposes. In contrast, common factor analysis is used primarily to identify underlying factors or dimensions not easily recognized (Hair et al., 1992). As the indicators and factors of TQoL have already been established, it was more appropriate to apply PCA in this study.

Other important issues to consider are whether the sample size is large enough and what form of extraction should be implemented. It is commonly acknowledged that the researcher should have a minimum sample size of five times the number of variables analyzed (Hair et al., 2003). There should be at least 135 cases for the 27 indicators of TQoL. This is similar to sample sizes collected in the modal corridors of each city. In some corridors the sample size is below that figure, for example it is only 133 and 130 in Manchester's LRT and bus corridors. It is therefore more appropriate to conduct factor analysis using data at the city level. The reliability scales of indicators and factors are strong enough to support repeated samples and a larger sample size is more suited. There are two types of factor extraction in PCA - orthogonal or oblique rotation. Orthogonal rotation ensures the factors are extracted independently of each other. Oblique rotation is more complex, with extraction of the factors rotated in a way that allows for correlation between the factors. Orthogonal

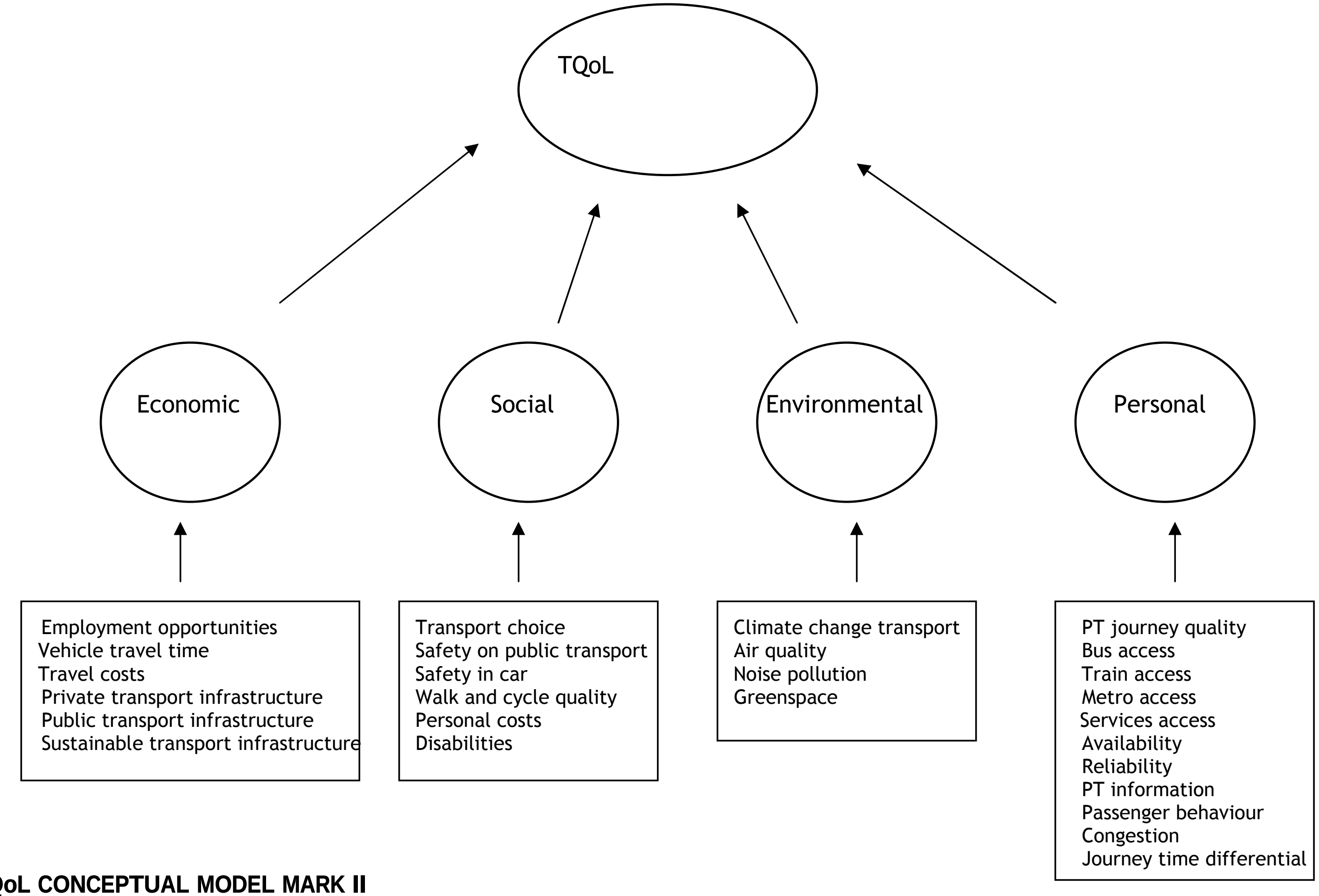

Figure 6.2 TQoL CONCEPTUAL MODEL MARK II

rotation will be used because there is no underlying correlation between the factors. Three orthogonal approaches that have been developed: QUARTIMAX, VARIMAX and EQUIMAX. VARIMAX rotation will be applied because not only has it proved very successful as an analytic approach it also gives a clearer separation of factors (Hair et al., 1992). *Kaiser's* criterion will determine how many factors are extracted. Factors with latent roots (eigenvalues) less than 1 are considered significant, and all others are disregarded. The scree test will also identify the optimum number of factors (Cattell, 1966) because in practice, most factor analysts seldom use a single criterion in determining how many factors to extract. The minimum coefficient score for an indicator to be included in a factor is 0.40 according to the sample size (Stevens, 1994). Reliability of each factor is then tested using Cronbach's alpha. A factor structure that accounts for 60% of the total variance is regarded as a respectable level in social sciences (Hair et al., 1992).

A number of tests were conducted at the beginning that will not be presented. This was to find out which technique is more suitable for this data. Oblique rotation was used, as were other orthogonal rotation approaches. However these proved not to be applicable and will not be included. Factor analysis was also tested on data from individual modal corridors in both Glasgow and Manchester, however the sample sizes prevented successful development of factor structures. The results of this are not presented. If more research is conducted that generates larger sample sizes it would be possible to compare factor structures within a city to the TQoL conceptual model.

6.2 TESTING THE TQoL CONCEPTUAL MODEL MARK II

6.2.1 GLASGOW INITIAL FACTOR ANALYSIS

The first stage of the analysis tests the initial factor structure of TQoL separately for both cities. This is to observe if the same factor structures are established in both Glasgow and Manchester. The results from the factor analysis are presented in Appendix F.

All of the indicators were included at the beginning with only specification made that factors extracted should have a latent root above 1. There are four items from the results presented: the KMO and Bartlett's test, total variance explained and rotated component matrix. For the initial and final factor analyses the scree plot is included to confirm the amount of factors to be extracted. The Kasier-Meyer-Olkin (KMO) measures the reliability of the model. It is recommended that if the reliability of structure Is below .50 it is *unacceptable*, in the .50s *miserable*, in the .60s *mediocre*, in the .70s *middling*, in the .80s *meritorious* and in the .90s *marvellous* (Kaiser, 1974). The higher the measure, the better the reliability of the factor structure. The Bartlett's test measures if there are relationships between variables. If the test is significant the rotated matrix is not an identity matrix and there are some relationships between the variables (Field, 2005). The variance explained contains the detail on how much variance is explained by the selected factor. Factors are ordered in terms of most variance explained. The figure of importance is the percentage of variance on the factor loadings. The cumulative percentage reports the total variance explained by the factor structure. The eigenvalues associated with each factor represent the variance explained by that particular factor. The main part of the table is the rotated component matrix containing details of the factor loadings. Each factor contains a factor loading score for each variable that varies from 0 to 1, with values closer to 1 being most important. It is recommended to interpret only factor loadings with an absolute value greater than .4 (Stevens, 1994). These have been highlighted in colour. Indicators will be removed if it has no factor loading scores above .4 or is loadings on more than one component.

The initial factor analysis for Glasgow shows that the KMO is .80, which is almost *meritorious* and the Bartlett test is significant. Kaiser's criteria selected eight factors with eigenvalues above 1. The scree plot illustrates that the point of inflexion of the curve could be after 6 or 8 factors. Taking the latent root criteria into consideration it is better to include eight factors. The first factor accounts for 12.6% of the total variance, with the remaining seven factors accounting for 9.8%, 8.9%, 6.5%, 6.0%, 5.7%, 5.6%, and 5.4%. This factor structure explains 60.6% total variance of TQoL, which is just above the level required in social science research. The main matrix shows that the economic, social and personal indicators do not all load onto one factor each. Only the environmental factor has environmental indicators loading successfully onto the factor. This demonstrates that the original model does not accurately explain TQoL because the factors are not clearly separated and some indicators are not contributing to TQoL. To determine which need to be excluded each factor is tested separately.

The economic factor analysis reports the KMO as .65 and a significant Bartlett test. Two factors account for 53.5% of the total variance. If the economic factor were accurate there would be only one factor extracted. In the matrix, factor 1 contains three high loading variables and factor 2 has only two variables loading. The first variable is also multi-loading. It should also be possible to draw logical conclusions from the relationships formed in the factors. This model shows that the infrastructure investment variables are related together and travel time is related to travel costs. Reliability statistics are used at this stage to test the accuracy of the construct and establish which indicators need to be removed. The coefficient alpha, or Cronbach's alpha, measures the internal consistency reliability. These results are also shown in Appendix F. The coefficient alpha ranges from 0 to 1. Less than .6 is regarded as *poor*, .6 to <.7 *moderate*, .7 to <.8 *good*, .8 to <.9 *very good* and .9 *excellent* (Hair et al., 2003). The table of item-total statistics reports changes in the scale if indicators are deleted. The two key columns are the *Corrected Item-Total Correlation* and *Cronbach's Alpha if Item Deleted*. If any variables have a minus correlation or a score less than .3 in the corrected item-total correlation column this variable needs to be removed.

Economic reliability analysis stage 1 shows that the reliability of the structure is *very poor* as the Cronbach alpha = .31. The first indicator to be deleted is travel cost because the correlation is a minus and the Cronbach alpha would be .59 if it were removed. Stage 2 highlights the next indicator to be removed is vehicle travel time because correlation is only .16 and the Cronbach alpha would improve to .63. In stage 3 employment opportunities is to be deleted as the correlation is still below .3 and the Cronbach alpha would be .66 without the indicator. This leaves three indicators of economic TQoL - private transport infrastructure investment, public transport infrastructure investment and sustainable transport infrastructure investment. The Cronbach alpha is .658 and could not be improved if any further variables are deleted. While there is a clear relationship on the investment in transport the reliability of the structure is *moderate* and economic TQoL may not be accurate for repeated samples.

Social factor analysis has a KMO of .62 and significant Bartlett's test of Sphericity. There are two factors accounting for 47.9% total variance. In the rotated component matrix, factor 1 loads on four variables and factor 2 loads two variables. The first stage of the reliability analysis shows that Cronbach alpha = .47. The two worst performing variables, car safety and personal costs can be deleted because the correlation of the items is well below .3. This produces the social factor with a Cronbach alpha of .55. This is still *poor* but removing any of the remaining variables would not increase the reliability. There is no clear explanation of why these variable relate together, which could mean that a new conceptual model may be more appropriate.

Environmental factor analysis has extracted only one factor accounting for 53.39% total variance. This factor is not rotated because there is no other factor to rotate against. The only indicator not loading successfully onto the factor is greenspace. The reliability analysis confirms that greenspace should not be included in the analysis as the correlation is only .12 and Cronbach alpha increases to .79 if it is deleted. Stage 2 illustrates that these three indicators provide *good* reliability. Whilst the Cronbach alpha could increase if air quality is removed, correlation is above .3 and has a major role in the relationship with the other variables.

Personal factor analysis has a KMO of .75 and significant Bartlett's test. Three factors are extracted accounting for 54.7% total variance. In the matrix three indicators are multi-loading - journey quality, bus access and service access. Factor 1 has five variables, factor 2 has two and factor 3 is not significant because only one is left after the two multi-loading variables are removed. The reliability of the personal factor is .684. Stage 1 identifies three variables that can be removed - bus access and train access because the correlation is very low and journey time differential because it has a minus correlation. In stage 2 the Cronbach alpha increases to .78 and LRT access should be removed as the correlated score is .26. No further indicators need to be removed as the Cronbach alpha is .78 and all variables are correlating successfully.

Factor analysis was then conducted with only indicators that are significant to the economic, social, environmental and personal factors. The analysis is run applying the priori criteria. This specifies that only four factors should be extracted for the four TQoL factors. Final initial factor analysis produces a KMO of .82 and four factors account for 58.1% total variance. With the exception of the environmental factor, these variables do not load onto the initial factors of TQoL. Many indicators are multi-loading, component 1 has variables from social and personal TQoL, component 2 has economic, social and personal variables loading and component 4 has economic and social variables loading. This means that the TQoL model mark II needs to be redefined if the results from Manchester provide similar conclusions.

6.2.2 MANCHESTER INITIAL FACTOR ANALYSIS

Manchester's initial factor analysis produces a KMO statistic of .76 and a significant Bartlett's test. Eight factors account for 60.8% total variance. The scree plot also displays a clear levelling off after the eighth factor. In the rotated component matrix the variables do not load onto the conceptual factors of TQoL. On the first factor, variables load from personal, economic and social variables. This occurs for all factors except component factor 4 where the environmental factor appears significant. This highlights the inability of the initial structure of the TQoL model mark II. The reliability of these factors is tested to confirm which variables need to be deleted from the analysis.

The economic factor analysis produces a KMO of .66 and three factors account for 70.3% total variance. In the rotated component matrix the three infrastructure investment variables load onto factor 1, factor 2 reveals a relationship between employment opportunities and vehicle travel time and factor 3 contains only travel cost. The reliability of these relationships can be evaluated in the Cronbach alpha statistics. Stage 1 indicates travel cost should be removed because there is negative correlation and the Cronbach alpha would improve to .594. The second stage identifies that both employment and vehicle travel should be removed as they both have a correlation score below .3. In stage 3, reliability is now .695 and correlation on the remaining three variables is above .3. At this stage these should be considered the economic TQoL indicators.

The social factor analysis has a KMO statistic of .70 and significant Bartlett's test. Two factors account for a total variance of 53.7%. Factor 1 contains four loading variables and factor 2 has two. Reliability analysis produces a Cronbach alpha of .62. Car safety and personal costs should be removed because their correlated scores are below .3. In stage 2 reliability increases to .70 with all correlation scores above .3. The reliability is still moderate and it is not clear why these variables are related together. Despite this removing any further variables would not increase the reliability of the social TQoL.

Environmental factor analysis produced a KMO of .69 and significant Bartlett's test. One factor accounts for 50.0% total variance with all variables loading successfully. The reliability analysis shows that greenspace should be removed due to its low correlation with the other variables and the improvement to the Cronbach alpha. Stage 2 confirms the correlation of the variables. This factor has *good* reliability and should be kept in further analysis of TQoL.

Personal factor analysis produces a KMO of .70 and significant Bartlett's test. Four factors account for 62.6% total variance. In the rotated component matrix two variables are multi-loading, three indicators load onto factor 1, three onto factor 2, one on factor 3 and two on factor 4. All these different issues cannot be explained by one factor. The reliability of the factor is only .52 and the first variable to be removed is journey time differential because it has a negative correlation. The reason for this negative value is that the difference in journey time between the car and public transport has no relationship to this factor. In stage 2, the Cronbach alpha increases to .67, but bus access, transport information and passenger behaviour should be deleted because they all contain a correlation score lower than .2. In stage 3 Cronbach alpha increases to .70 and train access and LRT access should be removed as the correlations are well below .3. The reliability of this structure is .76 with five variables contributing to personal TQoL. Although the structure does not display any common relationships the variables are clearly related together. Final factor analysis will confirm if they relate to the other factors.

The final initial factor analysis is run including only the reliable variables. Priori criterion specifies only four factors are to be extracted. This produced a KMO statistic of .80 and a significant Bartlett test. The four factors account for 61.3% total variance. In the rotated component matrix the formation of the structure is not according to the economic, social, environmental and personal factors. On the economic factor, there are social variables loading as well as multi-loading indicators. For the social factor there are personal variables and a multi-loading variable. On the personal factor not all variables are loading and there is a multi-loading social variable. The environmental factor is the only component containing only the environmental variables.

Factor and reliability analysis in Glasgow and Manchester support the conclusion that the TQoL model mark II does not accurately explain passenger journey experience. Economic, social and personal indicators do not load successfully onto single factors. The main reason is that these issues cannot easily be grouped into only four factors. Whilst there are relationships with the indicators they should not be in predetermined broad factors. The next stage of analysis will test the accurate relationship of TQoL indicators.

6.3 TESTING FOR THE TQoL MODEL MARK III

6.3.1 GLASGOW FINAL FACTOR ANALYSIS

Factor analysis is now conducted with no restrictions on the Glasgow and Manchester data. This will confirm if the new factor structure of TQoL is similar in both cities. If any variables are not significant they will be removed and factor analysis will be repeated until only indicators successfully relating to TQoL are included. Glasgow's final factor analysis stage 1 without any restrictions produces a KMO of .80 and significant Bartlett's test. Eight factors are extracted by the latent root criterion accounting for 60.6% total variance.

The scree plot also indicates that eight factors should be included as there is a levelling off after the 8th component. In the matrix, factors have been ordered in terms of importance. Variables have been coloured to help factor identification. Each factor has a different colour and variables loading onto this factor are coloured the same. Indicators are removed if they are multi-loading on more than one factor, do not contain loading score higher than .4 on any factor, or are the only variable loading onto a factor. In stage 1, congestion, employment opportunities and greenspace are removed as they do not have a loading score above .4 on any factor. Services access and journey quality remain in the analysis at this point as removing too many variables could affect the output.

In stage 2, the KMO has reduced slightly to .79 and the Bartlett's test is still significant. Seven factors account for 60.7% total variance. The three indicators are removed - private infrastructure investment, journey time differential and LRT access for multi-loading onto more than one factor. Services access and safety on public transport remain in the analysis at this stage for their importance in journey quality. It is necessary to observe if they become significant in subsequent analysis.

Stage 3 produces a KMO of .78 and seven factors account for 64.0% total variance. Two variables are removed - journey quality and vehicle travel time due to loading onto more than one factor. Services access and safety on public transport, previously multi-loading, are now relating without concern. Stage 4 produces a KMO of .751 and six factors accounting for 61.6% total variance. No further indicators can be removed from the structure at this stage because they are all loading successfully. It is appropriate to make theoretical meaning of what the factors describe. Factor 1 can explain access and availability, factor 2 - environmental condition, factor 3 - infrastructure investment and users experience, factor 4 - access to transport infrastructure, factor 5 - safety and factor 6 - travel costs. The strength of these relationships is confirmed in the reliability analysis. Each factor is tested to check if all the indicators should be included in the structure. Factors also need to have meaning in contributing to TQoL, so if there are indicators not suitably relating to the other indicators they will be removed.

The reliability of factor 1 is .80. This can be improved by deleting transport information. Although the correlation is above .3 the reliability of the factor will improve to .819. Reliability is now *very good* and the factor can be classified as access and availability. Factor 2 also has *good* reliability (α = .79) and positive correlation between the variables - this explains the environment.

Factor 3 has relatively low reliability at .64 and needs considering what it actually represents. Sustainable transport infrastructure has an influence on the quality of walking and cycling, but not on disability provision and as correlation is not high with other variables it should be removed from the factor. In stage 2 the Cronbach alpha decreases to .61. Public transport infrastructure investment should be removed as correlation with the other two variables is not good and the Cronbach alpha would improve if it were deleted. In stage 3 the Cronbach alpha increases to .66. While it is recommended that the minimum number of variables in one factor should be three this does not apply in this case as there is a clear theoretical and statistical relationship between the two variables. Sustainable transport infrastructure is related to walking and cycling quality within an area. Cronbach alpha statistics do not present a solution for only two variables so it is necessary to conduct a Pearson correlation to confirm the full extent of the relationship. The correlation between the variables needs to be significant at the 0.001 level (2-tailed) and the Pearson correlation statistic should be above .3 (Field, 2005). Although stage 4 shows that the relationship is significant the validity of this factor may be questioned and will be tested in the final factor analysis. If the factor is extracted along with the other factors the component should be included. This factor can explain sustainable transport.

Factor 4 should be excluded for the poor Cronbach alpha, low correlation and incorrect theoretical composition. While stage 2 indicates a significant relationship between the two variables, a transport interchange factor without LRT access would devalue TQoL. The reliability of factor 5 is *very poor* (α = 0.33) and car safety should be removed due to the negative correlation. Stage 2 shows that the Cronbach alpha is now .68. Although this factor contains only two variables safety on public transport is related to passenger behaviour. The

Pearson correlation is significant at the 0.01 level and correlation is above .3. This factor reflects personal safety.

Factor 6 contains two indicators that theoretically related to each other - travel costs and personal costs. Cronbach alpha is low because there are only two variables in the analysis. The Pearson correlation shows that the correlation is significant at the 0.01 levels. The cost to travel per day is related to weekly transport budget. These two issues are very important to TQoL and should be kept in the factor structure at this stage. In the final factor analysis the results can be compared with and without this factor to observe the influence it contributes to TQoL. This factor is designated transport costs.

The final factor analysis is split into two parts to compare the difference with factor 6. Stage 1 produces a KMO of .74 and significant of Bartlett's test. If the latent root criterion is applied only four factors are extracted, however the scree plot clearly illustrates a levelling off after the 5th component. It is therefore appropriate to apply the priori criterion of five factors. These five factors account for 69.8% total variance. Factor 1 explains the most variance at 20.6%, with the rest accounting for between 16% and 9% total variance. All variables successfully load onto the factors with high factor loadings scores. These results are compared to factor analysis without the transport costs factor.

In stage 2, the KMO only increases to .75 and total variance explained rises from 69.8% to 70.7%. One percent change in total variance does not justify deleting the factor. Stage 1 revealed that the factor accounts for 9.7% total variance. Expenditure on transport is a major part of the experience for passengers and excluding these variables based on less than 1 percent rise in total variance would devalue the understanding of TQoL. The final TQoL model according to Glasgow's factor analysis is shown in Table 6.1.

In summary, the TQoL model mark II does not accurately represent journey experiences in Glasgow. The new factor structure should be applied as it explains 69.8% of TQoL. This is higher than the recommended 60% required in

Table 6.1 Dimensions of Transport Quality of Life in Glasgow

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1: Access and Availability					
Availability	0.89				
Reliability	0.85				
Transport choice	0.79				
Services Access	0.61				
Factor 2: Environment					
Noise Pollution		0.88			
Climate Change		0.86			
Air Quality		0.73			
Factor 3: Sustainable Transport					
Sustainable Transport Infrastructure investment			0.85		
Walking and Cycling Quality			0.84		
Factor 4: Personal Safety					
Passenger Behaviour				0.82	
Safety on Public Transport				0.72	
Factor 5: Transport Costs					
Travel Costs					0.79
Personal Costs					0.77
Eigenvalue	3.58	1.99	1.41	1.14	0.95
Variance (%)	20.62	16.39	12.04	11.01	9.74
Cumulative Variance (%)	20.62	37.02	49.05	60.06	69.81
Cronbach's alpha	0.81	0.79	0.66	0.68	0.58
Number of items (total = 13)	4	3	2	2	2

social sciences. Although thirty percent of TQoL is unexplained it is very difficult to measure 100% through social research. This is especially true for a concept like TQoL. There are many different aspects of QoL that are immeasurable due to specific issues considered by individual passengers. Whilst the other indicators not included in the model are relevant on one level, they do not relate together to form an understanding of TQoL. Five new factors should be used to represent TQoL in Glasgow: Access and availability, Environment, Sustainable transport, Personal safety, and Transport costs. The validity of this model to explain TQoL will be confirmed by the Manchester data.

6.3.2 MANCHESTER FINAL FACTOR ANALYSIS

Manchester's final factor analysis produced a KMO of .764 and significant Bartlett's test. The scree plot confirms eight factors accounting for 60.8% total variance. The first two variables to be removed are - disability provision for loading onto more than one factor and journey time differential for not loading onto any factor. Transport choice has been highlighted for loading on more than one factor. It is not removed at this point due to its significance in Glasgow's analysis.

In Stage 2 of the analysis the KMO is .75 and eight factors account for 62.5% total variance. The next two indicators removed are bus access - as it does not load onto any factor and car safety as the only variable left on factor 8. In stage 3, the KMO is .76 and seven factors account for 61.7% total variance. The variables to be removed in the rotated component matrix are transport choice and journey quality for loading on multiple factors. Transport choice is deleted following continued loading on more than one factor. Despite its significance in the access and availability factor in Glasgow its influence on the factor is not as strong in Manchester. Stage 4 produces a KMO of .72 and seven factors accounting for 63.0% total variance. At this point no further variables can be removed from the structure and the validity of the factors is tested in the reliability statistics.

The reliability of factor 1 is .80. Employment opportunities is removed despite the correlation being above .3 because the Cronbach alpha improves to .83 if it is deleted. This factor now has *very good* reliability. Although the Cronbach alpha could be further increased by deleting services access this would deduct validity from the factor. Correlation is high and these three variables represented access and availability in the Glasgow data.

The reliability of factor 2 is .73. Private transport infrastructure investment is removed as correlation is low and this investment is not related to walking and cycling quality. In stage 2 public transport infrastructure investment is deleted as the Cronbach alpha increases if it is removed. This factor now represents sustainable transport with a Cronbach alpha of .77. Stage 4 confirms that the two variables are significantly correlated.

Factor 3 has *good* reliability with a Cronbach alpha of .71. These variables are confirmed as a robust factor explaining the environmental condition. The Cronbach alpha for factor 4 is .51. Congestion is removed due to low correlation and the Cronbach alpha improves to .56 if it is deleted. The reliability is still *poor*, but there is definite correlation between the two items.

Pearson correlation confirms personal safety as an important component of TQoL.

Factor 5 is removed from the analysis due to negative correlation between the two items and negative Cronbach alpha. This factor would not have been suitable because the amount of greenspace does not relate to the access to a train station. Factor 6 is also deleted for the low Cronbach alpha and no correlation between any variables.

The Cronbach alpha of factor 7 is .53. Despite the low correlation between the variables, it is included for representing transport costs and the relationship is confirmed by the Pearson correlation. The extent of the positive correlation between the variables is analysed in the final factor analysis output.

The final factor analysis is once more separated into two parts to test the validity of transport costs. Part 1 produces a KMO of .67 and five factors account for 72.3% total variance. In the rotated component matrix all variables load successfully onto the factors. In part 2 the KMO is .69 compared to .67, and total variance explained is 73.8% compared to 72.3%. These differences are marginal and the value of including transport costs is much more important for TQoL.

The final factor structure for Manchester TQoL is almost identical to Glasgow's factor analysis (Table 6.2). The only difference is that transport choice is not included in the access and availability factor. This indicator will not be presented in the TQoL conceptual model mark III. There are still five significant factors - Access and availability, Environment, Sustainable transport, Personal safety, and Transport costs. These account for 72.3% total variance. Factor models producing 72.3% total variance in Manchester and 69.8% in Glasgow is a major breakthrough in the definition of TQoL. Although up to 30% variance is not explained, it is impossible to explain 100% total variance because there are so many conditions that can affect TQoL.

Table 6.2 Dimensions of Transport Quality of Life in Manchester

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1: Access and Availability					
Availability	0.89				
Reliability	0.85				
Services Access	0.79				
Factor 2: Environment					
Noise Pollution		0.85			
Climate Change		0.76			
Air Quality		0.72			
Factor 3: Sustainable Transport					
Sustainable Transport Infrastructure investment			0.88		
Walking and Cycling Quality			0.87		
Factor 4: Personal Safety					
Passenger Behaviour				0.84	
Safety on Public Transport				0.76	
Factor 5: Transport Costs					
Travel Costs					0.81
Personal Costs					0.73
Eigenvalue	3.19	1.85	1.37	1.20	1.06
Variance (%)	19.51	16.20	14.01	12.26	10.36
Cumulative Variance (%)	19.51	35.70	49.71	61.94	72.30
Cronbach's alpha	0.83	0.71	0.77	0.56	0.53
Number of items (total = 12)	3	3	2	2	2

While the process to eliminate indicators can be criticised for a loss of quality this technique was implemented as part of the model development to establish which variables explain TQoL. The final TQoL model includes only significant indicators that represent the true value of journey quality. Although the other excluded indicators were important to illustrate major differences in experience, testing the structure of the concept has added validity to the model development. This has produced the TQoL model mark III – the final conceptual model of TQoL (Figure 6.3). The new structure means new comparisons of TQoL are needed and are presented in the next section.

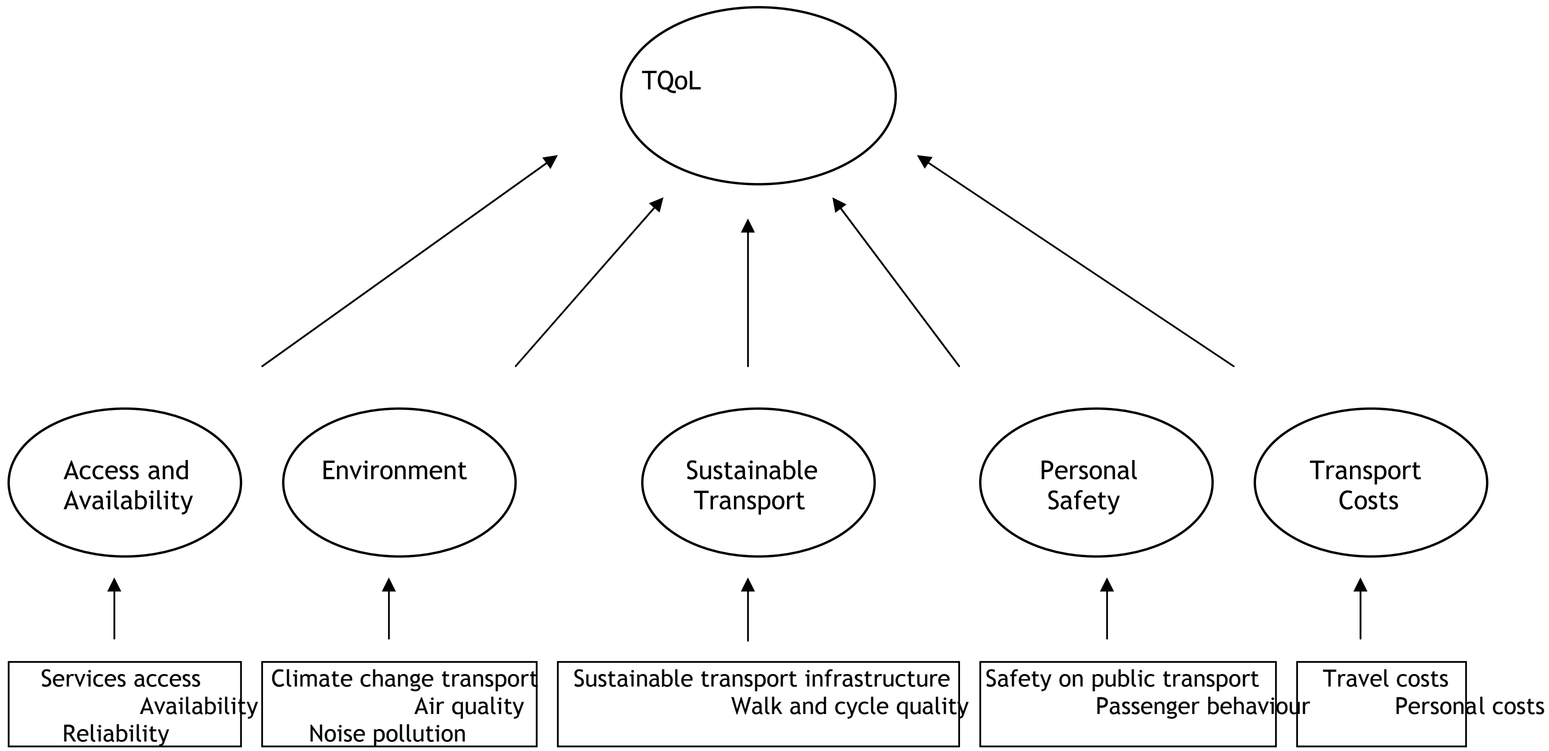

Figure 6.3 Final TQoL conceptual model mark III

6.4 FINAL TQoL MODELS

6.4.1 FINAL GLASGOW TQoL

The new conceptual TQoL model mark III allows more comprehensive assessment of differences in journey experience. This section will present the appraisal of TQoL using the new significant factors to highlight the differences by mode and individual characteristics. Results of the individual city comparisons are represented in the main text and t-test results for the demographic and transport characteristics are shown in Appendix E.

The new TQoL model for Glasgow is presented in Figure 6.4. There are differences between the fixed modes and the bus most notably for access and availability and personal safety. In the comparison between LRT TQoL and Bus TQoL there are significant differences for all indicators in the access and availability factor, both indicators in the personal safety factor and walking and cycling quality in the sustainable transport factor (Table 6.3, indicators with no significant differences are highlighted in red). LRT is providing a better journey experience for all these indicators. The difference in TQoL is quite high at 25.599 for transport choice, 12.805 for services access, 13.397 for availability and 13.378 for reliability. There are equally large differences for the other significant indicators. There are no significant differences in the environment and transport costs factors. This confirms previous findings that cost and environmental condition are similar for passengers of both modes of transport.

There are very similar differences between Train TQoL and Bus TQoL. Significant differences are found for all indicators of access and availability and air quality, walking and cycling quality and safety on public transport. The train is providing a better journey experience on all indicators. These differences are not as great as the LRT TQoL and Bus TQoL comparison. This means that although Train TQoL is significantly higher than Bus TQoL it is not as good as LRT TQoL. Despite this the results do confirm a clear variation between fixed modal TQoL and Bus TQoL.

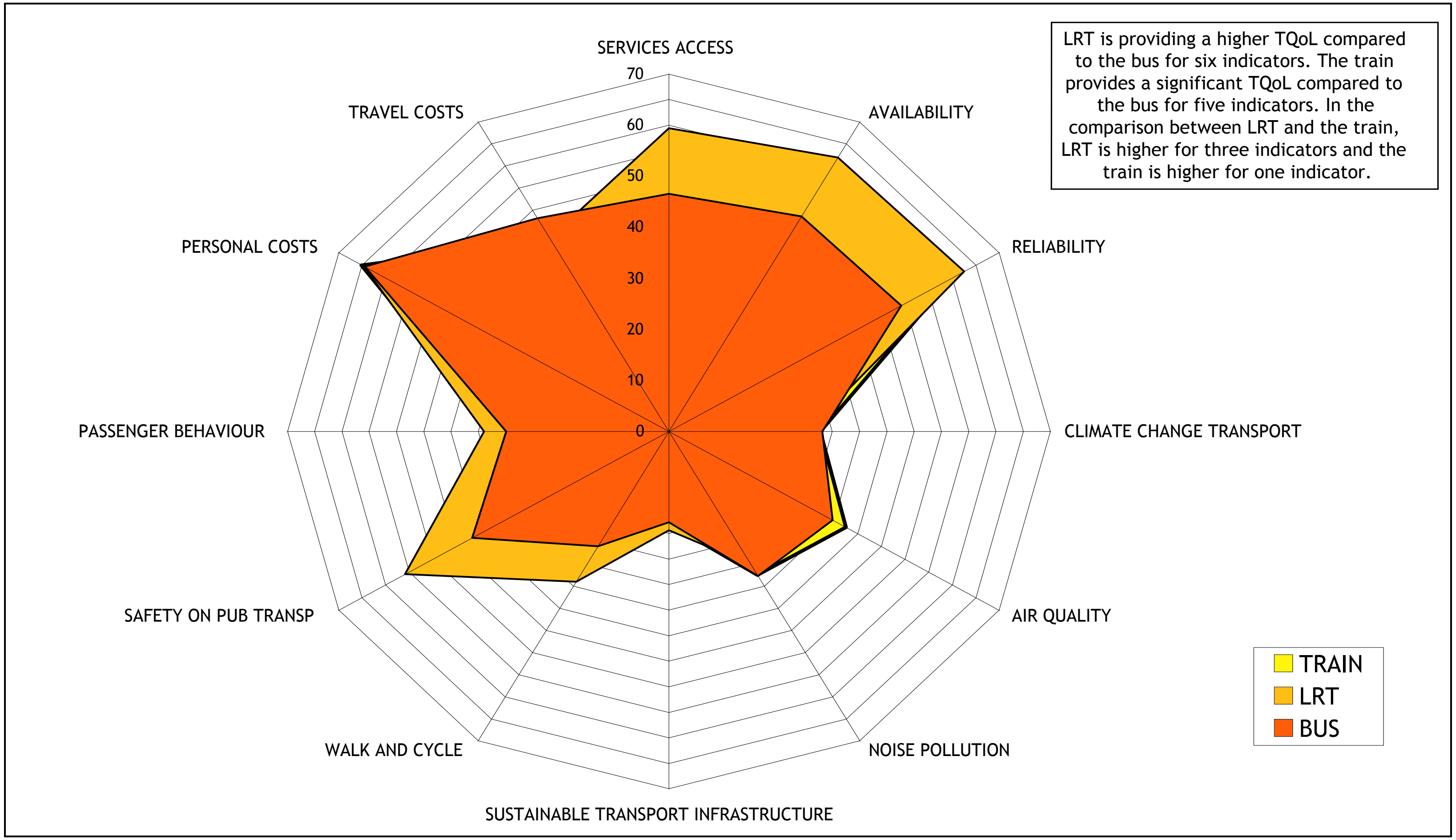

Figure 6.4 Final GLASGOW TQoL by mode

Table 6.3 t-Tests comparing the means of final Glasgow TQoL

t-Tests comparing LRT TQoL and Bus TQoL			**t-Tests comparing Bus TQoL and Train TQoL**			**t-Tests comparing LRT TQoL and Train TQoL**		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
SERVACC	8.139	**0.000**	SERVACC	-3.530	**0.000**	SERVACC	5.484	**0.000**

AVAIL	6.949	**0.000**	AVAIL	-5.363	**0.000**	AVAIL	2.276	**0.023**
RELIAB	6.582	**0.000**	RELIAB	-5.148	**0.000**	**RELIAB**	1.800	**0.073**
CLIMCHNG	-1.509	**0.132**	**CLIMCHNG**	0.169	**0.866**	**CLIMCHNG**	-1.390	**0.166**
AIRQUAL	-1.357	**0.176**	AIRQUAL	-2.074	**0.039**	AIRQUAL	-3.353	**0.001**
NOISEPOLL	-1.379	**0.169**	**NOISEPOLL**	0.083	**0.934**	**NOISEPOLL**	-1.409	**0.160**
SUSINFRAS	1.200	**0.231**	**SUSINFRAS**	-0.234	**0.815**	**SUSINFRAS**	1.037	**0.301**
WALK	4.460	**0.000**	WALK	-3.727	**0.000**	**WALK**	0.690	**0.491**
PUBSAF	5.962	**0.000**	PUBSAF	-3.421	**0.001**	PUBSAF	3.237	**0.001**
BEHAV	2.017	**0.045**	**BEHAV**	-0.885	**0.377**	**BEHAV**	1.329	**0.185**
TRAVCOST	-1.755	**0.080**	**TRAVCOST**	2.008	**0.045**	**TRAVCOST**	0.221	**0.825**
BUDG	0.126	**0.900**	**BUDG**	-0.526	**0.599**	**BUDG**	-0.494	**0.622**

Table 6.4 Importance of final TQoL indicators in Glasgow, highlighting the significant differences between the corridors

LRT AND BUS		TRAIN AND BUS		LRT AND TRAIN	
TQoL INDICATOR	SCORE OF IMPORTANCE	TQoL INDICATOR	SCORE OF IMPORTANCE	TQoL INDICATOR	SCORE OF IMPORTANCE
RELIABILITY	8.168	RELIABILITY	8.168	RELIABILITY	8.168
SAFETY ON PUB TRANSP	8.018	SAFETY ON PUB TRANSP	8.018	SAFETY ON PUB TRANSP	8.018
PASSENGER BEHAVIOUR	7.898	PASSENGER BEHAVIOUR	7.898	PASSENGER BEHAVIOUR	7.898
TRANSPORT CHOICE	7.553	TRANSPORT CHOICE	7.553	TRANSPORT CHOICE	7.553
AVAILABILITY	7.531	AVAILABILITY	7.531	AVAILABILITY	7.531
WALK AND CYCLE	7.270	WALK AND CYCLE	7.270	WALK AND CYCLE	7.270
TRAVEL COSTS	6.986	TRAVEL COSTS	6.986	TRAVEL COSTS	6.986
PERSONAL COSTS	6.986	PERSONAL COSTS	6.986	PERSONAL COSTS	6.986
AIR QUALITY	6.898	AIR QUALITY	6.898	AIR QUALITY	6.898
SERVICES ACCESS	6.876	SERVICES ACCESS	6.876	SERVICES ACCESS	6.876
NOISE POLLUTION	6.708	NOISE POLLUTION	6.708	NOISE POLLUTION	6.708
CLIMATE CHANGE TRANSPORT	6.292	CLIMATE CHANGE TRANSPORT	6.292	CLIMATE CHANGE TRANSPORT	6.292
SUSTAINABLE TRANSPORT INFRASTRUCTURE	5.115	SUSTAINABLE TRANSPORT INFRASTRUCTURE	5.115	SUSTAINABLE TRANSPORT INFRASTRUCTURE	5.115

In the comparison of the two fixed modes of transport there are significant differences on two access and availability indicators, air quality and safety on public transport. LRT TQoL is higher for all indicators except air quality. Although there is not a major difference in TQoL between the two modes, LRT still provides an enhanced experience for a number of issues.

In all three comparisons there are significant differences on access and availability, which is the factor that contains the most variance explained. This means that the area where fixed modes are providing better TQoL is the most important for TQoL. This is also confirmed by difference in passengers experience on the most valuable issues from the city-wide survey (Table 6.4, indicators with no significant differences are highlighted in red). The difference in TQoL is more important in the comparison of fixed modes and the bus. In the comparison between the fixed modes there is more equal distribution of indicators that have no significant difference.

Differences in TQoL were also examined by the four selected demographic and transport characteristics. Spider diagrams represent little different by sex on all modes of transport (Figures 6.5, 6.6, 6.7). For Train TQoL there are only three indicators with significant differences - the climate change transport indicator and the two transport costs indicators. Women have a better environmental condition compared to men and spend less when they travel, while men spend less of their weekly budget on transport. For LRT TQoL the only difference is on the two personal safety indicators – where women feel less safe and are more affected by other passengers. This highlights previous findings of greater insecurity for females when they travel (DfT 2004a). Passengers on the bus do not experience the same problems. There are significant differences for air quality, noise pollution, personal costs and travel costs, but not personal safety. Men feel there is better air quality and noise pollution and spend less of their weekly budget on transport. It is interesting to find significant differences for transport costs on Bus TQoL and LRT TQoL when there is no difference between all the modes. Safety is also a significant issue on LRT but not for the other modes.

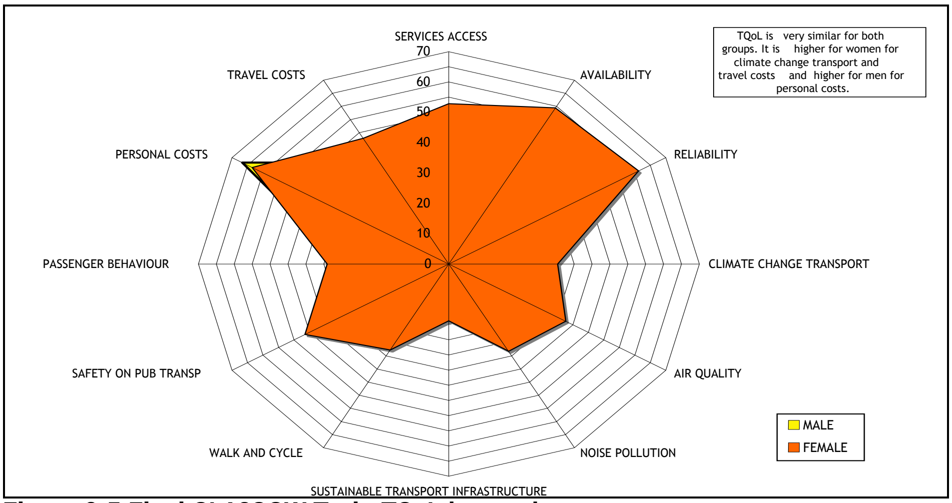

Figure 6.5 Final GLASGOW Train TQoL by gender

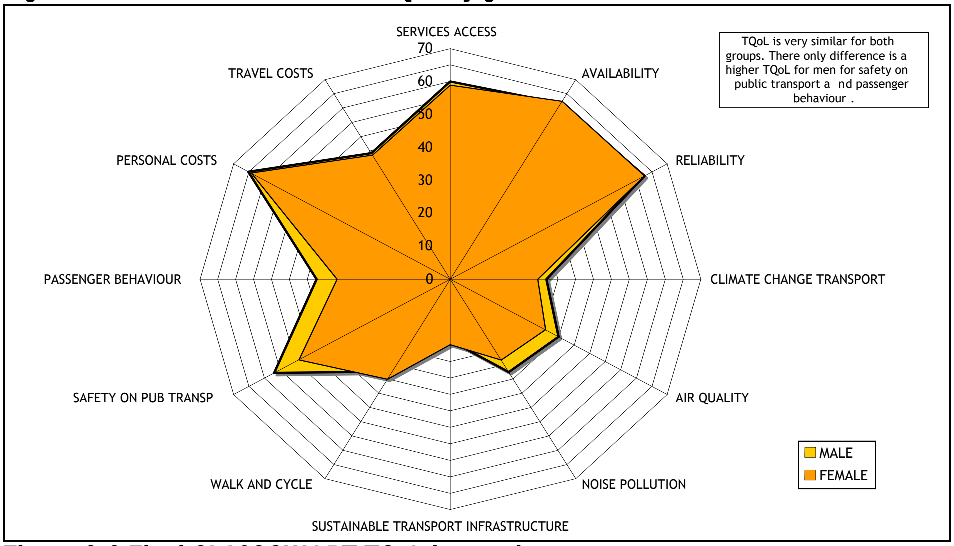

Figure 6.6 Final GLASGOW LRT TQoL by gender

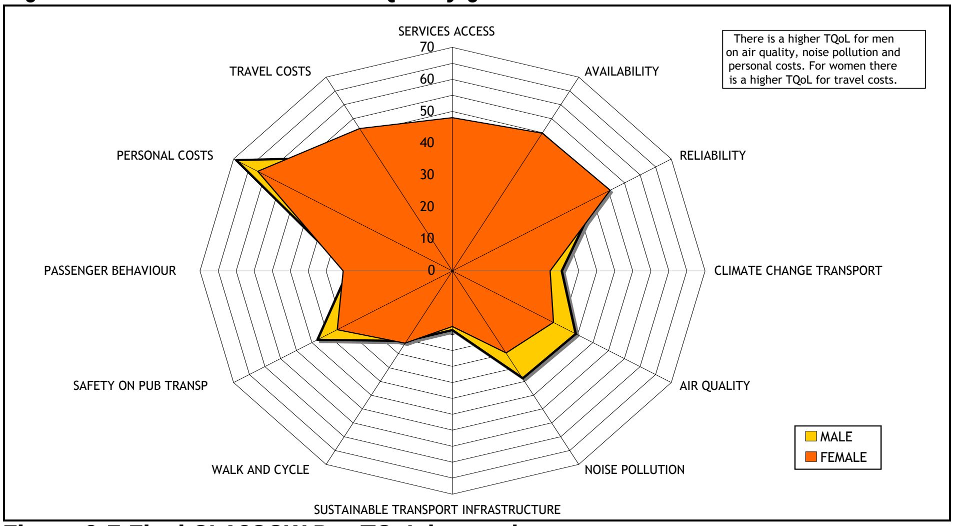

Figure 6.7 Final GLASGOW Bus TQoL by gender

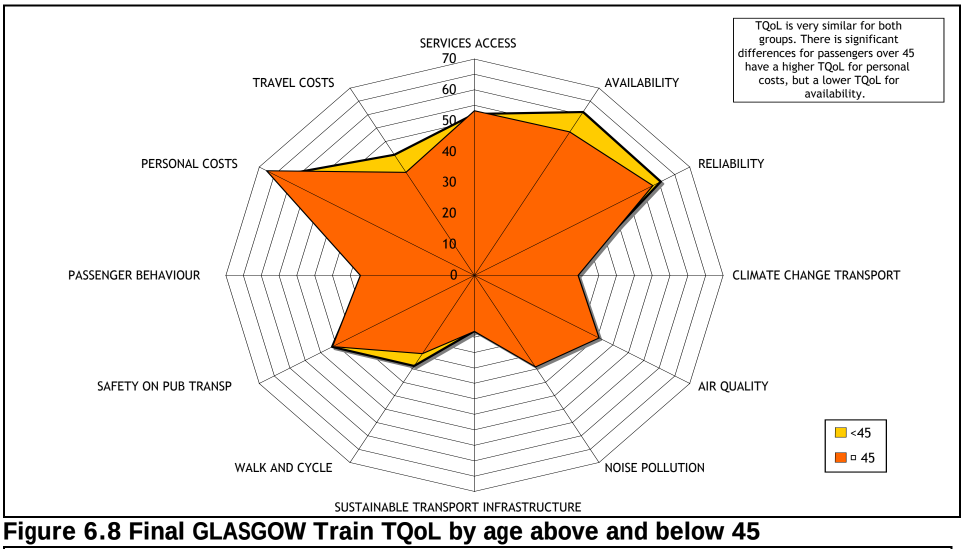

Figure 6.8 Final GLASGOW Train TQoL by age above and below 45

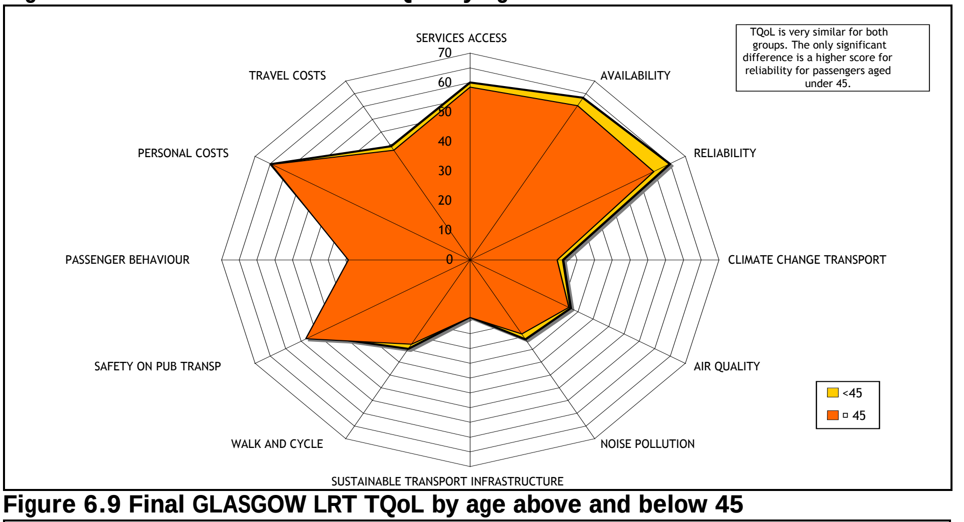

Figure 6.9 Final GLASGOW LRT TQoL by age above and below 45

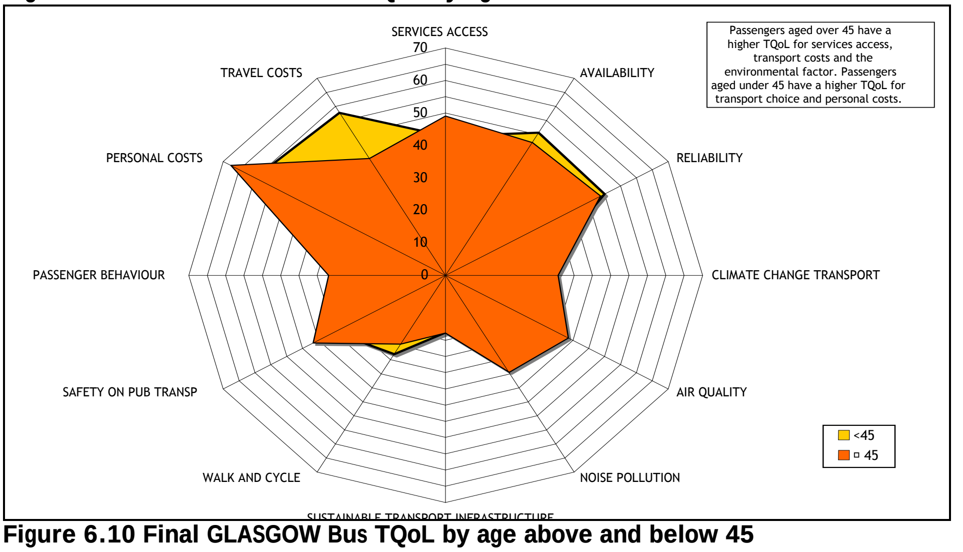

Figure 6.10 Final GLASGOW Bus TQoL by age above and below 45

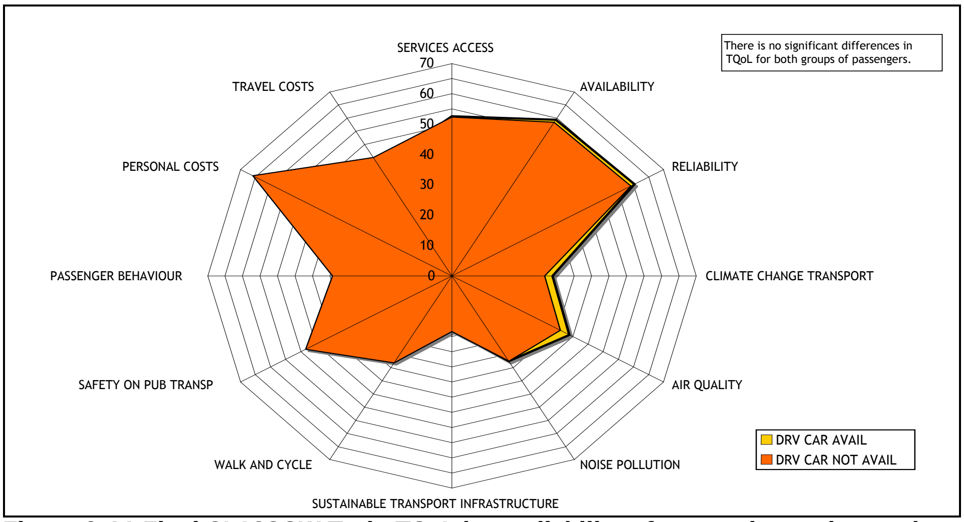

Figure 6.11 Final GLASGOW Train TQoL by availability of car as alternative mode

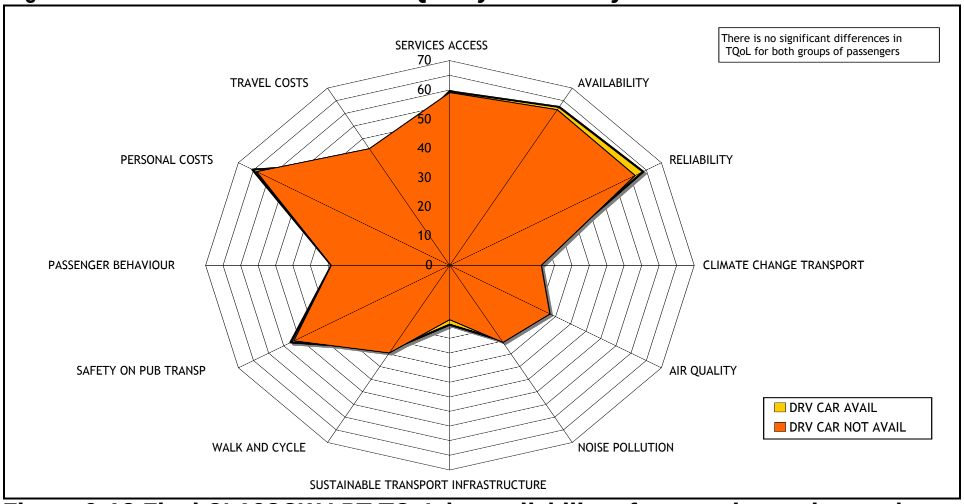

Figure 6.12 Final GLASGOW LRT TQoL by availability of car as alternative mode

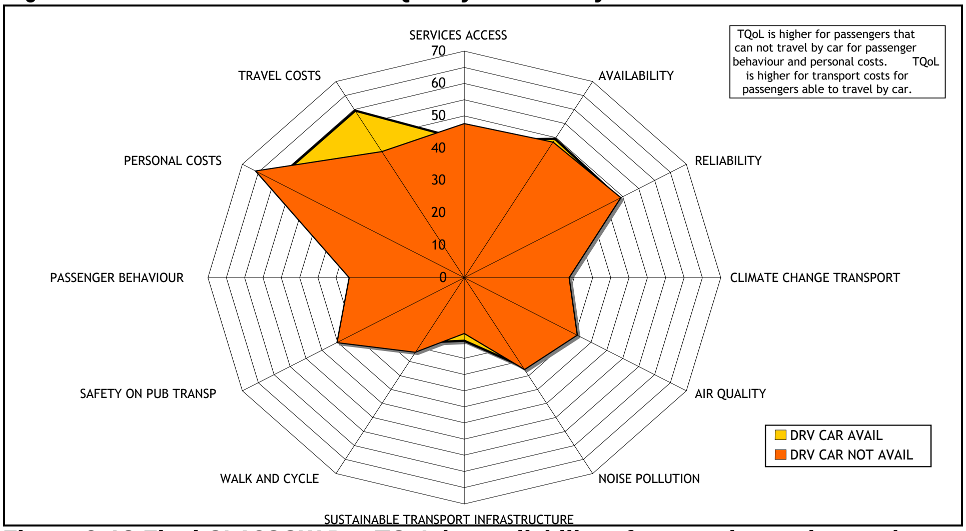

Figure 6.13 Final GLASGOW Bus TQoL by availability of car as alternative mode

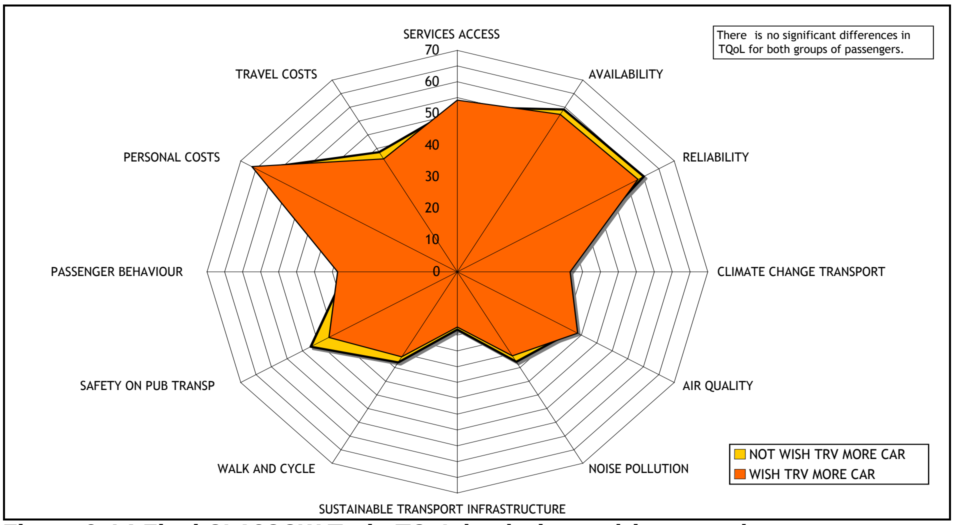

Figure 6.14 Final GLASGOW Train TQoL by desire to drive more by car

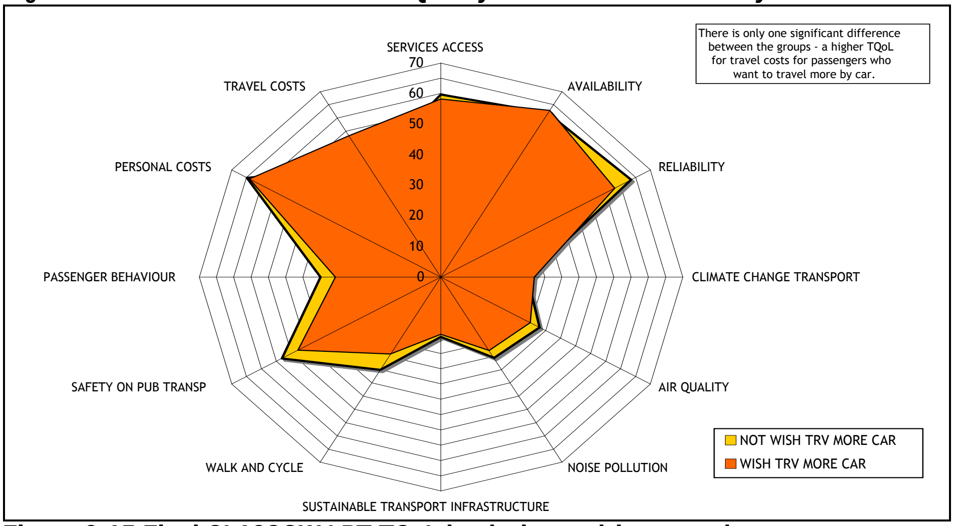

Figure 6.15 Final GLASGOW LRT TQoL by desire to drive more by car

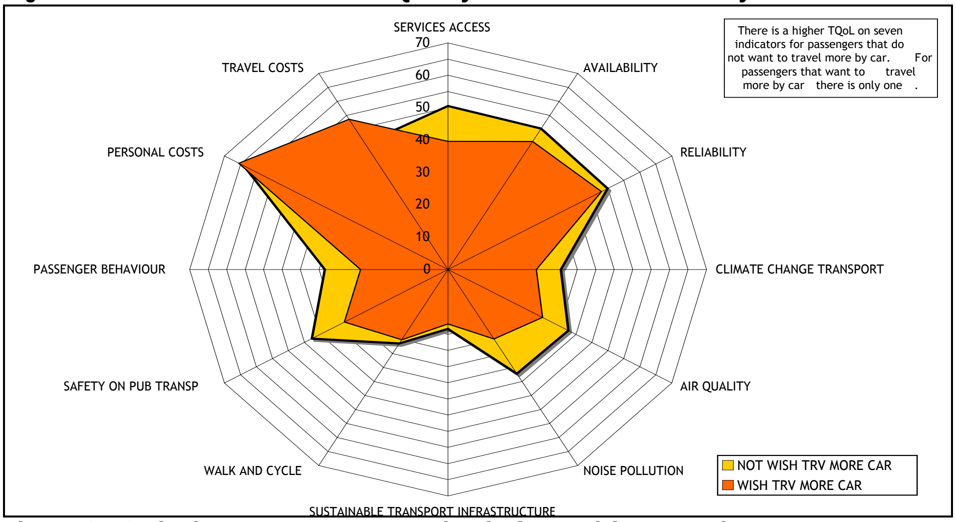

Figure 6.16 Final GLASGOW Bus TQoL by desire to drive more by car

For TQoL by age there appears to be very few differences for fixed modes of transport, but more variation on the bus (Figures 6.8, 6.9, 6.10). For Train TQoL the only significant differences are availability and personal costs. Passengers over 45 spend less of their weekly budget on transport and feel there is less availability. On LRT TQoL the only difference is reliability. For Bus TQoL there are significant differences for transport choice, services access, climate change, air pollution, personal costs and travel costs. In general, there is a better experience for passengers older than 45. These passengers have improved services access, environmental quality and transport costs. On all modes older passengers feel equally as safe as younger adults. This is interesting considering previous research has found that older people generally feel more unsafe than younger people and they are less likely to travel late into the evening (DfT 2004a).

Comparison of TQoL by car availability indicates very little difference in all modes of transport (Figures 6.11, 6.12 and 6.13). There are no significant differences in TQoL for passengers on both fixed modes. This demonstrates that being able to travel by car does not affect their TQoL. On the bus there are significant differences for the behaviour of other passengers indicators and both transport costs indicators. For the first two indicators there is a better experience for passengers that do not have a car available. Although indicating a slight influence on QoL, it does not confirm that having the ability to travel by car means lower quality experience on public transport.

For passengers wanting to travel more by car there is greater difference in Bus TQoL compared to fixed modal TQoL (Figures 6.14, 6.15 and 6.16). For Train TQoL there are no significant differences and only one indicator with significant differences for LRT TQoL - travel costs. This indicates a higher TQoL for people who want to travel more by car. In general the experience encountered on fixed modes has no impact on the desire to travel more by car. It is the opposite for bus passengers as there are eight indicators with significant differences. For people who do not want to travel more by car there is a higher score on all but one indicator. This means that if passengers are experiencing a lower TQoL they will want to travel more by car. This once more confirms findings of previous research showing how car use can affect bus experience (Anderson and Stradling, 2004; Stradling et al., 2005; Stradling et al., 2007).

Final TQoL in Glasgow has produced similar results to the previous assessment only this time the outcome is more valid. The most notable significant differences are found on access and availability and personal safety. Fixed modes provide a better TQoL for the most important issues in terms of total variance and the results from the city-wide survey. There is very little difference in TQoL by demographic statistics and whilst the car does not have an influence on fixed modal experience it does for bus passengers.

6.4.2 FINAL MANCHESTER TQoL

Final TQoL for Manchester is shown in Figure 6.17. The diagram indicates a difference in fixed modal TQoL compared to Bus TQoL for the access and availability factor. In the comparison between LRT TQoL and the Bus TQoL there are significant differences on seven indicators - all the access and availability and environment indicators and walking and cycling quality (Table 6.5, the indicators with no significant differences are highlighted in red). LRT TQoL is significantly better on all these indicators. This difference is important as it is on the two most influential TQoL factors by total variance explained. On all parts of TQoL, except travel costs, LRT is providing an improved TQoL. This shows that LRT is providing a superior passenger service compared to the bus.

In the comparison between Train TQoL and Bus TQoL there are significant differences on the access and availability factor and personal costs. The train is providing a better experience on each indicator. Although there is no significant difference for the environment factor it is clear that fixed modes provide a better TQoL for the most important TQoL issues. Differences in Train TQoL and Bus TQoL are not as large the LRT TQoL and Bus TQoL comparison.

Between the two fixed modes there are only three indicators with significant differences - climate change, noise pollution and the behaviour of other passengers. For each indicator LRT TQoL is higher. Access and availability,

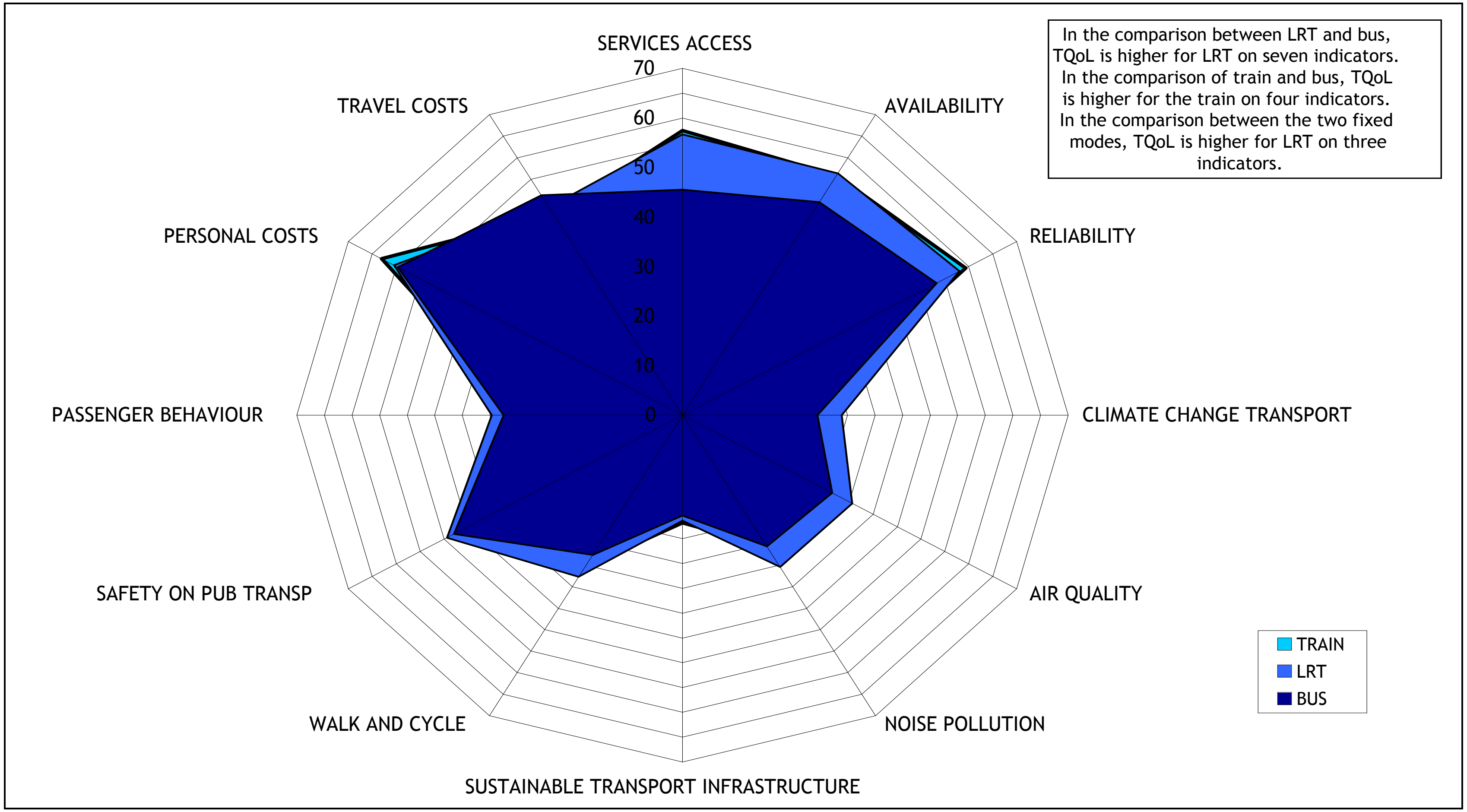

Figure 6.17 Final MANCHESTER TQoL by mode

Table 6.5 t-Tests comparing the means of final Manchester TQoL

t-Tests comparing LRT TQoL and Bus TQoL			t-Tests comparing Bus TQoL and Train TQoL			t-Tests comparing LRT TQoL and Train TQoL		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
SERVACC	5.573	**0.000**	SERVACC	-6.248	**0.000**	**SERVACC**	-0.471	**0.638**
AVAIL	3.157	**0.002**	AVAIL	-2.839	**0.005**	**AVAIL**	0.241	**0.810**
RELIB	2.039	**0.043**	RELIB	-2.578	**0.011**	**RELIB**	-0.656	**0.512**
CLIMCHNG	2.561	**0.011**	**CLIMCHNG**	1.344	**0.180**	CLIMCHNG	3.994	**0.000**
AIRQUAL	2.448	**0.015**	**AIRQUAL**	-1.027	**0.306**	**AIRQUAL**	1.471	**0.142**
NOISEPOLL	2.570	**0.011**	**NOISEPOLL**	-0.016	**0.987**	NOISEPOLL	2.727	**0.007**
SUSINFRAS	0.719	**0.473**	**SUSINFRAS**	-0.891	**0.374**	**SUSINFRAS**	-0.270	**0.787**
WALK	2.457	**0.015**	**WALK**	-1.259	**0.209**	**WALK**	1.086	**0.278**
PUBSAF	0.694	**0.488**	**PUBSAF**	1.140	**0.255**	**PUBSAF**	1.815	**0.071**
BEHAV	1.019	**0.309**	**BEHAV**	1.806	**0.072**	BEHAV	2.826	**0.005**
TRAVCOST	-1.089	**0.277**	**TRAVCOST**	1.573	**0.117**	**TRAVCOST**	0.578	**0.564**
BUDG	0.837	**0.404**	BUDG	-2.417	**0.016**	**BUDG**	-1.944	**0.053**

Table 6.6 Importance of final TQoL indicators in Manchester, highlighting the significant differences between the corridors

LRT AND BUS		TRAIN AND BUS		LRT AND TRAIN	
TQoL INDICATOR	SCORE OF IMPORTANCE	TQoL INDICATOR	SCORE OF IMPORTANCE	TQoL INDICATOR	SCORE OF IMPORTANCE
RELIABILITY	7.805	RELIABILITY	8.805	RELIABILITY	8.805
PASSENGER BEHAVIOUR	8.566	PASSENGER BEHAVIOUR	8.566	PASSENGER BEHAVIOUR	8.566
SAFETY ON PUB TRANSP	8.344	SAFETY ON PUB TRANSP	8.344	SAFETY ON PUB TRANSP	8.344
AVAILABILITY	7.617	AVAILABILITY	7.617	AVAILABILITY	7.617
SERVICES ACCESS	7.430	SERVICES ACCESS	7.430	SERVICES ACCESS	7.430
WALK AND CYCLE	7.238	WALK AND CYCLE	7.238	WALK AND CYCLE	7.238
AIR QUALITY	7.180	AIR QUALITY	7.180	AIR QUALITY	7.180
TRAVEL COSTS	7.112	TRAVEL COSTS	7.112	TRAVEL COSTS	7.112
NOISE POLLUTION	6.934	NOISE POLLUTION	6.934	NOISE POLLUTION	6.934
PERSONAL COSTS	6.813	PERSONAL COSTS	6.813	PERSONAL COSTS	6.813
CLIMATE CHANGE TRANSPORT	6.297	CLIMATE CHANGE TRANSPORT	6.297	CLIMATE CHANGE TRANSPORT	6.297
SUSTAINABLE TRANSPORT INFRASTRUCTURE	5.484	SUSTAINABLE TRANSPORT INFRASTRUCTURE	5.484	SUSTAINABLE TRANSPORT INFRASTRUCTURE	5.484

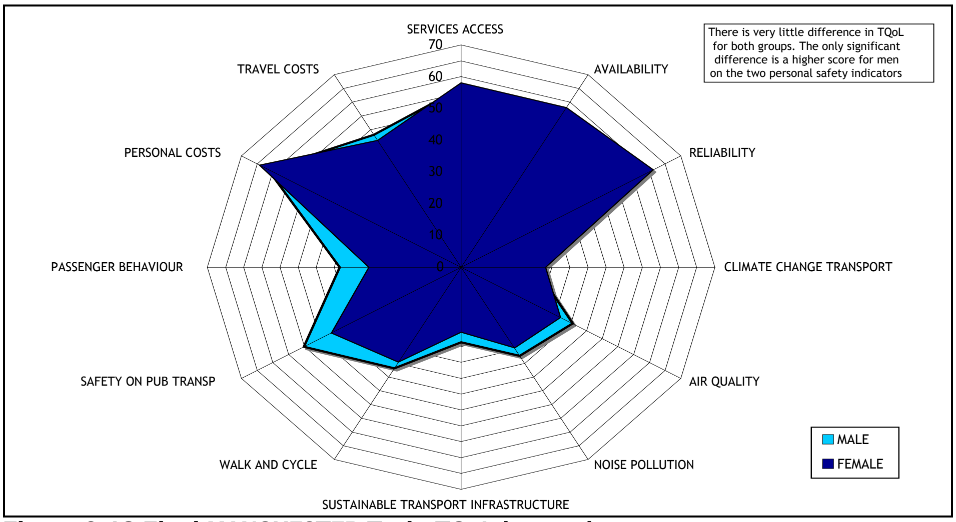

Figure 6.18 Final MANCHESTER Train TQoL by gender

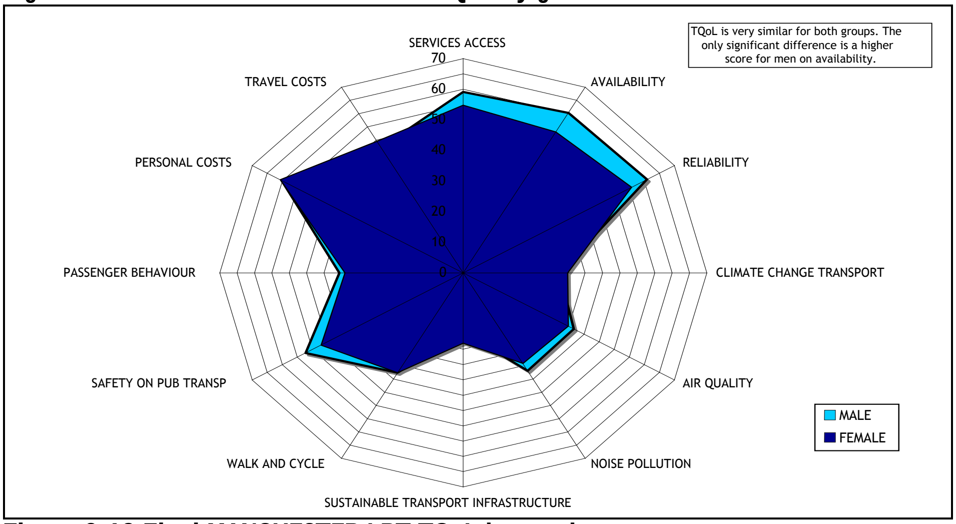

Figure 6.19 Final MANCHESTER LRT TQoL by gender

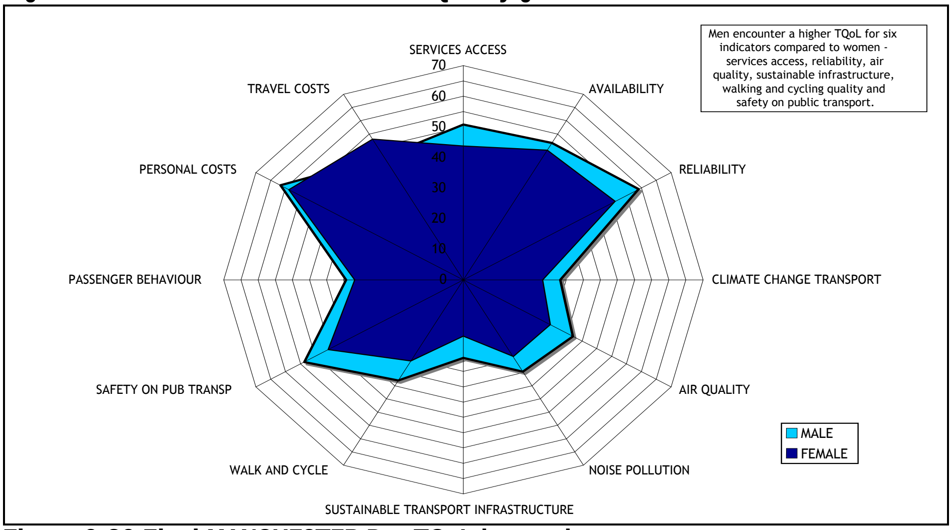

Figure 6.20 Final MANCHESTER Bus TQoL by gender

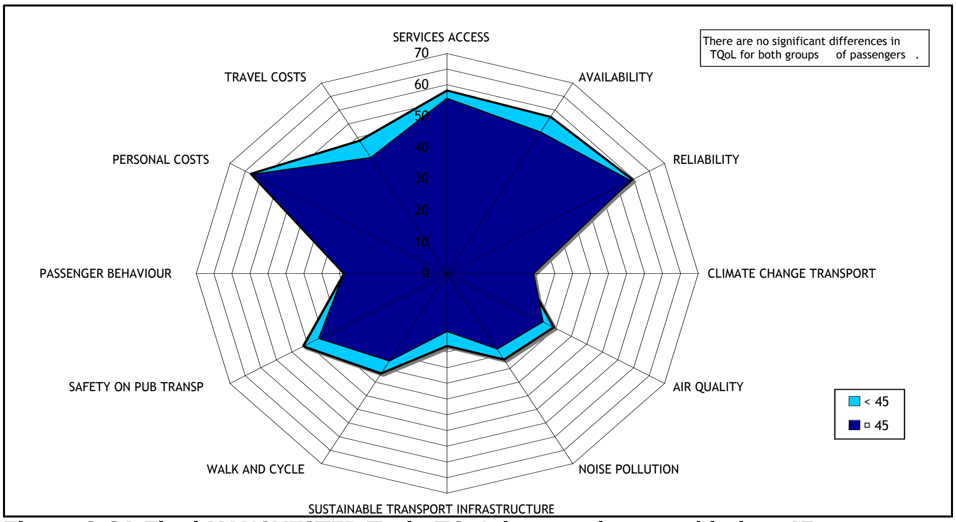

Figure 6.21 Final MANCHESTER Train TQoL by age above and below 45

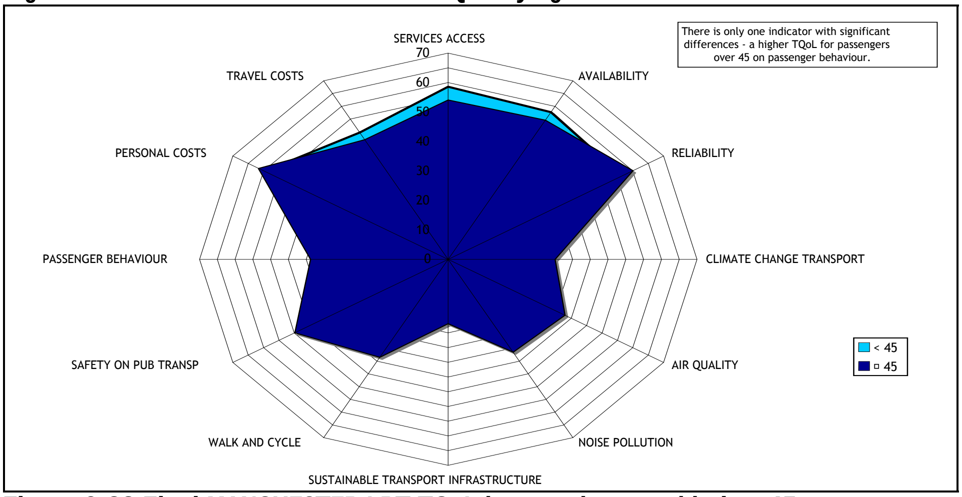

Figure 6.22 Final MANCHESTER LRT TQoL by age above and below 45

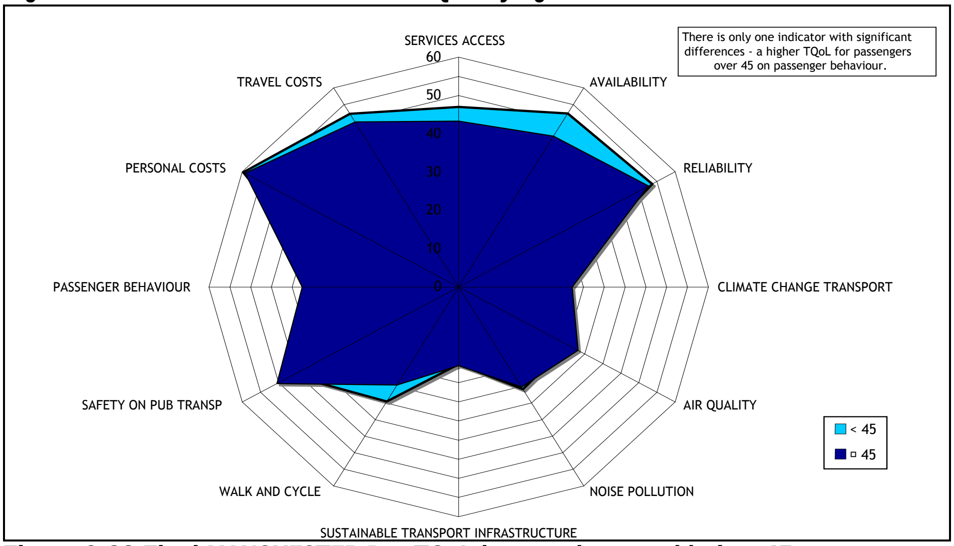

Figure 6.23 Final MANCHESTER Bus TQoL by age above and below 45

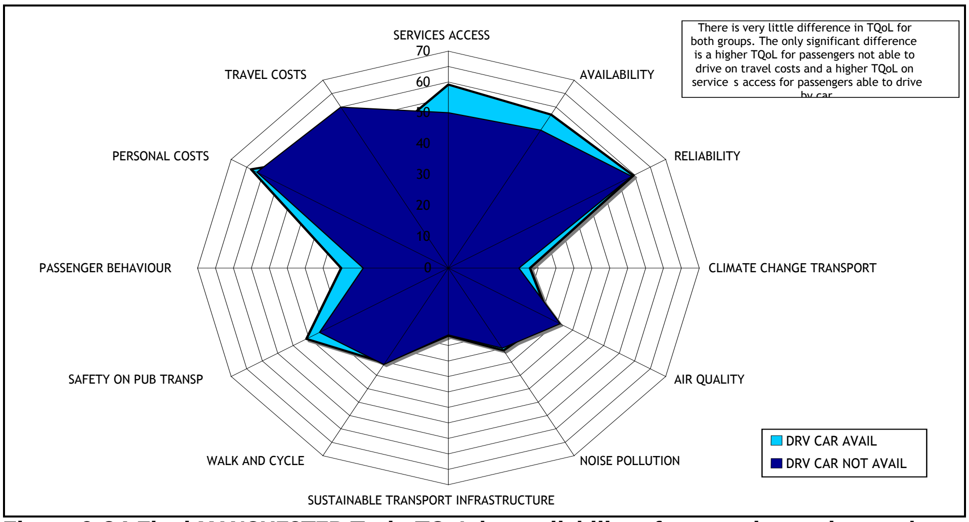

Figure 6.24 Final MANCHESTER Train TQoL by availability of car as alternative mode

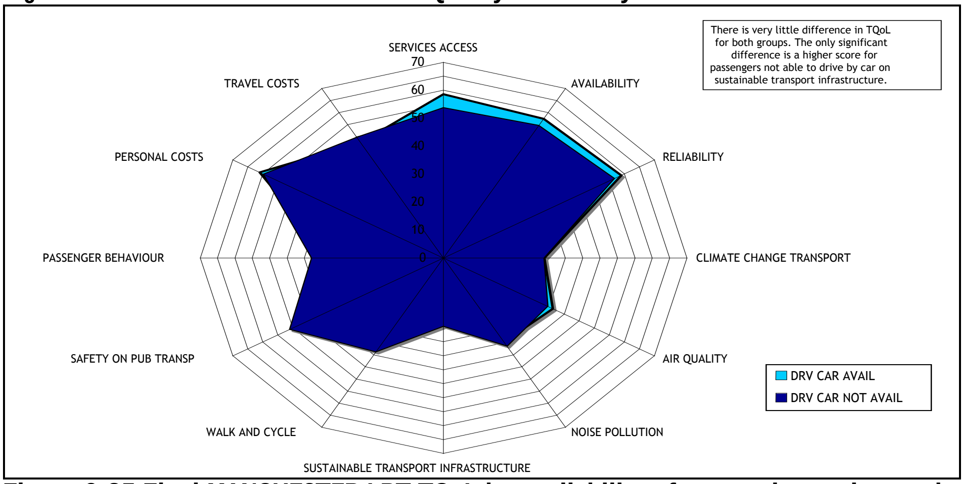

Figure 6.25 Final MANCHESTER LRT TQoL by availability of car as alternative mode

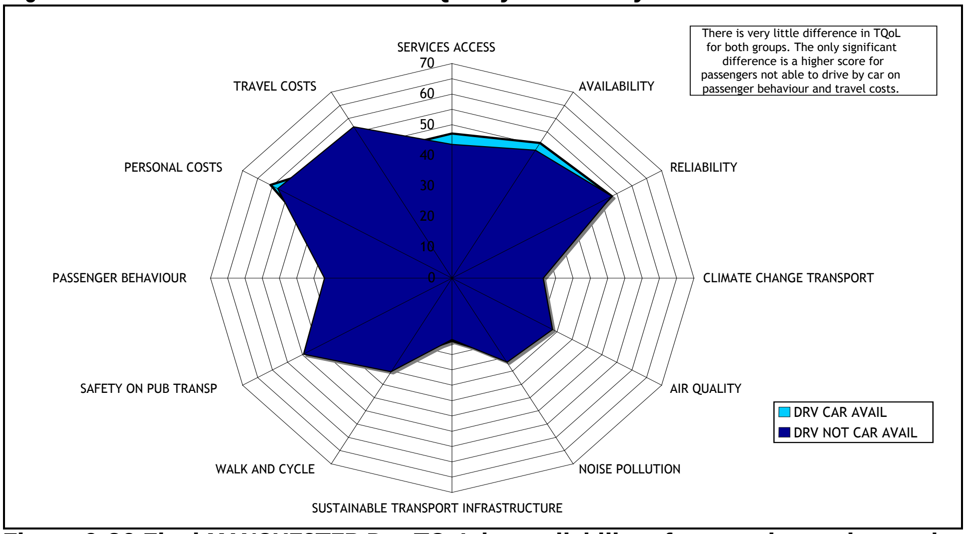

Figure 6.26 Final MANCHESTER Bus TQoL by availability of car as alternative mode

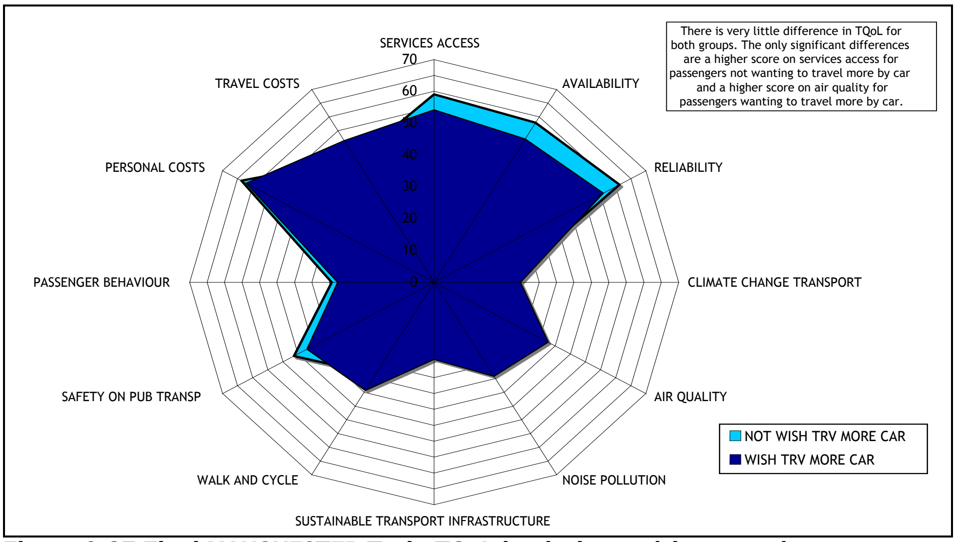

Figure 6.27 Final MANCHESTER Train TQoL by desire to drive more by car

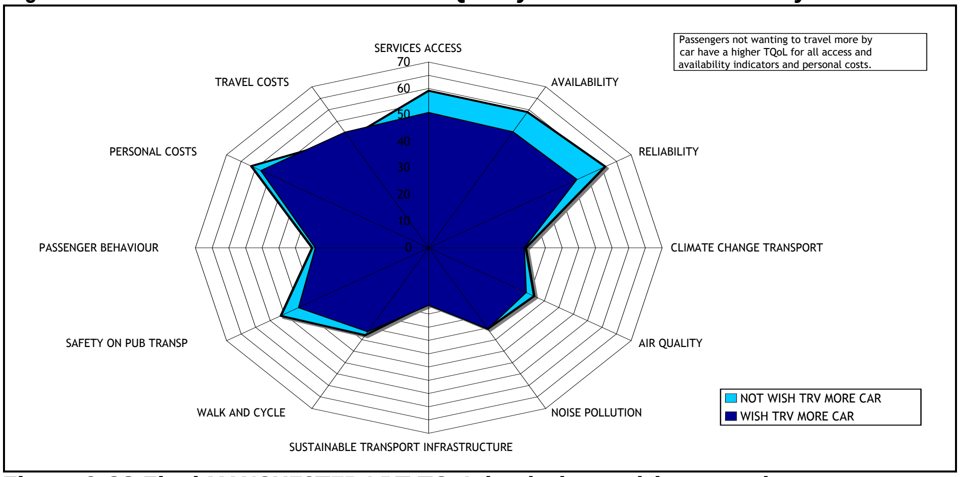

Figure 6.28 Final MANCHESTER LRT TQoL by desire to drive more by car

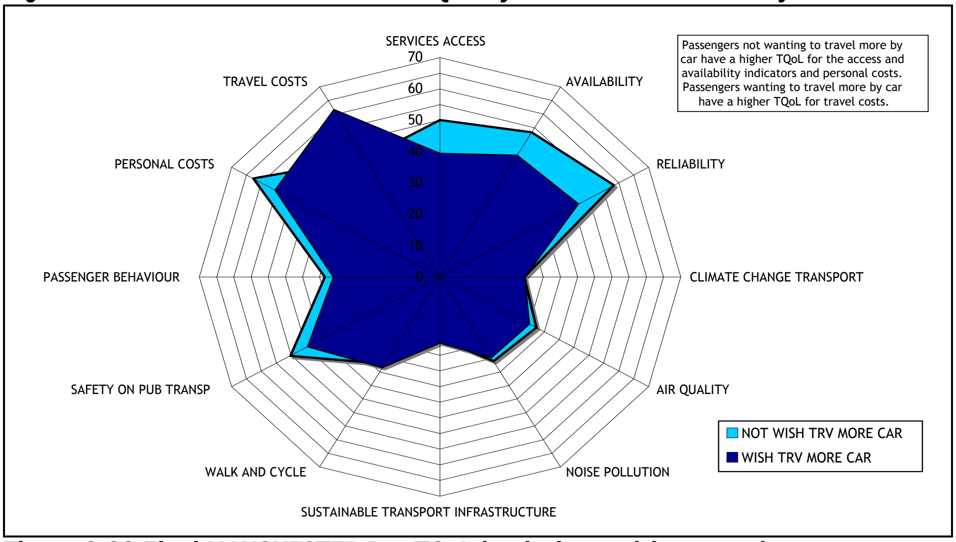

Figure 6.29 Final MANCHESTER Bus TQoL by desire to drive more by car

sustainable transport and transport costs factors all have no significant differences. Indicators in the environment and personal safety factors also contain no significant difference. This means that in all parts of TQoL there is no difference between fixed modes of public transport. The most important point is no difference for the most significant factor.

When these differences are compared to the importance indicators there is not as clear a variation as was found in Glasgow. In the comparison of fixed modes and the bus there are only two indicators in the top five with no significant difference (Table 6.6). Although it shows that LRT is providing a better experience on the most important issues it is less clear on the train because there is more equal distribution of significant differences. In the comparison between the two fixed modes there are even more indicators with no significant difference.

The modes of transport were then analysed by the four selected characteristics. The results of the t-tests are shown in Appendix E. There is very little difference for males and females on fixed modal TQoL but more variation for Bus TQoL (Figures 6.18, 6.19 and 6.20). On the train there are only two indicators with significant differences - the personal safety indicators. This once more highlights that women feel less safe compared to men on public transport. While there is also a difference for personal safety on LRT this is not significant. There is only one indicator with significant differences for LRT TQoL - availability. For Bus TQoL, men are encountering a better experience on six indicators of TQoL compared to women.

There is little difference in TQoL by age (Figures 6.21, 6.22 and 6.23). The t-tests confirm no significant differences for Train TQoL and only one indicator with significant differences for both LRT TQoL and Bus TQoL - passenger behaviour. For LRT and the bus experience with other passengers is better for people over the age of 45.

There are also no major differences in TQoL by car availability (Figures 6.24, 6.25 and 6.26). For Train TQoL there are only two indicators with significant differences - services access and travel costs. Passengers able to travel by car feel there is better access to local services but spend more on their journey. For LRT TQoL there is only one indicator with significant differences - sustainable transport infrastructure investment. Passengers unable to travel by car feel there is better investment.

There are only two indicators with significant differences on Bus TQoL. These show that people unable to travel by car have a better experience with other passengers and spend less on their journey. In general, on each mode the influence of being able to travel by car does not affect TQoL. There is a greater difference for passengers wanting to travel more by car (Figure 6.27, 6.28 and 6.29). The Train TQoL t-tests reveal only two significant differences - services access and air quality. Although passengers not wanting to travel more by car have a higher score for each access and availability indicators, only services access is significant. There is also improved air quality for passengers wishing to travel more by car. Overall, this does not present a relationship where the impact of TQoL makes individuals want to travel more by car.

For LRT TQoL all indicators of access and availability and personal costs have a significantly higher score for passengers not wanting to travel more by car. This means that if LRT passengers encounters poor access and availability and spend more of their weekly budget on the transport they want to travel more by car.

Bus passengers who also experience poor *access and availability* wish to travel more by car. The other indicators with significant differences on Bus TQoL are the transport costs indicators. Passengers not wanting to travel more by car spend less of their weekly budget on transport but more on each journey. This means that the impact of weekly budget has greater influence in how much people want to travel by car.

The outcome from the final Manchester TQoL models is similar to Glasgow. Overall, fixed modal TQoL is better than Bus TQoL. These differences are more significant in the comparison of LRT TQoL and Bus TQoL. While individually, there is very little difference for demographic and car availability characteristics more variance was found for passengers wanting to travel more by car. People experiencing poor access and availability want to travel more by car. This is significant because it the most important TQoL factor in terms of variance explained and importance. The other important conclusion is how inconsequential personal safety is by sex, age and influence on travel by car. There were significant differences for men and women on Train TQoL, but no other common significance. This is valuable because safety is considered to be a major part of journey quality.

6.4.3 FINAL MODAL COMPARISONS OF TQoL

Modal corridors were compared to discover how closely related TQoL is in both cities. Spider diagrams comparing final TQoL in the train, LRT and bus corridors are presented in Figures 6.30, 6.31 and 6.32. Each chart shows very little difference in Glasgow and Manchester. For the train corridors there are only four indicators with significant differences - services access, climate change, air quality and sustainable transport (Table 6.6). In Manchester, Train TQoL is higher for services access and sustainable transport infrastructure investment, while in Glasgow Train TQoL has better environmental quality. In this comparison it is not possible to state one city is providing an improved Train TQoL.

There is a similar result for the LRT corridors with only five indicators of significant difference. In Glasgow there is significantly higher LRT TQoL for availability, reliability and personal costs. In Manchester climate change transport and noise pollution is higher. This once more highlights that journey experience is enhanced on some issues in Glasgow and others in Manchester. Whilst these different fixed modes of transport could have produced a better TQoL in Manchester as the Metrolink is a newer system both cities delivered a similarly good journey experience.

Bus TQoL is even more closely related. There are only three indicators with significant differences - walking and cycling quality, safety on public transport and personal costs. Bus TQoL in Glasgow provides an improved experience for personal costs, while in Manchester Bus TQoL is higher for walking and cycling

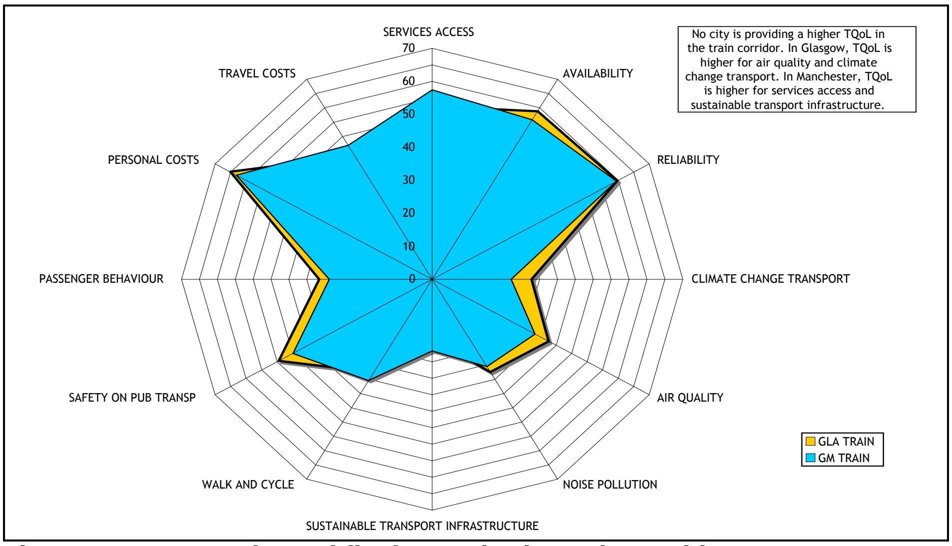

Figure 6.30 Comparison of final TQoL in the train corridors

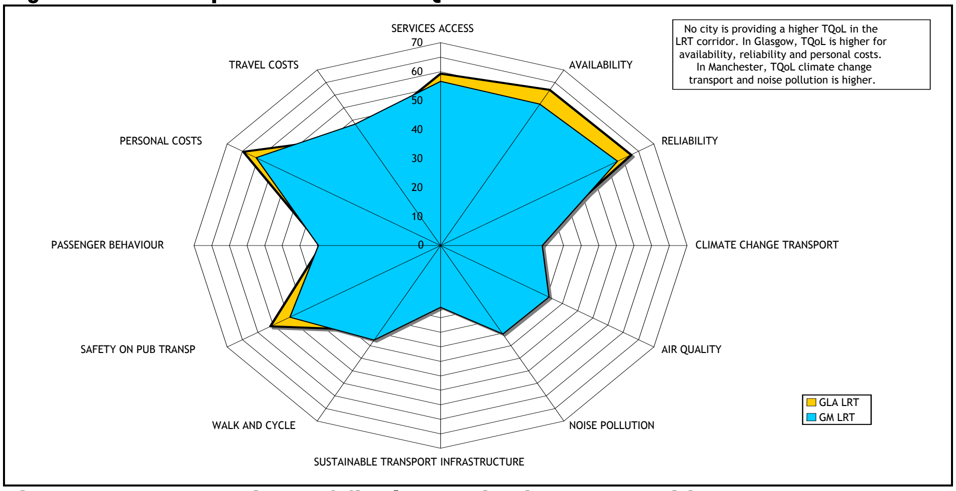

Figure 6.31 Comparison of final TQoL in the LRT corridors

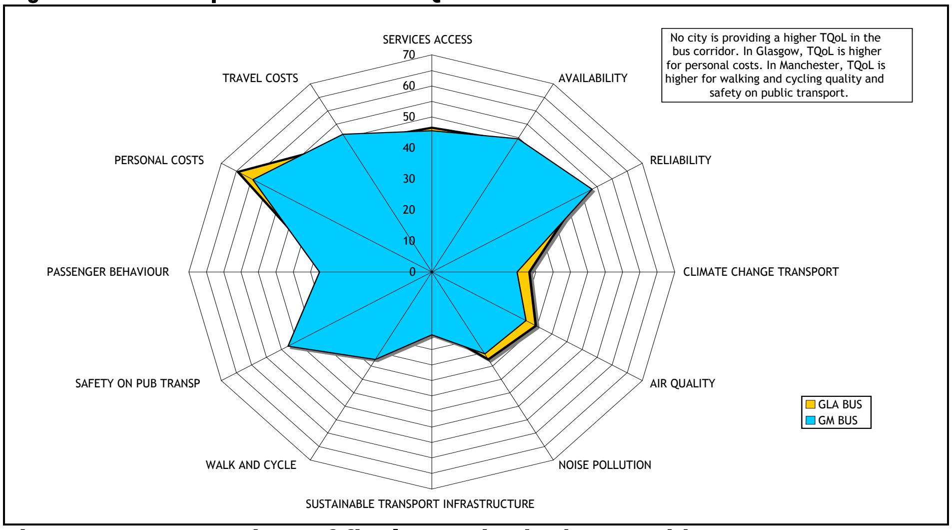

Figure 6.32 Comparison of final TQoL in the bus corridors

Table 6.6 t-Tests comparing TQoL in the modal corridors

t-Tests comparing TQoL in the Train corridors	t-test for Equality of Means t-Stat	Sig. (2-tailed)	t-Tests comparing TQoL in the LRT corridors	t-test for Equality of Means t-Stat	Sig. (2-tailed)	t-Tests comparing TQoL in the Bus corridors	t-test for Equality of Means t-Stat	Sig. (2-tailed)
SERVACC	3.371	**0.001**	SERVACC	-1.880	**0.061**	SERVACC	-0.456	**0.649**
AVAIL	-1.766	**0.079**	AVAIL	-3.573	**0.000**	AVAIL	0.443	**0.658**
RELI	-0.199	**0.843**	RELI	-2.542	**0.012**	RELI	1.628	**0.105**
CLIMCHNG	-3.225	**0.001**	CLIMCHNG	2.076	**0.039**	CLIMCHNG	-1.962	**0.051**
AIRQUAL	-2.822	**0.005**	AIRQUAL	1.987	**0.048**	AIRQUAL	-1.855	**0.065**
NOISEPOLL	-1.123	**0.262**	NOISEPOLL	2.984	**0.003**	NOISEPOLL	-1.072	**0.285**
SUSINFRS	2.463	**0.014**	SUSINFRS	1.488	**0.138**	SUSINFRS	1.737	**0.084**
WALK	1.346	**0.179**	WALK	1.986	**0.048**	WALK	3.349	**0.001**
PUBSAF	-0.554	**0.580**	PUBSAF	-1.263	**0.208**	PUBSAF	3.665	**0.000**
BEHAV	-1.554	**0.121**	BEHAV	0.353	**0.724**	BEHAV	1.175	**0.241**
BUDG	-1.421	**0.157**	BUDG	-4.464	**0.000**	BUDG	-3.847	**0.000**
TRVCOST	1.456	**0.147**	TRVCOST	1.971	**0.050**	TRVCOST	1.139	**0.256**

quality and safety on public transport. Despite these differences the overall journey quality on the bus is very similar in both cities.

In Manchester and Glasgow, TQoL is very similar for the same modes of transport as results present very few significant issues. One city is not providing a better experience compared to another. The purpose of conducting modal comparison is to observe how closely related the modes of transport are across two cities. It is now possible to make cross-city conclusions on TQoL confidently knowing the TQoL levels are very similar. The major conclusion is that fixed modal TQoL is much better compared to Bus TQoL.

6.5 TQoL MODEL DEVELOPMENT CONCLUSIONS

This chapter has presented the final stage on model development. It was a crucial part in the development of the TQoL model. The factor analysis process has made the model more reliable and a better representation of TQoL. It could have been possible to produce the results of journey experiences based on the 27 TQoL indicators, however this would have been inaccurate because not all are necessary to explain TQoL. Literature and qualitative research alone are insufficient to confirm the robustness of the model’s structure. Factor analysis provided a statistical technique that selected a parsimonious final set of indicators that can adequately capture and assess TQoL. The model’s validity has now been tested in three independent ways and with modifications following each stage it has become more robust. As the TQoL conceptual model (Mark III) explains 70% total variance in both cities, it can be confidently stated that appraisal of public transport should be assessed using five factors of journey quality: (i) Access and Availability; (ii) Environment; (iii) Sustainable transport; (iv) Personal safety; and (v) Transport costs.

The TQoL Model Mark III is able to determine the differences in journey quality on the different modes of transport in Glasgow and Manchester. This research has demonstrated that fixed modes are a more desirable mode of transport and provide a better experience in Glasgow and Manchester. Although the outcome of the models were not a key aim of the project it is important to note this conclusion. This may be part of the reason why LRT has been so successful in creating modal shift away from the car (Hass-Klau et al., 2007; Knowles, 1996; Steer Davies Gleave 2005).

This chapter's key contribution – and, more generally, that of the thesis - is the development of this TQoL Model. The results have shown that it is a successful appraisal technique that can evaluate the difference in public transport journey experience. It has also been demonstrated that this Model Mark III has met the performance criteria specified in chapter three, being robust, precise, relevant, displaying a sophisticated level of complexity, yet easy to understand and adding value to the transport appraisal process.

The next phase in the development is to consider its potential impact on policy and practice. This is the task of the next two chapters: the first assesses the merits of the TQoL Model as an appraisal technique; the second assesses the implications for future policy and practice. These two chapters thus present the thesis's overall contribution to knowledge.

Chapter Seven

CONCLUSIONS: TQoL AS AN APPRAISAL TECHNIQUE

7.0 INTRODUCTION

The previous two chapters demonstrated the TQoL model's effectiveness in identifying and assessing the differences in journey experience. Chapter 5 presented the results from the TQoL Model Mark II, while, using factor analysis, chapter 6 developed the Mark III model. This and the next chapter provide the model evaluation stage of model development (**Figure 7.1**). This chapter will discuss the merits of TQoL as an appraisal technique. Chapter 8 will assess the model's implications for current and future policy and practice.

This chapter is organised in four main sections. The first discusses how successful the TQoL model has been to evaluate journey experiences. The second comments on the validation of the TQoL model and the contribution gained through factor analysis. The third interprets the results in the UK transport context. The final section discusses the limitations to the scope of the research. When designing a new technique it is important to reflect upon the success of the process, to consider what could be done to improve the TQoL model and to recognise what this means for the future. These issues are addressed in this and the final chapter.

7.1 SUCCESSFUL TQoL APPRAISAL

This research project aimed to develop a technique that could appraise public transport from the perspective of the quality of passenger experience. The previous two chapters have shown that this can be achieved using QoL techniques. In the social sciences the development of QoL methods are not as advanced as those for health-related QoL (Fayers and Machin, 2007). Furthermore, they have not previously been used in a transport context.

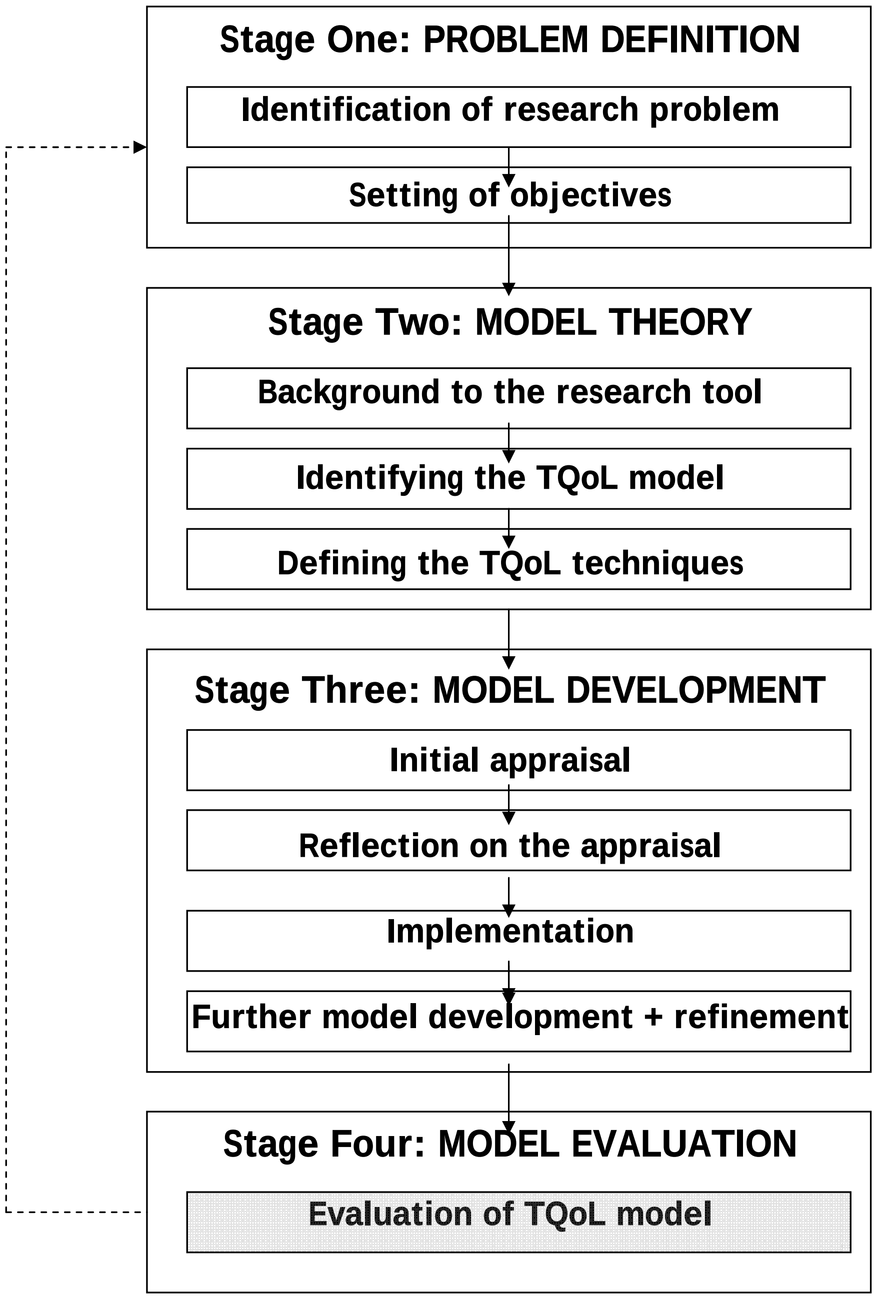

Figure 7.1 TQoL model development in relation to chapter 7

The principles of Rogerson et al.'s research (1987; 1989c) remain relevant in urban studies and, as argued in Chapter 3, their method is suited to the understanding of travel behaviour. It was not clear that Rogerson et al's method would work in this context and the initial appraisal (Chapter 4) showed that changes were needed. These modifications to the methodology enabled more appropriate data to be gathered. Subjective data is more relevant for the transport context than objective data or a combination of objective and subjective data. Despite recommendations from prominent QoL theorists suggesting a combination of objective and subjective data (Beesley and Russwurm, 1989; Diener and Suh, 1997; Pacione, 2003; Randall and Morton, 2003; Rogerson, 1995), passenger experience was the principal method used. The initial appraisal showed that unless the data is recent and to the same scale, the output of the model is irrelevant. The TQoL model was designed to measure passenger experiences and objective data cannot provide enough quality. Even if more reliable at the local level, the use of objective data would still not provide a robust representation of passenger experience. Only the passenger can value their experience and their views are the most important for this methodology. Although this is a different direction from standard QoL research, it is not a disadvantage - there is no other way that you can appraise an individual's experience without asking them about their journey.

This project's contribution to QoL research is that QoL can be analysed in multiple specific locations using new techniques to advance the field in social sciences. Rogerson's method has been improved through the addition of qualitative research, better sampling and survey design, factor analysis and presentation of the results. TQoL varies from QoL because it assesses specific experiences in predetermined spatial settings and these can be compared using t-tests. This varies from general QoL studies and means that future QoL research can be conducted and compared with statistical reliability.

Using an 11-point scale in the household surveys added precision to the result of TQoL. All the values are in the same scale and it allowed respondents to make a more valued assessment of their passenger experience. The standard 5-point Likert scale used by many researchers (including Rogerson et al.) does not provide sufficient variation for the respondent to fully appraise their experience (Cummins, 2003; Cummins and Gullone, 2000). Whilst a continuous TQoL scale would have been most effective, this would have caused problems for the respondent. The problems of using the Likert scale have been well examined in social psychology (Heine et al., 2002; Russell and Bobko, 1992) and Cummins and Gullone's scale enabled a confident measurement of subjective journey experience. The other improvements to Rogerson et al.'s method increased the method's reliability. Using a city-wide weighting survey instead of a nationwide survey made the weighting values more representative of what is important to passengers in that specific city. Introducing spider diagrams, t-tests and factor analysis have all led to improved quality in the TQoL output. The spider diagrams provide readily recognisable (pictorial) differences in QoL for different modal passengers. This approach is new to the field of QoL. Although it does not provide a statistical difference between the modes, it increases the applicability and understanding of the results. The statistical difference is provided by t-tests. Whilst a technique that compares three modes of transport may have been more appropriate, comparing only two samples did present effective understanding of the difference in TQoL between the different modes. Factor analysis strengthened the validity of the model by confirming the structure of the TQoL concept. This was the final stage in refining the TQoL Model (i.e. from Mark II to Mark III) and was important for the project as it changed the underlying conceptual model. This is discussed in more detail in the next section.

Despite the scale giving respondents more variation in their value of TQoL, it must be noted that the model is restricted by what it represents. It is a quantitative research method that evaluates TQoL for a chosen population. As the score from both surveys was consolidated into a single number for each indicator, the validity of this can be questioned. Critics of the TQoL model may argue that QoL cannot be represented by a single score or total and should be described through qualitative studies. While these do provide valuable insights into people's attitudes towards transport (Beirão and Cabral, 2007; Guiver, 2007; Hagman, 2003; Jensen, 1999), they have rarely had significant influence on policy decisions. Despite the UK government incorporating more qualitative research into its policy (DfT 2008b), it still values numbers over words - especially in transport appraisal. The DfT's stated ambition is to extend monetary valuation of transport investment impacts (DfT 2004c). Even when there are aspects that cannot be readily monetised, they must still be quantified (i.e. reduced to numbers). In any transport appraisal, the qualitative data is presented in the appraisal summary table and is recommended to be restricted to only essential information for decision making - in the majority of cases this is to be only on a single page format (DfT 2009). Integration of the TQoL model into NATA is considered in the next chapter.

TQoL appraisal thus corresponds well with current and future policy making as major decisions on transport investment are principally made on calculations of fact and figures. Through a new approach to appraisal it evaluates current travel behaviour. The indicators distinguish how and why TQoL is good or bad for a particular issue on three different modes of transport, which cannot (as yet) be fully appraised by qualitative research, especially not to a level that can be appreciated by practitioners and policy makers.

The TQoL Model is perhaps most effective in appraising public transport rather than merely providing a survey. It evaluates all three modes of transport, which is a new approach to transport research. There are passenger surveys and travel diaries that are conducted by transport operators, local transport authorities and organisations. Examples of this include the Rail Passenger Council annual survey and the DfT's national travel survey and bus and light rail statistics. But currently there is no method that can appraise the quality of journey on all modes of transport in a single model. The advantage of this model is that it is also transferable and is not restricted to towns and cities with more than (or less than) three modes of transport in operation.

PERFORMANCE CRITERIA

This thesis has presented the design development stages for a new transport appraisal technique. The TQoL model was designed to meet specific performance criteria. It needed to be robust; precise; relevant; not over complex, but easily understood; and must ultimately add value to transport appraisal. This thesis has shown that the TQoL Model Mark III can appraise public transport under the following conditions:

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- *Robustness* – Qualitative research and factor analysis strengthened the model development. The qualitative research ensured the indicators selected from the literature were all relevant to passenger TQoL and factor analysis confirmed that the accurate concepts were contributing to TQoL. At the end of chapter 3 it was argued that the model's robustness can only be tested in the initial appraisal and implementation stages. The results presented in chapters 5 and 6 clearly show that the model can describe the differences in journey experience, and thus the model is robust.
- *Precise* - The initial appraisal and the implementation stages of the research showed that combining objective and subjective data in a single model is ineffective for appraising travel behaviour. As discussed previously, subjective data provides a much more reliable and precise assessment of passenger experience.
- *Relevance* – The model development stages of design ensured that each indicator used in the model was relevant to a passenger of public transport. The qualitative research tested the relevance of the indicators on a one-to-one level, while the factor analysis provided statistical confirmation of the TQoL conceptual model's accuracy.
- *Complexity* – The final TQoL Model (Mark III) developed is a transparent and easily understood technique. There are many different aspects involved that affect passenger experience and all are considered in a single (relatively) straightforward model. It was decided to have a parsimonious set of indicators would inhibit interpretation and would stifle effective modal comparison. The factor analysis helped in this process by presenting only those indicators that relate significantly to TQoL.
- *Adding Value* – The final TQoL model provides an alternative transport appraisal technique that can be used in addition to existing methods. It is however not the only technique that should be used in the appraisal process. Transport appraisal needs to be inclusive and holistic, and a TQoL model can add value to CBA and SP by appraising public transport from the passengers' perspective. TQoL should be used in combination with the existing methods.
- *Easily understood* – the final presentation of the TQoL Model outcome was deliberately designed to provide a readily communicable impression of the performance of public transport modes. The spider diagrams illustrate

which modes have higher TQoL, while the t-tests confirm the statistical difference. This is a method that can be easily understood by practitioners and policy makers.

The main objective of this research was to introduce and develop an appraisal technique that can improve the relationship between research and policy and practice. Based on the foregoing research, it is contended that TQoL appraisal methods generally and the TQoL Model developed here specifically can increase relevance, improve interface, strengthen credibility and provide effective dissemination - these are essential if researchers and their methods are to have an impact on public policy, the planning process and transport operators (Ben-Akiva and Bonsall, 2004):

I. *Increase relevance* – this is achieved by contributing to one of the most important issues of transportation research. Current travel behaviour and passenger experience are very important for the understanding of transport systems and urban development. As Jones (2009) has argued, appraisal under the attitude-based paradigm is underdeveloped, TQoL appraisal can lead to more research in this field, which is vital for the future transport research.
II. *Improving the interface* – the TQoL model has be designed to make the appraisal process more transparent so that practitioners and policy makers can become involved in the process and understand how and what the results show.
III. *Strengthening credibility* – the TQoL models and the appraisal process has been deliberately designed to be attractive and understandable for decision makers, practitioners and transport operators. This is to improve the interface between all parties and make the appraisal process a lot more logical. In this way the TQoL model can strengthen the credibility of transport appraisal by evaluating passenger experience.
IV. *Effective dissemination* – The spider diagrams provide a clear message of which mode is providing the best experience and why. This is essential so that the results can be communicated to practitioners and operators in non-technical language. Integration between the researcher, policy maker and operator can become easier if the results and the process is clearly

understood.

7.2 VALIDATION OF THE TQoL MODEL

The model development stage helped to validate the TQoL Model's conceptual basis by identifying those factors contributing most to passenger experience. The TQoL Model Mark II did not report good reliability and thus a new model (Mark III) was developed. Factor analysis is commonly used in health-related QoL to reaffirm the relationships between the variables and ensure that all the issues actually contribute to QoL. It has not been widely adopted in social sciences QoL, so introducing the technique into this project is a new direction for the study of QoL in urban studies.

The TQoL Model's main objective was to consider all indicators together as an alternative to a single dependent variable. Passenger experience cannot be simplified into a single score and nor should it be aggregated as this would conceal or remove the nuances (and thus value) in the data. The loss of information would diminish the quality of data gathered. Factor analysis treats each of the indicators as dependent variables and analyses whether the factors and indicators are appropriate to measure TQoL.

Factor analysis added a new dimension to the redefinition of the TQoL model. Its contribution was to understand whether the original indicators effectively measured TQoL. If factor analysis had not been applied then the initial results (Chapter 5) would have been the final product of the research project. The initial factor analysis found that not all of the factors were important in explaining TQoL. The reason for not excluding the results in chapter 5 is that the weighting surveys found all indicators to be important to individual TQoL. This approach, however, does not consider how, in practice, the indicators function in combination to describe one concept. Factor analysis was the most appropriate technique to be used because it is an interdependence technique. No single dependent variable can be analysed against all of the variables and each indicator needs to be measured.

The analysis found that the initial 27 TQoL indicators were not all relating together in the TQoL Model Mark II and that only the environmental factor had good reliability. Factor analysis produced a new conceptual model based on five factors – (I) access and availability; (II) sustainable transport; (III) environment; (IV) personal safety; and (V) transport costs. This structure was found in both Manchester and Glasgow and accounted for 72.3% and 69.8% total variance respectively. These are good results because both levels are above the recommended level of 60% for social research. Although thirty per cent of TQoL remains unexplained, it is almost impossible to obtain explanations approaching 100% total variance in factor analysis. This is especially true for TQoL when so many different contextual factors affect passenger experience.

The outcome of the factor analysis is that not all information found in the theoretical literature can be adopted in active research. Whilst TQoL indicators were selected from sustainable transport indicator literature because of the close relationship to QoL and project limitations, this could have affected the outcome of the model. Having too many indicators in a single factor is not practicable in the context of TQoL. While it may have worked for Rogerson et al, so many issues cannot be included in only four factors - economic, social, or environmental TQoL. There are too many different aspects within social transport and economic transport that cannot be broadly measured in a single concept. Two or three indicators for each factor is more appropriate and, as the factor analysis shows, only the five factors need to be used in measuring journey quality (i.e. TQoL).

A current focus of transport appraisal is on the costs and benefits of new transport infrastructure or, rather, on how much people are willing to pay for an improvement to service. This is inappropriate for two reasons - not all aspects of public transport can be monetised and travel costs are not only the important issue in travel decisions. The economic benefit is important but it is not the only factor that needs to be evaluated. It is also not possible to make an accurate assessment of public transport based purely on financial grounds. Furthermore many TQoL issues cannot be monetised. And while transport cost is a significant aspect of evaluating public transport, it needs to be considered with other issues, such as accessibility or safety – Nb although it may be done for roads and rail to do so for this evaluation would be incorrect. A passenger could not put an accurate price on the cost of safety as it varies from person to person and there is a problem with definition of safety so to group it into one price does not provide an accurate assessment for TQoL. Also the cost to travel is very important to some people, but to others it is not. In the TQoL Model Mark III the transport costs factor contributed the smallest amount of variance and, indeed, was almost excluded for having an eigenvalue of less than 1 in Glasgow.

The advantage of using factor analysis is that it greatly increases the validity of the TQoL conceptual model. It helped to refine the methodology by showing which components contribute to TQoL. Without this, the model would have lacked reliability for the analysis of the results. Critics of the approach may feel that there is a loss of information as each indicator was found to be important from the weighting survey. For this reason chapter 5 presents the results from the appraisal using TQoL Model Mark II. As the concept is new it is necessary to use appropriate redefinition techniques. Factor analysis contributes extra rigour to the TQoL Model that was not present in the initial conceptual model.

Confidence in the TQoL Model Mark III is enhanced by finding the same factor structure in both cities. If the factor analysis on the Manchester data had found a different structure to that in Glasgow, then it would not be possible to draw conclusions on how to measure TQoL. High total variance and good reliability in the structures mean it is possible to confidently interpret a major difference in experience for fixed and flexible modal public transport passengers.

7.3 INTERPRETING THE RESULTS

The successful implementation of the TQoL Model allows for key observations of journey quality for passengers of different modes. The TQoL method's strength is that it clearly shows how and where the modes provide significantly better QoL. The spider diagrams are a valuable addition to the methodology as they present an immediate, pictorial representation of the differences in TQoL. T-tests then confirm the differences by reporting the statistical difference between two modes of transport. The headline findings are the same for both cities - *fixed modes provide superior journey experience in Manchester and Glasgow*. Although there were a number of indicators with no significant difference, Bus TQoL was not higher for any indicator compared to Train TQoL or LRT TQoL.

The findings for each city can be summarised as follows:

For Glasgow - comparison of LRT TQoL and Bus TQoL found significant differences for all the indicators in the access and availability factor, both indicators of personal safety and for walking and cycling quality in the sustainable transport factor. In the comparison of Train TQoL and Bus TQoL there are significant differences on all access and availability indicators, air quality, walking and cycling quality and safety on public transport. For the fixed modal comparison there are significant differences on two access and availability indicators, air quality and safety on public transport. LRT provides a better experience for all these indicators except air quality. These results show that in Glasgow LRT provides the superior TQoL. This mode has better access, reliability, availability and safety. The main conclusion is a significant difference on the factor with the most variance - access and availability. This is the factor that is most valuable to the concept of TQoL. When the results are compared to the weighting scores the indicators with significant differences are more important for the fixed modal TQoL comparison to Bus TQoL. In the comparison between the two fixed modes the distribution of significant indicators is not as important.

For Manchester - LRT TQoL is significantly different to Bus TQoL for all indicators of the access and availability and environment factors, and walking and cycling quality. In the Train TQoL and Bus TQoL comparison, the train is also significantly different on all access and availability indicators and the personal costs indictor. For the comparison of the fixed modes, LRT TQoL is higher for climate change, noise pollution and the behaviour of other passengers. This is the clearest indication of no difference between two modes of transport. In general, the fixed modes of transport provide an improved travel experience compared to the bus.

The results from both cities are very similar. This is partly to be expected as they were chosen for their similar transport characteristics, but, equally, it does not mean that the TQoL provided by the public transport modes will be the same. In both cases fixed modal TQoL is significantly higher than Bus TQoL.

It is also important to comment on the indicators containing no significant difference. For the majority of TQoL comparisons in Glasgow and Manchester there were no differences for the environment and transport costs. Although Glasgow Train TQoL is significantly higher for air quality against both modes there was no differences for all other environment indicators. In Manchester, LRT TQoL is higher for environmental quality than for Bus TQoL and Train TQoL, and the weekly budget on transport is less for Train TQoL than for Bus TQoL. Overall, there is very little difference in these two factors - the most important is transport costs. It is widely accepted that the cost to travel by bus is less than for train and LRT. In Manchester, an average peak time fare on LRT is more expensive than the bus by £3.59 and the train is more expensive that the bus by £3.94. An average off-peak journey is also more expensive by £2.29 on LRT and £1.94 on the train (AGMA, 2007). The results from this project showed no major difference for the different modes. This contrasts with a previous study that found higher LRT fares does not affect modal shift from the bus (Knowles, 1996). Although travel costs are an important point of the journey experience, the TQoL difference is minimal.

TQoL was also appraised by a number of characteristics to explore the strength of the model and to present differences in journey experience by gender, age and car use. Whilst there was very little difference was found for gender and age groups in both cities, there was a distinct difference between fixed modal TQoL and Bus TQoL for car availability and the desire to travel more by car. In Glasgow, there were no significant differences for car availability for fixed modal TQoL and only three indicators of significant difference for Bus TQoL - two of which had a higher score for passengers without car availability. For car availability in Manchester, there were two indicators of significant difference for Train TQoL and only one for both LRT TQoL and bus TQoL. There was a greater difference for passengers wanting to travel more by car. In Glasgow, there is no significant difference for Train TQoL and only one significant indicator for LRT TQoL. For Bus TQoL, there are seven significant indicators - on all but one of these indicators there is a higher score for passengers not wanting to travel more by car. In Manchester the relationship between poor TQoL and increased car use is not as clear. On all modes there are higher significant indicators for passengers not wanting to travel more by car. This means that while there is a relationship with poor TQoL and passengers wanting to travel more by car in Glasgow, a lower TQoL score (bus passengers) does not necessarily mean people will want to travel more by car in Manchester. This may be due to the prevailing conditions for car drivers in Manchester, as peak traffic speeds have fallen by 17.7% between 1999/00 and 2006 (DfT 2007b). Increasing congestion problems in Greater Manchester were due to be addressed by a congestion charge until the recent public referendum rejection – this is discussed further in chapter 8.

The TQoL models do not reveal any major new conclusions on the state of public transport in Glasgow and Manchester. It is widely accepted that LRT provides an enhanced journey quality compared to the bus (Hass-Klau et al., 2007; National Audit Office 2004; PTEG 2005). The main contribution is that the TQoL appraisal can compare public transport modes and reveal why LRT and train provide a superior TQoL compared to bus. Research on the impact of LRT in Manchester has shown a modal shift to Metrolink from the bus and cars (Knowles, 1996; Senior, 2009; Senior, 1999). The benefit of this thesis is that it is to explain why people travel more by LRT and train compared to the bus. This is how the method differs from a survey approach. Many studies are able to establish how many people are travelling by a particular mode and to determine whether there is a shift in modal choice, but are unable to find out why. The TQoL model appraises the differences in public transport modes to show why particular modes are more attractive. In Glasgow and Manchester fixed modes provide a significantly higher TQoL for access and availability, personal safety and aspects of environmental quality and sustainable transport. Passengers are willing to shift to these modes because they provide an enhanced QoL.

Although LRT TQoL is highest in both cities, this does not, ip so facto, mean that all future investment in transport should be made in LRT. While it may be considered an ideal solution, the high financial costs of light-rail presents difficulties, especially in the current economic climate. There are, nonetheless, opportunities to use TQoL appraisal methods to improve current modes of transport - these are discussed in the next chapter. Many towns and cities are looking at bus-rapid transport (BRT) as an alternative to LRT and the next chapter will consider how the results of TQoL appraisal can lead to an improved BRT service.

7.4 LIMITATIONS TO THE SCOPE OF RESEARCH

This research project has developed a new method that can be implemented to appraise public transport. Despite this, there are issues that need to be considered in recommending the methodology for future transport projects. Three limitations of the technique and project are highlighted here.

The first is to recognise that the research project was limited in its capability to examine TQoL. Only a small sample was used in both cities to evaluate journey experiences. A larger data set would bring two major benefits. The first is improved robustness of the model development stage. Larger samples in the transport corridors would enable successful factor analysis at the local level instead of using the city-wide data. The advantage of this approach would confirm whether the factor structure was found in different areas of the city rather than the whole city. It is expected that the same factors would have been found considering they were observed in both Glasgow and Manchester, however having that extra dimension of quality would further validate the TQoL model. The second benefit of a larger data set is greater reliability in the results. If a larger sample revealed the same results, this would gain more respect in the field because it would reaffirm the conclusion that fixed modes of transport provide a superior experience to the bus. Whilst the output from the models was not a key objective of the project, it is an issue that should be considered in future research projects applying the TQoL methodology.

In respect to the limited capabilities point, it is important to note that this project developed the model by appraising only public transport and did not assess TQoL in other locations or for other modes. While it focused on appraising three public transport modes to develop the model, it could also have been used to evaluate the experience of other public and private modes. While the assessment of car TQoL compared to public transport modes would have been valuable, this was not the research aim. The objective was to develop a method that can appraise the differences in current travel behaviour. The output of the models was never an important part of the projects findings. The results have been presented and discussed only because the design project has been successful.

The second limitation relates to the origin of the TQoL indicators. In reflection it is clear that using qualitative research for the selection of TQoL indicators would be a more reliable source. As discussed previously in chapters three and four, due to financial and timing restrictions, this was not possible within the research capabilities. Sustainable transport indicator literature was used to select the indicators and considering the findings from the factor analysis this could have damaged the concept of TQoL. Despite this, all of the indicators were important following the city-wide surveys and the small qualitative research phase. The important issue to raise is the model would be strengthened if more time and money had permitted a larger qualitative research project. Factor analysis did help validate the TQoL model so this reduced concern regarding the final conceptualisation. In future TQoL research the project should begin with a large-scale qualitative stage to identify factors that should be used to appraise journey quality. This would enhance the validity of the survey instrument and the concept of TQoL.

There are a number of survey design issues that could have been improved. The sample size selection process should have followed the original plan of selecting the percentage of public transport passengers. In the modifications to the technique a uniform approach was adopted whereby a standard number of surveys were sent out to each corridor. This was to make sure a similar number of questionnaires were returned from each corridor. While this did help in comparative terms, more representative samples of the public transport passengers would make the results more reliable. This adds to the point that a larger sample would increase the validity of the TQoL models. To improve the response rates from the surveys implementing all phases of Dillman's TDM design would have also increased the reliability of the results. Although the rates received from both questionnaires are still relatively respectable they could have been higher if there was a larger financial budget.

The third limitation relates to the model design and to some of the TQoL indicators. A number of the indicator names should have been changed so they are more clearly understood. These indicators include the infrastructure investment indicators, climate change transport, journey time differential and greenspace. These indicators cannot be changed because this is how they were presented to the respondents in the surveys and the qualitative research. In addition to this, on reflection the public transport quality indicator should not have been included in the model. In the survey, passengers were asked to rate their overall experience of public transport quality. This issue is too general and it lacks the specific nature of TQoL that is supplied by all the other indicators. As this was included in the surveys it could not be removed from the analysis. The factor analysis did not, however, highlight this as significant and so it did not affect the TQoL Model Mark III.

There are also some issues with the household survey instrument that on reflection could have been improved to enhance the quality of the data. The most effective way could have been to improve many of the terms so that the respondents could grasp exactly what the question was asking. This is clearly seen in question 25 of the assessment survey. The question is how does congestion affect your journey? This is the same question for all the three modes and it is left to the respondent to answer on how it affects there journey, whether it be traffic on the roads, crowding on a train or congestion reaching a stop. These are potentially different issues for some passengers and a clearer definition is required. It was left to the respondent to infer their answer rather than impose a researcher bias on the question, however on reflection a more detailed question is required for the different modes including a separate question on crowding. This is perhaps why congestion was found to be insignificant in the factor analysis. It is clearly an issue that cannot be explained by one component, and inclusion of different meanings of congestion – i.e. crowding on trains, traffic on the roads would have been more beneficial. The same issue may have affected travel time, which was not relevant in the factor analysis. In regard to question 4 on the access of transport services for mobility impaired passengers it would have been more effective if separate analysis was conducted for disabled passengers. This is because respondents only present their own perspective or just assume the difficulties that these passengers could face without knowing exactly how they feel about access. Travel diaries or a separate survey for passengers who are mobility impaired would have been more effective. The final issue is how relevant some of questions are to TQoL. This includes question 17 (walking and cycling quality) and question 24 (greenspace). As explained in chapter 3, these are more indirect issues of TQoL and were included as they are part of Litman's sustainable transport indicators. They are also relevant because the quality of the walking and cycling infrastructure can impact the likelihood of selecting to travel by public transport and how it can overall impact TQoL. If the infrastructure is better people may choose to travel by bus, train or LRT because walking can become a pleasant part of the journey. The significance of this point however would need to be examined further with qualitative research. Greenspace is important because if roads surround the local area it can impact negatively on their QoL, however if the area is surrounded by parkland and the journey experience is more pleasant their level of TQoL will be higher. Despite this both these indicators were found to be insignificant in the factor analysis. Overall more clarity in the questionnaire could have led to an improvement in the data and allowed the respondent to reflect their TQoL more effectively. Factor analysis did improve the quality of the data through determining the relationships of the indicators however it is through improving the questionnaire in the design stage that could have been most valuable.

Despite these limitations the TQoL model is an effective technique that will help to improve transport appraisal. The ability to examine public transport from the passengers experience adds validity to the existing appraisal techniques. It will help policy makers, transport operators and practitioners in the decision making process to improve existing transport systems.

7.5 CONCLUSION

This chapter is the final stage of the design process. It has evaluated the successful use of the TQoL assessment; explained how the contribution of factor analysis helped in the model development process; discussed what the results reveal about public transport in Glasgow and Manchester; and discussed the limitations of the method and how it could have been improved. Although it forms the final part in the model development process presented in this thesis, it should not be regarded as the end point of the design process. Further improvements can be made and any appraisal technique should be continuously re-evaluated. Following this research it would be beneficial to return to the start of the design process in order to further refine and develop TQoL techniques. The dotted arrow returns to the beginning of the chart so that all the stages can be re-evaluated (Figure 7.1).

The research presented here has shown that the model developed can appraise individual TQoL for different modes of transport. The next chapter assesses the implications of the TQoL model for future policy and practice. It discusses the benefits of the model as an alternative/supplementary appraisal technique and examines how it can be used in the future to shape short and long-term policy. The chapter forms the final step in the model development process and, inter alia, demonstrates how TQoL can become a vital part of the transport appraisal process.

Chapter Eight

IMPLICATIONS FOR POLICY AND PRACTICE

8.0 INTRODUCTION

This thesis has developed a transport appraisal technique for use as an alternative - or supplement – to existing appraisal methods. The research presented has demonstrated how a Transport Quality of Life (TQoL) model can appraise passenger travel experience for different public transport modes. The initial TQoL Model (Mark I) was progressively modified through the research to become a more developed and streamlined tool (Mark III). Accordingly this final chapter examines the research project's potential impact on policy and practice. This is the final step in the model development - a reflection on its potential contribution to the design of new transport policies and to the appraisal of existing (public) transport systems. It is contended that the TQoL Model Mark III can provide much needed information on transport passenger experience, and is thus a valid and useful technique to aid transport policy and decision-making. Accordingly, the main purpose of this chapter is to present the capabilities of the TQoL model as an alternative or supplementary transport appraisal technique. It is organised in two main sections. The first highlights how it can contribute to the debate on transport appraisal. The second illustrates how the technique can be used in future appraisals, with an example used in the case of Manchester's transport future. The chapter concludes with an agenda for further research.

8.1 TQoL AND TRANSPORT APPRAISAL

This research project has demonstrated the use of TQoL to identify and evaluate differences in passenger experience on public transport. It values the experience on different modes to highlight which provides the superior QoL and which aspects of provision could be improved to enhance TQoL. It offers a different form of appraisal to that which currently operates.

Transport appraisal in the UK presently focuses on assessing costs and benefits in financial terms (HM Treasury 2003). This 'monetisation' however, fails to cover all aspects of public transport, particularly passenger journey quality (Eddington, 2006a). Under the government's New Approach to Transport Appraisal (NATA), other techniques are specified to value aspects that cannot be monetised (DfT 2007c). The DfT's revision of NATA's techniques following the Eddington Study and Stern Review have improved the focus of NATA to meet DfT's objective but still do not value how the passenger encounters their mode of transport and how public transport can affect or enhance journey quality. An approximate valuation is placed on the non-monetised impacts, which include quality of life. Although stated preference (SP) modelling has advanced significantly in recent years and has contributed greatly to transport research it still evaluates the alternative without taking full account of the present experience. It is contended here that it is essential to evaluate the present experience before we learn about how people want to travel. SP illustrates how people would like to travel if certain conditions exist. In this method it is not possible to compare journey experiences on different modes to highlight the success of a transport mode. Furthermore, the method should not be used to appraise current travel behaviour due to inconsistencies found between hypothesised and actual behaviour. Despite this, the value of the technique still remains and it should be used alongside the TQoL assessment, or as the follow-up to the TQoL model, to estimate how much, for example, people are prepared to pay for improvements in TQoL. SP can thereby appraise monetary differences in journey quality.

The TQoL Model overcomes the problem of evaluating travel behaviour that has been discussed by transport researchers for many years (Goodwin et al., 1990). The reliability issues that are raised with SP and the theory of planned behaviour are addressed in the model, with travel behaviour evaluated using quality of life techniques. This provides an accurate description of experience from the passenger's actual behaviour. It is how they encounter the mode and what QoL provides rather than their (possible) intended behaviour. Through this the TQoL model can contribute to transport appraisal in four main ways:

First, the TQoL Model can improve the quality of CBA and SP by evaluating transport from the passenger's viewpoint. The technique is an alternative form of appraisal and if allied with CBA it can make the appraisal process more holistic and inclusive. Each element of an appraisal should not be considered in isolation because they each need to be evaluated to improve the quality of policy and investment decisions. When financial assessments are made through CBA, TQoL is evaluated on transport experience and SP models measure preferred choice, the process is much more legitimate. The policy maker and practitioner can then make better informed decisions on how to invest money to improve transport quality. This appraisal system becomes a co-ordinated planning and decision-making process that can evaluate both the objective and subjective benefits of public or private transport.

Second, TQoL accords with the recent change of thinking in UK policy. The last decade has seen a shift in how policy is addressed, with a gradual move away from reliance on 'hard' quantitative and economic (and supposedly objective) models to the inclusion of 'soft', qualitative (and thus more subjective) assessments. This is seen in changes to departmental guidelines and objectives (Cabinet Office 2008; Department for Environment Food & Rural Affairs 2008; Department of Health 2008). Health is a policy field where this shift is particularly evident, with an increasing focus on life-quality rather than life-expectancy. A similar shift is apparent in transport. The DfT recently funded research on the influence of soft factor interventions on travel demand. This was following growing interest in 'soft' transport policy measures that seek to give better information and opportunities, aimed at helping people to choose to reduce their car use by enhancing the attractiveness of alternatives (Cairns et al., 2004). Soft measures include:

- Workplace and school travel plans (Dickinson et al., 2003; Roby, 2009; Rye, 2002);
- Personalised travel planning, travel awareness campaigns, and public transport information and marketing (Dziekan and Kottenhoff, 2007;

Eriksson et al., 2006; Grotenhuis et al., 2007);

- Car clubs and car sharing schemes (Enoch and Taylor, 2006; Prettenthaler and Steininger, 1999; Shaheen et al., 1998); and
- Teleworking, teleconferencing and home shopping (Cairns, 1998; Hjorthol and Gripsrud, 2009; Hjorthol, 2002; Lyons, 2002).

The main conclusion from Cairns et al's (2004) report was that: 'provided they are implemented within a supportive policy context, soft measures can be sufficiently effective in facilitating choices to reduce car use, and offer sufficiently good value for money, that they merit serious consideration for an expanded role in local and national transport strategy'. Given that transport policy makers have indicated greater willingness to investigate alternative policy solutions, the TQoL Model accords with this change - it is a 'softer' appraisal technique evaluating the subjective passenger experience.

Third, TQoL has strong synergies with the government's Quality Partnership Scheme (QPS). Introduced by the Transport Act 2000 to help improve the quality of bus services (DfT 2008a), under the QPS a local transport authority (LTA) agrees to invest in improved facilities at specific locations along bus routes and operators who wish to use those facilities undertake to provide services to a particular standard. TQoL can help in this assessment by measuring the service from the passengers' experience. LTA's will still be able to set targets but the process would become more integrated by measuring TQoL in addition to simple quantitative measures. Authorities and operators will then be able to evaluate their service from the passengers' viewpoint. The advantage of using the TQoL model in the QPS is that it does not need to be restricted to bus services and could be used to improve fixed modal public transport service. Regular assessment can then help to monitor the service to ensure good journey quality and satisfied passengers.

Fourth, TQoL can contribute to the government's long-term transport strategy. One of the five objectives of the strategy was "Improving quality of life for transport users and non-transport users, including through a healthy natural environment, with the desired outcome of improved well-being for all" (DfT 2007d). The TQoL Model can help DfT meet this objective by enhancing the appraisal process and increasing understanding of individual QoL – as noted in Chapter one, research commissioned by DfT identified difficulty in collating evidence on the subject (DfT 2008b; Lyons et al., 2008). It could thereby enable better decision-making by planners, practitioners and transport operators, which, in turn, would deliver enhanced QoL.

INTEGRATION WITH NATA

With these contributions to transport appraisal it is necessary to explain how the TQoL model can integrate into the UK's existing transport appraisal procedures. As identified in chapter 3, there are some issues with the NATA process due to the 'adjusted BCR' placed on non-monetised impacts. Adjusted values are calculated for travel experience and journey ambience that are designed to represent quality of life. This process does need improvement for the impacts to be fully understood in the appraisal.

In DfT's refresh of NATA it was made clear that they will be looking to improve the value for money process to understand those impacts where little evidence exists (DfT 2009). The TQoL model can contribute to this understanding by delivering a new form of appraisal that can help the appraisal process. TQoL appraisal can provide a robust evaluation for the quality of life objective. This represents a large part of the AST with many of these impacts non-monetised. The TQoL evaluation could provide an alternative valuation technique to show how the new transport proposal could benefit passengers versus an alternative mode. Following this assessment the valuation could be approximated or a SP assessment could determine how much people are willing to pay for the improvement in their quality of life.

Many of the impacts that are unable to be valued will remain undervalued because they are issues that cannot be given an economic benefit or cost. It is the author's belief that economic valuation should not be placed on all impacts, particularly those affecting journey experience, because they can only be evaluated by the passenger. When they travel by their mode of transport they do not consider only one aspect to be important. As this thesis has shown, there are multiple factors that need to be assessed many of which cannot be evaluated in economic cost.

Therefore whilst it is recognised that the TQoL model can be integrated in the NATA process to provide valuations of non-monetised impacts, careful consideration is needed. The most appropriate way to apply the TQoL model is to appraise journey experience on its own and use the assessment alongside NATA. Journey quality is a major part of any new transport development and evaluation needs to be conducted to highlight the benefits of a new development for the passengers. The following section will describe in detail how best to use the TQoL model.

8.2 FUTURE USE OF THE TQoL MODEL

This section discusses how the TQoL appraisal methods generally and, more specifically, the TQoL Model developed within this thesis can be applied in different contexts. The model is of potential value to two main groups involved in future transport appraisal – (I) transport operators and (II) policy makers and practitioners. A practical example is used to illustrate how the TQoL model could have contributed to the future of transport in Manchester.

(I) Benefits to transport operators

Transport operators can make use of TQoL to better understand the experience of their passengers. Given the imperative for companies to improve their service to retain and increase patronage, the TQoL Model can evaluate QoL on multiple routes to identify those areas providing a superior TQoL. It would also show how the service can be improved to enhance TQoL.

To improve the quality of the service - in other terms, TQoL - in the north of Glasgow, the service provider (First) would need to improve the level of safety on board, increase availability, provide a more reliable service and improve the emissions from its vehicles. To improve the service it would be productive to also conduct a comparative assessment of TQoL. If TQoL on the bus is compared to other modes of transport, First could determine how to improve the service to match that of the fixed modes. Appraisal in Glasgow shows that, if First improved access and availability and safety, bus TQoL would be similar to LRT or the train. Practical improvements could be increasing more reliable services on that route. Since the TQoL assessment, Real Time Passenger Information (RTPI) has been introduced in an attempt to increase information and reliability of services. It would be therefore interesting to conduct another appraisal following the introduction of RTPI to assess whether there is a change in passenger's perception of reliability. Safety could be improved in the corridor through installing cameras on board, as introduced on Lothian buses in Edinburgh. Stronger enforcement of the smoking ban on buses would also be beneficial. The presence of the driver on board a bus does not make the passenger feel personally safer. Results in Glasgow and Manchester showed a significant difference in safety on the bus compared to fixed modes, and using monitors or conductors on buses may enhance personal safety. While this may not be new information for the operators, the TQoL Model provides a means of monitoring performance and may, ultimately, lead to enhanced TQoL.

The TQoL Model could also be adopted by transport operators to improve the journey quality of their services in various ways. It is not only of benefit for poorly performing modes. LRT and train operators could use the technique to increase the level of TQoL relative to bus TQoL. This could lead to increased numbers of passengers switching from bus to fixed modes and also to modal shift away from the car. A useful assessment for operators, particularly fixed modal operators, is to compare TQoL for their passengers with that of car drivers. The differences in TQoL would highlight why car passengers choose to travel by car. The operators can then address the areas where the car provides significantly enhanced journey experience. While the operator may never be able to provide service levels equivalent to those of personal private transport, it could lead to a long-term strategy to increase patronage by encouraging a modal shift. Annual assessments should then be conducted to monitor the level of performance, which can link into how best to invest in the service.

(II) Benefits to policy makers and practitioners

The second set of potential benefits is to policy makers and practitioners. Given it is commonly accepted, both in practice and theory, that we cannot 'build our way out of congestion', the aim of future transport policy should be to improve the quality of the journey - as opposed to facilitating, counterproductively, an increase in the quantity of travel (Metz, 2005). Metz argues that the objective of transport policy should be to develop powerful travel information systems and employ a discriminatory road-pricing scheme. Whilst these are influential policy directions, under the current economic and political climate, it seems unlikely that these can be implemented. The financial cost of a new travel system – which, inter alia, requires cooperation with car manufacturers – appears unrealistic when there is a record decline in production caused by people not buying new cars (Morris, 2009). Given its overwhelming rejection in Manchester, the future of road pricing in the UK is at best uncertain (Woodman, 2008). Despite continuing political interest in road pricing (Millward, 2008), it is unlikely that a national scheme will be introduced that will have a serious effect on journey quality.

Future transport policy should be based on increasing the journey quality for *every* individual. As transport is an essential component of everyday life, it is important to find out more about the quality of passenger experience so that policy can be better directed to improve QoL. These points emphasise how the TQoL Model can help policy makers:

- by understanding the differences in the journey experiences provided by public transport modes.
- by highlighting the difference in QoL for public transport users and car drivers.
- by showing which mode is performing best and highlight which are underperforming and in need of improvement.
- by showing how the passenger experience can be enhanced.

Many suggestions about how to improve policy making better have been presented (Bullock et al., 2001; Cabinet Office 1999). In transport, TQoL appraisal can assist policy decisions to become more inclusive of governmental and departmental objectives and central to the needs of the people who use transport. DfT’s fourth objective in its transport strategy is to improve quality of life for transport users and non-transport users, and to promote a healthy natural environment (DfT 2007d). If there is no method that can evaluate QoL successfully, it is difficult to comprehend how can this be achieved in practice. The TQoL model provides a successful technique for meeting this objective. Policy makers can assess TQoL in many different locations in the UK to determine the experience provided by each mode of transport. The appropriate policy can then be introduced to improve the areas where modes of transport are not providing good TQoL. This can be through direct investment or partnership with transport operators. Although they may appear to have different objectives private operators and policy makers ultimately want the same outcome - increased use of the service and enhanced journey quality.

Using the TQoL appraisal results for Glasgow, policy makers can observe that environmental quality and transport costs are similar for all modes. To enhance journey experience improvement is needed to services access, availability, reliability, walking and cycling quality and personal safety. Direct intervention through transport policy can involve investment in better sustainable transport infrastructure and stronger partnership schemes with operators.

The government could also use TQoL appraisal to develop short-term policy on transport services. For bus services, appraisal of current services can lead to a more coherent short-term bus policy that inter alia would also address current problems of service quality. As this is the most commonly used mode of public transport and the period of economic difficulty, action here would improve public transport for the majority of UK citizens.

TQoL appraisal can also be valuable in constructing long-term policy on future transport investment. The outcome of the model clearly highlights differences in QoL arising from different modes of transport. Although these values should not be considered in isolation, they do provide grounds for increased investment on fixed modes rather than bus. The government is currently investigating the possibilities of a High-Speed Rail (HSR) network (Wright, 2009) – and proposes that the schemes be appraised using CBA and SP techniques. It would be beneficial to evaluate the QoL provided by this mode. International comparisons could also be conducted to compare TQoL for HSR vis-a-vis air travel or the car. In Spain, for example, introducing HSR led to a 20% reduction in domestic flights and an increase of 28% in HSR passengers (Tremlett, 2009). It is important to learn why this occurred and how passenger TQoL can be improved by investment. If the results show that QoL is significantly better than air-travel TQoL or car TQoL, then it provides a more robust argument for introducing HSR in the UK.

In addition to long-term rail policy, TQoL appraisal could also help long-term public transport investment policy. TQoL appraisal can be conducted in major cities to determine the variation between different modes. If one mode is consistently providing a better QoL compared to others, it thus provides a stronger case for further investment in that mode. Although this is especially true for LRT, it still seems unlikely that any further light rail lines will be built in England outside London unless new funding sources are secured to wholly or partly replace Government capital grants (Knowles, 2007). The government has stated that it will only finance future LRT schemes if they are considered together as a package of measures to improve the overall transport network. As is examined in the next section, this provides some difficulty as road pricing remains part of the package of measures. Lack of investment is not the only reason for it being unlikely that there will be future LRT systems. The financial cost for new LRT schemes is substantially higher than other alternatives. Under the current economic climate it is very unlikely that any new developments will go ahead - despite this research showing that LRT provides significantly better TQoL.

As an alternative to LRT, many areas are turning to Bus Rapid Transit (BRT) to improve public transport quality (Currie, 2006; Hensher, 2007; Levinson et al., 2002; Wright and Hook, 2007; Rodríguez and Mojica, 2009). BRT can operate in a wide range of environments without forcing transfers or incurring high running costs. Through this flexibility, BRT can provide high-quality transit performance over a geographic range beyond that of dedicated guideways (Levinson et al., 2002). BRT has much of the appeal of LRT but the flexibility of a bus. Currie (2006) has shown that BRT has become a viable alternative to rail in Australasia, and in some cases a more attractive mode choice. The schemes in the UK are growing and TQoL appraisal can become a valuable part in the development. Assessment of BRT TQoL compared to other modes would highlight how the modes enhance QoL and indicate ways in which they can be improved. If the aim is to make the journey quality comparable to LRT then it is possible identify the ways in which the service can be improved. The results of subsequent TQoL appraisal can then contribute to the future direction of transport policy. It could, for example, confirm that BRT is a cost-effective alternative to LRT and thus should be the focus of the long-term transport strategy. Alternatively, it might show that new BRT systems are still a long way short of providing similar TQoL to LRT and would caution against encouraging modal shift. These decisions can only be made through more TQoL appraisal. The matter here is less the outcome and more the process: that is, how the technique can help policy makers make more informed long and short-term policy decisions. The advantage of this can be demonstrated in the case of Manchester's transport future outlined in the next section.

8.3 TQoL IN OPERATION: A PRACTICAL EXAMPLE

To illustrate the implications of TQoL appraisal on policy and practice, a case study of Manchester can be used. Recent developments have brought the city's transport future into focus. It is also apparent that applying TQoL methods could have been an influential tool in shaping the decisions made over the past twelve months.

On 12 December 2008, the future of Manchester's transport redevelopment was dealt a major blow when a public referendum overwhelmingly rejected plans for a congestion charge scheme (Ottewell, 2008). The Secretary of State for Transport formally announced on 9 June 2008, that the Association of Greater Manchester Council's (AGMA) Transport Innovation Fund (TIF) bid for an investment of up to £3 billion to boost the region's public transport system had been approved for Programme Entry. The TIF package consisted of a number of planned investments that would deliver effective integration between the bus, train and tram networks, and provide attractive alternatives for car users (Greater Manchester Future Transport 2008a). The plans included major extensions to the Metrolink network, an expanded bus network, more trains and new stations, improved school buses, cycle routes and an integrated ticketing system. TIF was introduced by the government in its 2004 white paper to support smarter, innovative local transport packages that combine demand management measures with measures to encourage modal shift (DfT 2004b).

Although funding had been secured for Metrolink Phase 3 extensions to Oldham, Rochdale, Tameside, South Manchester and MediaCity (GMPTE, 2006b), the plan was to improve the whole network. With road congestion a major problem in Greater Manchester, the TIF bid was seen as a way to address this problem for the benefit of the population. The success of the bid depended upon public approval of the planned congestion charge. A demand management scheme is a mandatory part of TIF bids, and unless there is backing from 7 of the 10 local authority areas affected (e.g. through a majority ballot of residents) then investment for improvements will not be approved. In the referendum, the overall vote was a 78.8 per cent ‘No’ to the congestion charge with a majority against in each local authority area (Ottewell, 2008). This leaves a major question mark over how the future of public transport will be shaped.

TQoL appraisal could have helped the TIF bid process. If included in the promotion of the bid, the results found in this project – highlighting a superior LRT TQoL and much poorer Bus TQoL could have changed the outcome of the vote. This extra dimension in the appraisal process could more effectively have presented the benefits of the public transport improvements to the public. The TQoL model is a successful appraisal technique that can deliver a better understanding of passenger experience. Applied alongside the traditional techniques, it may have given the general public a clearer idea of the scheme’s benefits. A survey before the referendum found that more people were much more aware of the congestion charge scheme than of the improvements to the public transport (Ipsos MORI North 2008). If TQoL appraisal were included in the TIF bid, more emphasis might have been placed on the wider benefits to the public transport system.

Five forms of economic analysis supported the development of the TIF package: Benefit/Cost Analysis, Competitiveness Analysis, Employment Opportunities Analysis, Costs of Growth Impacts and Employment and GVA Impacts Analysis (Greater Manchester Future Transport 2008b). There was no analysis of the benefits provided for the passenger for either public or private transport. The TQoL model could have been used to assess the level of QoL on each mode to highlight which mode provided better journey quality. These could then have been presented to the public to show how their experience could be enhanced from the scheme. If the results from this project were included, for example, it would have shown that the LRT TQoL and Train TQoL is significantly higher than Bus TQoL. If advertisement and promotions were made in areas where there was proposed expansion of Metrolink and rail networks, greater support may have been found in these areas. The results could also be reported in areas where there was poor Bus TQoL to show the benefits the investments could make to improving their QoL. This may have encouraged them to vote in favour of the bid.

In addition to highlighting improvements for public transport users, it could have been applied to determine the changes in Car TQoL. An assessment could have been conducted in London and Manchester to compare the differences for drivers encountering the charge and those not. This could also have contributed to the campaign supporting acceptance of the TIF bid.

The benefit of applying the TQoL model is not simply to help the campaign for the TIF bid. It is to provide a more balanced appraisal process that clearly illustrates the transport passenger experience. The most important component of a campaign should be to provide the public with all the facts so they can make an informed decision on what will benefit them most. If they do not fully understand the benefits of the scheme they are unable to make an informed decision; similarly, if they are unable to appreciate how the congestion will get worse in the future or how much the public transport quality will deteriorate. In essence, the public were only able to make a decision on the basis of the information they received.

Despite this, the key to the story in Manchester may have been how the information was presented to the public. As was found in Edinburgh's congestion charge proposals, the media has a significant influence on how the public votes (Ryley and Gjersoe, 2006). The influence of, not only the press, but also the 'for' and 'against' campaigns certainly had an impact on the referendum. The focus of all campaigns ultimately centred upon the congestion charge. Whatever the reason for this, the focus of the whole scheme and the major long-term investment of public transport in Greater Manchester were lost in translation.

Manchester's transport future now is unclear. Following the massive loss in the referendum AGMA formally resolved to cease pursuing the TIF proposals. While work on Metrolink phase 3 is well underway, this scheme only benefits a small area of Greater Manchester. The TIF proposals would have had a wide-ranging impact on transport and daily lives in the whole of the region. Would the introduction of the TQoL model helped reverse the decision? The answer is probably no, due to the nationwide opposition to road pricing, but it would have enabled a more informed debate about options, including opportunity costs, and hopefully a better informed electorate.

Although TQoL appraisal may not have had an influence on this particular outcome it is nonetheless evident that it does have a major part to play in the transport decision-making process. It provides a clearly understood evaluation of public transport experience, something that is lacking in current transport appraisal. For all decisions about new transport projects, it is imperative to consider not only the potential benefits or costs for the passenger, but also their wider transport quality of life. This is not fully understood in CBA because the current experience of passengers is not accurately evaluated. The TQoL model provides an alternative appraisal technique that broadens the scope of transport appraisal.

8.4 AGENDA FOR FURTHER RESEARCH

The main theme of further research is to develop TQoL appraisal methods and to provide evidence of the value of applications, with the longer-term aim of enabling it to become an accepted part of transport appraisal. The two projects outlined below would further test and, if successful, would demonstrate the method's applicability and value.

The first project would be a large-scale study of TQoL. This assessment will be conducted in multiple UK and European or US cities. This project will maintain the success of the TQoL model and evaluate the success of modal journey experience in the UK compared to other countries. The significance of this project is a greater understanding of the passenger experience on public and private transport. Whereas this thesis has focused on public transport assessment this project will also evaluate the experience of car users. The results will present which mode of transport is providing a better QoL. This can lead to two forms of action for governments, cities or operators: (i) investment in areas where the mode is performing poorly to improve the TQoL or (ii) greater investment in the most successful mode. International comparison is important to highlight the differences in experience in a context other than the UK. The innovation of this project is the adoption of an alternative form of transport appraisal that will provide a more comprehensive evaluation of passengers' QoL.

There are three stages to this project. The first is an extensive qualitative assessment to redefine what TQoL meant to individuals. This is an important stage because qualitative methods, including focus groups, interviews, and participant–observer techniques can help fill the gaps left by quantitative techniques and it has been argued that qualitative research is vital to understand the complexity of transportation behaviour, which rests upon the subjective beliefs and behaviours of the individual person (Clifton and Handy, 2001; Poulenez-Donovan and Ulberg, 1994).This will be conducted in ten focus group sessions in each city and 15-20 in-depth interviews. The focus group sessions will be held to re-design the TQoL indicators. Respondents will be encouraged to express their opinions on TQoL in a similar way to the Participatory Evaluation and Appraisal in Newcastle-upon-Tyne (PEANuT) approach used in the mapping tranquillity project (Jackson et al., 2008). The in-depth interviews will be conducted to reaffirm the findings of the focus group sessions and to address the clarity issues of the survey instrument identified in the previous chapter. At this stage the questionnaire would be designed and respondents will be encouraged to identify any questions that they may not understand. These can then be made clearer in order for the correct data to be collected. The second phase of the research is assessment of TQoL in each city completed the same way as in this project using two household surveys, traditional quality of life techniques and factor analysis. The third stage of the research project is applying a second stage of qualitative research to understand some of the differences that are found in the analysis of TQoL. In this project there were some findings that could not be explained by only quantitative analysis (Page 146, 168 and 174) and required more detailed qualitative research. At this point it is important to use focus group sessions and in-depth interviews to understand why the variations in TQoL occur for the different demographic groups. As in the first stage of the research ten focus group sessions and 15-20 interviews will be held.

The second project would be designed to evaluate the success of incorporating the TQoL model into the transport appraisal process. Transport appraisal will be conducted to evaluate the potential for a new project scheme. This would be conducted in a city seeking to extend its transport network, such as Nottingham or Manchester. All the components of current transport appraisal will be assessed together with TQoL appraisal. This will be conducted to test the integration with NATA as described earlier in this chapter. This project will value the effectiveness of including the TQoL model in the appraisal process. The greatest benefit for the project is to the government, as well as authorities looking to expand its LRT or train network.

These two research projects are intended to enhance the quality of the TQoL model and to widen its acceptability. The main objective of this thesis was to design an appraisal technique that can improve the quality of transport appraisal. These projects would have a similar objective. The proposed research is thus about developing Ben-Akiva and Bonsall's (2004) recommendations for transport research to (i) increase in relevance with current policy issues; (ii) improve the interface between practitioners and researchers; (iii) strengthen the credibility of the results and; (iv) provide effective dissemination that is easily understood by practitioners.

APPENDIX A

SURVEY DESIGN

INITIAL APPRAISAL - WEIGHTING SURVEY COVER LETTER

Official Letterhead	UNIVERSITY of GLASGOW Room 404 School of Business and Management Gilbert Scott Building University of Glasgow GLASGOW, G12 8QQ
Date mailed	8 July, 2006
Inside Address and Name in matching type	Recipient's address Dear Mr/Ms X:
What study is about: its social usefulness	Transport is important to the vitality of the city of Glasgow, but it is very important to the individuals that live in Glasgow. The success of a good transport system can result in a good individual quality of life, whilst poor transport services can affect your quality of life on transport. In your daily routine transport can play a very important role in helping you to get to work, college or the shops. Unfortunately there is little genuine information which has been produced to learn what different factors affect peoples quality of life when travelling on transport. Without this, the government and Glasgow city council cannot not truly understand which transport services would benefit from investment.
Why recipient is important (and, if needed, who should complete the questionnaire)	Your household is one of a small number in which people are being asked to give their opinion on these matters. It was drawn from a random sample of the whole city. In order that the results will truly represent the thinking of the people of Glasgow, it is important that each questionnaire be completed and returned using the stamped addressed envelope. It is important that we have about the same number of men and women participating in this study. Thus, we would like the questionnaire for your household to be completed by an <u>adult male</u>. If none is present, then it should be completed by an adult female.
Promise of confidentiality; explanation of identification number	You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only. This is so that we may check your name off the mailing list when your questionnaire is returned. Your name and the information received will never be passed on to any other parties.
Usefulness of study	The results of this research will be used to determine the most important indicators of transport quality of life. These will be used to construct a formula for transport quality of life that will help public policy makers, transport operators and city council bodies determine which transport modes to invest in. You may receive a summary of the results by printing your name and address on the 'Copy of results requested form', and submitting this with your completed questionnaire. Please do not put this information on the questionnaire.
What to do if questions arise	I would be most happy to answer any questions you might have. Please write or call. The telephone number is 0141 330 2000 (extension 0273).
Appreciation	Thank you for your assistance Sincerely,
Hand-written signature	Andrew Carse Doctoral Researcher
Title	

INITIAL APPRAISAL - WEIGHTING SURVEY

What is important to your Transport Quality of Life?

In order to understand the issues which you think are most significant to your quality of life on transport, please indicate on the scale of 1 to 5 how much importance each factor plays.

Q.1 How important is the ability to access many different job opportunities to your quality of life? (Circle the number of your answer)

1 **OF VERY LITTLE IMPORTANCE**
2 **OF LITTLE IMPORTANCE**
3 **NEITHER UNIMPORTANT OR IMPORTANT**
4 **OF SOME IMPORTANCE**
5 **OF GREAT IMPORTANCE**

Q.2 How important is the time it takes you travel to work to your quality of life on transport? (Circle number)

1 **OF VERY LITTLE IMPORTANCE**
2 **OF LITTLE IMPORTANCE**
3 **NEITHER UNIMPORTANT OR IMPORTANT**
4 **OF SOME IMPORTANCE**
5 **OF GREAT IMPORTANCE**

Q.3 How important is time spent in traffic jams to your quality of life? (Circle number)

1 **OF VERY LITTLE IMPORTANCE**
2 **OF LITTLE IMPORTANCE**
3 **NEITHER UNIMPORTANT OR IMPORTANT**
4 **OF SOME IMPORTANCE**
5 **OF GREAT IMPORTANCE**

Q.4 How important is the cost of parking to your transport quality of life? (Circle number)

1 **OF VERY LITTLE IMPORTANCE**
2 **OF LITTLE IMPORTANCE**
3 **NEITHER UNIMPORTANT OR IMPORTANT**
4 **OF SOME IMPORTANCE**
5 **OF GREAT IMPORTANCE**

Q.5 How important is having a number of different transport options to your quality of life? (Circle number)

1 **OF VERY LITTLE IMPORTANCE**
2 **OF LITTLE IMPORTANCE**
3 **NEITHER UNIMPORTANT OR IMPORTANT**
4 **OF SOME IMPORTANCE**
5 **OF GREAT IMPORTANCE**

Q.6 How important is safety to your quality of life on transport? (Circle number)

1 **OF VERY LITTLE IMPORTANCE**
2 **OF LITTLE IMPORTANCE**
3 **NEITHER UNIMPORTANT OR IMPORTANT**
4 **OF SOME IMPORTANCE**
5 **OF GREAT IMPORTANCE**

Q.7 How important is disabled access on transport to your quality of life? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.8 How important is climate change considered in your transport choices? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.9 How important is local air pollution considered in your transport choices? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.10 How important does noise affect your quality of life on transport? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.11 How important does the access to parkland affect your quality of life? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.12 How important is it to have a bus stop within 5 minutes walk to your quality of life? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.13 How important is it to have a train station within 10 minutes walk to your quality of life? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.14 Do you own a car ?

1 No
2 Yes

(If you do not own a car)

Q.15a How important are the costs to travel by public transport to your quality of life? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.16a How important is the quality of your journey by public transport on your quality of life? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

(If you own a car)

Q.15b How important are the costs to travel by car to your quality of life? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.16b How important is the quality of your journey by car on your quality of life? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.17 How important is walking and cycling to your quality of life? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.18 How important having the information about your local transport services to your quality of life? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.19 How important is having the choice of transport mode for your main journey to your quality of life? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.20 In summary how important is the overall quality of transport to your quality of life? (Circle number)

1 OF VERY LITTLE IMPORTANCE
2 OF LITTLE IMPORTANCE
3 NEITHER UNIMPORTANT OR IMPORTANT
4 OF SOME IMPORTANCE
5 OF GREAT IMPORTANCE

Q.21. What other aspects do you consider to be important in affecting your quality of life on transport? (if none leave blank)

____

Finally, we would like to ask some questions about yourself for statistical purposes.

Q.22 Your Sex (Circle number)

1 MALE
2 FEMALE

Q.23 Your present Age (Circle number)

1 16-24
2 25-34
3 35-44
4 45-54
5 55-64
6 65+

Q.24 Which of these phrases best describes your Current Working Status? (Circle number)

1 FULL-TIME
2 PART-TIME
3 HOUSEPERSON
4 RETIRED
5 REGISTERED UNEMPLOYED
6 UNEMPLOYED NOT REGISTERED
7 ON A TRAINING SCHEME
8 VOLUNTARY WORK
9 STUDENT
10 OTHER

Q.25 Which is the highest level of education that you have completed? (Circle number)

1 O GRADE, STANDARD GRADE, GCSE, OR EQUIVALENT
2 HIGHER GRADE, CSYS, 'A' LEVEL, OR EQUIVALENT
3 GSVQ LEVEL 1 OR 2, SCOTVEC, BTEC, CITY AND GUILDS CRAFT, RSA DIPLOMA OR EQUIVALENT
4 GSVQ LEVEL 3, ONC, OND, OR EQUIVALENT
5 HNC, HND, SVQ LEVEL 4 OR 5, RSA HIGHER DIPLOMA OR EQUIVALENT
6 FIRST DEGREE, HIGHER DEGREE
7 PROFESSIONAL QUALIFICATIONS (FOR EXAMPLE TEACHING, ACCOUNTANCY)
8 NONE OF THESE

Q.26 Which of these describes your current type of accommodation? (Circle number)

1 HOUSE OR BUNGALOW
2 FLAT/MAISONETTE
3 OTHER

Q.27 What is your current housing tenure? (Circle number)

1 OWN OUTRIGHT
2 BUYING ON MORTGAGE
3 RENTED FROM THE COUNCIL/HOUSING ASSOCIATION
4 RENTED FROM PRIVATE LANDLORD
5 OTHER

Q.28 How many people are there in your household? (Circle number)

1 ONE
2 TWO
3 THREE
4 FOUR
5 FIVE OR MORE

Q.29 How many of these are children/dependents under the age of 16? (Circle number)

1 NONE
2 ONE
3 TWO
4 THREE
5 FOUR OR MORE

Q.30 Your Postcode (Put your postcode in the box)

INITIAL APPRAISAL – ASSESSMENT SURVEY COVER LETTER

Official Letterhead	UNIVERSITY of GLASGOW Room 404 School of Business and Management Gilbert Scott Building University of Glasgow GLASGOW, G12 8QQ
Date mailed	8 July, 2006
	Recipient's address
Inside Address and Name in matching type	Dear Mr/Ms X:
What study is about: its social usefulness	Transport is important to the vitality of the city of Glasgow, but it is very important to the individuals that live in Glasgow. The success of a good transport system can result in a good individual quality of life, whilst poor transport services can affect your quality of life on transport. In your daily routine transport can play a very important role in helping you to get to work, college or the shops. Unfortunately there is little genuine information which has been produced to learn what different factors affect peoples quality of life when travelling on transport. Without this, the government and Glasgow city council cannot not truly understand which transport services would benefit from investment.
Why recipient is important (and, if needed, who should complete the questionnaire)	Your household is one of a small number in which people are being asked to give their opinion on these matters. It was drawn from a random sample of the whole city. In order that the results will truly represent the thinking of the people of Glasgow, it is important that each questionnaire be completed and returned using the stamped addressed envelope. It is important that we have about the same number of men and women participating in this study. Thus, we would like the questionnaire for your household to be completed by an <u>adult male</u>. If none is present, then it should be completed by an adult female.
Promise of confidentiality; explanation of identification number	You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only. This is so that we may check your name off the mailing list when your questionnaire is returned. Your name and the information received will never be passed on to any other parties.
Usefulness of study	The results of this research will be used to understand the experience of quality of life on transport. This will help public policy makers, transport operators and city council bodies comprehend which transport modes are enhancing individuals' quality of life and so decide where best to invest more money. You may receive a summary of the results by printing your name and address on the 'Copy of results requested form', and submitting this with your completed questionnaire. Please do not put this information on the questionnaire.
What to do if questions arise	I would be most happy to answer any questions you might have. Please write or call. The telephone number is 0141 330 2000 (extension 0273).
Appreciation	Thank you for your assistance Sincerely,
Hand-written signature	Andrew Carse
Title	Doctoral Researcher

INITIAL APPRAISAL - ASSESSMENT SURVEY

Questionnaire for the Transport quality of life in Glasgow

Q.1 What is the purpose for your *most common* journey taken? (Circle number of your answer)

1 SHOPPING
2 WORK
3 SCHOOL/COLLEGE
4 UNIVERSITY
5 TRAINING SCHEME
6 VISITING
7 FRIENDS/FAMILY
8 LEISURE
9 OTHER. . . . (please specify) __________________________

Q.2 Which *method of transport* do you use for this journey? (Circle number)

1 SUBWAY
2 TRAIN
3 BUS
4 TAXI
5 DRIVING A CAR/VAN
6 PASSENGER IN CAR/VAN
7 BICYCLE
8 ON FOOT
9 OTHER . . . . (please specify) __________________________

Q.3 How *long* does your journey take you? (Circle number)

1 < 5 MINUTES
2 5-10 MINUTES
3 11-15 MINUTES
4 16-20 MINUTES
5 21-30 MINUTES
6 30 MINUTES +

Q.4 If your main mode of travel is by public transport, how *much quicker* do you think your journey would be if travelling by Car? (Circle number)

1 < 5 MINUTES
2 5-10 MINUTES
3 11-15 MINUTES
4 16-20 MINUTES
5 21-30 MINUTES
6 30 MINUTES +
7 WOULD NOT BE QUICKER

Q.5 How *much longer* do you feel congestion adds to your journey? (Circle number)

1 NONE
2 NOT A LOT
3 SOME
4 A LOT
5 A GREAT DEAL

Q.6 How strongly do you agree that *public transport* is to blame for congestion? (Circle number)

1 STRONGLY DISAGREE
2 DISAGREE
3 NEITHER AGREE NOR DISAGREE
4 AGREE
5 STRONGLY AGREE

Q.7 How strongly do you agree that *car traffic* is to blame for congestion? (Circle number)

1 STRONGLY DISAGREE
2 DISAGREE
3 NEITHER AGREE NOR DISAGREE
4 AGREE
5 STRONGLY AGREE

Q.8 How *safe* do you feel when you travel on *public transport*? (Circle number)

1 VERY UNSAFE
2 UNSAFE
3 NEITHER UNSAFE OR SAFE
4 SAFE
5 VERY SAFE

Q.9 How safe do you feel when you travel by *private transport* (i.e. car)? (Circle number)

1 VERY UNSAFE
2 UNSAFE
3 NEITHER UNSAFE OR SAFE
4 SAFE
5 VERY SAFE

Q.10 How much on average do you spend on transport per week? (Circle number)

1 NOTHING
2 £5 OR LESS
3 £5.01-£10.00
4 £10.01-£15.00
5 £15.01-£20.00
6 £20.01-£30.00
7 £30 +

Q.11 On a scale from 1(very poor) to 5(very good) how would you rate the *overall quality* of the public transport service? (Circle number)

1 VERY POOR
2 POOR
3 NEITHER POOR NOR GOOD
4 GOOD
5 VERY GOOD

Q.12 On a scale from 1(very unsatisfied) to 5(very satisfied) how *satisfied* are you with the public transport service? (Circle number)

1 VERY UNSATISFIED
2 UNSATISFIED
3 NEITHER UNSATISFIED NOR SATISFIED
4 SATISFIED
5 VERY SATISFIED

Q.13 On average how many miles do you travel per year *by Car*? (Circle number)

1 NONE
2 5,000 OR LESS
3 5, 001-10,000
4 10,000-15,000
5 15,000-20,000
6 20,000 +

Q.14 Do you wish to travel more by car? (Circle number)

1 NO
2 YES

Q.15 What would be the *maximum extra* amount you would be willing to pay *per day* to improve your quality of life on public transport? (i.e. clean, easily accessible, fast and reliable, value for money, extended service)

1 NOTHING
2 £1 OR LESS
3 £1.01-£2.00
4 £2.01-£3.00
5 £3.01-£4.00
6 £4.01-£5.00
7 £5.01+

Finally, we would like to ask some questions about yourself for statistical purposes.

Q.16 Your Sex (Circle number)

1 MALE
2 FEMALE

Q.17 Your present Age (Circle number)

1 16-24
2 25-34
3 35-44
4 45-54
5 55-64
6 65+

Q.18 Which of these phrases best describes your *Current Working Status*? (Circle number)

1 FULL-TIME
2 PART-TIME
3 HOUSEPERSON
4 RETIRED
5 REGISTERED UNEMPLOYED
6 UNEMPLOYED NOT REGISTERED
7 ON A TRAINING SCHEME
8 VOLUNTARY WORK
9 STUDENT
10 OTHER

Q.19 Which is the highest level of education that you have completed? (Circle number)

1 **O GRADE, STANDARD GRADE, GCSE, OR EQUIVALENT**
2 **HIGHER GRADE, CSYS, 'A' LEVEL, OR EQUIVALENT**
3 **GSVQ LEVEL 1 OR 2, SCOTVEC, BTEC, CITY AND GUILDS CRAFT, RSA DIPLOMA OR EQUIVALENT**
4 **GSVQ LEVEL 3, ONC, OND, OR EQUIVALENT**
5 **HNC, HND, SVQ LEVEL 4 OR 5, RSA HIGHER DIPLOMA OR EQUIVALENT**
6 **FIRST DEGREE, HIGHER DEGREE**
7 **PROFESSIONAL QUALIFICATIONS (FOR EXAMPLE TEACHING, ACCOUNTANCY)**
8 **NONE OF THESE**

Q.20 Which of these describes your current type of **accommodation**? (Circle number)

1 **HOUSE OR BUNGALOW**
2 **FLAT/MAISONETTE**
3 **OTHER**

Q.21 What is your current housing tenure? (Circle number)

1 **OWN OUTRIGHT**
2 **BUYING ON MORTGAGE**
3 **RENTED FROM THE COUNCIL/HOUSING ASSOCIATION**
4 **RENTED FROM PRIVATE LANDLORD**
5 **OTHER**

Q.22 How many people are there in your household? (Circle number)

1 **ONE**
2 **TWO**
3 **THREE**
4 **FOUR**
5 **FIVE OR MORE**

Q.23 How many of these are children/dependents under the age of 16? (Circle number)

1 **NONE**
2 **ONE**
3 **TWO**
4 **THREE**
5 **FOUR OR MORE**

Q.24 Your Postcode (Put your postcode in the box)

QUALITATIVE ASSESSMENT – FOCUS GROUP LETTER

UNIVERSITY of GLASGOW

Room 404
School of Business and Management
Gilbert Scott Building
University of Glasgow
GLASGOW, G12 8QQ

DATE

RESPONDENTS ADDRESS

Dear Sir or Madam:

It is now over a couple of months since you kindly returned a questionnaire to help contribute on a study of quality of life on transport. I would like to take this opportunity to thank you for taking the time to complete the survey and returning it to me. I am currently in the process of analysing the results, which shall be forwarded onto you when they have been fully processed.

The study I am conducting also involves gaining a more detailed understanding on people's feelings toward transport. The more information that we can gather the better the analysis will be made of the different transport methods in operation in Glasgow. There are a number of focus group sessions, listed below, that will be held at the University of Glasgow to discuss transportation in Glasgow and to find out how people experience the current system. I would very much like it if you could make it to one of the sessions. There will be five different times to choose from. Refreshments will be served in addition to a fixed imbursement of £5 for your time and travel cost.

If are able to make the session then simply complete the section below or contact me directly. You can also call or email me. The telephone number is 0141 330 2000 (ask for extension 0273) and my email address is A.carse.1@research.gla.ac.uk. I will contact you further to inform you which room the sessions will take place. If you or have any questions at all then please do not hesitate to contact me.

Thanking you Kindly
Sincerely,

Andrew Carse
Doctoral Researcher

I Will / Will not (Please indicate) be able to make the focus group session on

- Monday 12 February at 12.30pm
- Monday 12 February at 5.45pm
- Tuesday 13 February at 12.30pm
- Tuesday 13 February at 5.45pm

Name: Address:

Tel No.:

Please return to Andrew Carse, Room 404, School of Business and Management, Gilbert Scott Building, University of Glasgow GLASGOW, G12 8QQ

IMPLEMENTATION – WEIGHTING AND ASSESSMENT SURVEY COVER LETTER

UNIVERSITY of GLASGOW

Room 404
School of Business and Management
Gilbert Scott Building
University of Glasgow
GLASGOW, G12 8QQ

DATE

RECIPIENTS ADDRESS

Dear Sir/Madam:

Transport is important to the vitality of Greater Manchester, but it is very important to the individuals that live within Greater Manchester. The success of a good transport system can result in a good individual quality of life, whilst poor transport services can affect your quality of life on transport. Unfortunately little research has been understood about people's quality of life when travelling on transport. Without this, the government and city council officials cannot not truly understand which transport services would benefit from investment.

You have been selected at random and form part of a small sample in which people are being asked to give their opinion on these matters. In order that the results will represent people of Greater Manchester, it is important that each questionnaire be completed and returned using the stamped addressed envelope. You may receive a summary of the results by printing your name and address on the 'Copy of results requested form', and submitting this with your completed questionnaire. If you would be willing to attend an informal discussion on transport and issues important to you, please tick the box at the bottom of the copy of results page.

I would be most happy to answer any questions you might have. Please write, call or email. The telephone number is 0141 330 2000 (extension 0273). Email address is A.carse.1@research.gla.ac.uk

Thank you for your assistance
Sincerely,

Andrew Carse
Doctoral Researcher

IMPLEMENTATION - WEIGHTING SURVEY QUESTIONNAIRE

YOUR EXPERIENCE OF TRANSPORT AND YOUR QUALITY OF LIFE

In order to understand more about your transport experiences please complete the Questionnaire in relation to your most common journey.

Q.1 **Thinking about the journey you make most often:**

- Q.1a What is the purpose? (Circle number of answer)

1 Shopping
2 Work
3 School/college
4 University
5 Training scheme
6 Visiting family/friends
7 Leisure
8 Other. . . . (please specify) ______________________

- *Q.1b* **How long does it take from door to door?**

[ ] Minutes

- Q.1c How often do you make this journey each week? (Circle answer)

1 Once
2 Two to three times
3 Four to five times
4 Everyday

- Q.1d Which method of transport do you use (The longest part of the journey)? (Circle answer)

1 Subway
2 Train
3 Bus
4 Taxi
5 Driving a car/van
6 Passenger in car/van
7 Bicycle
8 On foot
9 Other . . . . (please specify) ______________________

- Q.1e How much does it cost? (Please specify)

____

- Q.1f Which other alternative modes of transport are available? (Circle all that are applicable)

1 Subway/Tram
2 Train
3 Bus
4 Taxi
5 Driving a car/van
6 Passenger in car/van
7 Bicycle
8 On foot
9 Other . . . . (please specify) ______________________

- Q.1g How would you prefer to make this journey? (Circle Answer)

1 Subway/Tram
2 Train
3 Bus
4 Taxi
5 Driving a car/van
6 Passenger in car/van
7 Bicycle
8 On foot
9 Other . . . . (please specify) ____________________

- Q.1h What stops you from using this mode of transport? (Please explain reason)

____

Q.2 When considering you quality of life how important to you is:
(Circle relevant number)

	Of Little Importance ← → Of Great Importance										
Having access to a range of employment opportunities?	0	1	2	3	4	5	6	7	8	9	10
Having access to local services? e.g. shops, hospital	0	1	2	3	4	5	6	7	8	9	10
Step-free access on public transport?	0	1	2	3	4	5	6	7	8	9	10
Having a bus stop within 3 minutes walk?	0	1	2	3	4	5	6	7	8	9	10
Having a train station within 8 minutes walk?	0	1	2	3	4	5	6	7	8	9	10
Having a subway/tram station within 8 minutes walk?	0	1	2	3	4	5	6	7	8	9	10
Transport costs in relation to your weekly budget?	0	1	2	3	4	5	6	7	8	9	10
Investment spent on roads and parking?	0	1	2	3	4	5	6	7	8	9	10
Investment spent on public transport services?	0	1	2	3	4	5	6	7	8	9	10
Investment spent on walkways and cycle paths?	0	1	2	3	4	5	6	7	8	9	10
The journey time?	0	1	2	3	4	5	6	7	8	9	10
Spending time in traffic jams?	0	1	2	3	4	5	6	7	8	9	10
Having a choice of transport options?	0	1	2	3	4	5	6	7	8	9	10
Having a reliable public transport service?	0	1	2	3	4	5	6	7	8	9	10
Having a regular public transport service?	0	1	2	3	4	5	6	7	8	9	10
Having accurate information on local transport services?	0	1	2	3	4	5	6	7	8	9	10
Being able to travel quicker on public transport than a car?	0	1	2	3	4	5	6	7	8	9	10
Being able to walk and cycle when you want to?	0	1	2	3	4	5	6	7	8	9	10
Personal safety when travelling by car?	0	1	2	3	4	5	6	7	8	9	10
Personal safety when travelling by public transport?	0	1	2	3	4	5	6	7	8	9	10
The presence of other passengers behaviour?	0	1	2	3	4	5	6	7	8	9	10
Climate change when considering your transport mode?	0	1	2	3	4	5	6	7	8	9	10
The level of local air pollution?	0	1	2	3	4	5	6	7	8	9	10
The level of noise?	0	1	2	3	4	5	6	7	8	9	10
Access to greenspace/parkland?	0	1	2	3	4	5	6	7	8	9	10

Q.3 **Do you own a car?**

1 No → Go directly to question 6
2 Yes Go to the next question

When considering you quality of life how important to you is: (Circle relevant number)	**Of Little Importance** ⟷ **Of Great Importance**
Q.4 The costs to travel by car?	0 1 2 3 4 5 6 7 8 9 10
Q.5 The quality of your journey by car?	0 1 2 3 4 5 6 7 8 9 10
Q.6 The costs to travel by public transport?	0 1 2 3 4 5 6 7 8 9 10
Q.7 The overall quality of public transport?	0 1 2 3 4 5 6 7 8 9 10

Finally, for comparative purposes, some questions about yourself.

Q.8 Sex (Circle number)

1 Male
2 Female

Q.9 Age (Circle number)

1 16-24
2 25-34
3 35-44
4 45-54
5 55-64
6 65+

Q.10 Which of these phrases best describes your current working status? (Circle number)

1 Full-time
2 Part-time
3 Houseperson
4 Retired
5 Registered Unemployed
6 Unemployed not registered
7 On a training scheme
8 Voluntary work
9 Student
10 Other

Q.11 Which is the highest level of education that you have completed? (Circle number)

1 O Grade, Standard Grade, GCSE, or Equivalent
2 Higher Grade CSYS, 'A' Level, or Equivalent
3 GSVQ Level 1 OR 2, Scotvec, BTEC, City and Guilds Craft, RSA Diploma or Equivalent
4 GSVQ Level 3, ONC, OND, or Equivalent
5 HNC, HND, SVQ Level 4 or 5, RSA Higher Diploma or Equivalent
6 First Degree, Higher Degree
7 Professional Qualifications (e.g. Teaching, Accountancy)
8 None of the above

Q.12 Which of these describes your current type of accommodation? (Circle number)

1 House or bungalow
2 Flat/maisonette
3 Other

Q.13 What is your current housing tenure? (Circle number)

1 Own outright
2 Buying on mortgage
3 Rented from the council/housing association
4 Rented from private landlord
5 Other

Q.14 How many people are there in your household? (Circle number)

1 One
2 Two
3 Three
4 Four
5 Five or more

Q.15 How many of these are children/dependents under the age of 16? (Circle number)

1 None
2 One
3 Two
4 Three
5 Four or more

THE END – THANK YOU

IMPLEMENTATION – ASSESSMENT SURVEY QUESTIONNAIRE

YOUR EXPERIENCE OF TRANSPORT AND YOUR QUALITY OF LIFE

The purpose of this questionnaire is to find out more about your experience when you travel on public transport. Answer this only if you travel by Train/Bus/Subway/Tram.
Answer each of the questions thinking about the journey you make most often.

Q.1 Thinking about the journey you make most often:

- Q.1a What is the purpose? (Circle number of answer)

1 Shopping
2 Work
3 School/college
4 University
5 Training scheme
6 Visiting family/friends
7 Leisure
8 Other. . . . (please specify) ____________________________

- *Q.1b* **How long does it take from door to door?** (Please check the box with of your answer)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Long time										*Short time*

- Q.1c How often do you make this journey each week? (Circle answer)

1 Once
2 Two to three times
3 Four to five times
4 Everyday

- Q.1d Which method of transport do you use (for the longest part of the journey)? (Circle answer)

1 Subway
2 Train
3 Bus
4 Taxi
5 Driving a car/van
6 Passenger in car/van
7 Bicycle
8 On foot
9 Other . . . . (please specify) ____________________________

- Q.1e How much does it cost? (Please check the box with of your answer)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
A lot										*Nothing*

- Q.1f Which alternative modes of transport are available? (Circle all that are applicable)

1 Subway/Tram
2 Train
3 Bus
4 Taxi
5 Driving a car/van
6 Passenger in car/van
7 Bicycle
8 On foot
9 Other . . . . (please specify) ____________________________

- Q.1g How would you prefer to make this journey? (Circle Answer)

1 Subway/Tram
2 Train
3 Bus
4 Taxi
5 Driving a car/van
6 Passenger in car/van
7 Bicycle
8 On foot
9 Other . . . . (please specify) ________________________

- Q.1h What stops you from using this mode of transport? (Please explain reason)

____

- Q.1i Overall, how do you describe the journey quality? (Please check the box with of your answer)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Very Poor										*Excellent*

Q.2 How would you describe the access to job opportunities from your area? (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Very Poor										*Excellent*

Q.3 **How would describe the access to the local services you need?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Very Poor										*Excellent*

Q.4 **How do you describe the access of transport services for mobility impaired passengers?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Very Poor										*Excellent*

Q.5 **How close is your nearest bus stop?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Far Away										*Very Close*

Q.6 **How close is your nearest train station?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Far Away										*Very Close*

Q.7 **How close is your nearest subway/tram station?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Far Away										*Very Close*

Q.8 **How much of your weekly budget is taken up by transport costs?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Majority *Minimal*

Q.9 **How effectively do you feel money is spent on roads and parking services?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Not Effectively *Very Effectively*

Q.10 **How effectively do you feel money is spent on public transport services?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Not Effectively *Very Effectively*

Q.11 **How effectively do you feel money is spent on pedestrian walkways and cycle paths?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Not Effectively *Very Effectively*

Q.12 **How would you describe the range of public transport options in your area?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Very Limited *Many Options*

Q.13 **How regular are public transport services in your local area?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Irregular *Very Regular*

Q.14 **How reliable is the public transport service in local area?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Very Unreliable *Very Reliable*

Q.15 **What level of knowledge do you have about the public transport services in your area?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

No Knowledge *Know all services*

Q.16 **If your main mode of travel is by public transport, how much quicker do you think your journey would be if travelling by car?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
A lot quicker										*A lot slower*

Q.17 **How do you rate the quality of pedestrian walkways and cycle paths in your local area?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Very Poor										*Excellent*

Q.18 **How safe do you feel travelling on public transport?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Very Unsafe										*Very Safe*

Q.19 **How safe do you feel travelling by car?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Very Unsafe										*Very Safe*

Q.20 **Does the behaviour of other passengers enhance or detract from your travel experience?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Detract										*Enhance*

Q.21 **How much of the pollution in your local area is due to transport?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
All										*None*

Q.22 **How do you think the level of air quality in your local area is?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Very Polluted										*Very Clear*

Q.23 **How do you relate the level of noise from transport?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Very Noisy										*Very Quiet*

Q.24 **How much greenspace/parkland is there within 500m of your home?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
None										*A lot*

Q.25 **How does congestion affect your journey?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
A lot										*None*

Q.26 **What is the main cause for congestion?**

____

Q.27 **How would you rate the overall quality of the public transport service in your area?** (Check the relevant box)

0	1	2	3	4	5	6	7	8	9	10
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Very Poor										*Excellent*

Q.28 **On average how many miles do you travel per year by Car?**

☐ Miles

Q.29 **Do you wish to travel more by car?** (Check the relevant box)

1	2
☐	☐
No	Yes

Q.30 **What would be the maximum extra amount you would be willing to pay** *per day* **to improve your quality of life on public transport? (i.e. clean, easily accessible, fast and reliable, value for money, extended service)**

£ ☐

Q.31 **What is the most important factor that would improve your travel experience?**

____

Finally, for comparative purposes, some questions about yourself.

Q.32 Sex (Circle number)

1 Male
2 Female

Q.33 Age (Circle number)

1 16-24
2 25-34
3 35-44
4 45-54
5 55-64
6 65+

Q.34 Which of these phrases best describes your current working status? (Circle number)

1 Full-time
2 Part-time
3 Houseperson
4 Retired
5 Registered Unemployed
6 Unemployed not registered
7 On a training scheme
8 Voluntary work
9 Student
10 Other

Q.35 **Which is the highest level of education that you have completed? (Circle number)**

1 O Grade, Standard Grade, GCSE, or Equivalent
2 Higher Grade CSYS, 'A' Level, or Equivalent
3 GSVQ Level 1 OR 2, Scotvec, BTEC, City and Guilds Craft, RSA Diploma or Equivalent
4 GSVQ Level 3, ONC, OND, or Equivalent
5 HNC, HND, SVQ Level 4 or 5, RSA Higher Diploma or Equivalent
6 First Degree, Higher Degree
7 Professional Qualifications (e.g. Teaching, Accountancy)
8 None of the above

Q.36 **Which of these describes your current type of accommodation? (Circle number)**

1 House or bungalow
2 Flat/maisonette
3 Other

Q.37 **What is your current housing tenure? (Circle number)**

1 Own outright
2 Buying on mortgage
3 Rented from the council/housing association
4 Rented from private landlord
5 Other

Q.38 **How many people are there in your household? (Circle number)**

1 One
2 Two
3 Three
4 Four
5 Five or more

Q.49 **How many of these are children/dependents under the age of 16? (Circle number)**

1 None
2 One
3 Two
4 Three
5 Four or more

THE END – Thank you

IMPLEMENTATION - SURVEY INFORMATION SHEET

Public Transport and Quality of Life

Aims

The aim of this research is to understand more about people's experiences when they travel on public transport. This questionnaire forms part of a research project exploring the concept and measurement of transport quality of life. The research objectives are to produce a measurement tool which will act as an alternative to cost-benefit analysis. Quality of life is a complex term but gathering information from individuals in Glasgow and Manchester makes it possible to understand what issues are important when travelling by public transport. The data from the surveys will then be evaluated to illustrate the experience of transport quality of life on bus, train and subway/tram in the two cities.

This will help public policy makers, transport operators and city council bodies comprehend which transport modes enhance individuals' quality of life and so decide where best to invest additional money.

Publications

The research results will form part of my PhD submission and may also be reported in academic and published papers. However the results that will be reported will not contain any individual information from the questionnaire. You may be assured of complete confidentiality and anonymity.

The questionnaire has an identification number for mailing purposes only. This is so that we may check your name off the mailing list when your questionnaire is returned. Your name and the information received will not be passed on to any other parties.

Contact Information

The research is being conducted in accordance with the University of Glasgow ethics committee, details of which can be seen at the following webpage:
www.gla.ac.uk/businessandmanagement/content/research/ethics/ethics.htm.
If you would like a copy of the Principles of Ethical Research policy please contact me and I will send you on a copy.

If you wish to verify any details of this research please contact me using the information at the bottom of the page. To confirm my credentials please contact Dr Iain Docherty. His telephone number is 0141 330 3668.

Andrew Carse
Tuesday, July 17, 2007

Tel: 0141 330 2000 (extension 0273)
Email: A.carse.1@research.gla.ac.uk
Contact Address: Room 404
Department of Management
Gilbert Scott Building
University of Glasgow
GLASGOW, G12 8QQ

IMPLEMENTATION – RESULTS REQUEST FORM

COPY OF RESULTS REQUEST FORM

If you would like a copy of the results please enter your name and address and return this form with your completed questionnaire. You are assured that your personal details will not be passed on to any other parties.

Name: ______________________________

Address: ______________________________

____

____

Postcode: ______________________________

☐ If you are able to attend an informal discussion session on transport held in Glasgow/Manchester in a couple of months then please tick the box. Your time and travel costs will be compensated.

APPENDIX B

STUDY LOCATIONS

The key criterion for selecting the case study cities was the need to have three principal public transport modes in operation – bus, train and metro or light-rail – and to contain key transport corridors served by one or more of these modes. This reduced the search to a small number of cities: Glasgow, Sheffield, Manchester, Nottingham, Birmingham, Croydon and Dublin (Ireland). The search of cities is limited to within the British Isles. This is due to project cost limitations, data availability and culture. While comparison of TQoL across different countries would be a valuable experiment this project is purely a design process to test the reliability of the method. There are many complications that could occur through cross-country research. Language and culture differences require a lot more time and attention to ensure that the results gathered are not affected. As de Vaus (2008) has observed cultural variations within a country may even be greater than those between nations, while cross-country differences may simply be a statistical artefact.

Glasgow was chosen for the first city for it is a very important city in public transport terms, with a strong history of public transport patronage and relatively low car dependency. The local authority has the highest percentage of households without a car outside London. Public transport is central to the daily activities of Glasgow's residents. Understanding TQoL on three different modes of transport includes the performance of Light-Rail Transit (LRT). There is no LRT system in Glasgow, but it does have the subway. This is a small underground network where fifteen stations serve the centre and west-end of the city. Under DfT's classification – it is a metro with passenger statistics measures together with LRT networks.

Following the selection of Glasgow it was necessary to chose another city that displays similar characteristics. The first city dismissed was Croydon because it is not being a large metropolitan centre. It is a commuting centre - one of the constituencies of the Greater London Authority. The first stage of selecting a second city is to compare key statistics against Glasgow.

THE SECOND CITY

The most appropriate means of comparing cities against Glasgow was to look at transport and demographic statistics. Travel to work data illustrates similar transport behaviour and population, social condition and economic development presents accurate structural comparison. The data compared was mainly from the 2001 UK census and European Urban Audit programme. This provided the most updated information possible on individual cities. For all tables except aspects of labour force and benefit payments the data was only for 2001. Labour force and benefit payment data was continuous from 2000-2005 and analysed through t-tests. This provided an accurate comparison of the differences between Glasgow and the second city. Although this was the preferred method to examine two separate samples continuous data was not accessible for the other characteristics.

Cities needed to contain a substantial train network, metro reliance and a lower scale of car use by transit and percentage of households without a car. Data on the mode of travel to work was compared against the patterns found in Glasgow (Table B.1). Glasgow has a long history of high use of public transport, and car ownership and travel was lower than all other cities in the UK, except London. There are also many other local characteristics that contribute to different transport behaviour, including transport operators, location of employment and services and housing locations. Despite this the city that is selected will contain closely related transport behaviour.

Dublin was excluded from the evaluation stages first for practical reasons. Although the international comparison would be beneficial, access to data may be very difficult and could affect the overall accessibility of TQoL. Financial restrictions also pose a problem and it was more useful to test the methodological structure of the research tool in UK cities before looking to those outside the UK.

The first factor in Table B.1 compared is population and people in employment. Whilst the size of the population was not the most important

Table B.1 Travel to work statistics for selected cities

Source: Adapted from 2001 census (ONS, 2001b; Scrol, 2001f; Central Statistics Office Ireland 2002)

City	Total Pop.	All people aged 16-74	All people aged 16-74 in employment	%	Underground, metro, light rail or tram	%	Train	%	Bus, minibus or coach	%	Driving a car or van	%	% of households No car or van
Glasgow	585,090	430,967	255,481	59	9,404	3.7	17,182	6.2	74,847	29.3	90,797	35.4	56.2
Birmingham	977,087	680,059	367,141	54	818	0.2	9,289	2.5	73,658	20.0	212,859	51.8	38.5
Sheffield	513,234	374,143	218,493	58	6,104	2.8	1,613	0.7	38,801	17.8	114,397	52.4	35.7
Manchester	392,819	284,994	142,449	50	1,792	1.3	1,924	1.4	31,599	22.2	64,769	45.4	47.8
Nottingham	266,988	195,788	101,697	52	73.6m[1]	-	693	0.7	21,758	21.4	45,407	44.7	44.9
Newcastle	259,536	191,158	101,498	53	5,591	5.5	950	0.9	19,136	19.0	46,561	45.9	45.2
Dublin	495,781	408,426[2]	291,509	60	16,452,856[3]	-	17,236	5.9	68,789	23.6	203,973	70.0	41.7

1 Total Patronage in six months up to end of 2005
2 Total aged 15 and over
3 Total Patronage in first year- 2005

Table B.2 Demographic comparisons

Source: (Urban Audit 2004)

City	Demographic Dependency Index	UK Rank	Total annual population change over 5 years	UK Rank	Pop. Density – total resident per km^2	UK Rank
Glasgow	61.48	23	-0.18	22	3301	9
Birmingham	74.74	4	0.17	13	3703	3
Sheffield	67.55	13	0.02	20	1391	23
Manchester	60.77	24	2.21	1	3767	2
Newcastle	64.97	18	0.40	9	2343	19
Nottingham	62.72	22	-		3668	4
UK Average	66.34		0.35		2441	

Table B.3 Housing comparisons

Source: (Urban Audit 2004)

	Average price per m2 for a house (euros)	Rank	Proportion of households: social housing	Rank	Proportion of households: lone-parent households	Rank
Glasgow	2034.00	18	39.21*	-	10.01	8
Birmingham	2261.00	11	27.67	10	11.82	3
Sheffield	2103.00	15	30.28	8	7.33	21
Manchester	2127.00	14	38.51	1	13.69	1
Newcastle	2230.00	13	33.12	3	8.86	14
Nottingham	1921.00	22	33.30	2	11.80	4
UK Average	2209.83				9.08	

* 2001 data

Table B.4 Other comparisons

Source: (Urban Audit 2004)

	Total number of recorded crimes per 1,000 pop[1]	Rank	Proportion of resident working pop. qualified at ISCED level 5-6	Rank	Annual average concentration of PM10	Rank
Glasgow	147.38	1	0.23	6	20.14	14
Birmingham	72.27	8	0.18	14	22.30	10
Sheffield	44.95	18	0.20	10	21.62	12
Manchester	105.51	5	0.17	16	24.63	4
Newcastle	43.75	20	0.19	11	17.40	21
Nottingham	115.78[2]	-	0.17	17	22.47	8
UK Average	66.20		0.17		21.30	

1 2001
2 07/08

consideration the percentage of people in employment does provide a brief introduction into the employment characteristics. Although Sheffield was the most comparable in size and people in employment the transport behaviour is not ideally suited to Glasgow. Birmingham had a much larger population but did not automatically mean that is it excluded on population alone. This is the same for Newcastle, Manchester and Nottingham, which had much smaller populations. The figures in employment were all very similar.

Manchester, Nottingham and Newcastle contained the most similar transport characteristics, due to LRT, Bus and car use. LRT patronage is closely related in Newcastle. As the tram network in Nottingham was only introduced in 2004, there is not statistics available for the percentage of people using this mode to travel to work. Since it has been in operation it has been very popular, with overall satisfaction increasing to 75% from 2006 and 2007 (NET, 2008). In Manchester, LRT is a very important public transport mode. Although the percentage of users in Manchester city is only 1%, it serves the wider Greater Manchester to Salford, Trafford and Bury. There was almost thirty percent of the working population travelling by bus in Glasgow, and the closest city is Manchester as it has the next highest percentage. This was the same for driving by car. Only 36% of workers travel by driving a car. This was the lowest percentage are outside London. Manchester, Nottingham and Newcastle are closest, with remaining areas containing over 50%. The final statistic presented further information on the transport characteristics of the cities. Percentage of households without a car shows how much public transport plays in everyday life. If there is a high percentage car use is not essential and public transport can support travel for the majority of its citizens. In Glasgow over half of the population resided in properties that do not own a car. The closest city was Manchester, with 47%, although both Nottingham and Newcastle also contained over 40% of households with no car.

Although transport characteristics were important it was difficult to select a second city based on these results alone. It was necessary to compare demographic, economic, housing and social composition of each city. Using only the travel to work data the closest cities were Nottingham, Newcastle and Manchester.

There were three different issues in the demographic comparison (Table B.2). The demographic index shows how dependent the vulnerable age groups of the city are on the working population. It is calculated through the following formula: (< 20 years + > 65 years) / 20-64 years. In each table there is a column UK rank, which was where the city in placed in 25 largest urban areas studied in the Urban Audit research programme. The dependency index showed Birmingham to be the most dependent city in the United Kingdom. Glasgow was rated as 23, at a level below the UK average. The most comparable cities to Glasgow were Manchester and Nottingham. Total annual population change over the past 5 years in Glasgow had been declining by 0.18, and this was well below the average, and the only city close to this was Sheffield. The data was not available for Nottingham. Glasgow is a heavily densely populated city and the closet city was Nottingham. Overall in terms of the demographic comparison the closet related cities were Nottingham and Manchester.

The housing comparison looked at difference in average house price per m^2, and the proportion of households living in social and lone-parent households (Table B.3). All cities contained similar level of house prices, with only €340 separating all six cities.

The closest figure to Glasgow was Nottingham and Sheffield. Although not the most useful indicator in the current economic climate it did allow for effect comparison. Only 2001 data was available for the Glasgow's proportion of households living in social housing. Comparing this to the 2004 data Manchester was the closest city. The cities with the most similar proportion of lone-parent households were Newcastle and Nottingham.

The other comparisons include a selection of variables from crime, education and the environment (Table B.4). Glasgow was the city with the most recorded crimes per 1,000 population in the UK and Manchester was the next city. Birmingham's rate was more than half that of Glasgow, and Newcastle and Sheffield's was even lower. Whilst there was no data available by urban audit, figures Gibbs and Haldenby (2006) report that in 2005 the crime rate was 104.82. Along with Manchester it was the closest related. There was not much difference in education attainment between all the cities. Using the

International Standard Classification of Education (ISCED) level 5-6 Glasgow was ranked 6th, the closest city was Sheffield. There is no clear second city in this comparison as only 0.03 was separating all other cities. There was a similar result for the annual average concentration of PM10. Glasgow's concentration was 20.14$\mu g/m^3$ and there was only 7.23$\mu g/m^3$ difference between all of the cities.

The next part of the analysis covered two aspects in more detail, employment and social benefit payments. These were examined to gather a better comparison of the economic and social condition of the city. This was the only data available that would allow t-test assessment. T-test's identifies whether there is any significant difference between two samples. The hypothesis for this t-test was that there is a significant difference between the two samples. As it was the intention to identify cities with similar employment and benefit payment characteristics, the aim was to find cities where the hypothesis could be disproved.

The data compared in the t-tests for employment was employment and unemployment rates, economic activity and inactivity rates, and the percentage of full-time, part-time and self-employed workers from 2000-2005. The rates for Glasgow were compared against each of the other cities with t-tests reporting if there is any significant difference between the cities. Prior to the t-test calculations the Levene's test identified whether there was equal variance between the samples. This led to a t-test for equal variance assumed or t-test for equal variance not assumed. The appropriate t-test was conducted according to the Levene's test results. The t-statistic and significant level were presented (Table B.5). If the significance level was ≥ 0.05 it is possible to reject the null hypothesis, that there were significant differences between the samples. The comparisons with no significant differences between the samples are highlighted in red.

The only city with a significant difference on employment rate was Sheffield. All the other locations have a significance level 0.05, meaning they were closely related to Glasgow. This was the same for the unemployment rate. For

Table B.5 Detailed employment comparisons - t-test results

		GLA-BIRM	GLA-SHEF	GLA-MAN	GLA-NEW	GLA-NOTT
EMPLOYMENT RATE	F	2.70	5.50	5.30	1.11	2.25
	P (Sig. one-tailed)	0.18	0.06	0.07	0.46	0.23
	t Stat	-1.33	-6.49	0.85	-1.50	-0.99
	P (Sig. two-tailed)	**0.22**	0.00	**0.42**	**0.17**	**0.36**
UNEMPLOYMENT RATE	F	2.01	8.00	1.93	0.67	3.54
	P (Sig. one-tailed)	0.26	0.03	0.27	0.35	0.12
	t Stat	-0.15	3.55	0.62	0.88	1.31
	P (Sig. two-tailed)	**0.88**	0.01	**0.55**	**0.40**	**0.23**
ECONOMIC ACTIVITY RATE	F	2.31	1.84	5.16	0.67	0.94
	P (Sig. one-tailed)	0.22	0.28	0.07	0.35	0.48
	t Stat	-2.66	-7.96	1.78	-1.88	-0.54
	P (Sig. two-tailed)	0.03	0.00	**0.11**	**0.09**	**0.60**
ECONOMIC INACTIVITY RATE	F	2.31	1.84	5.16	0.67	0.94
	P (Sig. one-tailed)	0.22	0.28	0.07	0.35	0.48
	t Stat	2.66	7.96	-1.78	1.88	0.54
	P (Sig. two-tailed)	0.03	0.00	**0.11**	**0.09**	**0.60**
% OF FULL-TIME WORKERS	F	0.69	2.61	0.27	0.21	0.11
	P (Sig. one-tailed)	0.37	0.19	0.12	0.08	0.03
	t Stat	0.99	8.29	0.12	2.58	2.52
	P (Sig. two-tailed)	**0.35**	0.00	**0.91**	0.04	0.03
% OF PART-TIME WORKERS	F	0.68	2.32	0.25	0.20	0.10
	P (Sig. one-tailed)	0.36	0.22	0.10	0.07	0.02
	t Stat	-1.01	-8.36	-0.09	-2.61	-2.56
	P (Sig. two-tailed)	**0.33**	0.00	**0.93**	0.03	0.03
% SELF-EMPLOYED	F	0.07	0.15	0.07	0.04	0.02
	P (Sig. one-tailed)	0.01	0.05	0.01	0.00	0.00
	t Stat	-4.46	-5.36	-4.33	-3.22	-2.01
	P (Sig. two-tailed)	0.00	0.00	0.00	0.01	**0.07**

Table B.6 Detailed benefit payment comparisons – t-test results

		GLA-BIRM	GLA-SHEF	GLA-MAN	GLA-NEW	GLA-NOTT
INCAPACITY BENEFIT	F	13.85	198.69	2.43	1.93	4.44
	P (Sig. one-tailed)	0.01	0.00	0.21	0.27	0.09
	t Stat	24.52	29.29	10.52	16.56	21.89
	P (Sig. two-tailed)	0.00	0.00	0.00	0.00	0.00
LONG TERM IB	F	39.96	18.80	3.59	2.47	7.72
	P (Sig. one-tailed)	0.00	0.01	0.12	0.20	0.04
	t Stat	16.30	16.49	9.79	9.65	14.43
	P (Sig. two-tailed)	0.00	0.00	0.00	0.00	0.00
INCOME SUPPORT	F	1.62	2.15	1.40	1.71	2.04
	P (Sig. one-tailed)	0.33	0.24	0.38	0.31	0.25
	t Stat	2.23	3.69	0.68	2.51	2.51
	P (Sig. two-tailed)	**0.05**	0.01	**0.51**	0.03	0.03
JOB SEEKERS	F	1.94	0.50	0.37	0.47	0.57
	P (Sig. one-tailed)	0.27	0.26	0.18	0.24	0.30
	t Stat	-1.93	3.59	0.87	2.25	1.20
	P (Sig. two-tailed)	**0.09**	0.00	**0.41**	**0.05**	**0.26**

Table B.9 Summary of comparison findings

		GLA-BIRM	GLA-SHEF	GLA-MAN	GLA-NEW	GLA-NOTT
TRANSPORT	LRT		X		x	
	Train	x				
	Bus			x		x
	Driving by car			**x**	x	x
	% households no car			**x**	x	x
DEMOGRAPHY	Pop. Size		x			
	DDI			x		x
	Pop. Change		x			
	Pop. Density					x
HOUSING	Ave. house price		x			x
	Prop. social housing			x		
	Prop. lone parent				x	x
OTHER	Tot. recorded crime			x		x
	Prop. work pop. level 5-6	x	x	x	x	x
	Annual ave. PM10	x	x	x	x	x
INITIAL EMPLOYMENT	Employ. rate	x				x
	Unemploy. Rate			x	x	
	Econ. activity rate					x
	PTE			x		
	FTE				x	x
	Self-employ			x		x
	Unemploy.	x				x
	Student		x		x	
	Econ inactivity rate	x				x
	Retired	x				
	Look after home			x		x
	Perm sick/disabled			x		
INITIAL BENEFIT PAYMENT	IB			x		
	IB Long			x		
	IS			x		
	JSA		x			
DETAILED EMPLOYMENT	Employ. rate	x		x	x	x
	Unemploy. rate	x		X	x	x
	Econ act. rate			X		x
	Econ inact. rate			X	x	x
	% FTE			x	x	
	% PTE			x	x	
	% Self-employ					x
DETAILED BENEFIT PAYMENT	IB					
	IB Long					
	IS	x		x		
	JSA	x		x	x	x
TOTAL		11	8	24	14	23

the economic activity rate only Manchester and Nottingham had a significance level above 0.05. There were three cities with no significant difference for economic inactivity rate Manchester, Newcastle and Nottingham. For the percentage of full time workers only Manchester and Newcastle had no significant difference. The same two cities also reported no significant difference for part-time workers. In the final variable only Nottingham had no significant difference. Manchester and Nottingham are the most similar cities for the employment statistics. On all but one of the variables Manchester contained no significant difference compared to Glasgow.

The benefit payment t-test results did not show a clear difference between these two cities and the remaining four cities (Table B.6). On the first two variables, there was no city that had significantly similar levels. For income support Birmingham and Manchester contained no significant differencecompared to Glasgow, and for job seekers allowance Birmingham, Manchester, Newcastle and Nottingham reported no significant difference.

These t-tests provided detailed comparison of the economic and social condition of the city. To determine which city was most closely related to Glasgow for all of these variables a summary table showed how many times each city had characteristics similar to Glasgow (Table B.7). Whilst there was many cases where each city does contained similar characteristics to Glasgow, Manchester and Nottingham are most comparable. Of the 26 different issues compared Manchester and Nottingham both contained 16 similar levels. To decide between the two cities it was appropriate to look closely at the transport patterns within each city to decide which was best to assess transport quality of life.

The second city needed to have a good public transport system where car travel does not overwhelmingly dominate travel patterns. In both cities travel to work by driving a car only represents 45% of total journeys. A major point to contend with was the recent introduction of light rail to Nottingham. This has been in operation since 2004 and there was not enough statistics to select appropriate corridors and assess objective TQoL. There are possible problems for both cities for the selection of train corridors that could be compared to Glasgow. In Manchester and Nottingham the percentage of commuter travelling by train was low, only 1.4% in Manchester and 0.7% in Nottingham. The corridor areas needed to be locations with high patronage on each mode and this may not be possible when only 693 people travelled by train in the whole of Nottingham (ONS, 2001b). In Glasgow 17,182 people used the train to travel to work. In Manchester it was be possible to select a corridor because for Greater

Manchester 18,418 people travelled by train. In Nottinghamshire the figure was only 2,849. This was the whole of the region and there was no urban centre with more than 700 people travelling to work by train.

City structure was also important. Glasgow is dominated by a central city, but surrounded by important towns that are both independent centres and commuting towns. From these locations many people travel into Glasgow each day for their work. It is a mini-region, supporting the employment, social and development needs of more than just the central city. Manchester has the same structure with the central city supporting the needs of the Greater Manchester. In Greater Manchester there are 10 metropolitan boroughs, which contain individual town centres. These are locations for many commuters working in Manchester city centre. The structure of Nottingham is different. It is one of three major cities in East Midlands - a wider region incorporating Derbyshire, Leicestershire and Nottinghamshire. The region covers 4 million people and 15,627 km^2. It could be argued that as a region Nottinghamshire could have been compared to Glasgow, however the county only has a population of just over 825,000 people, which is much smaller than greater Glasgow's population of 1,747,100 (Urban Audit 2004). There is no clear distinctive urban centres, and if East Midlands was used the size of the areas becomes too large for the purpose of this study.

Considering the transport behaviour and structure, and the previous comparisons, Manchester was selected as the second. It was never going to be possible to select two cities that are identically matched. Despite this implementation in Glasgow and Manchester will be a good test of the reliability for the TQoL model. The fact that the results from the assessment may not vary immensely is not important. The output of the models is not the objective of the thesis. It is to test whether the methodology can effective measure transport quality of life.

IDENTIFYING THE TRANSPORT CORRIDORS

In each city there will be three transport corridors where selected for the locations to assess TQoL. The first corridor has high patronage on the bus, the second high patronage on the train and the third high patronage on LRT. As previously highlighted the Subway will be used as the LRT system in Glasgow. The same criterion used for selecting the cities was used to identify the corridors. The modal corridors in Manchester needed to display similar characteristics to the same Glasgow modal corridors. This is also to test the reliability of the method. The bus corridor in Glasgow needed to contain similar characteristics as the bus corridor in Manchester. The same is repeated for the train and the LRT corridors.

Before the comparison is presented a number of points need to be raised. The first is that areas used for the corridor locations were not the same. This is due to the difference in size of the electoral wards in England and Scotland. As wards in England covers a larger population it was necessary to select three neighbouring wards in Glasgow and two in Manchester. The second issue is the change in electoral boundaries. In May 2002, the Boundary Committee for England recommended changes to the existing arrangements as they provided an unequal representation of electors in Bury, Manchester, Stockport, Tameside and Trafford (The Boundary Committee for England 2003e; 2003b; 2003d; 2003c; 2003a). These changes affected some of the wards assessed in the comparison. The data compared is from the 2001 census and a number of these wards have now changed due to the review conducted by The Boundary Committee for England. The changes were noted when introducing the wards used in the corridors. The last point is the change in characteristics compared. It was not possible to use the same variables analysed in the second city comparison. This data was only available at the city level. Despite this age, qualifications, economic activity and housing were still compared. T-tests were not analysed as this was non- continuous data.

BUS CORRIDORS

Prior to the comparison of potential Manchester corridors to the Glasgow corridors it is important to identify why the Glasgow corridor was selected. Wards with the highest percentage of people travelling to work or study by bus were identified and ranked in order (Table B.8). This provided three potential Glasgow corridors; Corridor 1 to the north of the city including Milton, Ashfield

Table B.8 Comparison of Potential Glasgow Bus Corridors - Travel to work Statistics

Source: (Scrol, 2001f)

	All People aged 16-74 in employment or studying	Work from home	Underground, metro or light rail	Train	Bus, minibus or coach	Driving a car or van	Passenger in a car or van	Motorcycle, scooter or moped	Bicycle	On foot
Glenwood	2400	5.04	0.71	2.13	**42.75**	28.25	8.71	0.46	0.38	9.96
Milton	2258	4.69	0.84	2.52	**38.04**	30.91	8.06	0.31	1.15	11.51
Queenslie	1774	5.41	0.34	3.27	**37.49**	28.47	8.51	0.39	0.62	12.97
Castlemilk	2856	4.20	0.74	2.17	**36.83**	36.59	6.90	0.25	0.63	10.4
Easterhouse	2401	5.12	0.71	4.00	**36.73**	30.11	7.75	0.25	0.46	12.91
Drumry	2126	5.03	0.80	3.90	**36.45**	28.32	7.53	0.38	0.56	15.48
Wallacewell	2606	4.87	0.73	2.00	**36.34**	30.12	9.25	0.50	0.61	13.09
Garthamlock	2603	4.46	0.38	1.84	**36.30**	36.34	8.80	0.38	0.31	9.22
Parkhead	2088	5.08	0.81	3.59	**36.25**	23.99	7.71	0.77	0.62	19.49
Carntyne	2550	4.08	1.37	4.71	**34.98**	32.63	7.61	0.43	0.78	11.96
Toryglen	2052	4.14	1.56	2.63	**34.31**	30.65	8.97	0.39	0.58	14.38
Barlanark	2213	4.56	0.41	7.64	**34.25**	28.65	8.27	0.27	0.50	13.15
Maryhill	2589	5.02	1.08	4.13	**34.22**	33.84	7.34	0.31	0.89	11.05
Braidfauld	2315	4.62	0.35	3.24	**34.17**	32.35	7.99	0.39	0.65	14.43
Summerhill	2157	6.21	0.32	8.39	**33.29**	28.79	7.74	0.14	0.79	11.68
Crookston	2832	4.20	0.78	1.84	**33.16**	38.81	7.80	0.32	0.88	10.52
Nitshill	2956	4.53	0.68	2.33	**32.71**	38.84	9.30	0.27	0.85	9.20
Bridgeton/Dalmarnock	1543	6.09	1.43	6.09	**32.60**	25.21	6.55	0.52	0.97	18.86
Wyndford	2776	4.86	3.39	2.38	**32.53**	27.77	5.48	0.29	2.20	19.16
Ashfield	2193	6.43	0.55	3.74	**32.01**	34.29	7.66	0.46	0.78	11.54
Gartcraig	2499	4.56	0.56	1.88	**31.97**	37.25	7.64	0.4	0.72	13.05
Keppochhill	2093	5.45	2.25	2.82	**31.92**	25.42	7.07	0.43	1.19	21.45
Cowlairs	3048	4.66	0.72	7.19	**31.63**	32.19	7.78	0.16	0.89	12.96
Springburn	2441	4.18	0.45	3.77	**31.54**	31.67	8.23	0.29	0.78	16.71
Royston	2492	8.15	1.65	3.89	**31.42**	21.39	5.74	0.28	1.61	22.95

Table B.9 Comparison of Potential Manchester Bus Corridors - Travel to work Statistics

Source: (ONS, 2001b)

	All People aged 16-74 in employment or studying	Work from home	Underground, metro or light rail	Train	Bus, minibus or coach	Driving a car or van	Passenger in a car or van	Motorcycle, scooter or moped	Bicycle	On foot
Moss Side	2,991	6.15	1.27	1.14	**34.74**	0.37	32.83	4.21	3.64	14.04

Rusholme	4,125	6.40	1.04	1.94	**32.51**	0.22	33.87	5.41	3.59	13.45
Longsight	4,436	6.85	1.44	1.22	**30.07**	0.32	35.75	6.04	3.49	13.17
Withington	5,807	6.51	0.65	2.03	**28.84**	0.43	44.48	4.60	3.25	8.40
Old Moat	6,063	6.47	0.45	1.07	**28.45**	0.49	43.48	5.01	3.38	10.08
Fallowfield	4,289	5.60	0.61	0.89	**27.54**	0.51	42.34	6.16	3.92	10.84
Gorton South	3,748	7.31	0.83	1.68	**26.07**	0.48	40.18	6.94	3.58	11.21
Barlow Moor	5,797	5.80	0.36	0.86	**24.81**	0.28	50.39	5.11	3.69	7.62
Levenshulme	5,224	7.01	0.59	3.02	**22.49**	0.50	45.56	7.06	3.31	9.00
Gorton North	4,768	5.83	0.40	2.03	**21.71**	0.76	46.98	7.51	2.92	10.55
Whalley Range	5,001	7.84	1.14	1.20	**21.30**	0.56	49.53	5.46	5.12	6.26
Droylsden West	5,064	6.64	0.32	0.51	**20.75**	0.77	52.73	7.62	1.78	7.94
Burnage	4,900	6.41	0.49	2.37	**20.59**	0.65	48.06	7.37	3.39	8.88
Chorlton	7,932	6.76	1.80	1.10	**20.18**	0.54	51.94	5.30	4.94	6.45
Droylsden East	5,774	7.17	0.00	0.48	**18.74**	1.02	54.38	6.84	1.68	8.83
Northenden	5,248	6.96	0.76	0.38	**17.63**	0.72	55.26	6.38	2.93	7.70
North Reddish	7,635	7.41	0.20	1.31	**16.36**	0.85	56.90	6.80	1.93	7.60
Didsbury	7,420	8.13	0.40	1.64	**15.97**	0.40	59.54	4.51	2.32	6.28
South Reddish	6,287	7.11	0.11	1.40	**15.65**	1.00	53.75	6.20	1.78	12.20
Audenshaw	6,094	7.66	0.26	1.21	**15.54**	0.92	55.81	6.27	1.90	9.83

Figure B.1 Glasgow's Bus Corridors
Source: (Glasgow City Council 2006)

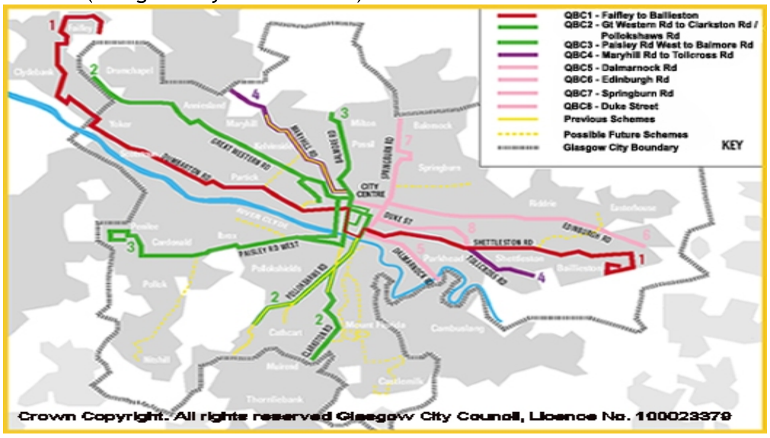


Figure B.2 Glasgow Bus corridor map

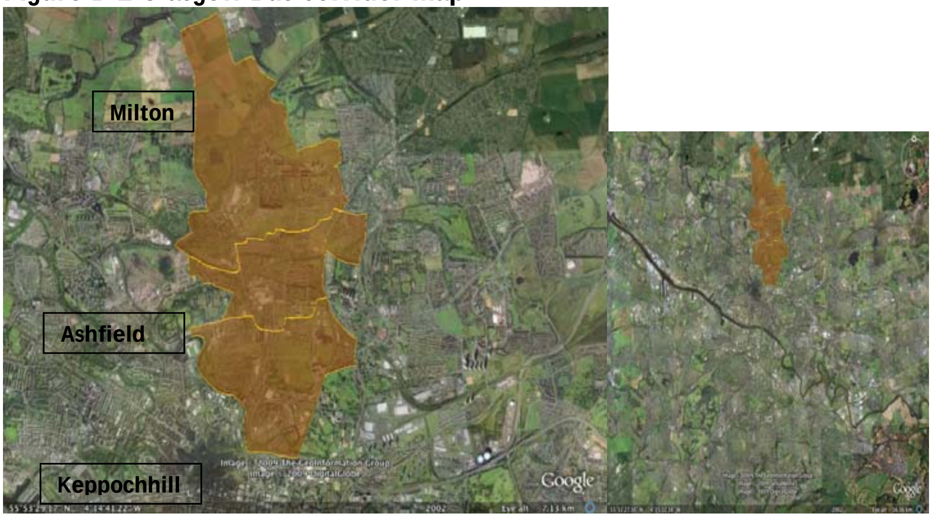


Figure B.3 Manchester Bus Corridor 1 - Old Moat and Chorlton Park

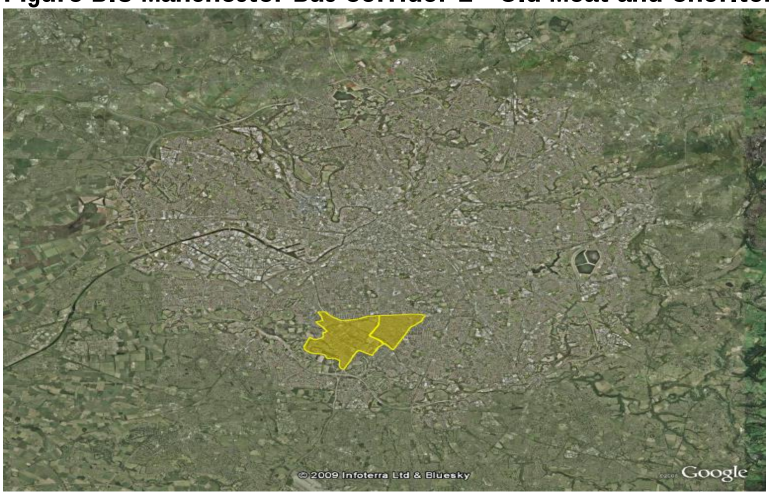


Figure B.4 Manchester Bus corridor 2 – Didsbury and Withington

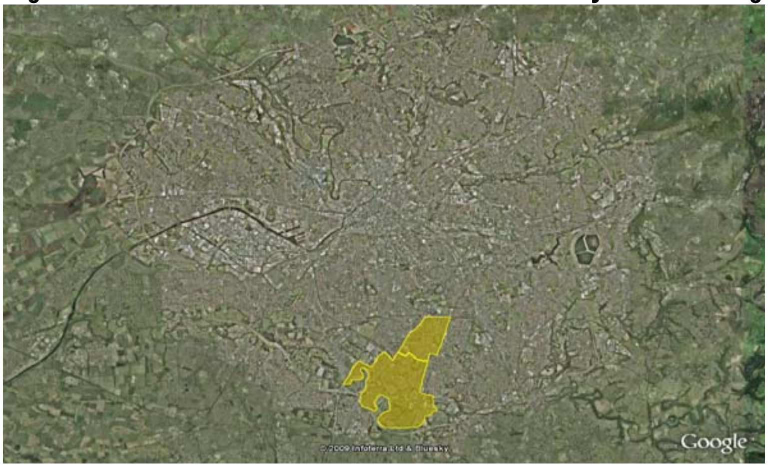


Figure B.5 Manchester Bus Corridor 3 – Droylsden East and Droylsden West

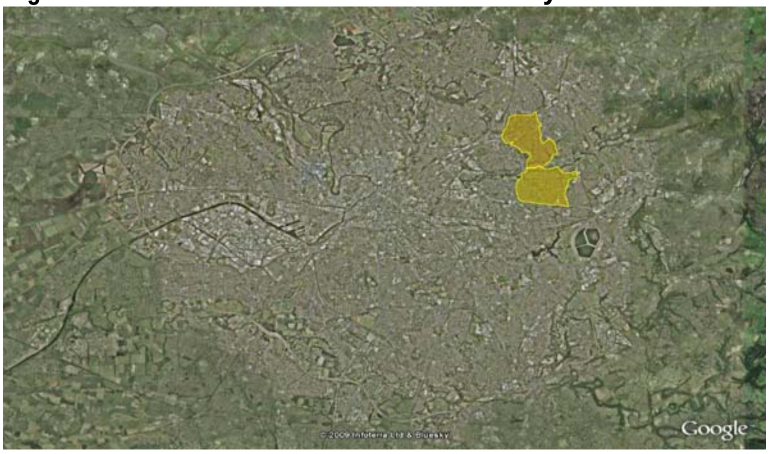


Figure B.6 Greater Manchester Quality bus corridors

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

and Keppochhill; Corridor 2 to the east of the city including Queenslie, Carntyre and Barlanark; and Corridor 3 to the far west of the city including Drumry and Summerhill. The wards needed to be located next to each other on a Quality Bus Corridor (QBC). There are currently 8 QBC's in Glasgow (Figure B.1). Corridor 1 is the northern section of QBC3, Corridor 2 is the eastern section of QBC1, and Corridor 3 is the western end of QBC1. While other QBC locations were considered they did not contain enough neighbouring wards with high percentage of bus commuters. It was difficult to decide between the corridors because they contained very similar percentages of people travelling by bus and driving by car. Corridor 1 was selected for having less people travelling by train and more people in total travelling by bus, 3,155 compared to 2,976 in Corridor 2 and 2,127 in Corridor 3. A map of Glasgow corridor is shown in Figure B.2.

There were three potential corridors in the Greater Manchester area (Table B.9). Corridor 1 was within Manchester authority to the south-southwest of the city including Old Moat and Chorlton Park (Figure B.3). Chorlton Park is a new ward that replaced Barlow Moor after the review by The Boundary Committee for England. This ward is almost exactly the same area as the previous arrangement so using the data for Barlow Moor in this comparison will not affect the results. Corridor 2 was also within the Manchester authority to the south of the city including the wards of Withington and Didsbury (Figure B.4). The ward of Didsbury was split into Didsbury East and Didsbury West following the review of electoral boundaries. These two new wards are the exact same area as Didsbury. Corridor 3 was to the east of Manchester with wards Droylsden West and Droylsden East within the borough of Tameside (Figure B.5). The three corridors were locations on Greater Manchester's Quality Bus Corridor programme (Figure B.6). Corridor 1 is located the Manchester-Northenden Major QBC, in Corridor 2 is the Manchester-East Didsbury major QBC and Corridor 3 is on the Manchester-Hyde and Stalybridge-Ashton-Manchester QBC.

Using the travel to work statistics the most alike corridor to Glasgow's bus corridor was Corridor 1 with 26.63% travelling to work by bus, compared to 22.41% in Corridor 2 and 19.75% in Corridor 3. In total more people travel by bus in Corridor 1 (3,163), compared to Corridor 2 (2,860) and Corridor 3 (2,133). In corridor 1 an average of 46.93% travelling by driving a car compared to 52.01 in Corridor 2 and 53.55% in Corridor 3. In the Glasgow corridor only 30% of commuters travelled by car so the lowest percentage is better. Corridor 1 was the closest related bus corridor to Glasgow.

Differences in the size of the wards in England and Scotland are highlighted in the age comparison. In total there were 20,720 people in the Glasgow bus corridor (Table B.10), and the closest corridor in Manchester is Corridor 3 (Table B.11). This still contains almost 3,00 more people, with the other corridors containing 7,000 more people. This is a factor of electoral boundary differences in England and Scotland. In the Glasgow bus corridor there was slightly more females than males, with a relatively equal range across all age groups, the largest group was 16-34. In Manchester, corridor 3 had the highest percentage of females and a more equal range of age groups.

In Glasgow 60.5% of the working age population had no qualifications, indicating a poor area of educational attainment (Table B.12). In all three Manchester corridors there was higher educational success (Table B.13). The most comparable area was Corridor 3 because it had the highest percentage of no qualifications (37.4%) and the lowest percentage of level 4/5 (8.5%). Although the level of no qualifications was almost half the amount in Glasgow it is even lower for the other corridors.

In the Glasgow bus corridor there was a higher rate of economic inactivity compared to economic activity (Table B.14). Full-time was the highest activity at 24.6% and there was a relatively high retired population. In the NC-Sec groupings only 9.5% are in any managerial position and the largest proportion of occupations were not classifiable. In all potential Manchester bus corridors there is a higher economic activity rate (Table B.15). Corridor 1 had the highest percentage of inactivity and the most comparable full-time workers. It is also had a large student population. Manchester University is very close to both Corridor 1 and 2, which is why there was more full-time students. Corridor 3 contained the highest retired population. This location also

Table B.10 Glasgow Bus corridor - Age ranges
Source: (Scrol, 2001c)

	ALL PEOPLE	Males	Females	0-15	16-34	35-49	50-59	60-64	65-84	85+
Ashfield	6,932	45.2	54.8	16.9	21.0	19.5	12.1	7.1	21.4	2.1
Keppochhill	6,604	46.3	53.7	21.3	28.2	20.8	10.9	5.3	12.1	1.4
Milton	7,184	45.0	55.0	20.9	22.7	19.5	12.0	6.0	16.8	2.0
	20,720	**45.5**	**54.5**	**19.7**	**24.0**	**19.9**	**11.7**	**6.1**	**16.8**	**1.8**

Table B.11 Comparison of Potential Manchester Bus corridors – Age Ranges
Source: (Nomis, 2001)

	ALL PEOPLE	Males	Females	0-15	16-34	35-49	50-59	60-64	65-84	85+
Old Moat	15,049	49.1	50.9	16.4	47.6	15.0	7.5	3.1	9.4	1.1
Barlow Moor	12,278	49.2	50.8	17.2	42.5	17.9	8.0	3.2	10.0	1.1
	27,327	**49.2**	**50.8**	**16.8**	**45.0**	**16.5**	**7.8**	**3.1**	**9.7**	**1.1**
Didsbury	13,958	49.1	50.9	17.4	32.4	20.8	10.6	4.0	13.0	1.9
Withington	14,041	49.7	50.3	13.8	51.4	14.3	7.1	3.0	9.1	1.4
	27,999	**49.4**	**50.6**	**15.6**	**41.9**	**17.5**	**8.8**	**3.5**	**11.0**	**1.7**
Droylsden East	12,322	48.2	51.8	21.5	24.1	22.6	12.2	4.9	13.1	1.6
Droylsden West	10,782	48.2	51.8	22.5	24.5	21.5	12.1	5.0	12.8	1.5
	23,104	**48.2**	**51.8**	**22.0**	**24.3**	**22.0**	**12.2**	**5.0**	**13.0**	**1.6**

Table B.12 Glasgow Bus corridor – Qualifications
Source: (Scrol, 2001d)

	ALL PEOPLE	No qualifications	Level 1	Level 2	Level 3	Level 4
Ashfield	5,078	62.3	19.9	8.3	4.0	5.6
Keppochhill	4,836	59.4	21.0	7.9	4.3	7.4
Milton	5,079	59.9	22.7	8.5	4.3	4.6
	14,993	**60.5**	**21.2**	**8.2**	**4.2**	**5.9**

Level 1: 'O' Grade, Standard Grade, Intermediate 1, Intermediate 2, City and Guilds Craft, SVQ level 1 or 2, or equivalent
Level 2: Higher Grade, CSYS, ONC, OND, City and Guilds Advanced Craft, RSA Advanced Diploma, SVQ level 3 or equivalent
Level 3: HND, HNC, RSA Higher Diploma, SVQ level 4 or 5, or equivalent
Level 4: First degree, Higher degree, Professional Qualification

Table B.13 Comparison of potential Manchester Bus corridors – Qualifications
Source: (Nomis, 2001)

	ALL PEOPLE	No qualifications	Level 1	Level 2	Level 3	Level 4/5	Other qualifications/ level unknown
Old Moat	11,991	22.1	7.6	10.8	24.2	31.7	3.6

Barlow Moor	9,971	22.6	9.8	11.7	12.3	39.8	3.8
	21,962	**22.4**	**8.7**	**11.3**	**18.2**	**35.7**	**3.7**
Didsbury	10,757	14.9	8.1	13.8	10.1	49.9	3.3
Withington	11,383	16.5	6.7	10.8	30.3	32.9	2.7
	22,140	**15.7**	**7.4**	**12.3**	**20.2**	**41.4**	**3.0**
Droylsden East	8,858	37.2	20.2	20.0	5.8	9.3	7.6
Droylsden West	7,678	37.7	20.9	19.9	5.7	7.7	8.1
	16,536	**37.4**	**20.5**	**20.0**	**5.8**	**8.5**	**7.8**

Table B.14 Glasgow Bus corridor - Economic activity

Source: (Scrol, 2001a; Scrol, 2001e)

	Total economically active	Total economically inactive	Part-time	Full-time	Unemployed	Full-time students	Retired	Looking after home/family	Permanently sick/disabled	Other
Ashfield	41.8	58.2	7.7	24.5	6.1	4.7	19.4	7.5	19.6	10.7
Keppochhill	43.6	56.4	8.3	24.1	7.9	5.5	10.5	10.7	19.9	13.2
Milton	44.1	55.9	8.5	25.3	6.7	4.9	16.4	9.5	17.9	10.9
	43.2	**56.8**	**8.1**	**24.6**	**6.9**	**5.0**	**15.4**	**9.2**	**19.1**	**11.6**

	Higher managerial and professional occupations	Lower managerial and professional occupations	Intermediate occupations	Small employers and own account workers	Lower supervisory and technical occupations	Semi-routine occupations	Routine occupations	Never worked	Not classifiabl
Ashfield	2.03	7.72	6.14	2.32	6.2	12.11	12.19	9.61	34.9
Keppochhill	2.92	7.63	5.56	1.57	5.48	14.68	13.65	11.75	28.1
Milton	1.42	6.81	7.15	2.32	6.64	14.92	13.11	8.11	32.3
	2.1	**7.4**	**6.3**	**2.1**	**6.1**	**13.9**	**13.0**	**9.8**	**39.**

Table B.15 Comparison of Potential Manchester Bus Corridors – Economic Activity

Source: (Nomis, 2001)

	Total economically active	Total economically inactive	Part-time	Full-time	Unemployed	Full-time students	Retired	Looking after home/family	Permanently sick/disabled	Other
Old Moat	55.5	44.5	7.8	36.6	4.0	29.2	7.6	4.9	6.3	3.5
Barlow Moor	63.8	36.2	8.7	45.8	4.7	16.3	7.9	5.3	7.9	3.4
	59.6	**40.4**	**8.2**	**41.2**	**4.4**	**22.8**	**7.7**	**5.1**	**7.1**	**3.5**
Didsbury	72.1	27.9	10.8	54.9	2.5	10.7	11.0	3.8	3.9	2.3
Withington	55.4	44.6	7.9	35.1	3.1	36.3	7.0	3.7	4.3	2.5
	63.8	**36.2**	**9.4**	**45.0**	**2.8**	**23.5**	**9.0**	**3.8**	**4.1**	**2.4**

Droylsden East	68.2	31.8	12.9	50.6	2.7	5.0	13.4	5.3	7.4	2.7
Droylsden West	69.2	30.8	13.6	50.4	3.1	4.7	13.3	4.8	7.4	2.6
	68.7	**31.3**	**13.2**	**50.5**	**2.9**	**4.8**	**13.4**	**5.1**	**7.4**	**2.7**

	Higher managerial and professional occupations	Lower managerial and professional occupations	Intermediate occupations	Small employers and own account workers	Lower supervisory and technical occupations	Semi-routine occupations	Routine occupations	Never worked	Not classifiabl
Old Moat	11.2	14.7	6.7	3.2	3.9	6.9	6.1	5.5	41.
Barlow Moor	14.4	19.2	8.1	3.6	4.5	8.1	6.0	6.3	29.
	12.8	**17.0**	**7.4**	**3.4**	**4.2**	**7.5**	**6.0**	**5.9**	**35.**
Didsbury	22.2	25.4	8.3	5.3	3.3	5.0	3.4	3.0	24.
Withington	10.8	14.9	7.1	3.6	3.4	5.9	4.4	4.1	45.
	16.5	**20.1**	**7.7**	**4.5**	**3.3**	**5.5**	**3.9**	**3.5**	**35.**
Droylsden East	4.5	15.2	12.1	6.1	9.9	14.4	11.9	2.7	23.
Droylsden West	4.1	13.8	12.1	5.7	11.0	15.5	12.5	2.5	22.
	4.3	**14.5**	**12.1**	**5.9**	**10.5**	**15.0**	**12.2**	**2.6**	**22.**

Table B.16 Glasgow Bus Corridor – Housing

Source: (Scrol, 2001g; Scrol, 2001b)

	All Households	Detached house	Semi-detached house	Terraced house	Flat, maisonette or apartment	Caravan or temporary structure	Owned	Social rented	Private rented	Living rent free
Ashfield	3,258	3.9	26.1	18.9	51.0	0.1	38.3	54.5	1.4	5.9
Keppochhill	3,348	1.2	6.4	6.4	85.5	0.6	16.7	74.0	3.5	5.8
Milton	3,282	1.9	19.3	27.0	51.8	0.0	32.7	58.4	1.7	7.2
	9,888	**2.3**	**17.2**	**17.4**	**62.8**	**0.2**	**29.2**	**62.3**	**2.2**	**6.3**

	No car or van Households	1 car or van Households	2 cars or vans Households	3 cars or vans Households	4 or more Households	All cars or vans in the area
Ashfield	66.1	28.1	5.1	0.5	0.2	1,335
Keppochhill	76.2	21.0	2.5	0.2	0.1	904
Milton	68.2	27.5	3.8	0.4	0.2	1,208
	70.1	**25.5**	**3.8**	**0.4**	**0.1**	**1,149**

Table B.17 Comparison of Potential Manchester Bus Corridors – Housing
Source: (Nomis, 2001)

	All Households	Detached house	Semi-detached house	Terraced house	Flat, maisonette or apartment	Caravan or temporary structure	Owned	Social rented	Private rented or living rent free
Old Moat	6,246	3.4	38.8	24.1	33.7	0.0	35.7	32.7	31.5
Barlow Moor	5,862	4.0	31.5	21.7	42.8	0.0	35.6	33.7	30.9
	12,108	**3.7**	**35.1**	**22.9**	**38.2**	**0.0**	**35.6**	**33.3**	**31.2**
Didsbury	6,234	8.8	48.9	16.7	25.5	0.1	69.5	9.6	20.7
Withington	5,612	3.3	45.9	20.3	30.5	0.0	45.0	21.6	33.7
	11,846	**6.1**	**47.4**	**18.5**	**28.0**	**0.0**	**57.3**	**15.6**	**27.2**
Droylsden East	5,265	12.3	41.7	32.5	13.6	0.0	73.0	15.9	11.2
Droylsden West	4,409	5.3	65.2	21.2	8.3	0.0	78.6	10.1	11.3
	9,674	**8.8**	**53.5**	**26.8**	**10.9**	**0.0**	**75.8**	**13.0**	**11.3**

	No car or van Households	1 car or van Households	2 cars or vans Households	3 cars or vans Households	4 or more Households
Old Moat	41.5	41.3	13.4	2.6	1.3
Barlow Moor	40.5	42.8	13.9	2.0	0.8
	41.0	**42.1**	**13.7**	**2.3**	**1.0**
Didsbury	22.9	46.6	25.7	3.6	1.2
Withington	38.5	41.4	16.3	2.7	1.1
	30.7	**44.0**	**21.0**	**3.1**	**1.1**
Droylsden East	34.6	44.5	17.7	2.7	0.5
Droylsden West	32.1	48.6	16.7	2.4	0.3
	33.4	**46.5**	**17.2**	**2.5**	**0.4**

contained the lowest percentage of managerial occupations. Corridors 1 and 2 had more comparable not classifiable percentages.

Locating corridors with similar housing type in Glasgow and Manchester was difficult because Glasgow has traditionally always had a higher concentration of flats. In England there are more semi-detached and terraced houses. In the Glasgow corridor 62.8% of all households were flat, maisonette or apartment (Table B.16). In Manchester the highest percentage of flats were found in Corridor 1 (Table B.17). In Corridor 2, 72.0% of all households were houses and this is higher in Corridor 3. The high number of houses socially rented in Glasgow once more indicated this corridor as a poor location. Only 29.2% of houses were owned. In Manchester 57.3% were owned in corridor 2 and 75.8% in corridor 3. Corridor 1 was the closest for tenure as it had the highest percentage of homes that were social rented and lowest owned. Households without a car were another indication of the reliance on public transport and the mobility patterns of the corridor. In the Glasgow ward over 70% of households did not own a car. There are very few areas in the UK that will have similar figures. The closet of the three corridors is Corridor 1. It had the highest percentage of households with no car (41.0) and the lowest number of 2 or more car households (17.0%).

It was very difficult to identify a corridor that displays similar characteristics to the Glasgow bus corridor. The bus corridor in Glasgow was a poor area, with high public transport use, poor educational attainment, high economic inactivity and social rented properties. Overall the closest area in Manchester was corridor 1. This had the highest percentage of people travelling to work or study by bus, and the lowest number of commuters travelling by car. It also contained the lowest economic inactivity and biggest proportion of households that are flats, socially rented and have the highest number of no cars.

TRAIN CORRIDORS

There were three possible locations identified for the Glasgow train corridor (Table B.18). Corridor 1 to the south of the city was on the eastern Cathcart circle line incorporating Battlefield, Mount Florida and Cathcart. Corridor 2 to

Table B.18 Comparison of Potential Glasgow Train Corridors – Travel to work Statistics
Source: (Scrol, 2001f)

	All People aged 16-74 in employment or studying	Work from home	Underground, metro or light rail	Train	Bus, minibus or coach	Driving a car or van	Passenger in a car or van	Motorcycle, scooter or moped	Bicycle	On foot
Garrowhill	4,891	3.64	0.37	**16.15**	9.28	54.45	8.24	0.29	0.33	5.68
Cathcart	4,032	4.71	0.60	**15.92**	15.63	46.06	5.41	0.35	0.74	9.23
Battlefield	3,959	5.08	0.96	**14.83**	22.35	36.73	5.00	0.18	1.57	12.43
Maxwell Park	3,660	8.66	4.40	**14.59**	7.54	50.22	5.90	0.46	0.82	5.85
Mount Florida	3,585	3.82	0.95	**13.86**	20.17	42.48	6.11	0.39	1.17	10.07
Greenfield	3,119	4.20	0.61	**12.50**	19.24	41.55	8.69	0.38	0.42	10.26
Strathbungo	4,188	5.90	2.51	**12.37**	27.24	30.75	5.16	0.38	1.55	12.75
Hyndland	4,833	6.62	9.48	**11.13**	5.98	36.44	3.12	0.33	1.86	23.75
Anniesland	3,718	4.09	1.29	**10.73**	24.72	38.76	5.70	0.32	1.18	11.81
Jordanhill	4,040	6.61	1.41	**10.59**	7.92	51.29	4.65	0.27	1.98	13.39
Pollokshaws	3,302	4.91	2.15	**10.15**	28.07	35.31	4.91	0.30	1.00	11.27
Victoria Park	3,647	4.55	4.14	**10.06**	19.96	41.49	4.74	0.25	1.86	11.65
Blairdardie	3,052	3.60	0.69	**9.90**	22.58	43.81	7.99	0.59	1.18	7.93
Hayburn	4,402	4.04	15.65	**9.81**	12.70	30.60	3.88	0.20	2.34	19.22
Pollokshields East	3,272	10.48	8.77	**9.78**	14.46	35.61	6.94	0.15	1.74	10.45
Knightswood South	2,529	4.39	0.40	**9.25**	23.92	41.83	6.64	0.63	1.07	10.32
Summerhill	2,157	6.21	0.32	**8.39**	33.29	28.79	7.74	0.14	0.79	11.68
Dennistoun	3,314	4.71	1.84	**7.97**	29.12	24.47	4.98	0.33	1.81	23.02
Tollcross Park	2,363	3.72	0.42	**7.74**	28.73	33.64	8.04	0.25	0.55	14.73
Barlanark	2,213	4.56	0.41	**7.64**	34.25	28.65	8.27	0.27	0.50	13.15

Figure B.7 Glasgow Train corridor Map

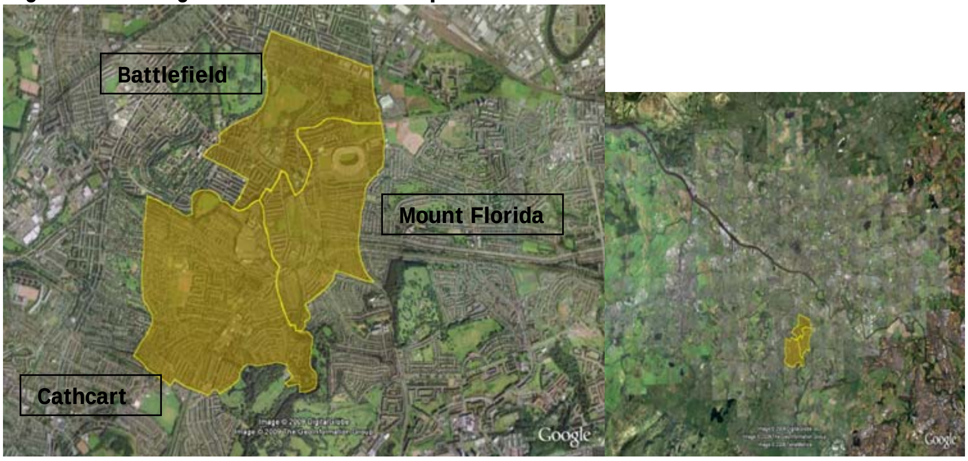


Figure B.8 Greater Manchester rail network map
Source: (GMPTE, 2006a)

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Figure B.9 Manchester train corridor 1 – Heatons North and Heatons South

Figure B.10 Manchester Train corridor 2 – Bredbury Green and Romiley and Marple North

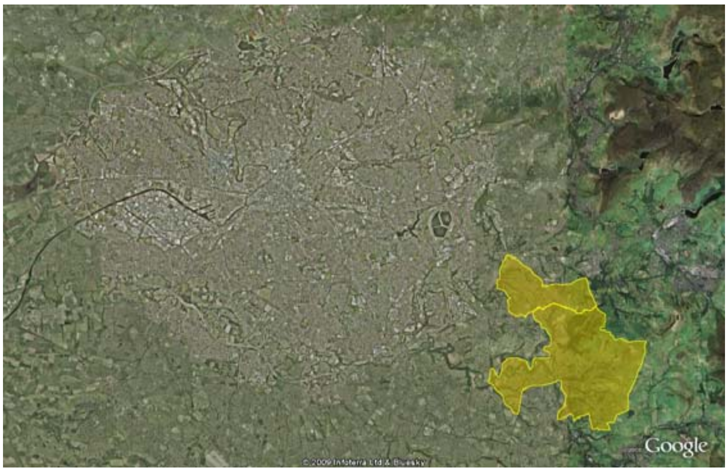


Figure B.11 Manchester Train corridor 3 – Bramhall North and Bramhall South

the east of the city was on the low-level line from Glasgow Queen Street to Airdrie, including Garrowhill, Greenfield and Tollcross Park. Corridor 3 is also to the south of the city on the western Cathcart circle line, incorporating Maxwell Park, Strathbungo and Pollokshields East. Corridor 1 was selected as it had a higher average percentage of people travelling by train to work or study and a higher total number of passengers (1,932) compared to Corridor 2 (1,501) and Corridor 3 (1,477). The corridor also had the highest percentage of households without a car. The location of the corridor is shown in Figure B.7.

Three train corridors were identified in Manchester, all located within Stockport. These were within commuting distance, although corridors 2 and 3 are located at the boundary edge of Greater Manchester. Corridor 1 was located at the top of the Stockport Border with Heaton Chapel station serviced by the Crewe-Manchester, Manchester-Buxton, Manchester-Chester and Manchester-Stoke routes (Figure B.8). The corridor incorporated the wards Heatons North and Heatons South (Figure B.9). These were previously known as Heaton Moor and Heaton Mersey, but were changed following the review by the Boundary Committee for England. Data used in this comparison was for the previous definition. Corridor 2 is to the south-east of Stockport in Bredbury Green and Romiley and Marple North is served by the Chinley-Manchester and Sheffield-Manchester lines (Figure B.10). Bredbury Green and Romiley was changed following the boundary review. This change to the ward area is very minimal. Corridor 3 is to the south of Stockport with Bramhall station served by the Manchester-Stoke line. The corridor includes the wards Bramhall North and Bramhall South (Figure B.11). Before the review they were known as East Bramhall and West Bramhall. The change is also very marginal.

For the travel to work statistics corridor 2 is more alike Glasgow's train corridor (Table B.19). There were slightly more commuters travelling by train (5.72%) compared to in Corridor 1 (4.12%) and Corridor 3 (4.10%). These figure were lower than the Glasgow corridor and contained much fewer total passengers. In Corridor 2 there were 656, compared to 603 in corridor 3 and 575 in corridor 1. The closest corridor for car passengers was split between corridor 1 and corridor 2. When passenger and driver of a car is added both areas scored an average of 68%, which is high than Glasgow's 47%. As the train corridors contained a small number of train commuters the other characteristics become important for the selection process.

In the Glasgow train corridor there were 21,756 people with slightly more female citizens. The largest age ranges were 16-34 and 35-49 (Table B.20). Corridor 2 is closest for population with 25,088 people and a larger female population (Table B.21). Corridor 1 contains the highest 16-34 and 35-49 age ranges.

In Glasgow a quarter of the working age population did not have any qualifications, but thirty percent had acquired level 4 (Table B.22). Although corridor 3 had more even distribution and more comparable level 4/5

Table B.19 Comparison of Potential Manchester Train Corridors - Travel to work Statistics
Source: (ONS, 2001b)

	All People aged 16-74 in employment or studying	Work from home	Underground, metro or light rail	Train	Bus, minibus or coach	Driving a car or van	Passenger in a car or van	Motorcycle, scooter or moped	Bicycle	On foot
North Marple	5,454	9.79	0.11	**6.71**	5.15	63.84	4.66	0.55	0.81	7.77
Davenport	5,654	9.41	0.05	**5.62**	8.95	57.71	5.39	0.67	2.33	9.16
Mossley	5,093	8.31	0.12	**5.24**	7.87	59.47	6.95	0.98	1.22	9.21
Heaton Moor	6,343	8.99	0.35	**5.09**	9.87	62.05	5.01	0.55	1.80	5.61
Romiley	6,138	8.85	0.20	**4.72**	8.62	61.49	6.11	0.81	1.03	7.61
East Bramhall	7,968	10.15	0.10	**4.47**	3.55	69.01	4.81	0.46	1.63	5.21
Hyde Newton	5,403	6.92	0.11	**4.46**	8.38	55.89	7.63	1.15	1.57	12.75
Cheadle Hulme South	7,096	9.72	0.04	**4.37**	3.58	68.21	5.12	0.55	1.76	5.81
Westhoughton	6,228	8.00	0.05	**4.08**	5.56	65.38	7.68	1.30	1.25	6.12
South Marple	5,680	11.29	0.11	**3.98**	4.26	66.64	5.30	0.65	0.74	6.32
Edgeley	6,049	6.98	0.18	**3.95**	10.76	53.81	6.27	0.84	2.58	13.77
West Bramhall	6,609	12.23	0.09	**3.74**	2.95	69.60	4.30	0.44	1.53	4.54
Littleborough	6,160	8.13	0.05	**3.73**	5.81	62.92	6.59	1.19	1.27	8.96
Heald Green	6,062	8.58	0.10	**3.50**	4.34	66.35	6.33	0.99	2.34	6.42
Bromley Cross	6,838	8.50	0.04	**3.42**	5.16	69.03	6.35	0.92	0.85	5.16
Hulton Park	8,493	7.88	0.07	**3.31**	5.16	70.01	6.91	0.93	0.93	4.30
Hazel Grove	7,887	8.84	0.13	**3.17**	7.34	64.66	5.21	0.89	1.91	7.24
Heaton Mersey	7,995	9.11	0.13	**3.15**	9.13	65.40	4.79	0.44	1.65	5.60
Bredbury	7,488	8.32	0.04	**3.03**	9.39	62.27	6.38	0.89	1.62	7.45
Deane-Cum-Heaton	7,335	9.99	0.08	**2.84**	6.84	65.40	6.26	0.86	0.74	6.11

Table B.20 Glasgow Train corridor - Age ranges
Source: (Scrol, 2001c)

	ALL PEOPLE	Males	Females	0-15	16-34	35-49	50-59	60-64	65-84	85+
Mount Florida	6,701	46.7	53.3	15.6	30.8	22.6	10.3	4.0	15.0	1.7
Battlefield	7,199	47.6	52.4	13.6	36.7	21.4	8.8	3.4	13.7	2.5

Cathcart	7,856	48.3	51.7	16.4	24.9	23.6	10.8	4.9	16.9	2.5
	21,756	**47.5**	**52.5**	**15.2**	**30.8**	**22.5**	**10.0**	**4.1**	**15.2**	**2.2**

Table B.21 Comparison of Potential Manchester Train corridors – Age Ranges

Source: (Nomis, 2001)

	ALL PEOPLE	Males	Females	0-15	16-34	35-49	50-59	60-64	65-84	85+
Heaton Mersey	15,553	48.7	51.3	20.1	24.8	24.5	12.5	4.1	12.6	1.4
Heaton Moor	12,423	49.4	50.6	19.0	23.8	23.9	12.1	4.5	14.9	1.8
	27,976	**49.0**	**51.0**	**19.5**	**24.3**	**24.2**	**12.3**	**4.3**	**13.7**	**1.6**
North Marple	11,437	48.4	51.6	19.0	18.3	21.9	15.6	6.3	16.8	2.1
Romiley	13,651	47.7	52.3	19.4	20.7	20.3	14.5	6.4	16.9	1.9
	25,088	**48.0**	**52.0**	**19.2**	**19.5**	**21.1**	**15.0**	**6.3**	**16.9**	**2.0**
East Bramhall	15,866	48.7	51.3	20.2	18.9	23.0	15.8	5.8	14.8	1.5
West Bramhall	14,348	48.3	51.7	20.5	16.3	22.7	15.4	6.5	16.7	1.9
	30,214	**48.5**	**51.5**	**20.4**	**17.6**	**22.9**	**15.6**	**6.1**	**15.8**	**1.7**

Table B.22 Glasgow Train corridor – Qualifications

Source: (Scrol, 2001d)

	ALL PEOPLE	No qualifications	Level 1	Level 2	Level 3	Level 4
Battlefield	5,568	26.0	16.5	16.0	8.2	33.4
Cathcart	5,785	25.7	20.2	18.0	7.6	28.6
Mount Florida	5,134	26.0	18.8	18.1	8.9	28.3
	16,487	**25.9**	**18.5**	**17.3**	**8.2**	**30.1**

Table B.23 Comparison of potential Manchester Train corridors – Qualifications

Source: (Nomis, 2001)

	ALL PEOPLE	No qualifications	Level 1	Level 2	Level 3	Level 4/5	Other qualifications/ level unknown
Heaton Mersey	11,457	19.3	13.5	18.7	8.0	35.0	5.4
Heaton Moor	9,191	18.4	13.5	19.8	8.5	34.0	5.8
	20,648	**18.8**	**13.5**	**19.3**	**8.2**	**34.5**	**5.6**
North Marple	8,333	20.2	13.8	20.6	8.5	30.0	6.9
Romiley	9,828	28.8	17.4	20.1	6.4	18.9	8.4
	18,161	**24.5**	**15.6**	**20.3**	**7.4**	**24.5**	**7.7**

East Bramhall	11,646	16.3	15.6	22.5	8.7	30.3	6.6
West Bramhall	10,265	15.4	13.4	22.3	8.6	34.4	6.0
	21,911	**22.8**	**13.3**	**17.3**	**11.6**	**29.3**	**5.6**

Table B.24 Glasgow Train corridor - Economic activity

Source: (Scrol, 2001a; Scrol, 2001e)

	Total economically active	Total economically inactive	Part-time	Full-time	Unemployed	Full-time students	Retired	Looking after home/family	Permanently sick/disabled	Other
Battlefield	68.7	31.3	6.9	47.4	4.5	8.8	9.7	4.6	7.8	10.4
Cathcart	67.3	32.7	9.4	43.7	3.3	7.8	14.7	4.6	5.9	10.6
Mount Florida	67.4	32.6	9.0	45.4	4.1	8.2	12.8	4.2	6.4	9.9
	67.8	**32.2**	**8.43**	**45.5**	**3.97**	**8.27**	**12.4**	**4.47**	**6.7**	**10.3**

	Higher managerial & professional occupations	Lower managerial & professional occupations	Intermediate occupations	Small employers & own account workers	Lower supervisory & technical occupations	Semi-routine occupations	Routine occupations	Never worked	Not classifiable
Battlefield	10.51	25.04	10.74	4.83	5.08	8.53	5.32	4.96	14.8
Cathcart	10.39	22.45	11.91	5.76	5.06	9.01	5.19	2.44	18.84
Mount Florida	9.38	23.1	12.12	4.69	5.65	9.1	5.88	3.27	17.63
	10.09	**23.5**	**11.6**	**5.1**	**5.3**	**8.9**	**5.5**	**3.6**	**17.1**

Table B.25 Comparison of Potential Manchester Train Corridors – Economic Activity

Source: (Nomis, 2001)

	Total economically active	Total economically inactive	Part-time	Full-time	Unemployed	Full-time students	Retired	Looking after home/family	Permanently sick/disabled	Other
Heaton Mersey	72.2	27.8	13.4	54.2	2.2	6.7	12.8	4.8	3.4	2.5
Heaton Moor	71.3	28.7	13.2	53.3	2.1	7.1	14.2	3.7	4.3	2.0
	71.8	**28.2**	**13.3**	**53.8**	**2.1**	**6.9**	**13.5**	**4.2**	**3.8**	**2.3**
North Marple	67.6	32.4	15.7	47.3	1.9	6.2	18.1	5.0	3.9	1.8
Romiley	65.3	34.7	14.7	45.8	2.5	5.3	17.6	5.8	5.8	2.5
	66.4	**33.6**	**15.2**	**46.5**	**2.2**	**5.8**	**17.9**	**5.4**	**4.8**	**2.2**
East Bramhall	70.1	29.9	16.2	49.5	1.4	6.6	17.1	5.0	2.7	1.4
West Bramhall	66.2	33.8	16.0	46.0	1.5	6.4	19.0	6.7	2.7	1.6
	68.1	**31.9**	**16.1**	**47.8**	**1.5**	**6.5**	**18.0**	**5.9**	**2.7**	**1.5**

	Higher managerial & professional occupations	Lower managerial & professional occupations	Intermediate occupations	Small employers & own account workers	Lower supervisory & technical occupations	Semi-routine occupations	Routine occupations	Never worked	Not classifiable
Heaton Mersey	15.4	26.0	10.4	7.1	4.9	7.8	4.7	2.6	21.3
Heaton Moor	14.9	25.4	10.1	7.3	5.2	7.4	4.5	2.4	22.8
	15.2	**25.7**	**10.3**	**7.2**	**5.0**	**7.6**	**4.6**	**2.5**	**22.1**
North Marple	12.9	23.9	11.4	7.3	5.1	8.2	4.3	1.6	25.3
Romiley	8.5	18.8	11.0	7.7	7.0	10.9	8.1	2.4	25.5
	10.7	**21.4**	**11.2**	**7.5**	**6.0**	**9.5**	**6.2**	**2.0**	**25.4**
East Bramhall	14.3	24.5	12.0	6.5	5.3	8.1	3.6	1.3	24.5
West Bramhall	16.9	24.2	9.6	7.6	3.6	7.2	2.9	1.3	26.6
	15.6	**24.4**	**10.8**	**7.0**	**4.4**	**7.6**	**3.3**	**1.3**	**25.5**

Table B.26 Glasgow Train Corridor – Housing
Source: (Scrol, 2001g; Scrol, 2001b)

	All Households	Detached house	Semi-detached house	Terraced house	Flat, maisonette or apartment	Caravan or temporary structure	Owned	Social rented	Private rented	Living rent free
Battlefield	3,801	1.4	2.9	5.8	89.7	0.0	**67.9**	**13.4**	16.7	**2.0**
Cathcart	3,537	5.0	22.2	21.8	51.0	0.0	**81.7**	**9.0**	7.8	**1.6**
Mount Florida	3,404	2.4	8.1	17.0	72.5	0.0	**72.8**	**10.7**	15.0	**1.6**
	10,742	**2.9**	**11.1**	**14.9**	**71.1**	**0.0**	**74.1**	**11.0**	**13.1**	**1.7**

	No car or van Households	1 car or van Households	2 cars or vans Households	3 cars or vans Households	4 or more Households	All cars or vans in the area
Battlefield	47.43	43.38	8.21	0.71	0.26	2,400
Cathcart	35.28	46.23	16.12	1.92	0.45	3,050
Mount Florida	44.77	42.83	10.72	1.18	0.5	2,379
	42.5	**44.1**	**11.7**	**1.3**	**0.4**	**2,610**

Table B.27 Comparison of Potential Manchester Train Corridors – Housing
Source: (Nomis, 2001)

	All Households	Detached house	Semi-detached house	Terraced house	Flat, maisonette or apartment	Caravan or temporary structure	Owned	Social rented	Private rented or living rent free
Heaton Mersey	6,777	17.8	44.4	19.1	18.7	0.0	81.4	7.6	11.0
Heaton Moor	5,316	19.0	42.9	12.4	25.7	0.0	79.5	5.7	14.6
	12,093	**18.4**	**43.6**	**15.8**	**22.2**	**0.0**	**80.5**	**6.6**	**12.8**
North Marple	4,761	38.2	34.7	17.8	9.2	0.0	83.3	9.8	7.1
Romiley	5,930	22.2	39.9	24.2	13.8	0.1	73.8	20.2	6.0
	10,691	**30.2**	**37.3**	**21.0**	**11.5**	**0.0**	**78.5**	**15.0**	**6.5**
East Bramhall	6,297	45.3	42.8	5.8	6.1	0.0	94.9	1.4	3.8
West Bramhall	5,776	48.3	33.5	8.5	9.8	0.0	89.8	6.2	4.0
	12,073	**46.8**	**38.2**	**7.1**	**7.9**	**0.0**	**92.3**	**3.8**	**3.9**

	No car or van Households	1 car or van Households	2 cars or vans Households	3 cars or vans Households	4 or more Households
Heaton Mersey	18.7	47.5	28.6	4.3	1.0
Heaton Moor	20.9	43.7	28.8	5.3	1.3
	19.8	**45.6**	**28.7**	**4.8**	**1.1**
North Marple	19.0	39.8	32.7	6.7	1.8
Romiley	25.3	44.3	24.5	4.7	1.2
	22.1	**42.0**	**28.6**	**5.7**	**1.5**
East Bramhall	9.2	41.0	40.3	7.7	1.8
West Bramhall	10.9	37.2	41.4	8.0	2.5
	10.1	**39.1**	**40.8**	**7.9**	**2.1**

Appendix B – Study locations

qualifications there was little difference in all of the potential Manchester train corridors (Table B.23).

Two-thirds of the working age population in the Glasgow train corridor were economically active (Table B.24). The highest category was full-time workers and there was a low retired population (12.4%). For the NC-Sec classifications 33% of all occupations are in a managerial position, 3.6% have never worked and over 17% cannot be classified. All three potential corridors in Manchester are similar (Table B.25). In all locations full-time is the highest grouping, with corridor 1 having the lowest retired population. There were high percentage of managerial occupations in all locations and Corridor 1 had the highest percentage never worked and lowest comparable not classified grouping.

The Glasgow train corridor was also dominated by flats, maisonette or apartment (Table B.26). Almost three-quarters of homes were owned and 13.1% houses privately rented. In the corridor 42.5% of all houses did not have a car and only 13.4% own 2 or more cars. Corridor 1 in Manchester had the highest percentage of flat, maisonette or apartment (Table B.27). Despite this only being 22.2% it is more than double the other two corridors. Corridor 2 had the most similar amount of owned homes, and corridor 1 has the most private rented properties. Corridors 1 and 2 also had the closest percentage of households with and without a car. There was a major difference from corridor 3 and the Glasgow corridor. Only 10.1% of households did not have a car and 50.8% of households had more than 2 or more cars.

The selection of the Manchester train corridor was more difficult than the bus corridor. Whilst there was very little between all three corridors, it needed to be between corridor 1 and corridor 2, purely due to the last statistic on households with access to car. Corridor 1 was chosen because it is closer to the city of Manchester and was served by more train services.

LRT CORRIDORS

Only two possible Glasgow LRT corridors were identified due to the small size of the network and no other clearly identifiable wards (Table B.28). Corridor 1

Table B.28 Comparison of Potential Glasgow LRT Corridors – Travel to work Statistics
Source: (Scrol, 2001f)

	All People aged 16-74 in employment or studying	Work from home	Underground, metro or light rail	Train	Bus, minibus or coach	Driving a car or van	Passenger in a car or van	Motorcycle, scooter or moped	Bicycle	On foot
Ibrox	2,643	4.54	**25.84**	3.18	20.13	23.34	5.11	0.19	1.66	14.49
Partick	4,347	4.99	**16.59**	5.31	10.88	26.06	3.36	0.16	1.98	29.42
Kingston	4,310	5.50	**15.75**	4.22	16.43	35.45	5.08	0.32	1.30	14.27
Hillhead	4,469	6.58	**15.73**	3.02	8.86	18.77	2.60	0.16	1.77	41.35
Hayburn	4,402	4.04	**15.65**	9.81	12.70	30.60	3.88	0.20	2.34	19.22
Govan	2,602	5.15	**14.49**	2.42	25.83	27.82	6.61	0.77	1.50	13.64
Woodlands	4,568	5.52	**10.90**	4.05	10.73	18.28	2.80	0.15	1.75	44.48
Firhill	3,573	5.32	**10.22**	3.72	17.27	25.61	3.92	0.34	1.60	30.59
Hyndland	4,833	6.62	**9.48**	11.13	5.98	36.44	3.12	0.33	1.86	23.75
Pollokshields East	3,272	10.48	**8.77**	9.78	14.46	35.61	6.94	0.15	1.74	10.45
North Kelvin	4,488	5.01	**7.98**	2.56	11.99	24.18	3.05	0.25	2.58	41.2
Drumoyne	2,759	3.91	**7.83**	2.28	22.80	33.89	8.66	0.29	1.09	17.36
Hutchesontown	2,298	4.53	**5.13**	4.66	21.71	26.81	3.79	0.61	1.13	30.03
Maxwell Park	3,660	8.66	**4.40**	14.59	7.54	50.22	5.90	0.46	0.82	5.85
Victoria Park	3,647	4.55	**4.14**	10.06	19.96	41.49	4.74	0.25	1.86	11.65
Anderston	3,743	4.46	**4.06**	5.53	12.45	17.82	2.73	0.24	1.26	50.12
Kelvingrove	5,910	6.73	**3.40**	4.23	11.18	18.00	2.08	0.27	2.10	51
Wyndford	2,776	4.86	**3.39**	2.38	32.53	27.77	5.48	0.29	2.20	19.16
Kelvindale	3,950	6.51	**2.66**	4.25	17.01	45.01	4.53	0.28	2.03	16.2
Calton	3,396	3.98	**2.59**	7.10	18.35	25.32	4.48	0.38	0.94	34.92

Figure B.12 Glasgow LRT corridor map

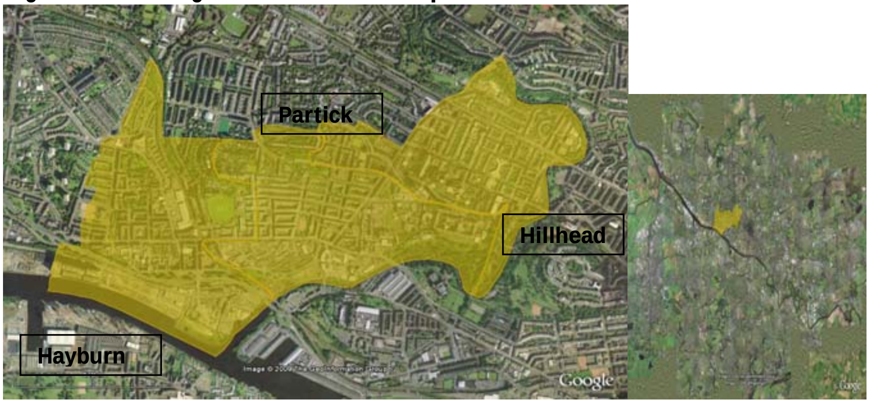


Figure B.13 Manchester LRT corridor 1 – Longford and Priory

Figure B.14 Manchester LRT corridor 2 – Brooklands and Timperley

Figure B.15 Manchester LRT corridor 3 – Sedgley and Holyrood

Table B.29 Comparison of Potential Manchester LRT Corridors – Travel to work Statistics
Source: (ONS, 2001b)

	All People aged 16-74 in employment or studying	Work from home	Underground, metro or light rail	Train	Bus, minibus or coach	Driving a car or van	Passenger in a car or van	Motorcycle, scooter or moped	Bicycle	On foot
Priory	5,187	8.21	**12.86**	0.96	3.43	0.44	55.99	4.36	2.51	10.45
Crumpsall	4,242	6.58	**10.96**	1.41	11.62	0.87	48.04	5.56	2.05	10.91
Ordsall	2,548	5.57	**9.58**	1.77	8.79	0.67	42.66	6.08	3.22	18.56
Longford	3,937	6.45	**9.22**	0.94	8.89	0.46	51.41	6.15	3.86	11.38
Brooklands	4,915	9.26	**8.73**	0.73	3.34	0.35	65.21	4.66	2.08	4.98
Timperley	5,837	8.98	**8.60**	0.87	2.81	0.84	61.95	4.97	2.91	7.21
Sedgley	4,790	7.95	**7.91**	0.94	8.04	0.73	58.46	5.66	1.54	6.76
Altrincham	5,407	10.12	**7.25**	1.00	3.40	0.50	59.55	3.85	2.37	11.23
Holyrood	5,065	7.60	**6.73**	0.73	9.38	0.85	59.19	6.10	1.24	6.75
Pilkington Park	4,661	9.61	**6.67**	0.64	5.92	0.49	63.70	6.31	0.99	4.59
Radcliffe South	4,669	7.75	**6.43**	0.62	7.09	0.92	57.68	7.28	1.33	9.92
Besses	3,837	6.91	**6.31**	0.70	9.59	0.83	57.10	8.16	1.30	7.71
Broadheath	5,879	8.40	**6.14**	0.78	5.39	0.82	61.54	4.93	3.38	7.89
Sale Moor	4,582	7.20	**6.11**	0.44	8.25	0.68	61.04	5.67	3.01	6.70
St. Mary's	5,317	8.05	**6.00**	0.77	8.50	0.58	60.75	6.43	1.28	6.41
Radcliffe Central	5,499	6.80	**5.95**	0.53	7.42	1.18	57.76	8.09	1.64	9.57
Stretford	4,618	7.02	**5.52**	0.84	11.67	0.65	53.88	6.82	3.68	8.60
Mersey St. Mary's	6,163	10.03	**5.37**	0.63	5.19	0.89	63.96	4.40	2.01	6.69
Bowdon	5,627	13.72	**4.92**	1.07	1.79	0.41	67.44	3.39	1.30	5.08
Village	5,458	9.22	**4.64**	0.57	6.10	0.75	62.99	6.43	3.11	5.22

Table B.30 Glasgow LRT corridor - Age ranges
Source: (Scrol, 2001c)

	ALL PEOPLE	Males	Females	0-15	16-34	35-49	50-59	60-64	65-84	85+
Hayburn	7,007	47.0	53.0	10.0	43.4	22.2	8.3	3.5	11.0	1.7
Hillhead	5,969	47.8	52.2	9.0	59.1	16.5	7.0	2.1	5.4	1.0
Partick	6,796	46.6	53.4	9.3	45.4	20.9	9.8	3.5	9.9	1.3
	19,772	**47.1**	**52.9**	**9.4**	**49.3**	**19.9**	**8.3**	**3.0**	**8.8**	**1.3**

Table B.31 Comparison of Potential Manchester LRT corridors – Age Ranges
Source: (Nomis, 2001)

	ALL PEOPLE	Males	Females	0-15	16-34	35-49	50-59	60-64	65-84	85+
Longford	9,467	49.4	50.6	21.1	24.4	22.1	10.0	4.6	16.3	1.6
Priory	9,563	49.1	50.9	15.4	30.8	22.2	11.1	4.2	14.0	2.4
	19,030	**49.3**	**50.7**	**18.2**	**27.6**	**22.1**	**10.5**	**4.4**	**15.1**	**2.0**
Brooklands	9,719	49.1	50.9	19.1	21.1	24.0	13.7	5.2	15.0	1.9
Timperley	10,986	49.9	50.1	20.1	23.1	23.8	13.8	5.0	12.7	1.4
	20,705	**49.5**	**50.5**	**19.6**	**22.1**	**23.9**	**13.7**	**5.1**	**13.9**	**1.6**
Holyrood	10,617	48.1	51.9	21.5	22.9	22.7	13.2	4.6	13.5	1.6

Sedgley	10,979	48.6	51.4	25.8	24.6	21.3	11.1	4.3	11.5	1.5
	21,596	**48.4**	**51.6**	**23.6**	**23.7**	**22.0**	**12.2**	**4.5**	**12.5**	**1.5**

Table B.32 Glasgow LRT corridor - Qualifications

Source: (Scrol, 2001d)

	ALL PEOPLE	No qualifications	Level 1	Level 2	Level 3	Level 4
Hayburn	5,872	20.2	14.4	18.6	8.9	37.9
Hillhead	5,241	8.4	6.5	34.6	6.8	43.6
Partick	5,825	19.5	10.8	20.6	6.6	42.5
	16,938	**16.0**	**10.6**	**24.6**	**7.4**	**41.4**

Table B.33 Comparison of potential Manchester LRT corridors - Qualifications

Source: (Nomis, 2001)

	ALL PEOPLE	No qualifications	Level 1	Level 2	Level 3	Level 4/5	Other qualifications/ level unknown
Longford	6,634	32.4	15.8	18.5	7.0	20.0	6.3
Priory	7,252	18.2	13.2	20.2	8.4	34.5	5.5
	13,886	**25.3**	**14.5**	**19.4**	**7.7**	**27.3**	**5.9**
Brooklands	7,080	18.4	14.0	22.0	8.0	31.0	6.6
Timperley	8,094	19.6	16.1	22.3	7.5	27.7	6.8
	15,174	**19.0**	**15.0**	**22.2**	**7.8**	**29.4**	**6.7**
Holyrood	7,694	28.7	17.2	20.5	7.1	19.5	7.0
Sedgley	7,533	26.2	14.2	20.4	9.5	24.1	5.6
	15,227	**27.5**	**15.7**	**20.4**	**8.3**	**21.8**	**6.3**

Table B.34 Glasgow LRT corridor - Economic activity

Source: (Scrol, 2001a; Scrol, 2001e)

	Total economically active	Total economically inactive	Part-time	Full-time	Unemployed	Full-time students	Retired	Looking after home/family	Permanently sick/disabled	Other
Hayburn	68.4	31.6	6.9	47.6	4.6	14.0	8.6	2.6	7.7	8.0

Hillhead	63.3	36.7	5.7	35.0	3.3	36.5	4.0	2.9	2.6	10.0
Partick	66.0	34.0	6.3	41.8	5.0	19.1	8.1	2.9	7.3	9.4
	65.9	**34.1**	**6.3**	**41.47**	**4.3**	**23.2**	**6.9**	**2.8**	**5.87**	**9.13**

	Higher managerial & professional occupations	Lower managerial & professional occupations	Intermediate occupations	Small employers & own account workers	Lower supervisory & technical occupations	Semi-routine occupations	Routine occupations	Never worked	Not classifiable
Hayburn	0	25.46	9.76	2.88	5.01	8.46	5.45	2.2	13.49
Hillhead	0	19.73	6.62	3.61	2.4	5.17	2.44	2.29	5.91
Partick	0	21.68	7.93	3.24	3.88	6.73	5.15	2.82	12.79
	0	**22.3**	**8.1**	**3.2**	**3.8**	**6.8**	**4.3**	**2.4**	**35.2**

Table B.35 Comparison of Potential Manchester LRT Corridors – Economic Activity

Source: (Nomis, 2001)

	Total economically active	Total economically inactive	Part-time	Full-time	Unemployed	Full-time students	Retired	Looking after home/family	Permanently sick/disabled	Other
Longford	63.3	36.7	12.3	44.6	3.6	7.6	14.3	6.1	7.7	3.7
Priory	74.2	25.8	11.4	58.0	2.4	5.7	12.0	4.0	4.4	2.1
	68.7	**31.3**	**11.9**	**51.3**	**3.0**	**6.7**	**13.2**	**5.1**	**6.1**	**2.9**
Brooklands	71.5	28.5	14.3	52.5	1.8	6.1	15.2	4.4	3.9	1.6
Timperley	74.0	26.0	15.8	53.7	1.7	5.7	13.6	4.5	3.3	1.7
	72.8	**27.2**	**15.1**	**53.1**	**1.8**	**5.9**	**14.4**	**4.5**	**3.6**	**1.6**
Holyrood	68.8	31.2	13.8	49.9	2.6	5.9	12.5	4.6	6.2	4.5
Sedgley	67.1	32.9	15.5	46.0	3.2	8.0	10.8	6.9	6.3	3.3
	67.9	**32.1**	**14.6**	**48.0**	**2.9**	**6.9**	**11.7**	**5.7**	**6.2**	**3.9**

	Higher managerial & professional occupations	Lower managerial & professional occupations	Intermediate occupations	Small employers & own account workers	Lower supervisory & technical occupations	Semi-routine occupations	Routine occupations	Never worked	Not classifiable
Longford	7.3	17.3	10.9	5.0	6.2	11.8	9.3	5.2	27.1
Priory	15.1	26.6	11.8	5.4	6.0	8.6	4.9	1.8	19.7
	11.2	**22.0**	**11.3**	**5.2**	**6.1**	**10.2**	**7.1**	**3.5**	**23.4**
Brooklands	14.2	26.7	11.4	6.0	5.1	8.0	4.0	1.7	23.0
Timperley	13.5	25.5	12.5	7.1	5.9	8.8	4.4	1.1	21.1
	13.8	**26.1**	**12.0**	**6.5**	**5.5**	**8.4**	**4.2**	**1.4**	**22.0**
Holyrood	7.5	21.2	11.7	7.2	6.9	11.5	7.6	3.3	23.1
Sedgley	9.5	22.5	10.6	8.1	5.1	10.2	5.8	4.3	24.0

	8.5	**21.8**	**11.1**	**7.7**	**6.0**	**10.8**	**6.7**	**3.8**	**23.5**

Table B.36 Glasgow LRT Corridor – Housing
Source: (Scrol, 2001g; Scrol, 2001b)

	All Households	Detached house	Semi-detached house	Terraced house	Flat, maisonette or apartment	Caravan or temporary structure	Owned	Social rented	Private rented	Living rent free
Hayburn	4,098	0.6	1.2	5.4	92.8	0.0	56.2	22.9	18.6	2.2
Hillhead	2,732	0.3	0.9	4.8	93.8	0.0	52.0	6.0	40.3	1.6
Partick	3,798	0.6	0.6	3.4	95.4	0.1	49.1	28.1	21.5	1.4
	10,628	**0.5**	**0.9**	**4.5**	**94.0**	**0.0**	**52.4**	**19.0**	**26.8**	**1.8**

	No car or van Households	1 car or van Households	2 cars or vans Households	3 cars or vans Households	4 or more Households	All cars or vans in the area
Hayburn	53.8	39.8	5.4	0.7	0.3	2,218
Hillhead	47.2	42.6	9.0	1.1	0.2	1,766
Partick	55.1	36.9	7.3	0.5	0.2	2,052
	52.0	**39.7**	**7.2**	**0.8**	**0.2**	**2,012**

Table B.37 Comparison of Potential Manchester Bus Corridors – Housing
Source: (Nomis, 2001)

	All Households	Detached house	Semi-detached house	Terraced house	Flat, maisonette or apartment	Caravan or temporary structure	Owned	Social rented	Private rented or living rent free
Longford	4,111	4.6	55.3	16.8	23.3	0.0	59.3	26.3	14.2
Priory	4,627	6.1	32.9	30.7	30.3	0.0	66.0	11.0	23.2
	8,738	**5.4**	**44.1**	**23.8**	**26.8**	**0.0**	**62.7**	**18.6**	**18.7**
Brooklands	4,091	18.9	56.0	7.6	17.5	0.0	83.0	6.1	10.8
Timperley	4,480	10.9	64.6	17.8	6.7	0.0	88.0	3.8	7.9
	8,571	**14.9**	**60.3**	**12.7**	**12.1**	**0.0**	**85.5**	**5.9**	**9.4**
Holyrood	4,480	9.7	54.2	23.1	12.9	0.1	79.6	10.9	9.6
Sedgley	4,176	12.3	59.2	16.1	12.4	0.0	74.9	12.1	12.9

	8,656	**11.0**	**56.7**	**19.6**	**12.6**	**0.0**	**77.2**	**11.6**	**11.2**

	No car or van Households	1 car or van Household	2 cars or vans Households	3 cars or vans Households	4 or more Households
Longford	36.8	44.1	16.4	1.9	0.9
Priory	27.3	46.0	22.7	3.3	0.8
	32.0	**45.0**	**19.5**	**2.6**	**0.8**
Brooklands	16.4	43.7	33.1	5.4	1.5
Timperley	14.7	45.9	33.1	5.1	1.2
	15.5	**44.8**	**33.1**	**5.2**	**1.4**
Holyrood	24.6	48.4	23.1	3.3	0.5
Sedgley	25.8	44.9	24.4	4.0	1.0
	25.2	**46.6**	**23.8**	**3.6**	**0.8**

is to the west of the city centre in the area known locally as the 'west-end'. The subway's orbital circle runs directly through the wards of Partick, Hillhead and Hayburn. Corridor 2 is to the south-west of the city centre, with the subway circle running through the neighbouring wards of Ibrox, Kingston and Govan. Corridor 1 was selected for the Glasgow LRT corridor due to more favourable transport characteristics. Although there are a higher average percentage of LRT passengers in corridor 2 (18.66%) compared to corridor 1 (15.99%), more people in total travelled by LRT in corridor 1 (2,147) to corridor (1,829). There was also double the amount of people travelling by bus (20.80%) and a larger percentage of car travellers (34.47%) in corridor 2. Corridor 1 was therefore a better location to assess TQoL as it does not rely upon the car as much as corridor 2. The LRT corridor is shown in Figure B.12.

In Manchester there were three possible LRT corridors. These were locations with high patronage on the Metrolink tram (Table B.29). Corridor 1 is to the south-west of the city centre in Trafford (Figure B.13). The Manchester-Altrincham line runs directly through Priory and Longford. Corridor 2 is the two neighbouring wards to the south of corridor 1 (Figure B.14). Brooklands and Timperley are also served by the Manchester-Altrincham line. Corridor 3 is to the north of the city centre at the bottom of Bury (Figure B.15). The wards of Sedgley and Holyrood are on the Manchester-Bury line.

Corridor 1 was the most comparable location in terms of travel to work statistics. This area contained the highest percentage (11.04%) and total LRT passengers (1,030), compared to corridor 2 (8.66%, 931) and corridor 3 (7.32%, 360). Corridor 1 also had the lowest percentage of driver by car (53.70%) and combined driver and passenger by car (58.95%). These figures were higher than the Glasgow corridor, but the lowest of all three Manchester corridors.

The total number of people in the Glasgow corridor is similar to all the Manchester corridors at 19,772 (Table B.30). In Glasgow there was slightly more females and 16-34 and 35-49 were the largest age groups. The area in Manchester with the largest age range 16-49 is corridor 1 (Table B.31). The lowest percentage of over 65 is corridor 3 (14.0%).

In the Glasgow corridor only 16.0% had no qualifications and the biggest percentage (41.4%) is level 4/5 (Table B.32). In Manchester the closest area was corridor 2, which had the lowest level of no qualification (19.0) and the highest level 4/5 (29.4%) (Table B.33). The area most dislike Glasgow is corridor 3, with the highest no qualification and the lowest level 4/5.

The percentage of working age population economically active in the Glasgow corridor was 65.9 (Table B.34). The largest proportion of these were working full-time (41.5%), although there was a high student population (23.2%) and relatively low number of people retired (6.9%). In terms of the NS-SeC classification, 36.1% of all working age people were occupied in a managerial position and the not classifiable category is high (35.2%). All three corridors in Manchester have similar levels of economic activity and inactivity (Table B.35). Whilst corridor 3 had the most comparable full-time workers (48.0%), highest students (6.9%) and lowest retired population (11.7%) there was little difference in all the three corridors. Corridors 1 and 2 had the nearest managerial occupations and there is an even distribution of all other occupations in the three corridors.

Almost all housing in the Glasgow corridor is a flat, maisonette or apartment (94.0%) (Table B.36). The largest proportion of these was owned (52.4%), and there are a relatively high percentage of private rented households (26.8%). Over half of the households did not own a car and only 8.2% of households owned 2 or more cars. Corridor 1 is most like the Glasgow corridor (Table B.37). It had the highest percentage of flat, maisonette or apartment (26.8%), the lowest number of owned (62.7%) and highest private rented properties (18.7%). This area also contained the highest number of households without a car (32.0%) and lowest 2 or more car households (22.9%). Although the number of two or more car households was much higher than the Glasgow corridor the percentages in corridor 2 and 3 are even greater.

Identifying the LRT corridors in both cities was a difficult task considering the mode of transport is not exactly the same. The subway system in Glasgow is different from the Metrolink tram in Manchester. One is a small orbital underground system and the other is an on-road light-rail network covering a much larger area. The Glasgow LRT corridor is densely populated with a strong student population and high concentration of flats. Despite it being almost impossible to replicate an exact corridor in any other city in the UK, it was possible to observe some similar characteristics in Manchester. These were found in corridor 1. It had a good reliance upon public transport, a large working age population, with a relatively high number of flat households without a car. Of the three corridor locations compared it was the most suitable and provides a good sample size to analyse TQoL.

APPENDIX C

QUALITATIVE RESEARCH DETAIL

FOCUS GROUP DETAIL

The focus group session was set up to take place for residents in Glasgow and was held at the University of Glasgow. The sample was carefully selected using details from the weighting survey. On the copy of results request form, a box was included asking whether respondents would be willing to take part in the short discussion session. A letter was then sent out to willing participants to find their availability for selected dates. The format of the letter was similar to the survey cover letters. It was necessary to initially thank the respondent for completing the survey before explaining why it is important to conduct the focus groups and why their view is valued. A list of pre-determined times were presented, and they were asked to identify their availability on the returnable slip. An equal amount of letters sent to male and female respondents, whilst making sure all ages and socio-economic groups were included in the sample. A smaller group was chosen for the session as they often provide an environment where all participants can play a part in the discussion (Smithson, 2008). Although Vaughn (1996) indicates that up to 12 participants is the ideal number, the likelihood is that some participants will remain silent and not get involved, the aim was to get 4-6 participants. Initially the response was poor with only two people replying. A further 16 letters were sent out to different households and eight people identified a possible time. In a number of cases, the days and times were different so a telephone call was required to reach agreement on the time and day. Five people were able to attend one date and further instructions on the focus group and directions were sent out to the participants.

The focus group was set up as an unstructured interview guide. As moderator it was important to guide the discussion, making sure all topics are covered, and respond neutrally to the discussion as it unfolds (Albrecht et al., 1993). There were three parts to the focus group: an introduction to the subject; the main section to explore perceptions on the indicators' validity; and the group's opinions on the survey. It was important to start the discussion by introducing myself and setting the agenda for the session. It was made clear that the purpose of the discussion was primarily to gain information on their opinions to transport. The topic of the project was explained and it was indicated that no information gained form the discussion would be used by any other person or organisation. This was followed by assurance that they feel as relaxed as possible so they could say what they want. It was made clear that nobody was making judgements, most of all myself. The first part of the focus group was a general introduction on transport, with participants asked about how they travelled to the university and their feelings toward transport. Once it was clear that each person was involved in the discussion the debate was directed to the TQoL indicators. This started with a broad question on what are the most important factors to them when they travelled on public transport. A sheet was distributed to them with a list of the indicators and each was debated for their relevance. After approximately thirty minutes of discussion, the final section of the agenda was raised. They were asked how they found the questionnaire and what aspects were easier to understand than others. This led on to discussion on the end product from the research. The focus group was concluded by gaining their opinions on what could be achieved in the future to improve their quality of life on transport.

The focus group was intended to explore whether all the indicators were contributing to individual quality of life on public transport. It was not necessary to use Nvivo software to analyse the focus group. The session was held as an informal exercise to confirm the validity of the indicators. Each of the indicators was discussed and the contribution was confirmed by the respondents. All of the factors were considered important to them when they travelled on public transport. Some had to be explained in more detail, such as the infrastructure investment indicators and sustainable transport. Once they were explained all focus group members understood the importance of including the indicators. When discussion was raised regarded other possible indicators no issues identified. This meant that all of the participants felt that the indicators were important for their quality of life and no other new ones should be included. The only issue that was raised was the congestion blame indicators. Prior to the focus group this was one issue that needed clarity, and they agreed that inclusion does not add value into quality of life. The group also questioned the validity of including a variable that focused on the blame of congestion. It does not report a difference in journey quality, only personal feelings towards cars or public transport. Following this, the indicator was removed from the model.

TELEPHONE INTERVIEW DETAIL

There are many guidelines available for telephone interviews, with the majority recommending a rigid script, just as if the respondent were completing a questionnaire (Frey and Oishi, 1995; Groves and Kahn, 1979). This was not the aim as they had already completed a survey. The interviews were treated as an informal discussion to make the respondent feel comfortable with the subject and able to put their views across regarding the TQoL indicators. While it is suggested that a normal telephone interview can last well over an hour the interviews were made shorter to within twenty minutes to consider personal time constraints. Some interviews did last up to forty minutes, but most were completed within twenty minutes. Keeping them shorter meant the content was also shorter. The indicators were split into two, the first half were covered in the first five interviews and the second half assessed in the second five interviews. The same structure used in the focus groups was adapted in each interview. It started by asking them about their experience with transport and what they thought about public transport in Glasgow. Then the project was explained in more detail and the TQoL indicators were introduced. Each was identified and they were asked if any were missing. Following this the interview focused on either the economic and social indicators or the environmental and personal indicators. If they had more time all were discussed in more detail. At the end of the interview their future aspirations for public transport was discussed.

APPENDIX D

DATA CHARACTERISTICS

Analysis of the representation of the data to the population was conducted in two parts. The first was a brief summary of how the data collected in the second survey compares to the same variables for the total population. The second was more detailed assessment of the modal corridors. Demographic, social and transport characteristics were assessed using t-tests. These verified if the corridors have similar characteristics to support effective comparison of TQoL across both cities. T-tests are not evaluated initially because the different sources of data and scales do not allow effective statistical comparison.

Table D.1 displays demographic and social characteristics for the data collected in the second survey, Table D.2 presents the same information for the total population. The sex and age categories are relatively equal, with the exception of the bus corridors. In Glasgow and Manchester there are more female respondents compared to male. This should not affect the results of TQoL, but will be tested by analysing TQoL by sex. There are no concerns with the age ranges, just a positive note that surveys were not only completed by older adults. Age distribution of respondents is also quite similar to the population. The economic activity has full-time workers forming the largest majority in all corridors, which is the same for the total population. There is also a high percentage of students in the bus corridor in Manchester and the LRT corridor in Glasgow, which is reflected in the sample. Qualifications are similar for the percentages of first degree and professional qualifications groupings. Important to note is that the highest group in the Glasgow bus corridor is no qualifications. Household type is very similar to the population, with house or bungalow forming largest percentages of in Manchester's three corridors and flat or maisonette the same in LRT and train corridors in Glasgow. The bus corridor in Glasgow has more even division between the types of housing. This is not reflected in that area, but should not affect the outcome of the research. Tenure is also a similar reflection to the population in both cities.

T-tests can analyse the transport corridors in more detail. T-tests are applied to examine if there are any significant differences in two samples. In order to conduct an examination of TQoL by mode, we expect the characteristics of the means to be the same, and not to have too many unexplainable significant differences. The hypothesis for the t-test is that there is a significant difference

Table D.1 Demographic and social characteristics of the transport corridors, from Survey 2

	MAN			GLA			
	LRT	Train	Bus	LRT	Train	Bus	Total
Sex							
Male	45.1	41.2	26.9	41.1	50.3	32.0	40.0
Female	54.9	58.8	73.1	58.9	49.7	68.0	60.0
Age							
16-24	12.0	16.9	18.5	10.1	12.6	10.2	13.2
25-34	19.5	20.6	14.6	27.2	31.7	10.9	21.4
35-44	25.6	33.8	28.5	18.4	28.4	19.7	25.6
45-54	17.3	14.0	24.6	17.1	8.7	23.8	17.1
55-64	14.3	12.5	6.2	15.2	10.9	14.3	12.3
64+	11.3	2.2	7.7	12.0	7.7	21.1	10.4
Economic Activity							
Full-time	60.9	52.2	48.5	48.1	69.4	44.2	54.5
Part-time	15.8	26.5	15.4	12.0	8.2	12.2	14.5
Houseperson	3.0	2.9	6.9	5.1	1.1	10.9	4.8
Retired	12.8	6.6	8.5	14.6	8.2	22.4	12.2
Registered Unemployed	4.5	0.0	2.3	3.8	0.0	4.8	2.5
Unemployed no registered	0.0	0.0	1.5	0.0	1.1	0.7	0.6
On a training scheme	0.0	0.0	0.8	1.3	0.5	1.4	0.7
Voluntary work	0.0	0.0	2.3	2.5	1.6	0.0	1.1
Student	3.0	11.8	12.3	8.2	8.7	2.0	7.7
Other	0.0	0.0	1.5	4.4	1.1	1.4	1.5
Qualifications							
O' grade/GCSE or equiv	24.1	11.0	10.8	6.3	3.3	17.0	11.5
Higher grade/A' Level or equiv	11.3	17.6	10.8	8.9	15.8	8.8	12.3
GSVQ Level 1 or 2 or equiv	4.5	2.9	5.4	2.5	1.1	4.8	3.4
GSVQ Level 3 or equiv	0.8	0.0	0.0	0.6	3.8	5.4	1.9
HNC or equiv	3.0	5.1	4.6	10.8	10.9	14.3	8.5
First Degree	19.5	33.1	40.0	43.0	43.2	6.1	31.5
Professional Qual.	22.6	27.2	18.5	18.4	13.1	4.8	17.0
None	14.3	2.9	10.0	9.5	8.7	38.8	14.0
Household type							
House or bungalow	69.9	79.4	77.7	3.8	12.6	46.3	45.0
Flat/maisonette	30.1	20.6	22.3	93.7	87.4	40.8	52.4
Other	0.0	0.0	0.0	2.5	0.0	12.9	2.6
Tenure							
Own outright	26.3	20.6	21.5	29.1	14.8	17.7	21.4
Mortgage	48.9	55.9	28.5	36.7	61.2	38.1	45.5
Council Rent	3.8	0.0	24.6	14.6	5.5	36.7	14.0
Private Rent	15.8	15.4	18.5	19.6	15.8	3.4	14.8
Other	5.3	8.1	6.9	0.0	2.7	4.1	4.3
All People	133	136	130	158	183	147	887

Table D.2 Demographic and social characteristics of the transport corridors
Source: (ONS, 2001a)

	MAN LRT	MAN Train	MAN Bus	GLA LRT	GLA Train	GLA Bus
Sex						
Males	**49.1**	**48.9**	**48.9**	**47.1**	**47.6**	**45.8**
Female	**50.9**	**51.1**	**51.1**	**52.9**	**52.4**	**54.2**
Age						
16-24	**12.2**	**10.4**	**25.1**	**24.5**	**10.8**	**11.8**
25-34	**16.6**	**14.9**	**21.2**	**24.3**	**19.8**	**13.4**
35-44	**15.7**	**16.7**	**11.9**	**14.5**	**16.2**	**15.7**
45-54	**12.4**	**14.2**	**8.5**	**10.3**	**12.0**	**12.0**
55-64	**8.8**	**9.5**	**6.4**	**6.8**	**8.4**	**11.0**
64+	**17.6**	**16.2**	**11.6**	**10.2**	**17.5**	**14.9**
Economic Activity						
Full-time	**44.3**	**44.3**	**31.7**	**41.5**	**45.5**	**31.8**
Part-time	**9.9**	**10.6**	**5.9**	**6.3**	**8.4**	**9.8**
Looking after home/family	**4.8**	**4.2**	**4.3**	**2.8**	**4.5**	**7.8**
Retired	**12.6**	**12.9**	**6.6**	**6.9**	**12.4**	**13.3**
Unemployed	**2.9**	**2.1**	**3.7**	**4.3**	**4.0**	**5.7**
Student	**6.4**	**6.6**	**19.9**	**23.2**	**8.3**	**6.3**
Other	**18.9**	**19.3**	**28.0**	**15.0**	**17.0**	**25.3**
All People Aged 16-74	**14,453**	**21,543**	**25,771**	**16,938**	**16,487**	**15,716**
*Qualifications**						
No qualifications	**25.3**	**18.8**	**22.4**	**16.3**	**25.9**	**50.2**
Level 1	**14.5**	**13.5**	**8.7**	**10.7**	**18.5**	**24.3**
Level 2	**19.4**	**19.3**	**11.3**	**24.3**	**17.3**	**11.5**
Level 3	**7.7**	**8.2**	**18.2**	**7.5**	**8.2**	**5.1**
Level 4/5	**27.3**	**34.5**	**35.7**	**41.3**	**30.1**	**8.8**
Other qualifications	**5.9**	**5.6**	**3.7**			
All people aged 16 to 74	**14,453**	**21,543**	**25,771**	**16,938**	**16,487**	**15,716**
Household Type						
House or bungalow	**38.7**	**77.8**	**61.8**	**6.0**	**28.5**	**39.9**
Flat, maisonette or apartment	**26.0**	**21.8**	**37.4**	**94.0**	**71.4**	**60.1**
Other	**0.7**	**0.4**	**0.8**	**0.0**	**0.0**	**0.0**
Tenure						
Owned	**85.2**	**68.5**	**35.7**	**73.9**	**52.6**	**42.0**
Social rented	**4.9**	**15.8**	**32.1**	**11.1**	**20.4**	**49.8**
Private rented or rent free	**9.9**	**15.6**	**32.3**	**13.2**	**25.2**	**2.5**
Other				**1.7**	**1.8**	**5.6**
All People	19,160	28,375	28,133	19,772	21,756	21,649

*Level 1: 1+ ‘O’ levels/CSE/GCSE (any grade) or equivalents
Level 2: 5+ ‘O’ levels/CSEs/GCSEs (grade A - C) or equivalents
Level 3: 2+ ‘A’ levels, 4+ ‘AS’ levels, Advanced GNVQ or equivalents.
Level 4/5: First degree, Higher Degree, Qualified Teacher Status, Qualified Medical Doctor, or equivalents
Other qualifications/level unknown: Other qualifications, or Other Professional Qualifications.

between the two samples. As we wish to compare the modal corridors, it is the intention to disprove this null hypothesis for as many variables as possible.

Demographic and transport characteristics are examined for the LRT, train and bus corridors. The demographic tables are presented in Tables D.3, D.4 and D.5. In each table the number of respondents, mean and standard deviation score are shown in the left hand side. The important statistics are the Levene’s Test for

Table D.3 T-tests comparing the demographic characteristics of the LRT corridors

	N	Mean	Std. Deviation		Levene's Test for Equality of Variances F	Sig.	t-test for Equality of Means T	df	Sig. (2-tailed)	Mean Difference
SEX										
1	133	1.549	0.499	Equal variances assumed	1.643	0.201	-0.680	289	**0.497**	-0.040
2	158	1.589	0.494	Equal variances not assumed			-0.680	279.460	0.497	-0.040
AGE										
1	133	3.361	1.524	Equal variances assumed	0.516	0.473	0.001	289	**0.999**	0.000
2	158	3.361	1.557	Equal variances not assumed			0.001	282.468	0.999	0.000
CURRENT WORKING STATUS										
1	133	2.023	1.747	Equal variances assumed	36.471	0.000	-3.831	289	0.000	-1.098
2	158	3.120	2.889	Equal variances not assumed			-3.987	263.811	**0.000**	-1.098
HIGHEST LEVEL OF EDUCATION										
1	133	4.677	2.718	Equal variances assumed	66.453	0.000	-3.038	289	0.003	-0.830
2	158	5.506	1.925	Equal variances not assumed			-2.952	232.165	**0.003**	-0.830
CURRENT TYPE OF ACCOMMODATION										
1	133	1.301	0.460	Equal variances assumed	184.274	0.000	-16.102	289	0.000	-0.687
2	158	1.987	0.252	Equal variances not assumed			-15.371	196.515	**0.000**	-0.687
CURRENT HOUSING TENURE										
1	133	2.248	1.164	Equal variances assumed	0.010	0.920	0.010	289	**0.992**	0.001
2	158	2.247	1.081	Equal variances not assumed			0.010	272.468	0.992	0.001

1 MANLRT
2 GLALRT

Table D.4 T-tests comparing the demographic characteristics of the train corridors

					Levene's Test for Equality of Variances		t-test for Equality of Means			
	N	Mean	Std. Deviation		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
SEX										

1	136	1.588	0.494	Equal variances assumed	5.826	0.016	1.613	317	0.108	0.091
2	183	1.497	0.501	Equal variances not assumed			1.616	293.313	**0.107**	0.091
AGE										
1	136	2.912	1.314	Equal variances assumed	0.760	0.384	-0.355	317	**0.723**	-0.055
2	183	2.967	1.429	Equal variances not assumed			-0.359	303.051	0.720	-0.055
CURRENT WORKING STATUS										
1	136	2.463	2.532	Equal variances assumed	0.615	0.433	0.389	317	**0.698**	0.114
2	183	2.350	2.614	Equal variances not assumed			0.390	295.843	0.696	0.114
HIGHEST LEVEL OF EDUCATION										
1	136	4.934	2.278	Equal variances assumed	14.635	0.000	-1.508	317	**0.132**	-0.356
2	183	5.290	1.927	Equal variances not assumed			-1.472	261.833	0.142	-0.356
CURRENT TYPE OF ACCOMMODATION										
1	136	1.206	0.406	Equal variances assumed	14.991	0.000	-16.154	317	0.000	-0.668
2	183	1.874	0.332	Equal variances not assumed			-15.691	255.970	**0.000**	-0.668
CURRENT HOUSING TENURE										
1	136	2.346	1.201	Equal variances assumed	5.375	0.021	0.321	317	**0.748**	0.040
2	183	2.306	0.997	Equal variances not assumed			0.313	258.374	0.755	0.040

1 MANTrain
2 GLATrain

Table D.5 T-tests comparing the demographic characteristics of the bus corridors

					Levene's Test for Equality of Variances		t-test for Equality of Means			
	N	Mean	Std. Deviation		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
SEX										
1	130	1.731	0.445	Equal variances assumed	3.404	0.066	0.917	275	**0.360**	0.050
2	147	1.680	0.468	Equal variances not assumed			0.920	273.514	0.359	0.050
AGE										
1	130	3.085	1.442	Equal variances assumed	2.831	0.094	-4.140	275	**0.000**	-0.759
2	147	3.844	1.591	Equal variances not assumed			-4.165	274.829	0.000	-0.759
CURRENT WORKING STATUS										

1	130	3.046	2.890	Equal variances assumed	17.930	0.000	1.499	275	0.135	0.441
2	147	2.605	1.964	Equal variances not assumed			1.465	222.995	**0.144**	0.441
HIGHEST LEVEL OF EDUCATION										
1	130	5.208	2.223	Equal variances assumed	14.031	0.000	-0.056	275	0.956	-0.017
2	147	5.224	2.739	Equal variances not assumed			-0.056	273.038	**0.955**	-0.017
CURRENT TYPE OF ACCOMMODATION										
1	130	1.223	0.418	Equal variances assumed	63.936	0.000	-6.329	275	0.000	-0.444
2	147	1.667	0.696	Equal variances not assumed			-6.515	243.560	**0.000**	-0.444
CURRENT HOUSING TENURE										
1	130	2.608	1.210	Equal variances assumed	13.861	0.000	1.741	275	0.083	0.227
2	147	2.381	0.953	Equal variances not assumed			1.716	244.366	**0.087**	0.227

1 MANBus
2 GLABus

Equality of Variance and the t-test for Equality of Means. The Levene's test identifies if there is equal variance between the two samples. If F is non-significant (i.e. $p \geq 0.05$) then we must accept the null hypothesis that the variance between the samples is roughly equal (Field, 2005). The appropriate action is use the row labelled equal variance not assumed. The t-statistic is produced with the 2-tailed significance level for equal variance assumed and equal variance not assumed. If the significance level is ≥ 0.05 then it is possible to reject the null hypothesis, that there are significant differences between the samples. The variables are coloured in red if there are no significant differences between the samples.

For the variable sex, in the LRT corridor, equal variance is assumed because the significance of F is 0.201, which is greater than 0.05 (Table D.3). The t-statistic is significant at 0.497, which means it is possible to reject the null hypothesis of significant differences between the samples. Age also shows no significant difference between the samples - the significance of t taken at equal variance assumed is 0.999.

The age groups in the LRT corridors therefore are similar in both cities. The results from the t-tests for the next three characteristics show significant differences between the samples. For current working status the significance of t is 0.000. There is also significant difference between the samples on the highest level of education (significant at 0.003). Current type of housing is different between the two cities (significant at 0.000). There are no significance differences for housing tenure (significant at 0.992).

These t-tests prove the characteristics of the LRT corridors in both cities are dissimilar for a number of demographic factors. Looking at Table D.2 it is clear why there are differences for these characteristics. The key difference in the economic activity is more students living in Glasgow compared to Manchester. For qualifications, there are a lot more people with higher degrees or equivalent in Glasgow compared to Manchester. The difference for housing type is dissimilar due to the high percentage of respondents living in a flat or maisonette in Glasgow compared to Manchester. These issues were expected and will not affect the outcome of TQoL.

T-tests for the train corridors reveal more closely related data (Table D.4). There is only one variable with significant differences between the samples - housing type. For sex, the null hypothesis of difference in the samples can be rejected because the significance of t is 0.107 for equal variances not assumed. There is no significant difference for age (significant at 0.723), current working status (significant at 0.698), the highest level of education (significant at 0.132) and housing tenure (significant at 0.748). The type of accommodation is significantly different (significant at 0.000). This difference is also expected as more residents in Glasgow live in flat or maisonette compared to Manchester. Overall, the train corridors in both cities are very similar and will allow for good comparison.

T-tests for the bus corridors also present similar demographic characteristics (Table D.5). There are no significant differences for sex (significant at 0.360), current working status (significant at 0.144), highest level of education (significant at 0.955) and housing tenure (significant at 0.087). There are significant differences for age (significant at 0.000) and housing type (significant at 0.000) for equal variance not assumed.

Overall, the bus corridors are very comparable characteristics. The only significant differences are type of housing and age structure. The difference in housing is expected due to higher percentage of respondents living in a flat or maisonette in Glasgow compared to Manchester. The difference in the age structure is due to Glasgow respondents being more equally distributed in the age groups, whereas the majority of respondents in Manchester are between the ages 35-54. This is reflective of the total population (Table D.2). These issues should not present any problems for the analysis of TQoL. To test this further transport characteristics were examined.

It is important to examine transport characteristics to identify any possible concerns when interpreting TQoL. Table D.6 contains questions asked in the second household survey. Some of these issues are not directly involved in the TQoL model but provide a good insight into the respondent's transport behaviour. It presents the respondents journey time, how much it costs, how they would prefer to travel, if they drive by car, if they want to travel more by car and how much they would be willing to pay per day to improve their journey quality.

T-tests comparing the corridors are presented in Tables D.7, D.8 and D.9. For the LRT corridors there are four variables with no significant differences; the purpose of journey (significant at 0.104), time of journey (significant at 0.131), how they would prefer to travel (significant at 0.989), and the maximum willing to pay for improvement in quality of life (significant at 0.700 on equal variances assumed).

On average respondents in both cities use LRT for the same reason, it takes them a similar amount of time, they prefer to travel the same way and would pay the same amount for an improvement in journey quality.

The variables with significant differences are easily explained. There are significant differences for how much the journey costs (significant at 0.000), being able to drive by car (significant at 0.012), average miles travelled by car (significant at 0.000) and wishing to travel more by car (significant at 0.011). With the exception of journey cost, these all relate to car use. This is a key difference in transport characteristics of the two cities. In the Glasgow LRT corridor there are more households without a car (52%) compared to Manchester (32%) (ONS, 2001a). This means that less people rely upon the use of a car, travel fewer miles each year, and want to travel more by car. In Manchester the reason for the wanting the travel more by car can be related to how many miles are travelled by car each year. Research has shown that 10,000 miles is a pivotal point of car use, below which most drivers would like to use their cars more and above which they would like to use their cars less (Stradling, 2002). The average miles travelled per year is less than 10,000, which is related to wanting to travel more by car.

The difference in journey cost could be related to the transport operators or the distance travelled by passenger, given the size of the LRT network in Glasgow. Passengers in Glasgow generally pay less than £3, whilst the values are more equal in Manchester (Table D.6). These differences in samples were expected given the different transport characteristics of the two cities.

Table D.6 Basic transport characteristics of corridors

	MAN LRT	MAN Train	MAN Bus	GLA LRT	GLA Train	GLA Bus	Total
Purpose of Journey							
Shopping	23.3	14.7	25.4	19.0	15.3	23.1	19.8
Work	53.4	61.8	48.5	48.1	55.2	46.9	52.3
School/college	3.0	5.1	6.2	2.5	0.5	2.7	3.2
University	2.3	3.7	3.8	5.7	6.0	1.4	3.9
Training Scheme	0.8	2.2	0.8	1.3	0.0	2.0	1.1
Visiting Family/friends	5.3	5.1	5.4	7.0	6.6	10.9	6.8
Leisure	10.5	6.6	10.0	16.5	14.8	10.2	11.7
Other	1.5	0.7	0.0	0.0	1.6	2.7	1.1
Journey Time							
<5 Minutes	1.5	2.2	0.0	0.6	0.5	0.0	0.8
5-10 minutes	5.3	5.1	0.0	2.5	4.4	0.7	3.0
11-15 minutes	15.0	10.3	2.3	17.7	19.1	2.7	11.7
16-20 minutes	25.6	9.6	7.7	32.9	16.4	9.5	17.2
21-25 minutes	22.6	16.2	16.9	27.8	27.3	20.4	22.3
26-30 minutes	16.5	17.6	24.6	12.7	19.7	24.5	19.2
31-40 minutes	6.8	16.9	22.3	3.2	5.5	21.1	12.1
41-50 minutes	5.3	11.0	17.7	2.5	6.0	15.6	9.4
51-60 minutes	1.5	7.4	6.9	0.0	0.5	4.1	3.2
>60 minutes	0.0	3.7	1.5	0.0	0.5	1.4	1.1
Journey Cost							
<£1	9.8	6.6	19.2	29.7	8.2	33.3	11.8
£1-£1.99	14.3	35.3	40.8	46.8	55.7	31.3	30.1
£2-£2.99	41.4	16.2	23.1	22.8	36.1	19.7	26.8
£3-£3.99	18.0	39.0	16.9	0.0	0.0	15.6	24.8
>£4	16.5	2.9	0.0	0.6	0.0	0.0	6.5
Driving a car as an alternative							
Yes	60.9	80.9	57.7	46.2	56.8	21.8	53.6
No	39.1	19.1	42.3	53.8	43.2	78.2	46.4
Travel preference							
Subway/Tram	45.9	31.5	15.4	41.1	15.3	9.5	25.9
Train	1.5	5.4	32.4	10.1	42.6	23.8	20.5
Bus	3.8	15.4	5.9	11.4	10.9	27.9	12.6
Taxi	4.5	6.2	0.0	1.9	2.7	6.8	3.6
Driving a car/van	27.1	30.8	33.8	6.3	14.2	21.1	21.3
Passenger in car/van	4.5	1.5	2.9	7.0	3.3	8.8	4.7
Bicycle	6.8	6.2	2.9	12.0	7.1	0.7	6.1
On foot	3.8	3.1	6.6	10.1	3.8	1.4	4.8
N/A	2.3	0.0	0.0	0.0	0.0	0.0	0.3
Miles travelled per year by car							
<1000	25.6	12.5	28.5	48.7	28.4	70.7	36.2
1000-3000	24.8	30.1	24.6	18.4	25.7	13.6	22.8
3000-7000	17.3	18.4	12.3	15.8	15.3	11.6	15.1
7000-10000	20.3	20.6	26.2	12.0	16.9	3.4	16.2
10000-20000	12.0	16.9	8.5	5.1	12.6	0.7	9.2
20000+	0.0	1.5	0.0	0.0	1.1	0.0	0.5
Wish to travel more by car							
No	69.2	66.9	57.7	81.6	81.4	63.3	70.9
Yes	30.8	33.1	42.3	18.4	18.6	36.7	29.1
Maximum WTP per day for improved QoL on public transport							
Nothing	39.1	30.9	35.4	39.2	34.4	57.8	39.5
<50p	18.0	22.8	19.2	18.4	15.8	10.9	17.4
50p-£1	27.8	27.2	26.2	29.7	33.3	20.4	27.7
£1-£2	12.8	12.5	11.5	6.3	13.1	8.2	10.7
£2-£5	0.8	4.4	4.6	3.2	2.2	1.4	2.7
>£5	1.5	2.2	3.1	3.2	1.1	1.4	2.0
Total	133	136	130	158	183	147	887

Table D.7 T-tests comparing transport characteristics in the LRT corridors

					Levene's Test for Equality of Variances		t-test for Equality of Means			
	N	Mean	Std. Deviation		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
PURPOSE OF MOST COMMON JOURNEY										
1	133	2.692	1.997	Equal variances assumed	5.200	0.023	-1.620	289	0.106	-0.397
2	158	3.089	2.152	Equal variances not assumed			-1.630	286.228	**0.104**	-0.397
TIME OF JOURNEY FROM DOOR TO DOOR										
1	133	4.744	1.636	Equal variances assumed	8.510	0.004	1.550	289	0.122	0.263
2	158	4.481	1.260	Equal variances not assumed			1.516	245.365	**0.131**	0.263
HOW MUCH DOES IT COST										
1	133	2.444	1.194	Equal variances assumed	30.645	0.000	8.867	289	0.000	0.977
2	158	1.468	0.644	Equal variances not assumed			8.457	194.802	**0.000**	0.977
ABLE TO DRIVE BY CAR AS AN ALTERNATIVE										
1	133	1.391	0.490	Equal variances assumed	5.256	0.023	-2.521	289	0.012	-0.147
2	158	1.538	0.500	Equal variances not assumed			-2.526	282.453	**0.012**	-0.147
HOW WOULD PREFER TO MAKE JOURNEY										
1	133	3.406	2.529	Equal variances assumed	0.490	0.485	-0.038	289	**0.969**	-0.012
2	158	3.418	2.640	Equal variances not assumed			-0.039	284.202	0.969	-0.012
MILES TRAVELLED PER YEAR BY CAR										
1	133	5016.977	5088.761	Equal variances assumed	13.195	0.000	3.865	289	0.000	2051.053
2	158	2965.924	3957.221	Equal variances not assumed			3.784	246.818	**0.000**	2051.053
WISH TO TRAVEL MORE BY CAR										
1	133	1.308	0.464	Equal variances assumed	21.846	0.000	2.591	289	0.010	0.131
2	158	1.177	0.399	Equal variances not assumed			2.558	262.366	**0.011**	0.131
MAXIMUM EXTRA WTP TO IMPROVE QOL										
1	133	0.701	0.868	Equal variances assumed	0.388	0.534	-0.386	289	**0.700**	-0.043
2	158	0.745	1.028	Equal variances not assumed			-0.391	288.997	0.696	-0.043

1 MANLRT
2 GLALRT

Table D.8 T-tests comparing transport characteristics in the train corridors

					Levene's Test for Equality of Variances		t-test for Equality of Means			
	N	Mean	Std. Deviation		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference
PURPOSE OF MOST COMMON JOURNEY										
1	136	2.625	1.708	Equal variances assumed	19.124	0.000	-1.999	317	0.047	-0.446
2	183	3.071	2.146	Equal variances not assumed			-2.066	315.479	**0.040**	-0.446
TIME OF JOURNEY FROM DOOR TO DOOR										
1	136	5.787	2.182	Equal variances assumed	16.063	0.000	4.484	317	0.000	0.951
2	183	4.836	1.605	Equal variances not assumed			4.291	237.009	**0.000**	0.951
HOW MUCH DOES IT COST										
1	136	2.377	1.192	Equal variances assumed	77.859	0.000	6.591	317	0.000	0.676
2	183	1.701	0.612	Equal variances not assumed			6.046	187.820	**0.000**	0.676
ABLE TO DRIVE BY CAR AS AN ALTERNATIVE										
1	136	1.191	0.395	Equal variances assumed	91.863	0.000	-4.659	317	0.000	-0.241
2	183	1.432	0.497	Equal variances not assumed			-4.817	315.551	**0.000**	-0.241
HOW WOULD PREFER TO MAKE JOURNEY										
1	136	3.581	2.093	Equal variances assumed	3.463	0.064	1.850	317	**0.065**	0.428
2	183	3.153	2.005	Equal variances not assumed			1.838	284.009	0.067	0.428
MILES TRAVELLED PER YEAR BY CAR										
1	136	6140.441	5461.656	Equal variances assumed	0.465	0.496	1.643	317	**0.101**	1112.622
2	183	5027.820	6338.366	Equal variances not assumed			1.679	310.073	0.094	1112.622
WISH TO TRAVEL MORE BY CAR										
1	136	1.331	0.472	Equal variances assumed	33.838	0.000	3.001	317	0.003	0.145
2	183	1.186	0.390	Equal variances not assumed			2.919	257.462	**0.004**	0.145
MAXIMUM EXTRA WTP TO IMPROVE QOL										
1	136	0.847	1.012	Equal variances assumed	0.647	0.422	0.391	317	**0.696**	0.046
2	183	0.802	1.039	Equal variances not assumed			0.393	295.057	0.695	0.046

1 MANTrain
2 GLATrain

Table D.9 T-tests comparing transport characteristics in the bus corridors

					Levene's Test for Equality of Variances		t-test for Equality of Means			
	N	Mean	Std.		F	Sig.	t	df	Sig. (2-tailed)	Mean

			Deviation							Difference
PURPOSE OF MOST COMMON JOURNEY										
1	130	2.623	1.881	Equal variances assumed	8.872	0.003	-1.497	275	0.136	-0.370
2	147	2.993	2.194	Equal variances not assumed			-1.511	274.745	**0.132**	-0.370
TIME OF JOURNEY FROM DOOR TO DOOR										
1		6.454	1.515	Equal variances assumed	0.028	0.868	1.400	275	**0.163**	0.257
2		6.197	1.529	Equal variances not assumed			1.400	271.439	0.163	0.257
HOW MUCH DOES IT COST										
1		1.699	0.921	Equal variances assumed	12.705	0.000	2.109	275	0.036	0.263
2		1.436	1.129	Equal variances not assumed			2.135	273.253	**0.034**	0.263
ABLE TO DRIVE BY CAR AS ALTERNATIVE										
1		1.423	0.496	Equal variances assumed	47.313	0.000	-6.567	275	0.000	-0.359
2		1.782	0.414	Equal variances not assumed			-6.496	252.342	**0.000**	-0.359
HOW WOULD PREFER TO MAKE JOURNEY										
1		3.438	2.084	Equal variances assumed	17.017	0.000	0.075	275	0.940	0.017
2		3.422	1.617	Equal variances not assumed			0.074	242.306	**0.941**	0.017
MILES TRAVELLED PER YEAR BY CAR										
1		4983.462	5087.717	Equal variances assumed	94.513	0.000	8.001	275	0.000	3775.979
2		1207.483	2464.434	Equal variances not assumed			7.701	181.196	**0.000**	3775.979
WISH TO TRAVEL MORE BY CAR										
1		1.423	0.496	Equal variances assumed	3.281	0.071	0.946	275	**0.345**	0.056
2		1.367	0.484	Equal variances not assumed			0.944	269.082	0.346	0.056
MAXIMUM EXTRA WTP TO IMPROVE QOL										
1		0.844	1.074	Equal variances assumed	4.845	0.029	3.083	275	0.002	0.353
2		0.491	0.827	Equal variances not assumed			3.035	241.136	**0.003**	0.353

1 MANBus
2 GLABus

Consideration of car use must be made when comparing the output from the two corridors.

T-tests for the train corridors show only three variables with no significant differences between the samples - how people would prefer to travel (significant at 0.065), miles travelled per year (significant at 0.101) and the maximum extra willing to pay for an improved journey (significant at 0.696). Differences between the samples are the purpose of journey (significant at 0.040), journey time (significant at 0.000), journey cost (significant at 0.000), being able to travel by car (significant at 0.000) and wishing to travel more by car (significant at 0.004).

The reasons for the differences are easily understood (Table D.6). Although the patterns of journey purpose are relatively similar, more people use the train for leisure purposes in Glasgow (14.8%) compared to Manchester (6.6%). In Manchester there are also more respondents travelling to school/college (5.1%) compared to Glasgow (0.5%). In Glasgow the majority of respondents are taking 11-30 minutes compared to 21-50 minutes in Manchester. The cost to travel is more in Manchester as more respondents spending between £1 to £4 compared to £1 to £3 in Glasgow.

The difference in car use is also apparent in the train corridors. In Glasgow there are more households without a car (42%) compared to Manchester (20%) (ONS, 2001a). Consideration will be made therefore when comparing the TQoL scores across the two cities. Despite five of the variables illustrating significant differences, there are similarities in the preferred method of travel, miles per year by car and not wanting to pay extra for an improved service (over 50% in both cities would pay less than 50p). Together with the strong association of demographic characteristics these two corridors will provide effective comparison of TQoL.

In the bus corridor there are no significant differences for journey purpose (significant at 0.132), time of journey (significant at 0.163), how they would prefer to make the journey (significant at 0.941) and wishing to travel more by car (significant at 0.345). Passengers travel by the bus for the same purpose - to work and shop, travel for similar amounts of time - 20-50 minutes, prefer to travel by the train or car and are split almost 50-50 in wanting to travel more by car.

The variables with significant differences are the cost of journey (significant at 0.034), driving a car as an alternative mode (significant at 0.000), miles travelled per year (significant at 0.000) and how much they are willing to pay to improve quality of life (significant at 0.003). In regards to the difference in cost of journey more people in Glasgow pay less than £1 in Glasgow (33.3%) compared to Manchester (19.2%). This is due to the higher number of respondents in Glasgow above 65 and able to travel by free concession. If more respondents in Manchester were above 65 there may not have been a significant difference in the samples. Difference in driving as an alternative mode and miles travelled per year by car again relate to car use behaviour in Manchester. Individuals travel more by car because there are more households with a car. In Manchester the number of households without a car is 41%, compared to 60% in Glasgow (ONS, 2001a). The difference in willing to pay more to improve the QoL is due to more people not wanting to pay anything in Glasgow (57.8%) compared to Manchester (35.4%). This could be related to disposable income in the area, or perhaps just that local people do not feel it is justified to pay more money on public transport. This issue can only be explored further in a detailed study on willingness-to-pay.

The bus corridors in Glasgow and Manchester are closely related by transport and demographic characteristics. The differences caused by transport behaviour were expected and could not have been prevented. All of the corridors were selected for providing the best opportunities of modal comparison in the UK. There will always be differences in comparing two cities, because no two communities will have exactly the same characteristics.

APPENDIX E

T-TEST RESULTS

This appendix presents the results from the t-tests comparing TQoL by gender, age and transport characteristics on the initial and final models.

Table E.1 TQoL Indicator abbreviations

EMPLOY	EMPLOYMENT
VEHTRAV	VEHICLE TRAVEL
TRAVCOST	TRAVEL COSTS
PRVINFRAS	PRIVATE TRANSPORT INFRASTRUCTURE
PUBINFRAS	PUBLIC TRANSPORT INFRASTRUCTURE
SUSINFRAS	SUSTAINABLE TRANSPORT INFRASTRUCTURE
TRANCHC	TRANSPORT CHOICE
PUBSAF	SAFETY ON PUBLIC TRANSPORT
CARSAF	SAFETY IN CAR
WALK	WALK AND CYCLE
BUDG	PERSONAL COSTS
DISAB	DISABILITIES
CLIMCHNG	CLIMATE CHANGE
AIRQUAL	AIR QUALITY
NOISEPOLL	NOISE POLLUTION
GREENSPC	GREENSPACE
JRNQUAL	PT JOURNEY QUALITY
BUSACC	BUS ACCESS
TRNACC	TRAIN ACCESS
LRTACC	LRT ACCESS
SERVACC	SERVICES ACCESS
AVAIL	AVAILABILITY
RELIAB	RELIABILITY
TRANINFO	PUBLIC TRANSPORT INFO
BEHAV	PASSENGER BEHAVIOUR
CONG	CONGESTION
JRNDIFF	JOURNEY TIME DIFFERENTIAL

Table E.2 t-tests comparing the means of Glasgow TQoL by gender

t-Tests comparing Train TQoL by gender			t-Tests comparing LRT TQoL by gender			t-Tests comparing Bus TQoL by gender		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
EMPLOY	1.052	**0.294**	**EMPLOY**	-2.025	**0.045**	**EMPLOY**	-0.209	**0.835**
VEHTRAV	1.005	**0.316**	**VEHTRAV**	-1.774	**0.078**	**VEHTRAV**	1.190	**0.236**
TRAVCOST	-2.988	**0.003**	**TRAVCOST**	0.191	**0.849**	TRAVCOST	-2.517	**0.013**
PRVINFRAS	-0.700	**0.485**	**PRVINFRAS**	1.075	**0.284**	**PRVINFRAS**	0.123	**0.902**
PUBINFRAS	-1.596	**0.112**	**PUBINFRAS**	1.178	**0.241**	PUBINFRAS	2.313	**0.023**
SUSINFRAS	-0.754	**0.452**	**SUSINFRAS**	-0.730	**0.467**	**SUSINFRAS**	0.551	**0.583**
TRANCHC	-0.852	**0.395**	**TRANCHC**	1.695	**0.092**	**TRANCHC**	-0.938	**0.350**
PUBSAF	-0.239	**0.811**	PUBSAF	2.906	**0.004**	**PUBSAF**	1.688	**0.094**
CARSAF	1.642	**0.103**	**CARSAF**	-0.354	**0.724**	**CARSAF**	1.202	**0.231**
WALK	-0.044	**0.965**	**WALK**	-1.012	**0.313**	**WALK**	-0.309	**0.758**
BUDG	2.293	**0.023**	**BUDG**	0.738	**0.462**	BUDG	4.162	**0.000**
DISAB	1.039	**0.300**	**DISAB**	1.584	**0.115**	**DISAB**	0.445	**0.657**
CLIMCHNG	-2.162	**0.032**	**CLIMCHNG**	0.932	**0.353**	**CLIMCHNG**	1.164	**0.246**
AIRQUAL	-0.100	**0.920**	**AIRQUAL**	1.670	**0.097**	AIRQUAL	3.186	**0.002**
NOISEPOLL	-0.716	**0.475**	**NOISEPOLL**	1.548	**0.124**	NOISEPOLL	3.394	**0.001**
GREENSPC	-0.256	**0.799**	**GREENSPC**	1.178	**0.240**	**GREENSPC**	-0.070	**0.944**
JRNQUAL	-1.923	**0.056**	**JRNQUAL**	0.367	**0.714**	**JRNQUAL**	0.408	**0.684**
BUSACC	-1.077	**0.283**	**BUSACC**	-0.702	**0.484**	**BUSACC**	1.287	**0.200**
TRNACC	-0.973	**0.332**	**TRNACC**	0.352	**0.725**	**TRNACC**	-0.280	**0.780**
LRTACC	-1.633	**0.104**	LRTACC	-0.912	**0.363**	LRTACC	0.198	**0.843**
SERVACC	-0.367	**0.714**	**SERVACC**	0.700	**0.485**	**SERVACC**	-1.603	**0.111**
AVAIL	-0.556	**0.579**	**AVAIL**	-0.386	**0.700**	**AVAIL**	-1.160	**0.248**
RELIAB	-1.331	**0.185**	**RELIAB**	0.022	**0.982**	**RELIAB**	-1.109	**0.269**
TRANINFO	-0.427	**0.670**	**TRANINFO**	0.804	**0.423**	**TRANINFO**	0.149	**0.882**
BEHAV	-2.003	**0.047**	BEHAV	2.224	**0.028**	**BEHAV**	-0.393	**0.695**
CONG	-0.218	**0.827**	**CONG**	1.351	**0.179**	**CONG**	1.386	**0.168**
JRNDIFF	1.925	**0.056**	**JRNDIFF**	-0.823	**0.412**	**JRNDIFF**	0.067	**0.947**

Table E.3 t-tests comparing the means of Glasgow TQoL by age

t-Tests comparing Train TQoL by Age			t-Tests comparing LRT TQoL by Age			t-Tests comparing Bus TQoL by Age		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
EMPLOY	-1.879	**0.062**	**EMPLOY**	-1.344	**0.181**	**EMPLOY**	0.157	**0.876**
VEHTRAV	-1.788	**0.076**	**VEHTRAV**	1.748	**0.082**	**VEHTRAV**	0.237	**0.813**
TRAVCOST	-1.855	**0.065**	**TRAVCOST**	-0.465	**0.642**	TRAVCOST	-4.379	**0.000**
PRVINFRAS	-0.945	**0.347**	**PRVINFRAS**	-1.257	**0.211**	**PRVINFRAS**	1.365	**0.174**
PUBINFRAS	0.016	**0.987**	**PUBINFRAS**	-0.502	**0.616**	PUBINFRAS	3.041	**0.003**
SUSINFRAS	0.036	**0.972**	**SUSINFRAS**	0.077	**0.939**	**SUSINFRAS**	0.082	**0.935**
TRANCHC	0.645	**0.521**	**TRANCHC**	1.533	**0.127**	TRANCHC	-2.124	**0.035**
PUBSAF	-0.035	**0.972**	**PUBSAF**	0.809	**0.420**	**PUBSAF**	1.913	**0.058**
CARSAF	0.527	**0.599**	**CARSAF**	-1.479	**0.142**	**CARSAF**	-0.029	**0.977**
WALK	-1.571	**0.118**	**WALK**	-0.671	**0.503**	**WALK**	-1.427	**0.156**
BUDG	2.322	**0.022**	**BUDG**	-0.141	**0.888**	BUDG	4.264	**0.000**
DISAB	1.163	**0.249**	**DISAB**	1.618	**0.108**	**DISAB**	-1.953	**0.053**
CLIMCHNG	0.660	**0.510**	**CLIMCHNG**	-0.637	**0.525**	CLIMCHNG	2.397	**0.018**
AIRQUAL	1.975	**0.050**	**AIRQUAL**	-0.233	**0.816**	AIRQUAL	4.683	**0.000**
NOISEPOLL	0.972	**0.332**	**NOISEPOLL**	-0.825	**0.411**	**NOISEPOLL**	1.751	**0.082**
GREENSPC	1.771	**0.078**	**GREENSPC**	-0.136	**0.892**	**GREENSPC**	-1.407	**0.162**
JRNQUAL	-1.993	**0.050**	**JRNQUAL**	1.424	**0.157**	**JRNQUAL**	0.563	**0.574**
BUSACC	-1.784	**0.079**	**BUSACC**	-1.291	**0.199**	**BUSACC**	0.870	**0.386**
TRNACC	-2.016	**0.048**	**TRNACC**	-1.128	**0.261**	**TRNACC**	-1.324	**0.188**
LRTACC	0.492	**0.623**	LRTACC	-2.298	**0.023**	LRTACC	-0.097	**0.923**
SERVACC	0.478	**0.634**	**SERVACC**	-1.040	**0.300**	SERVACC	2.229	**0.027**
AVAIL	-2.769	**0.008**	**AVAIL**	-1.613	**0.109**	**AVAIL**	-0.999	**0.319**
RELIAB	-0.938	**0.351**	RELIAB	-2.432	**0.016**	**RELIAB**	-0.379	**0.705**
TRANINFO	1.648	**0.104**	**TRANINFO**	-1.840	**0.068**	**TRANINFO**	0.891	**0.374**
BEHAV	0.239	**0.812**	**BEHAV**	0.240	**0.811**	**BEHAV**	1.553	**0.123**
CONG	-1.637	**0.103**	**CONG**	-0.290	**0.772**	CONG	2.963	**0.004**
JRNDIFF	1.997	**0.047**	**JRNDIFF**	0.203	**0.839**	**JRNDIFF**	1.123	**0.263**

Table E.4 t-tests comparing the means of Glasgow TQoL by car availability

t-Tests comparing Train TQoL by Car availability			t-Tests comparing LRT TQoL by Car availability			t-Tests comparing Bus TQoL by Car availability		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)

EMPLOY	0.981	**0.328**	**EMPLOY**	-0.124	**0.902**	**EMPLOY**	-0.047	**0.963**
VEHTRAV	1.018	**0.310**	**VEHTRAV**	1.930	**0.055**	**VEHTRAV**	0.432	**0.666**
TRAVCOST	-0.962	**0.337**	**TRAVCOST**	-1.578	**0.116**	TRAVCOST	3.227	**0.002**
PRVINFRAS	-1.499	**0.136**	**PRVINFRAS**	-1.030	**0.305**	PRVINFRAS	-2.998	**0.004**
PUBINFRAS	0.205	**0.838**	**PUBINFRAS**	-1.243	**0.216**	**PUBINFRAS**	0.325	**0.746**
SUSINFRAS	-0.267	**0.790**	**SUSINFRAS**	0.915	**0.362**	**SUSINFRAS**	1.158	**0.251**
TRANCHC	1.006	**0.316**	**TRANCHC**	-0.042	**0.966**	**TRANCHC**	1.109	**0.269**
PUBSAF	-1.532	**0.127**	**PUBSAF**	0.399	**0.691**	**PUBSAF**	-1.374	**0.172**
CARSAF	4.668	**0.000**	CARSAF	2.086	**0.039**	**CARSAF**	1.519	**0.131**
WALK	-0.336	**0.737**	**WALK**	-0.537	**0.592**	**WALK**	-1.195	**0.234**
BUDG	-0.997	**0.320**	**BUDG**	1.031	**0.304**	BUDG	-2.807	**0.006**
DISAB	0.230	**0.818**	DISAB	-3.162	**0.002**	**DISAB**	-0.620	**0.538**
CLIMCHNG	0.918	**0.360**	**CLIMCHNG**	-0.672	**0.503**	**CLIMCHNG**	-0.828	**0.411**
AIRQUAL	1.636	**0.103**	**AIRQUAL**	-0.672	**0.503**	**AIRQUAL**	-1.733	**0.085**
NOISEPOLL	-0.064	**0.949**	**NOISEPOLL**	-0.278	**0.781**	**NOISEPOLL**	-0.290	**0.772**
GREENSPC	1.781	**0.077**	**GREENSPC**	1.594	**0.113**	**GREENSPC**	0.178	**0.859**
JRNQUAL	0.045	**0.964**	**JRNQUAL**	0.234	**0.815**	**JRNQUAL**	0.203	**0.839**
BUSACC	-0.763	**0.446**	**BUSACC**	0.200	**0.842**	BUSACC	2.615	**0.011**
TRNACC	0.166	**0.868**	**TRNACC**	0.589	**0.556**	**TRNACC**	0.694	**0.489**
LRTACC	0.001	**1.000**	LRTACC	0.518	**0.605**	**LRTACC**	0.836	**0.405**
SERVACC	0.127	**0.899**	**SERVACC**	0.277	**0.782**	**SERVACC**	-1.525	**0.129**
AVAIL	0.504	**0.615**	**AVAIL**	0.537	**0.592**	**AVAIL**	0.268	**0.789**
RELIAB	0.531	**0.596**	**RELIAB**	1.204	**0.231**	**RELIAB**	-0.129	**0.897**
TRANINFO	-2.583	**0.011**	**TRANINFO**	-1.922	**0.057**	TRANINFO	-2.492	**0.014**
BEHAV	-1.878	**0.062**	**BEHAV**	-0.056	**0.956**	BEHAV	-2.408	**0.018**
CONG	-1.580	**0.116**	**CONG**	-1.592	**0.113**	CONG	-3.405	**0.001**
JRNDIFF	-0.191	**0.849**	**JRNDIFF**	1.507	**0.134**	**JRNDIFF**	-0.222	**0.825**

Table E.5 t-tests comparing the means of Glasgow TQoL by desire to travel more by car

t-Tests comparing Train TQoL by desire to travel more by car			**t-Tests comparing LRT TQoL by desire to travel more by car**			**t-Tests comparing Bus TQoL by desire to travel more by car**		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
EMPLOY	0.809	**0.419**	**EMPLOY**	-1.377	**0.170**	EMPLOY	2.466	**0.015**
VEHTRAV	2.470	**0.014**	**VEHTRAV**	0.543	**0.588**	VEHTRAV	2.429	**0.016**
TRAVCOST	0.549	**0.586**	TRAVCOST	-2.783	**0.006**	TRAVCOST	-2.163	**0.032**
PRVINFRAS	2.352	**0.020**	PRVINFRAS	2.175	**0.031**	**PRVINFRAS**	-0.614	**0.540**
PUBINFRAS	2.639	**0.009**	**PUBINFRAS**	0.934	**0.352**	PUBINFRAS	2.719	**0.007**
SUSINFRAS	0.331	**0.741**	**SUSINFRAS**	0.297	**0.768**	**SUSINFRAS**	0.744	**0.458**

TRANCHC	0.525	**0.600**	TRANCHC	-2.136	**0.036**	TRANCHC	2.952	**0.004**
PUBSAF	1.647	**0.107**	**PUBSAF**	1.315	**0.197**	PUBSAF	2.707	**0.008**
CARSAF	-1.221	**0.224**	CARSAF	-3.244	**0.002**	**CARSAF**	0.286	**0.775**
WALK	0.578	**0.564**	**WALK**	1.441	**0.158**	**WALK**	0.548	**0.584**
BUDG	-0.805	**0.422**	**BUDG**	0.522	**0.602**	**BUDG**	-0.913	**0.363**
DISAB	-1.465	**0.145**	DISAB	-2.140	**0.034**	**DISAB**	0.846	**0.399**
CLIMCHNG	-1.783	**0.079**	**CLIMCHNG**	-0.592	**0.555**	CLIMCHNG	2.676	**0.008**
AIRQUAL	-0.651	**0.516**	**AIRQUAL**	0.980	**0.329**	AIRQUAL	3.714	**0.000**
NOISEPOLL	0.795	**0.428**	**NOISEPOLL**	0.841	**0.401**	NOISEPOLL	5.385	**0.000**
GREENSPC	-1.797	**0.074**	**GREENSPC**	-0.222	**0.825**	**GREENSPC**	-1.413	**0.160**
JRNQUAL	1.555	**0.128**	**JRNQUAL**	0.211	**0.833**	JRNQUAL	2.505	**0.013**
BUSACC	1.103	**0.272**	**BUSACC**	0.629	**0.531**	**BUSACC**	0.231	**0.818**
TRNACC	1.351	**0.178**	**TRNACC**	0.408	**0.684**	TRNACC	2.677	**0.008**
LRTACC	0.677	**0.500**	**LRTACC**	1.744	**0.090**	**LRTACC**	0.174	**0.862**
SERVACC	-0.848	**0.398**	**SERVACC**	0.680	**0.498**	SERVACC	4.023	**0.000**
AVAIL	0.766	**0.445**	**AVAIL**	-0.430	**0.668**	**AVAIL**	1.351	**0.179**
RELIAB	0.675	**0.501**	**RELIAB**	1.958	**0.052**	**RELIAB**	0.543	**0.588**
TRANINFO	-0.219	**0.827**	**TRANINFO**	-1.269	**0.206**	**TRANINFO**	0.910	**0.365**
BEHAV	-0.589	**0.559**	**BEHAV**	0.988	**0.330**	BEHAV	3.278	**0.001**
CONG	1.179	**0.240**	**CONG**	1.411	**0.160**	**CONG**	2.009	**0.046**
JRNDIFF	1.857	**0.071**	JRNDIFF	4.709	**0.000**	JRNDIFF	3.092	**0.002**

Table E.6 t-tests comparing the means of Manchester TQoL by gender

t-Tests comparing Train TQoL by gender			**t-Tests comparing LRT TQoL by gender**			**t-Tests comparing Bus TQoL by gender**		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
EMPLOY	-1.325	**0.188**	**EMPLOY**	-0.499	**0.619**	**EMPLOY**	0.912	**0.363**
VEHTRV	-1.683	**0.095**	**VEHTRV**	-0.036	**0.971**	**VEHTRV**	1.559	**0.121**
TRAVCOST	0.507	**0.613**	**TRAVCOST**	-0.661	**0.510**	**TRAVCOST**	-1.616	**0.109**
PRVINFRS	-0.330	**0.742**	**PRVINFRS**	0.184	**0.855**	PRVINFRS	3.011	**0.003**
PUBINFRS	0.908	**0.366**	**PUBINFRS**	-0.854	**0.394**	**PUBINFRS**	1.389	**0.167**
SUSINFRAS	1.292	**0.199**	**SUSINFRAS**	-1.955	**0.053**	SUSINFRAS	3.082	**0.003**
TRANCHC	1.638	**0.104**	**TRANCHC**	0.703	**0.483**	**TRANCHC**	1.011	**0.314**
PUBSAF	2.303	**0.023**	**PUBSAF**	1.614	**0.109**	PUBSAF	2.123	**0.036**
CARSAF	-0.492	**0.623**	CARSAF	3.875	**0.000**	**CARSAF**	0.543	**0.588**
WALK	0.690	**0.491**	**WALK**	-0.014	**0.989**	WALK	2.141	**0.034**
BUDG	-1.109	**0.269**	**BUDG**	-0.278	**0.782**	**BUDG**	1.493	**0.138**
DISAB	2.806	**0.006**	**DISAB**	1.527	**0.129**	DISAB	2.987	**0.003**
CLIMCHNG	-1.144	**0.255**	**CLIMCHNG**	-1.024	**0.308**	**CLIMCHNG**	1.788	**0.076**

AIRQUAL	1.502	0.135	AIRQUAL	0.899	0.371	AIRQUAL	2.504	0.014
NOISEPOLL	1.093	0.276	NOISEPOLL	1.125	0.263	NOISEPOLL	1.965	0.053
GREENSPCE	1.430	0.155	GREENSPCE	1.675	0.096	GREENSPCE	-0.553	0.581
JRNQUAL	-1.695	0.092	JRNQUAL	2.062	0.041	JRNQUAL	2.817	0.006
BUSACC	0.446	0.656	BUSACC	1.368	0.174	BUSACC	-1.002	0.320
TRNACC	1.499	0.136	TRNACC	1.579	0.117	TRNACC	2.782	0.006
LRTACC	-2.250	0.026	LRTACC	0.148	0.882	LRTACC	-0.441	0.661
SERVACC	-0.693	0.489	SERVACC	1.792	0.075	SERVACC	2.532	0.013
AVAIL	-1.789	0.076	AVAIL	3.009	0.003	AVAIL	0.796	0.429
RELIAB	-1.479	0.142	RELIAB	1.865	0.064	RELIAB	2.299	0.024
INFO	1.459	0.147	INFO	-1.696	0.092	INFO	0.407	0.685
BEHAV	2.972	0.004	BEHAV	0.514	0.608	BEHAV	0.738	0.462
CONG	0.524	0.601	CONG	-1.391	0.167	CONG	4.054	0.000
JRNDIFF	-1.015	0.312	JRNDIFF	0.297	0.767	JRNDIFF	1.709	0.091

Table E.7 t-tests comparing the means of Manchester TQoL by age

t-Tests comparing Train TQoL by Age			t-Tests comparing LRT TQoL by Age			t-Tests comparing Bus TQoL by Age		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
EMPLOY	0.516	0.607	EMPLOY	-1.747	0.084	EMPLOY	0.264	0.792
VEHTRV	-0.201	0.841	VEHTRV	0.259	0.796	VEHTRV	-0.511	0.610
TRAVCOST	-1.394	0.166	TRAVCOST	-0.793	0.429	TRAVCOST	-0.623	0.535
PRVINFRS	-1.540	0.126	PRVINFRS	-2.024	0.045	PRVINFRS	-1.667	0.098
PUBINFRS	-1.448	0.150	PUBINFRS	0.098	0.922	PUBINFRS	0.629	0.530
SUSINFRAS	-1.747	0.083	SUSINFRAS	0.474	0.637	SUSINFRAS	0.162	0.872
TRANCHC	-1.085	0.280	TRANCHC	-1.604	0.111	TRANCHC	0.827	0.410
PUBSAF	-1.208	0.229	PUBSAF	0.179	0.858	PUBSAF	1.145	0.256
CARSAF	-0.302	0.763	CARSAF	-1.914	0.059	CARSAF	-2.442	0.016
WALK	-1.312	0.192	WALK	0.524	0.601	WALK	-1.533	0.128
BUDG	-0.124	0.901	BUDG	1.558	0.122	BUDG	-0.286	0.775
DISAB	-0.394	0.694	DISAB	0.817	0.416	DISAB	-0.568	0.571
CLIMCHNG	0.841	0.404	CLIMCHNG	0.892	0.374	CLIMCHNG	1.564	0.122
AIRQUAL	-1.283	0.202	AIRQUAL	1.949	0.053	AIRQUAL	0.976	0.331
NOISEPOLL	-1.611	0.110	NOISEPOLL	0.810	0.419	NOISEPOLL	-0.229	0.820
GREENSPCE	-1.009	0.315	GREENSPCE	0.911	0.364	GREENSPCE	0.655	0.513
JRNQUAL	-0.854	0.394	JRNQUAL	2.084	0.039	JRNQUAL	0.783	0.435
BUSACC	-3.013	0.004	BUSACC	0.073	0.942	BUSACC	-1.729	0.086
TRNACC	-1.555	0.122	TRNACC	1.376	0.171	TRNACC	-2.631	0.010

LRTACC	-0.225	**0.822**	LRTACC	-3.709	**0.000**	LRTACC	-3.782	**0.000**
SERVACC	-1.049	**0.296**	SERVACC	-1.714	**0.090**	SERVACC	-1.171	**0.244**
AVAIL	-1.792	**0.075**	AVAIL	-1.166	**0.247**	AVAIL	-1.988	**0.049**
RELIAB	-0.175	**0.862**	RELIAB	1.209	**0.229**	RELIAB	-0.274	**0.785**
INFO	0.463	**0.644**	INFO	0.828	**0.409**	INFO	-2.359	**0.020**
BEHAV	0.024	**0.981**	BEHAV	2.295	**0.023**	BEHAV	2.831	**0.005**
CONG	-0.295	**0.768**	CONG	1.544	**0.125**	CONG	0.835	**0.405**
JRNDIFF	-0.731	**0.466**	JRNDIFF	-1.596	**0.113**	JRNDIFF	0.829	**0.408**

Table E.8 t-tests comparing the means of Manchester TQoL by car availability

t-Tests comparing Train TQoL by Car availability			**t-Tests comparing LRT TQoL by Car availability**			**t-Tests comparing Bus TQoL by Car availability**		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
EMPLOY	2.723	**0.007**	EMPLOY	0.618	**0.538**	EMPLOY	0.433	**0.666**
VEHTRV	2.714	**0.008**	VEHTRV	1.450	**0.149**	VEHTRV	-0.346	**0.730**
TRAVCOST	-3.241	**0.002**	TRAVCOST	-0.614	**0.540**	TRAVCOST	-2.707	**0.008**
PRVINFRS	0.142	**0.887**	PRVINFRS	-2.519	**0.014**	PRVINFRS	1.817	**0.072**
PUBINFRS	-0.470	**0.641**	PUBINFRS	-2.171	**0.033**	PUBINFRS	-0.156	**0.876**
SUSINFRAS	0.088	**0.930**	SUSINFRAS	-2.713	**0.008**	SUSINFRAS	0.199	**0.842**
TRANCHC	-0.068	**0.947**	TRANCHC	-0.135	**0.893**	TRANCHC	-0.599	**0.550**
PUBSAF	0.897	**0.371**	PUBSAF	-0.789	**0.431**	PUBSAF	-0.909	**0.365**
CARSAF	1.901	**0.068**	CARSAF	2.406	**0.018**	CARSAF	0.408	**0.684**
WALK	-0.158	**0.874**	WALK	-0.699	**0.486**	WALK	-1.473	**0.143**
BUDG	0.635	**0.527**	BUDG	0.915	**0.362**	BUDG	1.357	**0.177**
DISAB	-0.290	**0.772**	DISAB	-0.168	**0.867**	DISAB	-0.057	**0.955**
CLIMCHNG	0.945	**0.346**	CLIMCHNG	0.042	**0.966**	CLIMCHNG	-1.165	**0.247**
AIRQUAL	-1.074	**0.285**	AIRQUAL	0.805	**0.422**	AIRQUAL	-1.384	**0.169**
NOISEPOLL	0.257	**0.798**	NOISEPOLL	-0.689	**0.492**	NOISEPOLL	-0.641	**0.523**
GREENSPCE	1.695	**0.092**	GREENSPCE	1.880	**0.062**	GREENSPCE	-1.226	**0.223**
JRNQUAL	0.569	**0.571**	JRNQUAL	0.160	**0.873**	JRNQUAL	-1.499	**0.136**
BUSACC	0.830	**0.408**	BUSACC	-0.348	**0.728**	BUSACC	1.778	**0.078**
TRNACC	3.067	**0.003**	TRNACC	-0.456	**0.649**	TRNACC	0.802	**0.424**
LRTACC	5.197	**0.000**	LRTACC	0.737	**0.462**	LRTACC	0.911	**0.364**
SERVACC	3.464	**0.001**	SERVACC	1.915	**0.058**	SERVACC	1.127	**0.262**
AVAIL	1.384	**0.176**	AVAIL	1.073	**0.285**	AVAIL	0.790	**0.431**
RELIAB	0.150	**0.881**	RELIAB	0.726	**0.470**	RELIAB	-0.003	**0.998**
INFO	-2.798	**0.007**	INFO	-1.959	**0.052**	INFO	-1.386	**0.168**

BEHAV	1.771	**0.079**	BEHAV	-1.652	**0.101**	BEHAV	-2.597	**0.011**
CONG	0.835	**0.405**	CONG	0.378	**0.706**	CONG	0.560	**0.576**
JRNDIFF	2.194	**0.030**	JRNDIFF	-0.010	**0.992**	JRNDIFF	1.378	**0.171**

Table E.9 t-tests comparing the means of Manchester TQoL by desire to travel more by car

t-Tests comparing Train TQoL by desire to travel more by car			**t-Tests comparing LRT TQoL by desire to travel more by car**			**t-Tests comparing Bus TQoL by desire to travel more by car**		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
EMPLOY	2.465	**0.015**	EMPLOY	2.007	**0.047**	EMPLOY	4.361	**0.000**
VEHTRV	2.369	**0.019**	VEHTRV	3.397	**0.001**	VEHTRV	0.824	**0.412**
TRAVCOST	-1.562	**0.121**	TRAVCOST	-0.711	**0.478**	TRAVCOST	-5.732	**0.000**
PRVINFRS	-0.818	**0.415**	PRVINFRS	0.854	**0.396**	PRVINFRS	3.326	**0.001**
PUBINFRS	-1.315	**0.191**	PUBINFRS	-0.054	**0.957**	PUBINFRS	1.274	**0.205**
SUSINFRAS	-1.467	**0.145**	SUSINFRAS	-0.245	**0.807**	SUSINFRAS	-0.679	**0.499**
TRANCHC	0.620	**0.536**	TRANCHC	2.757	**0.008**	TRANCHC	1.330	**0.186**
PUBSAF	1.043	**0.299**	PUBSAF	1.777	**0.078**	PUBSAF	1.722	**0.088**
CARSAF	0.221	**0.826**	CARSAF	1.281	**0.206**	CARSAF	1.916	**0.059**
WALK	-1.872	**0.064**	WALK	0.614	**0.541**	WALK	-0.464	**0.644**
BUDG	0.623	**0.534**	BUDG	2.131	**0.037**	BUDG	4.468	**0.000**
DISAB	0.106	**0.916**	DISAB	0.430	**0.668**	DISAB	1.519	**0.131**
CLIMCHNG	-1.594	**0.113**	CLIMCHNG	0.184	**0.854**	CLIMCHNG	-0.070	**0.944**
AIRQUAL	-2.619	**0.010**	AIRQUAL	1.244	**0.216**	AIRQUAL	0.795	**0.428**
NOISEPOLL	-1.971	**0.051**	NOISEPOLL	0.001	**0.999**	NOISEPOLL	0.450	**0.653**
GREENSPCE	-0.744	**0.459**	GREENSPCE	-2.270	**0.025**	GREENSPCE	1.085	**0.280**
JRNQUAL	1.340	**0.182**	JRNQUAL	1.555	**0.122**	JRNQUAL	2.897	**0.004**
BUSACC	1.699	**0.092**	BUSACC	0.385	**0.701**	BUSACC	0.807	**0.421**
TRNACC	1.744	**0.083**	TRNACC	0.991	**0.323**	TRNACC	-0.201	**0.841**
LRTACC	0.779	**0.437**	LRTACC	3.007	**0.003**	LRTACC	-0.307	**0.760**
SERVACC	2.150	**0.033**	SERVACC	2.774	**0.007**	SERVACC	3.490	**0.001**
AVAIL	1.986	**0.049**	AVAIL	3.237	**0.002**	AVAIL	2.514	**0.013**
RELIAB	1.791	**0.076**	RELIAB	3.347	**0.001**	RELIAB	3.265	**0.001**
INFO	0.777	**0.439**	INFO	0.787	**0.432**	INFO	-1.248	**0.214**
BEHAV	0.568	**0.571**	BEHAV	0.217	**0.829**	BEHAV	0.805	**0.422**
CONG	-1.760	**0.081**	CONG	1.140	**0.256**	CONG	-0.270	**0.788**
JRNDIFF	2.757	**0.007**	JRNDIFF	3.186	**0.002**	JRNDIFF	4.007	**0.000**

Table E.10 t-Tests comparing the means of final Glasgow TQoL by gender

t-Tests comparing Train TQoL by gender			**t-Tests comparing LRT TQoL by gender**			**t-Tests comparing Bus TQoL by gender**		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	

	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
SERVACC	-0.367	0.714	**SERVACC**	0.700	0.485	**SERVACC**	-1.603	0.111
AVAIL	-0.556	0.579	**AVAIL**	-0.386	0.700	**AVAIL**	-1.160	0.248
RELIAB	-1.331	0.185	**RELIAB**	0.022	0.982	**RELIAB**	-1.109	0.269
CLIMCHNG	-2.162	0.032	**CLIMCHNG**	0.932	0.353	**CLIMCHNG**	1.164	0.246
AIRQUAL	-0.100	0.920	**AIRQUAL**	1.670	0.097	AIRQUAL	3.186	0.002
NOISEPOLL	-0.716	0.475	**NOISEPOLL**	1.548	0.124	NOISEPOLL	3.394	0.001
SUSINFRAS	-0.754	0.452	**SUSINFRAS**	-0.730	0.467	**SUSINFRAS**	0.551	0.583
WALK	-0.044	0.965	**WALK**	-1.012	0.313	**WALK**	-0.309	0.758
PUBSAF	-0.239	0.811	PUBSAF	2.906	0.004	**PUBSAF**	1.688	0.094
BEHAV	-2.003	0.047	BEHAV	2.224	0.028	**BEHAV**	-0.393	0.695
BUDG	2.293	0.023	**BUDG**	0.738	0.462	BUDG	4.162	0.000
TRAVCOST	-2.988	0.003	**TRAVCOST**	0.191	0.849	TRAVCOST	-2.517	0.013

Table E.11 t-Tests comparing the means of final Glasgow TQoL by age

t-Tests comparing Train TQoL by Age			t-Tests comparing LRT TQoL by Age			t-Tests comparing Bus TQoL by Age		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
SERVACC	0.478	0.634	**SERVACC**	-1.040	0.300	SERVACC	2.229	0.027
AVAIL	-2.769	0.008	**AVAIL**	-1.613	0.109	**AVAIL**	-0.999	0.319
RELIAB	-0.938	0.351	RELIAB	-2.432	0.016	**RELIAB**	-0.379	0.705
CLIMCHNG	0.660	0.510	**CLIMCHNG**	-0.637	0.525	CLIMCHNG	2.397	0.018
AIRQUAL	1.975	0.050	**AIRQUAL**	-0.233	0.816	AIRQUAL	4.683	0.000
NOISEPOLL	0.972	0.332	**NOISEPOLL**	-0.825	0.411	**NOISEPOLL**	1.751	0.082
SUSINFRAS	0.036	0.972	**SUSINFRAS**	0.077	0.939	**SUSINFRAS**	0.082	0.935
WALK	-1.571	0.118	**WALK**	-0.671	0.503	**WALK**	-1.427	0.156
PUBSAF	-0.035	0.972	**PUBSAF**	0.809	0.420	**PUBSAF**	1.913	0.058
BEHAV	0.239	0.812	**BEHAV**	0.240	0.811	**BEHAV**	1.553	0.123
BUDG	2.322	0.022	**BUDG**	-0.141	0.888	BUDG	4.264	0.000
TRAVCOST	-1.855	0.065	**TRAVCOST**	-0.465	0.642	TRAVCOST	-4.379	0.000

Table E.12 t-Tests comparing the means of final Glasgow TQoL by car availability

t-Tests comparing Train TQoL by Car availability			t-Tests comparing LRT TQoL by Car availability			t-Tests comparing Bus TQoL by Car ava		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Mea	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
SERVACC	0.127	0.899	**SERVACC**	0.277	0.782	**SERVACC**	-1.525	
AVAIL	0.504	0.615	**AVAIL**	0.537	0.592	**AVAIL**	0.268	
RELIAB	0.531	0.596	**RELIAB**	1.204	0.231	**RELIAB**	-0.129	
CLIMCHNG	0.918	0.360	**CLIMCHNG**	-0.672	0.503	**CLIMCHNG**	-0.828	
AIRQUAL	1.636	0.103	**AIRQUAL**	-0.672	0.503	**AIRQUAL**	-1.733	

NOISEPOLL	-0.064	**0.949**	NOISEPOLL	-0.278	**0.781**	NOISEPOLL	-0.290	
SUSINFRAS	-0.267	**0.790**	SUSINFRAS	0.915	**0.362**	SUSINFRAS	1.158	
WALK	-0.336	**0.737**	WALK	-0.537	**0.592**	WALK	-1.195	
PUBSAF	-1.532	**0.127**	PUBSAF	0.399	**0.691**	PUBSAF	-1.374	
BEHAV	-1.878	**0.062**	BEHAV	-0.056	**0.956**	BEHAV	-2.408	
BUDG	-0.997	**0.320**	BUDG	1.031	**0.304**	BUDG	-2.807	
TRAVCOST	-0.962	**0.337**	TRAVCOST	-1.578	**0.116**	TRAVCOST	3.227	

Table E.13 t-Tests comparing the means of final Glasgow TQoL by desire to travel more by car

t-Tests comparing Train TQoL by desire to travel more by car			**t-Tests comparing LRT TQoL by desire to travel more by car**			**t-Tests comparing Bus TQoL by desire more by car**		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Mea	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
SERVACC	-0.848	**0.398**	SERVACC	0.277	**0.782**	SERVACC	4.023	
AVAIL	0.766	**0.445**	AVAIL	-0.430	**0.668**	AVAIL	1.351	
RELIAB	0.675	**0.501**	RELIAB	1.958	**0.052**	RELIAB	0.543	
CLIMCHNG	-1.783	**0.079**	CLIMCHNG	-0.592	**0.555**	CLIMCHNG	2.676	
AIRQUAL	-0.651	**0.516**	AIRQUAL	0.980	**0.329**	AIRQUAL	3.714	
NOISEPOLL	0.795	**0.428**	NOISEPOLL	0.841	**0.401**	NOISEPOLL	5.385	
SUSINFRAS	0.331	**0.741**	SUSINFRAS	0.297	**0.768**	SUSINFRAS	0.744	
WALK	0.578	**0.564**	WALK	1.441	**0.158**	WALK	0.548	
PUBSAF	1.647	**0.107**	PUBSAF	1.315	**0.197**	PUBSAF	2.707	
BEHAV	-0.589	**0.559**	BEHAV	0.988	**0.330**	BEHAV	3.278	
BUDG	-0.805	**0.422**	BUDG	0.522	**0.602**	BUDG	-0.913	
TRAVCOST	0.549	**0.586**	TRAVCOST	-2.783	**0.006**	TRAVCOST	-2.163	

Table E.14 t-Tests comparing the means of final Manchester TQoL by gender

t-Tests comparing Train TQoL by gender			**t-Tests comparing LRT TQoL by gender**			**t-Tests comparing Bus TQoL by gender**		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
SERVACC	-0.693	**0.489**	SERVACC	1.792	**0.075**	SERVACC	2.532	**0.013**
AVAIL	-1.789	**0.076**	AVAIL	3.009	**0.003**	AVAIL	0.796	**0.429**
RELIAB	-1.479	**0.142**	RELIAB	1.865	**0.064**	RELIAB	2.299	**0.024**
CLIMCHNG	-1.144	**0.255**	CLIMCHNG	-1.024	**0.308**	CLIMCHNG	1.788	**0.076**
AIRQUAL	1.502	**0.135**	AIRQUAL	0.899	**0.371**	AIRQUAL	2.504	**0.014**
NOISEPOLL	1.093	**0.276**	NOISEPOLL	1.125	**0.263**	NOISEPOLL	1.965	**0.053**
SUSINFRAS	1.292	**0.199**	SUSINFRAS	-1.955	**0.053**	SUSINFRAS	3.082	**0.003**
WALK	0.690	**0.491**	WALK	-0.014	**0.989**	WALK	2.141	**0.034**
PUBSAF	2.303	**0.023**	PUBSAF	1.614	**0.109**	PUBSAF	2.123	**0.036**
BEHAV	2.972	**0.004**	BEHAV	0.514	**0.608**	BEHAV	0.738	**0.462**
BUDG	-1.109	**0.269**	BUDG	-0.278	**0.782**	BUDG	1.493	**0.138**

TRAVCOST	0.507	**0.613**	TRAVCOST	-0.661	**0.510**	TRAVCOST	-1.616	**0.109**

Table E.15 t-Tests comparing the means of final Manchester TQoL by age

t-Tests comparing Train TQoL by Age			t-Tests comparing LRT TQoL by Age			t-Tests comparing Bus TQoL by Age		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Means	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
SERVACC	-1.049	**0.296**	SERVACC	-1.714	**0.090**	SERVACC	-1.171	**0.244**
AVAIL	-1.792	**0.075**	AVAIL	-1.166	**0.247**	AVAIL	-1.988	**0.049**
RELIAB	-0.175	**0.862**	RELIAB	1.209	**0.229**	RELIAB	-0.274	**0.785**
CLIMCHNG	0.841	**0.404**	CLIMCHNG	0.892	**0.374**	CLIMCHNG	1.564	**0.122**
AIRQUAL	-1.283	**0.202**	AIRQUAL	1.949	**0.053**	AIRQUAL	0.976	**0.331**
NOISEPOLL	-1.611	**0.110**	NOISEPOLL	0.810	**0.419**	NOISEPOLL	-0.229	**0.820**
SUSINFRAS	-1.747	**0.083**	SUSINFRAS	0.474	**0.637**	SUSINFRAS	0.162	**0.872**
WALK	-1.312	**0.192**	WALK	0.524	**0.601**	WALK	-1.533	**0.128**
PUBSAF	-1.208	**0.229**	PUBSAF	0.179	**0.858**	PUBSAF	1.145	**0.256**
BEHAV	0.024	**0.981**	BEHAV	2.295	**0.023**	BEHAV	2.831	**0.005**
BUDG	-0.124	**0.901**	BUDG	1.558	**0.122**	BUDG	-0.286	**0.775**
TRAVCOST	-1.394	**0.166**	TRAVCOST	-0.793	**0.429**	TRAVCOST	-0.623	**0.535**

Table E.16 t-Tests comparing the means of final Manchester TQoL by car availability

t-Tests comparing Train TQoL by Car availability			t-Tests comparing LRT TQoL by Car availability			t-Tests comparing Bus TQoL by Car ava		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Mea	
	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
SERVACC	3.464	**0.001**	SERVACC	1.915	**0.058**	SERVACC	1.127	
AVAIL	1.384	**0.176**	AVAIL	1.073	**0.285**	AVAIL	0.790	
RELIAB	0.150	**0.881**	RELIAB	0.726	**0.470**	RELIAB	-0.003	
CLIMCHNG	0.945	**0.346**	CLIMCHNG	0.042	**0.966**	CLIMCHNG	-1.165	
AIRQUAL	-1.074	**0.285**	AIRQUAL	0.805	**0.422**	AIRQUAL	-1.384	
NOISEPOLL	0.257	**0.798**	NOISEPOLL	-0.689	**0.492**	NOISEPOLL	-0.641	
SUSINFRAS	0.088	**0.930**	SUSINFRAS	-2.713	**0.008**	SUSINFRAS	0.199	
WALK	-0.158	**0.874**	WALK	-0.699	**0.486**	WALK	-1.473	
PUBSAF	0.897	**0.371**	PUBSAF	-0.789	**0.431**	PUBSAF	-0.909	
BEHAV	1.771	**0.079**	BEHAV	-1.652	**0.101**	BEHAV	-2.597	
BUDG	0.635	**0.527**	BUDG	0.915	**0.362**	BUDG	1.357	
TRAVCOST	-3.241	**0.002**	TRAVCOST	-0.614	**0.540**	TRAVCOST	-2.707	

Table E.17 t-Tests comparing the means of final Manchester TQoL by desire to travel more by car

t-Tests comparing Train TQoL by desire to travel more by car			t-Tests comparing LRT TQoL by desire to travel more by car			t-Tests comparing Bus TQoL by desire more by car		
	t-test for Equality of Means			t-test for Equality of Means			t-test for Equality of Mea	

	t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)		t-Stat	Sig. (2-tailed)
SERVACC	2.150	**0.033**	SERVACC	2.774	**0.007**	SERVACC	3.490	
AVAIL	1.986	**0.049**	AVAIL	3.237	**0.002**	AVAIL	2.514	
RELIAB	1.791	**0.076**	RELIAB	3.347	**0.001**	RELIAB	3.265	
CLIMCHNG	-1.594	**0.113**	**CLIMCHNG**	0.184	**0.854**	**CLIMCHNG**	-0.070	
AIRQUAL	-2.619	**0.010**	**AIRQUAL**	1.244	**0.216**	**AIRQUAL**	0.795	
NOISEPOLL	-1.971	**0.051**	**NOISEPOLL**	0.001	**0.999**	**NOISEPOLL**	0.450	
SUSINFRAS	-1.467	**0.145**	**SUSINFRAS**	-0.245	**0.807**	**SUSINFRAS**	-0.679	
WALK	-1.872	**0.064**	**WALK**	0.614	**0.541**	**WALK**	-0.464	
PUBSAF	1.043	**0.299**	**PUBSAF**	1.777	**0.078**	**PUBSAF**	1.722	
BEHAV	0.568	**0.571**	**BEHAV**	0.217	**0.829**	**BEHAV**	0.805	
BUDG	0.623	**0.534**	BUDG	2.131	**0.037**	BUDG	4.468	
TRAVCOST	-1.562	**0.121**	**TRAVCOST**	-0.711	**0.478**	TRAVCOST	-5.732	

APPENDIX F

FACTOR ANALYSIS RESULTS

INITIAL GLASGOW FACTOR ANALYSIS

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
EMPLOY								
VEHTRV						-0.51		
TRVCOST								-0.74
PRVINFRS		0.68						
PUBINFRS		0.74						
SUSINFRS					0.76			
TRANCHC	0.72							
PUBSAF		0.43						
CARSAF	0.38					0.60		
WALK					0.74			
BUDG								0.68
DISAB		0.58						
CLIMCHNG			0.82					
AIRQUAL2			0.73					
NOISEPOLL			0.86					
GREENSPCE								
JRNQUAL		0.43		0.41				
BUSACC				0.71				
TRNACC				0.76				
METACC							0.82	
SERVACC	0.54						0.50	
AVAIL	0.86							
RELI	0.82							
INFO	0.45							
BEHAV		0.54						
CONG								
JRNDIFF						0.67		
Eigenvalue	5.78	2.51	1.75	1.49	1.46	1.22	1.14	1.02
Variance (%)	21.41	9.29	6.50	5.51	5.39	4.53	4.24	3.76
Cumulative Variance (%)	20.62	30.69	37.19	42.70	48.09	52.61	56.85	60.61
Kaiser-Meyer-Olkin	0.796							
Bartlett's Test of Sphericity Sig.	0.000							

GLASGOW ECONOMIC FACTOR ANALYSIS

	Factor 1	Factor 2
EMPLOY	0.39	0.54
VEHTRV		0.77
TRVCOST		0.64
PRVINFRS	0.79	
PUBINFRS	0.82	
SUSINFRS	0.67	
Eigenvalue	2.02	1.19
Variance (%)	33.71	19.75
Cumulative Variance (%)	33.71	53.46
Kaiser-Meyer-Olkin	0.653	
Bartlett's Test of Sphericity Sig.	0.000	

GLASGOW ECONOMIC RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.311	6

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
EMPLOY	147.039	1265.883	0.245	0.196
VEHTRV	140.813	1511.061	0.048	0.328
TRVCOST	139.499	1485.825	-0.155	0.593
PRVINFRS	167.674	1293.298	0.396	0.137
PUBINFRS	160.709	1207.952	0.322	0.139
SUSINFRS	165.949	1316.252	0.293	0.182

Stage 2

Cronbach's Alpha	N of Items
0.593	5

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
EMPLOY	102.202	979.166	0.356	0.536
VEHTRV	95.975	1206.858	0.155	0.634
PRVINFRS	122.836	1075.418	0.433	0.503
PUBINFRS	115.872	923.907	0.447	0.479
SUSINFRS	121.112	1053.145	0.386	0.519

Stage 3

Cronbach's Alpha	N of Items
0.634	4

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
EMPLOY	58.678	780.447	0.296	0.658
PRVINFRS	79.312	816.578	0.464	0.541
PUBINFRS	72.348	655.066	0.516	0.483
SUSINFRS	77.588	794.745	0.414	0.566

Stage 4

Reliability Statistics	
Cronbach's Alpha	N of Items
0.658	3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PRVINFRS	42.015	449.423	0.493	0.545
PUBINFRS	35.050	321.956	0.547	0.453
SUSINFRS	40.290	446.917	0.393	0.658

GLASGOW SOCIAL FACTOR ANALYSIS

	Factor 1	Factor 2
TRANCHC	0.68	
PUBSAF	0.62	
CARSAF		0.70
WALK	0.66	
BUDG		0.69
DISAB	0.64	
Eigenvalue	1.73	1.14
Variance (%)	28.89	19.06
Cumulative Variance (%)	28.29	47.95
Kaiser-Meyer-Olkin	0.623	
Bartlett's Test of Sphericity Sig.	0.000	

GLASGOW SOCIAL RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.470	6

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
TRANCHC	227.085	1554.963	0.381	0.320
PUBSAF	232.920	1724.671	0.333	0.360
CARSAF	215.670	2179.436	0.119	0.484
WALK	247.793	1945.383	0.253	0.413
BUDG	214.068	2502.832	0.010	0.505
DISAB	256.514	2106.830	0.278	0.409

Stage 2

Cronbach's Alpha	N of Items
0.546	4

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
TRANCHC	99.203	1160.243	0.362	0.451
PUBSAF	105.038	1281.174	0.340	0.467
WALK	119.911	1405.196	0.325	0.479
DISAB	128.632	1596.583	0.324	0.492

GLASGOW ENVIRONMENTAL FACTOR ANALYSIS

	Factor 1
CLIMCHNG	0.850
AIRQUAL2	0.773
NOISEPOLL	0.873
GREENSPCE	
Eigenvalue	2.14
Variance (%)	53.39
Cumulative Variance (%)	53.39
Kaiser-Meyer-Olkin	0.684
Bartlett's Test of Sphericity Sig.	0.000

GLASGOW ENVIRONMENTAL RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.619	4

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CLIMCHNG	110.118	1206.917	0.539	0.446
AIRQUAL2	102.250	1373.082	0.477	0.507
NOISEPOLL	105.496	1176.175	0.589	0.409
GREENSPCE	93.758	1451.251	0.123	0.788

Stage 2

Cronbach's Alpha	N of Items
0.788	3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CLIMCHNG	66.669	660.769	0.659	0.678
AIRQUAL2	58.801	826.673	0.544	0.797
NOISEPOLL	62.047	652.657	0.692	0.640

GLASGOW PERSONAL FACTOR ANALYSIS

	Factor 1	Factor 2	Factor 3
JRNQUAL	0.57	0.43	
BUSACC		0.68	0.50
TRNACC		0.83	
METACC			0.83
SERVACC	0.53		0.55
AVAIL	0.67		
RELI	0.70		
INFO	0.66		
BEHAV	0.61		
CONG	0.59		
JRNDIFF		-0.50	
Eigenvalue	3.54	1.34	1.14
Variance (%)	26.12	15.46	13.18
Cumulative Variance (%)	26.12	41.58	54.76
Kaiser-Meyer-Olkin	0.751		
Bartlett's Test of Sphericity Sig.	0.000		

GLASGOW PERSONAL RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.684	11

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
JRNQUAL	440.030	5464.088	0.491	0.635
BUSACC	444.958	6635.785	0.181	0.684
TRNACC	452.225	6425.274	0.177	0.682
METACC	463.578	6067.522	0.242	0.676
SERVACC	438.193	5365.480	0.575	0.622
AVAIL	434.286	5153.680	0.584	0.615
RELI	433.592	4959.606	0.611	0.605
INFO	438.326	5247.986	0.474	0.634
BEHAV	459.252	5601.853	0.338	0.662
CONG	447.101	5106.204	0.410	0.649
JRNDIFF	459.011	7519.114	-0.375	0.765

Stage 2

Cronbach's Alpha	N of Items
0.775	8

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
JRNQUAL	323.059	5627.207	0.493	0.749
METACC	346.607	6209.343	0.259	0.781
SERVACC	321.222	5537.138	0.571	0.738
AVAIL	317.315	5275.595	0.603	0.729
RELI	316.621	5081.493	0.628	0.723
INFO	321.355	5404.739	0.477	0.750
BEHAV	342.281	5689.312	0.372	0.768
CONG	330.129	5170.771	0.447	0.760

Stage 3

Cronbach's Alpha	N of Items
0.781	7

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
JRNQUAL	295.581	4918.448	0.507	0.754
SERVACC	293.745	4916.584	0.542	0.749
AVAIL	289.837	4608.245	0.608	0.734
RELI	289.143	4418.741	0.636	0.726
INFO	293.878	4725.875	0.481	0.758
BEHAV	314.804	4995.649	0.374	0.779
CONG	302.652	4515.407	0.445	0.772

GLASGOW FINAL INITIAL FACTOR ANALYSIS

	Factor 1	Factor 2	Factor 3	Factor 4
PRVINFRS		0.68		
PUBINFRS		0.72		
SUSINFRS				0.73
TRANCHC	0.72			
PUBSAF	0.46	0.45		
WALK				0.79
DISAB				0.47
CLIMCHNG			0.83	
AIRQUAL2			0.73	
NOISEPOLL			0.86	
JRNQUAL	0.48	0.40		
SERVACC	0.74			
AVAIL	0.84			
RELI	0.80			
INFO	0.50			
BEHAV		0.69		
CONG	0.44			
Eigenvalue	4.98	2.12	1.61	1.16
Variance (%)	20.09	13.73	13.33	10.90
Cumulative Variance (%)	20.09	33.82	47.15	58.05
Kaiser-Meyer-Olkin	0.817			
Bartlett's Test of Sphericity Sig.	0.000			

MANCHESTER INITIAL FACTOR ANALYSIS

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
EMPLOY	0.52							
VEHTRV						0.59		
TRVCOST							-0.75	
PRVINFRS		0.52						
PUBINFRS		0.63						
SUSINFRS		0.84						
TRANCHC	0.48	0.45						
PUBSAF			0.69					
CARSAF								0.80
WALK		0.79						
BUDG							0.61	
DISAB		0.43	0.46					
CLIMCHNG				0.84				
AIRQUAL2				0.72				
NOISEPOLL				0.70				
GREENSPCE					-0.66			
JRNQUAL	0.43							
BUSACC								0.42
TRNACC					0.76			
METACC						0.73		
SERVACC	0.73							
AVAIL	0.84							
RELI	0.83							
INFO						-0.53		
BEHAV			0.70					
CONG			0.50					
JRNDIFF								
Eigenvalue	3.27	2.65	2.18	2.11	1.74	1.61	1.53	1.34
Variance (%)	12.10	9.81	8.08	7.82	6.46	5.95	5.66	4.96
Cumulative Variance (%)	12.10	21.91	29.99	37.81	44.27	50.22	55.87	60.84
Kaiser-Meyer-Olkin	0.764							
Bartlett's Test of Sphericity Sig.	0.000							

MANCHESTER ECONOMIC FACTOR ANALYSIS

	Factor 1	Factor 2	Factor 3
EMPLOY		0.77	
VEHTRV		0.78	
TRVCOST			0.89
PRVINFRS	0.73		
PUBINFRS	0.84		
SUSINFRS	0.76		
Eigenvalue	2.09	1.11	1.02
Variance (%)	30.99	20.71	18.57
Cumulative Variance (%)	30.99	51.70	70.26
Kaiser-Meyer-Olkin	0.661		
Bartlett's Test of Sphericity Sig.	0.000		

MANCHESTER ECONOMIC RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.305	6

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
EMPLOY	149.461	1442.736	0.145	0.264
VEHTRV	150.263	1251.147	0.226	0.196
TRVCOST	143.250	1556.726	-0.177	0.594
PRVINFRS	171.336	1377.001	0.227	0.215
PUBINFRS	175.103	1306.920	0.318	0.157
SUSINFRS	170.946	1237.671	0.373	0.111

Stage 2

Cronbach's Alpha	N of Items
0.594	5

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
EMPLOY	100.640	1209.849	0.238	0.595
VEHTRV	101.442	1083.728	0.245	0.610
PRVINFRS	122.514	1092.609	0.405	0.512
PUBINFRS	126.281	1046.282	0.479	0.473
SUSINFRS	122.124	1054.113	0.427	0.498

Stage 3

Cronbach's Alpha	N of Items
0.695	3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PRVINFRS	38.095	434.466	0.489	0.629
PUBINFRS	41.862	394.024	0.605	0.480
SUSINFRS	37.705	434.205	0.444	0.688

MANCHESTER SOCIAL FACTOR ANALYSIS

	Factor 1	Factor 2
TRANCHC	0.76	
PUBSAF	0.67	
CARSAF		0.77
WALK	0.73	
BUDG		-0.62
DISAB	0.75	
Eigenvalue	2.20	1.03
Variance (%)	36.64	17.09
Cumulative Variance (%)	36.64	53.73
Kaiser-Meyer-Olkin	0.698	
Bartlett's Test of Sphericity Sig.	0.000	

MANCHESTER SOCIAL RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.621	6

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
TRANCHC	237.195	2004.856	0.498	0.509
PUBSAF	236.370	1977.266	0.431	0.544
CARSAF	216.927	2785.564	0.122	0.653
WALK	248.506	2102.542	0.465	0.527
BUDG	222.644	2912.297	0.107	0.647
DISAB	257.038	2354.887	0.497	0.533

Stage 2

Cronbach's Alpha	N of Items
0.697	4

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
TRANCHC	109.293	1462.557	0.536	0.597
PUBSAF	108.469	1484.522	0.423	0.682
WALK	120.605	1568.191	0.485	0.631
DISAB	129.136	1790.212	0.530	0.625

MANCHESTER ENVIRONMENTAL FACTOR ANALYSIS

	Factor 1
CLIMCHNG	0.783
AIRQUAL2	0.781
NOISEPOLL	0.765
GREENSPCE	0.437
Eigenvalue	1.99
Variance (%)	46.96
Cumulative Variance (%)	46.96
Kaiser-Meyer-Olkin	0.686
Bartlett's Test of Sphericity Sig.	0.000

MANCHESTER ENVIRONMENTAL RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.617	4

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CLIMCHNG	108.704	1264.991	0.463	0.505
AIRQUAL2	100.463	1237.920	0.509	0.476
NOISEPOLL	101.713	1226.605	0.459	0.504
GREENSPCE	90.651	1213.052	0.235	0.707

Stage 2

Cronbach's Alpha	N of Items
0.707	3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CLIMCHNG	65.511	607.735	0.559	0.574
AIRQUAL2	57.270	649.450	0.501	0.645
NOISEPOLL	58.520	597.200	0.516	0.629

MANCHESTER PERSONAL FACTOR ANALYSIS

	Factor 1	Factor 2	Factor 3	Factor 4
JRNQUAL	0.42	0.57		
BUSACC			0.75	
TRNACC			0.64	0.47
METACC				-0.78
SERVACC	0.72			
AVAIL	0.89			
RELI	0.87			
INFO				0.64
BEHAV		0.61		
CONG		0.75		
JRNDIFF		-0.58		
Eigenvalue	3.13	1.46	1.20	1.09
Variance (%)	22.36	16.18	12.36	11.70
Cumulative Variance (%)	22.36	38.54	50.89	62.59
Kaiser-Meyer-Olkin	0.698			
Bartlett's Test of Sphericity Sig.	0.000			

MANCHESTER PERSONAL RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.516	11

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
JRNQUAL	431.851	4382.003	0.500	0.413
BUSACC	436.057	5487.676	0.158	0.512
TRNACC	451.402	5101.834	0.159	0.504
METACC	457.115	5238.472	0.050	0.534
SERVACC	429.709	4246.016	0.538	0.397
AVAIL	428.997	4172.175	0.517	0.396
RELI	426.050	3970.890	0.569	0.370
INFO	433.112	4857.918	0.194	0.497
BEHAV	451.100	5016.285	0.121	0.518
CONG	449.289	4513.521	0.262	0.475
JRNDIFF	435.359	6530.188	-0.407	0.672

Stage 2

Cronbach's Alpha	N of Items
0.672	10

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
JRNQUAL	384.206	5189.368	0.509	0.615
BUSACC	388.411	6385.712	0.170	0.674
TRNACC	403.757	5882.837	0.211	0.669
METACC	409.470	6096.224	0.069	0.697
SERVACC	382.064	4943.045	0.596	0.595
AVAIL	381.352	4885.794	0.562	0.599
RELI	378.404	4721.222	0.588	0.590
INFO	385.467	5750.512	0.187	0.678
BEHAV	403.455	5823.182	0.153	0.685
CONG	401.644	5144.374	0.345	0.648

Stage 3

Cronbach's Alpha	N of Items
0.702	7

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
JRNQUAL	255.463	3722.841	0.532	0.641
TRNACC	275.014	4390.847	0.188	0.716
METACC	280.726	4493.039	0.084	0.745
SERVACC	253.321	3496.254	0.630	0.612
AVAIL	252.608	3454.138	0.587	0.620
RELI	249.661	3378.564	0.576	0.621
CONG	272.901	3703.259	0.343	0.692

Stage 4

Cronbach's Alpha	N of Items
0.759	5

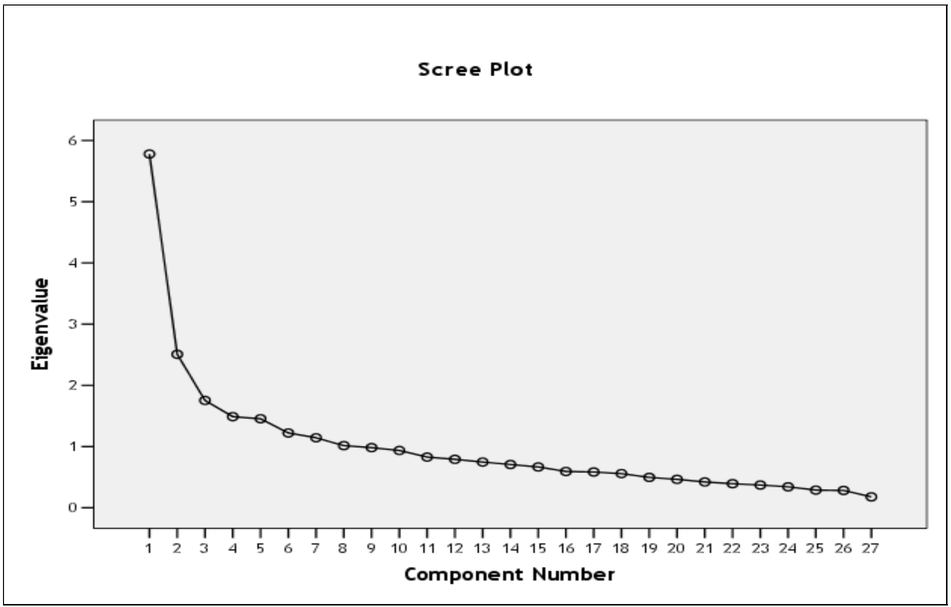
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
JRNQUAL	197.972	2798.419	0.510	0.723
SERVACC	195.829	2609.638	0.604	0.691
AVAIL	195.117	2485.148	0.622	0.681
RELI	192.170	2376.925	0.637	0.673
CONG	215.409	2774.767	0.319	0.799

MANCHESTER FINAL INITIAL FACTOR ANALYSIS

	Factor 1	Factor 2	Factor 3	Factor 4
PRVINFRS	0.57			
PUBINFRS	0.66			
SUSINFRS	0.83			
TRANCHC	0.47	0.43		
PUBSAF			0.53	
WALK	0.75			
DISAB	0.46		0.55	
CLIMCHNG				0.86
AIRQUAL2				0.68
NOISEPOLL				0.76
JRNQUAL			0.64	
SERVACC		0.76		
AVAIL		0.87		
RELI		0.84		
CONG			0.76	
Eigenvalue	4.79	1.81	1.46	1.14
Variance (%)	18.20	16.62	13.41	13.08
Cumulative Variance (%)	18.20	34.82	48.22	61.30
Kaiser-Meyer-Olkin	0.800			
Bartlett's Test of Sphericity Sig.	0.000			

GLASGOW FINAL FACTOR ANALYSIS STAGE 1

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
AVAIL	0.86							
RELI	0.82							
TRANCHC	0.72							
SERVACC	0.54						0.50	
INFO	0.45							
PUBINFRS		0.74						
PRVINFRS		0.68						
DISAB		0.58						
BEHAV		0.54						
PUBSAF		0.43						
JRNQUAL		0.43		0.41				
NOISEPOLL			0.86					
CLIMCHNG			0.82					
AIRQUAL2			0.73					
CONG								
TRNACC				0.76				
BUSACC				0.71				
EMPLOY								
SUSINFRS					0.76			
WALK					0.74			
JRNDIFF						0.67		
CARSAF						0.60		
VEHTRV						-0.51		
TRVCOST								0.74
METACC							0.82	
GREENSPCE								
BUDG								0.68
Eigenvalue	5.79	2.51	1.75	1.49	1.46	1.22	1.14	1.02
Variance (%)	21.41	9.29	6.50	5.51	5.39	4.53	4.24	3.76
Cumulative Variance (%)	20.62	30.69	37.19	42.70	48.09	52.61	56.85	60.61
Kaiser-Meyer-Olkin	0.796							
Bartlett's Test of Sphericity Sig.	0.000							



GLASGOW FINAL FACTOR ANALYSIS STAGE 2

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
AVAIL	0.83						
RELI	0.82						
TRANCHC	0.70						
INFO	0.57						
SERVACC	0.53					0.54	
JRNQUAL	0.46						
SUSINFRS		0.72					
DISAB		0.65					
PUBINFRS		0.63					
WALK		0.61					
PRVINFRS		0.56			0.44		
NOISEPOLL			0.86				
CLIMCHNG			0.83				
AIRQUAL2			0.75				
TRNACC				0.73			
BUSACC				0.59			
JRNDIFF				-0.57	-0.48		
VEHTRV				0.56			
CARSAF					-0.72		
BEHAV					0.52		
METACC						0.78	
PUBSAF							
BUDG							0.76
TRVCOST							0.65
Eigenvalue	5.20	2.50	1.69	1.46	1.38	1.21	1.13
Variance (%)	21.65	10.40	7.04	6.09	5.73	5.06	4.70
Cumulative Variance (%)	21.65	32.05	39.09	45.18	50.91	55.97	60.67
Kaiser-Meyer-Olkin	0.786						
Bartlett's Test of Sphericity Sig.	0.000						

GLASGOW FINAL FACTOR ANALYSIS STAGE 3

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
AVAIL	0.87						
RELI	0.83						
TRANCHC	0.74						
SERVACC	0.65						
INFO	0.48						
NOISEPOLL		0.87					
CLIMCHNG		0.84					
AIRQUAL2		0.75					
WALK			0.81				
SUSINFRS			0.80				
BEHAV				0.70			
CARSAF				-0.62			
PUBSAF				0.48			
JRNQUAL	0.41			0.43	0.40		
TRNACC					0.80		
BUSACC					0.74		
BUDG						0.75	
TRVCOST						0.75	
DISAB							0.77
PUBINFRS							0.56
VEHTRV					0.44		-0.47
AVAIL	0.87						
RELI	0.83						
TRANCHC	0.74						

Eigenvalue	4.82	2.30	1.62	1.35	1.21	1.11	1.02
Variance (%)	22.95	10.93	7.73	6.41	5.77	5.29	4.84
Cumulative Variance (%)	22.95	33.89	41.61	48.03	53.80	59.09	63.93
Kaiser-Meyer-Olkin	0.781						
Bartlett's Test of Sphericity Sig.	0.000						

GLASGOW NEW FACTOR ANALYSIS STAGE 4

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
AVAIL	0.86					
RELI	0.83					
TRANCHC	0.74					
SERVACC	0.64					
INFO	0.52					
NOISEPOLL		0.87				
CLIMCHNG		0.84				
AIRQUAL2		0.75				
SUSINFRS			0.80			
WALK			0.71			
DISAB			0.61			
PUBINFRS			0.52			
BUSACC				0.80		
TRNACC				0.75		
BEHAV					0.69	
CARSAF					-0.63	
PUBSAF					0.51	
BUDG						0.77
TRVCOST						0.73
Eigenvalue	4.32	2.21	1.62	1.32	1.19	1.04
Variance (%)	22.74	11.65	8.54	6.96	6.26	5.47
Cumulative Variance (%)	22.74	34.38	42.92	49.88	56.14	61.60
Kaiser-Meyer-Olkin	0.751					
Bartlett's Test of Sphericity Sig.	0.000					

FACTOR 1 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.798	5

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
TRANCHC	219.824	2541.701	0.588	0.762
SERVACC	218.654	3159.311	0.519	0.779
AVAIL	214.746	2696.195	0.737	0.713
RELI	214.052	2598.761	0.723	0.712
INFO	218.787	3121.767	0.387	0.819

Stage 2

Cronbach's Alpha	N of Items
0.819	4

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
TRANCHC	167.094	1647.147	0.621	0.794
SERVACC	165.925	2244.889	0.495	0.832
AVAIL	162.017	1795.942	0.774	0.713
RELI	161.323	1760.388	0.716	0.735

FACTOR 2 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.788	3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CLIMCHNG	66.669	660.769	0.659	0.678
AIRQUAL2	58.801	826.673	0.544	0.797
NOISEPOLL	62.047	652.657	0.692	0.640

FACTOR 3 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.643	4

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PUBINFRS	71.700	975.987	0.398	0.592
SUSINFRS	76.940	968.675	0.547	0.506
WALK	64.310	822.312	0.413	0.597
DISAB	73.031	1026.207	0.375	0.606

Stage 2

Cronbach's Alpha	N of Items
0.606	3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PUBINFRS	49.404	628.682	0.303	0.656
SUSINFRS	54.644	559.469	0.591	0.308
WALK	42.015	449.423	0.409	0.545

Stage 3

Cronbach's Alpha	N of Items
0.656	2

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SUSINFRS	31.017	284.491	0.520	.(a)
WALK	18.387	138.061	0.520	.(a)

Stage 4

Correlations

		SUSINFRS	WALK
SUSINFRS	Pearson Correlation	1	0.520
	Sig. (2-tailed)		0.000
	N	488	488
WALK	Pearson Correlation	0.520	1
	Sig. (2-tailed)	0.000	
	N	488	488

** Correlation is significant at the 0.01 level (2-tailed).

FACTOR 4 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.406	2

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
BUSACC	38.807	86.545	0.341	.(a)
TRNACC	46.102	17.324	0.341	.(a)

Stage 2

Correlations			
		BUSACC	TRNACC
BUSACC	Pearson Correlation	1	0.341
	Sig. (2-tailed)		0.000
	N	488	488
TRNACC	Pearson Correlation	0.341	1
	Sig. (2-tailed)	0.000	
	N	488	488

** Correlation is significant at the 0.01 level (2-tailed).

FACTOR 5 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.326	3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PUBSAF	94.959	507.971	0.344	-0.165
CARSAF	77.709	924.638	-0.016	0.678
BEHAV	109.030	636.601	0.258	0.084

Stage 2

Cronbach's Alpha	N of Items
0.678	2

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PUBSAF	31.819	298.913	0.408	.(a)
BEHAV	45.890	358.723	0.408	.(a)

Stage 3

Correlations			
		PUBSAF	BEHAV
PUBSAF	Pearson Correlation	1	0.408
	Sig. (2-tailed)		0.000
	N	488	488
BEHAV	Pearson Correlation	0.408	1
	Sig. (2-tailed)	0.000	
	N	488	488

** Correlation is significant at the 0.01 level (2-tailed).

FACTOR 6 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.579	2

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
TRVCOST	64.746	94.532	0.342	.(a)
BUDG	18.392	158.955	0.342	.(a)

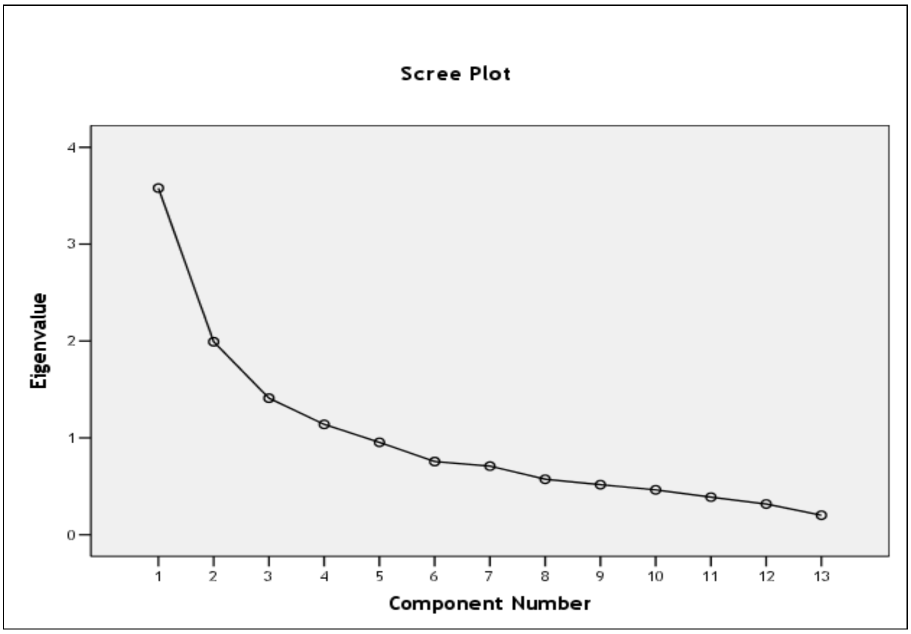
Stage 2

Correlations			
		TRVCOST	BUDG
TRVCOST	Pearson Correlation	1	0.342
	Sig. (2-tailed)		0.000
	N	488	488
BUDG	Pearson Correlation	0.342	1
	Sig. (2-tailed)	0.000	
	N	488	488

** Correlation is significant at the 0.01 level (2-tailed).

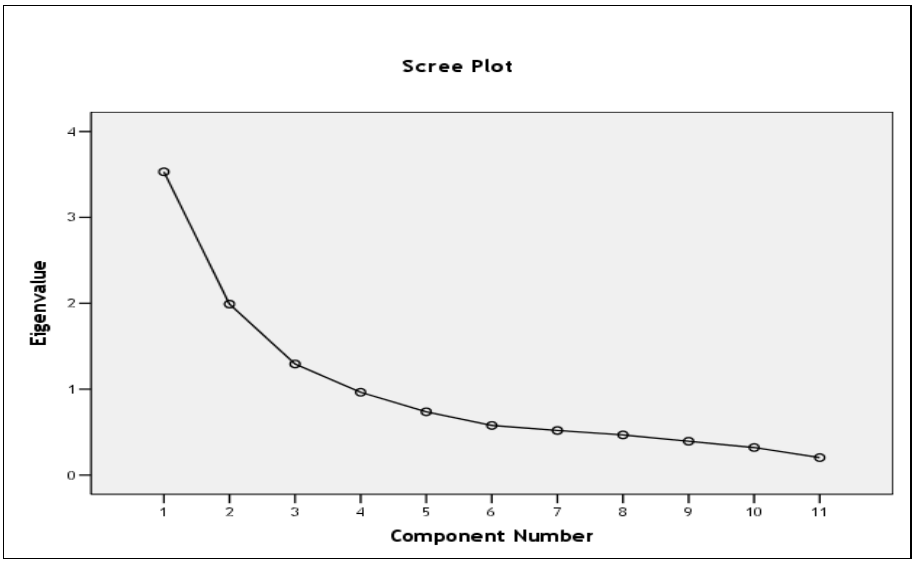
FINAL GLASGOW FINAL FACTOR ANALYSIS: STAGE 1

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
AVAIL	0.89				
RELI	0.85				
TRANCHC	0.79				
SERVACC	0.61				
NOISEPOLL		0.88			
CLIMCHNG		0.86			
AIRQUAL		0.73			
SUSINFRS			0.85		
WALK			0.84		
BEHAV				0.82	
PUBSAF				0.72	
TRVCOST					0.79
BUDG					0.77
Eigenvalue	3.58	1.99	1.41	1.14	0.95
Variance (%)	27.53	15.32	10.85	8.77	7.34
Cumulative Variance (%)	27.53	42.85	53.70	62.47	69.81
Kaiser-Meyer-Olkin	0.739				
Bartlett's Test of Sphericity Sig.	0.000				



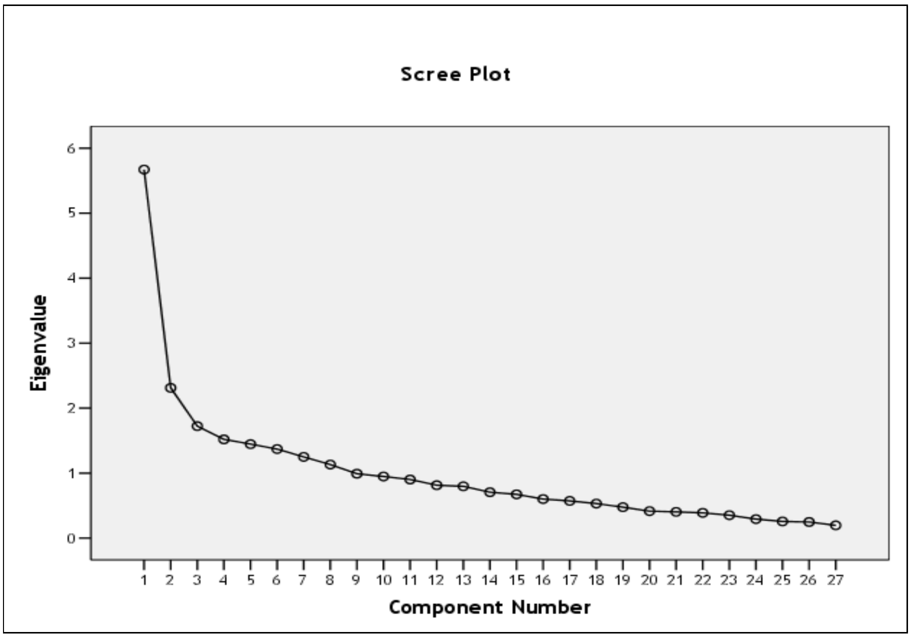
FINAL GLASGOW FINAL FACTOR ANALYSIS: STAGE 2

	Factor 1	Factor 2	Factor 3	Factor 4
AVAIL	0.90			
RELI	0.85			
TRANCHC	0.78			
SERVACC	0.61			
NOISEPOLL		0.88		
CLIMCHNG		0.86		
AIRQUAL2		0.73		
WALK			0.86	
SUSINFRS			0.85	
BEHAV				0.83
PUBSAF				0.73
Eigenvalue	3.53	1.99	1.29	0.96
Variance (%)	32.09	18.10	11.76	8.76
Cumulative Variance (%)	32.09	50.19	61.95	70.71
Kaiser-Meyer-Olkin	0.745			
Bartlett's Test of Sphericity Sig.	0.000			



MANCHESTER FINAL FACTOR ANALYSIS: STAGE 1

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
AVAIL	0.84							
RELI	0.83							
TRANCHC	0.73							
SERVACC	0.52							
INFO	0.48	0.45						
PUBINFRS	0.43							
PRVINFRS		0.84						
DISAB		0.79						
BEHAV		0.63						
PUBSAF		0.52						
JRNQUAL			0.70					
NOISEPOLL			0.69					
CLIMCHNG			0.50					
AIRQUAL2		0.43	0.46					
CONG				0.84				
TRNACC				0.72				
BUSACC				0.70				
EMPLOY					0.76			
SUSINFRS					-0.66			
WALK								
JRNDIFF						0.73		
CARSAF						0.59		
VEHTRV						-0.53		
TRVCOST							-0.75	
METACC							0.61	
GREENSPCE								0.80
BUDG								0.42
Eigenvalue	5.67	2.31	1.73	1.52	1.45	1.37	1.25	1.13
Variance (%)	21.00	8.57	6.38	5.63	5.39	5.08	4.63	4.19
Cumulative Variance (%)	21.00	29.57	35.95	41.58	46.94	52.01	56.64	60.86
Kaiser-Meyer-Olkin	0.764							
Bartlett's Test of Sphericity Sig.	0.000							



MANCHESTER FINAL FACTOR ANALYSIS: STAGE 2

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
AVAIL	0.83							
RELI	0.82							
SERVACC	0.74							
EMPLOY	0.53							
TRANCHC	0.50	0.45						
JRNQUAL	0.46							
SUSINFRS		0.84						
WALK		0.79						
PUBINFRS		0.62						
PRVINFRS		0.52						
CLIMCHNG			0.84					
AIRQUAL2			0.72					
NOISEPOLL			0.72					
BEHAV				0.75				
PUBSAF				0.70				
CONG				0.48				
TRNACC					0.78			
GREENSPCE					-0.64			
METACC						0.73		
VEHTRV						0.65		
INFO						-0.47		
TRVCOST							-0.72	
BUDG							0.64	
CARSAF								0.83
BUSACC								
Eigenvalue	5.15	2.26	1.70	1.51	1.37	1.32	1.25	1.07
Variance (%)	20.59	9.05	6.76	6.05	5.49	5.27	4.99	4.26
Cumulative Variance (%)	20.59	29.64	36.40	42.49	47.94	53.20	58.19	62.45
Kaiser-Meyer-Olkin	0.751							
Bartlett's Test of Sphericity Sig.	0.000							

MANCHESTER FINAL FACTOR ANALYSIS: STAGE 3

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
AVAIL	0.84						
RELI	0.81						
SERVACC	0.78						
EMPLOY	0.49						
TRANCHC	0.48	0.44					
JRNQUAL	0.41				0.40		
SUSINFRS		0.84					
WALK		0.76					
PUBINFRS		0.65					
PRVINFRS		0.56					
CLIMCHNG			0.84				
AIRQUAL2			0.73				
NOISEPOLL			0.73				
BEHAV				0.74			
PUBSAF				0.67			
CONG				0.48			
METACC					0.71		
VEHTRV					0.64		
INFO					-0.47		
TRNACC						0.77	
GREENSPCE						-0.67	
TRVCOST							0.76
BUDG							0.59

Eigenvalue	5.12	2.14	1.62	1.51	1.36	1.25	1.19
Variance (%)	22.27	9.30	7.07	6.56	5.93	5.42	5.15
Cumulative Variance (%)	22.27	31.56	38.63	45.19	55.16	56.37	61.69
Kaiser-Meyer-Olkin	0.760						
Bartlett's Test of Sphericity Sig.	0.000						

MANCHESTER FACTOR ANALYSIS: STAGE 4

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
AVAIL	0.85						
RELI	0.81						
SERVACC	0.79						
EMPLOY	0.48						
SUSINFRS		0.83					
WALK		0.73					
PUBINFRS		0.68					
PRVINFRS		0.60					
CLIMCHNG			0.84				
AIRQUAL2			0.73				
NOISEPOLL			0.73				
BEHAV				0.76			
PUBSAF				0.70			
CONG				0.43			
METACC					0.74		
VEHTRV					0.69		
INFO					-0.41		
TRNACC						0.77	
GREENSPCE						-0.68	
TRVCOST							0.76
BUDG							0.60
Eigenvalue	4.34	2.10	1.57	1.47	1.33	1.24	1.17
Variance (%)	20.66	10.00	7.49	7.00	6.35	5.90	5.56
Cumulative Variance (%)	20.66	30.66	38.16	45.15	51.51	57.41	62.97
Kaiser-Meyer-Olkin	0.716						
Bartlett's Test of Sphericity Sig.	0.000						

FACTOR 1 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.795	4

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SERVACC	153.572	1519.003	0.627	0.734
AVAIL	152.860	1345.259	0.722	0.682
RELI	149.913	1287.437	0.708	0.691
EMPLOY	164.256	1976.197	0.397	0.830

Stage 2

Cronbach's Alpha	N of Items
0.830	3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SERVACC	110.962	1094.709	0.597	0.851
AVAIL	110.249	898.788	0.759	0.694
RELI	107.302	864.750	0.724	0.732

FACTOR 2 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.726	4

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PRVINFRS	73.325	1154.038	0.421	0.716
PUBINFRS	77.092	1086.325	0.525	0.665
SUSINFRS	72.935	963.622	0.670	0.581
WALK	58.832	821.606	0.512	0.695

Stage 2

Cronbach's Alpha	N of Items
0.716	3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PUBINFRS	56.356	750.120	0.402	0.769
SUSINFRS	52.199	572.650	0.711	0.439
WALK	38.095	434.466	0.568	0.629

Stage 3

Cronbach's Alpha	N of Items
0.769	2

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
SUSINFRS	35.230	305.419	0.661	.(a)
WALK	21.126	156.182	0.661	.(a)

Stage 4

Correlations			
		SUSINFRS	WALK
SUSINFRS	Pearson Correlation	1	0.661
	Sig. (2-tailed)		0.000
	N	399	399
WALK	Pearson Correlation	0.661	1
	Sig. (2-tailed)	0.000	
	N	399	399
** Correlation is significant at the 0.01 level (2-tailed).			

FACTOR 3 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.707	3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CLIMCHNG	65.511	607.735	0.559	0.574
AIRQUAL	57.270	649.450	0.501	0.645
NOISEPOLL	58.520	597.200	0.516	0.629

FACTOR 4 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.512	3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PUBSAF	65.619	807.216	0.408	0.266
BEHAV	81.081	994.875	0.349	0.384
CONG	79.269	981.097	0.239	0.560

Stage 2

Cronbach's Alpha	N of Items
0.560	2

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
PUBSAF	31.904	301.190	0.394	.(a)
BEHAV	47.366	404.986	0.394	.(a)

Stage 3

Correlations

		PUBSAF	BEHAV
PUBSAF	Pearson Correlation	1	0.394
	Sig. (2-tailed)		0.000
	N	399	399
BEHAV	Pearson Correlation	0.394	1
	Sig. (2-tailed)	0.000	
	N	399	399

** Correlation is significant at the 0.01 level (2-tailed).

FACTOR 5 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha(a)	N of Items
-0.721	2

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
GREENSPCE	31.602	195.153	-0.283	.(a)
TRNACC	43.193	405.373	-0.283	.(a)

FACTOR 6 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha	N of Items
0.180	3

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
VEHTRV	75.781	474.855	0.281	-0.331
METACC	91.700	540.132	0.120	0.065
INFO	67.697	656.466	-0.070	0.512

FACTOR 7 RELIABILITY ANALYSIS

Stage 1

Cronbach's Alpha(a)	N of Items
0.534	2

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
TRVCOST	61.092	116.928	0.323	.(a)
BUDG	48.821	467.526	0.323	.(a)

Stage 2

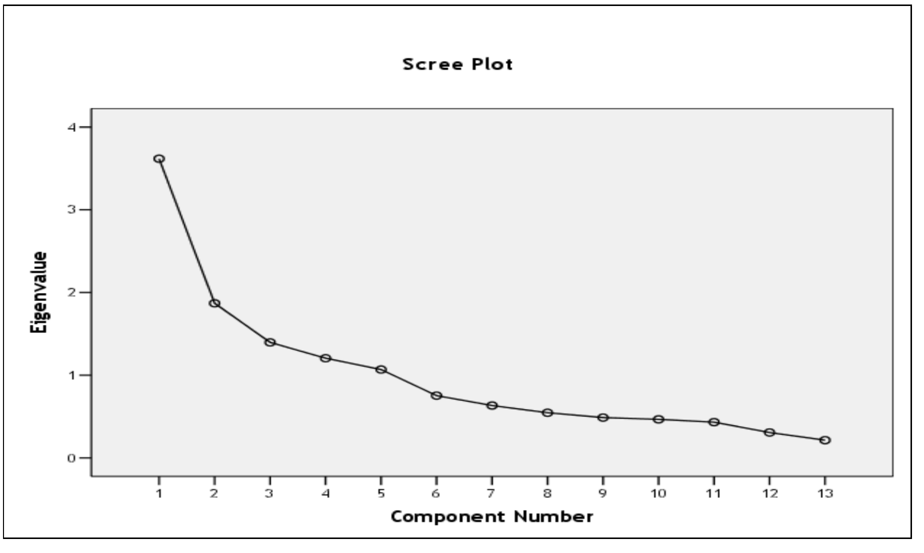
Correlations

		TRVCOST	BUDG
TRVCOST	Pearson Correlation	1	0.323
	Sig. (2-tailed)		0.000
	N	399	399
BUDG	Pearson Correlation	0.323	1
	Sig. (2-tailed)	0.000	
	N	399	399

** Correlation is significant at the 0.01 level (2-tailed).

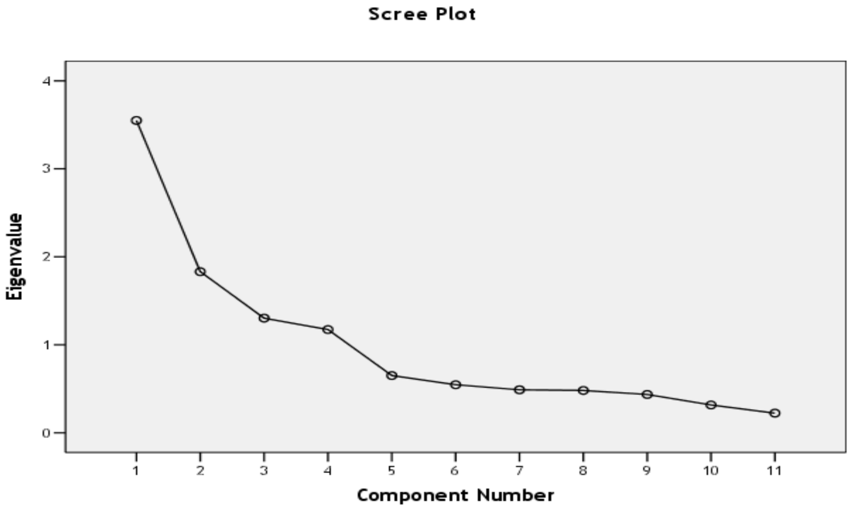
FINAL MANCHESTER NEW FACTOR ANALYSIS: PART 1

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
AVAIL	0.89				
RELI	0.85				
SERVACC	0.79				
CLIMCHNG		0.85			
NOISEPOLL		0.76			
AIRQUAL2		0.72			
WALK			0.88		
SUSINFRS			0.87		
BEHAV				0.84	
PUBSAF				0.76	
BUDG					0.81
TRVCOST					0.73
Eigenvalue	3.19	1.85	1.37	1.20	1.06
Variance (%)	26.59	15.43	11.43	9.99	8.85
Cumulative Variance (%)	26.59	42.02	53.45	63.45	72.30
Kaiser-Meyer-Olkin	0.674				
Bartlett's Test of Sphericity Sig.	0.000				



FINAL MANCHESTER NEW FACTOR ANALYSIS: PART 2

	Factor 1	Factor 2	Factor 3	Factor 4
AVAIL	0.89			
RELI	0.85			
SERVACC	0.80			
CLIMCHNG		0.85		
NOISEPOLL		0.76		
AIRQUAL2		0.73		
SUSINFRS			0.89	
WALK			0.89	
BEHAV				0.85
PUBSAF				0.77
BUDG				
TRVCOST				
Eigenvalue	3.13	1.81	1.29	1.16
Variance (%)	31.25	18.07	12.87	11.59
Cumulative Variance (%)	31.25	49.32	62.19	73.77
Kaiser-Meyer-Olkin	0.685			
Bartlett's Test of Sphericity Sig.	0.000			



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