

Department for Transport

**Analysis of Reliability Factors for
Accessibility Planning in Greater
Manchester**

**Issue 2
26 July 2004**



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Executive Summary

This report discusses approaches for considering transport reliability factors within accessibility planning. Reliability affects different people groups in different ways, and the consequences of poor reliability for lower income groups can be severe including losing jobs or disciplinary action.

Due to the complexity of reliability there is a poor track record in transport planning for considering issues effectively. In many cases, information about the reliability of services has not even been collected. Accessibility planning needs to recognise that new approaches are still being developed to give reliability issues the priority they deserve.

There are four main components of reliability relevant to accessibility needs:

- Extended journey times – These are most prevalent at certain times of day, due to congested operating conditions.
- The variability of journey times reflects the fact that journey time may only be extended on some days
- Cancelled services - The impact of these depends on service frequencies.
- Passengers being unable to board a bus due to overcrowding or a physically inaccessible vehicle being provided when a low floor bus had been scheduled.

Plans for wider application of real time information presents an opportunity to make available a higher quality data source for reliability statistics. A requirement to provide such data as a clear contractual requirement of bus quality partnerships and contracts would help to ensure that reliability problems can be more clearly identified and targeted.

In the meantime existing data for Greater Manchester has been mapped for late arrival of buses and non arrival of buses based on local surveys. Although not straightforward to consider in analytical terms, mapping of reliability using the sort of data can yield useful information, which would not be known purely from qualitative survey work in the area. Such data should be available from surveys and monitoring within many local authorities so this approach could be replicated elsewhere. The bus reliability mapping has enabled problem areas to be identified and could be used to inform further local consultation and joint working with operators and other partners.

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1.0 Introduction

- 1.1 Piloting accessibility planning in Greater Manchester showed how detailed mapping of travel time could help to inform the accessibility audits. However many other factors in addition to travel time were identified as potential barriers to access and were not analysed in detail. These included: information, security, physical access, cost and reliability.
- 1.2 This report discusses approaches for considering reliability factors in greater detail, as factors affecting access for a range of trip purposes across the GMPTE area. It has been prepared to illustrate the different approaches, which could be useful for accessibility planning across the country.
- 1.3 Although in this report reliability is considered in isolation from other factors, combinations of effects such as information and reliability can result in greater barriers than the sum of the separate components. Modelling cannot incorporate these complex effects, so the accessibility planning process envisages consistent national modelling based on simple travel time analysis to monitor trends over time, complemented with much more detailed local analysis of other issues including reliability, to ensure effective targeting of action.
- 1.4 This report has been prepared to identify possible approaches to ensure that reliability is considered thoroughly and robustly in accessibility planning.

Approach

- 1.5 The approach has been to:
 - Review what is known about reliability as a barrier to access
 - Identify conceptual approaches to analyse reliability barriers
 - Consult with Greater Manchester PTE to identify practical ways to use existing evidence to understand problems and plan improvements.
- 1.6 The report has been prepared by DHC and the Transport Studies Group at the University of Westminster.

Reliability within the GMPTE Pilot

- 1.7 Although the accessibility planning pilot was focused on access to learning in Wigan, this research is set in the context of the wider GMPTE area. In order to examine reliability issues in more depth this report takes a broader view of known issues across the GMPTE area.

This is consistent with the partnership approach being taken by GMPTE working with bus companies and the Traffic Commissioner to improve reliability across the area. The approach should therefore help to identify approaches for Wigan, which can be used to tackle relevant access to learning issues in taking forward the accessibility action plan developed through the pilot.

- 1.8 In particular, unreliable bus services were identified as an important element affecting student drop out from further education colleges. The accessibility action plan is developing measures to provide a safety net to ensure that students can still get to college on days when there are bus reliability problems.

2.0 Reliability as a Barrier to Accessibility

2.1 Reliability problems affect particular people groups and trip purposes in different ways. This section provides a brief review of the main mechanisms.

People

2.2 The frequency and reliability of public transport is particularly important for those with childcare responsibilities, who often have to combine journeys to work, school, childcare and shopping, thus punctuality and speed are at a premium¹.

2.3 It has been identified that people with disabilities can be made to feel more vulnerable as a result of poor reliability since issues such as being left waiting at bus stops increases exposure to abuse and attack². Similar concerns have also been raised by young people, women of all ages, and older people.

2.4 Reliability is also more likely to be an issue after dark when people do not like waiting at bus stops. In these circumstances poor public transport reliability can also lead to increased travel costs e.g. if people resort to taxis³.

Employment

2.5 Reliability is an especially important factor in relation to the journey to work. People in the most deprived areas are more likely to be late for work and problems with public transport reliability are a factor in this⁴. Over one in five of those in the 20 per cent most deprived wards were late at least once a week, compared with one in seven of those in the 20 per cent least deprived wards and the higher proportion of public transport travellers amongst the people in the deprived areas is a factor⁵.

2.6 Of particular importance is that low-income workers, particularly in temporary jobs, face more significant consequences from poor reliability including:

- Being disciplined as a result of lateness;

¹ SEU (2002) Making the Connections: transport and social exclusion: Interim report www.socialexclusionunit.gov.uk/publications/reports/html

² Lucas et al (2001) *ibid*

³ *Young People's Experience of crime and anti-social behaviour on public transport*, Report by Crime Concern for DETR, (1999)

⁴ SEU (2003). Transport and Social Exclusion

⁵ Office for National Statistics (ONS) *Omnibus Survey* November 2001

- Having to make up for lost time;
- Risk of losing their job.

Education

- 2.7 Research is needed to compare school lateness (which is a punishable offence) for pupils who are reliant on public transport to school with those who have lifts⁶.
- 2.8 Also for college education, education maintenance allowance can be withdrawn due to lateness.

Healthcare

- 2.9 Although unreliability is more often associated with public transport, health practitioners identify unreliable patient transport services as a factor affecting patient attendance. This has been analysed in greater detail in research for Lincolnshire and Merseyside access to healthcare pilots for DfT⁷.
- 2.10 At a personal level people may find that they lose priority within the system if they are late for appointments on transport grounds, and they can find that and may need to wait much longer for healthcare or even lose entitlement if there are repeated problems.

⁶ DHC 2002. Literature Review of School Travel. Scottish Executive.

⁷ DHC 2004. Accessibility and Attendance at Healthcare Appointments.

3.0 Methods of Analysing Reliability Factors

- 3.1 Reliability is consistently identified in surveys of travellers as one of the most important factors affecting travel behaviour and satisfaction with travel. Yet due to its complexity there is a poor track record in transport planning for considering these issues. In many cases, information about the reliability of services has not even been collected. In recent years the advent of processes to manage improvements in bus and rail services has resulted in greater availability of information. For the rail industry, service reliability is now a key factor in performance monitoring, and for buses quality partnerships are being used to manage progress.
- 3.2 However data remains fragmentary and accessibility planning needs to recognise that new approaches are still being developed to give reliability issues the priority they deserve.
- 3.3 There are four main components of reliability which are relevant to accessibility needs:
- Extended journey times – These are most prevalent at certain times of day, due to congested operating conditions.
 - The variability of journey times reflects the fact that journey time may only be extended on some days
 - Cancelled services - The impact of these depends on service frequencies.
 - Passengers being unable to board a bus due to overcrowding or an physically inaccessible vehicle being provided when a low floor bus had been scheduled.
- 3.4 Extended journey times consist of two components: extended running times and extended waiting times. The first of these is widely monitored resulting in available data which can be used in accessibility planning. Reliability of scheduled bus services is assessed by the Traffic Commissioner according to whether a bus is more than five minutes late or one minute early. An unreliable service is one that meets this target less than 95% of the time. Rail services are monitored using a range of thresholds and principally the number of trains more than 10 minutes late.
- 3.5 In contrast, there is little monitoring of overall changes in journey times taking account of extended waiting times. Some areas monitor passenger perceptions of reliability and it is likely that these will include both running and waiting time components, but other factors such as variability of journey times, cancelled services and overcrowding will be encompassed in these general measures.

- 3.6 Where frequencies are high, the effect of service cancellations may be fairly limited, but for most scheduled services with frequencies below six services an hour the impacts on accessibility can be very significant, particularly where interchange is needed as part of the trip.
- 3.7 Data on the number of cancelled services should be increasingly available, particularly as performance of bus services is often monitored within the growing number of quality partnerships. Monitoring of supported services is also more common and relates directly to socially necessary services.
- 3.8 These factors can be considered in several ways:
- The sensitivity of travel time based accessibility indices to reliability problems could be analysed. In some locations with high service frequencies accessibility will not be affected significantly by a limited number of late services. In other areas the impacts will be much more significant.
 - Reliability can be mapped to identify the locations affected by the greatest problems and an assessment made of the impacts on different sectors of the travel market and particularly on deprived groups.
 - Timetabled travel times and wait times used in time based mapping work could be factored to reflect the standard of reliability achieved by each operator.
- 3.9 The inability of a passenger to board a bus is the rarest of the components of reliability but also the one most likely to generate complaints from users. Although deprived people tend to complain less than the average for the population, complaints data is a good starting point for assessing the types of reliability problem experienced. The effects are the same as if the service had been cancelled so can be modelled in the same way. It is a problem likely to particularly affect certain socially disadvantaged groups (e.g. elderly people, wheelchair users, those with a shopping trolley or a children's buggy), who are not able to board crowded buses or some older buses, even if there is technically some remaining space on board. In addition to identifying types of problems in accessibility assessments to assist in planning generic improvement with operators, the complaints data can be mapped to identify any target locations where particular problems are prevalent.

Surveys of Reliability in Greater Manchester

- 3.10 If reliability factors are not included in accessibility gap analysis then levels of accessibility will be significantly overstated. As discussed above, it is particularly important to consider reliability where

interchange is involved. Although, in the past, there has been a sparsity of data on reliability, the need for tighter monitoring of bus performance is increasingly being recognised, so more authorities should have survey data on reliability.

- 3.11 GMPTE has faced particular reliability challenges so has developed various survey techniques. Recent surveys of user perceptions⁸ found that respondents described reliability as a combination of three related concepts: predictability, punctuality, and turning up. These are analogous to the variability of journey times, extended journey times and cancelled services described in paragraph 3.1.
- 3.12 Of particular interest is that the importance of reliability varies by trip purpose and people group. People were more sensitive to these issues when a timed appointment or travel to work was involved. They dislike being late, but seem to plan around this by travelling earlier than they need to for some trips, which they learn through experience. Depending on the service headway and the journey purpose, people try to go for the bus before the one they really need to catch. However headways over an hour are unattractive and people look to alternative modes of transport.
- 3.13 Low predictabilities of buses and large headways are therefore important factors particularly for accessing healthcare, work, and learning. Hence large headways of service can be a key barrier to the use of buses for these purposes.
- 3.14 The report identified that non-bus users, in particular car users, may not share the same tolerances of unreliability. This stems from the lack of waiting time and continuity of departure time, to which car users are accustomed.
- 3.15 A survey of the causes of unreliability for GMPTE⁹ from a small sample identified three key causes of delays, each accounting for approximately 10% of the delay as a proportion of actual journey time. These were: boarding and alighting, stuck in traffic, and awaiting traffic signals.
- 3.16 There is potential for reliability data to be collected and analysed in much more sophisticated ways in the future. Plans for wider application of real time information presents an opportunity since a data set could potentially be available which describes the location of each bus, which can be compared with timetabled service delivery. It

⁸ Faber Maunsell April 2004, Understanding Reliability Final Report for GMPTE

⁹ Presentation of Pilot Study on 'Identifying the Causes of Bus Service Unreliability'. Philip Higgs & Tim Howgego The TAS Partnership Ltd.

will be very important for GMPTE and other authorities to ensure that provision of data such as this is a clear contractual requirement of bus quality partnerships to ensure that the benefits of investment in the network can be monitored.

4.0 Reliability Mapping for Greater Manchester

Mapping Reliability

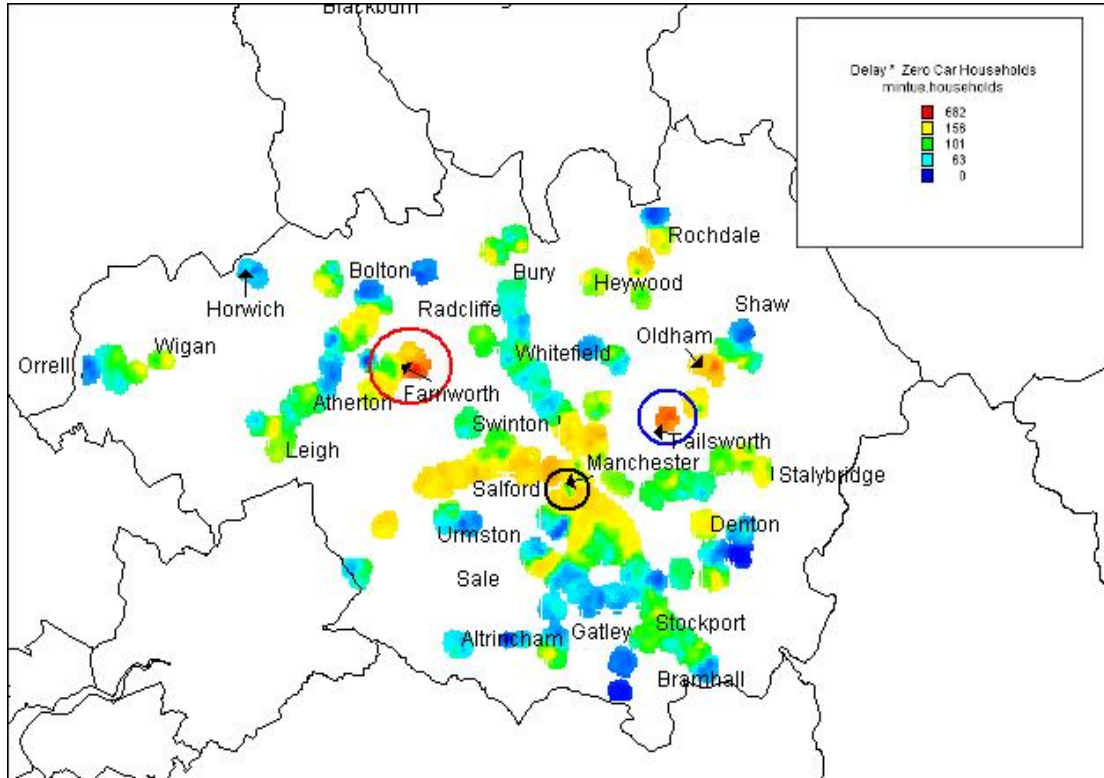
- 4.1 Reliability improvements are one of the key aims of bus quality partnerships and the development of better data to support the planning and delivery of improvements in these corridors is essential across the country. In GMPTE, data had been collected in one hour periods from bus stops since April 2003 on the Quality Bus Corridors, and since April 2004 on the general bus network.
- 4.2 Although this data was collected over a long time period, the volume of data for each stop was small and sampled inconsistently. Therefore the volume of data was not sufficient to allow disaggregation by services or routes, and the data was analysed initially by bus stop location over the entire sampling period and across the entire network.
- 4.3 From this database, data relating to the arrival of buses at stops was analysed to explore reliability in the following ways:
- Late arrival of buses
 - Non-arrival.

Late arrival of buses

- 4.4 All records of buses arriving one minute early or less, on time, or late were analysed collectively to assess if individual bus stops had particular reliability problems. Any bus stops with less than five records in the database were omitted. The average delay was then calculated for each stop. The minimum threshold of five records was chosen so that random single incidences would not distort the picture of reliability at any location, but that only clear problem locations would be identified. The volume of data collected by GMPTE meant that this was a practical approach, but other Transport Authorities may not have access to this volume of data and may need to accept a lower threshold. Nevertheless the availability of information is growing and could potentially be widespread with wider application of GPS based real-time information systems.
- 4.5 It is therefore sensible to work towards detailed analytical techniques that assume wide availability of information. The mapping undertaken here therefore aims to illustrate the sort of approach that will be of increasing benefit in presenting to partners in the accessibility planning process, the problems which need to be overcome.
- 4.6 To enable the implications for social exclusion to be calculated, the following indicator was developed. The average delay at all the bus

stops within 500m of the centroid of each Census Output Area (COA) was calculated and this was multiplied by number of zero car households in the COA. This was then mapped and is presented in figure 4.1

Fig 4.1 Late Arrival of Buses by Zero Car Households



- 4.7 Although the coverage of data is patchy, the figure gives a broad indication of the areas where late arrival is most likely to be a priority issue in terms of tackling social exclusion.
- 4.8 In addition to the factored zero car households and delays it is important, to consider the delays separately from the people groups to ensure that scale factors in the analysis are being represented correctly, i.e. a high value as displayed in figure 4.1 (e.g. the area in the red circle) may be as a result of very high numbers of zero car households, or very high delays or a combination of both. The comparisons of Figure 4.1 with Figures 4.2. and 4.3 therefore allows these issues to be evaluated.
- 4.9 It can be seen that the high value in the red circle is predominantly due to high average delays (approximately ten minutes) and fairly high zero car households. The situation in the blue circle is similar. The black circle in figure 4.3 shows high zero car households in Central Manchester, but this area does not show up as a high problem in the combined figure, as the delays are small (approximately 1 minute).

Fig 4.2 Average Delays

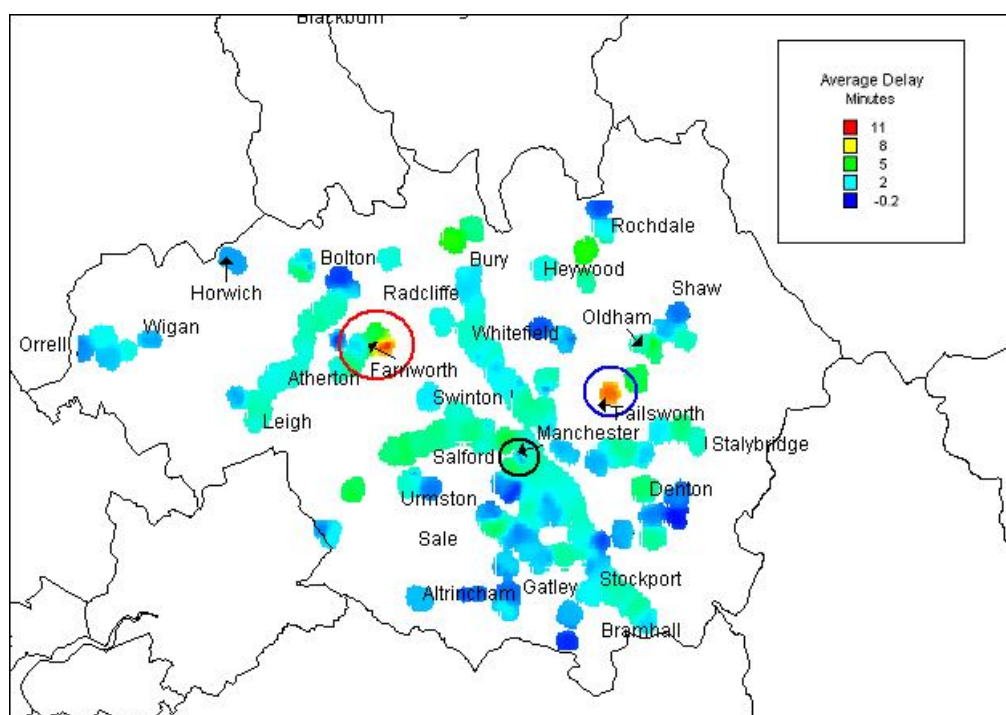
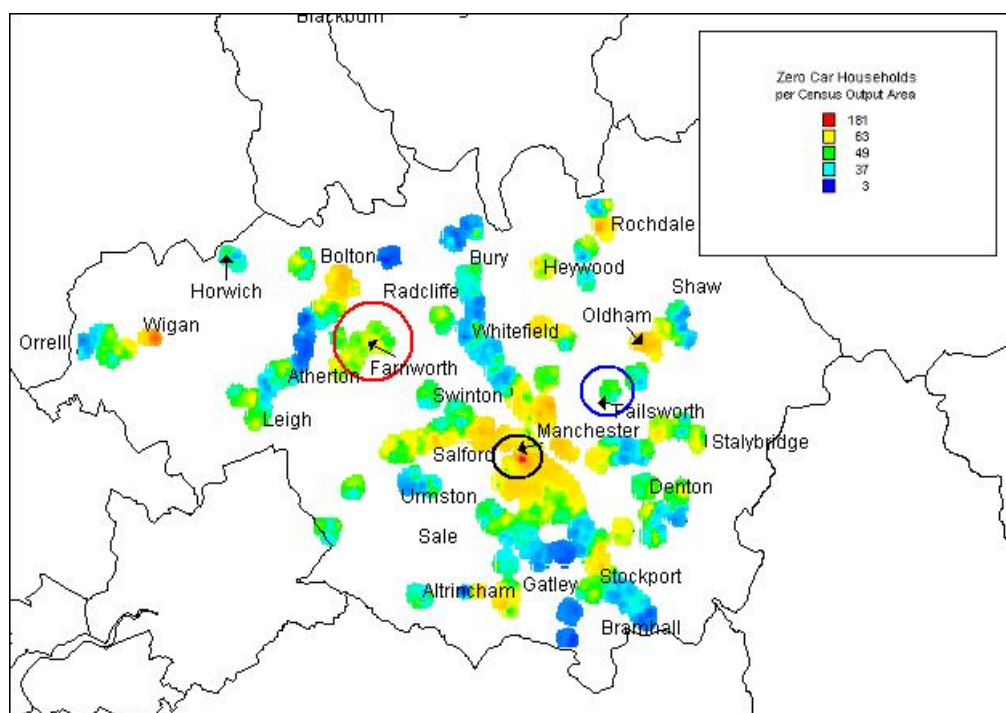


Fig 4.3 Zero Car Households

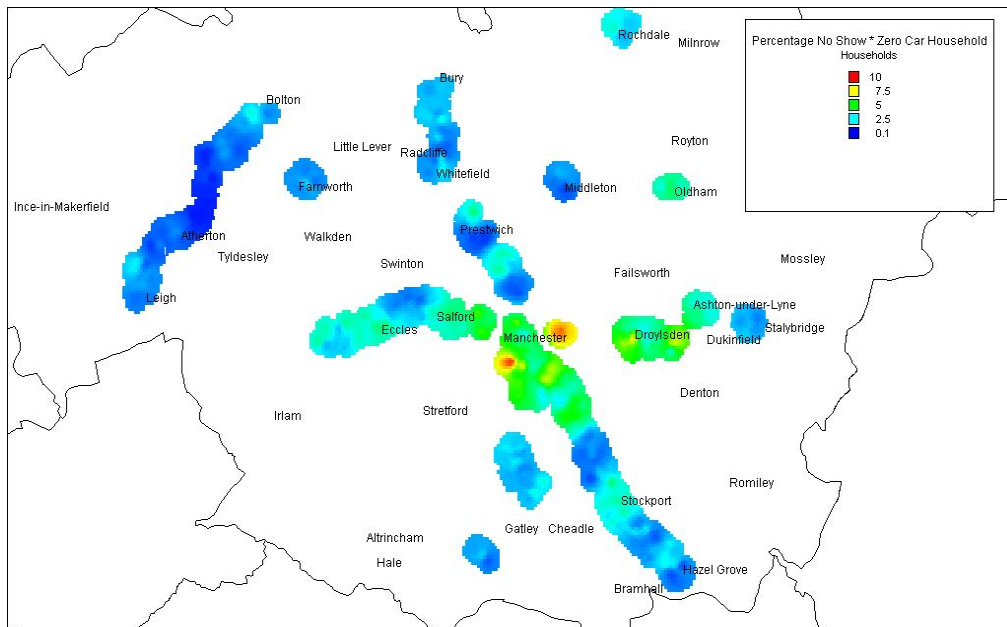


4.10 Further work with local stakeholders in these areas could identify problems in more detail.

Non-Arrival of Buses

4.11 A similar process was adopted, to calculate and map the effect of non-arrival of buses on zero-car households. However, instead of using average time of delay, the non-arrivals were calculated as a proportion of all scheduled arrivals at individual bus stops. Bus stops with less than 5 records were not included. These findings showing zero car households factored by proportion of non-arrivals at stops within 500m of COA centroids, are presented in figure 4.4

Fig 4.4 Non-Arrivals (as a proportion of total records) by Zero Car Household



4.12 Again the coverage of data is patchy and the problems are worst in Central Manchester. Overall the pattern on non-running buses is similar to that for late arrival. Although the prevalence of reliability problems is greatest in the congested areas these are also likely to be locations with frequent bus services.

4.13 As with the analysis of delays described above, it is important, to explore the reasons for high values, and to recognise these as either relating to high zero car households, high incidences of non arrivals, or a combination of both. Identification of these factors will assist in identifying potential solutions. For example, a high value as displayed in figure 6.4 may be as a result of an area of high zero car households, but low incidences of non arrivals.

4.14 Figure 4.5, shows that the worst area for non arrivals is the Droylsden area, but due to the low incidence of zero car households

in that area Figure 4.4 does not identify is as a particularly high priority area for action. Similarly, Oldham and Rochdale are areas of high zero car households, but the lower levels of non arrivals of buses result in these areas not appearing to be as high in Figure 4.4.

Fig 4.5 Non Arrivals as a percentage of total records

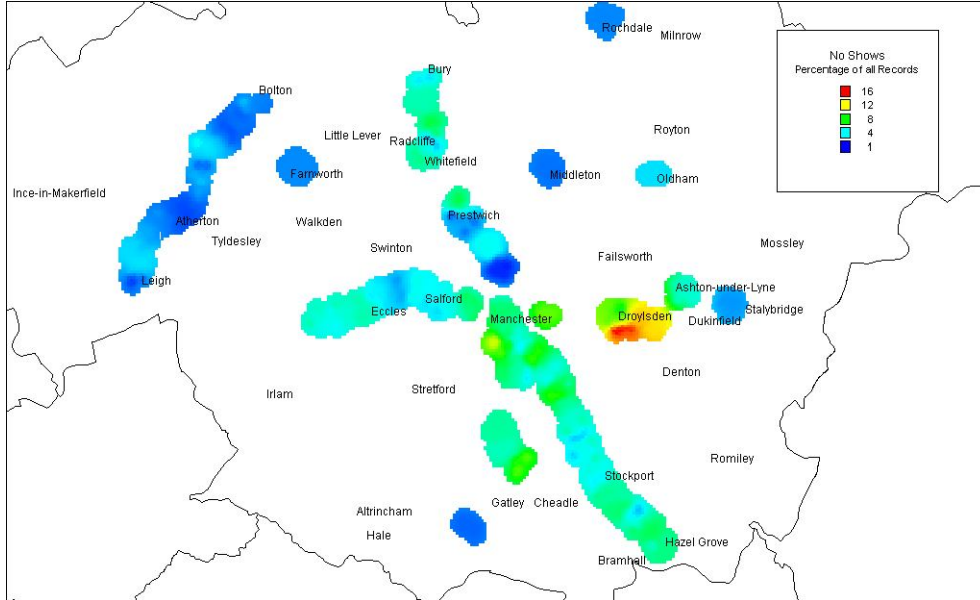
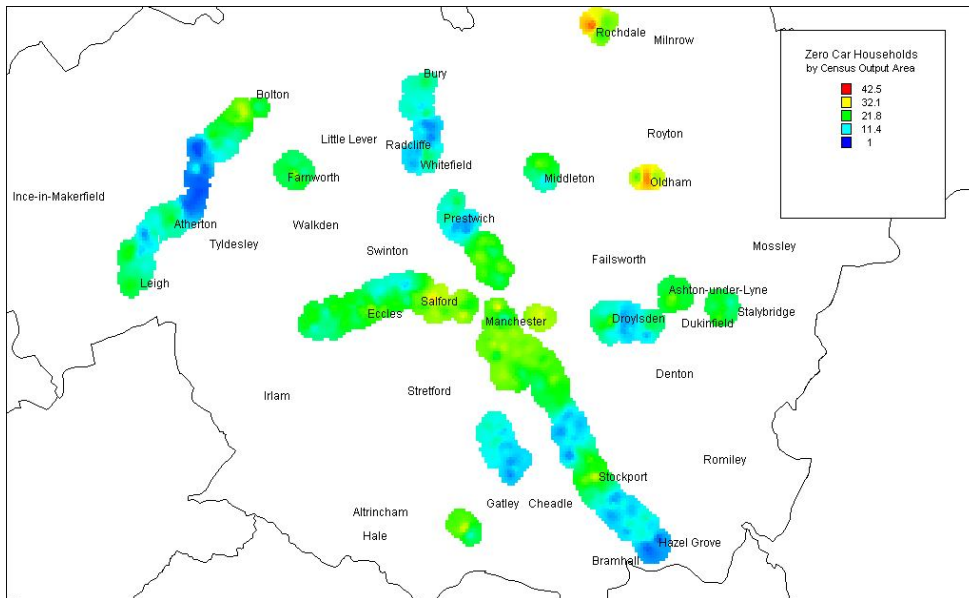


Fig 4.6 Zero Car Households



4.15 Overall the maps show the areas where further more detailed investigation of reliability problems would be needed to ensure that reliability induced social exclusion problems can be tackled effectively. Partnership working with bus companies to discuss these mapping

results may be a good starting point. In particular, figure 6.3 could be of particular use with bus companies to show areas where non arrival problems lie. Further analysis looking at which of the problem areas had relatively infrequent services would also assist the accessibility planning process and allow targeting of action at the greatest problems.

5.0 Conclusions

- 5.1 This report demonstrates that reliability is a very important factor in accessibility planning and can act as a significant barrier to social inclusion.
- 5.2 Although not as straightforward as travel time to consider in analytical terms, analysis and mapping of both cost and reliability using readily available data for most local authorities can yield useful information which would not be known purely from qualitative survey work in the area.
- 5.3 Bus reliability mapping has enabled problem areas to be identified and could be used to inform further local consultation. This could be of particular assistance when seeking to target action through joint working with local bus companies.