Investing in cycling to tackle transport poverty and promote equity

Alex Quayle, Senior Policy Officer, Sustrans Scotland

1   Introduction

In many places, access to shops, employment or participating fully in society demands car ownership. This is regardless of people's capacity to afford it. Sustrans' research in Scotland indicates that investment in cycling is a more effective way to promote equity and social inclusion through transport.

Though less tangible than some forms of poverty, transport poverty has a major impact on how people live. But if people are forced to own and run a car to participate in society and the economy, and this takes up a large proportion of income, people can suffer the effects of transport poverty.

Transport investment in deprived areas usually prioritises road building, rather than cycling infrastructure or ensuring the placement of local services remove the need to drive. Anecdotally, it is sometimes claimed that cycling infrastructure is most commonly placed in middle-class communities (or even contributes to gentrification of deprived areas).

Sustrans research compared car ownership, quality of public transport and measures of deprivation to assess areas of Scotland for risk of transport poverty. Geographical areas with high car ownership, poor public transport and low income have all the ingredients to enforce car ownership that is unaffordable. Our research uncovered that over 1 million people in Scotland lived in areas at a high risk of transport poverty.

However, further research found that 28% of areas at a high risk of transport poverty had essential services within a distance achievable as a 10 minute cycle journey. In other words, lifting people out of a risk of transport poverty could be achieved in these areas by making cycling safe and accessible for all.

This research has numerous practical applications, based on data that is commonly collected and freely available in the UK. Economic and social deprivation data has the capacity to better direct active travel investment.

2   Background to this paper

In 2012 Sustrans published Locked Out, a report examining transport poverty across England and Wales (Sustrans 2012). Using data on household income, accessibility of the public transport network and journey time to reach essential services by modes other than car, the research produced a risk rating for each Lower Super Output Area in England and Wales. This highlighted areas where car ownership places pressures on income, potentially putting communities at risk from exclusion where alternatives to accessing key services are not convenient or attractive.

This report presents the findings of research considering Scotland-specific data sets and their use to generate for the first time an indicator of potential for transport poverty in Scotland.

3   Methodology

3.1   Overview of approach

Building upon the approach applied in the Locked Out research, the methodology uses existing data to explore the concept of transport poverty. By bringing together data on income, car availability[i] and

access to key services using public transport, an approximation can be made of the potential for pressure on household finances as a result of reliance on private transport. This is reported geographically. The model works around the assumption that areas most at risk are those with low income, high car availability and low access to essential services by public transport.

Figure 1: Summary of research model
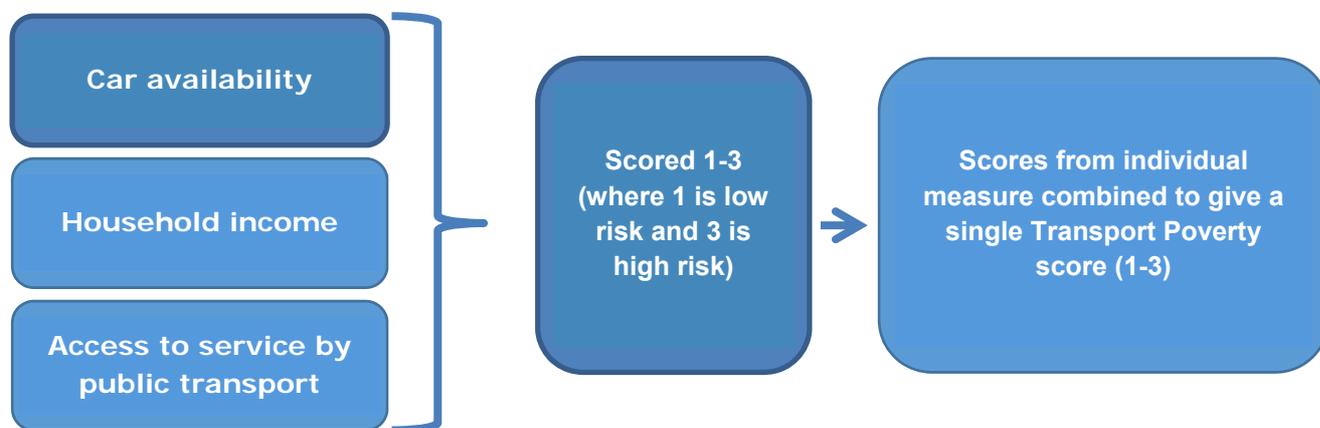
3.1.1 Data Review

A review was undertaken to identify data sets suitable for use in calculating a measure of transport poverty for Scotland. Measures of active travel were also identified to allow expression of the potential for such modes to replace car journeys. Table 1 below summarises the data sources used.

Table 1:   Transport poverty measure and data set selected

Measure	Data source
Income	Income domain of the Scottish Index of Multiple Deprivation (SIMD), number of people per data zone who are income deprived (Scottish Government 2012a)
Car availability	Number of cars or vans available. Scotland's Census 2011 Table CC04_a (Scotland's Census 2011)
Accessibility to services by public transport	Access domain of the SIMD, average time to access GP, Post Office and retail by public transport in each data zone (Scottish Government 2012b)
	Frequency of bus services. Transport Scotland bus and coach statistics Table 17 (Transport Scotland 2012)
Levels of Cycling	Percentage commuting to work by cycle. Scotland's Census 2011 Table QS701SC Method of Travel to Work (Scotland's Census 2011)

3.1.2 Geographic outputs

The geographic unit used in this analysis is the 2001 Scottish data zone. Each of the 6,505 data zones[ii] has a population of between 500 and 1,000 residents. As data zones are defined by population size, geographic area varies substantially depending upon the type of area in which the data zone is located. The smallest data zone area is 12,367 m2 and the largest, 1,159 km2 (National Records of Scotland 2011). Data zones are nested within council area boundaries.

3.1.3 Analysis and scoring of transport poverty metrics

In order to place each data zone into a category of risk (for each measure individually and the measures combined) it is first necessary to define thresholds for each component. The following sections describe for each measure in turn any manipulation of data prior to analysis, and the threshold applied. For most

measures, threshold definition is based around 60% of the median value. This is the threshold for income poverty adopted by the European Union Social Protection Committee - that is, households with an income that is less than 60% of the median are considered low income.

Income

Income data are taken directly from the SIMD Income Domain and expressed as the percentage of people living in each data zone who are income deprived. The SIMD defines income poverty based on the number of people in receipt of Income Support, Employment and Support Allowance, Job Seekers Allowance, Guaranteed Pension Credits and Child and Working Tax Credits. For three data zones, an income poverty rate is not provided in the SIMD data set. The median across data zones in the same council area are used as a proxy for income poverty in these data zones.

The following thresholds are applied:
- High (scores 3): Data zones where >11.4% of the population are income deprived (50%, n = 3,242)
- Medium (scores 2): Data zones where 6.8-11.4% of the population are income deprived (20%, n = 1,326)
- Low (scores 1): Data zones where <6.8% of the population are income deprived (30%, n = 1,937)

Car availability

Car availability is used here as a broad measure of the potential pressures placed on household income from running a vehicle. Based on the assumption that if car(s) are available in a household they are being used, then running costs will contribute to household expenditure. Considering income and car availability together indicates areas where already (relatively) low household incomes are under added pressure from motoring costs.

For each data zone, the total number of cars/vans available (recorded in the 2011 Census) was divided by the population in that data zone to give vehicles available per head. For five data zones, car ownership data are not included in the published census data set. The median across data zones in the same council area are used as a proxy for car availability in these data zones.

The following thresholds are applied:
- High (scores 3): Data zones where car availability is >1.3 vehicles per head (44%, n = 2,835)
- Medium (scores 2): Data zones where car availability is 0.8-1.3 vehicles per head (43%, n = 2,802)
- Low (scores 1): Data zones where car availability is <0.8 vehicles per head (13%, n = 868)

Access to services by public transport

The SIMD data set includes average time to reach key services by driving and by public transport. For public transport access, the services included are: GP surgeries, Post Offices and Retail Centres.[iii] The journey time to essential services used within the access domain of the SIMD includes the time taken to reach the public transport network as well as journey time by as many modes as necessary. The following thresholds are applied to public transport journey time:
- High (scores 3): Data zones where PT travel time to more than one of the three services is >1 hour 0.8%, n = 52)
- Medium (scores 2): Data zones where PT travel time to one of the three services is >1 hour (0.9%, n = 58)
- Low (scores 1): Data zones where all three services can be accessed by PT within an hour (98%, n = 6,395)

In addition to public transport travel time, the frequency of public transport services (using bus service frequency as a proxy) was also scored. Even if journey time by public transport to reach an essential service is relatively short, if services are infrequent the appeal of public transport as an alternative to car travel may be reduced. A score was attributed to each data zone depending on area type.[iv]

The following thresholds were applied:
- High (scores 3): Data zones in remote rural areas (29% of households have access to 1-2 services per hour, 29% have access to less than hourly service) and data zones in accessible rural areas (43% of households have access to 1-2 services per hour)
- Medium (scores 2): Data zones in small remote towns (55% of households have access to 1-2 services per hour) and data zones in small accessible towns (47% of households have access to 1-2 service per hour, 23% have access to 3-4 services per hour)
- Low (scores 1): Data zones in other urban areas (29% of households have access to 3-4 services per hour, 18% have access to 5+ services per hour) and data zones in large urban areas (43% of households have access to 5+ services per hour, 27% have access to 3-4 services per hour)

For each data zone the scores for public transport access time and frequency of bus services were summed. Combined scores ranged from 2 to 6. Areas with a combined score >4 were considered to high 'risk' – that is, areas where journey time and service frequency may make public transport a less acceptable alternative to driving.

Combined scores
A combined score to represent potential risk of transport poverty was arrived at by summing the scores awarded to each data zone for car availability, income and public transport access to essential services. The minimum possible score is 3 and the maximum, 9. Data zones scoring 3-5 are considered low risk and those scoring 7 or more, high risk.

3.1.4   Access to essential services by cycle and current levels of cycling

Cycling time to essential services and current levels of cycling are not included in the overall transport poverty score. These measures have been calculated to enable exploration of the potential for cycling to replace car journeys, particularly in areas at high risk of transport poverty.

Cycling time to essential services
An approximate time taken to reach essential services by cycle was derived from driving times to essential services from the SIMD access domain. A multiplication factor was calculated from Department for Transport accessibility statistics for England. DfT give average minimum travel times to essential services by area type and mode. By dividing cycle time by driving time, a factor was established for each area type. This factor was applied to the average driving time from the SIMD for GP, Post Offices and retail centres. Table 2 shows the English area types transferred to the Scottish data zones (urban and rural classifications are not consistent between England and Scotland), and the multiplication factor applied to arrive at an approximate cycle time.

Table 2: Multipliers applied to average drive times from SIMD to give approximate cycling time to essential services

Scottish area type	English area type applied	Average travel time to access essential services (England, minutes)		Factor applied to Scottish drive time to services
		Car	Cycle	
Large Urban Areas	Urban major conurbation	9.2	10.7	**1.2**
Other Urban Areas	Urban city and town	10.0	12.3	**1.2**
Accessible small Towns	Rural town and fringe	12.0	19.8	**1.7**
Remote Small Towns	Rural town and fringe in a sparse setting	12.6	22.5	**1.8**
Very Remote Small Towns	Rural village	13.9	26.0	**1.9**
Accessible Rural	Rural village in a sparse setting	17.6	36.9	**2.1**
Remote Rural	Rural hamlets and isolated dwellings	14.2	26.4	**1.9**

Following conversion of driving times to essential services from SIMD to give an approximate cycling time, the following thresholds were applied:

- High (scores 1): Data zones where cycle time to essential services is, on average, less than 10 minutes (85%, n = 5,537)
- Medium (scores 2): Data zones where cycle time to essential services is, on average, 10 - 20 minutes (10%, n = 679)
- Low (scores 3): Data zones where cycle time to essential services is, on average, more than 20 minutes (5%, n = 289)

Existing levels of cycling

Scores for current levels of cycling were derived from census commuting mode data. The percentage of the working age population who usually travel to work doing so by cycle is taken as a proxy for general levels of cycling in the data zone. The following thresholds were applied:

- High (scores 3): Data zones where more than 1% of the working age population commute by cycle[v] (50%, n = 3,234)
- Medium (scores 2): Data zones where 0.6-1% of the working age population commute by cycle (16%, n = 1,047)
- Low (scores 1): Data zones where <0.6% of the working age population commute by cycle (34%, n = 2,224)

4   Results

4.1   Risk of transport poverty

4.1.1   Distribution of risk – individual measures

Just over a third (36%) of data zones where car availability is (by our definition) high are located in remote and rural areas.[vi] Half are located in large or other urban areas. Low income tends also be to greatest in urban areas – 79% of data zones in the high risk category for income are in these area types. Considering car availability alongside income data, 303 data zones (almost 5% of all data zones) are in the 'high' risk category for both metrics. These are most concentrated in large/other urban areas (40%) and accessible rural areas (26%) and represent the areas where car use potentially places the greatest pressure on household income. The small proportion of data zones allocated to the highest risk category for public transport access are predominantly located in remote or very remote areas.

The percentages of data zones falling in each risk category for each measure separately, and measures combined are presented in Table 3.

Table 3:   Distribution of data zones between risk categories
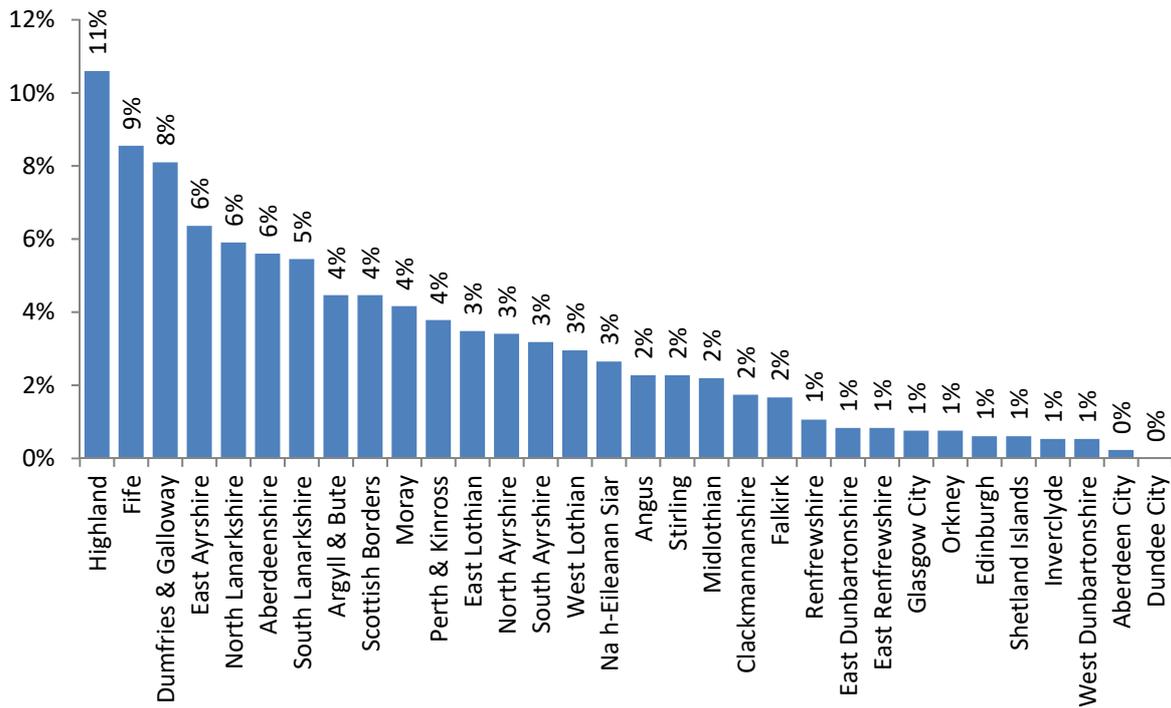
Measure	% data zones in each risk category		
	High	Medium	Low
Car availability	44%	43%	13%
Income	50%	20%	30%
Public transport access	2%	29%	69%
Combined	**20% [vii]**	**43%**	**37%**

#### 4.1.2   Distribution of risk - combined score

Of 1,370 high (overall) risk data zones, 49 are in the low risk category for income – in these cases, the combined score for car availability and public transport access has pushed the data zone into the high risk category overall, but in practical terms, the pressure on household income from running a car may not be problematic. All 49 are located in the most rural area types (accessible rural, remote rural and very remote rural areas). These 49 areas have been moved to the low risk category, leaving 1,321 high risk data zones.

The combined transport poverty score places 20% (1,321) data zones in the high risk category – encompassing 466,000 households and a population of 1 million. The distributions of all 1,321 high risk data zones between council areas and area types are shown in Figures 1-3, and mapped (with moderate and low risk areas) in Figure 4.
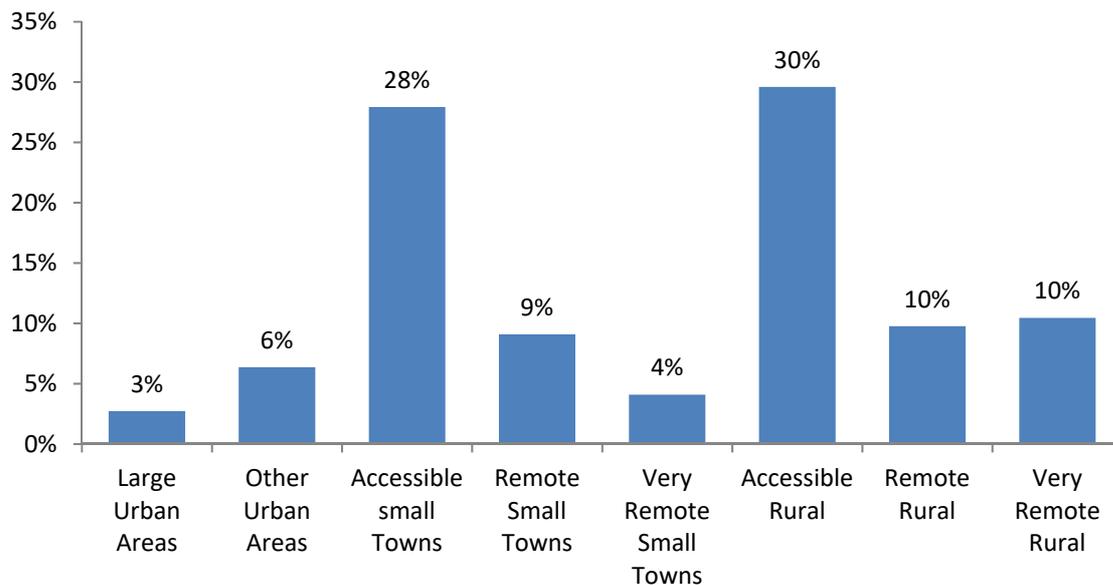
Figure 2: Percentage of high risk data zones located in each council area

Figure 3: Percentage of all data zones in each council area in the high risk category
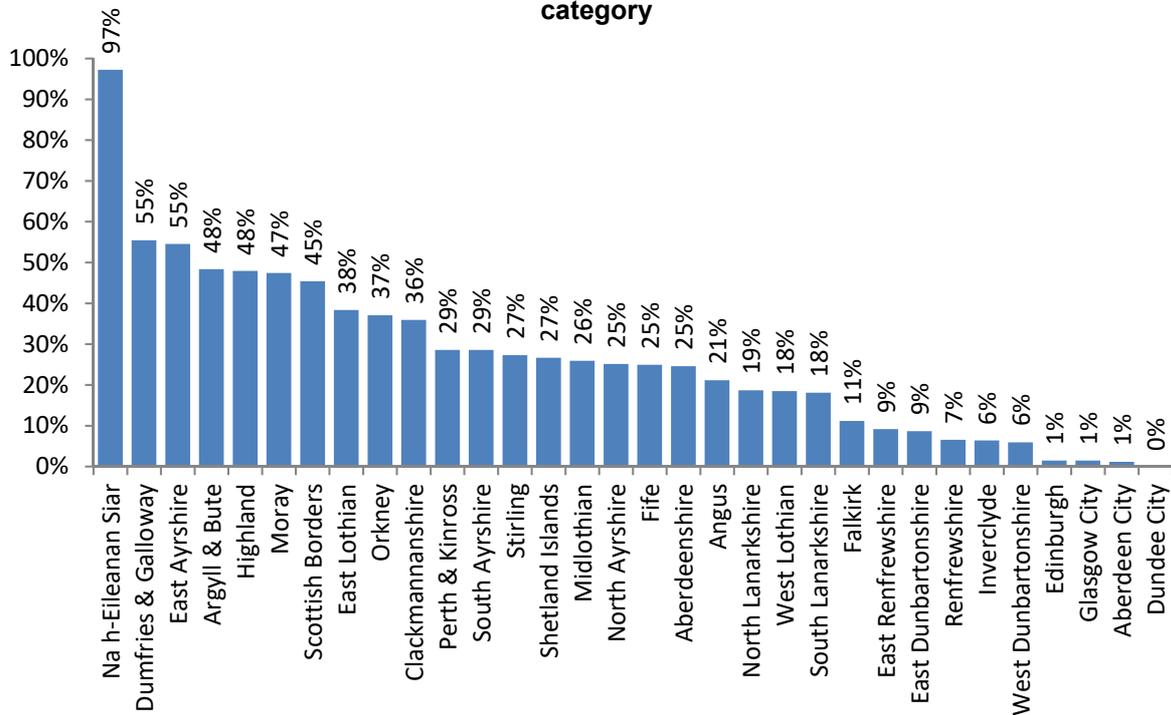
Figure 4: Percentage of high risk data zones located in each area type

Amongst the 1,321 high risk data zones, 9% (120 data zones) are in areas with good access to public transport. These are data zones with relatively low income and high car availability, in urban areas. Five per cent (61) high risk data zones are in areas with poor connectivity with the public transport network – predominantly in the most remote and rural areas.

Only 16 data zones are allocated the maximum risk score (9) – all are in rural areas, located predominantly in the Na h-Eileanan Siar and Highland council areas.

4.2   Potential for cycling to address transport poverty

Amongst the 1,321 high risk data zones, 810 (61%) are areas where essential services can be accessed by cycle within 10 minutes. Combining potential accessibility to services by cycle with existing levels of cycling, around 25% of all high risk areas (337 data zones) are areas where potential access to services by cycle and current cycling levels are, relatively speaking, high. A third (34%) of these areas are in the area classification type 'small, accessible towns' and 20% in 'remote small towns'. Cycling could present a viable alternative to driving to access services in these areas – travel times by cycling are reasonable, and some regular day to day journeys (namely commuting) are already being made by cycle.

4.3   Limitations

The following limitations apply to this analysis:

- The measures are area based, rather than population based. Whilst each data zone has been allocated a category of risk based on an average measure of income, car availability and public transport accessibility, this cannot be extended to individuals living within those areas.
- Similarly, when discussing estimated cycling times and existing levels of cycling these relate to the whole data zone area – cycling may be a more or less convenient transport option for sub-areas within a data zone.
- The measure of access to essential services by public transport includes a factor based on the frequency of bus services for different urban and rural areas. Access to essential services by rail is not considered. We assume that, geographically, coverage by bus services is more extensive than by rail. This approach may result in some areas being attributed a low public transport score when in fact households may have access to a frequent rail connection.
- The system of scoring allows relatively high income areas to be classified as at high risk of transport poverty where the overall area score is pulled up by low public transport accessibility

and high car availability. As noted above, this applies to 49 areas which have been reassigned to the low risk category.

- The approach does not allow for other factors that may influence accessibility to public transport – for example, health issues or practical limitations.
- The data sets used in generating a measure of transport poverty are not directly comparable to those used in the measure for England and Wales. Comparison between nations is not advisable.
- Severance issues are not taken into account when estimating the cycle times. The calculated times (which are derived from driving times) assume that there is a safe and convenient cycling route available. This approach will underestimate cycling time in situations where the equivalent driving route is not appropriate for cycling (for example, using motorway or busy roads without cycling facilities).

Figure 5: Distribution of transport poverty risk
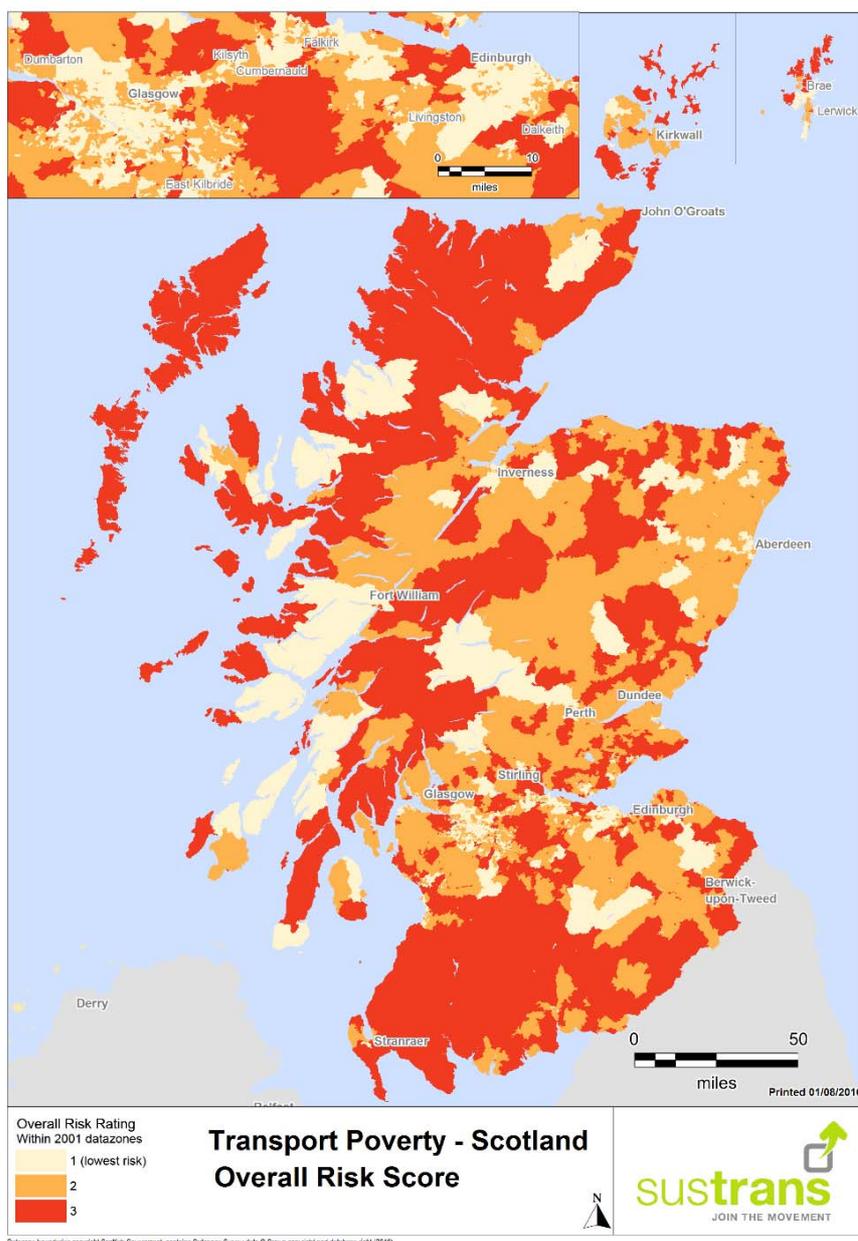
5   Applications of research

This research has numerous applications consistent with the Scottish Government goals to reduce economic and health inequalities and promote active travel. The following points introduce topics to be discussed in more detail in the oral presentation.

5.1   Targeting infrastructure investment

Results above highlight locations within a cycleable distance of essential services, though the data does not indicate existing levels of cycling. Nonetheless, this data can still support an assessment of locations where there is potentially untapped demand for cycling, or where improvements to cycling infrastructure can enable access to employment or essential services where enforced car ownership or the high cost of public transport may be most problematic.

As a result, applications for Sustrans' infrastructure grants, funded by the Scottish Government, take into account this data. The Places for Everyone funding programme (until March 2019 known as Community Links) measures an application against the benefits it could deliver to a community. Applications are scored more favourably if they are located in the 15% most deprived areas according to SIMD data (Sustrans 2019a). This assists an application to overcome any unforeseen structural bias in the application process towards more affluent areas and presents a way to prioritise investment and delivery of projects in areas of higher deprivation, with a capacity for increases in walking and cycling.

Sustrans Scotland's Street Design programme is a design and engagement service, empowering communities to transform their neighbourhoods and urban spaces to deliver places for walking, cycling and also for our physical and social health (Sustrans 2019b). The desired outcomes of the programme; stronger communities, more active travel and better places, are all relevant to factors recorded within SIMD data. For this reason, SIMD data is used as one of several assessment criteria to evaluate opportunities that exist within an area to deliver the goals of the programme.

Both these aspects help to contribute to Scottish government goals of reducing inequalities. Sustrans continue to integrate the findings of this research in the delivery of infrastructure in Scotland.

5.2   Naming and making a problem visible

Sustrans have been reluctant to name or promote another 'type' of poverty. Our work to promote the findings of this paper has included working with organisations which tackle poverty, and they have noted the difficultly of explaining the phenomenon.

However, giving a name to the issue of people prevented from accessing opportunity by transport options and supporting this with data has been of benefit to explaining the impact. In explaining the problem and outlining solutions, a named problem, underpinned by data, has been effective in raising the profile of the various issues that make up 'transport poverty'.

Where previously case studies of individual experience had variable impact, often localised to a particular area, a nationwide survey of the data has highlighted how widespread transport poverty is. Maps highlight the varied geographical distribution of areas at a high risk of transport poverty, which crystalise the issue for MSPs, councillors and officers. Furthermore, geographical risk helps to explain how problems can be structural and that they have policy (rather than individual) solutions.

As a conceptualisation of a problem (or multiple problems) this data is effective persuasion for local authority councillors and officers to engage with the work of Sustrans and to promote applications to funding programmes discussed above. By better understanding the impacts of transport and the impacts of Sustrans' work we can make a more successful case for active travel.

Sustrans continue to assess the social impact of our projects.

5.3 Mapping road casualty data to deprivation

Sustrans seek to understand other impacts of transport and infrastructure in areas of deprivation. Economic and social deprivation data has the capacity to better direct active travel investment.

One area of study is the increased likelihood of being involved in a road traffic accident as a young person (aged 0-16) on foot or cycling, depending on socioeconomic factors. Between 1997-2016 children in the most deprived 3/5 of the population in Scotland were consistently more likely to be involved in road traffic incidents and to be admitted to hospital as a consequence (Understanding Glasgow 2018). This implies both an increased frequency and severity of collisions for those in the most deprived 60% of the population.

This analysis focuses specifically on risk to young people travelling on foot or by bike. A similar trend emerges highlighting the increased risk of active travel in areas of higher deprivation. Figure 6 (below) displays mean number of accidents in an SIMD data zone for children aged under 16 travelling on foot or by bike. It indicates that a child's risk of being involved in an accident increases in areas of higher deprivation. Risk of an accident in the most deprived 1/5 of the population is more than three times that in the least deprived 1/5 of the population.

Figure 6: Mean number of road traffic accidents for children aged 0-16 on foot or bike based on SIMD quintile
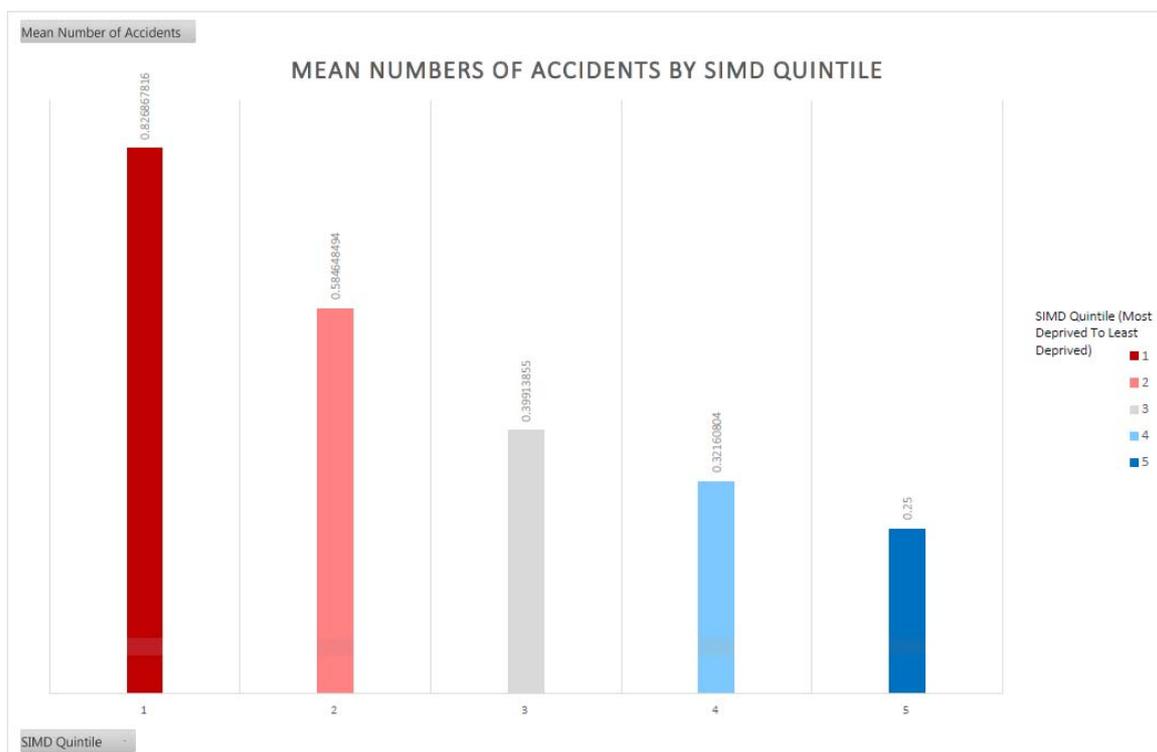

Figure 6 shows the aggregate national result. However, it has been instructive to map road traffic accidents in conurbations against SIMD datazones to identify priority areas for action.

Further research could consider how risk of road traffic accidents is proportionate to the availability of infrastructure and whether this contributes to supressing demand for cycling.

6   Conclusions

This paper has outlined research into social factors that affect people's ability to travel to access essential services. It indicated areas where car ownership places pressures on income, potentially putting communities at risk from exclusion where alternatives to accessing key services are not convenient or attractive.

This report presented the findings of research considering Scotland-specific data sets and their use to generate for the first time an indicator of potential for transport poverty in Scotland. Finally, it has briefly introduced how the research on transport poverty has so far been used and areas in which Sustrans seeks to expand our understanding of social data and the impact of our work.

7   References

National Records of Scotland (2011). *Geography – Background Information – 2011 Census Higher Geography Classifications*. Available: http://www.nrscotland.gov.uk/files//geography/2011-census/geog-2011census-higher-geography-classifications.pdf

Scotland's Census (2011). *Data Warehouse*. Available: http://www.scotlandscensus.gov.uk/ods-web/data-warehouse.html#standarddatatab

Scottish Government (2012a). *SIMD 2012 Background Data - Part 3 Income Domain*. Available: http://www.gov.scot/Topics/Statistics/SIMD/DataAnalysis/Background-Data-2012/Background3Income2012

Scottish Government (2012b). *SIMD 2012 Background Data - Part 8 Access Domain*. Available: http://www.gov.scot/Topics/Statistics/SIMD/DataAnalysis/Background-Data-2012/Background8Access2012

Sustrans (2012). *Locked Out: Transport Poverty in England*. Available: http://www.sustrans.org.uk/lockedout

Sustrans (2019a). *Places for Everyone: Application Guide 2019-20*. Available: https://www.sustrans.org.uk/sites/default/files/file_content_type/places_for_everyone_guide_2019_v4.pdf

Sustrans (2019b). *Street Design 2019/20 Guide for Applicants*. Available: https://www.sustrans.org.uk/sites/default/files/file_content_type/places_for_everyone_guide_2019_v4.pdf

Transport Scotland (2012). *Bus and Coach Statistics 2011-2012*. Available: www.transport.gov.scot/system/files/documents/tsc-basic-pages/B_C2011_12.xls

Understanding Glasgow (2018). *Road casualties trend in Glasgow*. Available: https://www.understandingglasgow.com/indicators/transport/road_casualties/child_road_casualties/deprivation

Acknowledgements

[i] We assume that the number of cars available in a household equates to the number of cars in use – therefore the greater the number of vehicles, the greater the expenditure on motoring

[ii] This research relies on the 2001 data zone boundaries to maximise use of available data. Data zone boundaries were revised in 2011 to give 6,976 units

[iii] For driving, average travel times are also included for access to primary schools, secondary schools and fuel stations

[iv] Transport Scotland publish statistics on the frequency of bus services in six area types: large urban, other urban, rural accessible towns, small remote towns, accessible rural and remote rural. Each of the 6,505 data zones is placed in one of these classifications

[v] Excludes those who usually work from home

[vi] Area type category remote small towns, very remote small towns, accessible rural areas, remote rural areas and very remote rural areas

[vii] Omits the 49 data zones that fall in the high risk category based on overall score but score as low risk for income