REES JEFFREYS ROAD FUND STUDY: MAJOR ROADS FOR THE FUTURE

# Identifying Network Users and their Characteristics

The Centre for Transport & Society
University of the West of England, Bristol

January 2015

*Report Authors:*

William Clayton

Tom Calvert

John Parkin

Graham Parkhurst

*With assistance from:*

Deirdre Toher

For any queries or correspondence regarding this report please contact the UWE Project Manager

*Professor Graham Parkhurst*

*Professor of Sustainable Mobility*

Centre for Transport & Society

Faculty of the Built Environment

University of the West of England, Bristol

Frenchay Campus

Coldharbour Lane

Bristol BS16 1QY

E-mail: Graham.Parkhurst@uwe.ac.uk

Tel: +44 (0) 117 32 82133

Fax: +44 (0) 117 32 83002

# CONTENTS

# 1. Introduction

The Rees Jeffreys Road Fund (RJRF) has commissioned an ambitious two-year study of major roads in England with a horizon of 2040. There are seven topics of interest, and the first topic of interest has two tasks, one of which (Task 1B) is to identify network users and their characteristics.

The RJRF Study Team needs a comprehensive picture of the nature of usage of major roads in England – who and where the users are, and what sort of journeys they are making.

Bringing together data from National Road Traffic Estimates and the National Travel Survey, this report provides:

- Explanations of the patterns of use of different types of user.
- Identification of the factors that may be used to define the nature and extent of roads that could be classified as forming part of a newly defined Major Road Network (MRN).
- Analysis of usage of the SRN in England by region, road type, vehicle type, journey purpose and length.

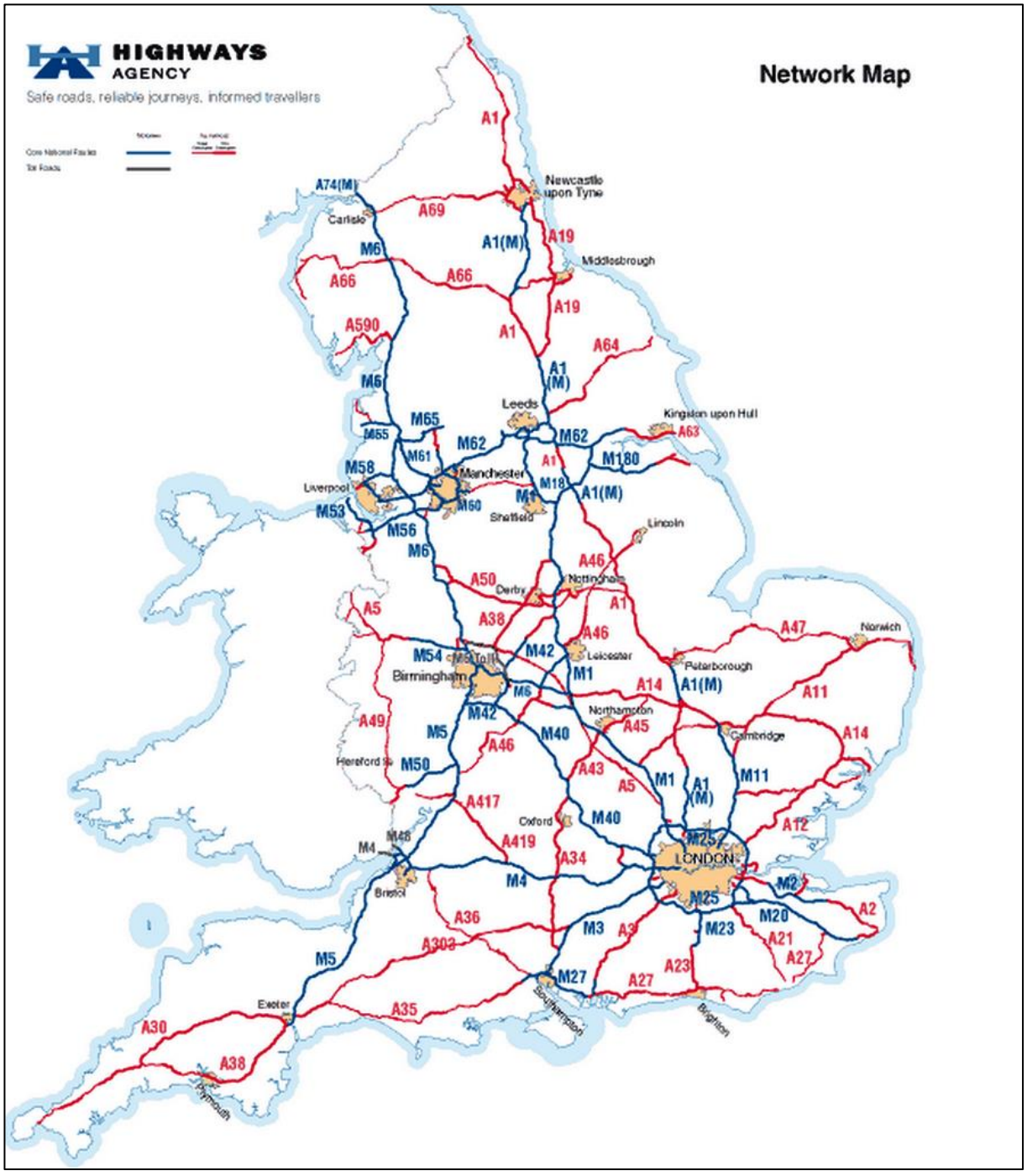
## Road classifications

At the highest level, the Strategic Road Network (SRN) is comprised of nationally significant roads used for the distribution of goods and services, and serves as a network for the travelling public. In legal terms, it can be defined as those roads which are the responsibility of the Secretary of State for Transport. It is managed by the Highways Agency. A road forming part of the SRN is known as a trunk road. The SRN totals 4,400 miles of roads – 14% of England's 31,000 mile A and B road network. Of this 4,400 mile network, 42% is motorway, 40% is dual carriageway A road, 17% is rural single carriageway, and 1% is urban single carriageway. The extent of the SRN is presented in Figure 1.

The SRN in its entirety is included in the Primary Route Network (PRN); these are roads used for transport on a regional or county level, or for feeding in to the SRN for longer journeys. They are defined as roads that provide the most satisfactory route between places of size or importance. No roads classified lower than an A road are be included in the PRN. A roads on the PRN are coloured green on most maps, as opposed to the red of county class A roads. The PRN is constructed around a series of primary destinations – significant locations that are likely to generate and attract significant volumes of traffic. A road on the PRN is known as a primary route.

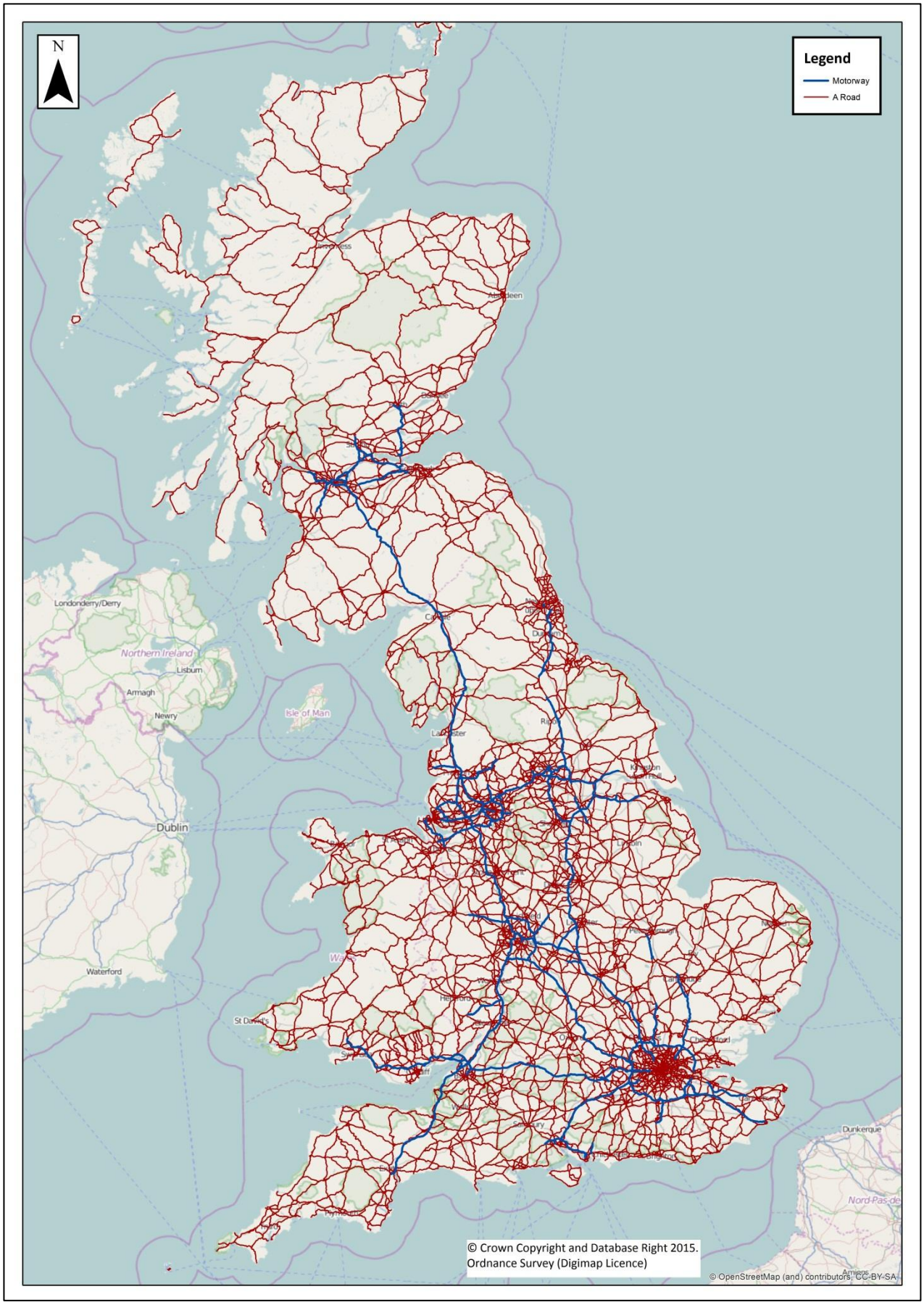
The PRN (and therefore SRN) is only a relatively small part of the entire road network in England. The 174 Local Highway Authorities are responsible for a total of 183,000 miles of roads, including the remaining 26,600 miles of the total 31,000 miles of A and B road not forming part of the SRN.

**Figure 1 - Highways Agency SRN network map**




In this report, figures for Annual Average Daily Flow (AADF) derived from National Road Traffic Estimate (NRTE) count data from the Department for Transport (DfT) are used to explore the use of major roads, defined as motorways and all classes of A road. DfT count data is collected from an extensive network of count sites covering every link on motorways and A roads. The extent of the major roads covered by these counts is outlined in Figure 2.

**Figure 2 – DfT Motorways and A Roads in Great Britain on which counts are undertaken (OS Meridian data)**



The road classifications used in this report are derived from the NRTE data definitions, and are outlined in Table 1.

**Table 1 - DfT major road classifications**

| Category | Category Description |
|---|---|
| TM | M or Class A Trunk Motorway |
| TR | Class A Trunk road in Rural area |
| TU | Class A Trunk road in Urban area |
| PM | M or Class A Principal Motorway |
| PR | Class A Principal road in Rural area |
| PU | Class A Principal road in Urban area |

The DfT (2015) provide the following classification:

***Major roads:*** Includes motorways and all class 'A' roads. These roads usually have high traffic flows and are often the main arteries to major destinations.

***Motorways:*** (built under the enabling legislation of the Special Roads Act 1949, now consolidated in the Highways Acts of 1959 and 1980): Includes major roads of regional and urban strategic importance, often used for long distance travel. They are usually three or more lanes wide in each direction and generally have the maximum speed limit of 70mph.

***'A' Roads:*** These can be trunk or principal roads. They are often described as the 'main' roads and tend to have high traffic flows though not as high as motorways.

- *Trunk roads* (designated by the Trunk Roads Acts 1936 and 1946): Most motorways and many of the long distance rural 'A' roads are trunk roads. The responsibility for their maintenance lies with the Secretary of State and they are managed by the Highways Agency in England, the National Assembly of Wales in Wales and the Scottish Executive in Scotland (National Through Routes).
- *Principal roads:* These are major roads which are maintained by local authorities. They are mainly 'A' roads, though some local authorities do have responsibility for some motorways.

# 2. Method

## Data sources

This report synthesises a number of existing data sources to explore current network users and their characteristics.

**Use of the Strategic Road Network (USRN):** The USRN report published by the DfT (2014) contains a number of useful measures about who currently uses the SRN, including analyses of vehicle class, occupation, income, regional differences, and trip characteristics.

**National Road Users Satisfaction Survey (NRUSS):** The NRUSS was conducted by the Highways Agency (2013), and data from the survey are included in this report to provide additional insight into trip distances by region and types of use of the SRN.

**National Travel Survey (NTS):** NTS data from 2002-2012 was obtained from the UK Data Archive. The NTS provides data on travel habits at the national level. The results used here are not specific to the SRN, however the measures used are relevant to situating the data from the USRN report and the NRUSS within the broader national context.

**National Road Traffic Estimate data (NRTE):** NRTE data from the DfT has been used to construct a picture of traffic flow across the different road types (TM trunk motorway, TU Trunk Urban, TR trunk Rural, PU Principal Urban and PR Principal Rural) (http://www.dft.gov.uk/traffic-counts/).

## Analysis

The NRTE data has been subjected to further analysis to understand the distribution of AADF frequencies across the different road classes. The analysis has been conducted using the following plan:

**Boxplots:** Boxplots are employed as the initial method of exploring traffic flow frequency distributions across the six road categories, and also providing an indicator as to how similar or dis-similar these categories are in terms of their frequency distributions.

**Frequency distributions:** Detailed frequency distributions are appended provided for all different road categories.

**Vehicle class proportions on different road types:** The proportion of different vehicle classes in relation to road type is used to create a fuller picture of the ways in which the different categories of road are being used.

**Linear discriminant analysis:** Linear Discriminant Analysis (LDA) is used in this context to explore the appropriateness of the current grouping of roads into different categories, and to provide an indication of the degree to which roads can be said to be in the 'correct' group – based on traffic flow.

# 3. Data and Analysis

## Use of the Strategic Road Network

There are a number of data sources which provide some insight into current use of the SRN. This section presents data on frequency of use of the SRN by vehicle class and occupation of the driver, average trip distances, and proportions of trips made on the SRN. It also presents data from the National Travel Survey (NTS) and which serves to place the SRN figures in the national context.

**Use of the strategic and principal road networks**

Table 2 – Table 4 present the headline figures for the use of major roads across Great Britain, taken from the DfT's National Road Traffic Estimates and showing traffic flow by vehicle miles. The aggregate data is further broken down into the trunk and principal road categories and shown by vehicle class for all vehicles, cars and taxis, and HGVs (over 3.5t).

Table 2 presents the figures for all vehicles. The trunk and principal road networks have similar levels of flow in terms of vehicle miles, with the mean figures for the period 2006-2013 being 101.7bn vehicle miles for trunk roads, and 98.2bn vehicle miles for the principal roads. In terms of percentage change over the period, trunk roads have seen a small growth in all vehicle miles of 0.8% on 2006 levels, whilst principal roads have seen a fall in all vehicle miles of 4.1% over the same period. When looking at the disaggregated road categories, the same pattern is evident, and it is a rise in vehicle miles on motorways which is creating the growth in use for the trunk road category, with a 2.4% increase since 2006. Trunk rural and trunk urban roads both saw a decline in vehicle miles over the period of 1.6% and 2.9% respectively. For principal road categories, principal rural roads saw a decline of 2.7% and principal urban roads a decline of 5.6%.

**Table 2 - Road traffic (vehicle miles) by road class in Great Britain - All vehicle types**

Billion vehicle miles

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | Mean | % +/- 2006-2013 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Trunk (all)** | 102.1 | 102.2 | 102.0 | 101.3 | 99.8 | 101.2 | 101.8 | 102.9 | 101.7 | 0.8 |
| **Principal (all)** | 100.3 | 100.0 | 98.7 | 98.7 | 97.6 | 97.5 | 96.4 | 96.2 | 98.2 | -4.1 |
| **Motorway** | 61.8 | 62.5 | 62.2 | 61.8 | 61.0 | 61.8 | 62.4 | 63.3 | 62.1 | 2.4 |
| **TR** | 36.8 | 36.4 | 36.4 | 36.1 | 35.5 | 36.1 | 36.0 | 36.2 | 36.2 | -1.6 |
| **TU** | 3.5 | 3.3 | 3.4 | 3.4 | 3.3 | 3.3 | 3.4 | 3.4 | 3.4 | -2.9 |
| **PR** | 52.5 | 52.8 | 52.3 | 52.1 | 51.4 | 51.6 | 51.2 | 51.1 | 51.9 | -2.7 |
| **PU** | 47.8 | 47.2 | 46.4 | 46.6 | 46.2 | 45.9 | 45.2 | 45.1 | 46.3 | -5.6 |

Table 3 presents the result for cars and taxis. The results follow a similar pattern to those in Table 2; however, for each category of road apart from motorways, cars and taxis demonstrate smaller increases and larger declines in total vehicle miles in comparison with the equivalent all vehicle increases and declines. In aggregate, the mean figures for car and taxi distance between 2006 and 2013 were 76.9bn vehicle miles for trunk roads, and 79.4bn vehicle miles for principal roads. Taken together, trunk roads saw an increase of 0.5% in vehicle miles across the period 2006-2013, with motorways experiencing an increase of 2.8% in vehicle miles and trunk rural and trunk urban roads experiencing decreases of 2.8% and 3.6% respectively. For principal roads, there was a decrease of 5.2% overall, with principal urban roads experiencing a fall of 4.3% and principal urban falling by 6.1%.

**Table 3 - Road traffic (vehicle miles) by road class in Great Britain - Cars and taxis**

Billion vehicle miles

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | Mean | % +/- 2006-2013 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Trunk (all)** | 77.2 | 76.8 | 76.8 | 77.1 | 75.6 | 76.7 | 77.2 | 77.6 | 76.9 | 0.5 |
| **Principal (all)** | 81.5 | 80.7 | 79.8 | 80.2 | 79.1 | 78.7 | 77.7 | 77.3 | 79.4 | -5.2 |
| **Motorway** | 46.1 | 46.5 | 46.5 | 46.7 | 45.9 | 46.6 | 47.0 | 47.4 | 46.6 | 2.8 |
| **TR** | 28.3 | 27.6 | 27.6 | 27.7 | 27.1 | 27.5 | 27.5 | 27.5 | 27.6 | -2.8 |
| **TU** | 2.8 | 2.7 | 2.7 | 2.7 | 2.6 | 2.6 | 2.7 | 2.7 | 2.7 | -3.6 |
| **PR** | 42.3 | 42.1 | 41.8 | 41.8 | 41.1 | 41.1 | 40.7 | 40.5 | 41.4 | -4.3 |
| **PU** | 39.2 | 38.6 | 38.0 | 38.4 | 38.0 | 37.6 | 37.0 | 36.8 | 38.0 | -6.1 |

The NRTE data does not disaggregate HGVs into articulated and non-articulated categories, simply classifying HGVs as vehicles over 3.5tonnes. The figures show that vehicle miles travelled by HGVs are predominantly accounted for by the trunk network, with vehicle miles on the trunk network being over double the vehicle miles on the principal network (10.7bn/4.1bn). This suggests that the volume of freight transport is an important distinguishing feature of the trunk network when compared to the principal network. Over the period 2006-2013, HGV vehicle miles show a marked decrease across both the trunk and principal networks. On trunk roads, total vehicle miles for HGVs fell by 9.6% from the 2006 figure, and on principal roads total miles for HGVs fell by 11.4%. HGV vehicle miles decreased across all of the disaggregated road types with the exception of trunk urban roads – where there has been no overall change since 2006. On motorways there was a decrease of 9.2% in vehicle miles, on trunk urban roads there was a decrease of 11.1%, principal rural roads declined by 10.7%, and principal urban roads experienced the largest proportional fall at 12.5%.

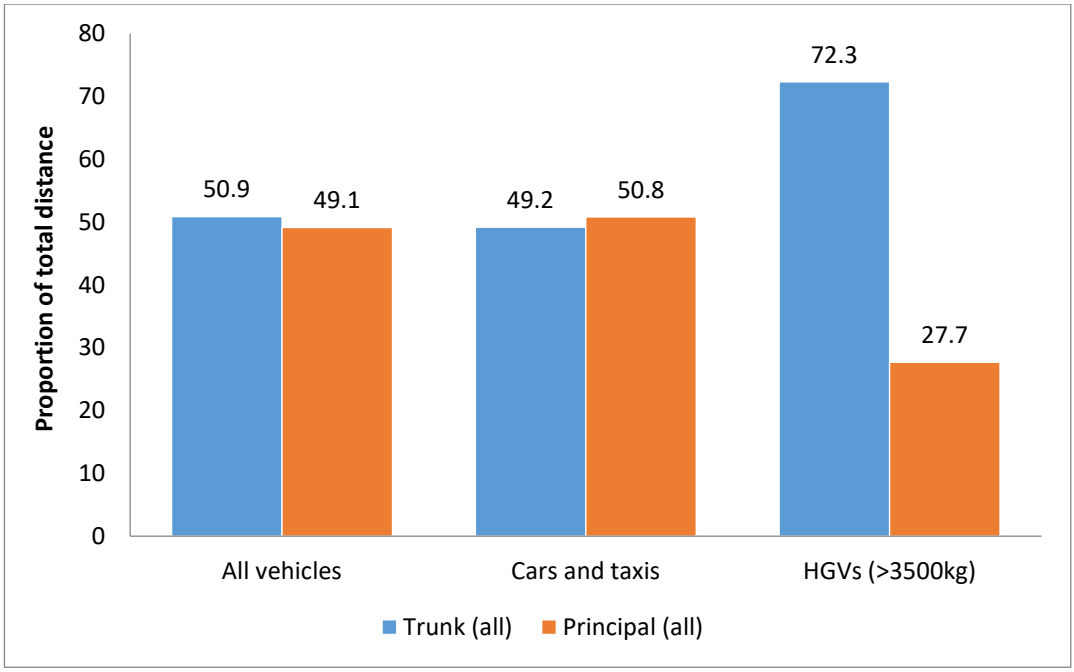
**Table 4 - Road traffic (vehicle miles) by road class in Great Britain - HGVs (>3.5t)**

Billion vehicle miles

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | Mean | % +/- 2006-2013 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Trunk (all)** | 11.4 | 11.5 | 11.2 | 10.5 | 10.5 | 10.3 | 10.2 | 10.3 | 10.7 | -9.6 |
| **Principal (all)** | 4.4 | 4.5 | 4.3 | 4.0 | 4.0 | 3.9 | 3.9 | 3.9 | 4.1 | -11.4 |
| **Motorway** | 7.6 | 7.7 | 7.5 | 7.0 | 7.1 | 6.9 | 6.8 | 6.9 | 7.2 | -9.2 |
| **TR** | 3.6 | 3.6 | 3.5 | 3.3 | 3.2 | 3.2 | 3.2 | 3.2 | 3.4 | -11.1 |
| **TU** | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.0 |
| **PR** | 2.8 | 2.9 | 2.8 | 2.6 | 2.6 | 2.5 | 2.5 | 2.5 | 2.7 | -10.7 |
| **PU** | 1.6 | 1.6 | 1.5 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.5 | -12.5 |

Chart 1 expands on the point in the paragraph above about the significance of freight transport as the key category of vehicle class differentiating between trunk and principal roads. From the NRTE data it is clear that for all vehicles, and for cars and taxis, the proportions of vehicle miles travelled on the trunk and principal networks are approximately the same: 50.9% of all vehicles miles were on the trunk network versus 49.1% on the principal network, and 49.2% of car and taxi miles were on the trunk network versus 50.8% on the trunk. Considering the smaller size of the trunk network this suggests a situation in which a smaller number of longer trips on the trunk network are creating equivalence with a higher frequency of shorter trips on the principal network. For the HGV category however, 73.2% of vehicle miles were attributed to the trunk network whilst only 27.7% were attributed to the principal roads. This suggests a situation in which there is a high frequency of long-distance trips being supported by the trunk network with a relatively smaller frequency of trips being facilitated by the principal network. This point is further developed over the course of this section.

**Chart 1 - Proportion of total distance travelled on trunk and principal roads - by vehicle class**




## Frequency of use of the SRN

The focus of this report is on England, and it is evident, using data aggregated to the national level, that the SRN is used frequently. Table 5 shows that 47% of people surveyed in England had used the SRN frequently, whilst a further 33% had used it regularly – meaning that 80% of those sampled had used the SRN at least once within the past month. By contrast, only a small proportion had no experience of the SRN, with just 5% reporting that they had not used it.

The figures for Scotland and Wales demonstrate the variation in use of the SRN between the regions within Great Britain. In both Scotland and Wales significantly lower proportions of people made frequent or regular use of the SRN, and this is likely to be explained by the fact that the SRN is less extensive outside England.

**Table 5- Frequency of SRN use across Great Britain**

| | Percentages | | | | |
|---|---|---|---|---|---|
| | **Frequent[1]** | **Regular[2]** | **Infrequent[3]** | **Have not used[4]** | **N** |
| **England** | 47 | 33 | 15 | 5 | 1856 |
| **Wales** | 14 | 17 | 37 | 32 | 97 |
| **Scotland** | 2 | 4 | 28 | 66 | 161 |

1: At least twice per week
2: At least once per month, but less than twice per week
3: At least once per year, but less than once per month
4: Less than once per year, or not used at all
(DfT, 2014)

**Table 6 - Proportion of adult residents who used the SRN at least once a month, by region (England)**

| | Percent | N |
|---|---|---|
| **North West** | 88% | 272 |
| **South East** | 80% | 331 |
| **East of England** | 86% | 236 |
| **South West** | 79% | 226 |
| **North East** | 84% | 86* |
| **Yorkshire & Humber** | 73% | 193 |
| **West Midlands** | 84% | 181 |
| **London** | 71% | 148 |
| **East Midlands** | 83% | 183 |

*The North East has a lower sample size than other regions, and, as a result, will have a wider confidence interval surrounding this estimate

(DfT, 2014)

Table 6 shows some – but small – regional variation in SRN use across England. People living in different regions in England tend to use the SRN to varying degrees. 88% of people in the North West travelled on the network 'at least once per month' while only 73% of residents of Yorkshire & Humber and 71% of London residents did so.

### Frequency of use of the SRN: Vehicle class

Some indication of the usage of the SRN by vehicle class is given by the DfT (2014) and is shown in Table 7. This demonstrates that HGVs are more likely to use the SRN frequently (71% of HGVs are frequent users) than LGVs (62%), which in turn are more likely to use the SRN more frequently than cars (43%). However, looking at frequency of SRN use including both frequent and regular use (that is, the likelihood of a vehicle using the SRN at least once per month), there is greater similarity between vehicle types: 91% of both cars and LGVs used the SRN frequently or regularly, with the equivalent percentage for HGVs being 94%. The large difference in frequency of use by HGVs as compared with cars suggests that road use by vehicle class could be a useful criteria in the classification of roads, and this point is developed over the course of this analysis.

**Table 7 - Frequency of SRN use by vehicle class**

| | Percentages | | | | |
|---|---|---|---|---|---|
| | **Frequent[1]** | **Regular[2]** | **Infrequent[3]** | **Have not used[4]** | **N (total)** |
| **Cars** | 43 | 48 | 8 | 0.5 | 54018 |
| **LGVs** | 62 | 29 | 8 | 1 | |
| **HGVs** | 71 | 23 | 6 | 0 | |

1: At least twice per week
2: At least once per month, but less than twice per week
3: At least once per year, but less than once per month
4: Less than once per year, or not used at all
(DfT, 2014)

### Frequency of use of the SRN: Occupation

Data on frequency of SRN use disaggregates, to some degree, the use of the SRN by the occupation of the users (DfT, 2014). It can be seen in Table 8 that those in managerial and professional positions used the SRN more frequently than those in the other classifications, and those in the category denoted as 'not classified' (which included students and people not in employment) used the network least frequently.

The data indicate that there could be an income-related effect on SRN use. In relation to this, the DfT (2014) data also suggest that frequency of SRN use peaks with an income of between £31,200 and £41,599, tailing off to either side of this range.

**Table 8 - Frequency of SRN use by type of occupation**

| | Percentages | | | | |
|---|---|---|---|---|---|
| | Frequent[1] | Regular[2] | Infrequent[3] | Have not used[4] | N |
| **Managerial/Professional** | 56 | 32 | 10 | 2 | 602 |
| **Intermediate** | 47 | 36 | 14 | 3 | 376 |
| **Routine/Manual** | 45 | 32 | 18 | 5 | 402 |
| **Not Classified** | 37 | 35 | 19 | 9 | 472 |

1: At least twice per week
2: At least once per month, but less than twice per week
3: At least once per year, but less than once per month
4: Less than once per year, or not used at all
(DfT, 2014)

At the same time, data from the HA (2013) shows trip distances for business and non-business trips, and it is evident that trips for business purposes are – on average – shorter than those made for non-business purposes (Table 9). This is interesting and rather counterintuitive. Further analysis of journey purpose and SRN use is included in the report for Task 1C. It is clear that there is an interesting relationship between occupation type and income, and levels of use of the SRN.

**Table 9 - Trip distance on SRN for business and non-business purposes**

| | Business trips | Non-Business trips | Average | N |
|---|---|---|---|---|
| **Distance of last trip (miles)** | 42 | 51 | 48 | 1930 |

(HA, 2013)

### Trip distance on the SRN

DfT (2014) data on trip distances on the SRN show that there are higher proportions of shorter trips being made on 'A' Roads than on motorways, where longer trips are more common (Chart 2). On 'A' Roads, the highest proportion of users (32%) used the network for under 1 mile, and these are followed by trips in the 2-5 mile (20%) and 5-10 mile (16%) categories. In total, 80% of trips made on SRN 'A' Roads were of 10 miles in length or less. By contrast, on motorways the highest proportion of users (31%) had used the network for between 10 and 25 miles, and 60% of SRN motorway users had used the network for 10 miles or more.

Chart 3 shows trip distance on the SRN stage of a given journey as a proportion of the total distance that trip. From the data it is evident that, as the total distance of the trip increases, so does the proportion of the trip that is conducted on the SRN. For example, for trips of 2 miles and under, approximately 33% of the total distance of the trip was made on the SRN; whereas on trips of 50 miles or more, approximately 80% of the total distance was made on the SRN. This stands to reason, and confirms that the SRN is important for facilitating longer-distance trips.

**Chart 2 - Trip distances on the SRN (motorway and 'A' Roads)**

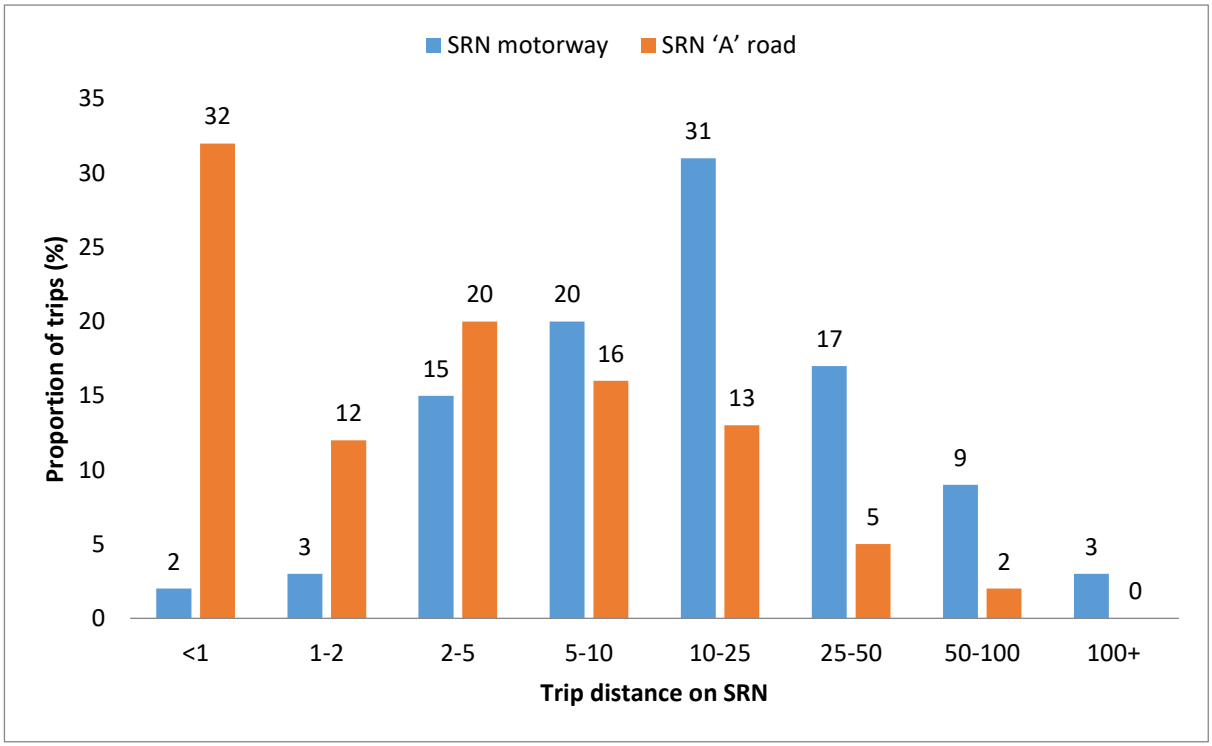



**Chart 3 - Proportion of trip distance on SRN relative to total trip distance**

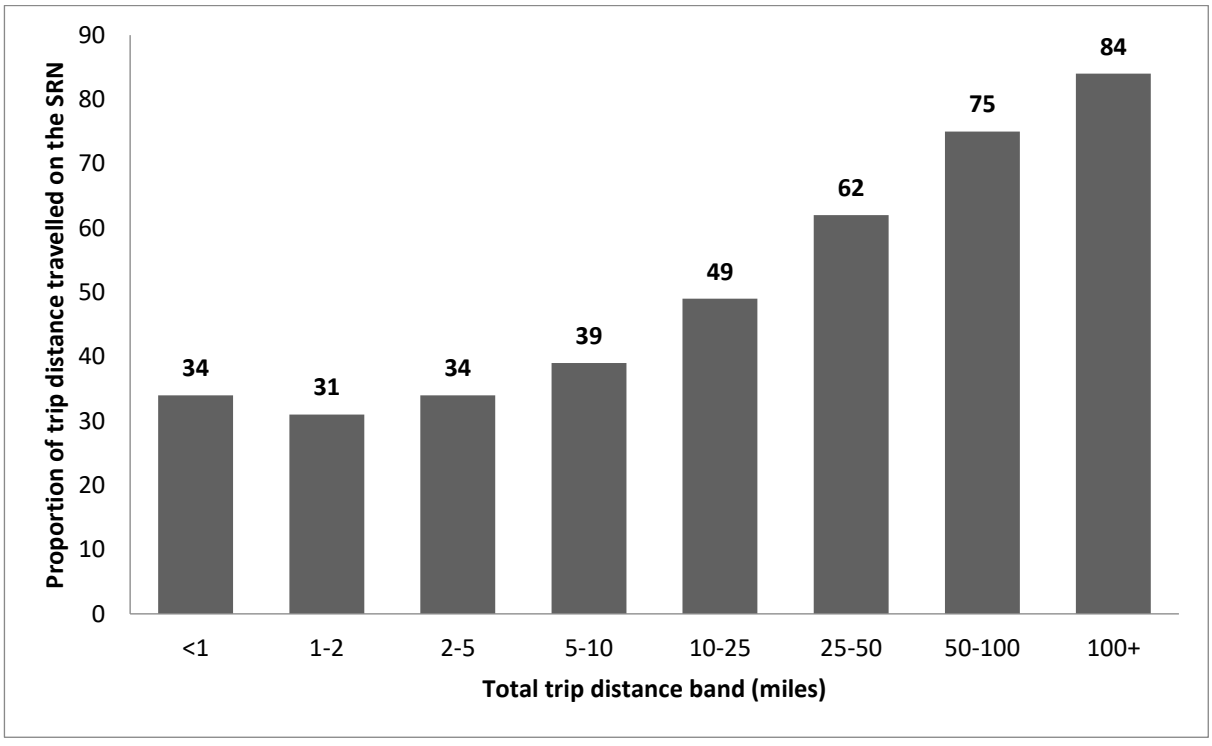



Table 10 demonstrates, however, that use of the SRN consists to a large degree of use 'within region', even for motorways. 91% of those surveyed in the North West had used a motorway in the North West within the last 12 months whilst much smaller percentages had used motorways elsewhere in the country. Users in other regions demonstrated a similar, if less extreme, pattern.

**Table 10 - Comparison of people's use of motorways in their own and other regions**

| | Percent | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **National** | **North West** | **Midlands** | **East** | **South West** | **Yorkshire & North East** | **South East** | **M25** |
| **North West** | 16 | 91 | 6 | 2 | - | 5 | 1 | 1 |
| **Midlands** | 16 | 5 | 56 | 5 | 7 | 5 | 3 | 8 |
| **East** | 12 | 1 | 11 | 39 | 2 | 3 | 9 | 28 |
| **South West** | 10 | - | 7 | 1 | 44 | 1 | 9 | 4 |
| **Yorkshire & North East** | 12 | 4 | 8 | 1 | - | 67 | - | 1 |
| **South East** | 17 | 0 | 4 | 11 | 10 | 2 | 62 | 65 |
| **M25** | 9 | - | 3 | 13 | 5 | 1 | 19 | 47 |
| ***Base*** | *2040* | *290* | *433* | *304* | *327* | *294* | *246* | *146* |

(HA, 2013)

Following from this, when data for use of the SRN is compared to data from the NTS for trips on all roads (Table 11), it is evident that the vast majority of trips made by car are for distances at the shorter end of the scale. Over 75% of all trips were for distances less than 10 miles, and over 90% of all trips were for distances of 25 miles or fewer.

**Table 11 - Trip distances across all roads**

| | **Percent** | **Cumulative Percent** | **N** |
|---|---|---|---|
| **< 1 mile** | 6.3 | 6.3 | 102805 |
| **1 to < 2 miles** | 16.4 | 22.7 | 268643 |
| **2 to < 3 miles** | 14.4 | 37.1 | 235597 |
| **3 to < 5 miles** | 19.1 | 56.2 | 312437 |
| **5 to < 10 miles** | 21.6 | 77.7 | 353168 |
| **10 to < 15 miles** | 9.0 | 86.7 | 147522 |
| **15 to < 25 miles** | 7.0 | 93.7 | 113813 |
| **25 to < 35 miles** | 2.5 | 96.2 | 41120 |
| **35 to < 50 miles** | 1.6 | 97.8 | 26452 |
| **50 to < 100 miles** | 1.5 | 99.3 | 24166 |
| **100 to < 200 miles** | 0.6 | 99.9 | 9299 |
| **200 miles +** | 0.1 | 100 | 2189 |
| **Total** | | | 1637209 |

NTS (2002-2012 – weighted travel survey data)

NTS data for trip travelling time on all roads similarly shows that, as well as being predominantly shorter trips, the majority of car journeys also have durations at the shorter end of the scale (Table 12). Of the sample, 45.7% of car trips lasted less than 15 minutes, 79.2% less than 30 minutes, and 95.3% lasted under one hour.

**Table 12 - Total trip travelling time**

| | Percent | Cumulative Percent | Frequency |
|---|---|---|---|
| **N/A** | 0.0 | 0.0 | 191 |
| **< 3 mins** | 1.2 | 1.3 | 20292 |
| **3 mins to < 8 mins** | 19.9 | 21.1 | 325579 |
| **8 mins to < 15 mins** | 24.6 | 45.7 | 402404 |
| **15 mins to < 30 mins** | 33.5 | 79.2 | 547753 |
| **30 mins to < 45 mins** | 12.3 | 91.5 | 202175 |
| **45 mins to < 1 hr** | 3.8 | 95.3 | 61473 |
| **1 hr to < 1.5 hrs** | 2.8 | 98.1 | 45664 |
| **1.5 hrs to < 2 hrs** | 0.9 | 99.0 | 14520 |
| **2 hrs to < 2.5 hrs** | 0.4 | 99.4 | 7150 |
| **2.5 hrs to < 3 hrs** | 0.2 | 99.6 | 3473 |
| **3 hrs to < 4 hrs** | 0.2 | 99.8 | 3696 |
| **4 hrs to < 5 hrs** | 0.1 | 99.9 | 1579 |
| **5 hrs to < 6 hrs** | 0.0 | 100.0 | 674 |
| **6 hrs +** | 0.0 | 100.0 | 588 |
| **Total** | | | 1637209 |

NTS (2002-2012 – weighted travel survey data)

Taken together with the data from Chart 2 and Chart 3, it is evident that the SRN roads – particularly motorways, are performing an important function in facilitating the bulk of longer-distance trips. It is also evident however that some SRN roads – and in particular the 'A' roads – are facilitating high proportions of relatively shorter trips, and that these shorter journeys comprise the greater part of people's car travel on all roads. These results demonstrate an association between trip distance and different categories of SRN roads, and they therefore emphasise the relevance of trip distance as a consideration in road classification.

## National Road Traffic Estimates data

This section presents an analysis of NRTE data from Great Britain over the period 2000-2013. The purpose of this analysis is to explore the current road classifications used in the NRTE data (i.e. TM, TU, TR, PM, PU, PR) in relation to traffic flows and vehicle classifications. This provides an assessment of the current road classification strictly in terms of actual *levels of use*. It allows us to compare trunk and non-trunk roads based on Annual Average Daily Flow (AADF).

When reading this section it is useful to consider the opening year economic AADT flow ranges provided in the Design Manual for Roads and Bridges (DMRB, HA, TA 46/97, 1997) – see Table 13. Whilst these flow ranges are only relevant to rural links, it is nonetheless useful to consider these standards in the context of the AADF data in this section.

**Table 13 - Opening year economic AADT flow ranges**

| Carriageway standard | Opening Year AADT | |
|---|---|---|
| | Minimum | Maximum |
| S2 | Up to 13000 | |
| WS2 | 6000 | 21000 |
| D2AP | 11000 | 39000 |
| D3AP | 23000 | 54000 |
| D2M | Up to 41000 | |
| D3M | 25000 | 67000 |
| D4M | 52000 | 90000 |

**AADF by road type and vehicle class**

The boxplot in Chart 4 provides a summary of the frequency distributions of AADF counts on the different road categories (note: more detailed histograms of individual road class distributions are included in the appendix, alongside year and regional breakdowns).

From Chart 4 (and the accompanying Table 14) it can be seen that there is some similarity between the AADF distributions of the road class 'pairs' (e.g. TM/PM; TU/PU; TR/PR). Trunk Motorways have the highest mean AADF (70,868, higher than the D3M upper limit of 67,000 in DMRB), and also the broadest distribution – with a standard deviation of 38,359. This reflects their high capacity and use. Principal Motorways[1] also have a relatively high mean AADF, at 54,482, however a narrower distribution than TMs with a standard deviation of 19,374. Trunk Rural and Trunk Urban roads have a higher mean AADF than their principal road counterparts, and also broader distributions. Principal Urban and Principal Rural roads have the lowest mean AADF and the narrowest frequency distributions of all road classes in the analysis, however they have reasonably similar AADF distributions to TR and TU roads. In each road class there is also a reasonably large group of outliers which have a much higher (or in the case of PM, lower) AADF than the average for their class.

The evidence from these frequency distributions suggests that there is not a particularly strong rationale for classifying a road as Trunk or Principal based on aggregate volumetric data alone. Indeed the AADF frequency distributions suggest that a large proportion of roads could comfortably fit into a different classification. This finding is expanded upon in the following sections.

[1] It should be noted that whilst Principal Motorways are included as an analysis category in this report, these roads only form a very small proportion of the network (approximately 26 miles of mainly spur motorways, run by LHAs), and as such are not a significant feature of the SRN.

**Chart 4 - Boxplot of AADF frequency by road type (2000-2013)**

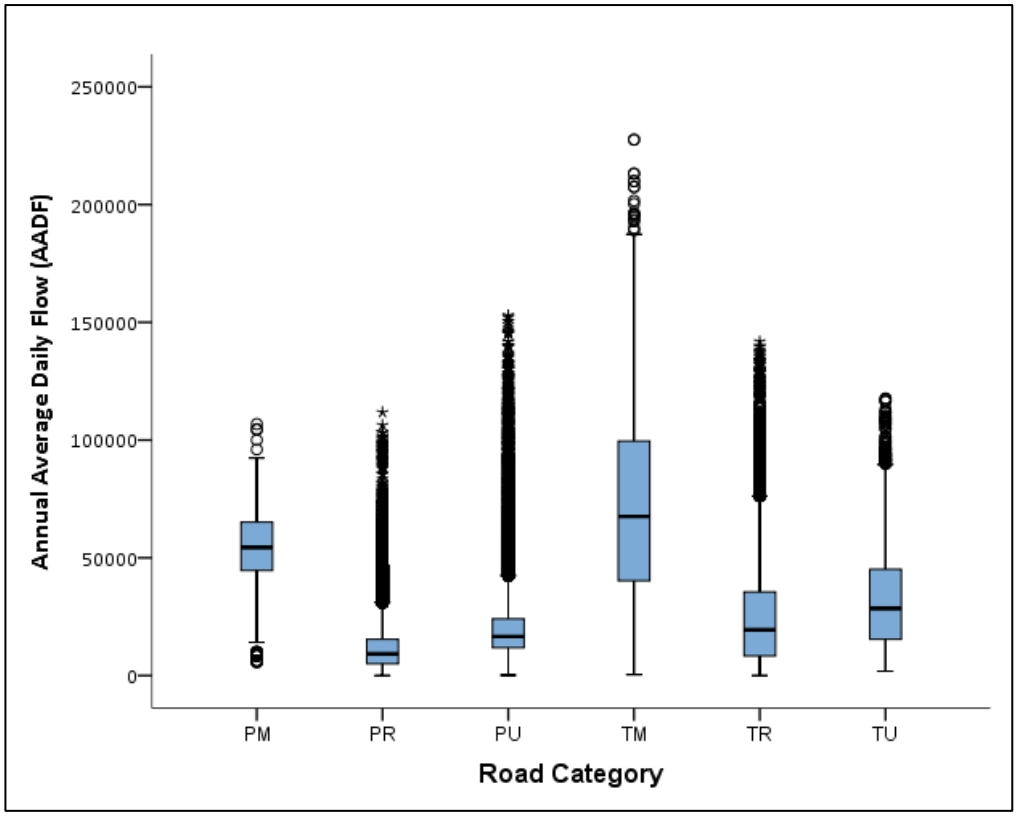



**Table 14 - Sample and frequency figures for road classes**

| | Mean AADF | SD | N |
|---|---|---|---|
| **Trunk Motorway** | 70868 | 38340 | 14410 |
| **Trunk Urban** | 33303 | 22119 | 4270 |
| **Trunk Rural** | 24500 | 20676 | 24660 |
| **Principal Motorway** | 54482 | 19375 | 514 |
| **Principal Urban** | 19866 | 13401 | 119971 |
| **Principal Rural** | 11632 | 9889 | 84497 |

The charts below disaggregate the data by vehicle class to explore the use of Trunk and Principal roads by HGVs and LGVs.

Chart 5 and Table 15 show the results for Heavy Goods Vehicles (HGVs) as a proportion of all traffic. The data suggest that there is a difference between Trunk and Principal roads based on the volume of HGV traffic that they carry. The mean percentage of HGVs as a proportion of traffic is over twice as high on Trunk Motorways as it is for Principal Motorways (10.98%/4.65%), and the same is true for Trunk Urban roads when compared to Principal Urban roads (6.32%/ 3.15%). On Trunk Rural routes the proportion is higher than on Principal Rural roads (8.85%/5.05%). This finding suggests that the proportions of HGV traffic on roads is a good indicator of their function.

**Chart 5 - Proportion of all HGVs by road type**

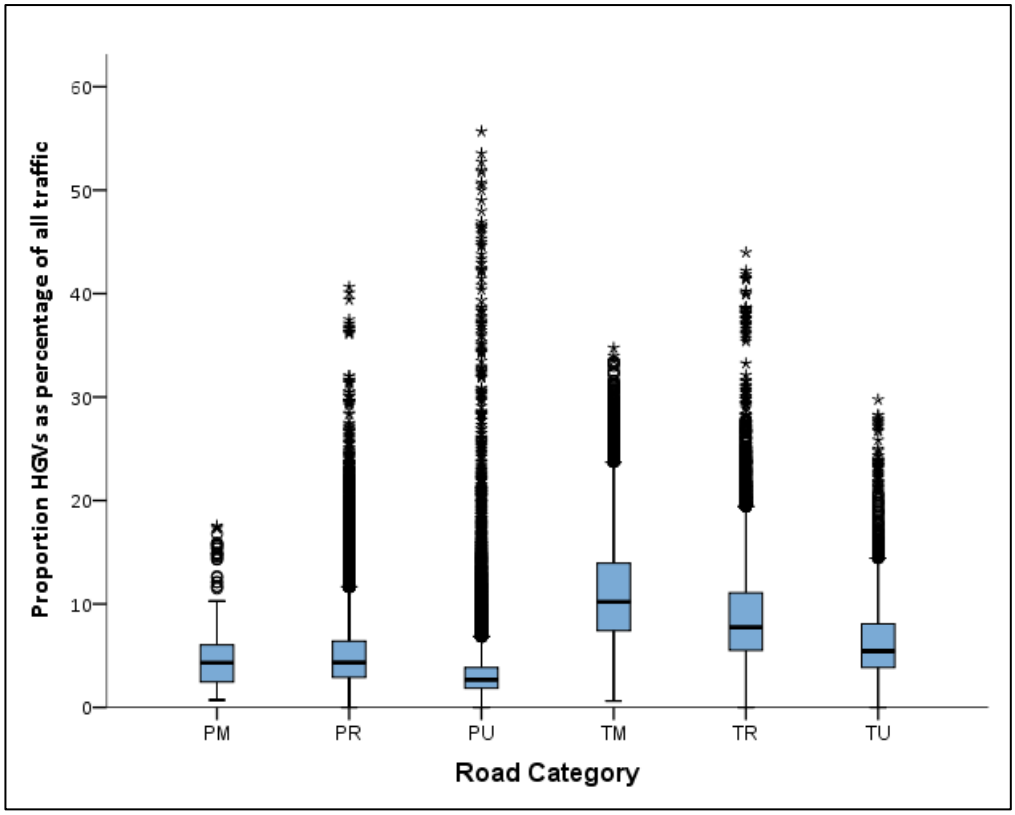
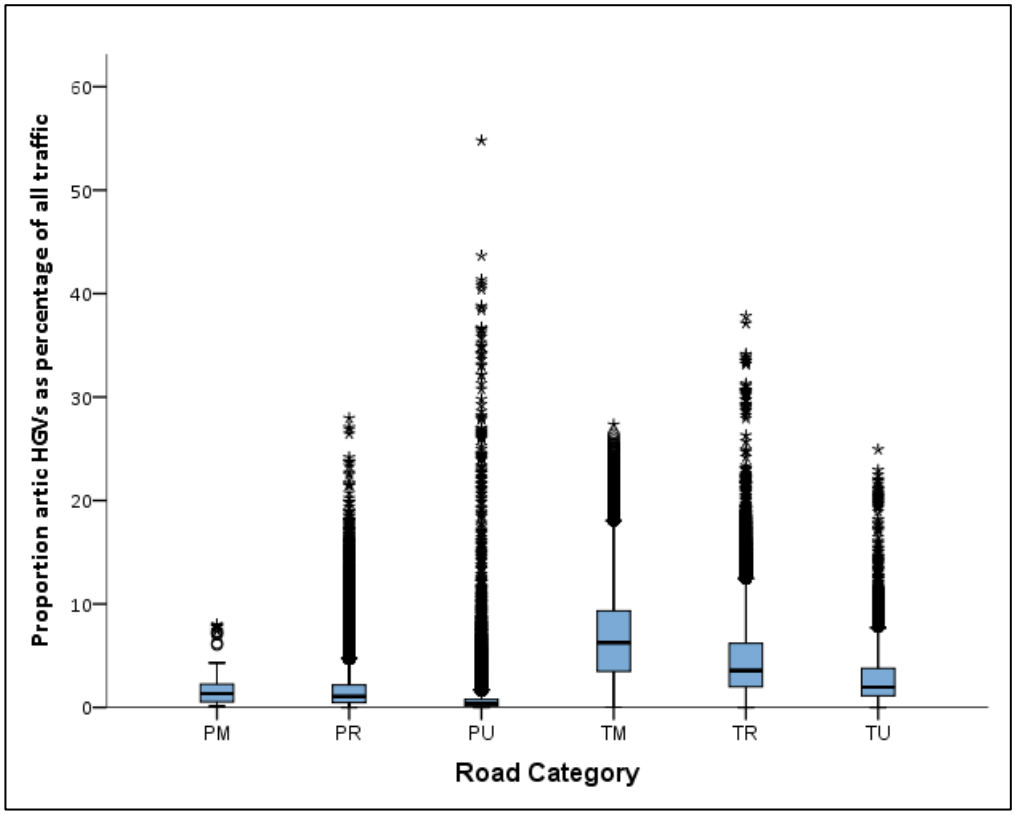



**Table 15 - Proportion of all HGVs by road type**

| | Mean | SD |
|---|---|---|
| **Trunk Motorway** | 10.98 | 5.10 |
| **Trunk Urban** | 6.32 | 3.70 |
| **Trunk Rural** | 8.85 | 4.65 |
| **Principal Motorway** | 4.65 | 3.01 |
| **Principal Urban** | 3.15 | 2.18 |
| **Principal Rural** | 5.05 | 3.11 |

Further weight to the use of HGV traffic as an indicator is provided by an analysis disaggregated to focus solely on the larger HGVs – articulated lorries. Chart 6 and Table 16 show the same distinction between Trunk and Principal roads, with Trunk roads carrying much higher proportions of articulated HGV traffic than Principal roads. In the case of articulated HGVs, the difference is greater - the mean percentage of articulated HGVs as a proportion of traffic is over three times as high on Trunk Motorways as it is for Principal Motorways (6.91%/1.58%) and the same is true for Trunk Urban roads when compared to Principal Urban roads (2.88%/0.66%). On Trunk Rural routes the proportion is not quite triple, but it is still more than double, the Principal Rural road proportion (4.71%/1.66%).

**Chart 6 - Proportion of articulated HGVs by road type**




This finding again emphasises the difference between the Trunk and Principal network in their facilitation of freight transport. An interesting feature of both Chart 5 and Chart 6 is the outliers for Principal roads. In the case of both Principal Rural and Principal Urban, there are relatively large groups of outliers at the higher end of the scale, meaning that a not-insignificant number of these roads are carrying the same or greater proportions of freight traffic as their Trunk counterparts. When considering the suitability of current road classifications, these findings suggest that there is a rationale for a focus on freight traffic as a proportion of all traffic in the development of criteria for categorisation.

**Table 16 - Proportion of articulated HGVs by road type**

| | Mean | SD |
|---|---|---|
| **Trunk Motorway** | 6.91 | 4.36 |
| **Trunk Urban** | 2.88 | 2.91 |
| **Trunk Rural** | 4.71 | 3.85 |
| **Principal Motorway** | 1.58 | 1.36 |
| **Principal Urban** | 0.66 | 1.19 |
| **Principal Rural** | 1.66 | 1.87 |

Chart 7 and Table 17 present the proportions of Light Good Vehicles (LGVs). These results show that there is little variation in the proportions of LGVs across the different road types, and this finding serves to emphasise that the main distinctions between Trunk and Principal roads in terms of vehicle class are related solely to HGV traffic and not to LGV traffic.

**Chart 7 - Proportion of LGVs by road type**

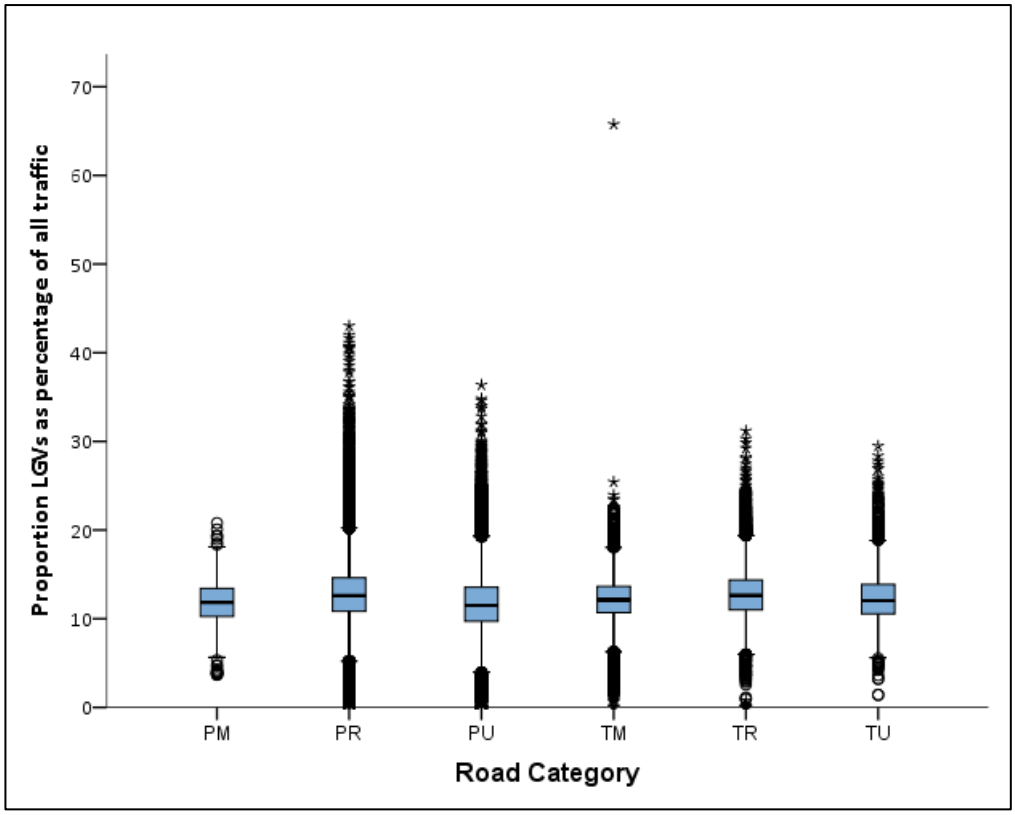



**Table 17 - Proportion of LGVs by road type**

| | Mean | SD |
|---|---|---|
| **Trunk Motorway** | 12.18 | 2.49 |
| **Trunk Urban** | 12.42 | 2.65 |
| **Trunk Rural** | 12.74 | 2.90 |
| **Principal Motorway** | 11.87 | 2.60 |
| **Principal Urban** | 11.82 | 3.06 |
| **Principal Rural** | 12.95 | 3.24 |

## Discriminant analysis of actual vs. predicted road categories

A linear discriminant analysis was performed to explore the relationship between traffic flow and road class in greater detail. The discriminant analysis provides a statistical recommendation of the road category to which a particular count site *could* belong, based on the overlaps between the distributions of AADF for different road categories.

Chart 8 plots AADF against the frequency of count sites with a given level of traffic, with the results stratified by road class. The X axis represents AADF for a particular count site, and the Y axis represents the number of count sites that have *that exact AADF*. A point on the chart represents the number of count sites which have returned a particular AADF figure (e.g. 10,000, 10,001, etc.) within each given road category. Taking the highest values on the Y axis category as an example, the chart shows that there are a group of points from the principal urban category clustered at both 18 and 17. This points to the fact that 18 PU sites had an AADF of perhaps 9,000, a different 18 had an AADF of perhaps 9,001 and so on. A different 17 sites also had an AADF of perhaps 9,000, and so on. The point of this representation is that it is possible to see the approximate AADF

*clusters* created by the different road types, and these relate directly to the frequency distributions for all traffic presented in Chart 4, and as shown in more detail in the appendix.

As an example, for the principal urban roads (the black cluster), Chart 8 shows the bunching of AADF counts to towards the lower end of the AADFs recorded (i.e. nearer to the Y axis). This indicates a high frequency of lower AADF counts, which quickly tails off as AADF rises. For trunk motorway however (the purple cluster), the counts are clustered in a more even pattern towards the middle and right of the X axis (some overlain by the orange points for Trunk Rural and red points for Trunk Urban), suggesting a more evenly distributed situation of medium to high AADF counts at slightly lower frequencies. If these results are compared to the individual frequency distribution histograms for the different road class presented in the appendix, it is possible to see the same shapes of the curves of these replicated together in Chart 8, and to the same scale.

The purpose of this chart is not analytical in-and-of itself, but rather to provide a visual representation of the discriminant analysis results presented in the following tables. From the chart it is evident that there are a number of distinct clusters each representing a road type, and also that a proportion of the cases of each road class are closer to other clusters than their own, and it is this closeness, or distance, to each case's own cluster in relation to the others which is the basis of Discriminant Analysis and possible reclassification.

**Chart 8 - Scatterplot of AADF by count frequency**

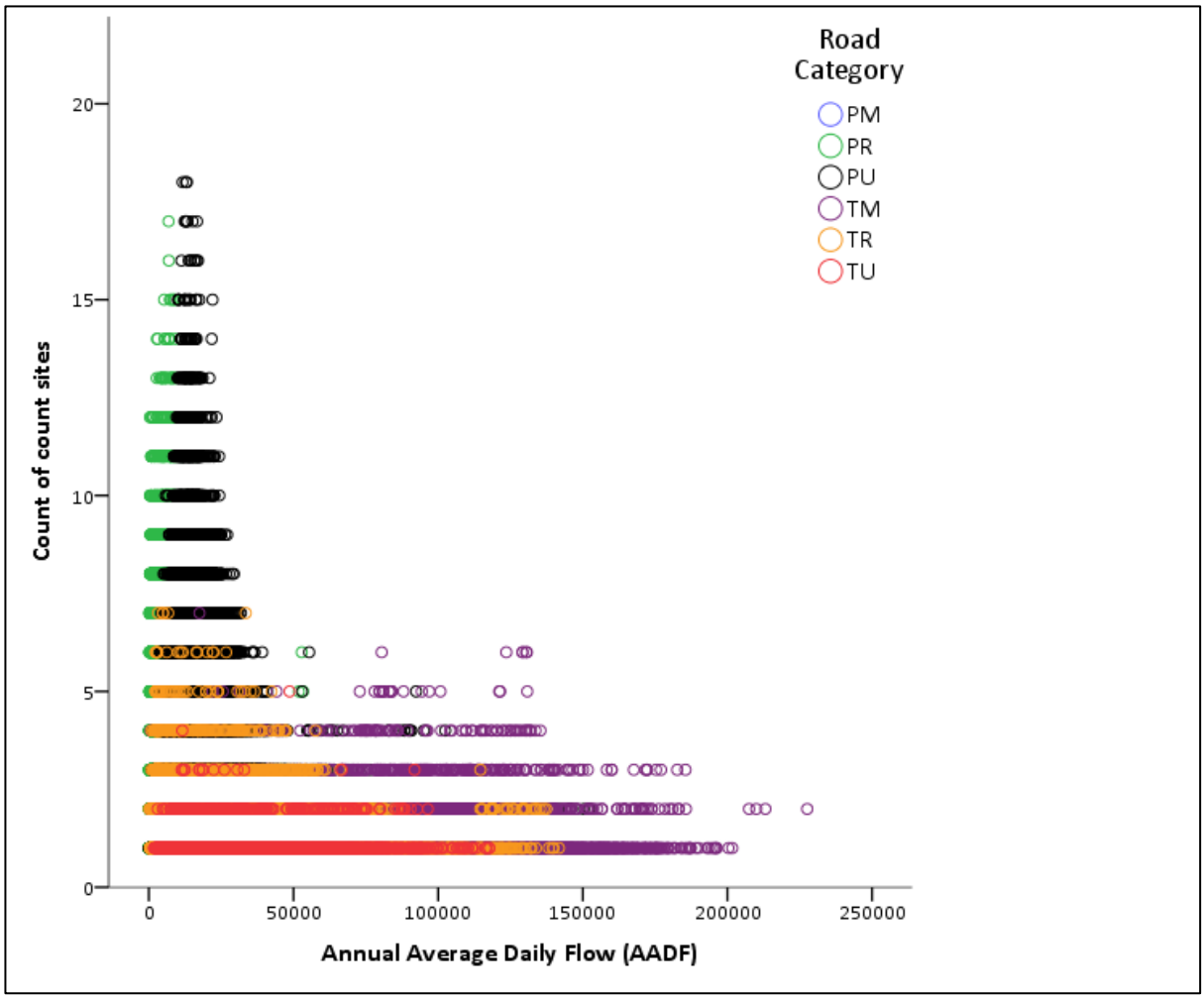



Table 18 presents a cross-tabulation of the discriminant analysis result for all vehicles, comparing actual road categories to predicted road categories.

The analysis shows that, using volumetric data alone, 67.2% of the cases for all vehicles were 'correctly' classified – that is these best fit into the profile of the road category that they are already in. 32.8% of cases were therefore 'incorrectly' classified, and the cross-tabulation shows their 'best fit'.

The most correctly classified cases were in the Principal Rural and Principal Urban categories, with 70.5% and 80.3% of their cases respectively classified correctly. For these categories, the majority of their incorrectly classified cases were essentially swapped (i.e. Principal Rural moved to Principal Urban, and vice versa). This is likely to be a result of the similarity in the frequency distributions for these categories (shown earlier in Chart 4).

Trunk Motorways were reasonably correctly classified (60.3%), however the majority of their incorrectly classified cases were in this case moved into the Principal Urban and Principal Rural categories. This suggests that, when looking at volumetric data alone, a proportion of Trunk Motorway cases are indistinguishable from these Principal roads.

Only 30.5% of Principal Motorways were correctly classified, with 58.8% of these being reclassified as Principal Urban. This is likely to be a reflection of the similarities between these two classes of road, demonstrating that the distinction between them is not supported by their traffic profile.

Trunk Rural and Trunk Urban were the least-correctly classified, at just 8.5% and 0.8% respectively. In these cases the majority of their cases were reclassified as either Principal Rural or Principal Urban, showing that on these roads the volume of all road traffic is not a useful determinant of road classification.

**Table 18 - All vehicles: Crosstabulation of discriminant analysis results – Actual road category vs. predicted road category**

| | | | Predicted Road Category* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | PM | PR | PU | TM | TR | TU | Total |
| Actual Road Category | PM | Count | 157 | 35 | 302 | 4 | 9 | 7 | 514 |
| | | % | 30.5% | 6.8% | 58.8% | 0.8% | 1.8% | 1.4% | 100.0% |
| | PR | Count | 74 | 59545 | 24393 | 97 | 359 | 29 | 84497 |
| | | % | 0.1% | 70.5% | 28.9% | 0.1% | 0.4% | 0.0% | 100.0% |
| | PU | Count | 778 | 22103 | 96321 | 139 | 404 | 226 | 119971 |
| | | % | 0.6% | 18.4% | 80.3% | 0.1% | 0.3% | 0.2% | 100.0% |
| | TM | Count | 765 | 1474 | 2154 | 8691 | 1213 | 113 | 14410 |
| | | % | 5.3% | 10.2% | 14.9% | 60.3% | 8.4% | 0.8% | 100.0% |
| | TR | Count | 359 | 13104 | 6505 | 2483 | 2145 | 64 | 24660 |
| | | % | 1.5% | 53.1% | 26.4% | 10.1% | 8.7% | 0.3% | 100.0% |
| | TU | Count | 208 | 958 | 2347 | 360 | 362 | 35 | 4270 |
| | | % | 4.9% | 22.4% | 55.0% | 8.4% | 8.5% | 0.8% | 100.0% |
| Total | | Count | 2341 | 97219 | 132022 | 11774 | 4492 | 474 | 248322 |
| | | % | 0.9% | 39.2% | 53.2% | 4.7% | 1.8% | 0.2% | 100.0% |

***67.2% of original grouped cases correctly classified**

Developing these findings, Table 19 presents the discriminant analysis for road classification based on HGV traffic. From the results it is evident that based on HGV traffic alone, only 52.8% of the cases were grouped correctly into their road classes.

The most significant outcome from this analysis is that, with the exception of Trunk Motorway, the majority of cases in all other classes were reclassified as Principal Urban. With the exception of Trunk Motorways, this suggests that when looking only at volumetric data for HGVs, there is little to distinguish between the Principal and the Trunk roads.

**Table 19 - All HGVs: Crosstabulation of discriminant analysis results – Actual road category vs. predicted road category**

| | | | Predicted Road Category* | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | PM | PR | PU | TM | TR | TU | Total |
| Actual Road Category | PM | Count | 29 | 22 | 449 | 0 | 14 | 0 | 514 |
| | | % | 5.6% | 4.3% | 87.4% | 0.0% | 2.7% | 0.0% | 100.0% |
| | PR | Count | 78 | 4265 | 79761 | 102 | 275 | 16 | 84497 |
| | | % | 0.1% | 5.0% | 94.4% | 0.1% | 0.3% | 0.0% | 100.0% |
| | PU | Count | 1000 | 2032 | 116418 | 77 | 228 | 216 | 119971 |
| | | % | 0.8% | 1.7% | 97.0% | 0.1% | 0.2% | 0.2% | 100.0% |
| | TM | Count | 195 | 247 | 3915 | 8847 | 1174 | 32 | 14410 |
| | | % | 1.4% | 1.7% | 27.2% | 61.4% | 8.1% | 0.2% | 100.0% |
| | TR | Count | 56 | 1445 | 18792 | 2701 | 1637 | 29 | 24660 |
| | | % | 0.2% | 5.9% | 76.2% | 11.0% | 6.6% | 0.1% | 100.0% |
| | TU | Count | 27 | 208 | 3320 | 319 | 391 | 5 | 4270 |
| | | % | 0.6% | 4.9% | 77.8% | 7.5% | 9.2% | 0.1% | 100.0% |
| Total | | Count | 1385 | 8219 | 222655 | 12046 | 3719 | 298 | 248322 |
| | | % | 0.6% | 3.3% | 89.7% | 4.9% | 1.5% | 0.1% | 100.0% |

***52.8% of original grouped cases correctly classified**

**Table 20 - Articulated HGVs: Crosstabulation of discriminant analysis results – Actual road category vs. predicted road category**

| | | | Predicted Road Category* | | | |
|---|---|---|---|---|---|---|
| | | | PU | TM | TR | Total |
| Actual Road Category | PM | Count | 493 | 0 | 21 | 514 |
| | | % | 95.9% | 0.0% | 4.1% | 100.0% |
| | PR | Count | 84253 | 96 | 148 | 84497 |
| | | % | 99.7% | 0.1% | 0.2% | 100.0% |
| | PU | Count | 119644 | 69 | 258 | 119971 |
| | | % | 99.7% | 0.1% | 0.2% | 100.0% |
| | TM | Count | 4566 | 8258 | 1586 | 14410 |
| | | % | 31.7% | 57.3% | 11.0% | 100.0% |
| | TR | Count | 20498 | 2881 | 1281 | 24660 |
| | | % | 83.1% | 11.7% | 5.2% | 100.0% |
| | TU | Count | 3611 | 234 | 425 | 4270 |
| | | % | 84.6% | 5.5% | 10.0% | 100.0% |
| Total | | Count | 233065 | 11538 | 3719 | 248322 |
| | | % | 93.9% | 4.6% | 1.5% | 100.0% |

***52.0% of original grouped cases correctly classified**

Table 20 presents the results of the discriminant analysis conducted only on articulated HGVs, and here the outcome is a more extreme version of that in Table 19. When looking at articulated HGVs, only three classes remain in the predicted outcome – Principal Urban, Trunk Motorway, and Trunk Rural. This shows that the

AADF frequency profiles for articulated HGVs across all road classes are relatively indistinguishable from one another, and that a classification based on volumetric data is likely not to be particularly useful.

It should be noted that the relative size of the clusters in the discriminant analysis will have an impact on the classification of cases, and the predominance of classifications into the Principal Urban class is likely to be a result of this cluster containing the most cases. The discriminant analysis is useful in this context in its ability to demonstrate that, beyond the motorway/non-motorway distinction, there is actually little to distinguish between the different road classes. There is therefore an opportunity to revisit the current classification scheme used for establishing what is considered 'strategic', 'trunk' and 'principal', and to consider carefully what criteria should be used beyond traffic volume.

The earlier sections of this analysis have provided some indication of where such criteria might be found – particularly in relation to trip distances on different classes of road (i.e. those roads facilitating longer-distance trips being the 'strategic' routes), and also in relation to vehicle class as a proportion of all traffic (for example routes with a certain percentage HGV traffic being designated 'freight' routes).

**Expansion of the SRN**

It should be noted that there are many more principal road count sites than trunk road counts sites (204,982 versus 43,340 respectively). If there is a presumption that one can classify the Strategic Road Network based on volume of flow, then the discriminant analysis suggests that there are low-flow trunk roads which might be classified as principal, and conversely there are high-flow principal roads which might be classified as trunk.

If all of the principal roads were assumed to form part of a Major Road Network, then the profile of all of these together would be similar to the principal road network profile. See Chart 9 – Chart 11:

**Chart 9 - Trunk network AADF frequency profile**

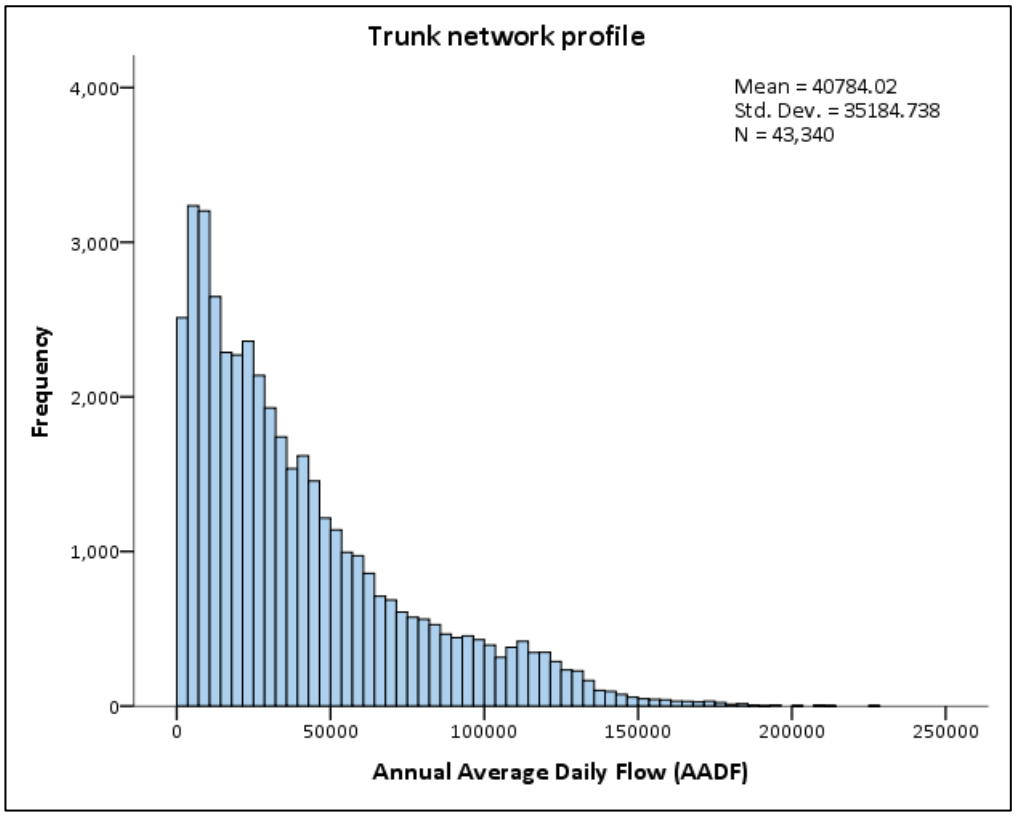


**Chart 10 - Principal network AADF frequency profile**

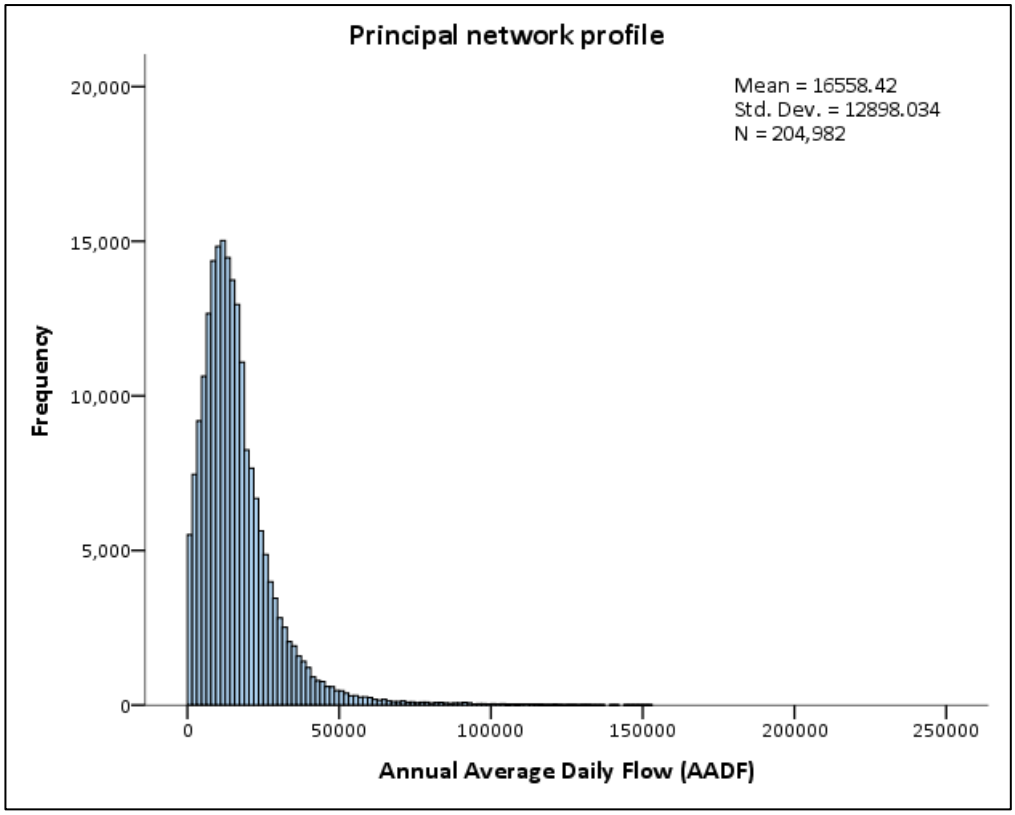
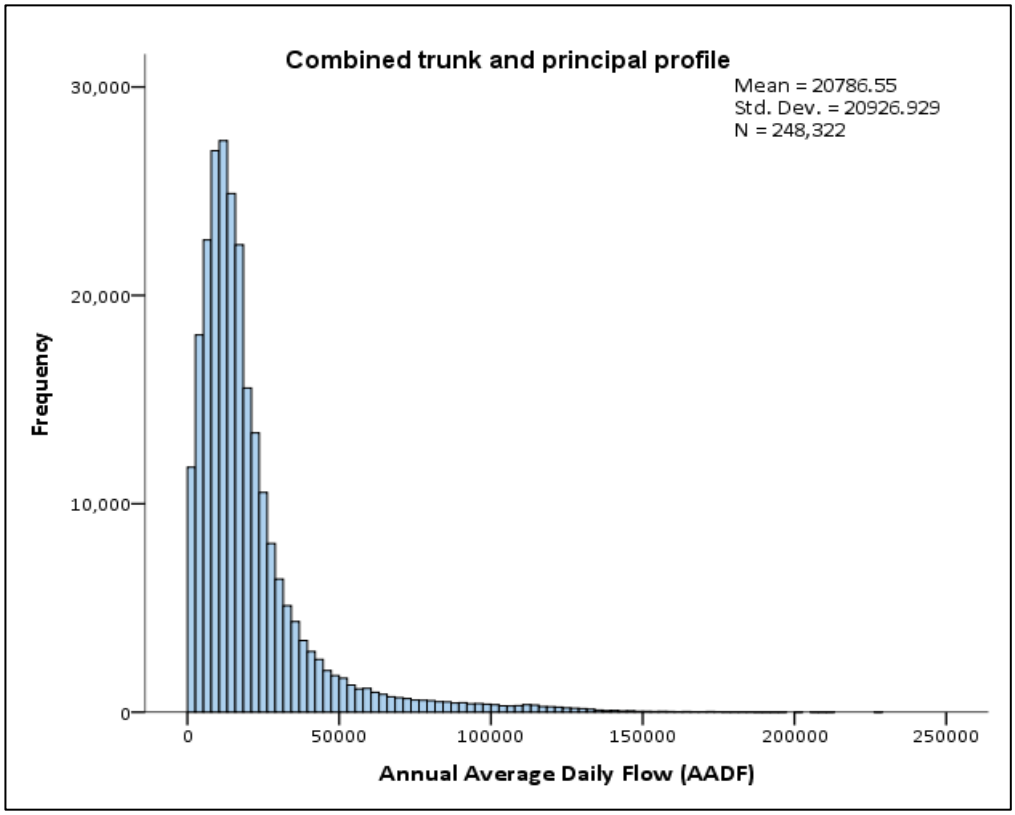



**Chart 11 - Combined trunk and principal network AADF frequency**



If there were a policy move to change the definition of some principal roads so that they form part of a Major Road Network based on flows, then, a priori, one would need to *specify the sort of distribution one would expect* for the profile of trunk roads. This might be a profile which has a more symmetrical distribution than is currently evident, i.e. with lower frequencies of lower flows, and this type of distribution is to some extent evident in the trunk motorway profile. With such an approach, we would be identifying a number of trunk roads with flows of less than 10,000 or so to re-classify as principal roads. We would also be looking to reclassify a number of principal roads with flows of approximately 40,000 and above.

The net result of this on the shape of the profile of trunk roads would be to create distributions that are less skewed. It should be noted that any such move would have the effect of reducing the proportion of HGVs as a proportion of all traffic on the trunk road network. However, the question remains as to whether, over time and due to geography and the specific nature of the origins and destinations, this would revert again to the currently observed proportions. Such an effect would need to be estimates using models of possible future demand.

Exploring proportions of HGVs as a percentage of all vehicles, it is possible to perform a crude expansion of the SRN to an MRN including a proportion of those PRN roads with the highest proportions of HGVs. Chart 12 - Chart 14 show the results of such an expansion.

Chart 12 shows proportions of HGVs on the current trunk and principal networks. As discussed the trunk network has a higher mean proportion of HGVs than the principal network, at 9.34% versus 3.94%. A proportion of principal roads however have HGV proportions much higher than the average for their class.

**Chart 12 - Proportion of HGVs on current Trunk and principal roads**

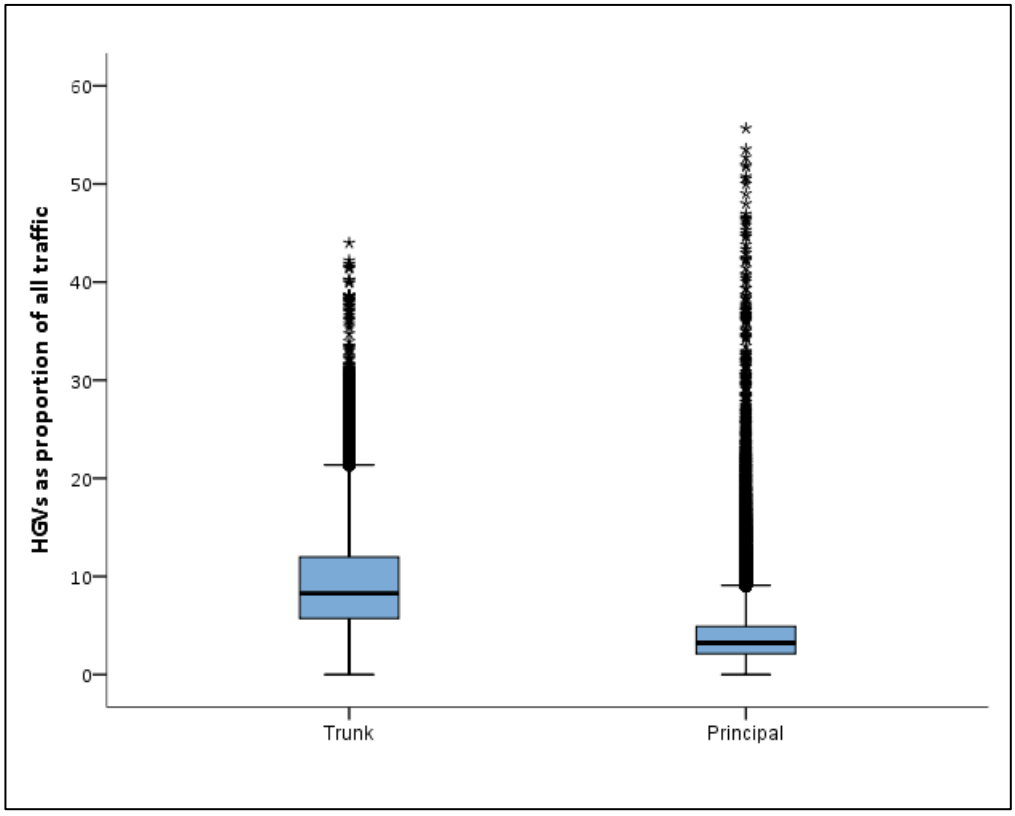


**Table 21 - Proportion of HGVs on current Trunk and principal roads**

| | Mean | SD |
|---|---|---|
| **Trunk** | 9.34 | 4.93 |
| **Principal** | 3.94 | 2.77 |

Chart 13 shows what the outcome would be if the 10% of principal road links with the highest HGV proportion were reallocated to the SRN to become part of the MRN. The data suggest that such a change would result in an SRN with a slightly higher proportion of HGV traffic on average than the current SRN. The new MRN would have a mean HGV proportion of 9.59%, whilst the current SRN has 9.34%. Therefore the MRN would have 0.25% more HGVs as a proportion of all traffic than the SRN.

**Chart 13 - Proportion of HGVs on MRN and non-MRN roads (MRN incorporating the SRN and top 10% of PRN by HGV proportion)**

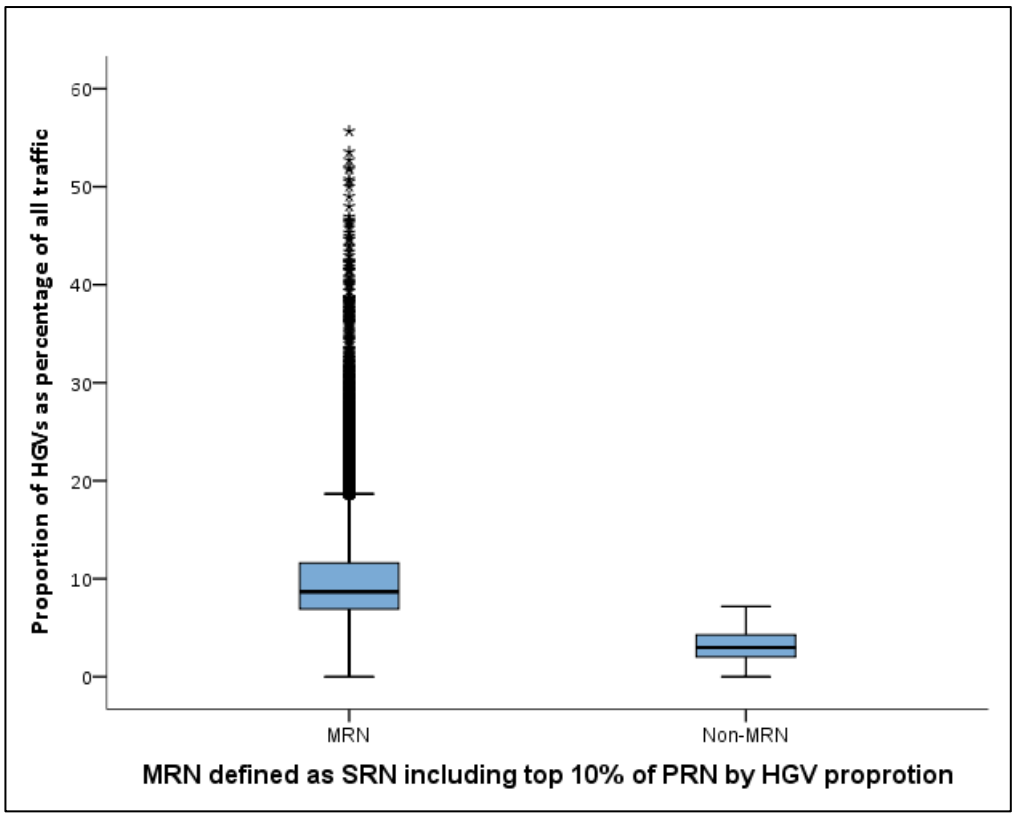



**Table 22 - Proportion of HGVs on MRN and non-MRN roads (MRN incorporating the SRN and top 10% of PRN by HGV proportion)**

| | Mean | SD |
|---|---|---|
| **MRN** | 9.59 | 4.55 |
| **Non-MRN** | 3.25 | 1.55 |

Chart 14 takes this slightly further and considers HGV proportions if the top 25% of PRN links by HGV proportion were reallocated to the MRN. This scenario however would create a slightly lower mean proportion of HGVs on the MRN when compared to the current SRN (although there would still exist a large difference between MRN and non-MRN in terms of HGV proportions). In this situation, the new MRN would have a mean HGV proportion of 8.19% compared to the existing SRN's 9.34%, representing a 1.15% decrease in the percentage of HGVs as a proportion of all traffic.

**Chart 14 - Proportion of HGVs on MRN and non-MRN roads (MRN incorporating the SRN and top 25% of PRN by HGV proportion)**

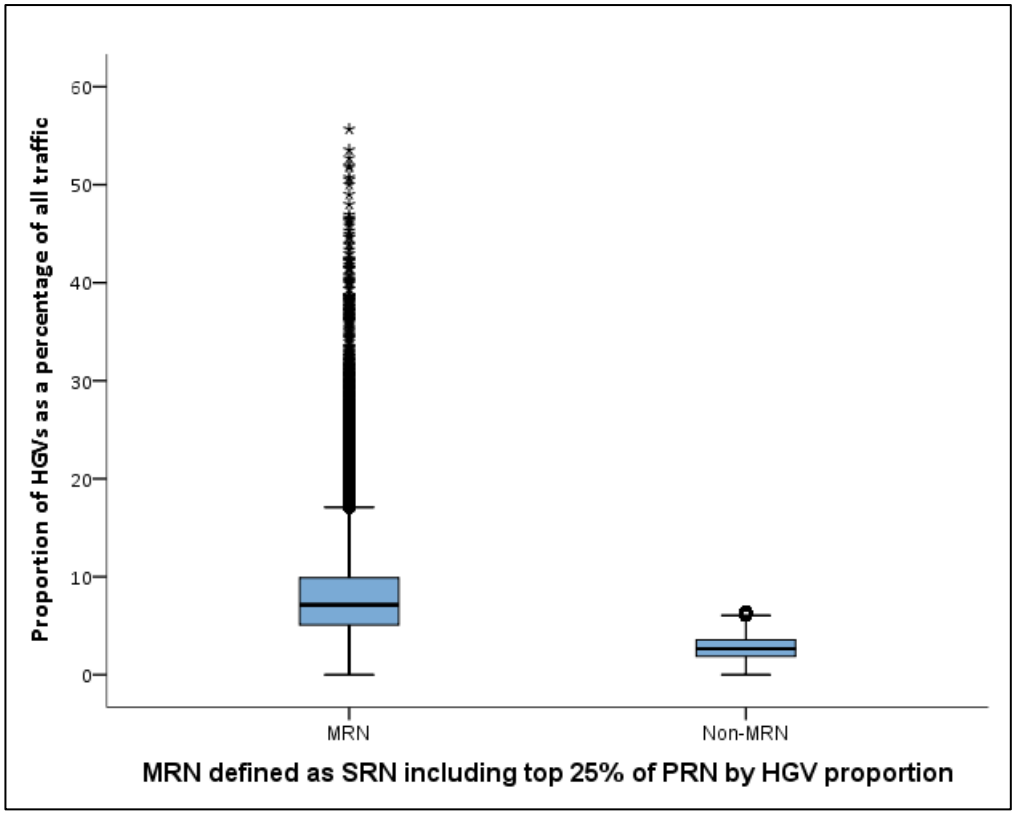



**Table 23 - Proportion of HGVs on MRN and non-MRN roads (MRN incorporating the SRN and top 25% of PRN by HGV proportion)**

| | Mean | SD |
|---|---|---|
| **MRN** | 8.19 | 4.29 |
| **Non-MRN** | 2.84 | 1.29 |

These results demonstrate that using HGV proportions as a method of road classification could lead to an outcome in which an MRN would carry higher proportions of HGV traffic on average than the current SRN. The data suggest that the approximate proportion of PRN roads which could be reallocated by this method whilst maintaining the same or higher proportions of HGVs as the current SRN is between 10% and 25%.

# 4. Conclusions

The analysis in this report provides insight into the current use of England's major roads, and provides a useful basis for considering the future nature of use of a network that might be classified as a 'Major Road Network'.

Data from the Use of the Strategic Road Network report, the National Road Users' Satisfaction Survey, and the National Travel Survey have provided a picture of the use of the SRN by region, vehicle class, occupation, income, and trip distance.

The USRN report found that people are using the SRN relatively often. There was some regional variation in levels of SRN use; however across the whole of England, over 70% of people surveyed had used the SRN at least once a month.

In terms of occupation, people in managerial/professional positions used the SRN more frequently than those in intermediate, routine/manual, or unclassified categories. Use of the SRN peaks for those people with incomes between £31,200 and £41,599.

Whilst the USRN report found that people are using the network relatively often, it also found that high proportions of trip distances on some parts of the SRN were quite short. This was particularly true for 'A' Roads, and there is an evident split between 'A' Roads and motorways, with motorways carrying the bulk of longer-distance traffic. This finding is similar to national data for all roads from the NTS, which shows that the majority of car trips are relatively short in terms of both distance and duration. This suggests that trip distance is an important distinguishing feature of different roads within the SRN, and that trip distance could be a useful criteria for classification.

An analysis of volumetric AADF data from across Great Britain has shown that, across the six road categories used by the Department for Transport (TM, TU, TR, PM, PU, PR), there is a high degree of overlap in the frequency distributions of AADF. This means that for those road categories with similar profiles (TM/PM; TU/TR/PU/PR), there is little to distinguish between them when considering only ratios of volumes of use. This finding demonstrates that the classification of roads into categories requires additional criteria beyond simple aggregate patterns of usage. One such criteria to emerge from this analysis is the ratios of HGVs as a percentage of all traffic. The analysis of the AADF data has shown that there is a stronger distinction between current Trunk and Principal road classes in terms of the proportions of HGVs using these routes – and this effect is particularly strong when only articulated HGVs are considered.

This finding links back to data from the USRN report, which included data on the use of the SRN by HGVs, and similarly found that HGVs are the class of vehicle using the SRN most frequently (followed by LGVs and finally by cars). This finding gives some insight into what might be deemed the 'strategic' nature of these roads, and demonstrates the possibility of using this as a key determinant of major road network size. There will clearly be other factors as well, linked with issues connected with wider national and regional policy and funding mechanisms.

# 5. References

Department for Transport (2014) *The use of the strategic road network: report*. UK: Department for Transport.

Department for Transport (2015) *Road Traffic Statistics Metadata.* Department for Transport. Available from: http://data.dft.gov.uk/gb-traffic-matrix/all-traffic-data-metadata.pdf

Highways Agency (1997) TA 46/97: Traffic Flow Ranges for use in the Assessment of New Rural Roads. *Design Manual for Roads and Bridges*. UK: Highways Agency.

Highways Agency (2013) *National road users' satisfaction survey: results 2012 to 2013*. UK: Highways Agency.

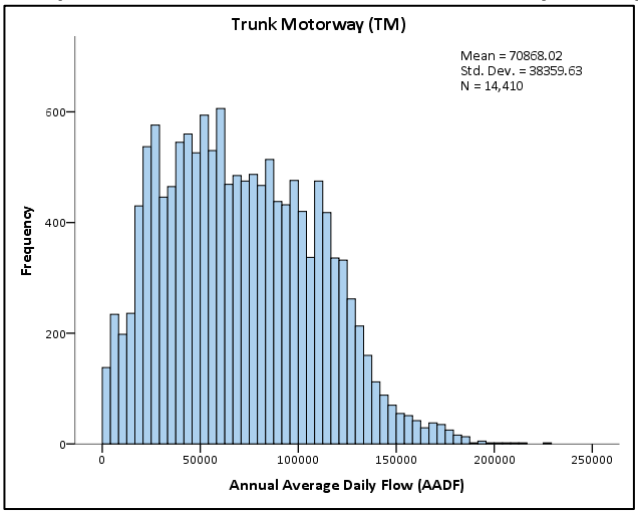
National Road Traffic Estimates (2000-2013) *Dataset*. UK: Department for Transport. Available from: http://www.dft.gov.uk/traffic-counts/

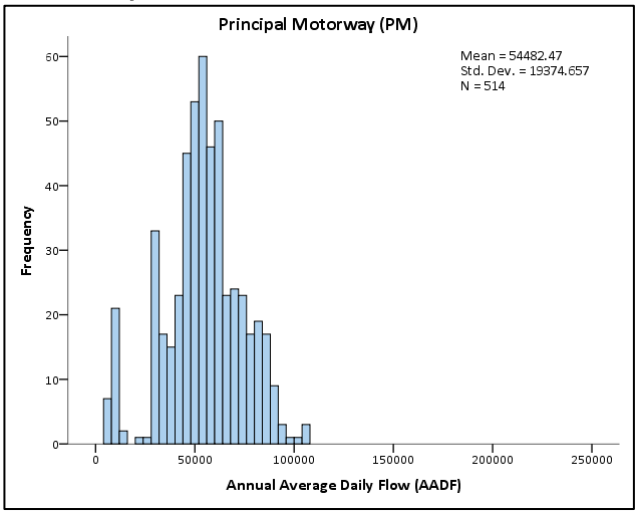
National Travel Survey (2002-2012) *Dataset.* UK: Department for Transport. Available from: http://www.data-archive.ac.uk/

# 6. Appendix

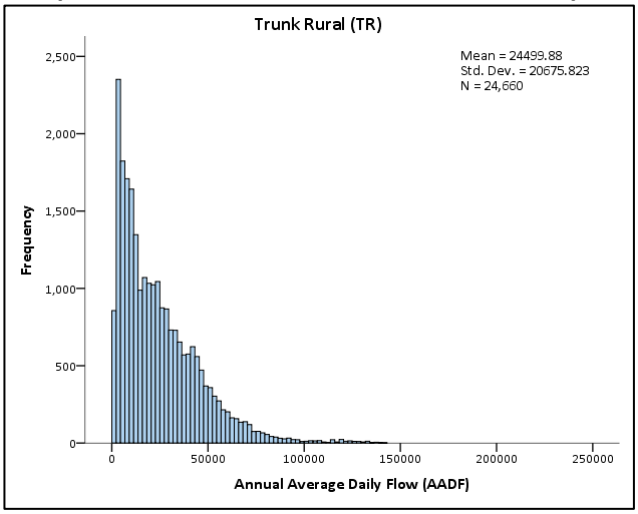
## Appendix 1: AADF frequency distribution histograms – All years

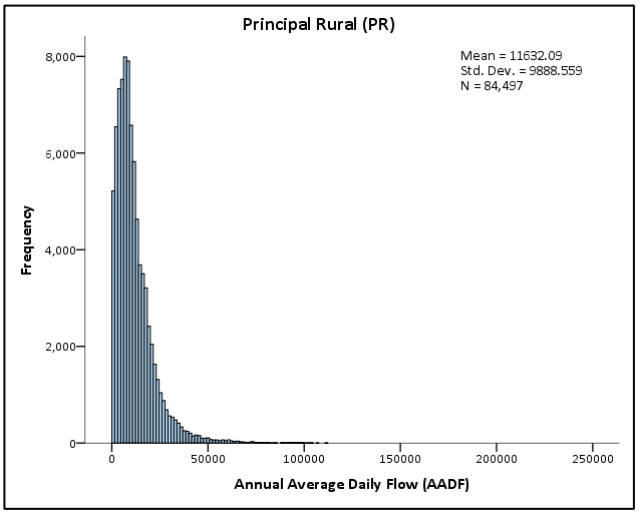
### Comparative distributions – Trunk Motorway/Principal Motorway



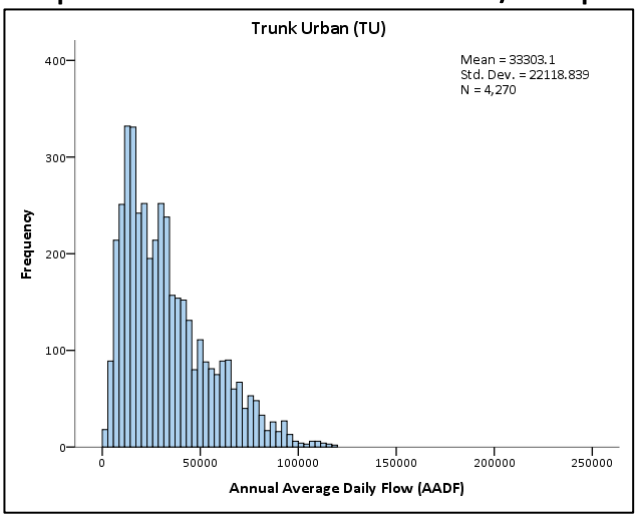



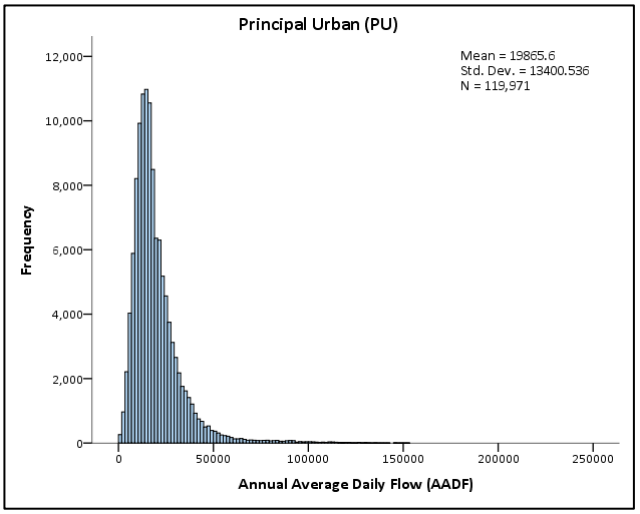

### Comparative distributions – Trunk Rural/Principal Rural




### Comparative distributions – Trunk Urban/Principal Urban

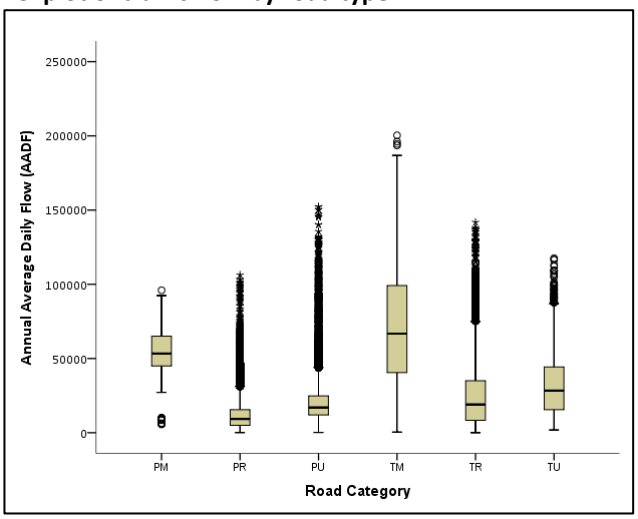


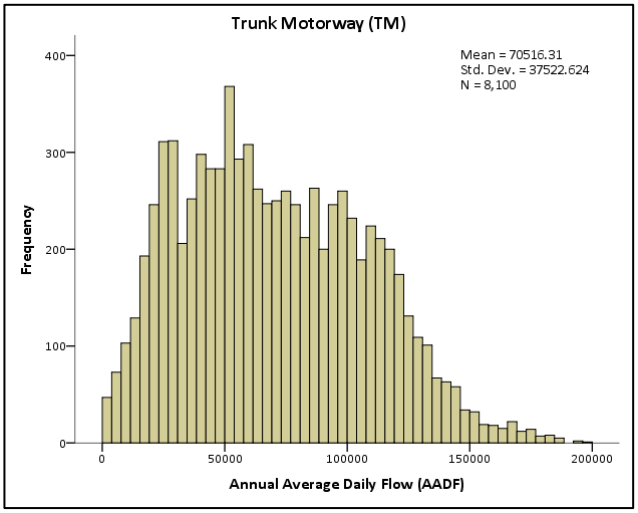
# Appendix 2: AADF frequency distribution histograms – 2000-2007/2008-2013

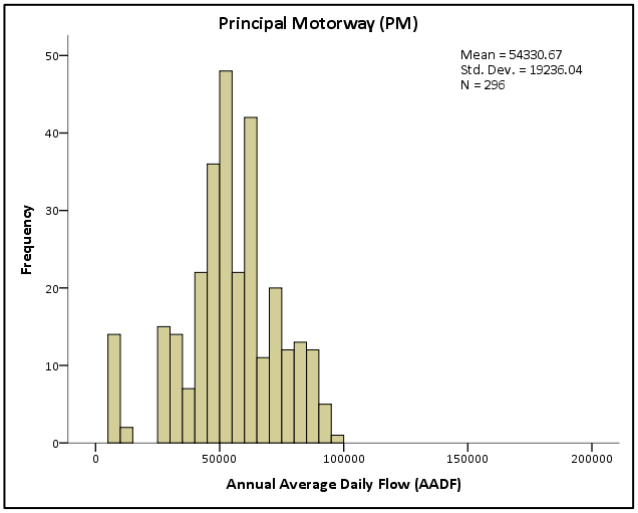
## 2000 – 2007

### Boxplot of traffic flow by road type

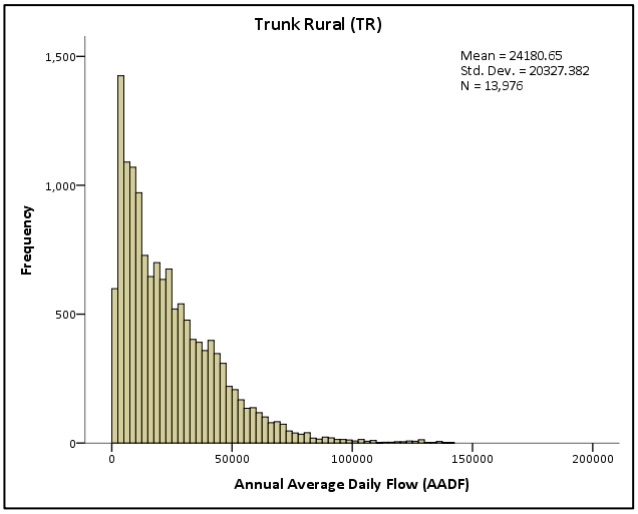


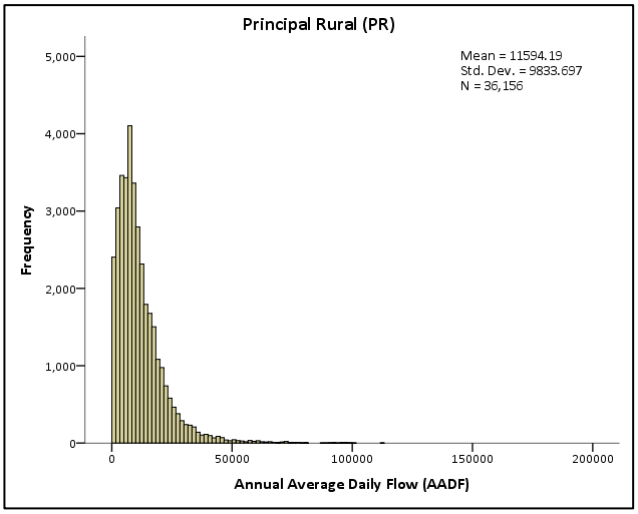

### Comparative distributions – Trunk Motorway/Principapl Motorway



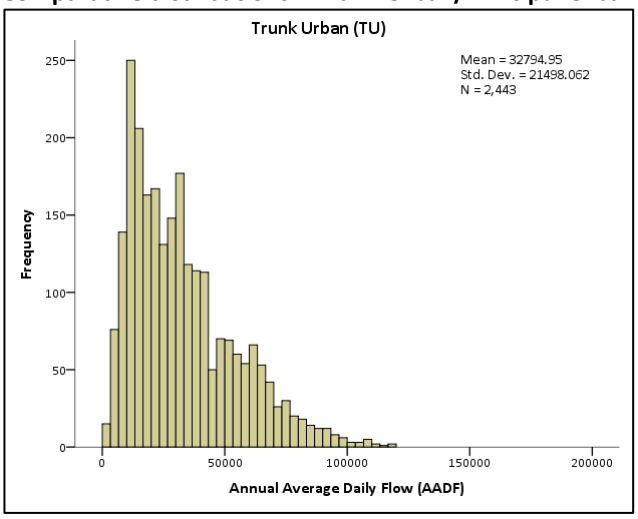



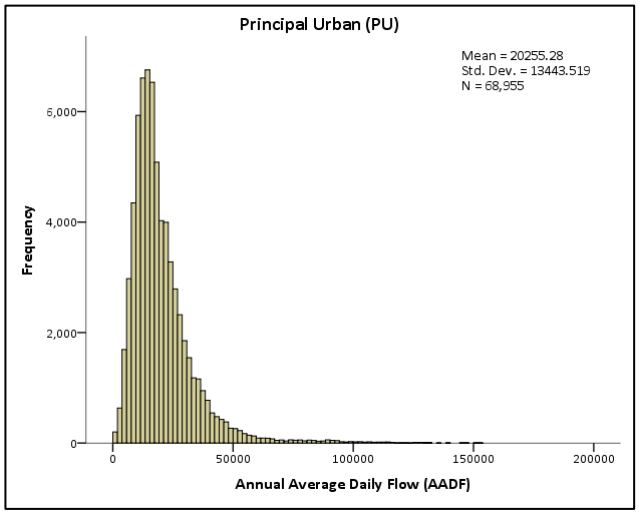

### Comparative distributions – Trunk Rural/Principal Rural



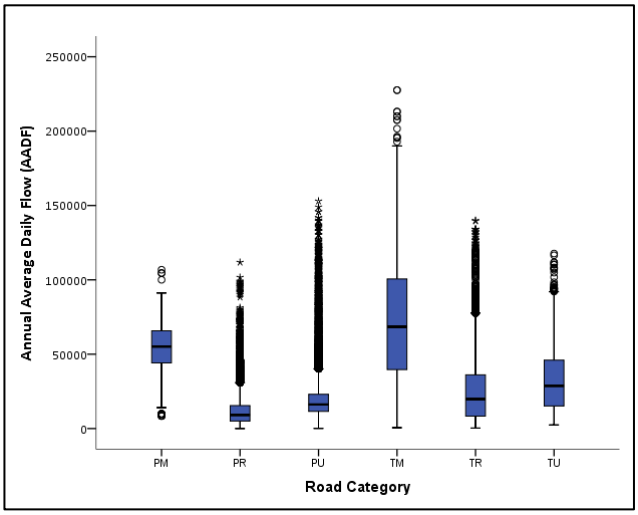
### Comparative distributions – Trunk Urban/Principal Urban



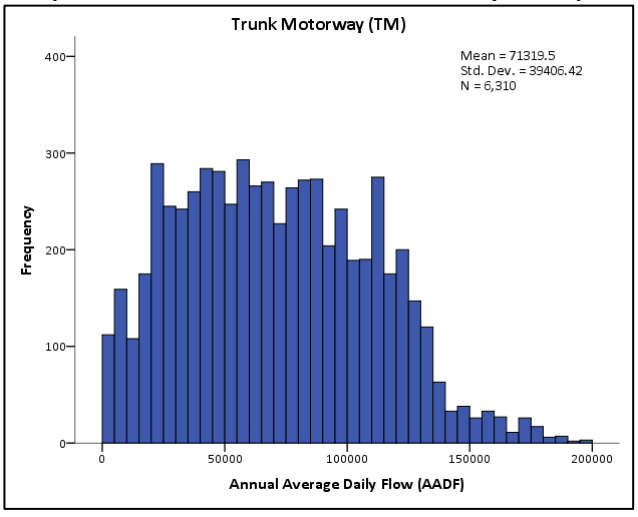



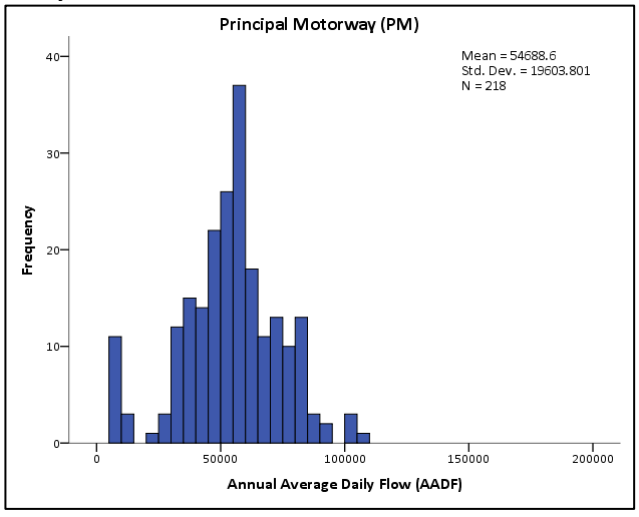

## 2008-2013

### Boxplot of traffic flow by road type

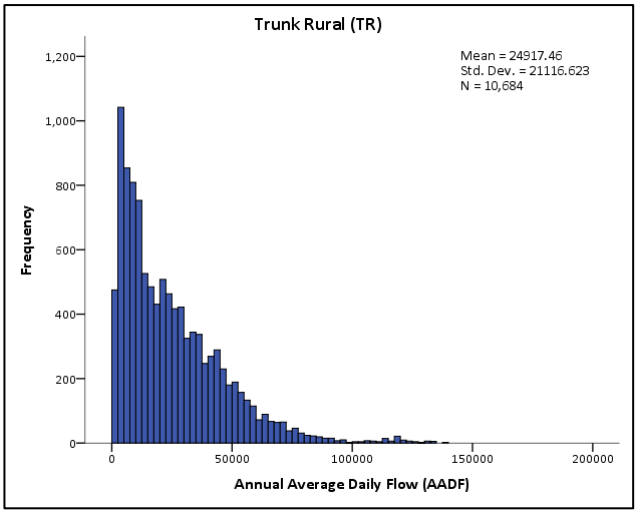


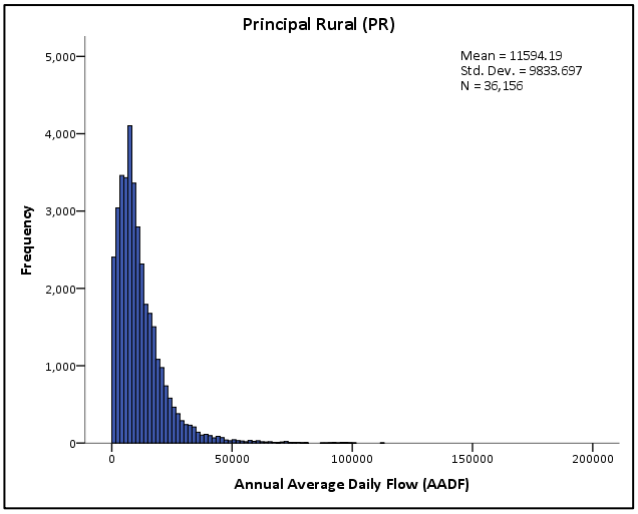

### Comparative distributions – Trunk Motorway/Principal Motorway



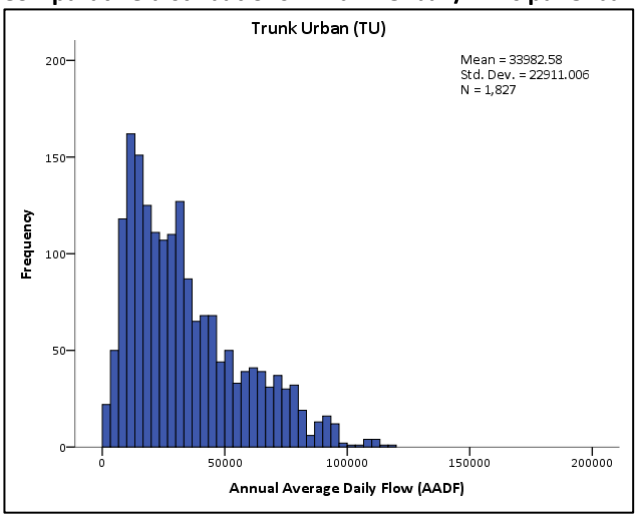



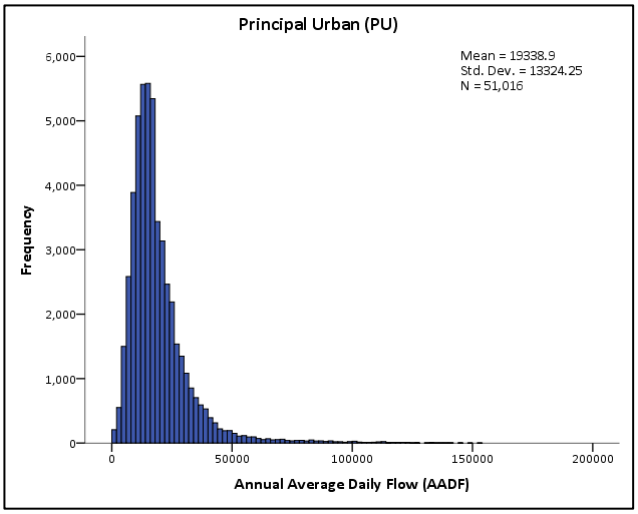

### Comparative distributions – Trunk Rural/Principal Rural



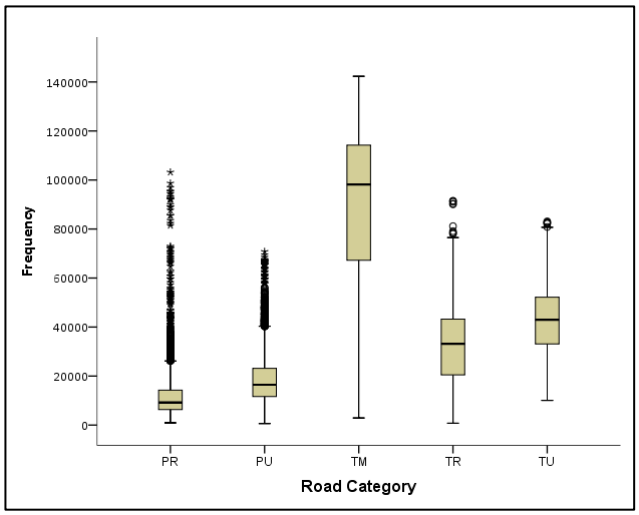

## Comparative distributions – Trunk Urban/Principal Urban



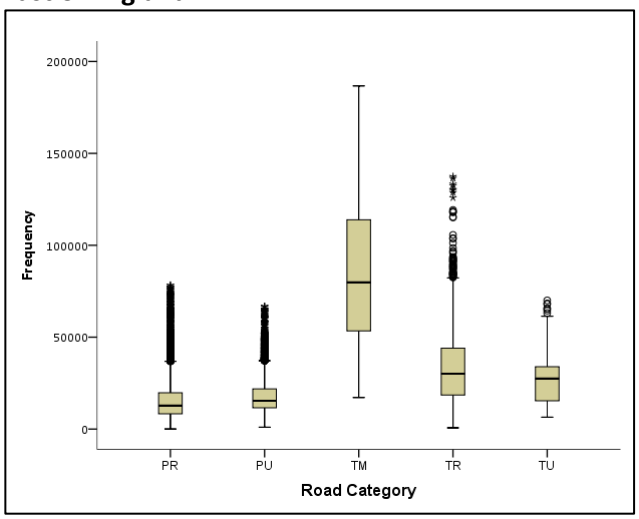



# Appendix 3: AADF frequency regional boxplots – All years

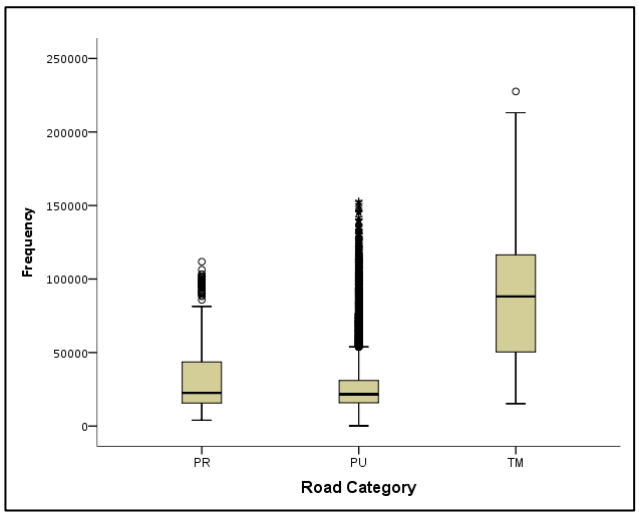
**East Midlands**



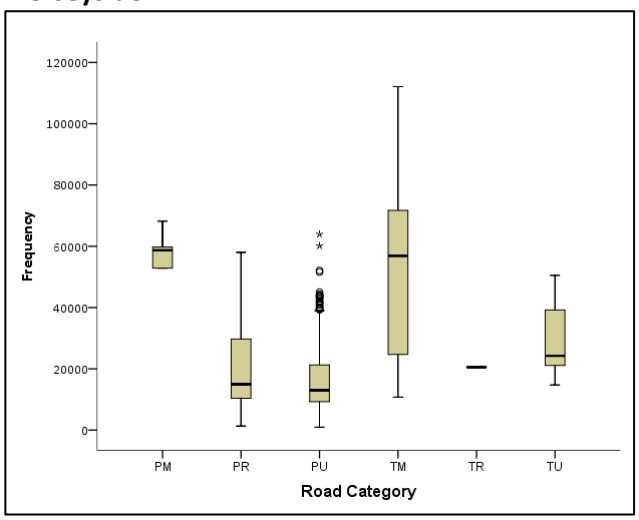

**East of England**



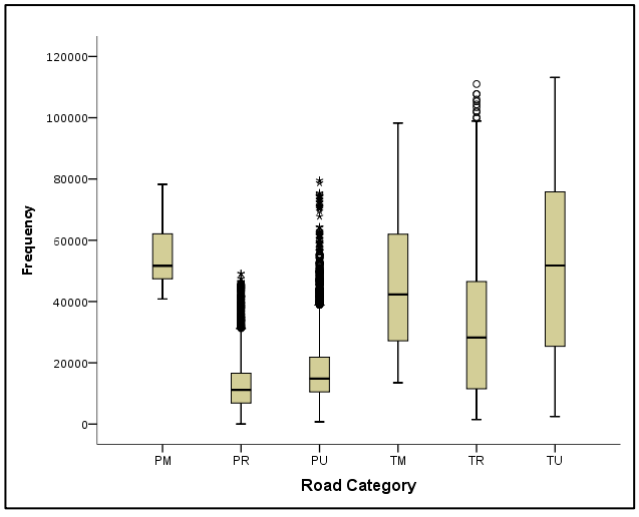

**London**



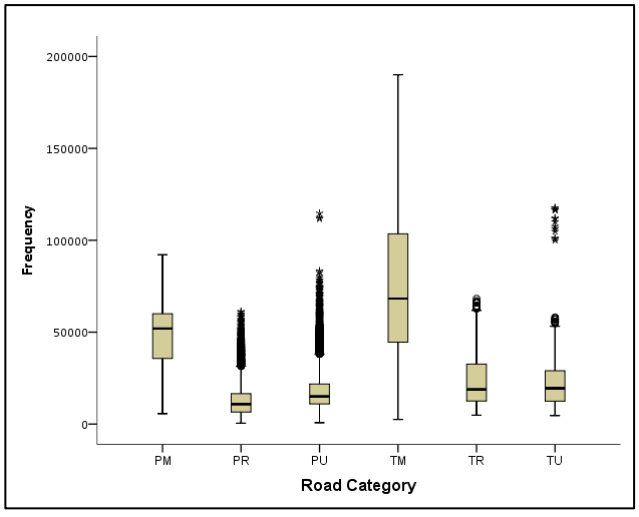

**Merseyside**



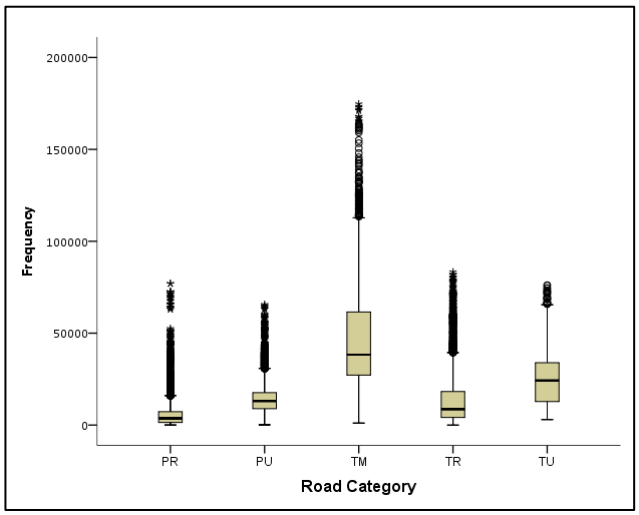

**North East**



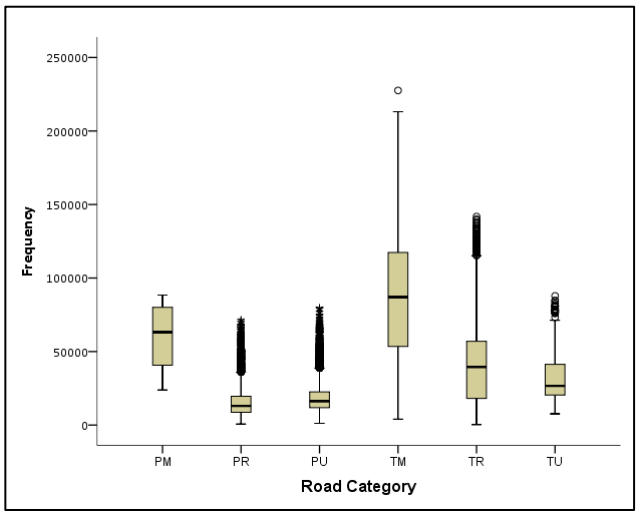

**North West**



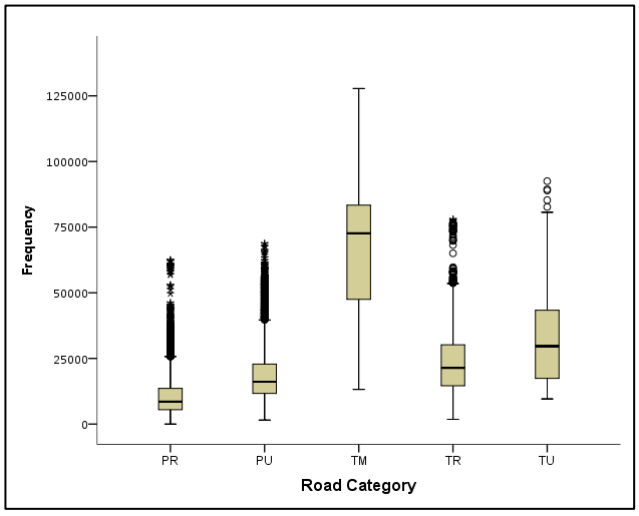
## Scotland



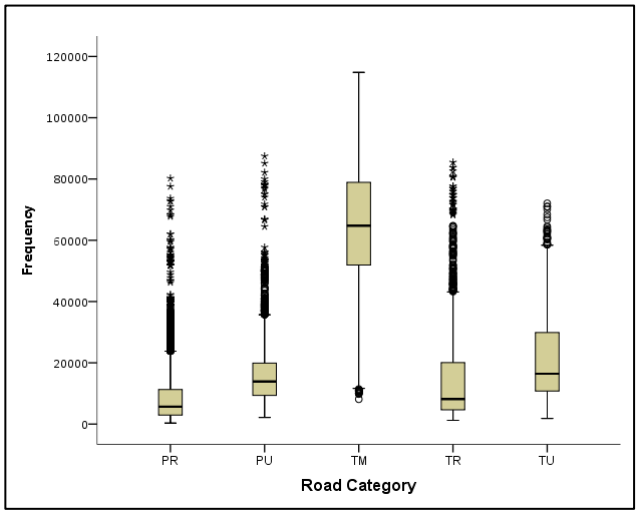

## South East



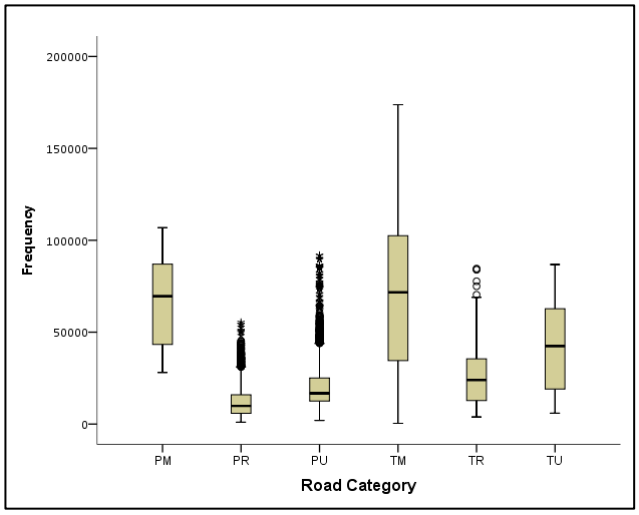

## South West




## Wales




## West Midlands




## Yorkshire and the Humber