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Annual Road Traffic Estimates: Vehicle Kilometres Travelled in Northern Ireland, 2014



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Annual Road Traffic Estimates, 2014

About this Report

This statistical report presents annual road traffic estimates for Northern Ireland for 2014. These annual road traffic statistics provide estimates of the vehicle kilometres travelled each year in NI, by road category and vehicle type. This is the second and likely to be the final¹ report produced by the Analysis, Statistics and Research Branch (ASRB) in the Department for Infrastructure (DfI) formerly known as the Department for Regional Development.

Annual estimates are mainly based on around 500 manual counts where trained enumerators count traffic by vehicle type over a 12 or 24 hour period. This survey is known as the Vehicle Kilometres Travelled (VKT) survey. Traffic data is also collected from a network of around 350 Automatic Traffic Counters (ATCs), of which 210 have continuous counts at permanent locations, and the remaining ATCs are rotated at defined locations. In addition to counting traffic, the ATCs record some of the physical properties of passing vehicles which are used to classify vehicles by type. These two data sources are combined with road lengths statistics to estimate the vehicle kilometres travelled each year by vehicle type and road type.

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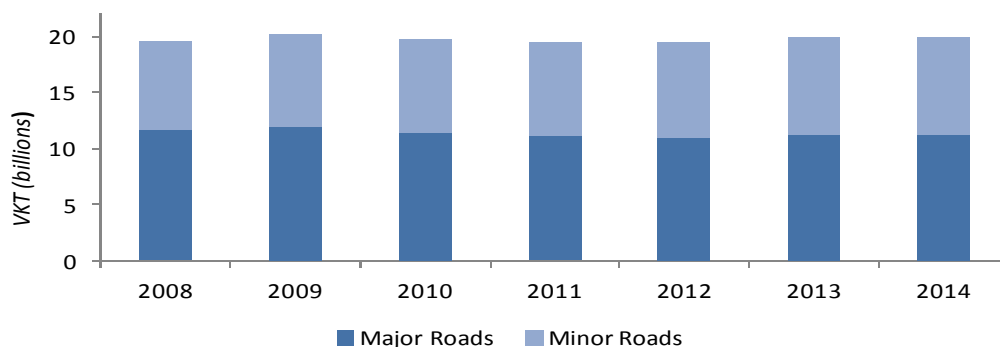
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¹ Due to budgetary pressures in the Department, Transport NI the VKT Survey has not been carried out since 2014.

Key Findings

- In 2014, overall road traffic in Northern Ireland was estimated at 19.8 billion vehicle kilometres. This has remained relatively consistent over the period 2008 to 2014 with the exception of a small increase in 2009.

Figure 1: Vehicle kilometres travelled on Major and Minor roads, 2008 to 2014



- Major roads account for only 10% of the total road length in NI, yet the traffic on these roads contributes to 57% of the total vehicle kilometres travelled. Conversely, the minor road network accounts for 90% of the total road length in NI and the traffic on these roads contributes to the remaining 43%.
- Less than 1% of the total road network in Northern Ireland is motorway yet motorway traffic accounted for 8% of the total vehicle kilometres travelled in 2014.
- In 2014, 8.6 billion vehicle kilometres (43% of the total) were travelled on minor roads.
- Among major roads, trunk A rural roads carried the largest proportion of traffic, 4.3 billion vehicle kilometres in 2014, around a fifth (21%) of the total.
- In 2014, cars accounted for almost 9 out of every 10 vehicle kilometres travelled on Northern Ireland roads with 17.7 billion vehicle kilometres travelled.

Background

TransportNI within the Department for Infrastructure (DfI) is the sole road authority in Northern Ireland, responsible for over 25,000 kilometres of public roads, as shown in the table below.

Table 1: Total Length of Road by Class, 2014

Road Class	Total Length (approx)
Motorway	115 km (excl slip roads)
'A' Class	2,289 km
'B' Class	2,906 km
'C' Class	4,726 km
Unclassified	15,475 km
All Road Classes	25,511km

For a further breakdown of road length by road type including urban/rural split please refer to Appendix 2.

This statistical report presents annual road traffic estimates for Northern Ireland for 2014. These annual road traffic statistics provide estimates of the vehicle kilometres travelled (VKT) each year in NI, by road category and vehicle type. This is the second and likely to be the final² report produced by the Analysis, Statistics and Research Branch (ASRB) in the Department for Infrastructure.

Uses of the Data

Department for Infrastructure

Road traffic data are a key source of management information on the country's infrastructure. This data is used by TransportNI to provide an indication of overall usage of the road network, enable its effective and efficient management, to assist in the allocation of TransportNI resources such as winter gritting and to aid the development of future proposals for the road network.

Road Safety Strategy

The Northern Ireland Road Safety Strategy to 2020³ details what government intends to do to further improve road safety in Northern Ireland. It identifies 4 key casualty reduction targets and sets out 199 measures to further reduce road deaths and serious injuries up to 2020. The Northern Ireland Road Safety Strategy to 2020 consists of 4 targets and 19 Key Performance Indicators (KPI's) and the VKT statistics are used in a number of these KPI's to calculate road traffic collision rates.

² Due to budgetary pressures in the Department, Transport NI the VKT Survey has not been carried out since 2014

³ This publication was previously published by DoE but from May 2016 onwards, will be published by DfI

The information is also useful to other government bodies and organisations for target setting and strategy monitoring purposes, for example:

Northern Ireland Greenhouse Gas (GHG) Inventory

The VKT data is sent to RICARDO-AEA for use in calculating GHG and air pollutant emissions from road transport in NI. These calculations are carried out by RICARDO-AEA for both the UK's national atmospheric emissions inventory (on behalf of Defra⁴ and DECC⁵) and the Devolved Authority (DA) emissions inventory for Northern Ireland (Department of Agriculture, Environment & Rural Affairs (DAERA), formerly the Department of the Environment (DOE) NI). These emissions data are required to meet mandatory reporting obligations that the UK Government must fulfill under international protocols, including the National Emission Ceilings Directive (NECD) and the Kyoto Protocol.

⁴ Department of Environment, Food and Rural Affairs, GB

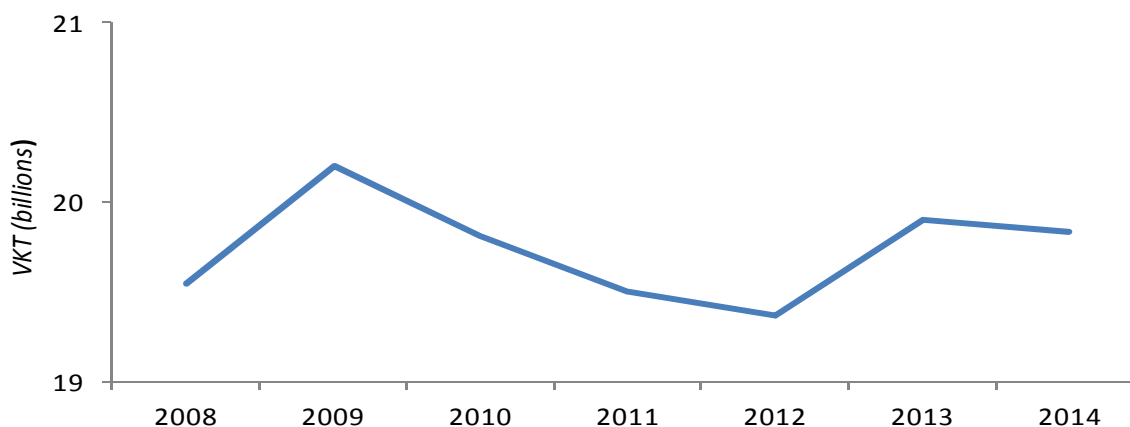
⁵ Department of Energy and Climate Change, GB

Section 1: Results

Vehicle Kilometres Travelled in Northern Ireland: 2014

In 2014, overall road traffic in Northern Ireland was estimated at 19.8 billion⁶ vehicle kilometres. This has remained relatively consistent over the period 2008 to 2014 with the exception of a small increase in 2009. The fluctuations year on year may be as a result of the sampling methodology used to produce the NI VKT values.

Figure 2: NI Overall VKT trend, 2008 to 2014



Year on year changes to the VKT can be related to a number of factors including:

- Population and demography
- Incomes and the economy; and
- Cost of motoring (e.g. fuel prices, fuel efficiency, insurance etc).

Increases to the cost of motoring could be expected to have a negative effect on changes in VKT. However, car use is also influenced by associated changes in the cost of alternative modes of transport (i.e. buses and trains).

It is not clear as to why VKT estimates were higher than for any other year in 2009. Fuel prices at the pump reached what was then a peak of 118.7p per litre in July 2008 and by January 2009 had fallen to 87.0p per litre⁷. This dramatic drop in fuel prices coupled with a small increase in the number of Private and Light Goods vehicles between 2008 and 2009⁸ may have contributed to a peak of VKT in NI in 2009. Alternatively, this rise may have been as a result of the sampling methodology.

Similarly VKT estimates were lower than any other year during 2012. In April 2012 fuel price peaked at 141.9p per litre having steadily increased since January 2009 before falling back gradually to 117.8p per litre in December 2014.

⁶ 1 billion vehicle kilometres = 1,000,000,000 vehicle kilometres

⁷ Average prices for a litre of unleaded petrol in the UK - <http://www.petrolprices.com/the-price-of-fuel.html>

⁸ Table 1.6 Northern Ireland Transport Statistics Annual 2012-13

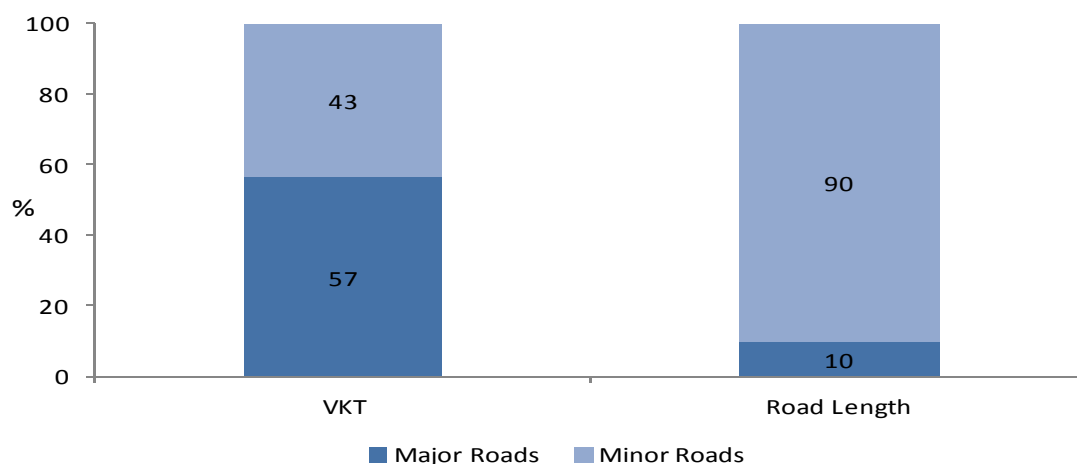
Table 2: Vehicle Kilometres Travelled by Road Type^{9 10}, 2008 to 2014 *billions*

Road Type		2008	2009	2010	2011	2012	2013	2014
Major Roads	Motorway	1.5	1.7	1.6	1.6	1.6	1.6	1.6
	Trunk A Rural	4.7	4.7	4.4	4.1	4.1	4.2	4.3
	Trunk A Urban	1.8	1.8	1.8	1.8	1.8	1.8	1.9
	Other A Rural	1.7	1.7	1.7	1.5	1.6	1.6	1.6
	Other A Urban	1.6	1.5	1.5	1.4	1.5	1.5	1.4
	B Roads >10,000 (Rural)	0.2	0.2	0.2	0.1	0.2	0.2	0.2
	B Roads >10,000 (Urban)	0.4	0.4	0.4	0.4	0.4	0.3	0.3
Major Roads VKT		11.8	11.9	11.4	11.0	11.0	11.2	11.3
Minor Roads VKT		7.8	8.3	8.4	8.5	8.4	8.7	8.6
NI Overall VKT		19.5	20.2	19.8	19.5	19.4	19.9	19.8

Road lengths and traffic counts are the two main factors in the VKT calculation. It is important to note that low traffic counts can result in a high VKT value if the journey is over a long distance. Equally, high VKT values can be obtained on short road lengths where the traffic counts are large.

VKT is not proportionate to road lengths, as can be seen in Figure 3. Major roads account for only 10% of the total road length in NI, yet the traffic on these roads contributes to 57% of the total VKT. Conversely, the minor road network accounts for 90% of the total road length in NI and the traffic on these roads contributes to the remaining 43% of the VKT.

Figure 3: Vehicle Kilometres Travelled compared with Road Length Proportions on Major and Minor Roads, 2014



Less than 1% of the total road network in Northern Ireland is motorway yet motorway traffic accounted for 8% in 2014.

In 2014, 8.6 billion vehicle kilometres were travelled on minor roads and this represents 43% of the total vehicle kilometres travelled. Broadly speaking, traffic on minor roads has increased since 2008 (7.8 billion vehicle kilometres; 40% of total VKT).

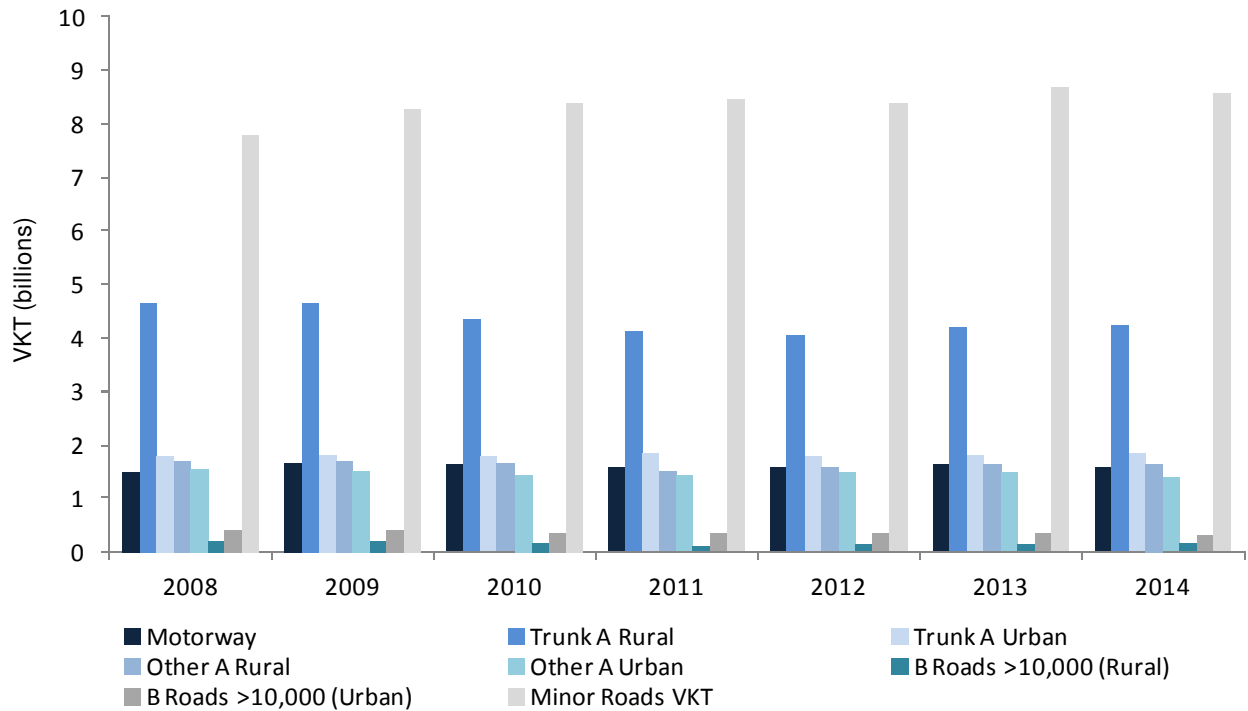
⁹ For definitions of types of road please refer to Appendix 1.

¹⁰ *Urban roads* are defined as having a speed limit of 40 mph (miles per hour) or less. *Rural roads* are defined as having a speed limit of 41 mph or more.

Among major roads, trunk A rural roads carried the largest proportion of traffic, 4.3 billion vehicle kilometres in 2014, around a fifth (21%) of the total VKT. In general, traffic on major roads has decreased since 2008 when it accounted for 24% of total VKT (4.7 billion VKT).

In 2014, 1.9 billion vehicle kilometres of traffic were carried on trunk A urban roads (9% of total VKT), a similar proportion to 2008.

Figure 4: Vehicle Kilometres Travelled by Road Type, 2008 to 2014 (billions)



In 2014, traffic on other A rural roads accounted for 1.6 billion VKT, 8% of the total VKT in Northern Ireland. This has remained relatively constant in the 7 year period between 2008 and 2014.

Figure 5: Indexed trend in Vehicle kilometres travelled by selected road types in Northern Ireland, 2008 – 2014 (2008 = 100)

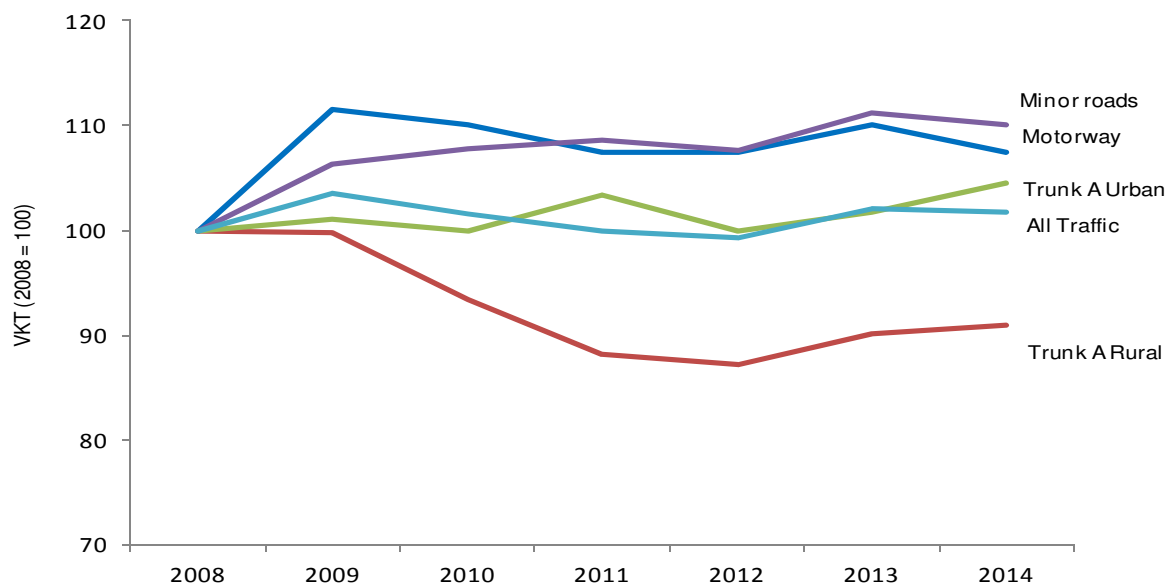


Table 3: Vehicle Kilometres Travelled by Vehicle Type^{11,12}: 2008 to 2014
billions

	2008	2009	2010	2011	2012	2013	2014
Car	17.2	17.8	17.6	17.4	17.3	17.8	17.7
Medium Commercial	1.3	1.3	1.1	1.1	1.1	1.2	1.2
HGV	0.6	0.6	0.6	0.5	0.5	0.5	0.5
Articulated Lorries	0.5	0.5	0.4	0.4	0.4	0.4	0.4
Bus	0.1	0.1	0.1	0.1	0.1	0.1	0.1
All Vehicles	19.5	20.2	19.8	19.5	19.4	19.9	19.8

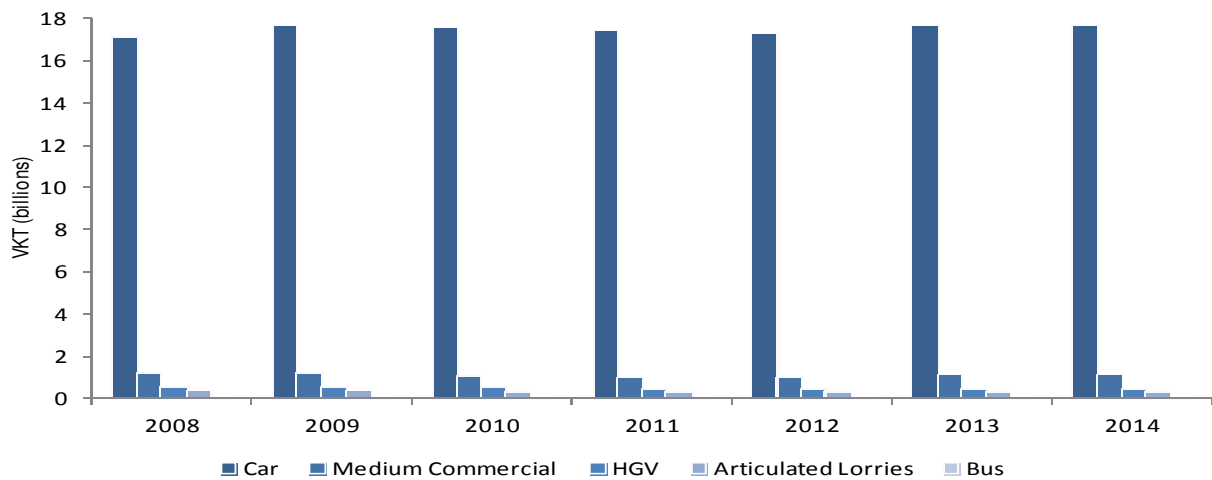
In 2014, cars accounted for almost 9 out of every 10 vehicle kilometres travelled on Northern Ireland’s roads with 17.7 billion vehicle kilometres travelled. Car traffic has remained relatively constant between 2008 and 2014 (Figure 6 and Figure 7). As car traffic accounts for almost 90% of traffic on NI roads, the overall trend for ‘all vehicles’ mirrors that of car traffic (Figure 8).

¹¹ Vehicle type figures may differ slightly from the previous publication due to a revision in the methodology used to calculate motorway vehicle type

¹²

Cars	Car, Car & Trailer and Light Vans
Medium Commercial	Medium Goods Van or mini bus (<8.7m long)
HGV	HGV Rigid (>8.7m long)
Articulated Lorries	Articulated Vehicle & Rigid HGV with Trailers
Buses	Bus & Coach

Figure 6: Vehicle Kilometres Travelled by Vehicle Type 2008 to 2014 - All Roads



Medium commercial vehicles accounted for the second highest proportion of vehicles on our roads, accounting for 6% of VKT in 2014.

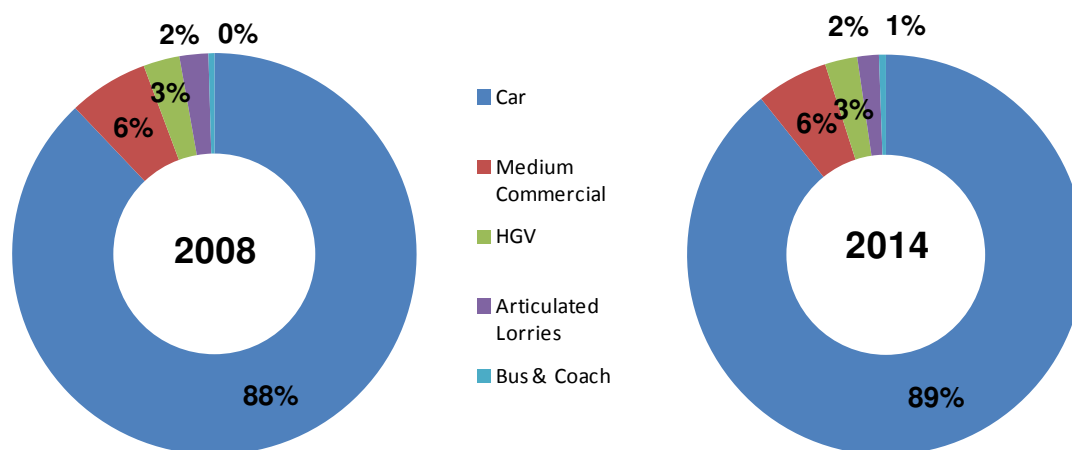
Heavy Goods Vehicles (HGVs) (3%) and Articulated lorries (2%) accounted for one in twenty vehicle kilometres travelled on NI roads in 2014. Whilst the proportion of the overall VKT accounted for by HGV's and Articulated lorries remained the same, there has been a downward trend in the VKT accounted for by HGV's and Articulated lorries (Figure 8). Many HGV trips relate to activities such as retail, construction and industry, activities which are closely linked to the general economic situation of the country. A general downward trend is to be expected given that there has been a marked decline in the number of Heavy Goods Vehicles (HGV's) that are currently licensed (by taxation group)¹³.

In addition, freight volumes have largely been in decline since 2008 (with the exception of 2012) and in 2014 freight volumes carried were at their lowest since 2004.

Buses and Coaches account for the smallest proportion of traffic on our roads, 1% of overall vehicle kilometres travelled in 2014.

¹³ <https://www.infrastructure-ni.gov.uk/publications/road-freight-statistics-2014>

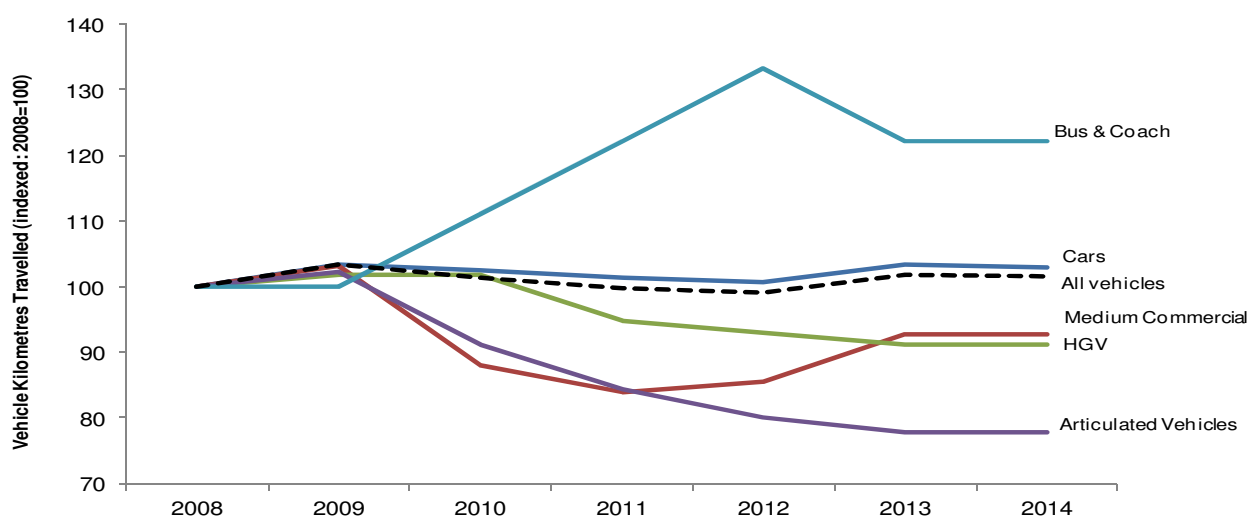
Figure 7: Road Traffic by Vehicle Type in Northern Ireland: 2008¹⁴ and 2014¹⁵



Over the period 2008 – 2014:

- There has been a small upward trend in car traffic.
- As car traffic accounts for almost 90% of traffic on NI roads, the overall trend for ‘all vehicles’ mirrors that of car traffic.
- The trend for HGV’s and Articulated lorries has been downward.
- In general there has been an upward trend for buses and coaches, however, as numbers are small for this category, small changes can account for large percentage differences.

Figure 8: Indexed Trends in Road traffic by Vehicle Type in Northern Ireland: 2008 – 2014 (2008=100)



¹⁴ 2008 vehicle type figures may differ slightly from the previous publication due to a revision in the methodology used to calculate motorway vehicle type

¹⁵ A ‘0%’ label on the chart represents a value that is less than 0.5%

Section 2: Methodology

The NI road network consists of over 25,000 km of public roads. For the purposes of collating VKT data the road network has been divided into two types, major roads and minor roads. The methodology used to calculate the VKT for the major road network is different from that used to calculate the VKT for the minor roads and is detailed separately below.

Major Roads

The major road network in NI consists of over 2,500km which is subdivided into motorway, trunk A and non-trunk A roads and B roads with flows greater than 10,000 (>10,000) vehicles per day. The major road network accounts for approximately 10% of the total road network in NI. Non-motorway roads are sub-divided into rural and urban¹⁶ resulting in 7 major road categories.

All the major roads have been divided into a series of links where a link is defined as a section of road between consecutive junctions with other major roads. The number of links in each of the 7 major road categories are given in Table 4.

Table 4: Number of links in each of the major road categories, 2014

Category	Number of Links
Motorways	28
Trunk A rural	242
Trunk A Urban	112
Other A Rural	154
Other A Urban	245
B roads > 10,000 Rural	19
B roads >10,000 Urban	63
Total	863

Motorways

The motorway network in NI is divided into 28 links which, in 2014 amounted to 115 km (excluding slipways). Traffic counts were taken on a single day, in each of the survey years until 2013, for a 12 hour period (7am to 7pm) on each of the 28 motorway links. In 2014 counts were a combination of those taken on a single day for a 12 hour period (7am to 7pm) and annual average for a 24 hour period. The count day may or may not have been a 'neutral day', where a neutral day is defined as a weekday between March and October, excluding all public and school holidays.

12 hour motorway counts were converted to 24 hour counts using a growth factor. A 12 to 24 hour growth factor was calculated for each year in the survey period (using data taken from permanent motorway counters), by dividing the average 24 hour count by the survey day 12 hour count. Once the growth factor is applied to the 12

¹⁶ Urban roads are defined as having a speed limit of 40 mph (miles per hour) or less. Rural roads are defined as having a speed limit of 41 mph or more.

hour count these 24 hour counts are then referred to as AADF's¹⁷. 24 hour data received in 2014 was in AADF format and required no further adjustment.

The annual VKT for the motorway network was calculated using the following formula:

$$VKT_j = 365 \times weight_j \times \sum_{i=1}^{28} AADF_i \times Length_i \quad (\text{Equation 1})$$

where j is the year and the *weight* is calculated as follows:

$$weight_j = \frac{Total\ Road\ Length_j}{Road\ Length\ Sampled_j} \quad (\text{Equation 2})$$

Explanation of the formula

Equation (1) means that the 24 hour traffic count, or AADF, for each link is multiplied by the length of the link to give a VKT for that stretch of road. The VKT values for each of the 28 links are then added together and weighted to account for the difference in the length of road sampled and the total length of the road. In the case of the motorway network, the total length of the links is equal to or almost equal to the total length of the motorway. Therefore, the weight $\cong 1$, for the motorway network. In order to obtain an annual VKT figure the daily VKT is multiplied by 365.

To calculate a VKT measure for the 5 vehicle types, data by vehicle type from motorway permanent counters were applied to overall motorway VKT to estimate the proportional split by Vehicle Type¹⁸.

Other Major Roads

The non - motorway network in NI was divided into 6 road categories: Trunk A Urban; Trunk A rural; Other A Urban; Other A Rural; B roads > 10,000 Urban; and B roads >10,000 Rural amounting to 2,437km of road and 835 links. The cost of surveying prohibited an annual count of traffic on each link. A 3-year survey cycle was adopted for each of the 6 road types, beginning in 2008. For each road category the traffic flow for a third of the links was measured once each year so that by year 3 of the cycle, the traffic flow count was available for all the links.

Growth factors between the years were used to estimate counts for the links not measured in any given year. The growth factors were calculated using data from permanent counting sites. The number of permanent counting sites that are used to

¹⁷ AADF – Annual average daily flow is the number of vehicles estimated to pass a given point on the motorway in a 24 hour period on an average day in the year. AADF's for NI motorways are not comparable with AADF's in GB as the NI counts were not all taken on neutral days.

¹⁸ Previously Equation 1 and Equation 2 above were repeated using vehicle type data from motorway counts to give a measure for the 5 vehicle types. Motorway vehicle type estimates has been revised for 2008-2013 resulting in a subsequent revision of overall VKT by vehicle type for this period.

produce the year-to-year growth factors for each category of road are detailed in Table 5.

Table 5: The number of permanent counting sites used to calculate growth factors by road type

Category	2008 to 2009	2009 to 2010	2010 to 2011	2011 to 2012	2012 to 2013	2013 to 2014
Trunk A rural	94	101	93	87	86	51
Trunk A Urban	26	29	24	21	21	18
Other A Rural	44	42	43	41	40	26
Other A Urban	27	30	29	28	30	15
B > 10,000 Rural	3	3	3	3	3	2
B >10,000 Urban	2	3	3	3	4	2

The VKT for each road category was calculated according to Equation (1) and (2) (Page 14). Annual VKT values for other major road types were produced for 5 traffic types: Cars; Medium Commercial; HGV; Articulated Lorries; and Buses by repeating these calculations using vehicle data from other major road traffic counts.

Minor Roads

The minor road network in NI consists of just under 23,000km of public roads categorised into B roads with flows of less than 10,000 (<10,000) vehicles per day and C and Unclassified Roads. Both B roads and C and Unclassified roads are split by rural and urban. The minor road network accounts for around nine tenths of the total length of the road network in Northern Ireland.

Table 6: Road lengths for minor road categories, 2014¹⁹

Category	Length (km)
B<10,000 Rural	2,450
B<10,000 Urban	307
C and Unclassified Rural	15,595
C and Unclassified Urban	4,606
Total	22,959

The network is divided into MARCH (Maintenance Assessment Ratings & Costing of Highways) stretches which are used to prioritise maintenance. When reviewing VKT methodology it was acknowledged that the network was too large to consider measuring traffic flows on each of the MARCH stretches.

It was recommended that a robust and representative base year figure of VKT be produced in 2008 in order to benchmark the minor road traffic flows across NI. Once the base year figure had been established, 200 sites were to be surveyed in each subsequent year to provide a year-on-year change or growth factor for the baseline data.

¹⁹ Totals may not sum due to rounding.

Base Year

A stratified random sampling methodology was recommended to establish baseline data for the minor roads in NI. The sample size calculation recommended that 2,000 sites, stratified by 4 geographical areas (based on TransportNI Divisions), urban/rural class and road type (resulting in 16 strata), should be surveyed in the base year. The number of sites to be surveyed, in each of the 16 strata, was determined using historic traffic count data.

A total of 1,906 traffic counts were to be used to calculate a VKT value for the 2008 base year.

However, of the 1,906 traffic counts specified for the base year measure, only 1,575 counts were actually measured in 2008. The majority of the under-sampling in 2008 occurred within a single stratum, namely Rural C and Unclassified roads in the Northern Division (Table 7). The 2008 sample was therefore not representative of the minor road network. The 331 unsampled Northern Division Rural C and Unclassified sites were surveyed in 2012 and growth factors were applied to estimate their value in 2008.

Table 7: Details of the sampling for the base year by stratum in Minor Roads, 2008 and 2012

Stratum	Agreed Sample Size	Number of Sites Sampled in 2008 (Percent of sample size)	Number of Sites sampled in 2008 and 2012 (Percent of sample size)
Eastern Rural B	112	109 (97%)	109 (97%)
Eastern Rural C/U	54	52 (96%)	52 (96%)
Eastern Urban B	27	23 (85%)	23 (85%)
Eastern Urban C/U	118	111 (94%)	111 (94%)
Northern Rural B	292	247 (85%)	289 (99%)
Northern Rural C/U	309	61 (20%)	304 (98%)
Northern Urban B	38	33 (87%)	33 (87%)
Northern Urban C/U	66	56 (85%)	56 (85%)
Southern Rural B	89	81 (91%)	81 (91%)
Southern Rural C/U	146	109 (75%)	140 (96%)
Southern Urban B	37	26 (70%)	37 (100%)
Southern Urban C/U	54	52 (96%)	52 (96%)
Western Rural B	313	305 (97%)	305 (97%)
Western Rural C/U	300	271 (90%)	271 (90%)
Western Urban B	18	18 (100%)	18 (100%)
Western Urban C/U	27	21 (78%)	26 (96%)
Total	2000	1575 (79%)	1906 (95%)

As with the major road network, traffic flows were counted for each of the 5 traffic types and the single count day may or may not have been a 'neutral day'. The counts were a mixture of 12 and 24 hour counts. The 12 hour counts were converted to 24 hour counts using growth factors calculated for each stratum using data taken from permanent counters.

The following calculation was used to produce the minor road VKT value for the base year, 2008:

1. For each of the sample sites i , VKT_i was calculated as

$$VKT_i = AADT_i \times Length_i \quad i = 1 \text{ to } 1,906 \quad (\text{Equation 3})$$

2. The VKT_i values for each stratum were summed to produce 16 VKT values. These values were then weighted to reflect the difference in the road length sampled and the total length of road within the stratum. The weights were calculated according to Equation 2, where $j = 1$ to 16.
3. The total VKT for NI was obtained by summing the weighted VKT values for each stratum.

To calculate a VKT measure for the 5 vehicle types, data by vehicle type from minor road permanent counters were applied to overall minor road VKT to estimate the proportional split by Vehicle Type

Having established the baseline in 2008, the methodology required that 200 of the baseline sites be surveyed in the subsequent years, which for this period is 2009 to 2014.

The number of sites that were actually measured each year varied and in some cases fell substantially below the required 200, as detailed in Table 8.

Table 8: The number of minor road sites surveyed, 2009 to 2014

	2009	2010	2011	2012	2013	2014
Number of Sites Sampled	141	110	106	198	196	197
(% of required)	(71%)	(55%)	(53%)	(99%)	(98%)	(99%)

Given the low number of counts available for 2010 and in particular 2011, existing data for each site was examined and where data was missing for a site, values were either assigned and set equal to the closest year of available data or averaged from other years of data to provide an estimate for the years in which data may have been missing.

A growth factor was calculated from the base year data for the 200 annual sites to each of the subsequent years for each of the 16 strata. The growth factors were calculated using the following formula, where i is the subsequent year and j is the stratum:

$$growth\ factor_{ij} = \frac{average\ AADT_{ij}}{average\ AADT_{2008j}} \quad (\text{Equation 4})$$

The VKT for the subsequent year i was calculated using the following:

$$VKT_i = \sum_{j=1}^{16} VKT_{2008j} \times growth\ factor_{ij} \quad (\text{Equation 5})$$

Quality

The quality of a statistical output is dependent on meeting the user's needs in terms of producing a 'fit for purpose' statistic. Aspects of quality include, but not exclusively so: accuracy; timeliness; and comparability.

This section considers the quality assurance procedures that were employed during the data collection, data cleansing and the data analysis phases of the statistical process. This section also includes a consideration of the limitations of the VKT figures produced using the methodology described above.

Quality Assurance

Data Collection

Since the VKT survey was implemented, processes and procedures have been reviewed on an ongoing basis with changes and improvements introduced where it was felt necessary as explained below.

TransportNI are responsible for ensuring that contracts and project briefs are in place for external contractors and internal teams to carry out the VKT Surveys. Each year (excluding the base year, 2008), some 500 traffic surveys are carried out on major and minor roads by both external consultants and TransportNI teams.

The specification for the external contracts and the project briefs to the internal TransportNI team aims to include all the relevant instructions needed to carry out the surveys, e.g. when they are to be carried out, what vehicle class scheme is to be used, duration of surveys, list of sites to be surveyed etc.

Once the surveys are completed by the external contractor, data is sent to TransportNI where the raw data is loaded onto a database. Checks are carried out to ensure that all sites in the external contractors brief have been carried out. TransportNI also validate surveys carried out by internal teams to ensure the list of sites sampled is the same as the list included in their brief.

TransportNI have a Quality Management System (QMS) in place for Temporary Traffic Counts. The time and date is checked on all temporary traffic counters prior to the surveys being carried out. When the raw count files have been loaded onto the database, the date a count has been taken is viewable while the data collection time can be obtained by running a report.

Survey files had not been received from external consultants until the end of the survey year or into the following year. This meant that data quality issues, including missing counts were not identified in time to address issues in the given year.

The process for the internal TransportNI team is to keep an overall register of their completed Major and Minor VKT surveys. As outlined in their QMS procedure, they check that the data is complete and, if not, the survey can be redone. The number of completed surveys is also monitored on a regular basis by TransportNI.

ASRB have provided TransportNI with a 'Quality Assurance of Traffic Counts' checklist for use by them and their contractors when collecting and collating data.

This includes a check that all counts are completed as set out at specified sites in the specification with appropriate classification and labelling, while ensuring new roads and re-classified roads are taken into account. It also requires TransportNI to examine the data for any unusual trends or fluctuations.

Data Cleansing & Analysis

The traffic flow data collected by the Department for Infrastructure (DFI), TransportNI was quality assured by statistical staff from the Northern Ireland Statistics and Research Agency (NISRA). The following checks were made:

1. Year-on-year variances to traffic flow counts were queried. The majority of significant changes were a result of either: mechanical error of the measuring devices; non-neutral day sampling; or the wrong site being sampled.
2. The traffic counts for the 5 vehicle types were summed and checked against the total traffic count for each site. Discrepancies were checked with the data collectors.
3. As all the recommended sites were not sampled, the length of roads for sampled sites only were summed and used in the calculation of weights, as per Equation 2 on page 14.
4. The sum of the VKT for the 5 vehicle types was compared with the total VKT within strata and for each year. Discrepancies were checked with the data supplier.

Limitations of the NI VKT data, 2008 to 2014

The VKT figures presented in this statistical report have been calculated from single day counts which may or may not have taken place on a neutral day. They do not account for the change in weekend traffic flows, school or public holidays or seasonal changes. They are therefore not comparable with the GB Road Traffic Estimates²⁰.

The growth factors used to estimate annual counts from 12 or 24 hour counts do not take into account the change in weekend traffic flows, school or public holidays or seasonal changes. The implications of this are that the VKT for Northern Ireland may have been overestimated for the period 2008 to 2014 but this has not been quantified.

Furthermore, traffic counts were taken on a sample of minor roads based on a $\pm 5\%$ error at the 95% confidence level. Therefore, the VKT figures are not exact but sit within a range of possible figures. It has not been possible to quantify the margin of error in the figures presented.

²⁰Department for Transport - Road Traffic Estimates Methodology
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/230528/annual-methodology-note.pdf

When considering trends in data it is important to remember that any figure produced from a sample sits within a range of possible figures. Therefore, what may appear to be an increase or a decrease from one year to the next may not be a 'real' change but just due to the sampling or other errors introduced in the statistical process.

Major Roads

The major road methodology was such that counts were to be taken on all 28 motorway links each year and that the other major road links would be measured on a 3-year cycle. The completeness of the motorway data was very good, however the accuracy of the resultant total motorway VKT for 2008 to 2014 has been impacted, mainly by the use of single non-neutral day counts.

Permanent counter data for calculating year-to-year growth factors was incomplete. This was most evident on B roads sites where the recommended sample was small in the first place meaning that one or two missing counts resulted in a growth factor being calculated on the basis of as little as half the recommended sites (Table 5).

Minor Roads

The number of minor road sites to be sampled in the benchmarking year, 2008, was determined using an accepted $\pm 5\%$ error on the total minor road VKT value, at the 95% confidence level. This margin of error will have increased due to the following:

1. The under-sampling of minor road sites within the Northern District for the 2008 benchmark base year figure.
2. The under-sampling of minor road year-on-year growth factor sites between 2008 and 2011.
3. The use of non-neutral day sampling.
4. Not all recommended site counts were used when calculating 12 to 24 hour growth factors.
5. Differences in traffic flow between neutral and non-neutral days have not been accounted for in the 12 to 24 hour growth factor calculation.
6. Equipment used to measure vehicle type varied by year so data on vehicle type was obtained from permanent counters based on minor roads and apportioned on that basis.

Appendix 1 – Definitions

Measurements of traffic:

Annual Average Daily Flow (AADF): The number of vehicles passing a point in the road network on an average day in the year.

Vehicle kilometre: One vehicle times one km travelled (vehicle km are calculated by multiplying the AADF by the corresponding length of road). For example, 1 vehicle travelling 1 km a day for a year would be 365 vehicle kilometres. This is known as the VKT of traffic.

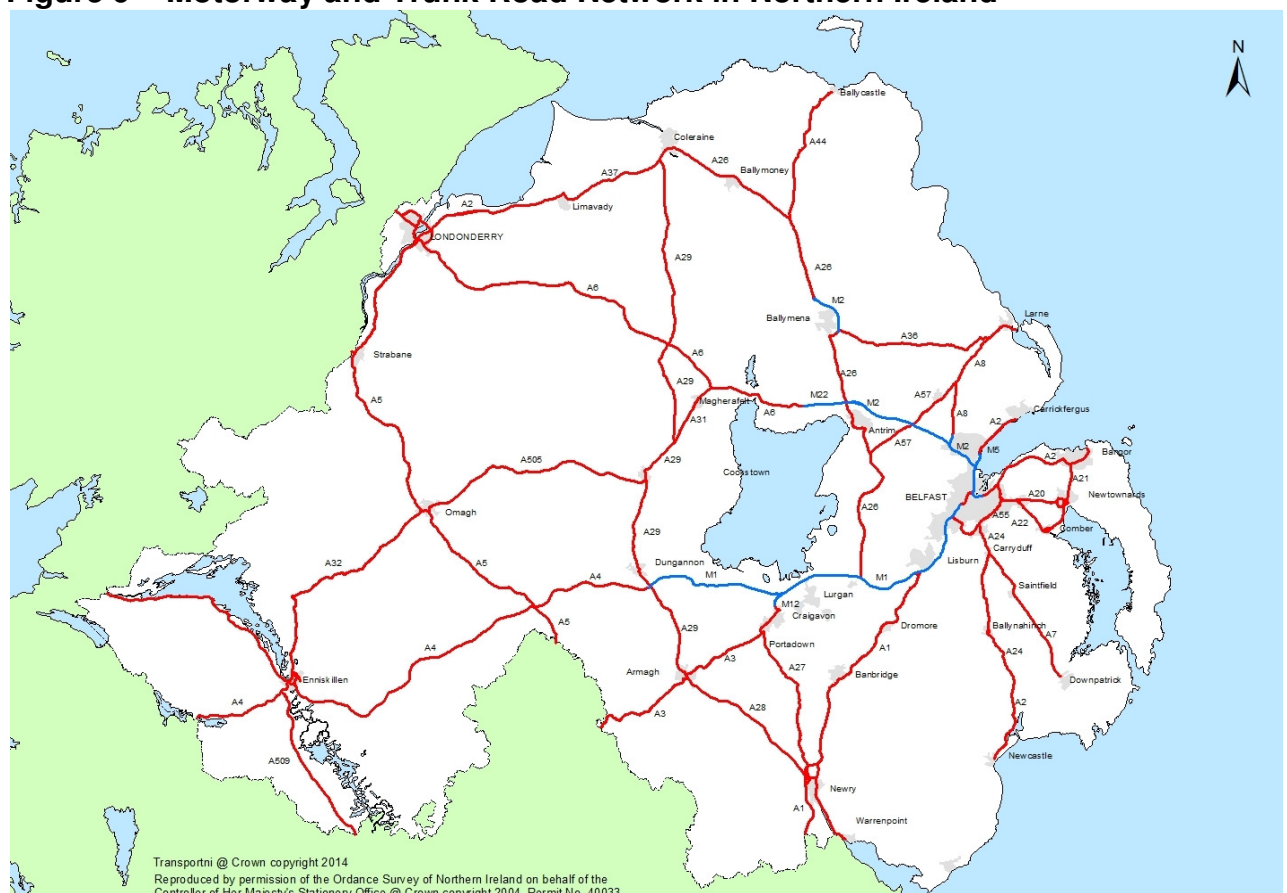
Types of road: The road definitions included in the traffic census are as follows:

Urban/ Rural

Urban roads are defined as having a speed limit of 40 mph (miles per hour) or less.
Rural roads are defined as having a speed limit of 41 mph or more.

Major roads: Includes motorways and all class 'A' roads and B roads with flows of greater than 10,000 vehicles per day. These roads usually have high traffic flows and are often the main arteries to major destinations.

Figure 9 – Motorway and Trunk Road Network in Northern Ireland



Motorways - high speed, non-stop routes restricted to certain types of vehicle. There are a total of 115km of this type of road in Northern Ireland. They are usually two or more lanes in each direction and generally have the maximum speed limit of 70mph. (Motorways are highlighted in blue in Figure 9).

Trunk Road Network: The Trunk Road Network is a designated network of strategic 'A' roads that because of their significance in transportation delivery, should attract priority in the allocation of maintenance and development funding. The network comprises those roads linking the main provincial towns with Belfast, Londonderry and the main air and sea ports; selected roads linking the largest provincial towns with each other and the principal roads linking to the *National Primary Road Network* in the Republic. (The trunk road network is highlighted in red in Figure 9).

Other 'A' Roads: These A roads that have not been designated as '*trunk routes*'. They are often described as 'main' roads and tend to have heavy traffic flows though not as high as motorways or trunk roads.

B Roads: For the purposes of this analysis, B roads with a flow of greater than 10,000 vehicles per day are categorised as major roads and B roads with a flow of less than 10,000 vehicles per day are categorised as minor roads. B roads typically form the remainder of inter-town and inter-village links. Smaller towns and villages may only have B-road connections. These routes are labelled similarly to A-routes except that they are prefixed by the letter B.

Minor Roads: These are 'B' and 'C' classified roads and unclassified roads (all of which are maintained by TransportNI), as referred to above. 'B' roads in urban areas can have relatively high traffic flows, but are not regarded as being as significant as 'A' roads, though in some cases may have similarly high flows. They are useful distributor roads often between towns or villages. 'B' roads in rural areas often have markedly low traffic flows compared with their 'A' road counterparts. 'C' Roads are regarded as of lesser importance than either 'B' or 'A' roads, and generally have only one carriageway of two lanes and carry less traffic. They can have low traffic flows in rural areas.

Unclassified roads include residential roads both in urban and rural situations and rural lanes, the latter again normally having very low traffic flows. Most unclassified roads will have only two lanes, and in rural areas may only have one lane with "passing bays" at intervals to allow for two-way traffic.

Types of vehicle: The definitions for the vehicle types included in the traffic census are as follows:

All motor vehicles: All vehicles.
Car, Car & Trailer, Light Van
Medium Goods Van or Minibus (<8.7m long)
HGV Rigid (>8.7m long)
Articulated Vehicle & Rigid HGV with trailer
Bus & Coach

Car, Car & Trailer, Light Van

Cars and taxis: Includes passenger vehicles with nine or fewer seats, three wheeled cars and four wheel-drive 'sports utility vehicles.' Cars towing caravans or trailers are counted as one vehicle.

Light vans: A Light van is defined as a van that is less than 5.2m in length.

Medium Goods Van or Minibus (<8.7m long)

Medium Goods Van or Minibus: Includes lorries and goods vehicles less than 8.7m in length.

Heavy goods vehicles (HGV)

Includes goods vehicles greater than 8.7m in length.

Articulated heavy goods vehicles & Rigid HGV with trailer

An Articulated Vehicle is one which has a separate cabin and trailer.

Buses and Coaches

Buses and coaches: Includes all public service vehicles and works buses.

Appendix 2 – Length of Roads

Table 9 - Length of Road by Road Type, 2008 to 2014

kilometres

Road Categories		2008	2009	2010	2011	2012	2013	2014
Major Roads	Motorways	114	114	114	115	115	115	115
	Trunk Rural	898	898	898	923	901	901	901
	Trunk Urban	200	200	200	207	211	211	211
	Other A Rural	817	820	824	833	824	824	824
	Other A Urban	350	350	350	355	353	353	353
	B Class > 10K Rural	76	76	76	76	76	76	76
	B Class > 10K Urban	72	72	72	72	72	72	72
Minor Roads	B Class < 10K Rural	2,432	2,432	2,433	2,434	2,450	2,450	2,450
	B Class < 10K Urban	305	305	305	305	307	307	307
	C & U/C Rural	15,555	15,556	15,567	15,588	15,603	15,603	15,595
	C & U/C Urban	4,315	4,346	4,411	4,470	4,580	4,580	4,606

Appendix 3 – Vehicle Kilometres Travelled: Road Type^{21,22} by Vehicle type²³ 2008 to 2014

Table 10: Vehicle Kilometres Travelled (VKT) - Cars

millions

Road Type		2008	2009	2010	2011	2012	2013	2014
Major Roads	Motorway	1,330	1,484	1,458	1,433	1,428	1,470	1,457
	Trunk A Rural	3,906	3,901	3,715	3,526	3,474	3,585	3,619
	Trunk A Urban	1,539	1,551	1,569	1,632	1,590	1,603	1,644
	Other A Rural	1,491	1,497	1,449	1,344	1,357	1,407	1,429
	Other A Urban	1,363	1,346	1,292	1,285	1,305	1,312	1,256
	B Roads >10,000 (Rural)	169	167	153	135	136	137	142
	B Roads >10,000 (Urban)	338	336	327	331	322	303	299
Major Roads VKT - Cars		10,137	10,280	9,963	9,685	9,612	9,817	9,846
Minor Roads VKT - Cars		7,048	7,499	7,651	7,734	7,674	7,945	7,860
All Roads VKT - Cars		17,186	17,779	17,614	17,419	17,286	17,761	17,706

Table 11: Vehicle Kilometres Travelled (VKT) - Medium Commercial

millions

Road Type		2008	2009	2010	2011	2012	2013	2014
Major Roads	Motorway	50	56	55	55	54	54	56
	Trunk A Rural	371	370	302	270	283	320	323
	Trunk A Urban	142	143	119	116	106	134	137
	Other A Rural	129	129	119	118	136	135	138
	Other A Urban	117	115	95	81	91	100	95
	B Roads >10,000 (Rural)	12	12	10	8	9	10	10
	B Roads >10,000 (Urban)	31	30	22	19	21	24	23
Major Roads VKT - Medium Commercial		851	856	722	668	700	776	783
Minor Roads VKT - Medium Commercial		403	436	383	379	372	380	376
All Roads VKT - Medium Commercial		1,253	1,292	1,105	1,047	1,072	1,156	1,159

Table 12: Vehicle Kilometres Travelled (VKT) - HGV

millions

Road Type		2008	2009	2010	2011	2012	2013	2014
Major Roads	Motorway	38	43	42	29	39	37	37
	Trunk A Rural	177	177	161	153	149	147	148
	Trunk A Urban	47	48	47	46	43	39	40
	Other A Rural	45	45	46	46	44	38	39
	Other A Urban	32	32	29	26	26	23	22
	B Roads >10,000 (Rural)	4	4	3	3	4	3	3
	B Roads >10,000 (Urban)	7	7	7	7	6	4	4
Major Roads VKT - HGV		351	355	334	310	311	291	294
Minor Roads VKT - HGV		219	227	248	234	223	226	223
All Roads VKT - HGV		570	583	582	544	534	517	517

²¹ On Motorways and Dual Carriageways: 2 Carriageway km = 1 Route Km

²² Motorway Figures exclude slip road lengths

²³ Vehicle type figures may differ slightly from the previous publication due to a revision in the methodology used to calculate motorway vehicle type

Table 13: Vehicle Kilometres Travelled (VKT) - Articulated Lorries *millions*

Road Type		2008	2009	2010	2011	2012	2013	2014
Major Roads	Motorway	53	59	60	61	57	58	52
	Trunk A Rural	193	193	160	145	134	130	131
	Trunk A Urban	43	44	35	34	28	26	27
	Other A Rural	33	33	27	25	24	22	22
	Other A Urban	21	21	17	14	13	10	9
	B Roads >10,000 (Rural)	3	3	2	2	1	1	1
	B Roads >10,000 (Urban)	4	4	3	3	2	2	2
Major Roads VKT - Articulated Lorries		351	357	303	284	260	248	243
Minor Roads VKT - Articulated Lorries		99	101	106	97	102	104	103
All Roads VKT - Articulated Lorries		449	458	408	380	362	352	346

Table 14: Vehicle Kilometres Travelled (VKT) - Buses *millions*

Road Type		2008	2009	2010	2011	2012	2013	2014
Major Roads	Motorway	11	12	12	12	12	13	13
	Trunk A Rural	20	20	25	29	34	33	33
	Trunk A Urban	10	10	11	12	14	12	13
	Other A Rural	7	7	12	15	18	15	15
	Other A Urban	20	20	21	20	23	20	19
	B Roads >10,000 (Rural)	0	0	1	1	1	1	1
	B Roads >10,000 (Urban)	4	4	4	3	4	3	3
Major Roads VKT - Buses		73	74	85	93	105	96	96
Minor Roads VKT - Buses		18	16	15	14	14	15	15
All Roads VKT - Buses		91	90	99	106	119	111	111

Table 15: Vehicle Kilometres Travelled (VKT) – All Modes *millions*

Road Type		2008	2009	2010	2011	2012	2013	2014
Major Roads	Motorway	1,483	1,654	1,625	1,591	1,589	1,632	1,615
	Trunk A Rural	4,667	4,663	4,363	4,123	4,073	4,214	4,253
	Trunk A Urban	1,781	1,795	1,781	1,840	1,781	1,814	1,860
	Other A Rural	1,704	1,710	1,653	1,548	1,579	1,617	1,643
	Other A Urban	1,553	1,533	1,453	1,426	1,459	1,464	1,402
	B Roads >10,000 (Rural)	188	185	168	149	151	152	157
	B Roads >10,000 (Urban)	384	381	363	362	355	335	331
Major Roads VKT - All Modes		11,762	11,921	11,407	11,039	10,987	11,227	11,261
Minor Roads VKT - All Modes		7,787	8,280	8,402	8,458	8,386	8,670	8,578
All Roads VKT - All Modes		19,549	20,201	19,808	19,497	19,373	19,897	19,839

Cars	Car, Car & Trailer and Light Vans
Medium Commercial	Medium Goods Van or mini bus (<8.7m long)
HGV	HGV Rigid (>8.7m long)
Articulated lorries	Articulated Vehicle & Rigid HGV with Trailers
Buses	Bus & Coach