Road Traffic Collision Analysis

The M11 in Essex

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1. Aim

This document has been produced in response to a perceived recent increase in collisions and casualties occurring on the Essex stretch of the M11. It seeks to identify patterns in these road traffic collisions as well as possible causes.

2. Key findings and Conclusions

- The collision rate on the M11 increased by 23% for the 19 months to July 2017 compared to the same period ending July 2013. The collision rate increased by 48% on the section between Loughton and the A414. Traffic increased on the M11, M25 and A12 during this period, however the A12 saw a 7% reduction in collisions. This could be related to the fact that there was some dedicated funding for roads policing on the A12 in place for the financial year 2015-16.
- The three main collision types, accounting for 93% of all collisions and 82% of KSI, were:
  - **Nose-to-tail**, and collisions in slowing traffic (51%), characterised by close following, inattention to the traffic in front, and aggressive or impatient manoeuvres. Caused by all drivers, especially young car drivers.
  - **Lane-change** collisions (19%), characterised by poor observation when changing lanes and aggressive or impatient manoeuvres. Caused by all drivers, especially goods vehicle drivers.
  - **Single vehicle and loss of control** collisions (23%), characterised by excess speed, fatigue, defective tyres and poor concentration. Caused by all drivers, especially young car drivers.
- Overall P2Ws were only involved in 6% of collisions, but as 60% were fatal or serious they accounted for 17% of KSI collisions. The most common rider-faults were filtering and loss of control (including heavy braking).
- 87% of traffic offences on the M11 can be classified into four roughly equal groups of driver behaviour type, comprising; distraction, excess speed, vehicle roadworthiness and dangerous driving – these behaviours may translate to the three main collision types described above.
- 51% of at fault parties were male car drivers, 46% of whom were aged 35 or under.
- 18% of at fault parties were male goods vehicle drivers, 58% of whom were aged 36-65.
- 23% of at fault parties were female car drivers, 58% of whom were aged 35 or under.
- 78% of goods vehicle drivers were primarily at-fault for the collision they were involved in.
- Four hotspot areas on the M11 were identified, these were:
  - **2km south of A120 (junction 8):** Most collisions occurred on the northbound approach to the A120, or the slip road itself. Relatively low severity as most were nose-to-tail collisions. Friday and Saturday were busiest days.
  - **1.8km south of A414 (junction 7):** Slightly more collisions on the northbound approach to the junction than after the southbound on-slip. Over 25% involved goods vehicles, nearly a third were lane-change collisions. Peak days were Wednesday and Friday.
  - **2km north of M25 (junction 6):** Slightly more collisions on the southbound approach to the M25 than on the northbound on-slip from the M25. Over a third involved goods vehicles. Busiest periods were Fridays 1100-2000 and weekdays 1700-1800.
  - **Loughton (junction 5) to A414 (junction 7):** Nearly a quarter of collisions resulted in a KSI, this high severity ratio may be partly due to the fact a quarter of collisions involved goods vehicles. Peak times were Friday 1500-2000 and weekdays 1700-1800. Higher proportion of loss of control collisions than other three hotspots may be related to the fact this is the only one which includes sections more than 2km from a junction, so slowing traffic and vehicles joining/exiting may be less of factor.

3. Recommendations

a. Enforcement

Long-term enforcement operation targeting close following, distraction, excess speed, careless or aggressive driving and vehicle roadworthiness on the section of the M11 from Loughton (J5) to the A414 (J7).

Operation to include keeping of police deployment records and using operational flags on TORs. This will enable evaluation of the enforcement strategy by comparing and quantifying the impact on the M11 and comparator roads. The evaluation will either help justify the continuation of the strategy, inform improvements to the strategy, or identify if a different approach should be explored.

b. Engineering

Highways England to review options for implementing safer systems approach to the following sections:

- Loughton (J5) to A414 (J7)
- Northbound approach to A120 (J8)
- Section from M25 (J6) to 2km north of the junction, both carriageways but with priority to southbound approach to J6 (M25).

c. Education

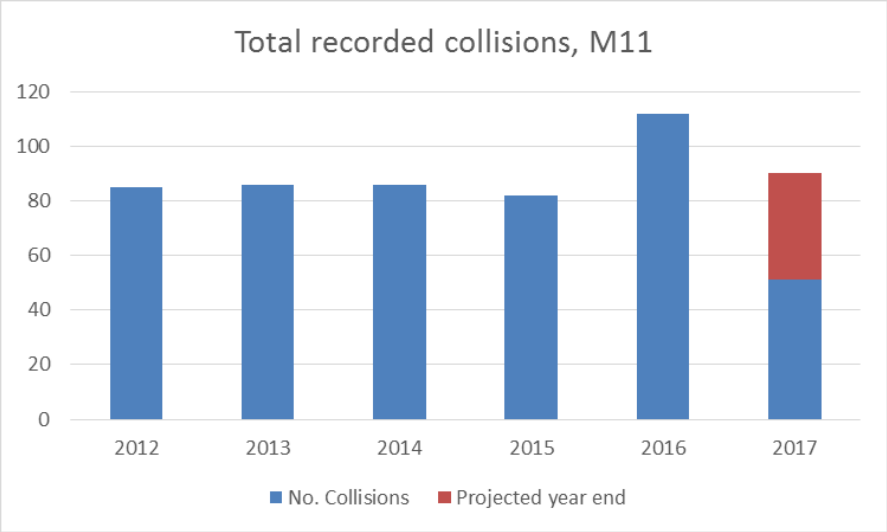
Motorway driving campaigns to tackle following behaviours:

- **Young drivers, especially males:** Aggressive, careless, or reckless manoeuvres, vehicle roadworthiness.
- **All drivers:** Driving while distracted, close following, excess speed, fatigue.
- **Goods vehicle drivers:** Proper observation, especially during lane changes.

4. Analysis

a. Long term trends

The bar graph below shows total collision numbers for the M11. This shows numbers fairly stable at around 85 per year until a notable increase to 112 in 2016. Data for 2017 indicates numbers are on course to total around 90 for the year, 6% above the pre-2016 average.

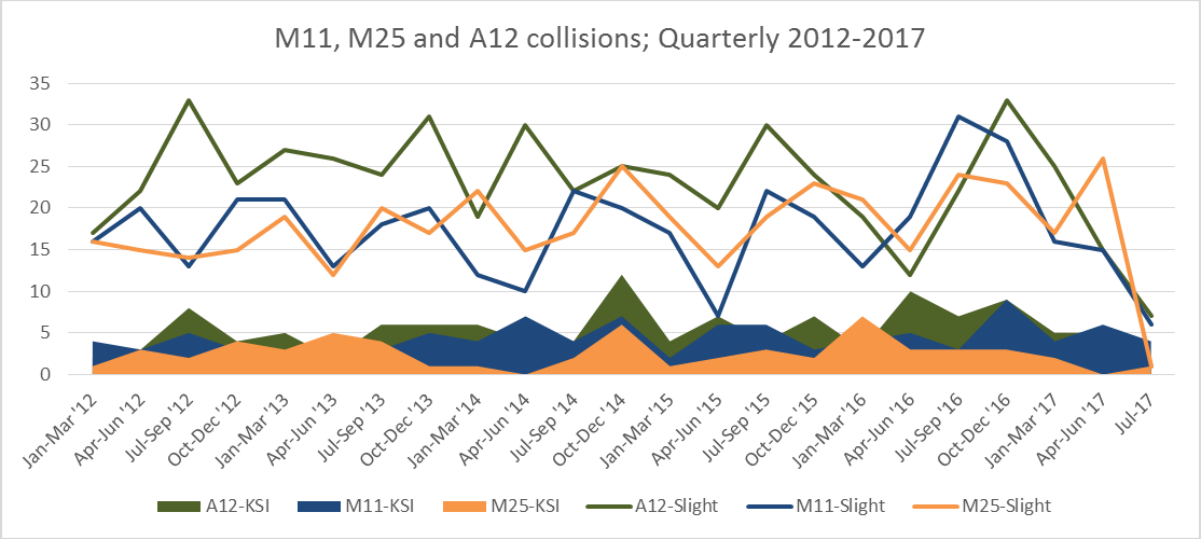


The table below compares collisions per km of road length for the M11, M25 and A12 during the period January 2016 to July 2017, with a baseline period from January 2012 to July 2013.

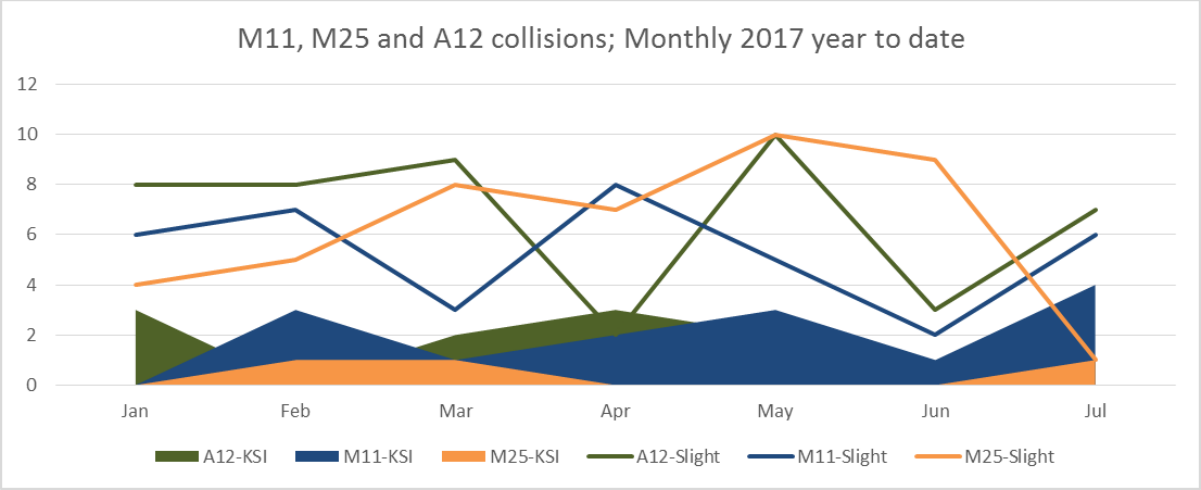
	A12	M25	M11	M11: Loughton to A414
No. collisions				
Jan'12 - Jul'13	187	119	133	46
Jan'16 - Jul'17	173	146	163	68
Length (km)	71	28	54	12.9
Collisions per km				
Jan'12 - Jul'13	2.6	4.3	2.5	3.6
Jan'16 - Jul'17	2.4	5.2	3.0	5.3
% change	***-7%***	***23%***	***23%***	***48%***
Change in traffic 2012-2016	***7%***	***20%***	***10%***	

This shows a 23% increase on the M11 and M25, while collision numbers of the A12 dropped. The collisions per km of road length measure *does not* take into account number of lanes or amount of traffic – hence the lower numbers for the A12 and higher numbers for the M25. It is possible that the changes on the M11 and M25 are largely the result of increases in traffic, although the M11 saw the same increase in collision rate as the M25 despite only having half the M25's increase in traffic. Traffic also increased on the A12 but **there was some dedicated funding for roads policing on the A12 in place for the financial year 2015-16 which may have had some sustained impact**.

The section of the M11 between Loughton and the A414 has seen a 48% increase in collisions, overtaking the M25 in terms of collision rate per km of road.



The chart above compares the longer term trend on the M11 with the A12 and M25. The recent perceived increase in collisions on the M11 has been from July onwards and is indicated on the chart below which covers 2017 in more detail:

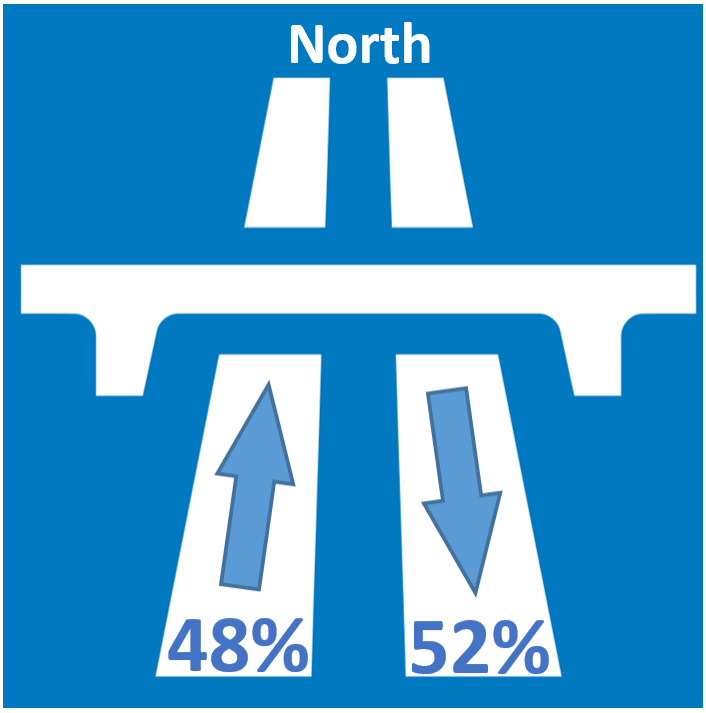


These charts indicate that over the longer term, collision numbers on the M11 and M25 have increased compared to the A12, and on the M11 there was an increase in July 2017 compared to the M25. Anecdotally, this July increase on the M11 has been maintained into August and September. However it is too early to say whether this is a statistical spike which will regress to mean of its own accord, or an emerging trend of higher risk on the M11.

The section of the M11 between Loughton and the A414 shows a much more sustained increase over the M25.

b. Carriageway comparison

The graphic below illustrates that there are slightly more collisions on the southbound carriageway than the northbound carriageway.



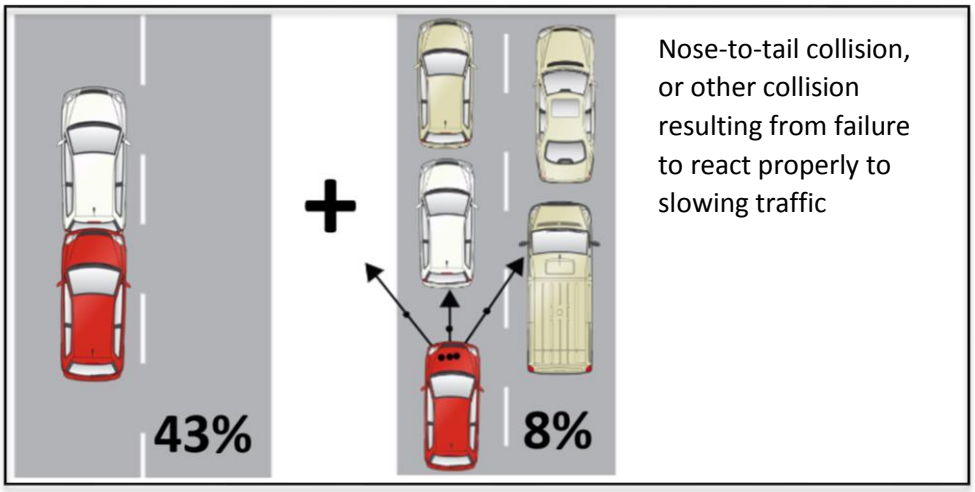
Notably, nose-to-tail collisions are more common on the *northbound* carriageway. It is single-vehicle, loss-of-control and lane-change collisions which account for the greater overall number of collisions on the southbound carriageway. Section c, overleaf, shows that single-vehicle, loss-of-control and lane-change collisions are more likely to result in a KSI than nose-to-tail collisions.

Furthermore **57% of KSI collisions take place on the southbound carriageway. '**KSI collisions' constitute a smaller sample than 'all collisions' so random variation will have a bigger effect. However these figures are consistent with the southbound carriageway having slightly more risk than the northbound carriageway due to both the nature and number of collisions.

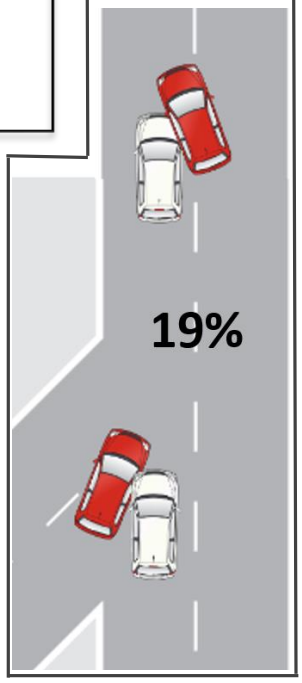
The southbound carriageway sees slightly more collisions than the northbound carriageway, both in total number of collisions and collision type being more likely to result in a KSI. This may be from the net effect of driver behaviour, traffic and road environment. For example the greater traffic density of the London area which southbound traffic is heading towards may cause conditions which increase collision risk more frequently.

c. Collision type

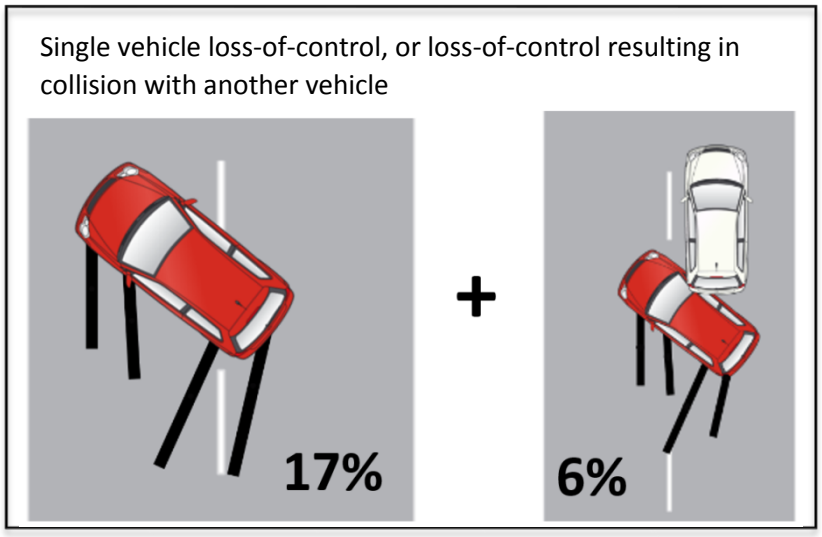
The manoeuvres, impact points and types of vehicles involved were used to infer the likely collision types, with the main types illustrated in the graphics below.



Nose-to-tail collision, or other collision resulting from failure to react properly to slowing traffic



Collision resulting from poor or unintended lane-change, including joining from a slip road



Between them, these three collision types account for nearly 93% of all collisions on the M11 and 82% of KSI collisions. The lower representation of the main collision types in the KSI data is mostly accounted for by P2W collisions. Only 6% of collisions involve a P2W, so these types do not appear among the most common collisions illustrated above. However, 60% of P2W collisions on the M11 are fatal or serious, and they comprise 17% of all KSI collisions.

The most common types of P2W KSI collision are when the P2W is filtering through traffic (3% of all KSI) and loss of control by the P2W rider – including under heavy braking (4% of all KSI).

Another minority group over-represented in KSI collisions is pedestrians. There were 3 fatal collisions involving pedestrians engaged in apparently deliberate dangerous action in the carriageway, accounting for 3% of KSI collisions.

The data shows 39% of lane-change collisions involved a goods vehicle. Just over 22% of all collisions involved a goods vehicle, indicating they are over-represented in lane-change collisions.

The most dangerous type of collision is single-vehicle. Despite none of these involving a P2W, 30% resulted in a KSI. Lane change collisions resulted in a KSI in 21% of cases and nose-to-tail collisions had a KSI rate of 13%.

The contributory factors most frequently involved in each of the three main collision types are summarised below:

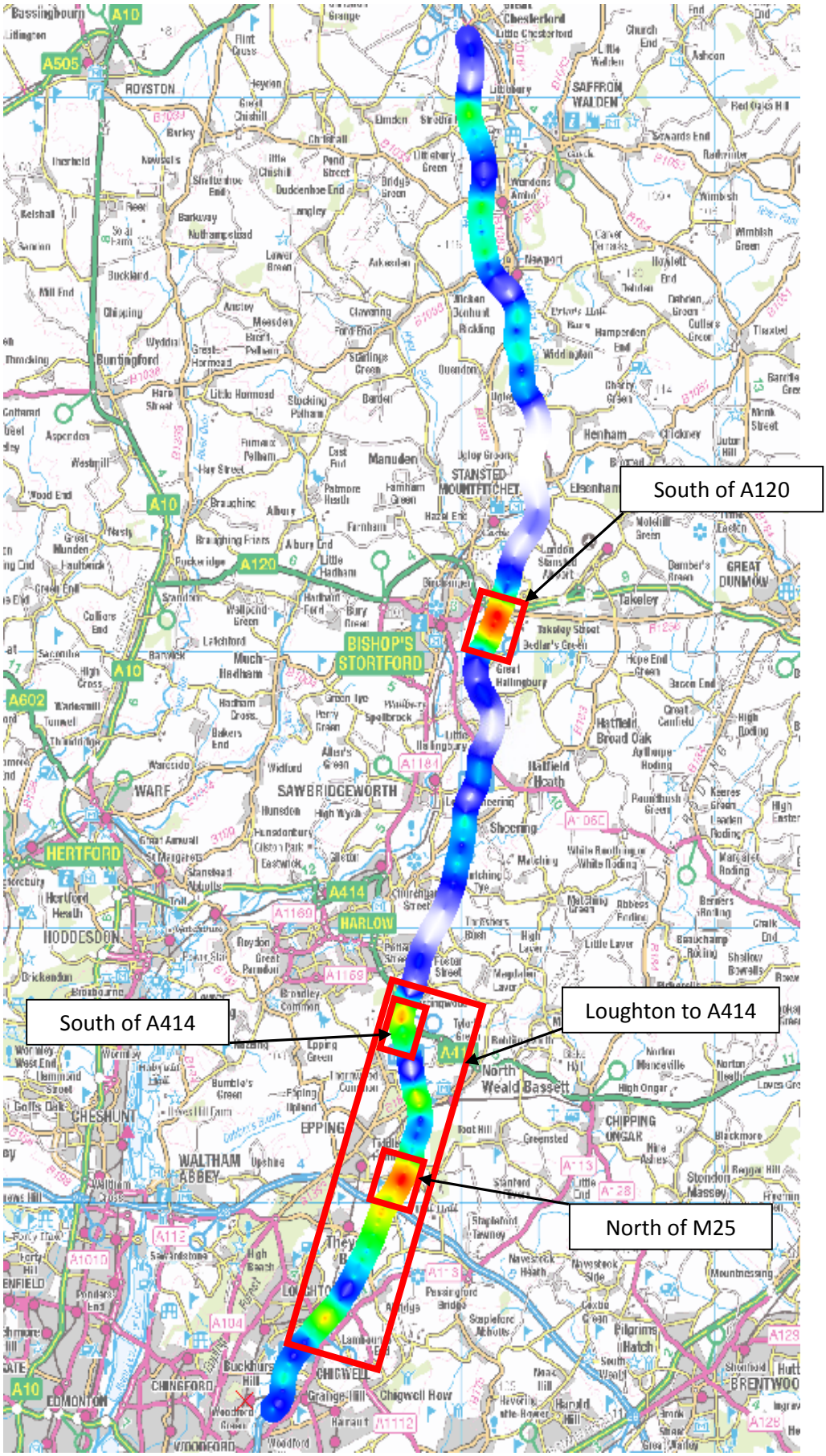
Contributory Factor	Nose-to-tail / Slowing traffic	Lane change	Loss of control
Failed to look properly	15%	25%	
Failed to judge other persons path or speed	22%	11%	
Loss of control	2%	5%	26%
Careless/Reckless/In a hurry	12%	13%	6%
Following too close	17%		
Swerved		6%	9%
Slippery road (due to weather)	3%		9%
Sudden braking	11%		
Poor turn or manoeuvre		11%	
Travelling too fast for conditions	4%		6%
Tyres illegal, defective or under inflated			6%
Fatigue			5%
Vehicle blind spot		4%	

The most common factors for nose-to-tail collisions indicate the best ways to prevent these are for drivers to leave a large enough gap to the vehicle in front, concentrate fully on what the traffic is doing, and avoiding aggressive or impatient manoeuvres.

The most common factors for lane-change collisions indicate the best ways to prevent these are proper observation when changing lanes and avoiding aggressive or impatient manoeuvres.

Clearly the factor “Loss of control” will feature heavily on loss-of-control collisions, but the other repeat factors indicate excess speed, fatigue, defective tyres and concentration are common root causes behind the loss of control and single vehicle collisions.

d. Hotspots

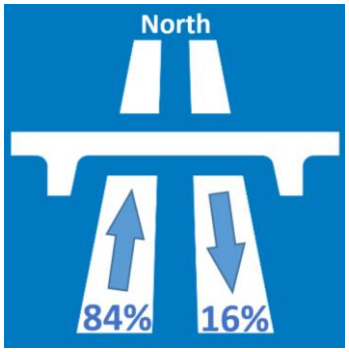

South of A120
Loughton to A414
South of A414
North of M25
A10
A505
ROYSTON
SAFFRON WALDEN
A120
BISHOP'S STORTFORD
A602
WARE
SAWBRIDGEWORTH
HERTFORD
A414
HARLOW
HODDESDON
CHESHUNT
EPPING
WALTHAM ABBEY
CHIGWELL
CHINGFORD
EDMONTON
North Weald Bassett
CHIPPING ONGAR
GREAT DUNMOW
STANSTED MOUNTFITCHET
BRENTWOOD

The map above shows four main areas of interest:

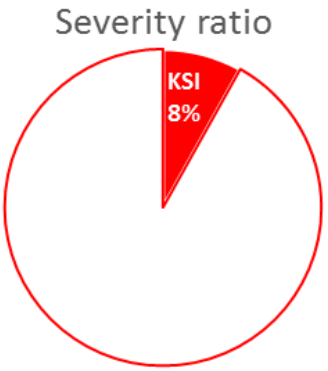
1) Section stretching 2,000m south of junction 8 (A120)
2) Section stretching 1,800m south of junction 7 (A414)
3) Section stretching 1,800m north of junction 6 (M25)
4) Section from junction 5 (Loughton) to junction 7 (A414)

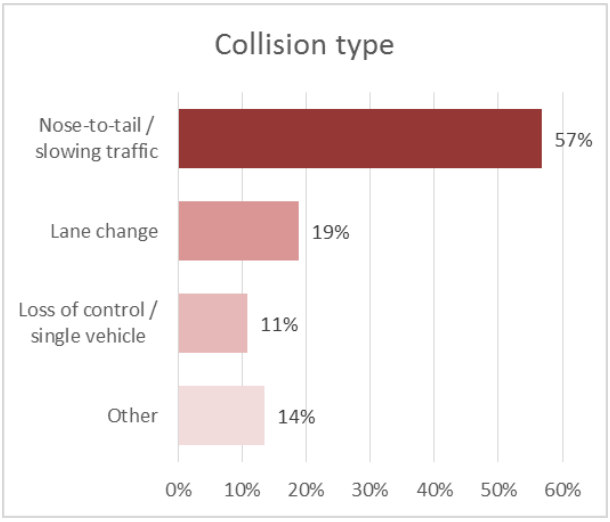
The nature of collisions in each of these sections is summarised below:

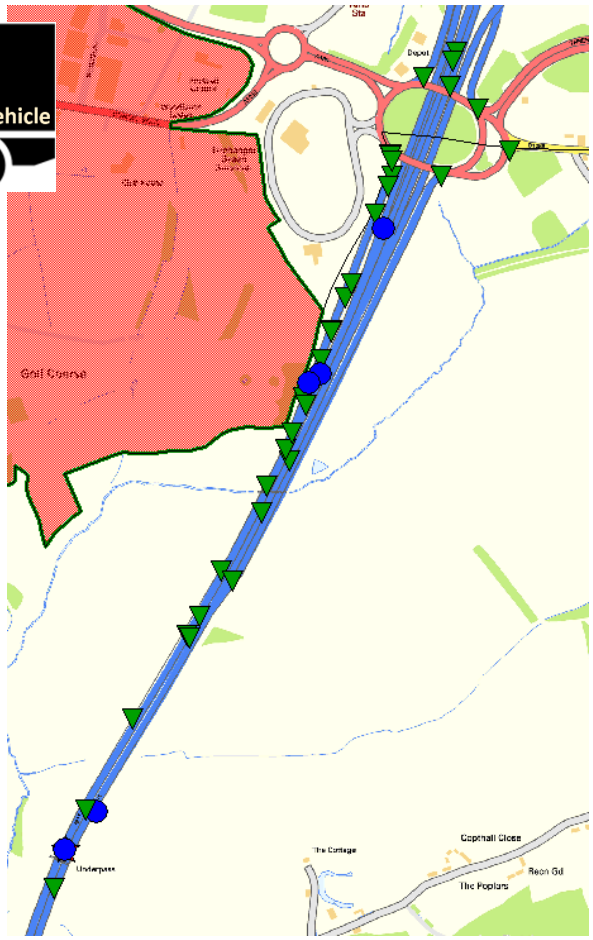
2km south of A120



Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0100-0159		1					
0200-0259					1		
0400-0459							1
0500-0559						1	1
0800-0859	1						
1000-1059	1		1				
1100-1159	1	1				1	
1200-1259	1			1	2	2	
1300-1359				1		2	2
1400-1459		1					
1500-1559					3		
1600-1659		1		1			
1700-1759		1					
1800-1859	1			1	1		1
1900-1959					1		
2100-2159						1	
2200-2259							1
2300-2359	1						

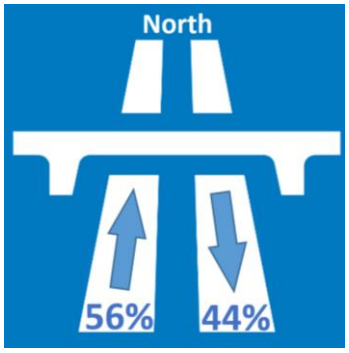




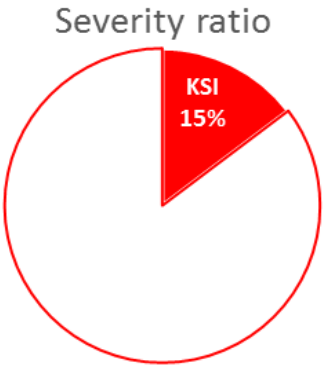


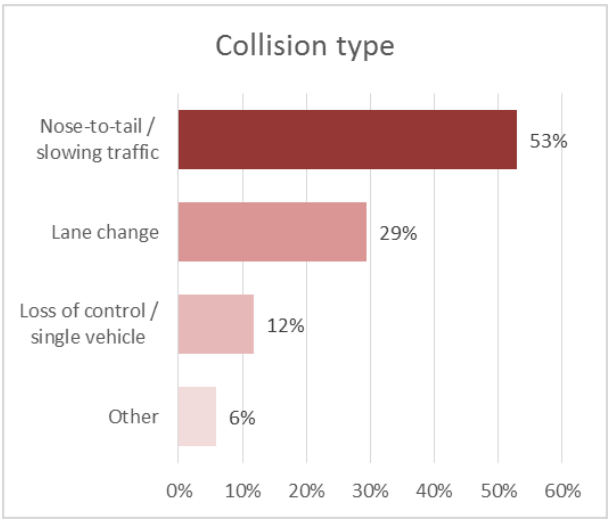
Most collisions occur on northbound approach to A120, or the slip road itself. Relatively low severity as most are nose-to-tail collisions. No clear peak time but Friday and Saturday are busiest days.

1.8km south of A414



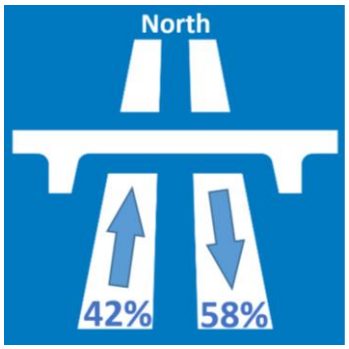
Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0100-0159			1				
0300-0359					1		
0500-0559					1		
0600-0659			1		1		
0700-0759		1					
0800-0859	1			1			
0900-0959		1					1
1000-1059					1	1	
1200-1259			1		1		
1300-1359			2				
1500-1559					1		1
1600-1659				1	1		1
1700-1759		1	1	1		1	
1800-1859	1			1	1	1	2
1900-1959			2				
2000-2059							1



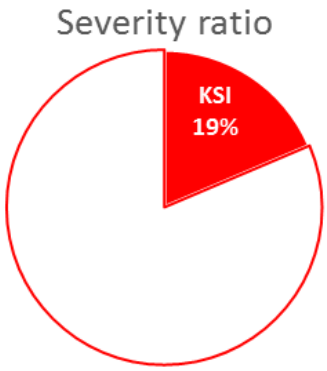


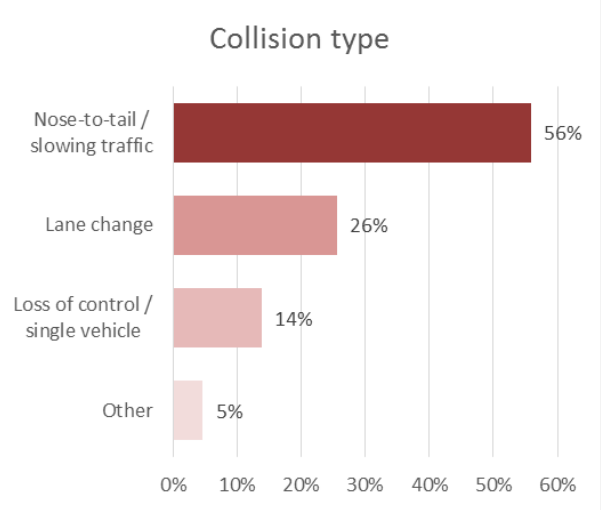
Slightly more collisions on the northbound approach to the junction than on section after the southbound on-slip. Over a quarter involve goods vehicles and nearly a third are lane-change collisions. No clear peak time but Wednesdays and Fridays are busiest days.

2km North of M25



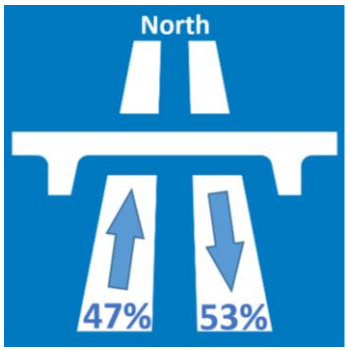
Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0000-0059				1			
0300-0359				1			
0400-0459	1						
0700-0759	1			2			
1000-1059	3					1	
1100-1159			1		1	1	
1200-1259			1		1	1	
1300-1359			1		1		1
1400-1459				2	1		1
1500-1559	1				1		
1600-1659					1		
1700-1759		1	3	2	2		1
1800-1859	1				1		1
1900-1959					2		
2000-2059						1	
2200-2259		1		1			



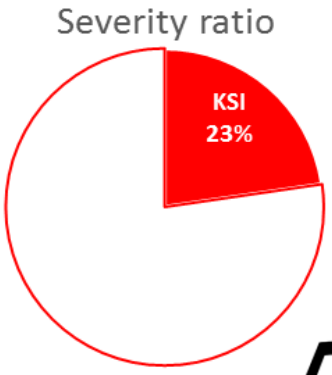


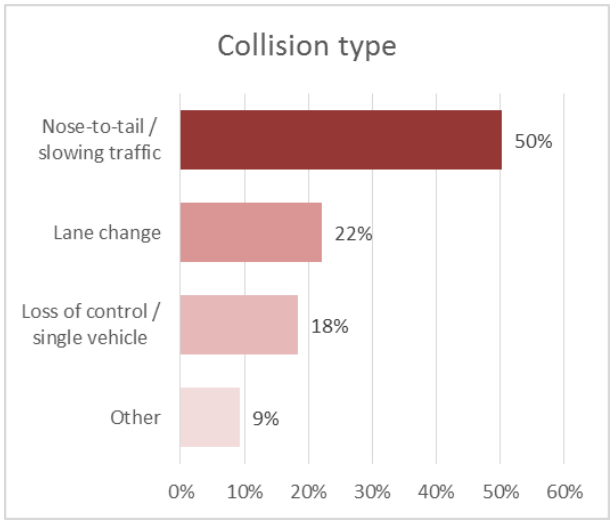
Slightly more collisions on the southbound approach to the M25 than on the northbound on-slip from the M25. Over a third involve goods vehicles. Busiest periods are Fridays 1100-2000 and weekdays 1700-1800.

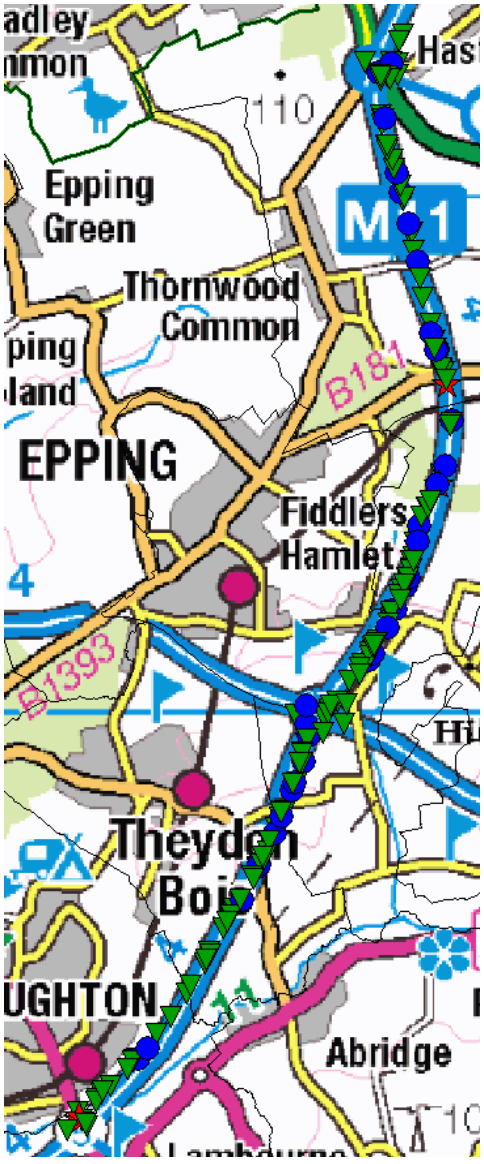
Loughton to A414



Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0000-0059			1	1	1		1
0100-0159	1		1				
0300-0359				1	1		
0400-0459	1			1		4	
0500-0559	1	1			2		
0600-0659		1	4	2	1		
0700-0759	4	1		3	1		1
0800-0859	1	1		3			
0900-0959		1	1		1	1	1
1000-1059	3			1	1	3	
1100-1159	1		1		2	1	
1200-1259		1	4		2	1	2
1300-1359			4		1	2	1
1400-1459	1			3	1	1	1
1500-1559	2		1	3	8	1	2
1600-1659	1	2	1	2	3	1	1
1700-1759	1	7	6	5	4	2	2
1800-1859	2		3	2	3	1	4
1900-1959	1	1	2	1	3		1
2000-2059	2	1	1	1	1	3	2
2100-2159				1	1	1	
2200-2259	1	2		1			
2300-2359				1	1		2





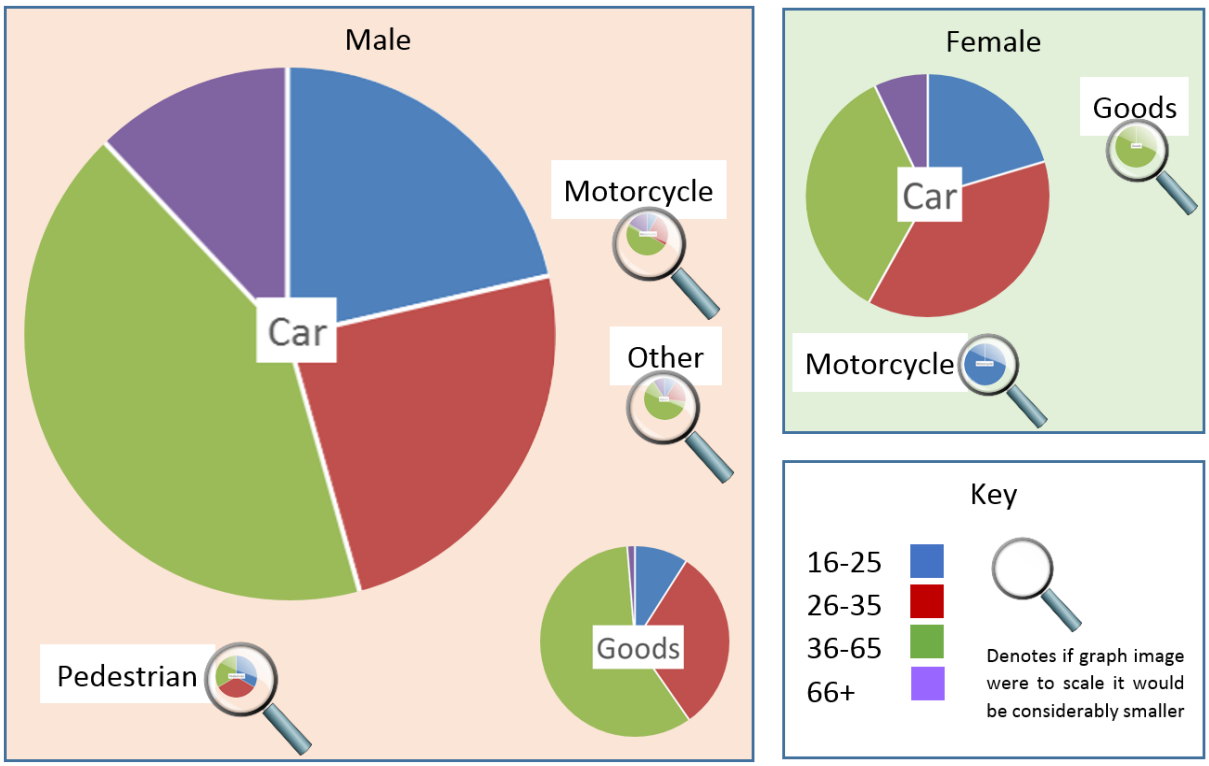


Nearly a quarter of collisions result in a KSI and a quarter involve goods vehicles. Peak time is Friday 1500-2000 and weekdays 1700-1800.

Higher proportion of loss of control collisions than other three hotspots may be related to the fact this is the only one which includes sections more than 2km from a junction.

e. Primary fault

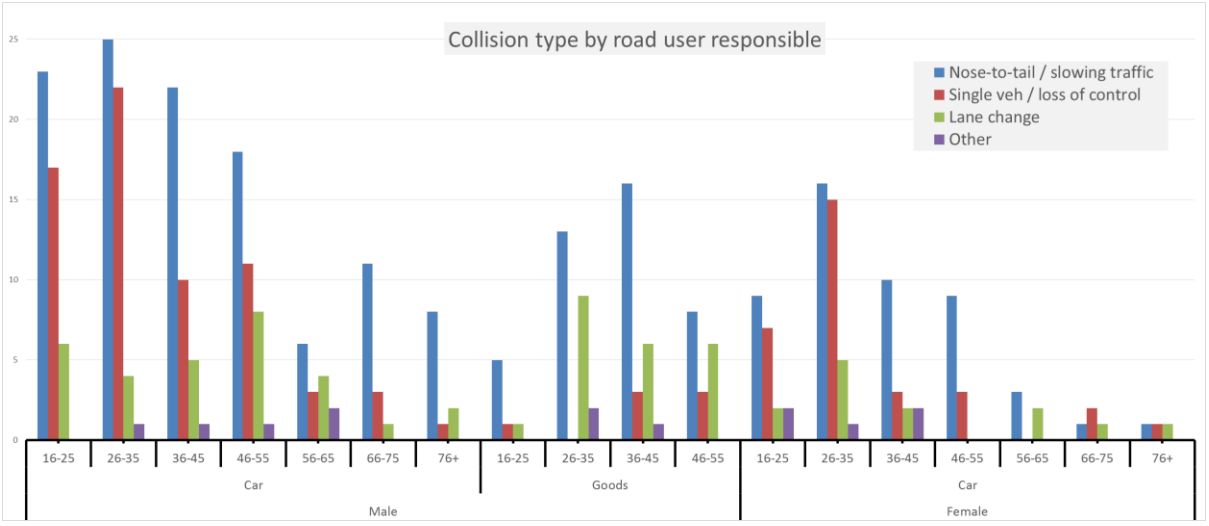
The graphic below gives a visual breakdown of the parties primarily at-fault for collisions on the M11. This shows the vast majority of collisions were caused by male car and goods vehicle drivers, and female car drivers. Almost half the male car drivers and over half of the female car drivers were aged 35 or under.



Going into slightly more detail shows:

- 51% of at fault parties were male car drivers, 46% of whom were aged 35 or under.
- 18% were male goods vehicle drivers, 58% of whom were aged 36-65.
- 23% were female car drivers, 58% of whom were aged 35 or under.
- 78% of goods vehicle drivers were primarily at-fault for the collision they were involved in.

The graph below shows the collision types caused by the main road user groups identified in the graphic above:



This shows all groups (except the tiny numbers of elderly female car drivers) are most likely to cause a nose-to-tail collision. However, as a proportion of all collisions, male and female car drivers aged under 36 are more likely than other groups to cause loss of control or single vehicle collisions; 39% of this group's collisions are loss of control or single vehicle compared to 28% average[1]. By comparison, goods vehicle drivers are more likely than other groups to be involved in lane-change collisions; 29% of this group's collisions are lane-change compared to 17% average.

The safest age group are 56-65 year olds; they cause the fewest collisions despite national travel survey data indicating they drive more miles than the under 30s and over 70s – and almost as many miles as 30-50 year olds.

The contributory factors most frequently attributed to each of the main at-fault groups are summarised below:

Gender	Male					Female	
Mode	Car driver			Goods driver		Car driver	
Age group	16-25	26-35	36-65	26-35	36-65	26-35	36-65
Failed to judge other persons path or speed	14%	12%	15%	13%	17%	14%	21%
Failed to look properly	8%	12%	13%	29%	16%	6%	18%
Careless/Reckless/In a hurry	13%	13%	9%	11%	16%	8%	9%
Sudden braking	6%	8%	7%	5%	7%	12%	9%
Loss of control	10%	13%	8%		5%	13%	
Following too close	10%	10%	10%	4%	9%		
Travelling too fast for conditions	5%	4%	5%	5%			
Poor turn or manoeuvre		4%		11%			
Swerved		4%	5%		4%		
Fatigue		4%					
Slippery road (due to weather)		4%					
Inexperience of driving on the left				4%			

Male car drivers aged under 36 are the group which account for the greatest number of collisions, with female car drivers aged under 36 and male goods vehicle drivers contributing to most of the rest.

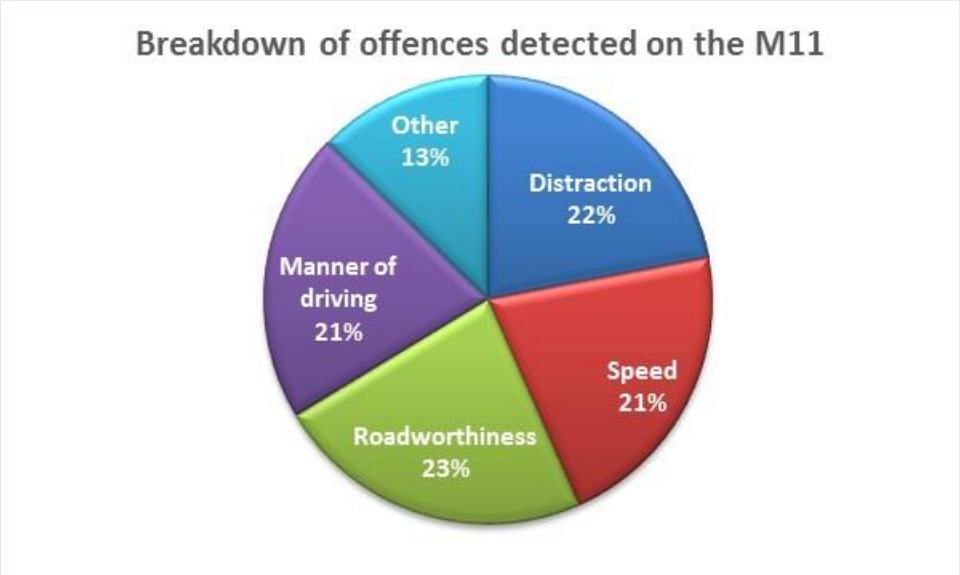
Nose-to-tail collisions were the most common type of collision caused by most car driver groups, but younger drivers had higher rates of loss of control and single vehicle collisions. Younger male drivers had higher incidence of careless or reckless driving and loss of control.

Goods vehicle drivers were disproportionately at-fault for the collisions they were involved in, with poor observation and carelessness the most common underlying driver behaviours. Although nose-to-tail collisions were the most common type for goods vehicles, they were disproportionately at-fault for lane-change collisions.

[1] For those groups sampled in the graph

f. Offence data

The graphic below gives a breakdown of the offences detected by Police Officers[2] on the M11 in Essex between January 2016 and August 2017.



This shows four main offence groups account for 87% of detected offences on the M11, and these are roughly equal in number. The other offence types include HGV tachograph offences, seatbelt offences, insurance/licencing and documentation offences, and dangerous positioning (e.g. inappropriate parking and travelling in wrong lane).

These four main offence types appear to translate to the three main collision types described previously in this document:

- **Distraction:** nose-to-tail, lane-change.
- **Speed:** loss-of-control/single-vehicle, nose-to-tail.
- **Roadworthiness:** loss-of-control/single vehicle.
- **Manner of driving:** lane-change, nose-to-tail, loss-of-control/single vehicle.

[2] This excludes automatic speed camera data in order to provide a fair comparison between offences. This is because unlike Police Officers, speed cameras will *only* detect excess speed, and will do this in much greater numbers than any manned equipment. Therefore the inclusion of camera data in this context would give a false impression that speed limit compliance is many times lower than compliance with other traffic laws.