

Traffic Safety Basic Facts 2012

Accident Causation

National accident databases mostly focus on crash circumstances so in-depth investigations are required to provide a more detailed analysis of causation. This Fact Sheet presents basic information about the causes of accidents based on two separate databases gathered in the SafetyNet project. It differs from other Basic Fact Sheets as the data is not currently expected to be updated, unlike the CARE database, so it provides a snapshot of accident causation factors. Nevertheless it illustrates some of the value that can be gained from the collection and analysis of in-depth accident data.

The EC SafetyNet project produced two crash database processes which examined different aspects of the European accident problem. These were a Fatal Accident database at intermediate level and an in-depth Accident Causation Database. In both cases the detail of the data recorded far exceeded that normally available from national databases.

The Fatal Accident database was collected from police investigations, witness reports and reconstructions of fatal accidents from a number of EU Member States (France, Germany, Finland, the Netherlands, United Kingdom, Italy and Sweden). The data is of an intermediate level of detail but was systematically collected according to defined sampling plans and hence is a broadly representative sample of fatal crashes in each country.

The SafetyNet Accident Causation Database was developed between 2005 and 2008. It contains in-depth data on 997 accidents covering all injury severities, collected from accidents that occurred in Germany, Italy, The Netherlands, Finland, Sweden and the UK. The data was collected 'at scene' or 'nearly at-scene' and complemented by follow up interviews, using a common methodology across all countries. Causation data was recorded according to the SafetyNet Accident Causation System (SNACS) methodology.

Table 1: Distribution of Accidents by Country

Country	Fatal Accident Database		Accident Causation Database	
Germany	174	13,4%	98	9,8%
Finland	60	4,6%	196	19,7%
France	40	10,8%		
Italy	479	37,0%	259	26,0%
The Netherlands	50	3,9%	126	12,6%
Sweden	125	9,6%	68	6,8%
United Kingdom	268	20,7%	250	25,1%

Source: SafetyNet Fatal Accident Database, SafetyNet Accident Causation Database

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Motoways

Junctions

Roads in
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Roads outside
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Gender

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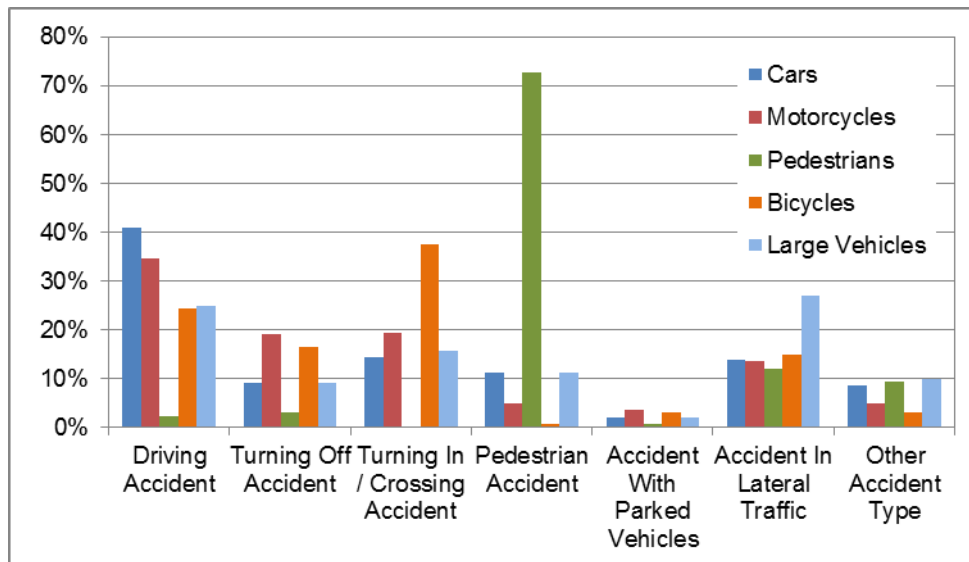
Fatal Accident Database

The database contains information on 2389 drivers, riders or pedestrians who were involved in fatal collisions. Males accounted for 82% of these, and the average age was 42.

This section presents information about the crash characteristics and key risk factors. All data is presented at an 'accident' level unless stated otherwise.

The accident type represents the conflict situation which led to the accident and can be chosen from one of seven separate classes. Further definitions of accident types are given at the end of this document.

Figure 1: Distribution of Accident Types by Road User Type



Source: SafetyNet Fatal Accident Database

Figure 1 shows that 41% of car drivers and 35% of motorcycle riders were involved in driving accidents. Bicycle riders were most often involved in turning in / crossing accidents. Large vehicles were most commonly involved in accidents in lateral traffic and driving accidents.

Table 2: Crash Avoidance Manoeuvre by Road User Type

Crash Avoidance Manoeuvre	Cars		Motorcycles		Large Vehicles	
No Avoidance Manoeuvre	844	64,6%	146	54,1%	132	55,9%
Braking	223	17,1%	93	34,4%	56	23,7%
Steering	153	11,7%	16	5,9%	21	8,9%
Other	86	6,6%	15	5,6%	27	11,4%
Total	1306		270		236	

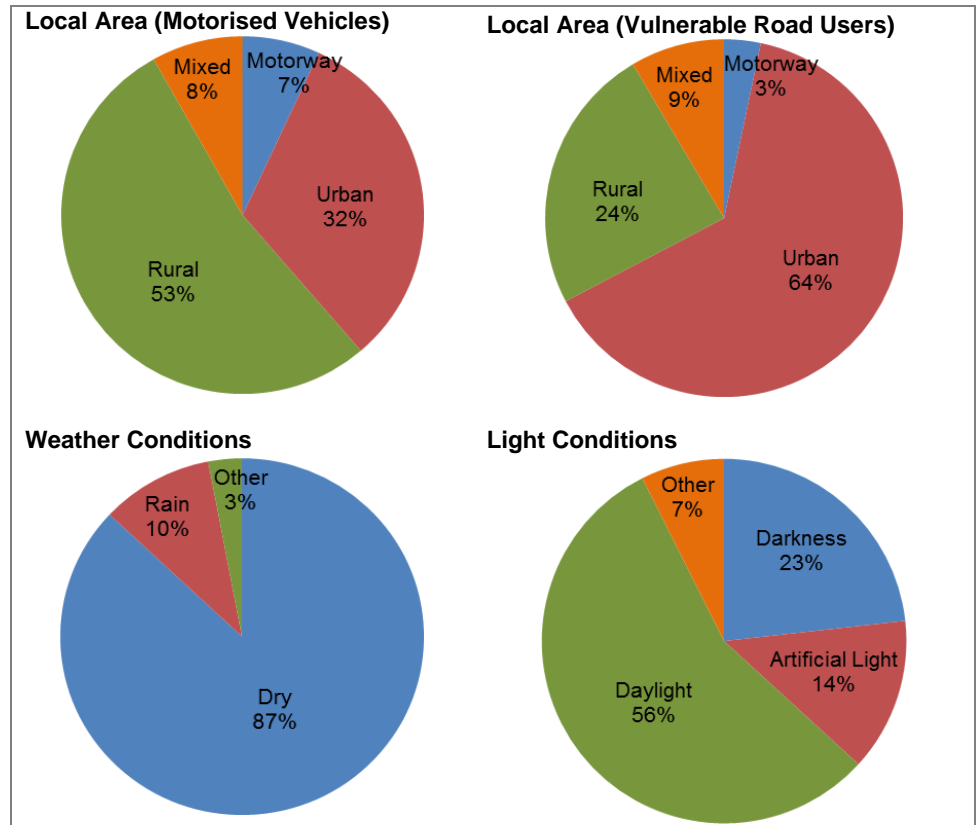
Source: SafetyNet Fatal Accident Database

According to Table 2, only 35% of cars, 46% of motorcycles and 44% of large vehicles made attempts to avoid the accident.

Less than 50% of vehicles made attempts to avoid the accident.

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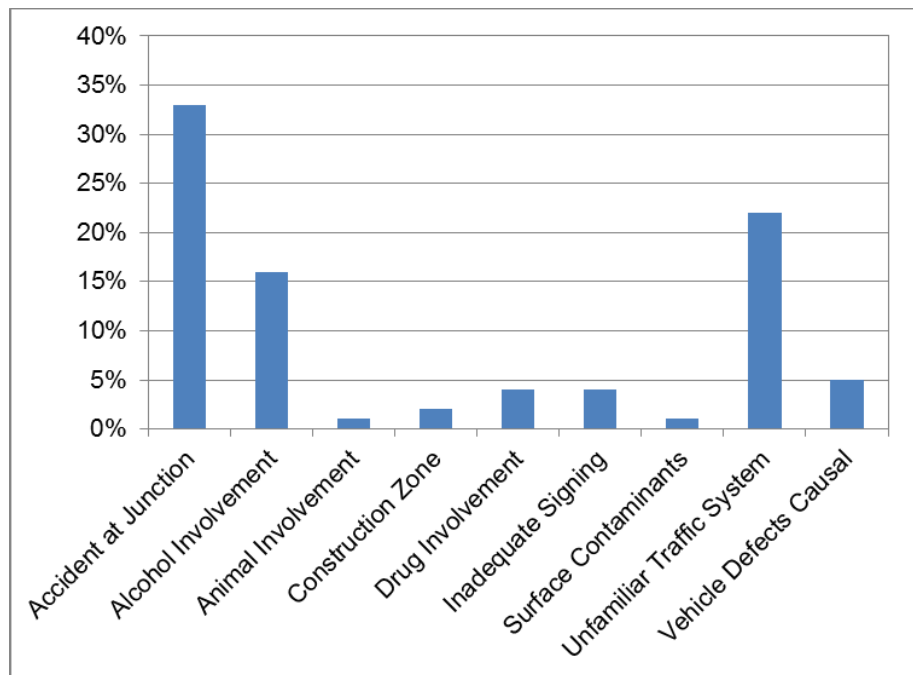
Figure 2: Accident Conditions



Source: SafetyNet Fatal Accident Database

Figure 2 shows that vehicle drivers and riders were most commonly involved in accidents in rural areas whereas pedestrians and cyclists were most often in accidents in urban areas. The majority of accidents occurred during the daytime in dry conditions.

Figure 3: Circumstantial Factors



Source: SafetyNet Fatal Accident Database

Figure 3 shows that more accidents occurred on straight roads (66%) than at junctions. 20% of accidents had alcohol or drug involvement.

20% of accidents had alcohol or drug involvement.

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The most harmful event is defined as the event which caused the most harm and damage to the road user (not the vehicle). For the fatal party the most harmful event is the one which caused the fatality.

Table 3: Most Harmful Event by Vehicle Type

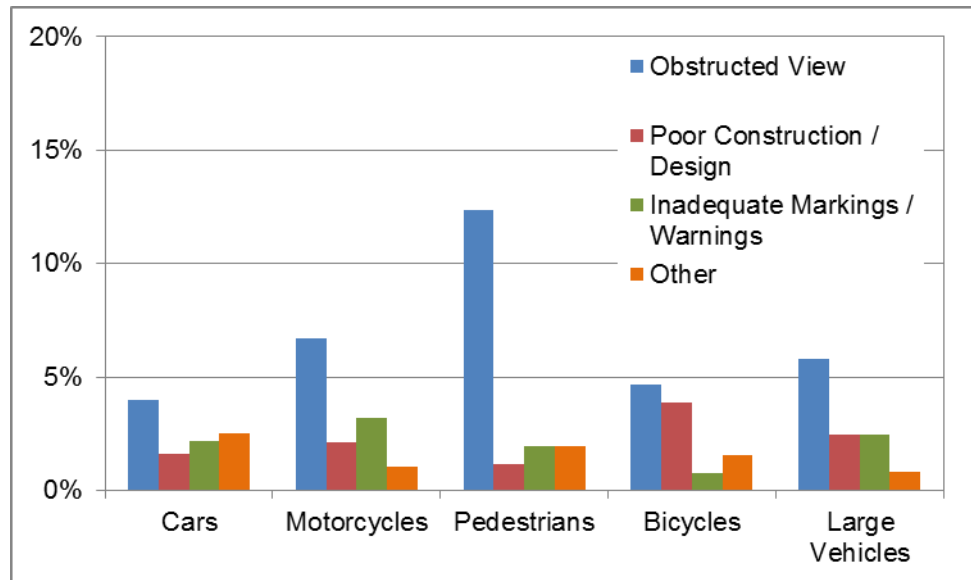
Most Harmful Event		Cars		Motorcycles		Pedestrians		Bicycles	
Non Collision		95	7,1%	40	14,1%	2	0,8%	12	9,4%
Collision with Roadside Object		185	13,8%	61	18,0%	1	0,4%	3	2,3%
Pedestrian		175	13,0%	13	4,6%	3	1,2%	1	0,8%
Bicycle		65	4,8%	7	2,5%	2	0,8%	33	25,8%
Collision with Other Vehicle	Car	360	26,8%	85	30,0%	143	55,2%	36	28,1%
	Motorcycle	105	7,8%	12	4,2%	11	4,2%	3	2,3%
	Large Vehicle	75	5,6%	11	3,9%	39	15,1%	10	7,8%
	Other Vehicle	31	2,3%	13	4,6%	9	3,5%	13	10,2%
Unknown Vehicle		161	12,0%	20	7,1%	38	14,7%	12	9,4%
Other / Not Applicable		11	0,8%	1	0,4%	0	0,0%	0	0,0%
Unknown		79	5,9%	30	10,6%	11	4,2%	5	3,9%
Total		1343		283		259		128	

Source: SafetyNet Fatal Accident Database

12% of pedestrians had an obstructed view prior to the accident.

According to Table 3 the majority of most harmful events for cars and motorcycles were colliding with another vehicle or colliding with a road side object. Pedestrians and cyclists were most often hit by a car or large vehicle.

Figure 4: Related Factors



Source: SafetyNet Fatal Accident Database

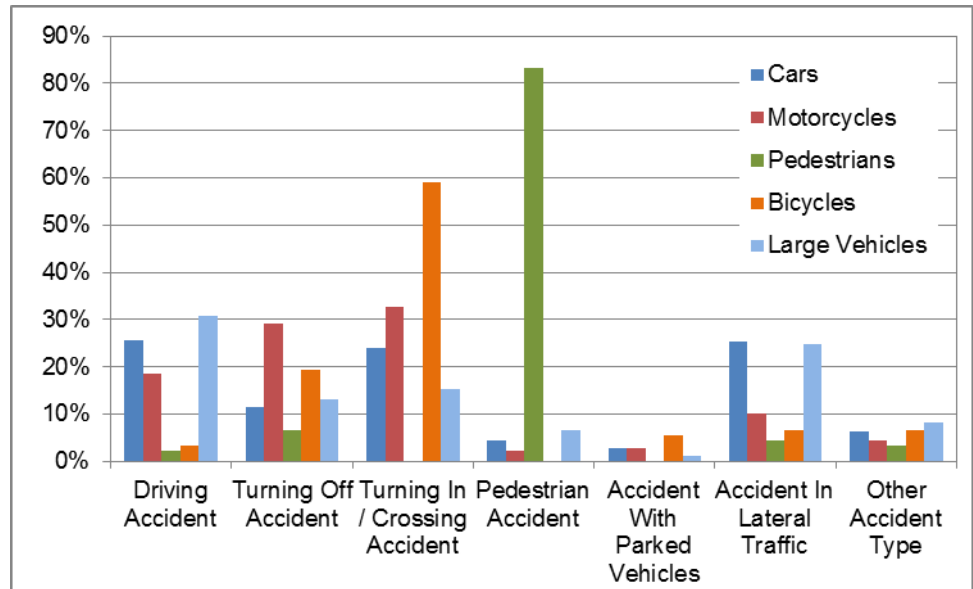
Figure 4 shows that 10% of cars and 13% of motorcycles were affected by factors such as obstructed view, poor construction etc. 12% of pedestrians had an obstructed view immediately prior to the accident.

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Accident Causation Database

The database contains information on 1801 drivers, riders or pedestrians who were involved in both fatal and non-fatal crashes. Males accounted for 70% of these, and the average age was 41.

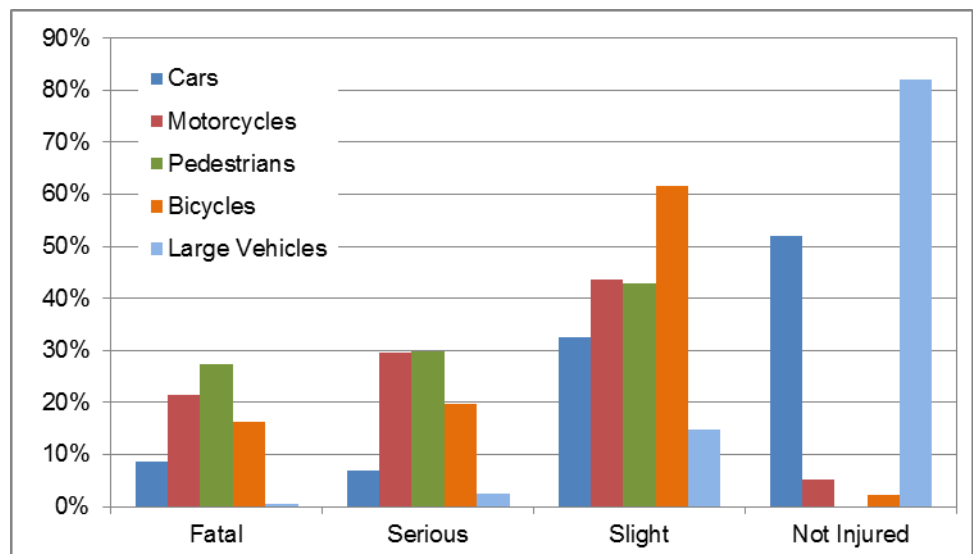
Figure 5: Distribution of Accident Types by Vehicle Type



Source: SafetyNet Accident Causation Database

Figure 5 compares the distribution of accident types for different vehicle types. Car drivers were most commonly involved in driving accidents, turning in / crossing accidents and accidents in lateral traffic - each accounting for 25% of the total. 62% of motorcycles were involved in turning accidents (in or off). Bicycle riders were most often involved in turning in / crossing accidents.

Figure 6: Injury Severity by Vehicle Type



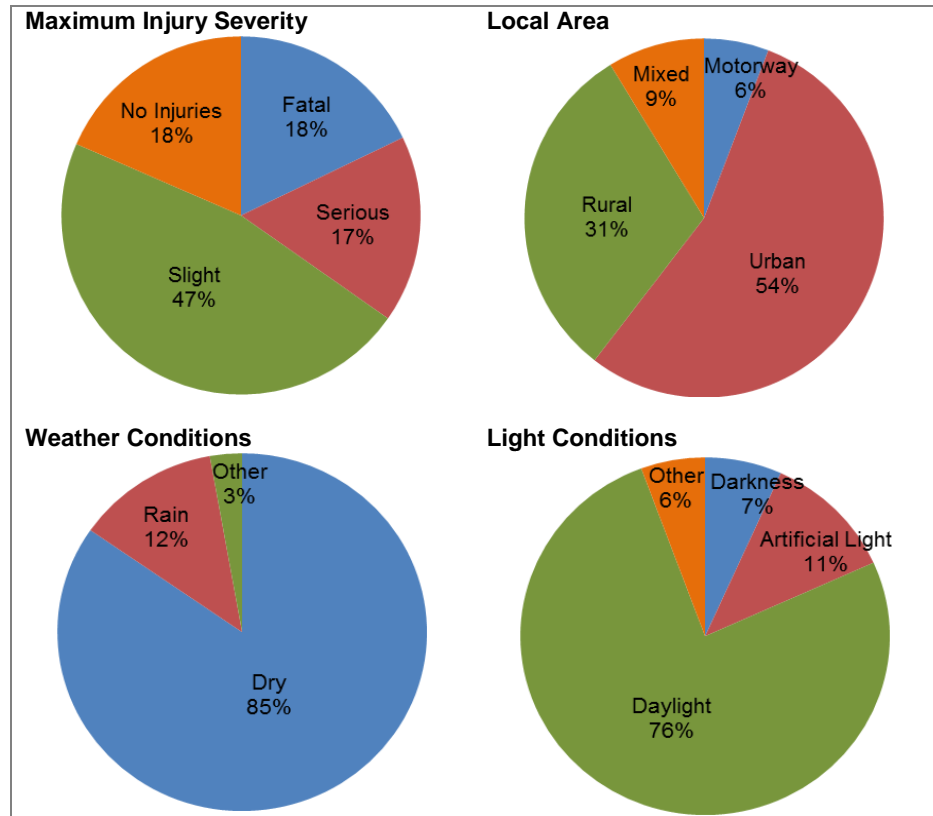
Source: SafetyNet Accident Causation Database

Figure 6 shows that over 50% of motorcyclists and pedestrians suffered fatal or serious injuries, compared with only 15% of car drivers. 52% of car drivers and 82% of large vehicle drivers received no injury at all - a figure which drops to less than 5% for other road users. All pedestrians had injuries of some level.

50% of motorcyclists and pedestrians suffered fatal or serious injuries in the accident.

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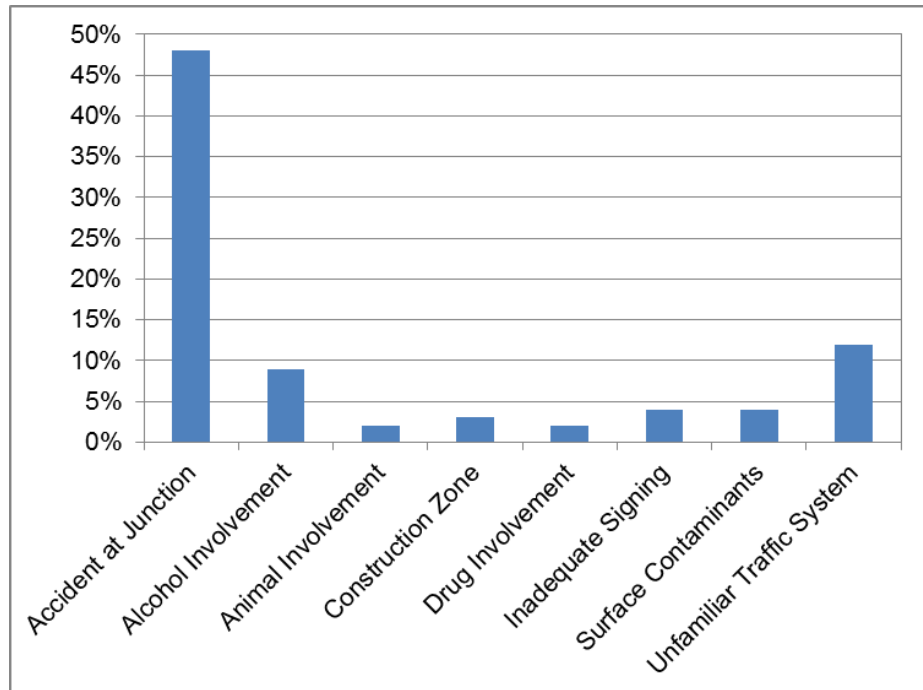
Figure 7: Accident Conditions



Source: SafetyNet Accident Causation Database

Figure 7 shows that 35% of accidents had serious or fatal injuries; in only 18% were no road users injured at all. Just over 50% of accidents occurred in urban areas. Over three quarters of accidents occurred during the daytime and in dry conditions.

Figure 8: Circumstantial Factors



Source: SafetyNet Accident Causation Database

There were approximately equal amounts of accidents at junctions as on straight roads. 11% of accidents had alcohol or drug involvement and 12% occurred in unfamiliar traffic systems.

18% of accidents had at least one fatal injury.

11% of accidents had alcohol or drug involvement.

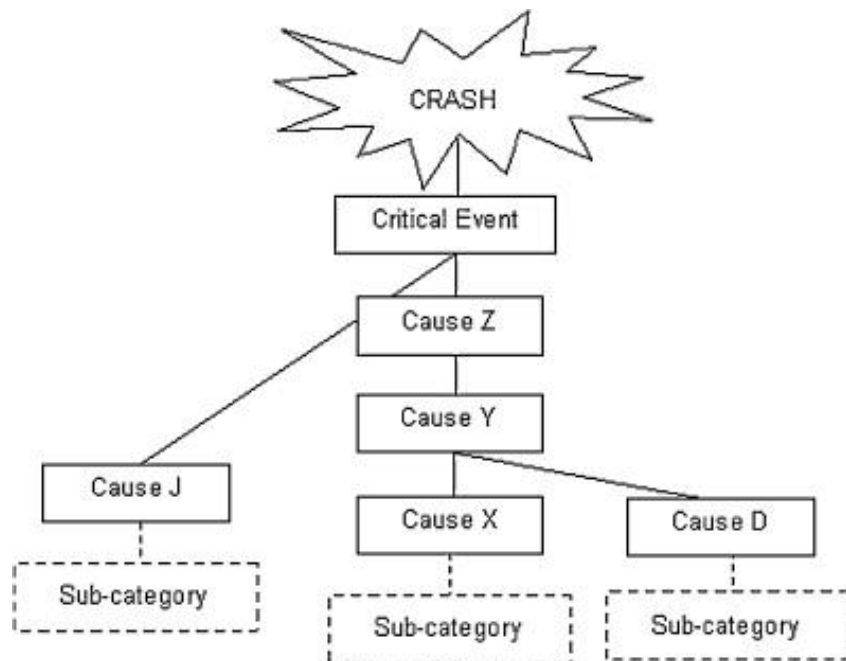
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SafetyNet Accident Causation System (SNACS)

The accident model underlying SNACS follows a system approach¹. It states that a crash occurs when the dynamic interaction between humans, technology and organisation fails to meet the demands of the current situation.

The SNACS method² allows the relationship between causes to be examined as it records the sequence in which the various causation factors that lead to the crash occur. It distinguishes between 'critical events' and 'causes'. A critical event is the observable consequence that leads to the crash and is expressed in terms of time, space or energy. Causes are the contributing factors that lead to this event. Causes are organised into categories and represent organisation, infrastructure, vehicle or road user related factors.

When interpreting results it is important to note that causation categories are not mutually exclusive - there are usually multiple causes that lead to the accident.



¹ Based on Hollnagel, E. Anticipating failures: What should predictions be about? In *Proceedings of the Human Factors and Medicine Panel (HFM) Workshop*, (Sienna, 1999).

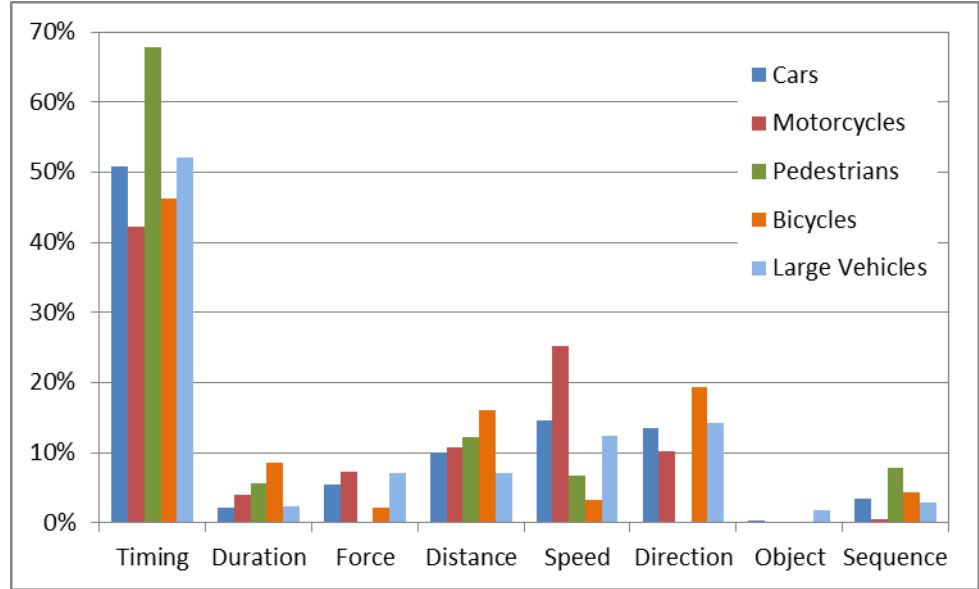
² [SafetyNet Deliverable 5.5, Glossary of Data Variables for Fatal and Accident Causation Databases](#)

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Critical Events

In the database 51% of road users had 'Timing' as the critical event that preceded the accident. This could be 'Premature Action' - for example overtaking another vehicle before there is good visibility, 'Late Action' - e.g. not changing lanes in time, or 'No Action' - e.g. failing to stop at a red traffic light.

Figure 9: Critical Event Category by Vehicle Type



Source: SafetyNet Accident Causation Database

Figure 9 shows that, for example, motorcycles were found to have more accidents due to 'Speed' whereas bicycles had a higher proportion of 'Direction' errors. The most common categories of causation are shown below in Table 4.

Table 4: Causation Categories by Vehicle Type

Critical Event	Cars		Motorcycles		Pedestrians		Bicycles		Large Vehicles	
Observation	513	45%	76	43%	39	43%	35	38%	70	41%
Interpretation	630	55%	84	47%	57	63%	58	62%	103	61%
Planning	384	33%	88	49%	40	44%	50	54%	39	23%
Temporary Personal Factors	471	41%	55	31%	40	44%	19	20%	36	21%
Permanent Personal Factors	39	3%	1	1%	4	4%	1	1%	5	3%
Equipment Failure	52	5%	8	4%	0	0%	3	3%	24	14%
Communication	387	34%	45	25%	21	23%	20	22%	61	36%
Maintenance	76	7%	10	6%	0	0%	3	3%	15	9%
Experience / Knowledge	70	6%	30	17%	7	8%	5	5%	7	4%
Road Design	217	19%	35	20%	16	18%	17	18%	21	12%

Source: SafetyNet Accident Causation Database

Table 4 shows that 'Interpretation' errors (faulty diagnosis, wrong reasoning, decision errors etc.) were the most frequently linked cause across all vehicle types. These errors can be the result of another underlying cause, for example a driver may have misjudged the time needed to stop because they were under the influence of alcohol.

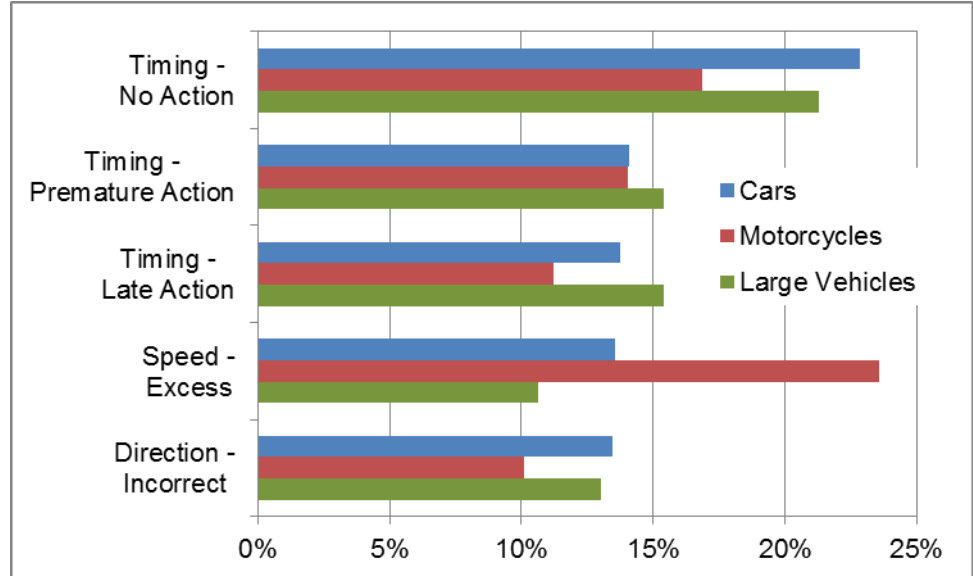
51% of road users made timing errors immediately prior to the accident.

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Motorised Vehicles

The database contains information on 1151 cars, 178 motorcycles and 169 large vehicles. Males accounted for 71% of drivers / riders and the mean age was 41 for cars, 32 for motorcycles and 42 for large vehicles. The most frequently occurring critical events for motorised vehicles are shown below.

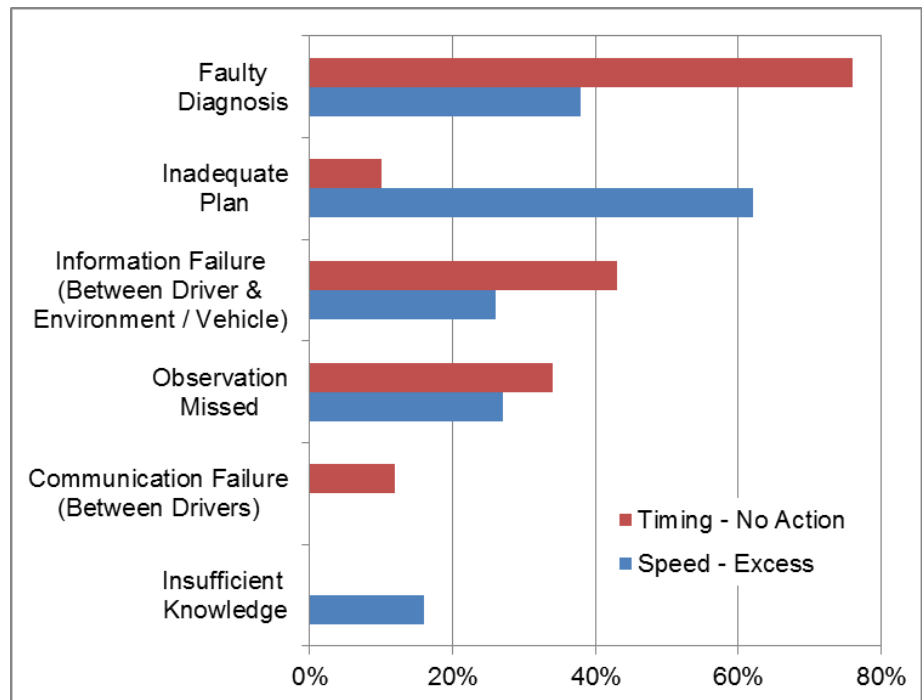
Figure 10: Five most frequent critical events for road vehicles



Source: SafetyNet Accident Causation Database

Figure 10 shows that 'Timing - No Action' was the critical event for 329 vehicles and 'Excess Speed' was the critical event for 216. The most frequently linked causes to these are shown in Figure 11.

Figure 11: Most frequently linked causes for road vehicle critical events



Source: SafetyNet Accident Causation Database

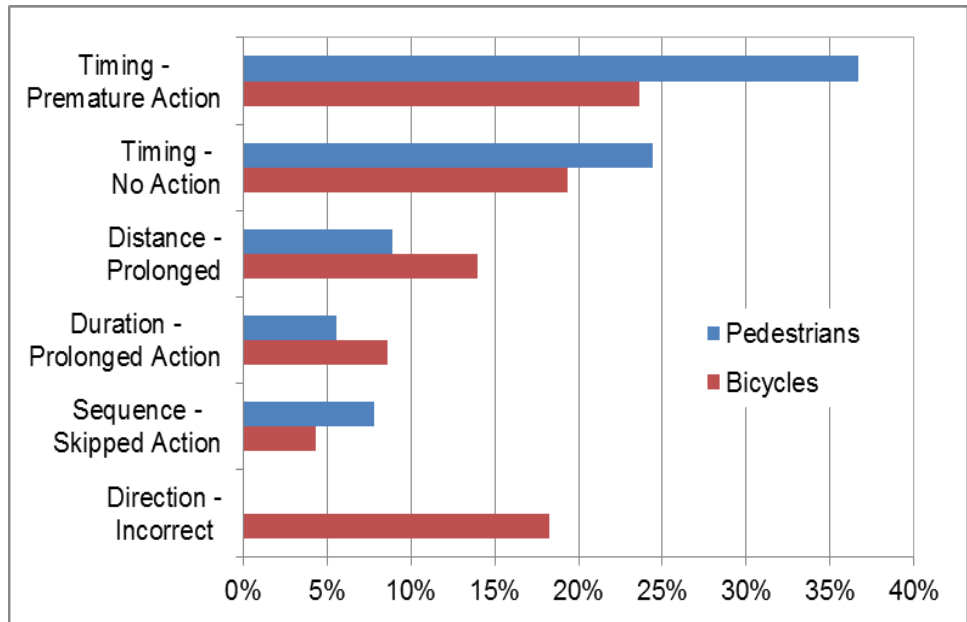
24% of motorcycle riders had the critical event 'Surplus Speed'.

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Vulnerable Road Users

The database contains information on 90 pedestrians and 93 cyclists. 50% of these were male and the mean age was 45 for pedestrians and 47 for cyclists.

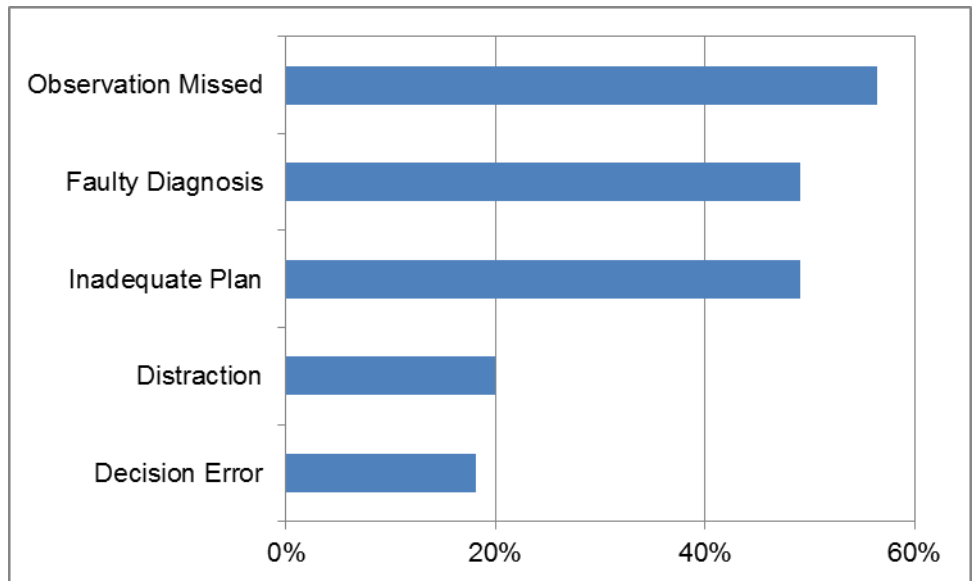
Figure 12: Five most frequent critical events for pedestrians and cyclists



Source: SafetyNet Accident Causation Database

Figure 12 shows that 'Timing - Premature Action' was the critical event for 30% (55) of road users. The five most frequently linked causes are shown in Figure 13.

Figure 13: Most frequently linked causes for pedestrian and bicycle critical events



Source: SafetyNet Accident Causation Database

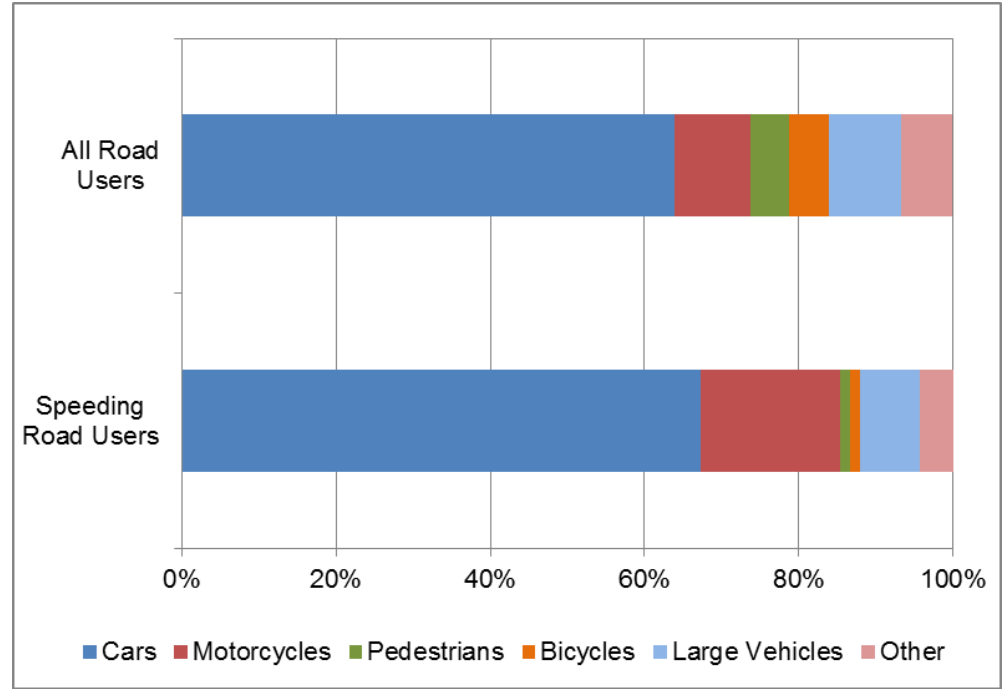
Pedestrians and cyclists were most commonly involved in accidents after making premature actions.

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Speed

23% of crashes (227) recorded in the database involved at least one driver, rider or pedestrian judged by the investigators to have been travelling at excess speed before the accident. 381 road users were involved, of which 71% were male and the average age was 37.

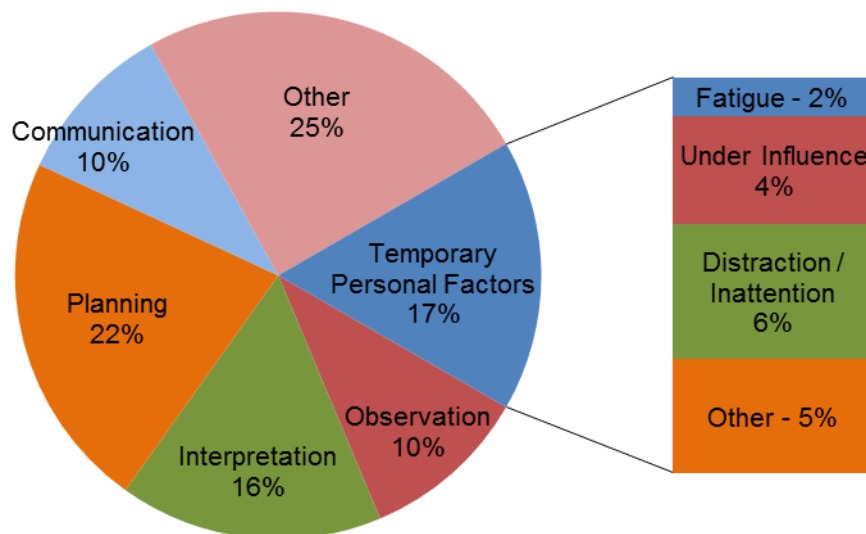
Figure 14: Distribution of vehicle types within excess speed cases



Source: SafetyNet Accident Causation Database

Figure 14 shows that in accidents with excess speed as a contributing factor, motorcycles represented a higher percentage compared with when all vehicles are included.

Figure 15: Distribution of causes for excess speed cases



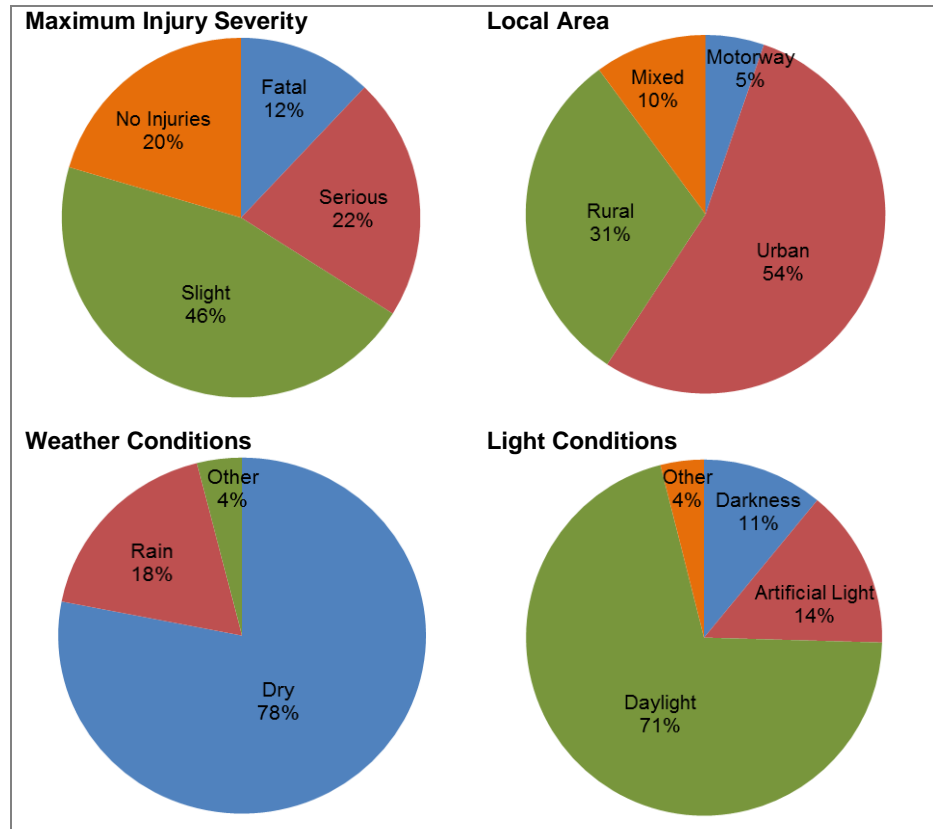
Source: SafetyNet Accident Causation Database

According to Figure 15, 17% of excess speed cases had 'temporary personal factors' (fatigue, influence of alcohol etc.) as a contributing factor.

23% of accidents were due to excess speed.

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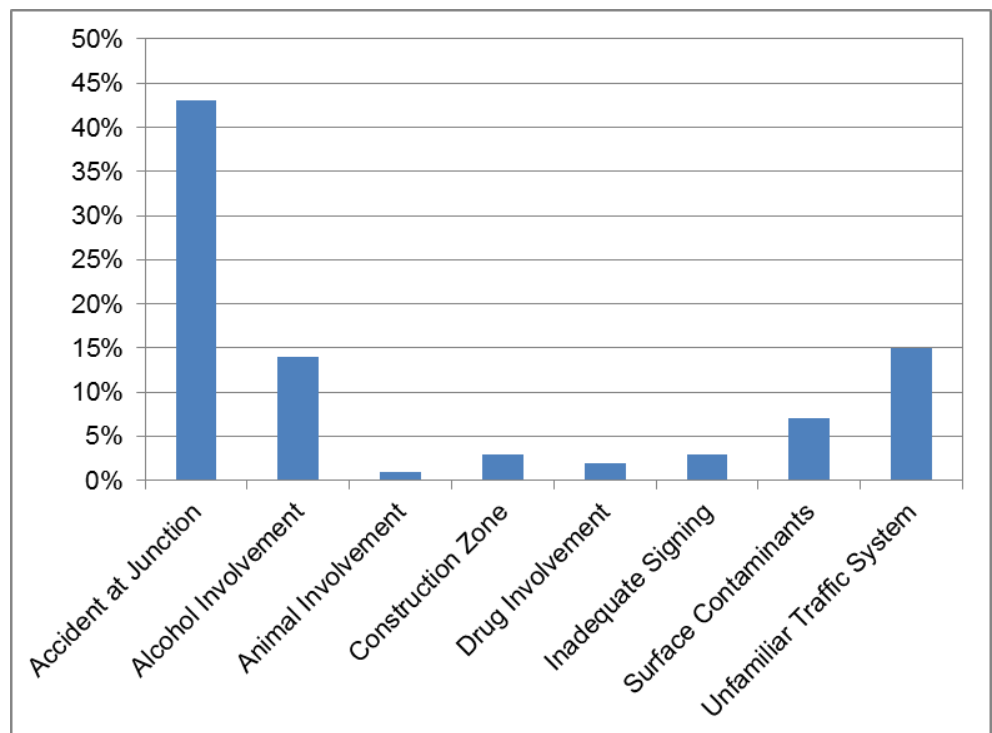
Figure 16: Accident Conditions



Source: SafetyNet Accident Causation Database

Less than a quarter of speeding accidents resulted in no injuries, 34% were serious or fatal. 25% of speeding accidents happened at night, compared to 18% when all accidents are included.

Figure 17: Circumstantial Factors



Source: SafetyNet Accident Causation Database

Figure 17 shows that 16% of speeding accidents had alcohol or drug involvement and 7% reported the presence of surface contaminants.

12% of speeding accidents were fatal.

16% of accidents caused by speeding also had alcohol or drug involvement.

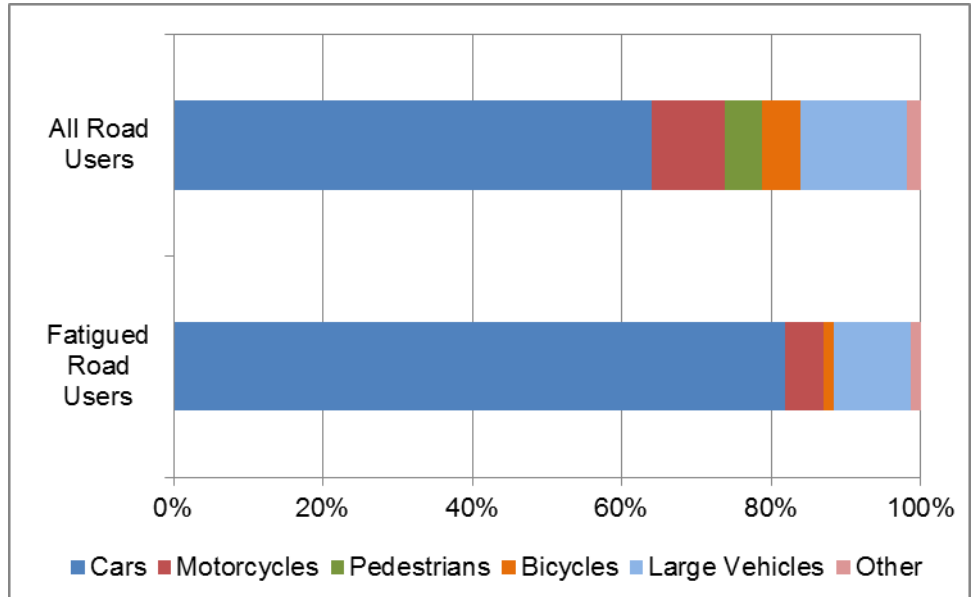
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Fatigue

8% of crashes recorded in the database involved at least one driver, rider or pedestrian who had been described as being fatigued. 121 road users were involved and of these 68% were male and the average age was 39.

Fatigue most often led to 'Direction' (49%) or 'Timing' (27%) critical events.

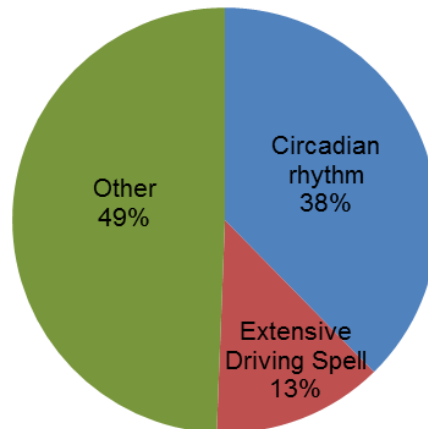
Figure 18: Distribution of vehicle types within fatigue cases



Source: SafetyNet Accident Causation Database

Figure 18 shows that in accidents with fatigue as a contributing factor, car drivers represented a higher percentage compared with when all accidents are included.

Figure 19: Distribution of causes for fatigue cases



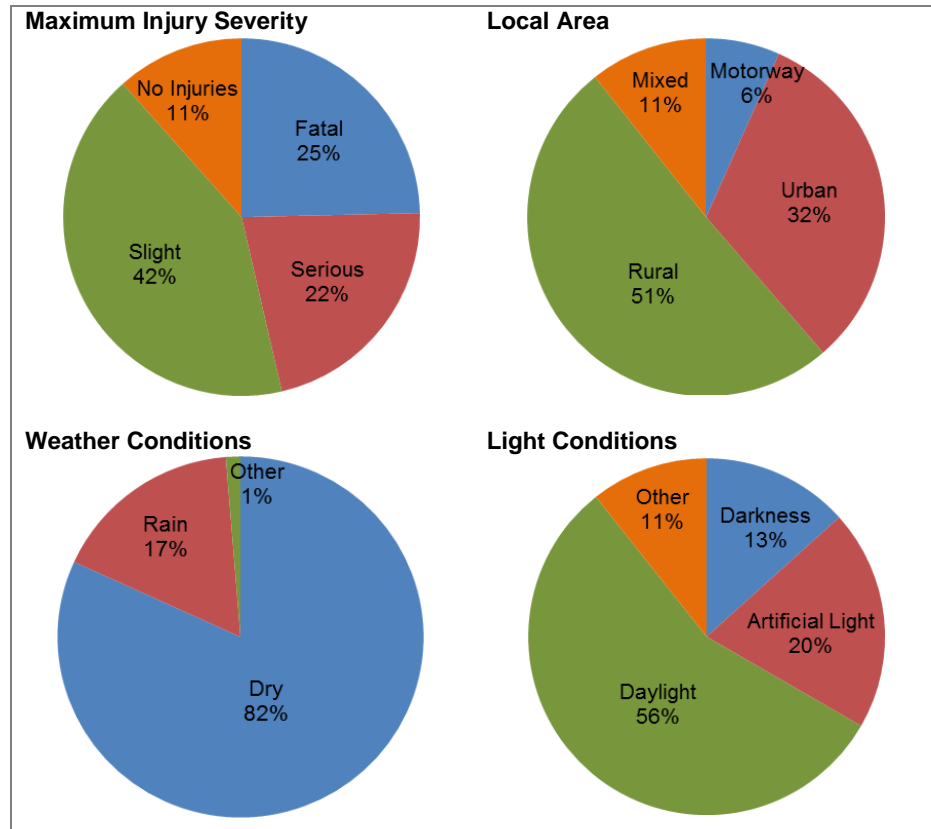
Source: SafetyNet Accident Causation Database

According to Figure 19, 51% of fatigue cases were due to circadian rhythm (travelling outside of normal driving hours) or extensive driving spells.

8% of accidents had fatigue as one of the contributing causes.

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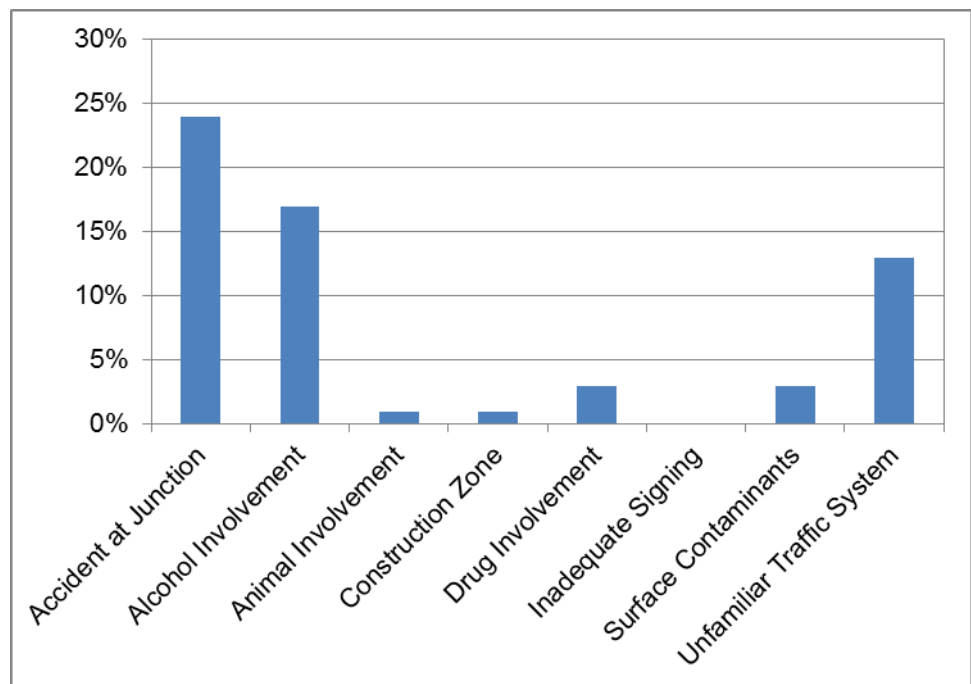
Figure 20: Accident Conditions



Source: SafetyNet Accident Causation Database

According to Figure 20 only 11% of fatigue accidents resulted in no injuries, 47% were serious or fatal. More accidents occurred in rural areas than in urban areas - the opposite to when all accidents are included. 33% of fatigue accidents happened at night, compared to 18% when all cases are included.

Figure 21: Circumstantial Factors



Source: SafetyNet Accident Causation Database

Figure 21 shows that only 24% of fatigue accidents occurred at junctions, compared to 48% when all cases are included. 20% of fatigue accidents also had alcohol or drug involvement.

25% of fatigue accidents were fatal.

20% of accidents caused by fatigue also had alcohol or drug involvement.

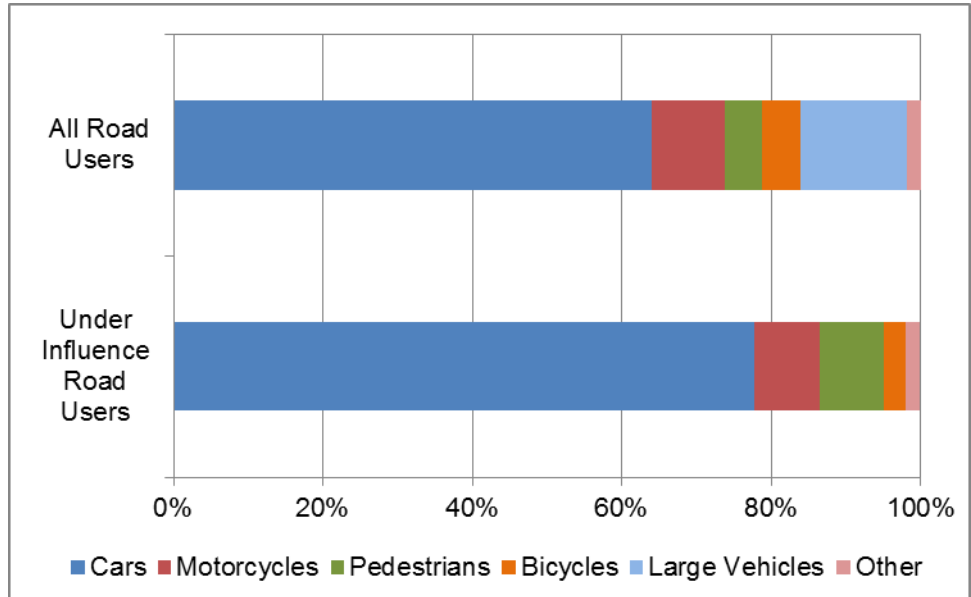
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Influence of Substances

10% of accidents recorded in the database involved at least one driver, rider or pedestrian who had been described as being under the influence of substances. 147 road users were involved, of which 76% were male and the average age was 36.

Being under influence most often led to 'Direction' (41%), 'Speed' (29%) and 'Timing' (18%) critical events.

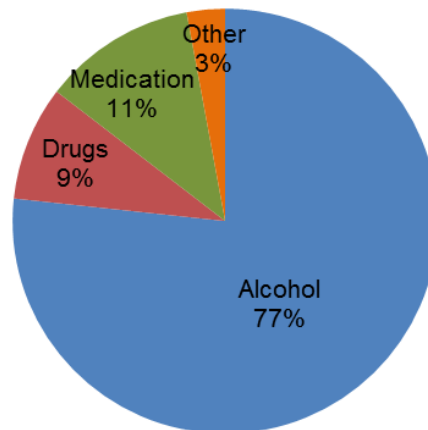
Figure 22: Distribution of vehicle types within under influence cases



Source: SafetyNet Accident Causation Database

In accidents with 'under influence' as a contributing factor, car drivers and pedestrians represented a higher percentage compared with when all cases are included. No large vehicle drivers were found to be under the influence of substances, compared with 14% of all accidents.

Figure 23: Distribution of causes for under influence cases



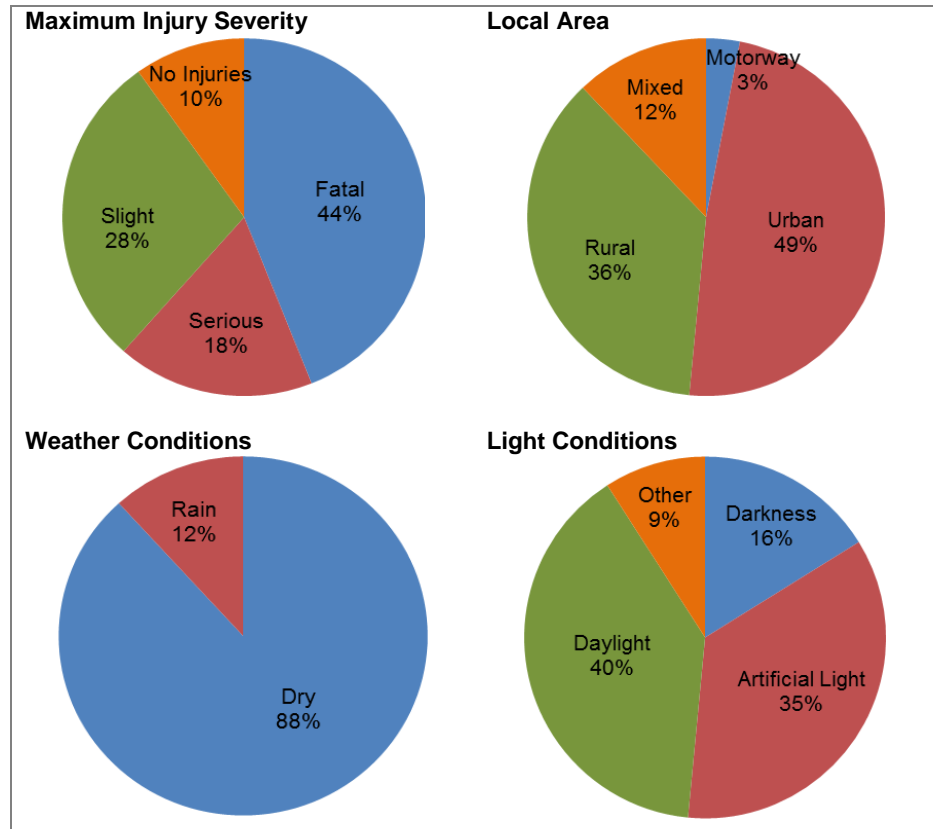
Source: SafetyNet Accident Causation Database

Figure 23 shows that the majority (77%) of 'under influence' accidents were due to the influence of alcohol.

10% of accidents had 'under the influence of substances' as a contributing cause.

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Figure 24: Accident Conditions

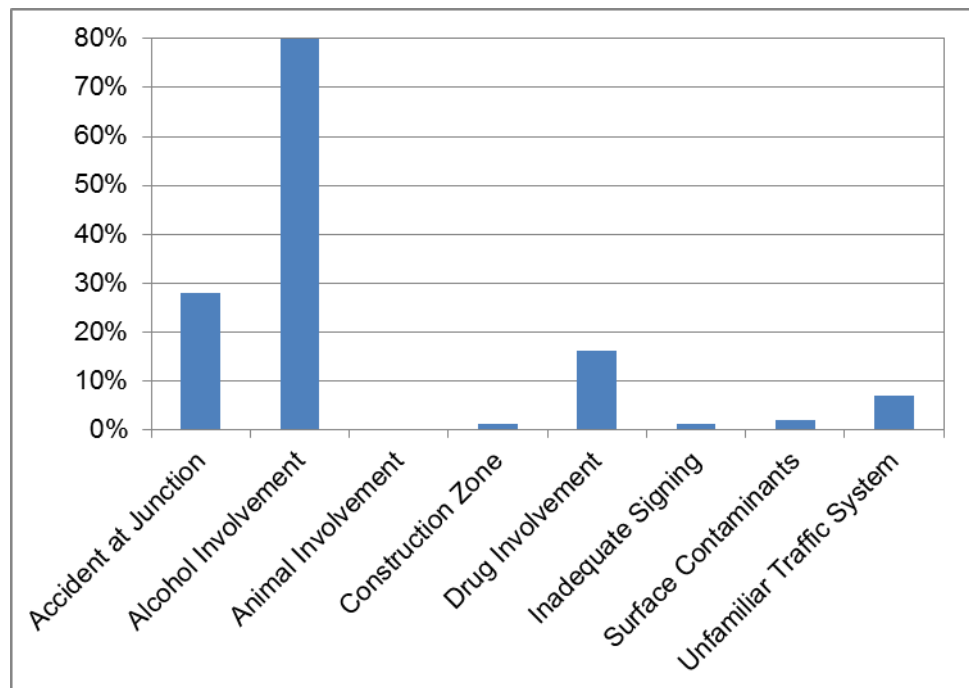


44% of 'under influence' accidents were fatal.

Source: SafetyNet Accident Causation Database

Figure 24 shows that only 10% of 'under influence' accidents resulted in no injuries, 62% were serious or fatal. 51% of 'under influence' accidents happened at night, compared to 18% when all cases are included.

Figure 25: Circumstantial Factors



Source: SafetyNet Accident Causation Database

Only 28% of 'under influence' accidents occurred at junctions, compared to 48% when all cases are included. 80% of accidents had alcohol involvement and 16% other drug involvement.

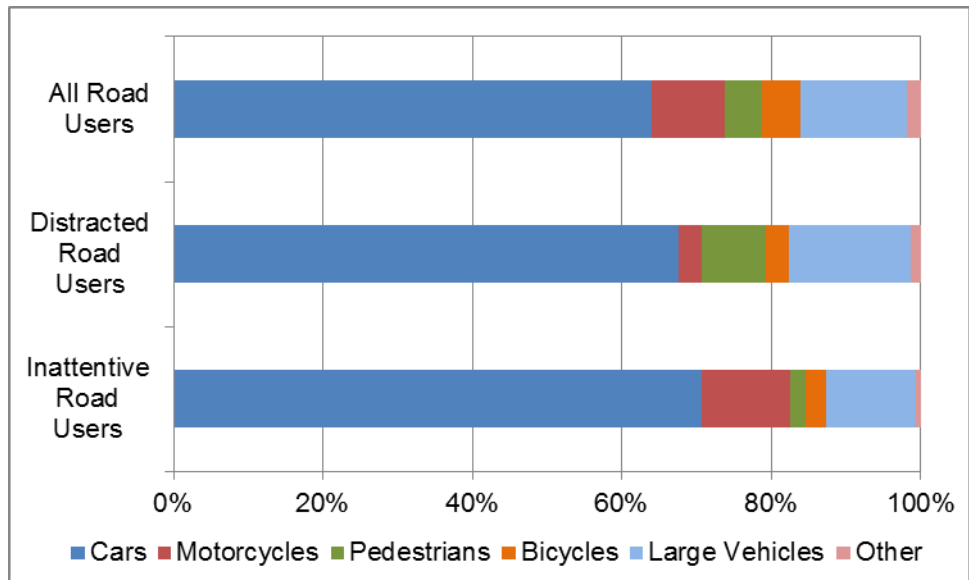
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Distraction and Inattention

32% of crashes recorded in the database involved at least one driver, rider or pedestrian who had been described as being distracted and/or inattentive. 222 road users were assigned the code 'Distraction' and 143 were assigned 'Inattention'. 628 road users were involved, of which 68% were male and the average age was 41.

Distraction or inattention most often led to 'Timing' (41%) or 'Direction' (21%) critical events.

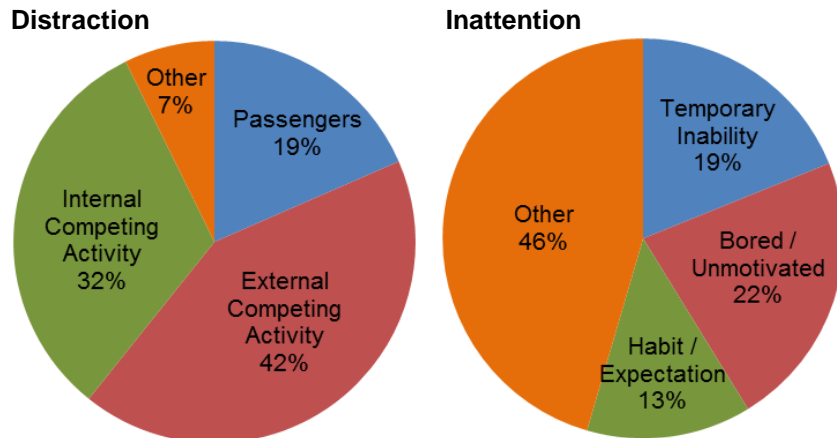
Figure 26: Distribution of vehicle types within distraction or inattention cases



Source: SafetyNet Accident Causation Database

Figure 26 shows that for 'Distraction', cars, large vehicles and pedestrians had a higher proportion of accidents compared to when all accidents are included. For 'Inattention', cars and motorcycles had a higher percentage than average.

Figure 27: Distribution of causes for distraction or inattention cases



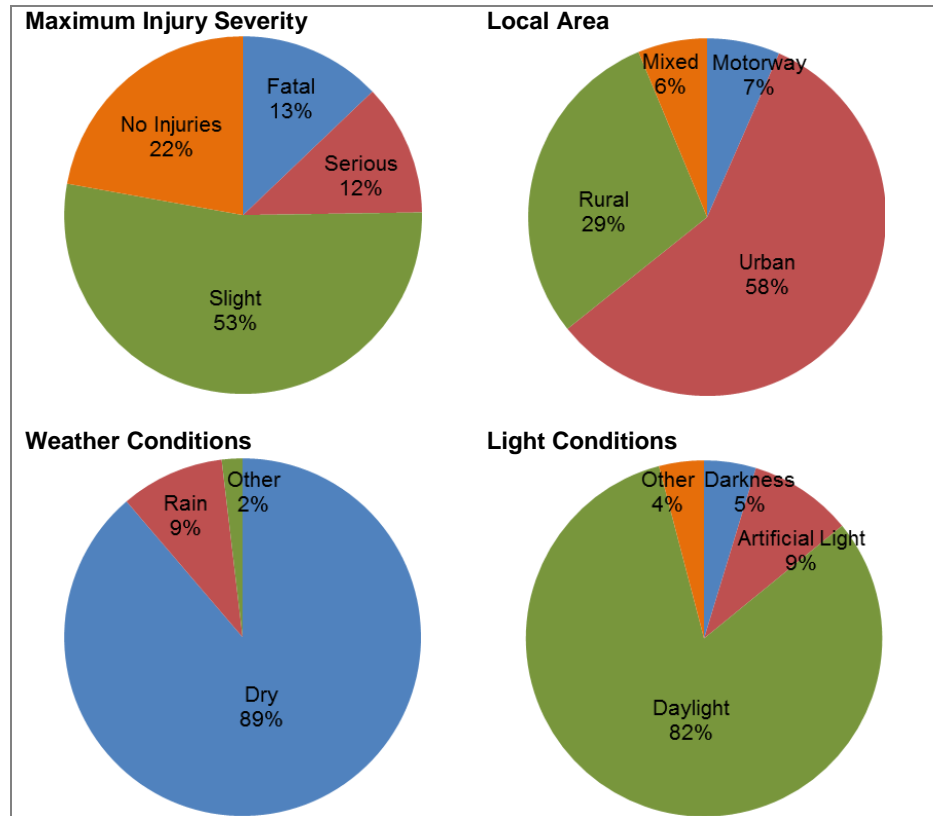
Source: SafetyNet Accident Causation Database 2005 to 2008 / EC

Figure 27 shows that within the 'Distraction' category the most common distractions were 'external' or 'internal competing activities'. Within 'Attention' the most common sub-factors were 'other' (unknown) and 'bored / unmotivated'.

32% of accidents had distraction or inattention as one of the contributing causes.

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Figure 28: Accident Conditions

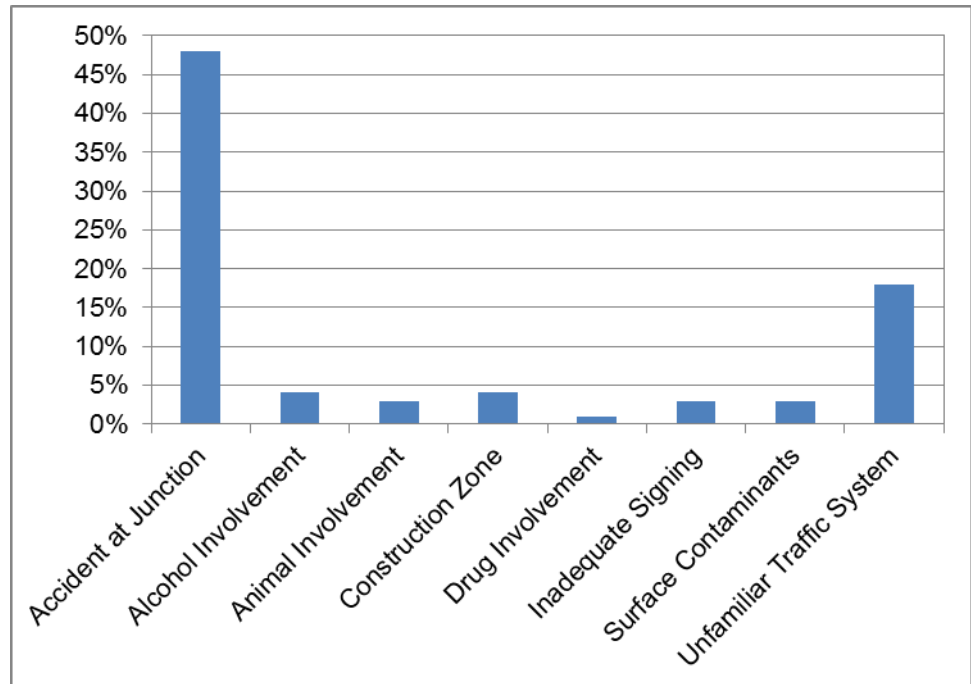


Source: SafetyNet Accident Causation Database

13% of distraction / inattention accidents were fatal.

Figure 28 shows that only 22% of distraction/inattention accidents resulted in no injuries, 25% were serious or fatal.

Figure 29: Circumstantial Factors



Source: SafetyNet Accident Causation Database

According to Figure 29 only 5% of distraction/inattention accidents also had alcohol or drug involvement. 18% of accidents were in unfamiliar traffic systems.

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Disclaimer

The information in this document is provided as it is and no guarantee or warranty is given that the information is fit for any particular purpose, Therefore, the reader uses the information at their own risk and liability.

For more information

Detailed data on traffic accidents are published annually by the European Commission in the Annual Statistical Report. This includes a glossary of definitions on all variables used.

More information on the DaCoTA Project, co-financed by the European Commission, Directorate-General for Mobility and Transport is available at the DaCoTA Website: <http://www.dacota-project.eu/index.html>.

Further statistical information about fatalities is available from the CARE database at the Directorate General for Energy and Transport of the European Commission, 28 Rue de Mot, B -1040 Brussels.

Traffic Safety Basic Fact Sheets available from the European Commission concern:

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Definition of Accident Types

The accident type classification determines the specific accident type from seven separate accident classes and represents the conflict situation which led to the accident, not the accident manner or the accident cause. The seven accident classes are:

- Type 1: Driving Accident – the accident occurred due to loss of control over the vehicle, without the involvement of other road users. (This can however have led to a crash with another road user).
- Type 2: Turning Off Accident – the accident occurred due to a conflict between a turning off road user and a road user coming from the same or opposite direction at crossings, junctions, parking lots etc.
- Type 3: Turning In / Crossing Accident – the accident occurred due to a conflict between a turning in or crossing road user without priority and a vehicle with priority at crossings, junctions, parking lots etc.
- Type 4: Pedestrian Accident – the accident occurred due to a conflict between a vehicle and a pedestrian on the road, unless he was walking in a lateral direction and unless the vehicle was turning in.
- Type 5: Accident with Parking Vehicles – the accident occurred due to a conflict between a moving vehicle and a vehicle which is parking or has stopped.
- Type 6: Accident in Lateral Traffic – the accident occurred due to a conflict between road users moving in the same or opposite direction unless this conflict applies to another type of accident.
- Type 7: Other Accident Type – accidents that cannot be assigned to types 1 – 6.

Please refer to this report as follows:
 Thomas P., et al. (2012) Basic Fact Sheet "Accident Causation", Deliverable D3.9 of the EC FP7 project DaCoTA.

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