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# **Data Science**

## **Road Accidents in the United Kingdom**

Tobias Kremeyer, Farid Razai, Alexander Fertig

4. December 2019

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# 1. Presentation of the data set

# 1.2 Million

[1]

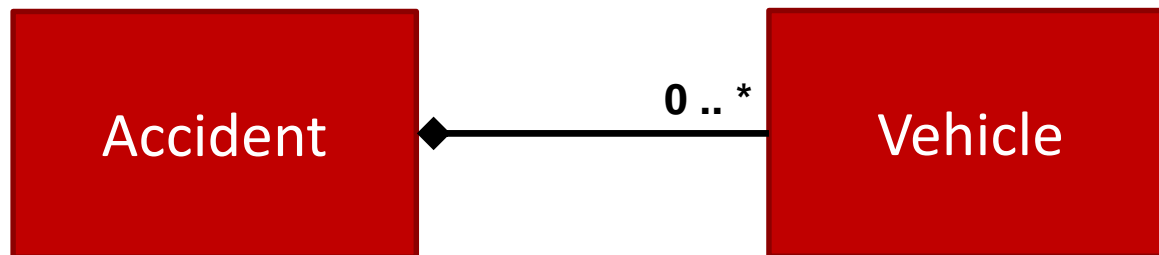
# 1. Presentation of the data set

## UK-Road-Safety: Traffic Accidents [2] [3]

- Department of Transport (UK-Gov)
- 2005 - 2017
- 2.177.000 Vehicles
- 2.045.000 Accidents
- Around 108 attributes per instance

## 2. Data curation

- Organizing and sorting values
- Exclude irrelevant data
- Union of redundant values
- Join by *Vehicles* and *Accidents* data by ID



## 2. Data curation

- A lot of 1-to-N categorical variables
  - Create N binary variables

```
> levels(accidents$Special_Conditions_at_Site)
[1] "None"
[2] "Auto signal part defective"
[3] "Auto traffic signal - out"
[4] "Mud"
[5] "Oil or diesel"
[6] "Road sign or marking defective or obscured"
[7] "Road surface defective"
[8] "Roadworks"
```

## 2. Data curation

- Different levels that all mean “no information”
  - Map all of them to NA

```
> levels(accidents$weather_conditions)
[1] "Data missing or out of range" "Fine + high winds"
[3] "Fine no high winds"         "Fog or mist"
[5] "other"                       "Raining + high winds"
[7] "Raining no high winds"      "Snowing + high winds"
[9] "Snowing no high winds"      "Unknown"
```

## 2. Data curation

- Composed variables
  - Create new separated variables
    - Precipitation
    - High\_Winds

```
> levels(accidents$weather_conditions)
[1] "Data missing or out of range" "Fine + high winds"
[3] "Fine no high winds"          "Fog or mist"
[5] "Other"                       "Raining + high winds"
[7] "Raining no high winds"       "Snowing + high winds"
[9] "Snowing no high winds"       "Unknown"
```



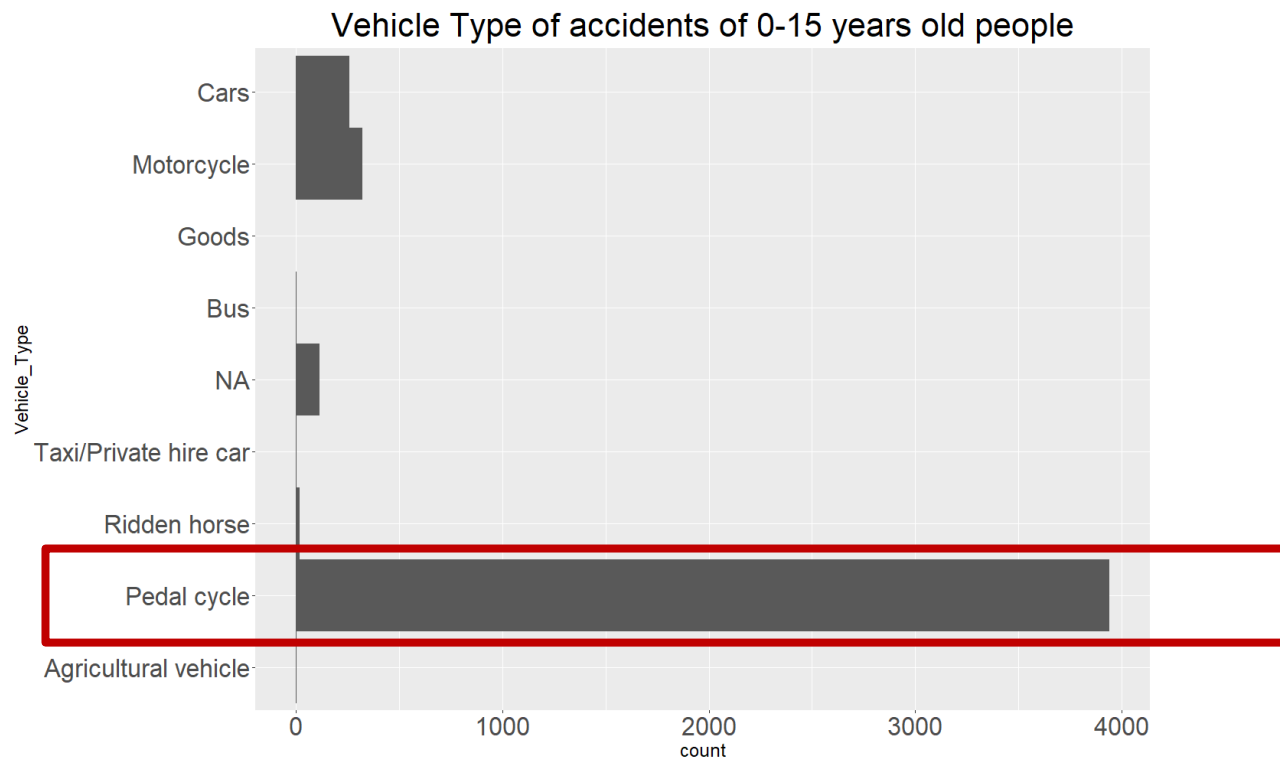
## 2. Data curation

- Surprising values
  - 0 – 15 year old drivers ?!



## 2. Data curation

- Surprising values



# 3. Data exploration

3.1. Accidents associated with age groups

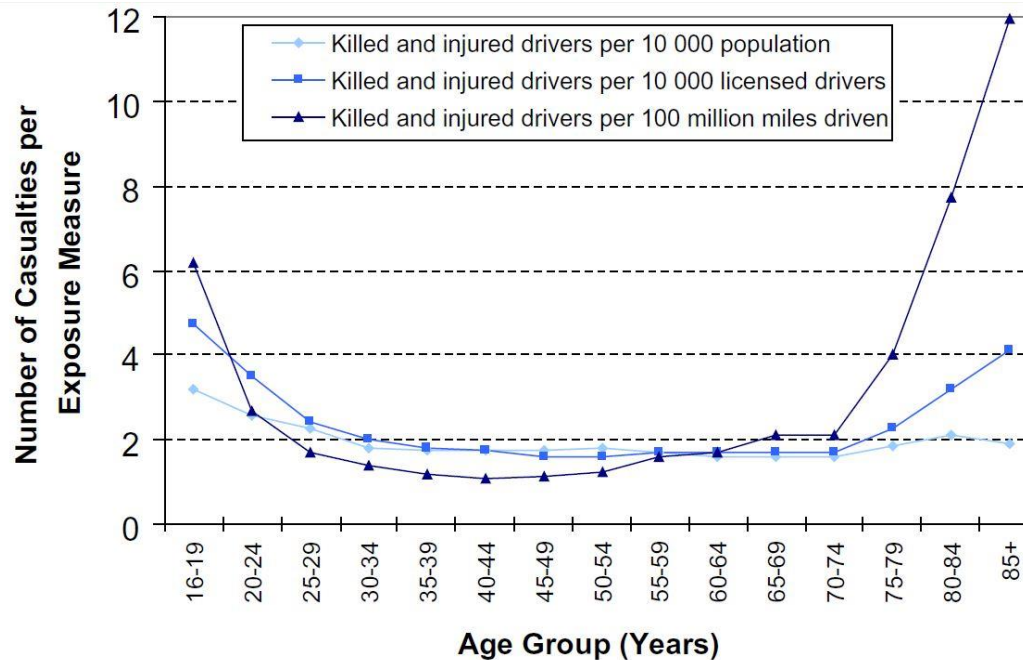
3.2. Driving accidents associated with special conditions

3.3. Visualized within a map

3.4. Market analysis

# 3.1. Accidents associated with age groups

US driver fatalities and injuries for different age groups [4].



## Young Drivers

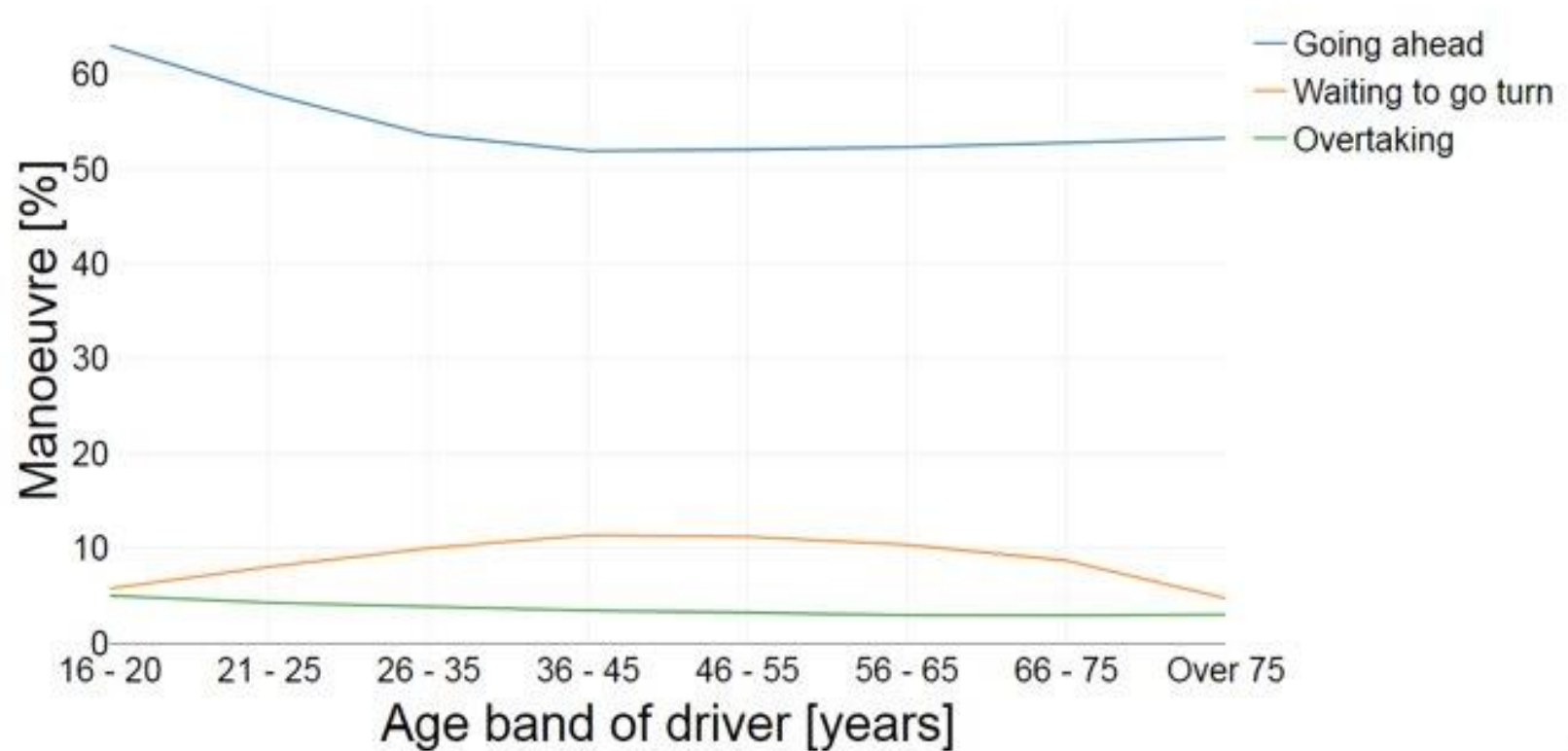
- Alcohol and drugs [5]
- Spedding [6]

## Older Drivers:

- ???

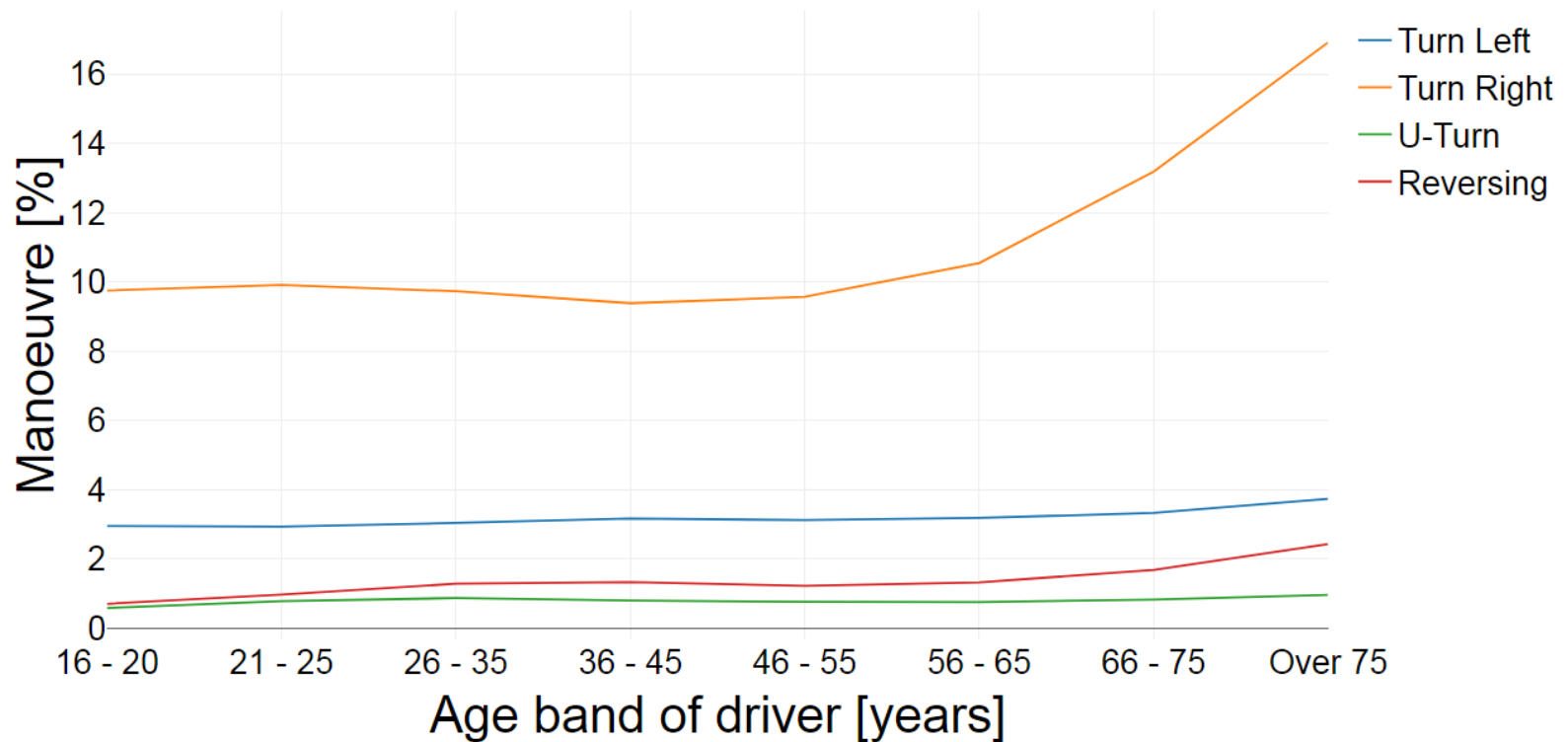
# 3.1. Accidents associated with age groups

## Accident manoeuvres wrt age



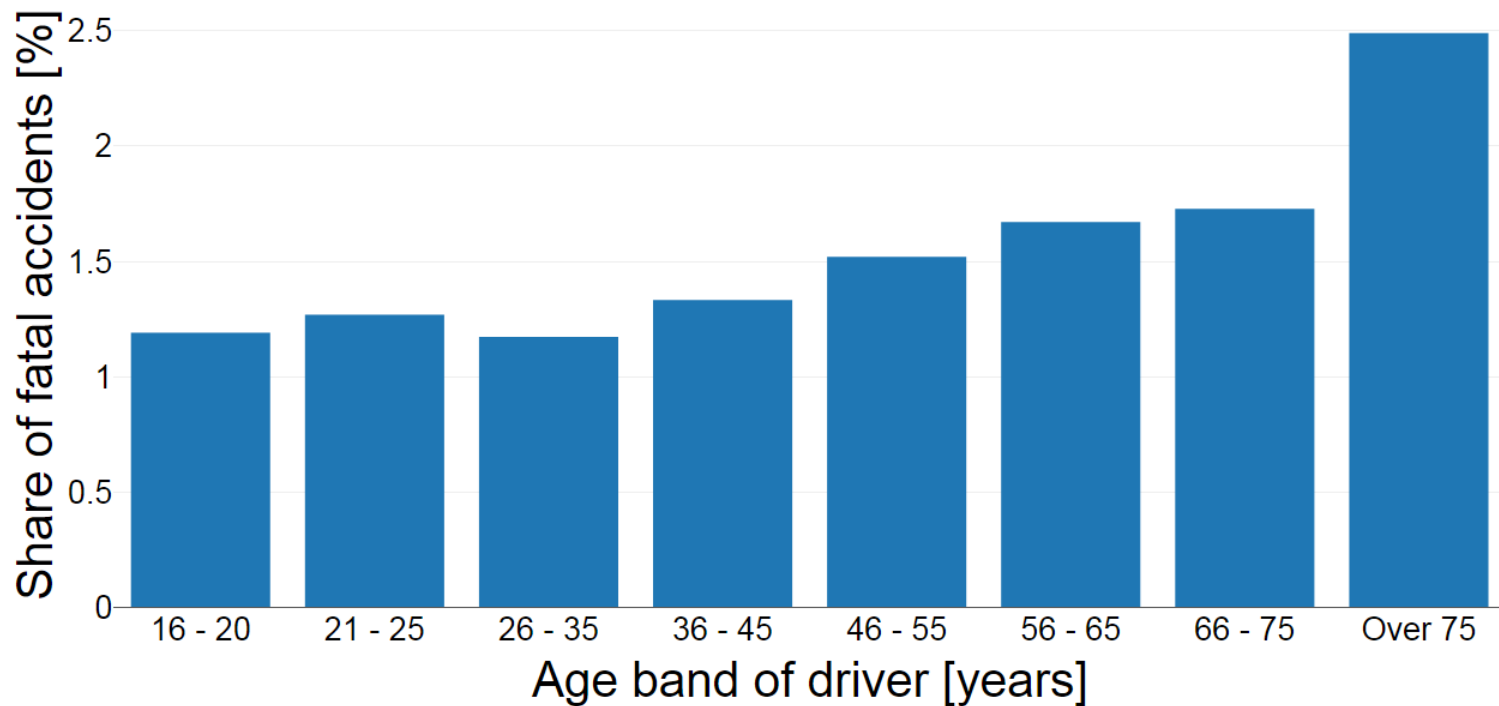
# 3.1. Accidents associated with age groups

## Accident manoeuvres wrt age



# 3.1. Accidents associated with age groups

## Fatal accidents wrt age



## 3.1. Accidents associated with age groups

Possible causes for higher risk for elderly drivers:

- Reduction in visual, cognitive and mobility functions
- Medical conditions [7]



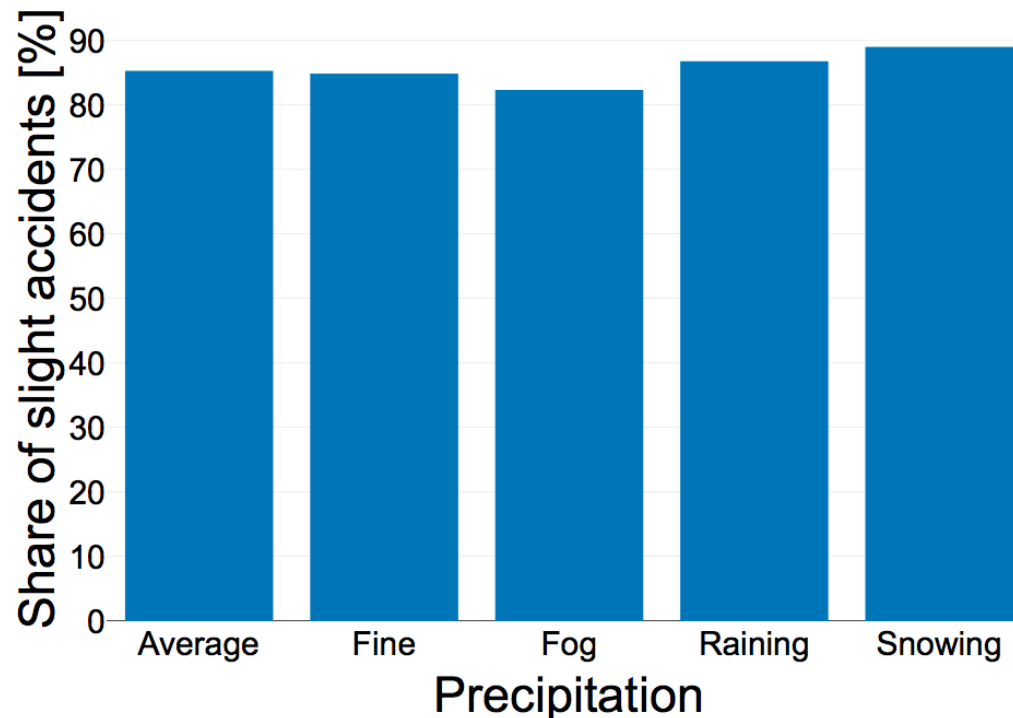
Action by the UK-Gov:

Drivers 70+ must renew their license every 3 years and make an eye-test [8]



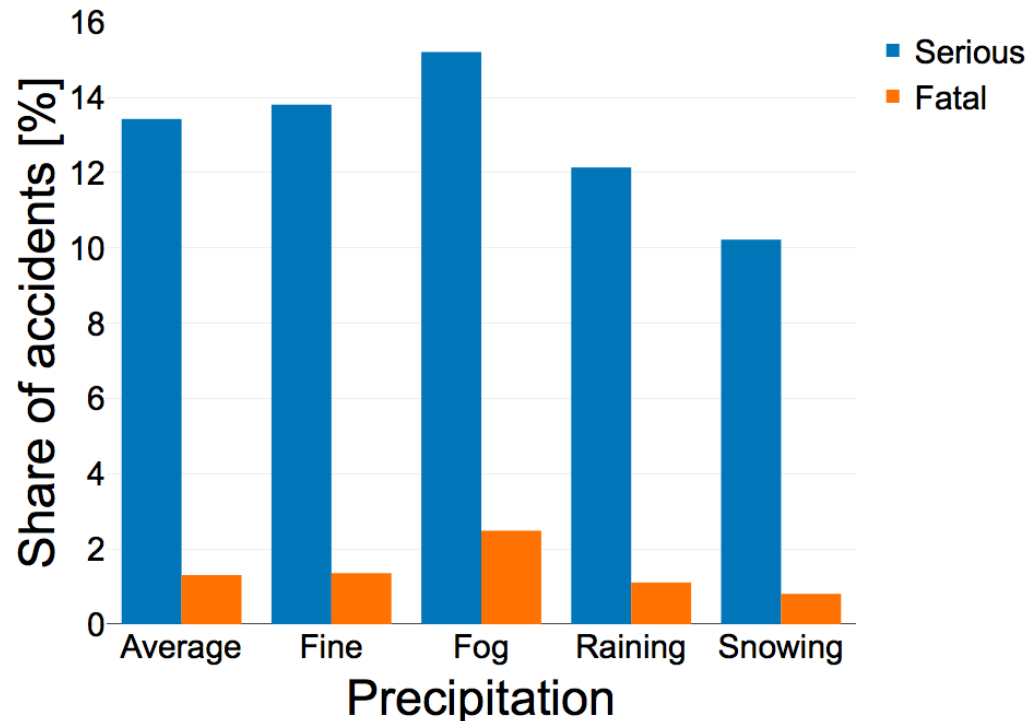
## 3.2. Accidents associated with special conditions

### Precipitation: Slight accidents



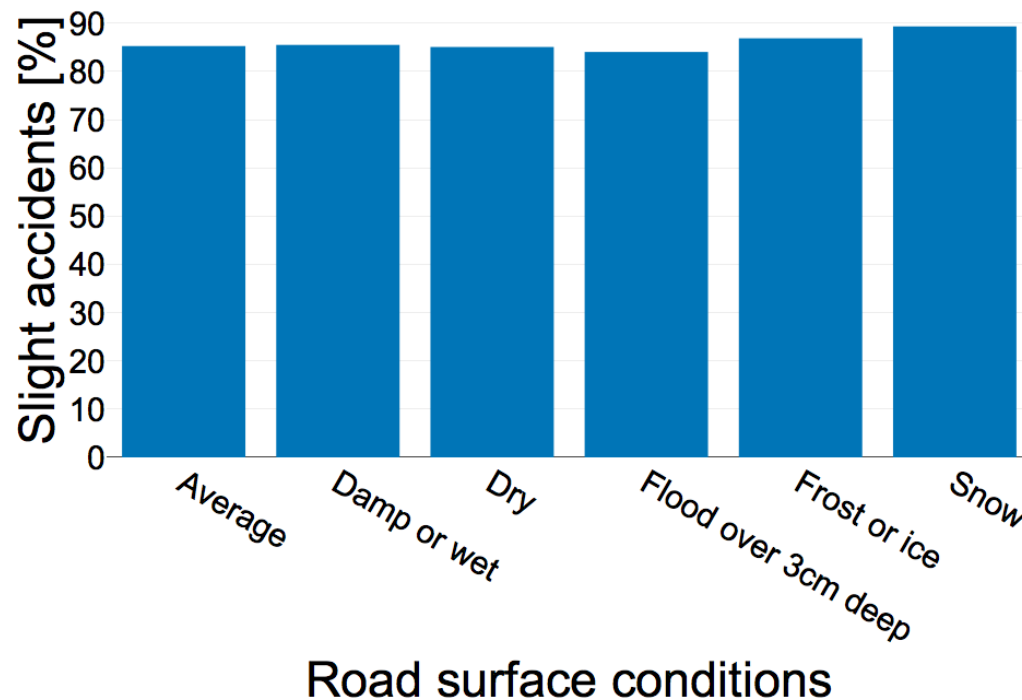
## 3.2. Accidents associated with special conditions

### Precipitation: Serious and fatal accidents



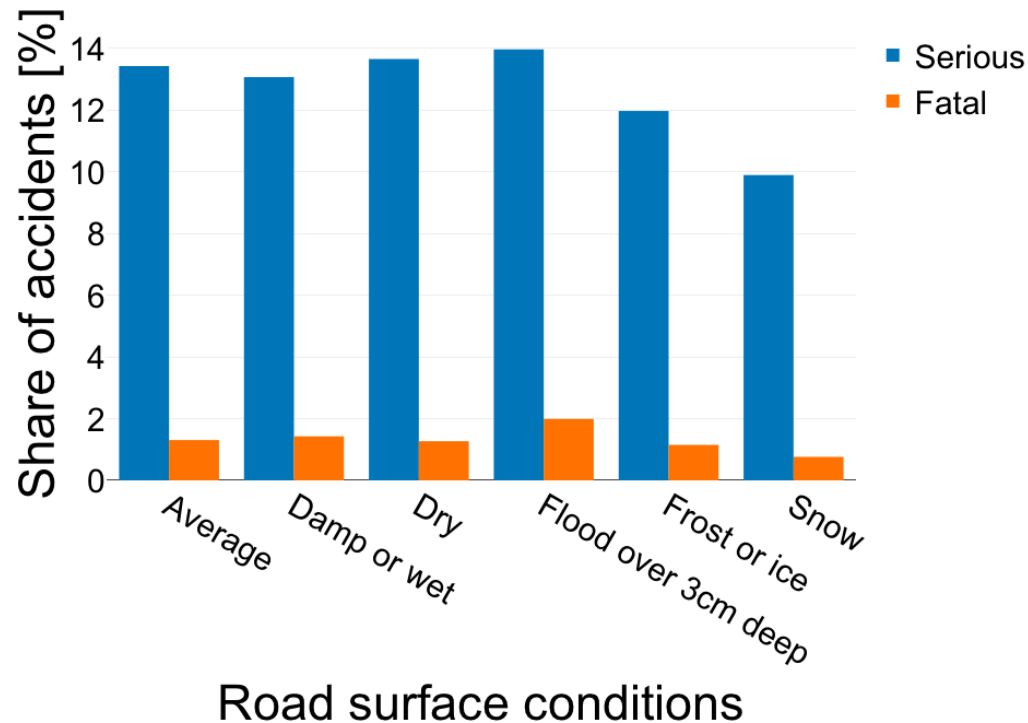
## 3.2. Accidents associated with special conditions

### Road Surface Conditions: Slight accidents



## 3.2. Accidents associated with special conditions

### Road Surface Conditions: Serious and fatal accidents



## 3.2. Accidents associated with special conditions

Possible causes for severity associated to conditions:

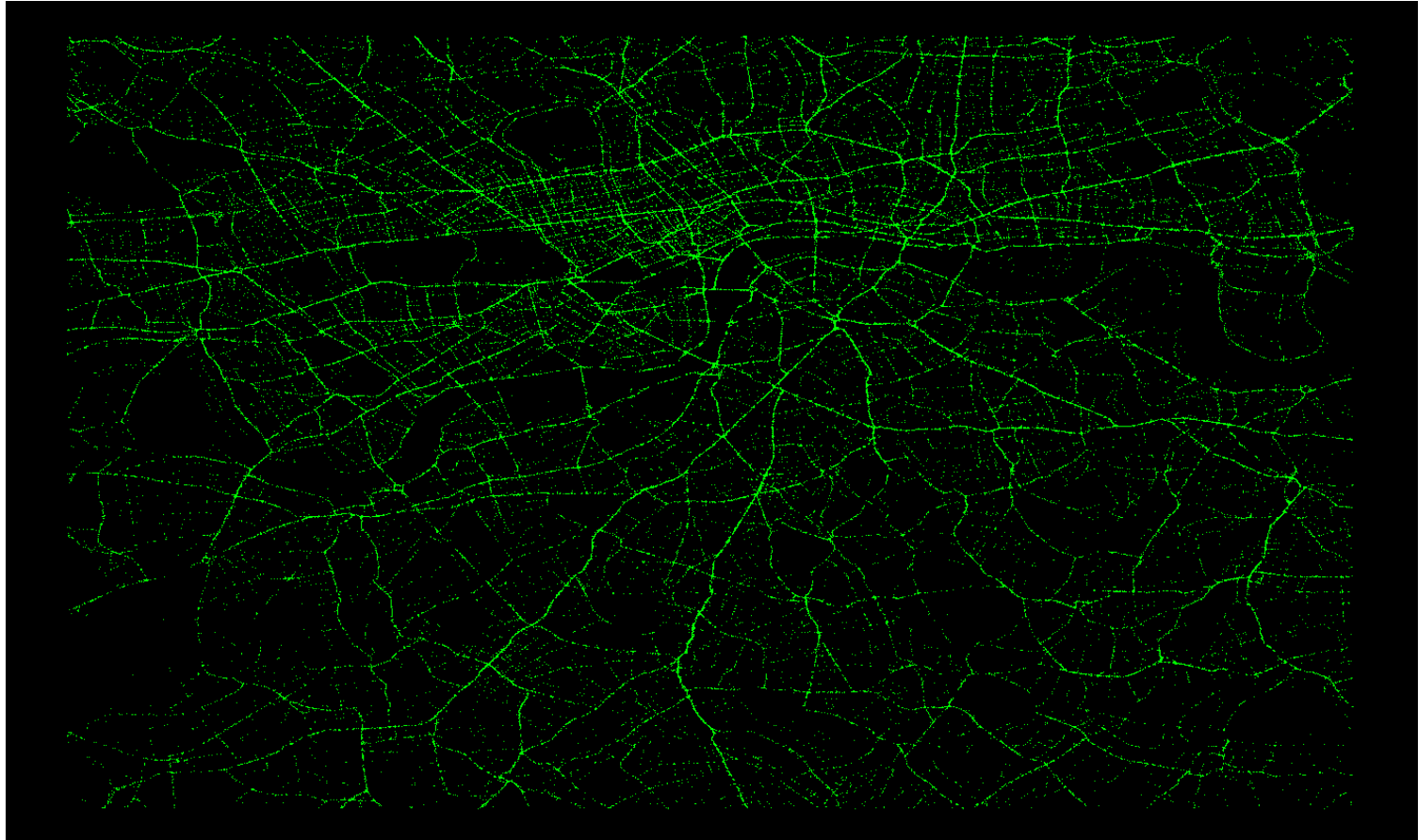
- Higher attentiveness during snow leads to reduced velocity
- Poor sight during fog leads to shorter stopping distance



Better lighting during fog could reduce severity of accidents

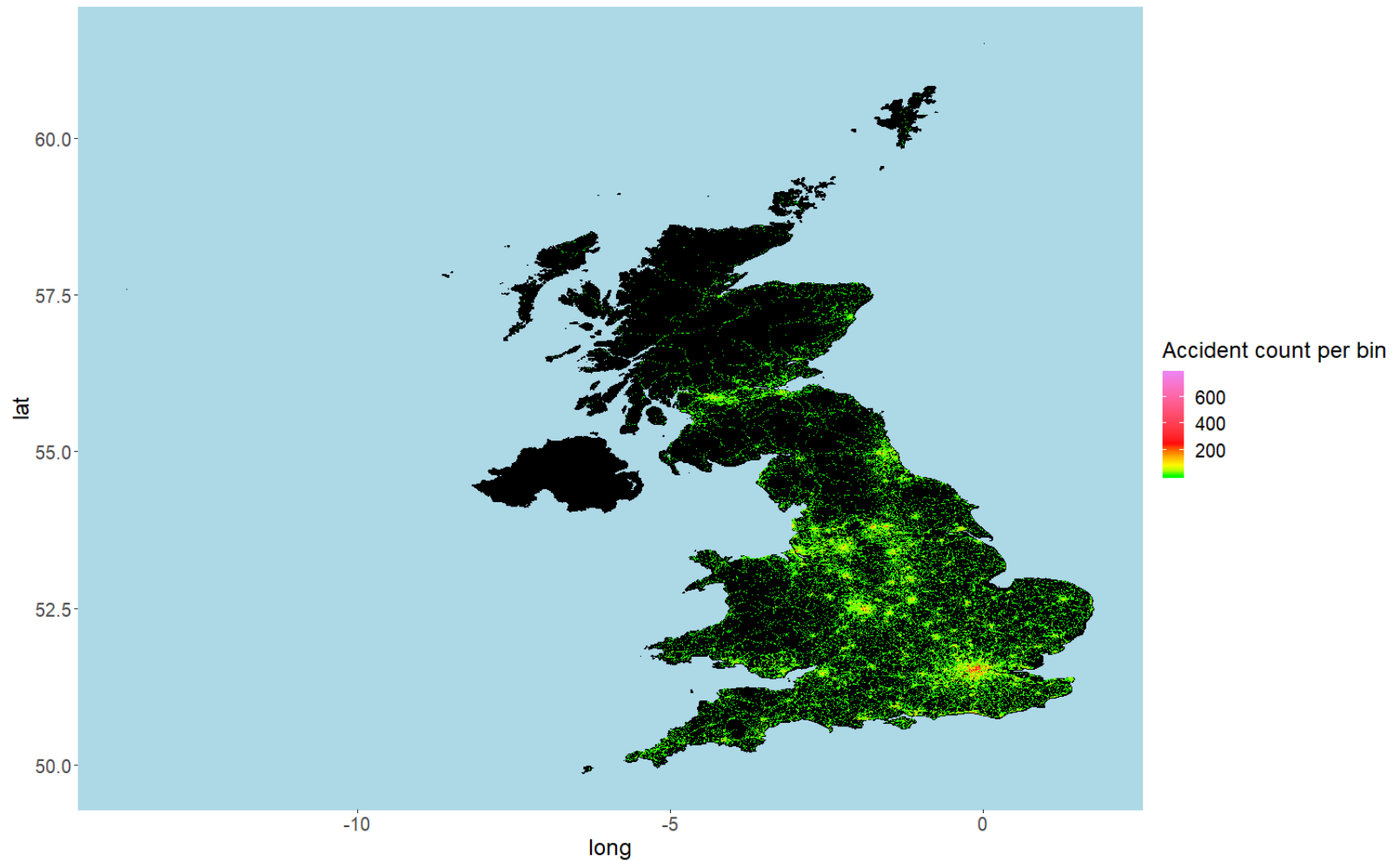
Advise drivers to reduce velocity during fog

## 3.3. Visualized within a Map



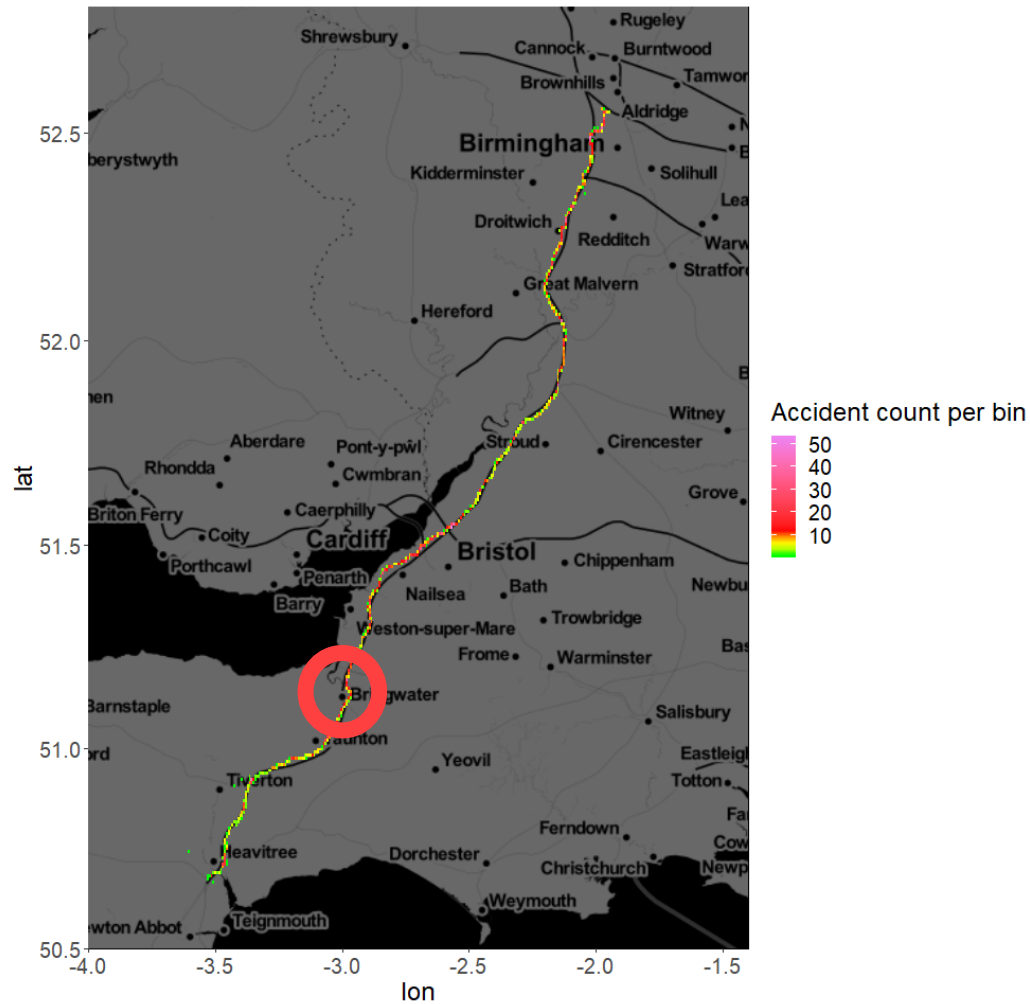
# Distribution of road accidents in UK

Bins of width  $0.005^\circ \times 0.005^\circ$



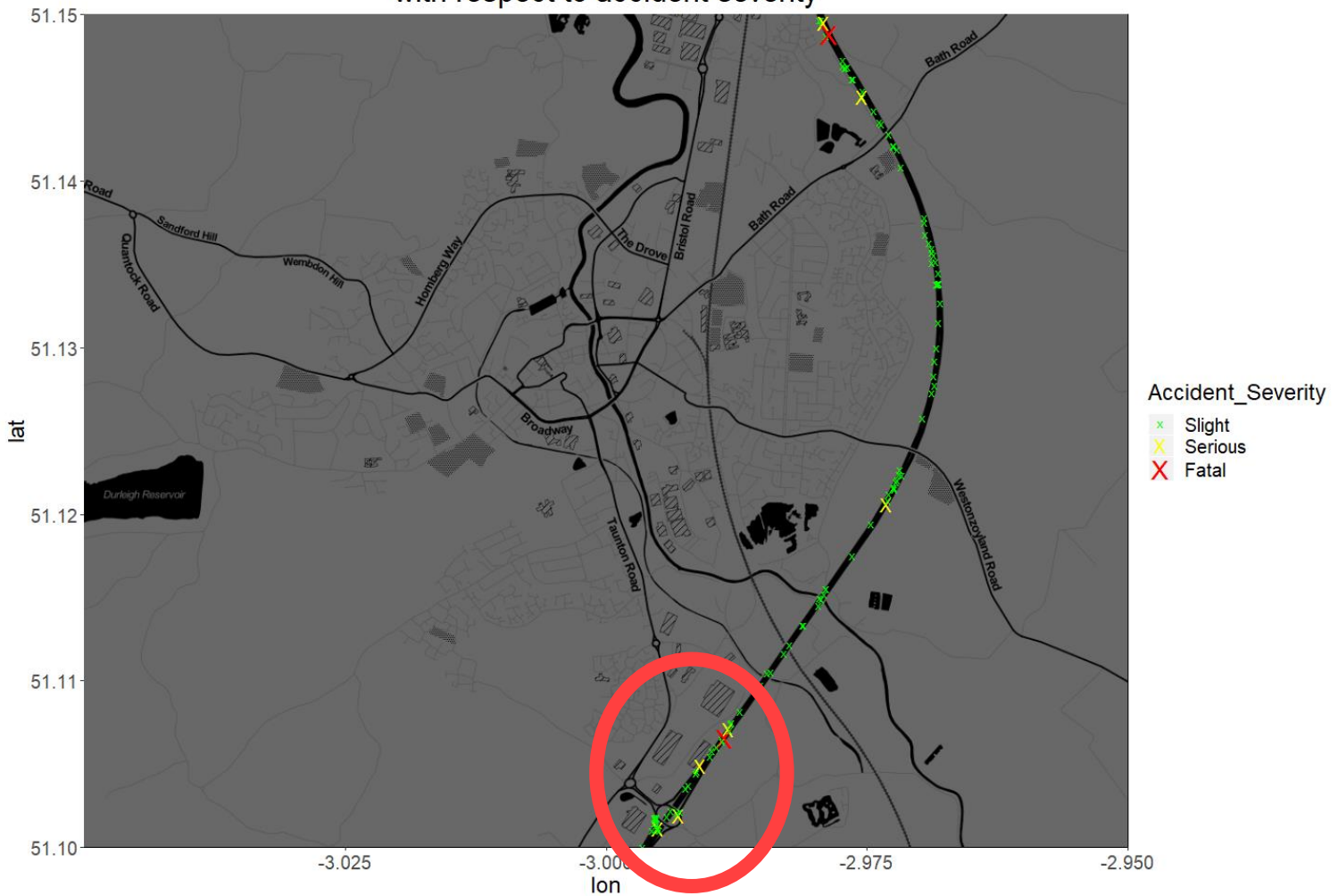
# Distribution of accidents on Motorway 5

Bins of width  $0.0075^\circ \times 0.0075^\circ$

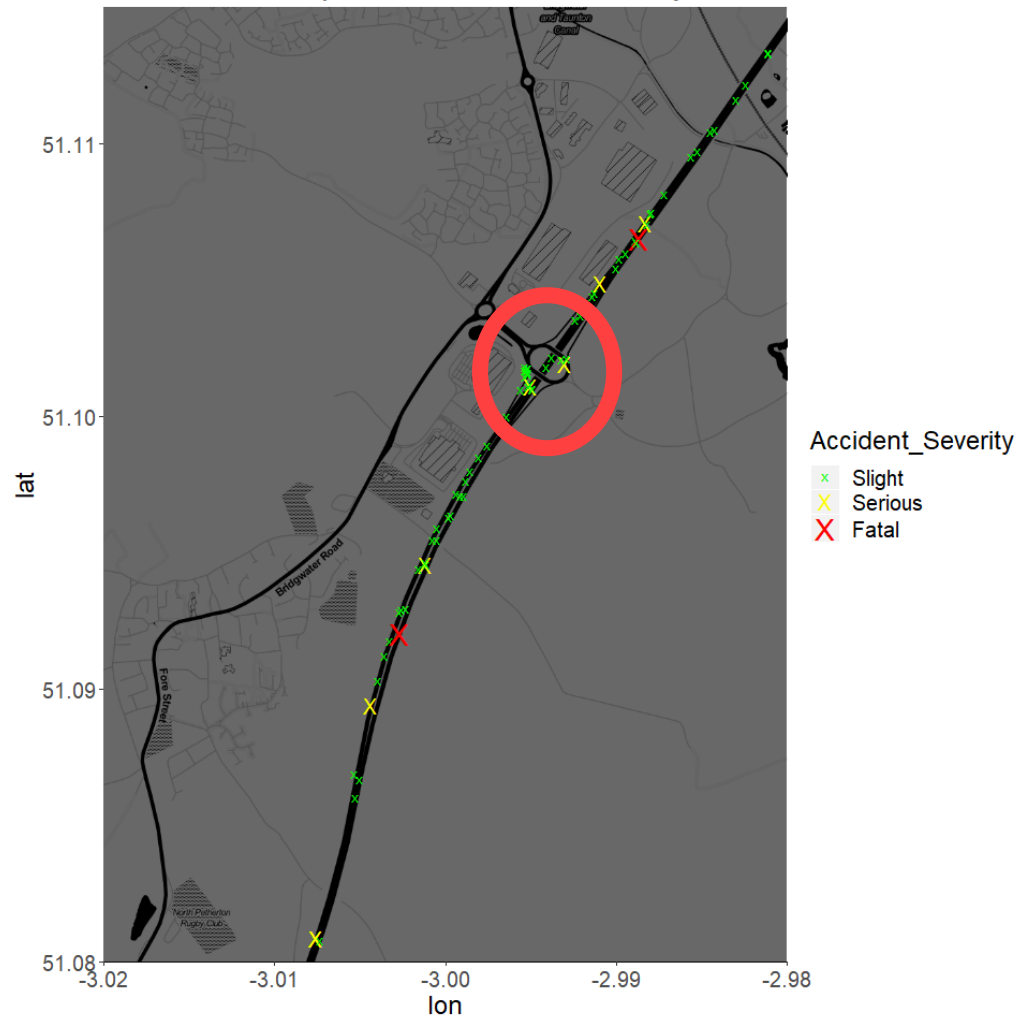




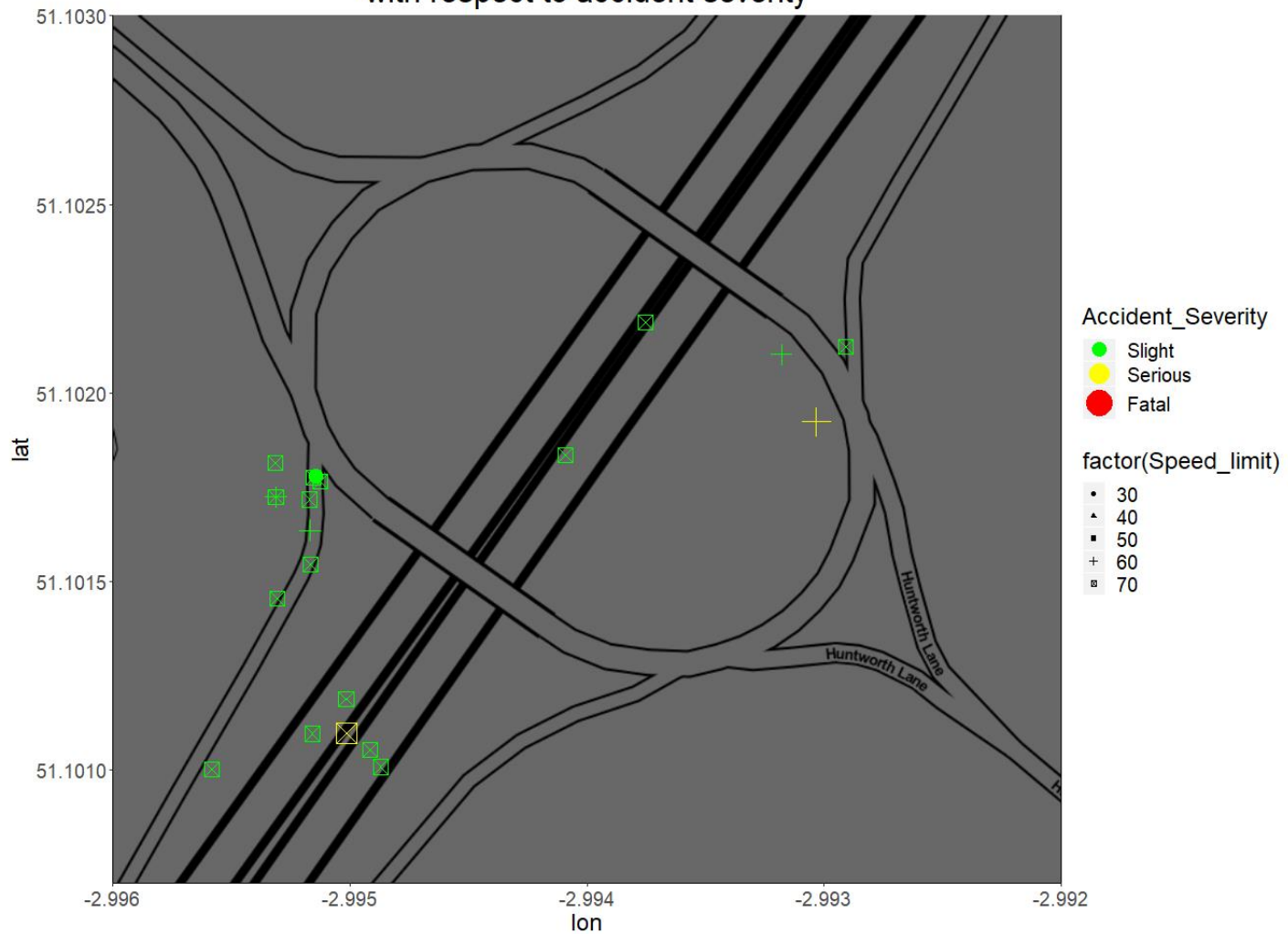
## Road Accidents in Bridgwater on Motorway 5 with respect to accident severity



## Road Accidents in Bridgwater on Motorway 5 with respect to accident severity



## Road Accidents in Bridgwater on Motorway 5 with respect to accident severity



# 3.4. Market Analysis and Research



## Urban navigation beyond shortest route: The case of safe paths

Esther Galbrun <sup>a</sup>, Konstantinos Pelechrinis <sup>b,✉</sup>, Evimaria Terzi <sup>a</sup>

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<https://doi.org/10.1016/j.is.2015.10.005>

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### (19) United States

(12) **Patent Application Publication**  
**Kortge et al.**

(10) **Pub. No.: US 2006/0247852 A1**  
(43) **Pub. Date: Nov. 2, 2006**

(54) **SYSTEM AND METHOD FOR PROVIDING SAFETY-OPTIMIZED NAVIGATION ROUTE PLANNING**

#### Publication Classification

(51) **Int. Cl.**  
**G01C 21/34** (2006.01)  
(52) **U.S. Cl.** ..... **701/209; 701/211; 340/995.19**

(76) Inventors: **James M. Kortge**, Ferndale, MI (US);  
**Jing Zhang**, Grosse Pointe Park, MI (US)

### (12) United States Patent **Kozak**

(10) **Patent No.: US 6,415,226 B1**  
(45) **Date of Patent: Jul. 2, 2002**

(54) **METHOD AND SYSTEM FOR PROVIDING SAFE ROUTES USING A NAVIGATION SYSTEM**

#### FOREIGN PATENT DOCUMENTS

EP 0 745 788 A1 4/1996  
EP 0 795 700 A2 9/1997

(75) Inventor: **Frank J. Kozak**, Naperville, IL (US)

(73) Assignee: **Navigation Technologies Corp.**, Chicago, IL (US)

#### OTHER PUBLICATIONS

Casparsson et al. "Volcano a revolution in on-board communications," (1998) <http://www.tech2.volvoo.se/reportage/9811volcano/main.htm>.

Melin, "Volvo S80 Electrical system of the future," (1998) <http://www.tech2.volvoo.se/reportage/9811electrical/main.htm>.

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/467,609**

(22) Filed: **Dec. 20, 1999**

*Primary Examiner*—William A. Cuchlinski, Jr.

## 4. Conclusion and Outlook

### ■ **OUT -> OUT:**

- Actionable insights for the government:
  - Harder reapplication process for elderly drivers
  - Adaption of road restrictions based on weather conditions
  - Modification of accident hotspots
- Actionable insights for insurance companies:
  - Adaption of policies for elderly drivers

### ■ **OUT -> IN:**

- App to find a safe route from A to B

# 5. References

- [1] World Health Organization, 2015. *Global Status Report on Road Safety 2015*. Available at: [http://www.who.int/violence\\_injury\\_prevention/road\\_safety\\_status/2015/en/](http://www.who.int/violence_injury_prevention/road_safety_status/2015/en/). (Accessed December 20, 2017)
- [2] UK Government, 2019, <https://data.gov.uk/dataset/cb7ae6f0-4be6-4935-9277-47e5ce24a11f/road-safety-data>
- [3] Thanasis, 2019, [https://www.kaggle.com/tsiaras/uk-road-safety-accidents-and-vehicles#Accident\\_Information.csv](https://www.kaggle.com/tsiaras/uk-road-safety-accidents-and-vehicles#Accident_Information.csv)
- [4] Langford, J., Koppel, S., 2006. *Epidemiology of older driver crashes—identifying older driver risk factors and exposure patterns*. Transp. Res. Part F: Traffic Psychol. Behav. 9 (5), 309–321.
- [5] Bingham, C.R., Shope, J.T., Zhu, J., 2008. *Substance-involved driving: predicting driving after using alcohol, marijuana, and other drugs*. Traffic Inj. Prev. 9 (6), 515–526.
- [6] Gonzales, M.M., Dickinson, L.M., DiGuseppi, L.M., Lowenstein, S.R., 2005. *Student drivers: A study of fatal motor vehicle crashes involving 16-year-old drivers*. Ann. Emerg. Med. 45 (2), 140–146.
- [7] Jonathan, J.R., Shirley, R., Salissou, M, Aidan, F., 2018, *What are the factors that contribute to road accidents? An assessment of law enforcement views, ordinary drivers' opinions, and road accident records*. Accident Analysis & Prevention 115 (2018) 11-24
- [8] Barr, S., 2019, *Drivers over 70 may have to take compulsory eyesight tests in future*, Independent, <https://www.independent.co.uk/life-style/drivers-over-70-elderly-eyesight-test-compulsory-research-department-for-transport-a9035306.html>



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