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SEVILLE
19–21 May 2025
Clean, resilient and connected mobility.

Leveraging naturalistic Connected LCV data for spatial surrogate safety measure applications

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Session: RP 4 Managing traffic safety

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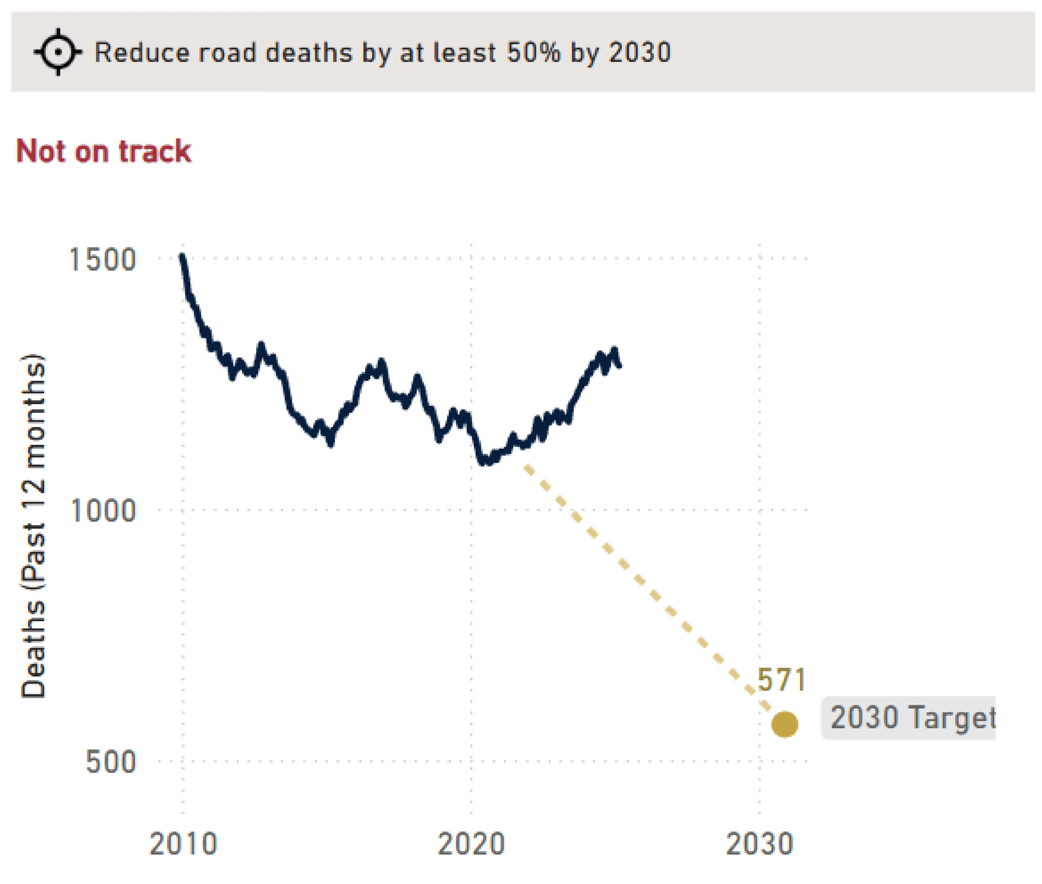
Connected Vehicle data as precursors of crash risk

- Road crashes remain a leading cause of death
- Progress in crash reduction has plateaued
- Traditional crash data is slow and mostly reactive



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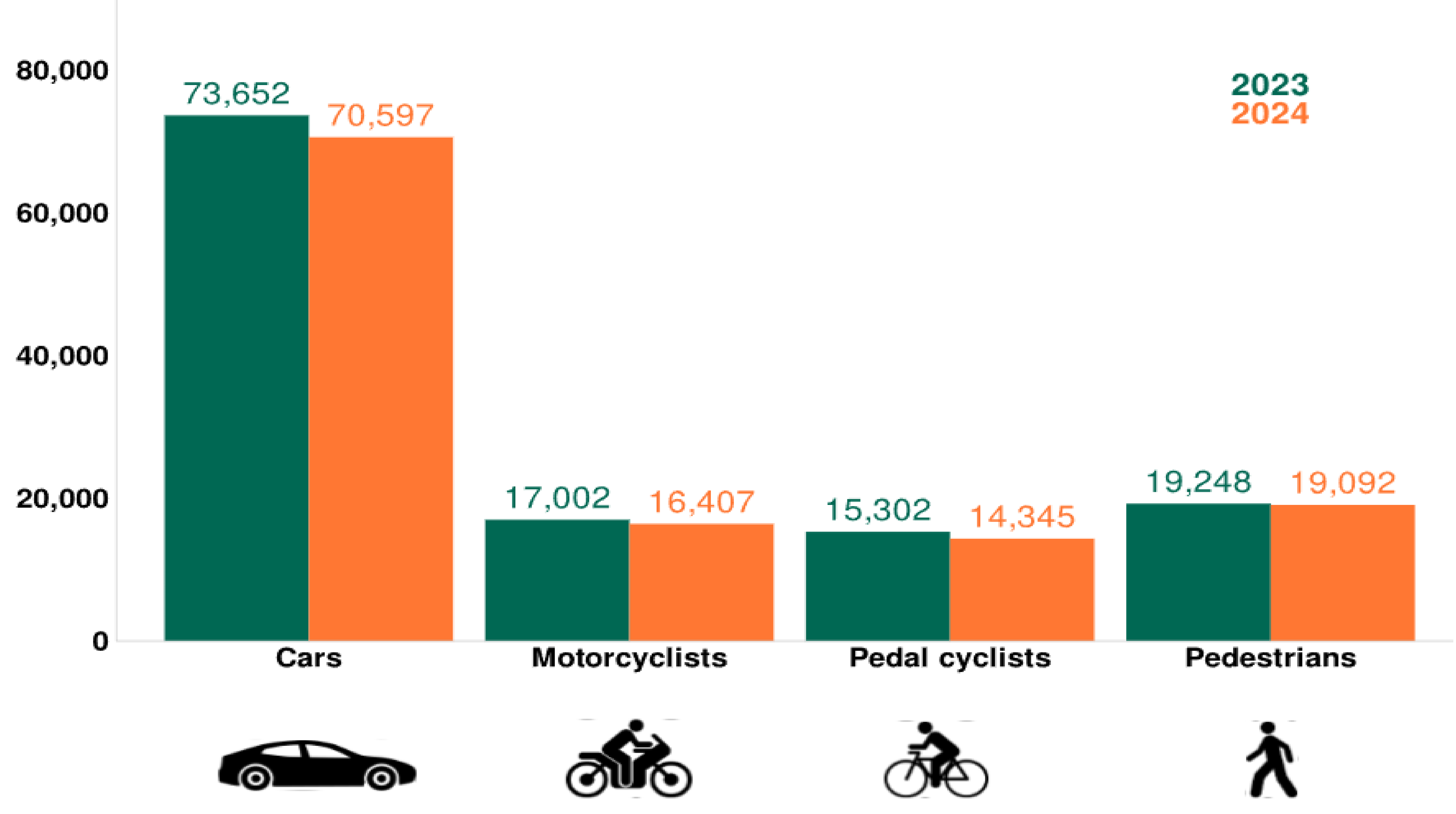

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- Proactive safety analytics is now possible using Connected Vehicle data
- Data from connected vehicles can identify high-risk locations before crashes occur – High braking G-forces
- The data comes directly from the vehicle sensors. The vehicle becomes the road risk detector

Connected LCV’s provide speed & braking data

- A large dataset from Compass IoT containing connected LCVs in Greater London (June – Dec 2024)

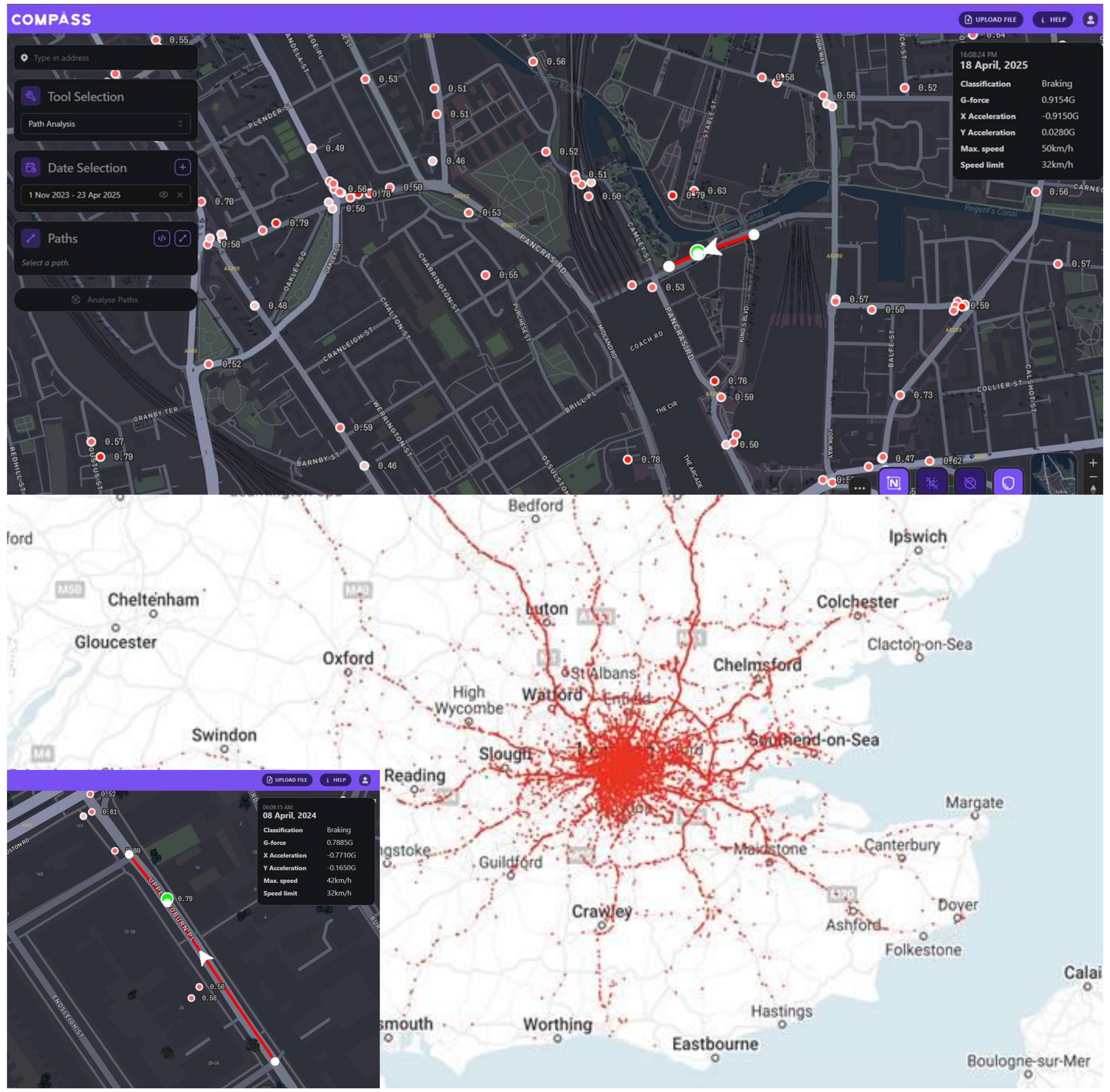
- Data obtained from 57,935 unique LCVs
  Metrics used: time, location, speed, acceleration, braking

- Focused on harsh braking as a surrogate safety measure

- Braking events were compared spatially, using cross-Nearest-Neighbour analysis and Ripley’s Cross K12 function

- Correlation was analyzed between connected LCV harsh braking incidents and crashes

- Map visualizations and spatial analysis indicate crash locations



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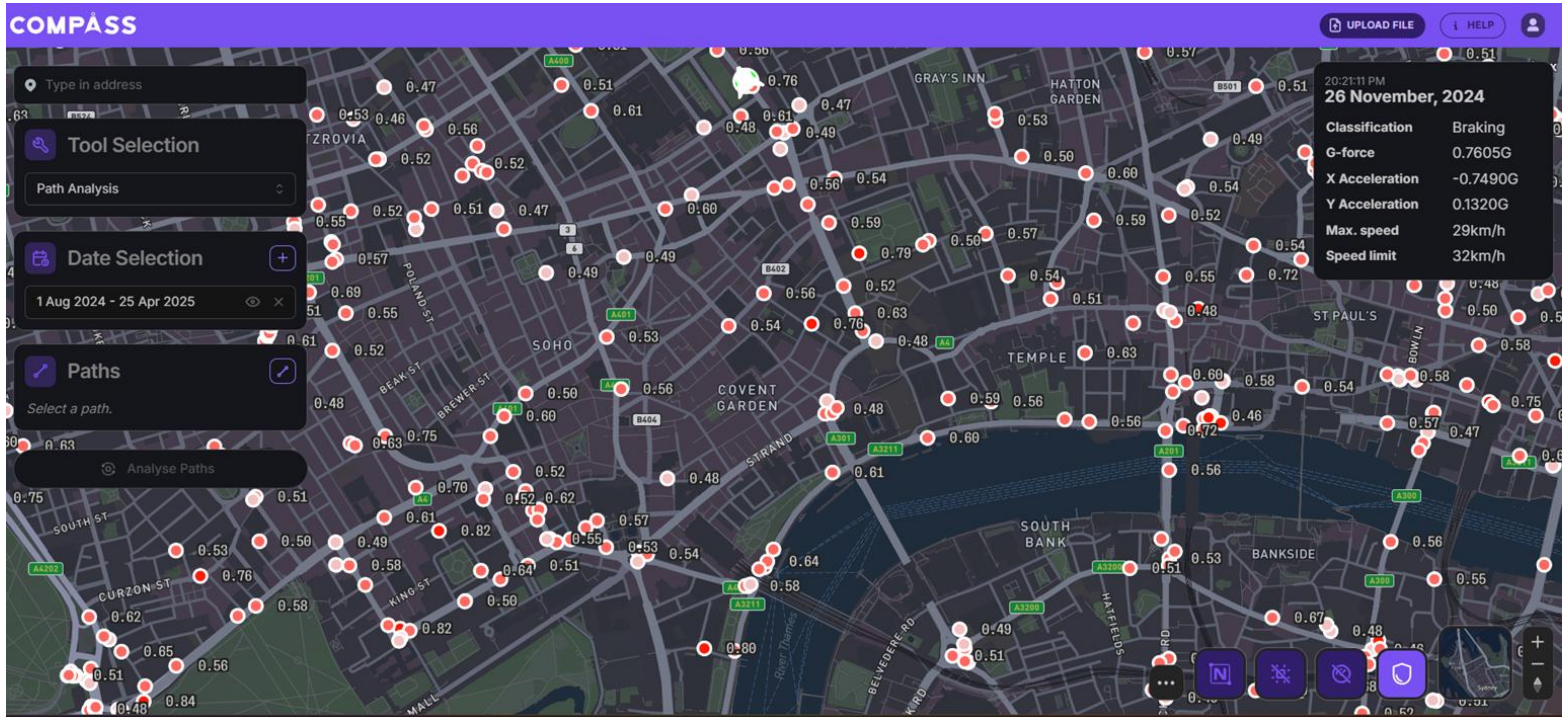
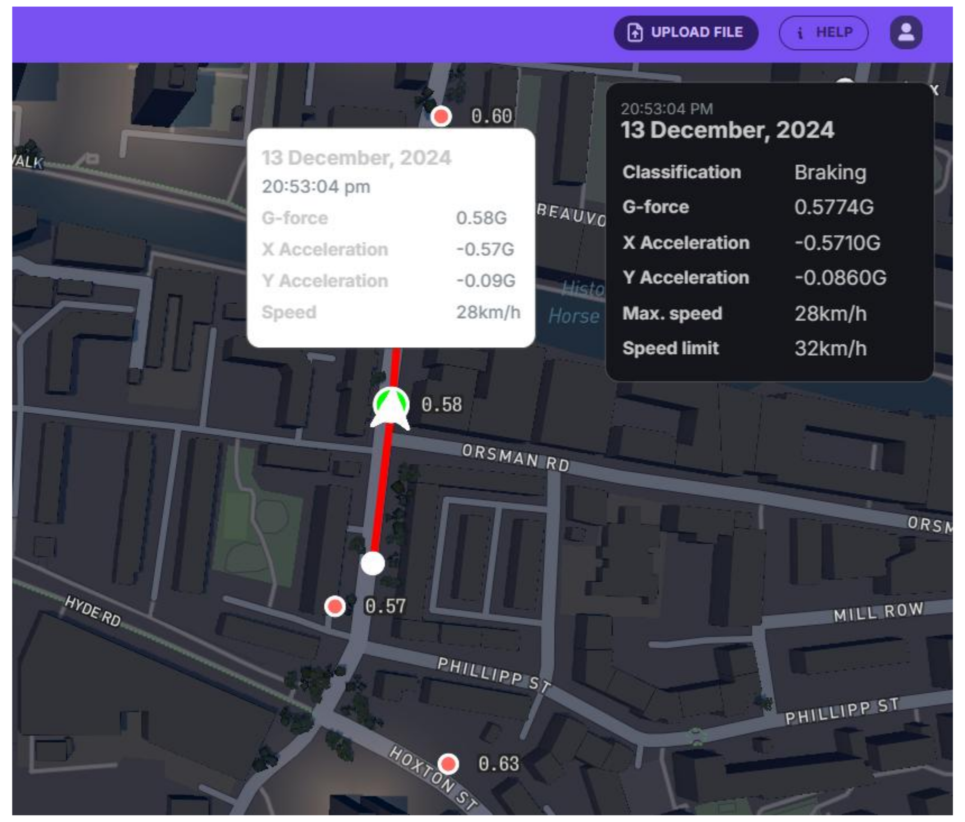
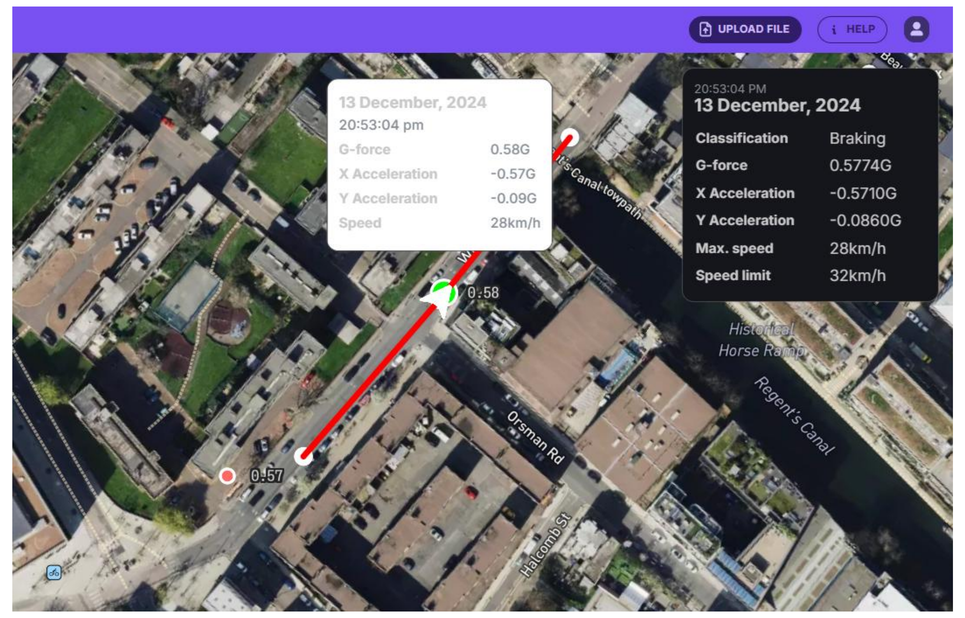
Strong evidence of near misses & crash locations

- Compass IoT provided CV data indicating ‘near misses’ - braking and swerving g-forces
- Evidence of strong Spatial Clustering of braking g-forces matched recorded crashes
- Strong correlation between braking & swerving g-force clusters with crash sites
- Most harsh braking points are within 200 – 500 m of LCV crashes







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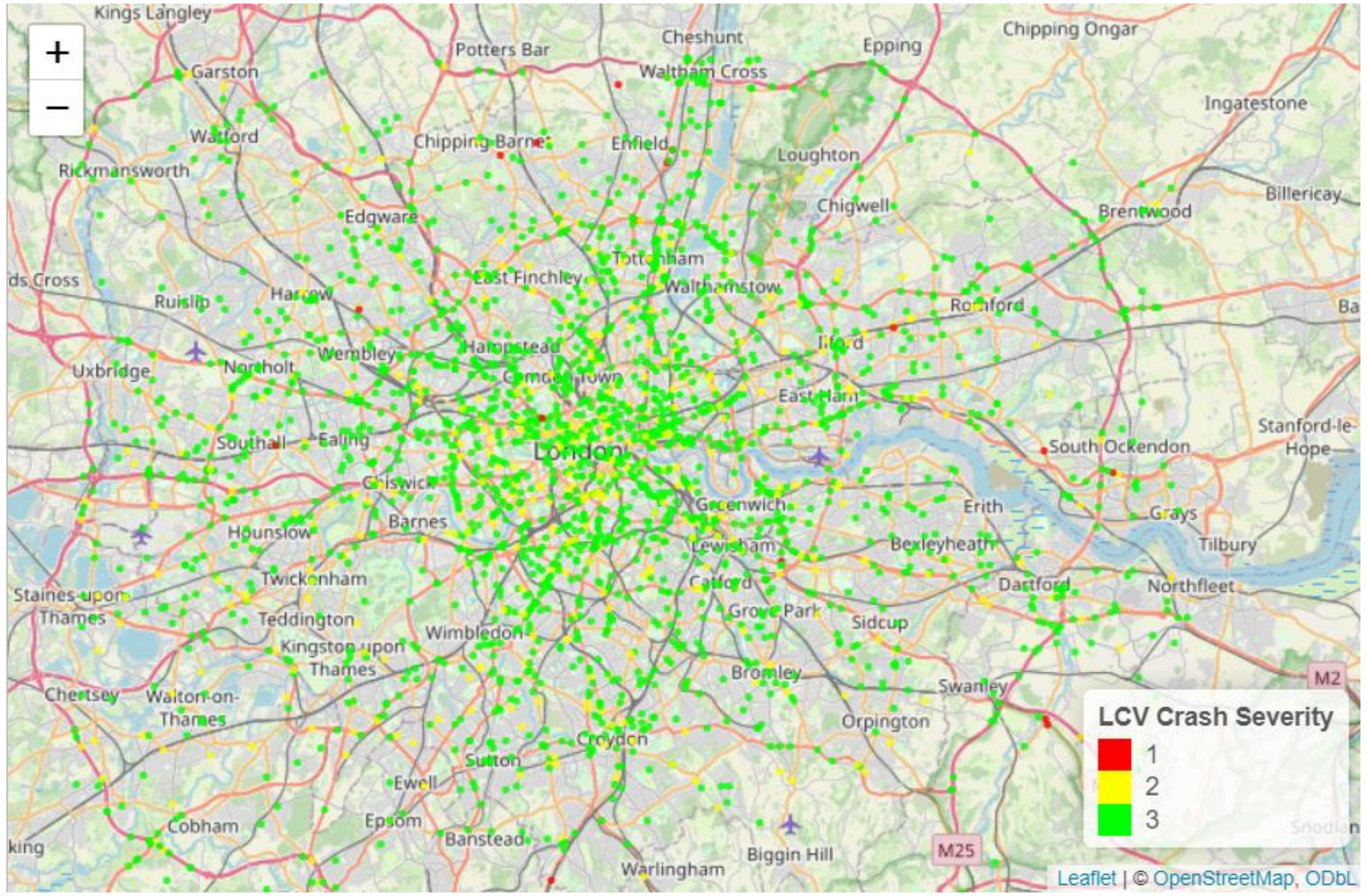
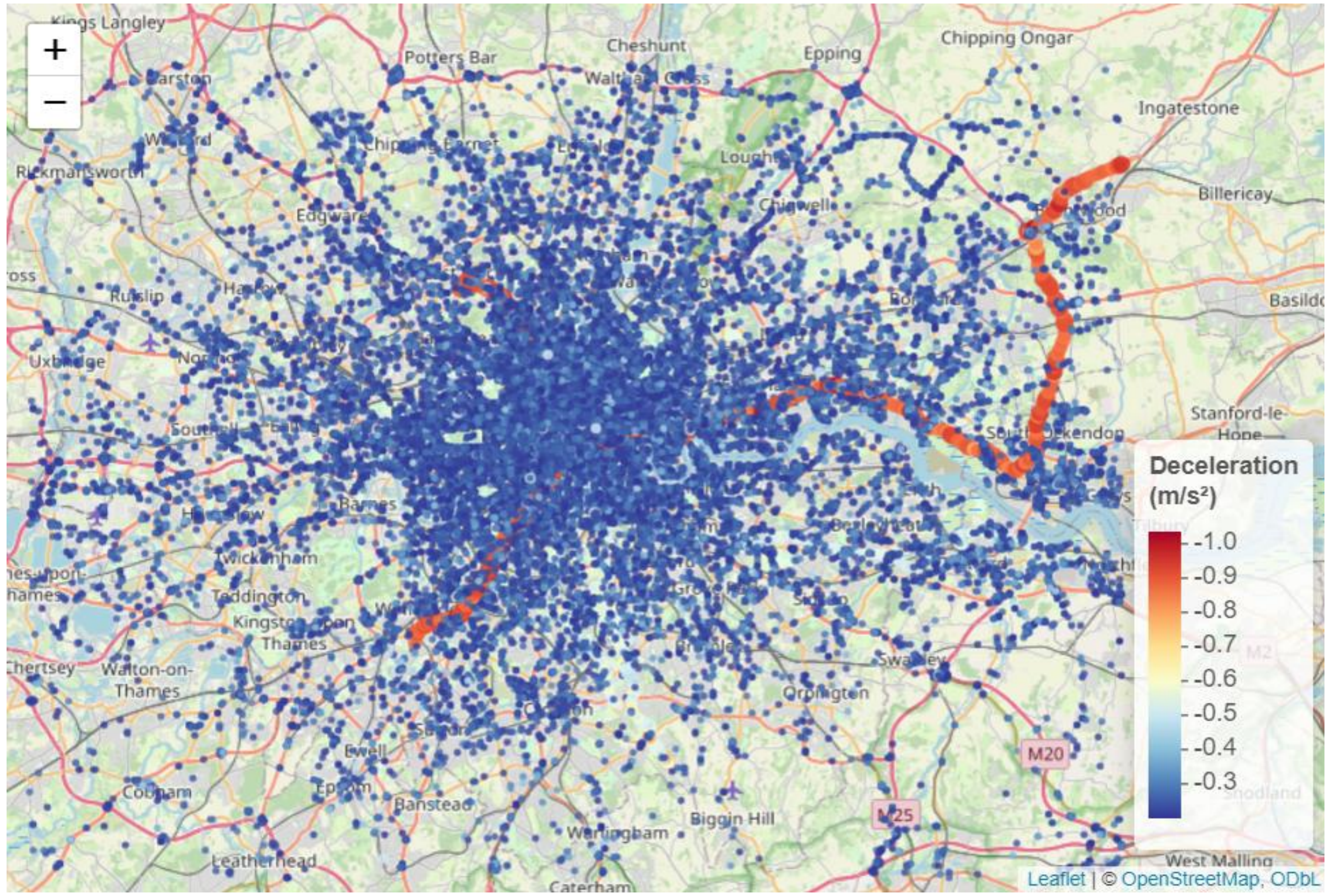
Mapping crash locations with vehicle braking data



LGV CV data indicating 'near misses'
(including braking, acceleration and swerving g-forces)
Mapped Recorded Crash locations



Harsh Braking events were isolated for analysis
57,935 individual connected LCV IDs
Study period - June to December 2024

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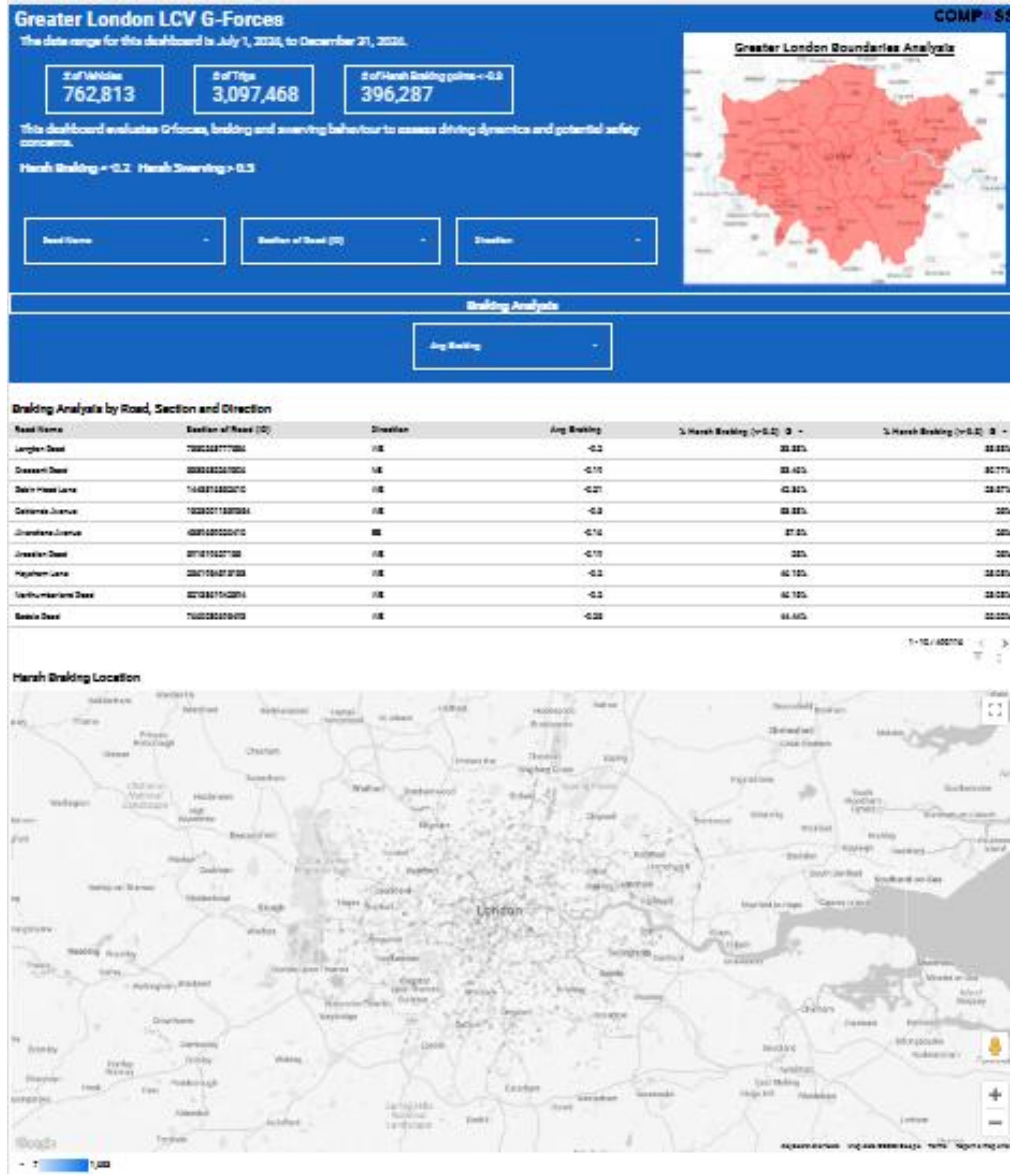
Mapping Crash Locations with Vehicle Braking Data

Greater London Boundaries Analysis

Harsh Swerving Location

Braking Analysis by Road, Section and Direction

Road Name	Section of Road (ID)	Direction	Avg Braking	% Harsh Braking (<-0.2)	% Harsh Braking (<-0.3)
Langton Road	7830268777586	WB	-0.2	33.33%	33.33%
Crescent Road	3385682269306	NB	-0.19	38.46%	30.77%
Robin Hood Lane	1443316852610	WB	-0.21	42.86%	28.57%
Oaklands Avenue	13280011839354	WB	-0.3	58.33%	25%
Alverstone Avenue	4889659020410	EB	-0.16	37.5%	25%
Arcadian Road	391519627138	WB	-0.19	25%	25%
Heysham Lane	2561954518138	WB	-0.2	46.15%	23.08%
Northumberland Road	5213861942394	WB	-0.2	46.15%	23.08%
Bedale Road	7660080698498	WB	-0.25	44.44%	22.22%
Bray Road	10977674499194	SB	-0.15	22.22%	22.22%



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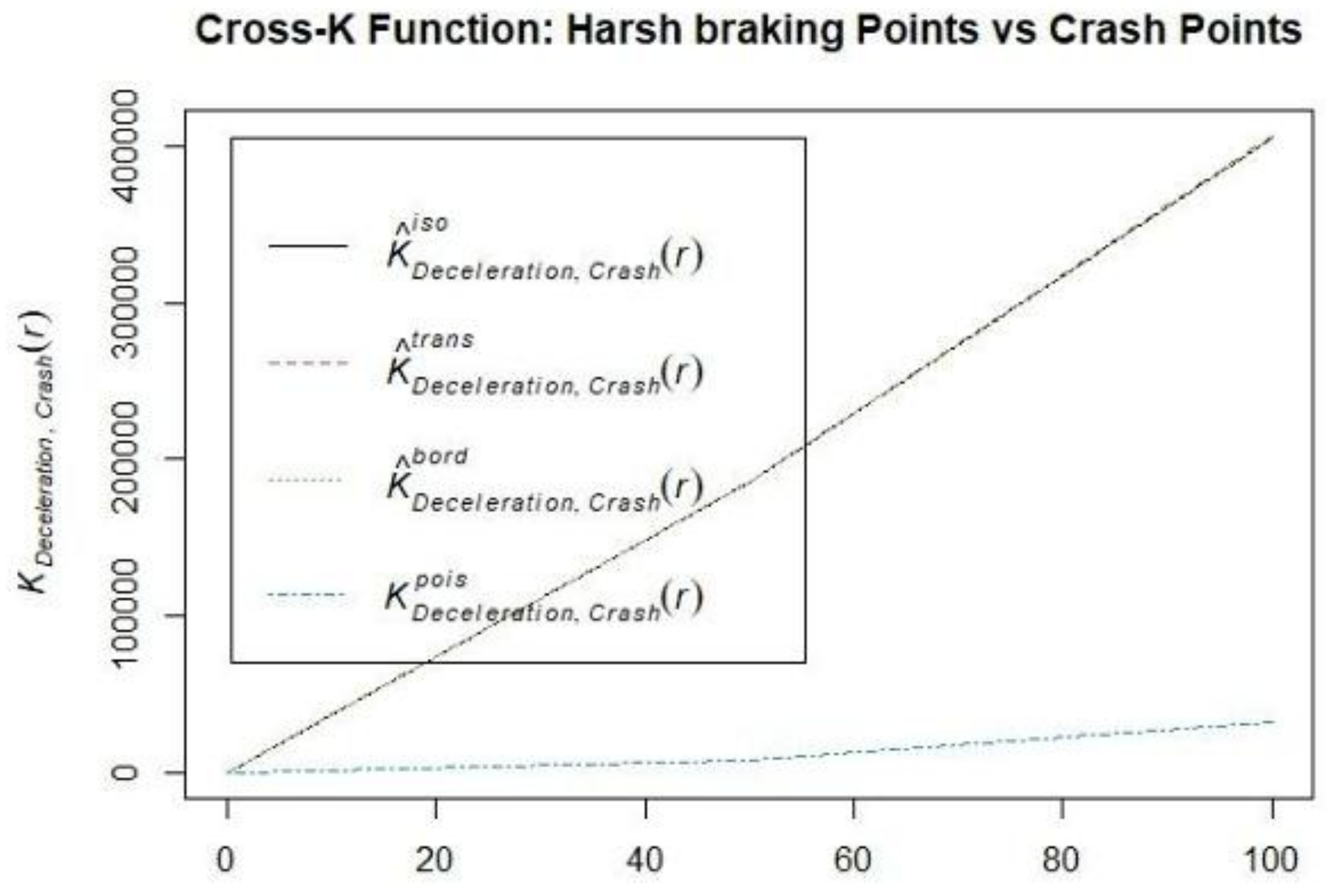
Harsh braking data compared to crash dataset

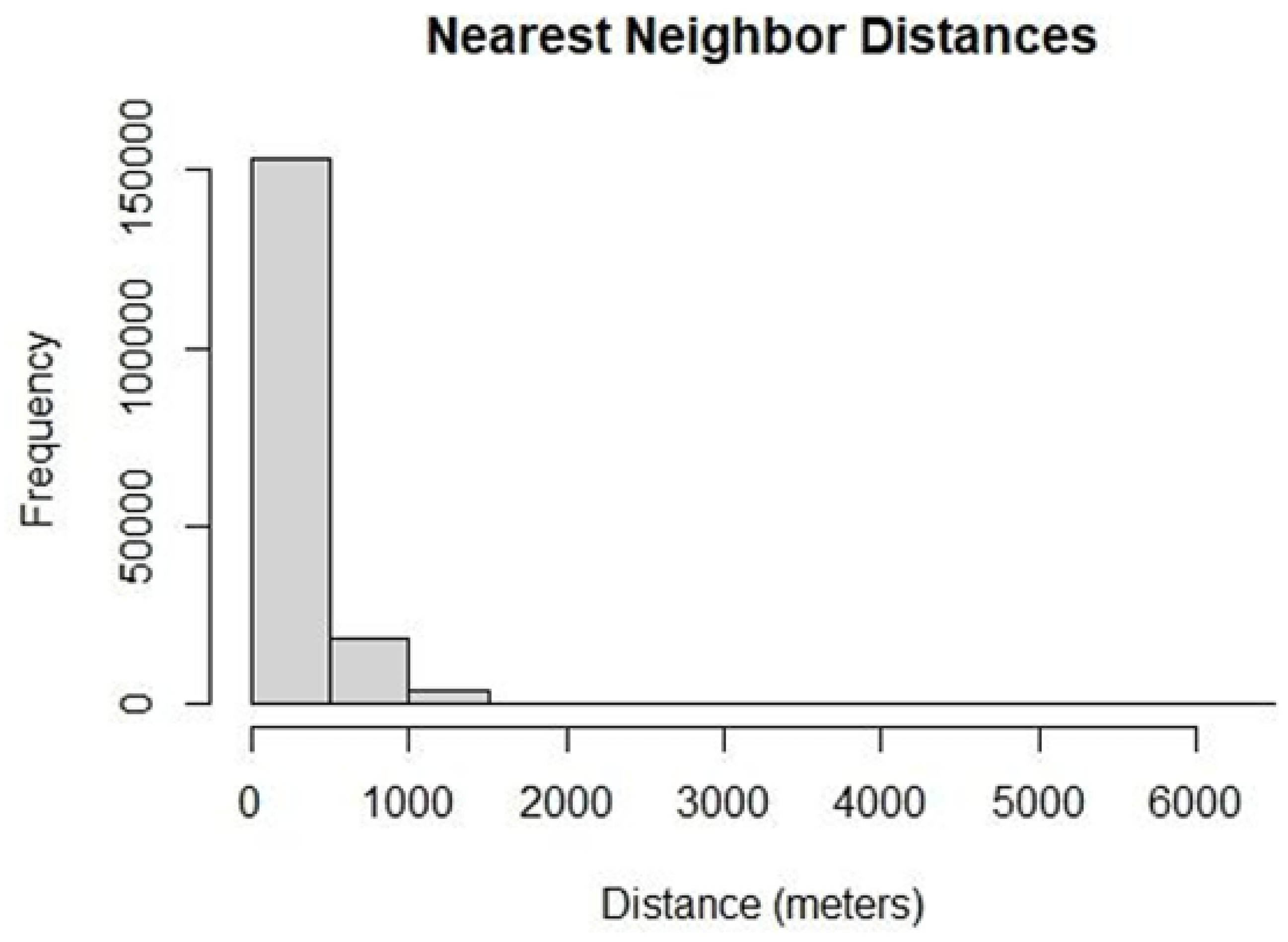
Methodology

$$K_{12}(r) = \frac{1}{N_1}\sum_{i-1}^{N_1}\frac{m_2(B_i(r))}{area(B_i(r))}$$

Where:

- $K_{12}(r)$ is the cross-K function value at a set distance r, denoting the spatial interaction between the two datapoint sets
- N_1 is the number of points of type 1 (i.e., deceleration points).
- $B_i(r)$ describes the circular region of radius radius r centered at the i-th point of type 1.
- $m_2(B_i(r))$ is the number of points of type 2 (i.e., crash points) within a distance r from the i-th point of type 1.
- $area(B_i(r))$ is the area size of the circular buffer of radius r centered at the i-th point of type 1.





All near misses mapped

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Key takeaways: From Reactive to Predictive

Findings highlight the **predictive value** of **connected vehicle data** by identifying road safety risk locations

Harsh braking data from thousands of **connected LCV vehicles** corelate strongly with **actual crash** locations

The **vehicle itself** is used as a real time road **risk detector** from its own sensors providing **direct evidence of risk**

It's time to shift from **reactive** to **predictive** road safety methodologies using data from connected vehicles

We don't have to wait for crashes to happen to act; **we can see the risk, map it, and prevent it**

Connected vehicle data is redefining how we understand and address road safety

THANK YOU!

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