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Crime Rates in London

Crimes negatively affect people's sense of safety and judgement towards a particular place. Crimes happen spatially and mapping them out and the different types of crimes can help understand the spatial patterns of crime and may reveal insight that might not have come from raw data. Demsar *et al*., (2009) suggested the advantages of visual exploration of spatial data; it is intuitive and does not require an understanding of complex computational methodology.

Figure 1 shows the number of crimes per 1000 population across the Greater London region in August 2021. It is the largest metropolitan area in England, which covers the City of London and thirty-two neighbouring boroughs. For this report, the boroughs were the geographical units of analysis.

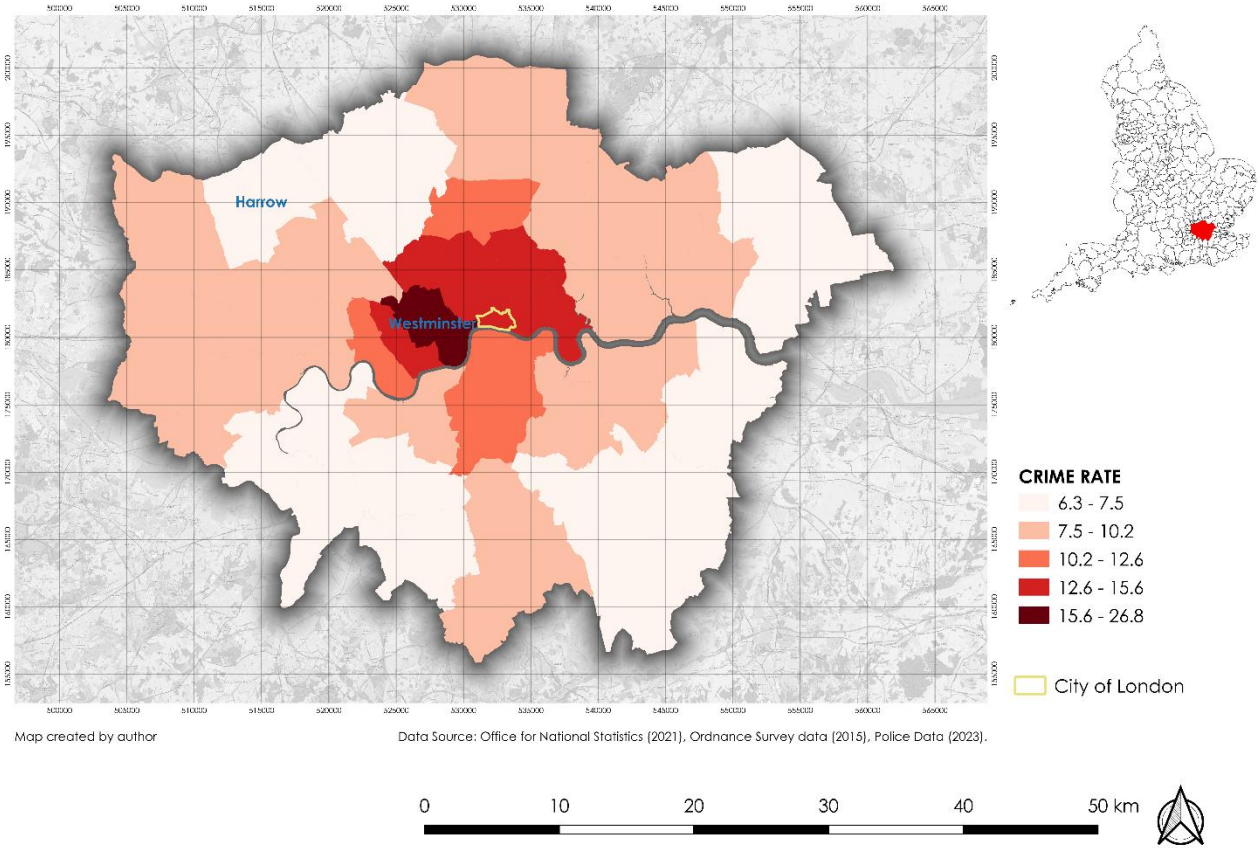

Figure 1: Borough-level Crime Rates (cases per 1000 population) across Greater London in August 2021.

Data and Methods

Shapefile for London borough boundaries is available from the Greater London Authority at https://data.london.gov.uk/dataset/statistical-gis-boundary-files-london. This also provided data on the area of each borough. Population data are available from the Office of National Statistics at https://www.statista.com/statistics/381055/london-population-by-borough/. The Metropolitan Police provides data on the monthly crime incidents in London at https://data.police.uk/data. The Metropolitan Police is responsible for law enforcement in Greater London boroughs except the City of London borough which has its police force. However, data derived showed some recorded crime in the City of London borough. This may not provide a full picture of crimes occurring in that region. While the crime data are collected at the street level, the analysis is conducted at the borough level to avoid potential biases caused by the presence of zero crime cases in more specific units such as streets or census areas.

Methods of vector functions were initially performed to transform data and to produce the visualization. Firstly, the clip tool was used to exclude crimes reported by the Metropolitan police in areas outside Greater London. Then, vector analysis of the count point in the polygon was used to determine the number of crimes reported in each borough. Finally, the crime rate was calculated per 1000 population using the number of crimes and population of each borough. A graduated symbology with Jenks classification is used to produce the map to maximise the data variances. As the aim of this map is to understand the spatial patterns, local authorities' boundaries need not much shading or none to draw the attention of observers to the spatial patterns. Fotheringham *et al*., (2000, p. 79 - 81), proposed methods of map visualizations for spatial analysis which were used to produce this map.

Analysis and Interpretation

From the map, the spatial pattern of crimes per 1000 population shows a radiating pattern with central London having the highest crime rates. Westminster has the highest rate with 26.8 crimes per 1000 population, while Harrow has the lowest rate with 6.3 per 1000 population. The City of London is shown to have a high crime rate. It should be noted that not only the data used is gotten from one source (Metropolitan Police) but also this borough has a relatively small population density compared to the rest of the region.

The map shows spatial patterns of crimes in Greater London. To go further, an unclassified choropleth map may have been used to show the spatial patterns.

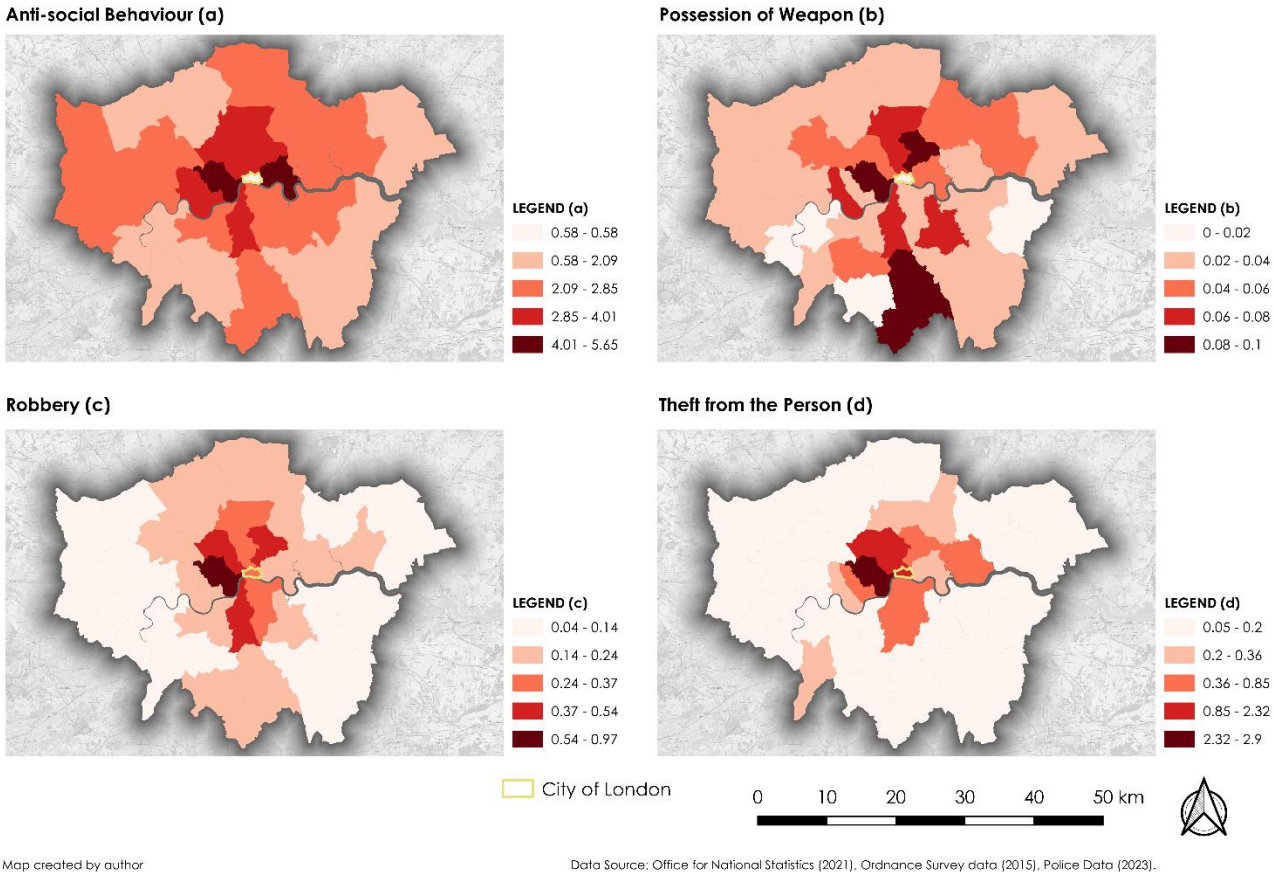

Figure 2: Borough-level Crime Rates (cases per 1000 population) of different crime across Greater London in August 2021.

Data and Methods

Figure 2 shows the number of different crimes per 1000 population across Greater London in August 2021. Four crime types were analysed: antisocial behaviour, possession of a weapon, robbery, and theft from the person. Antisocial behaviours were defined as behaviour by a person which causes or is likely to cause, harassment, alarm or distress to persons not of the same household as the person, weapons as any article made or adapted for use for causing injury to the person or intended by the person having it with him for such use by him or by some other person, robberies as theft with the use of force, intimidation or threats of force and theft from the person as theft without the use of force (Metropolitan Police, 2021; CPS, 2019; CPS, 2022). It is important to note that this crime dataset does not contain data for specific categories or subtypes

of antisocial behaviour, possession of a weapon, robbery, or theft from the person. A graduated symbology with Jenks classification was used for all maps to maximise the data variances.

Analysis and Interpretation

The map shows the spatial patterns of antisocial behaviour, possession of weapons, robbery, and theft from a person. In terms of all crime types, areas with high rates of crime per 1000 population were primarily concentrated in and around inner London, while areas with low crime rates were found in the southwest, southeast, and northwest areas. Spatially, there seem to be similar patterns in the occurrence of robberies and theft from the person, with high rates concentrated in central London, and lower rates in East and West London Antisocial behaviour crimes appear to have spatial patterns like overall crime rates in Figure 1, with radial pattern having high rates in central London. This may infer this is the most recorded type of crime recorded by the Metropolitan Police. Possession of weapons spatial pattern shows high rates in central London and south London, particularly Croydon borough. The pattern here appears to be random.

Population density is selected as the explanatory factor for understanding the spatial distribution of all types of crimes. In the field of criminology, it is widely acknowledged that crime tends to be more prevalent in densely populated areas (Oliveira, 2021). Various criminology theories propose a connection between population size and the occurrence of crime. The structural perspective suggests that a larger population increases social interaction, leading to more opportunities for crime (Chamlin and Cochran, 2004; Mayhew and Levinger 1976). In cities, population size is a strong predictor of crime (Bettencourt *et al*., 2007), highlighting the need to account for population size when analysing crime rates.

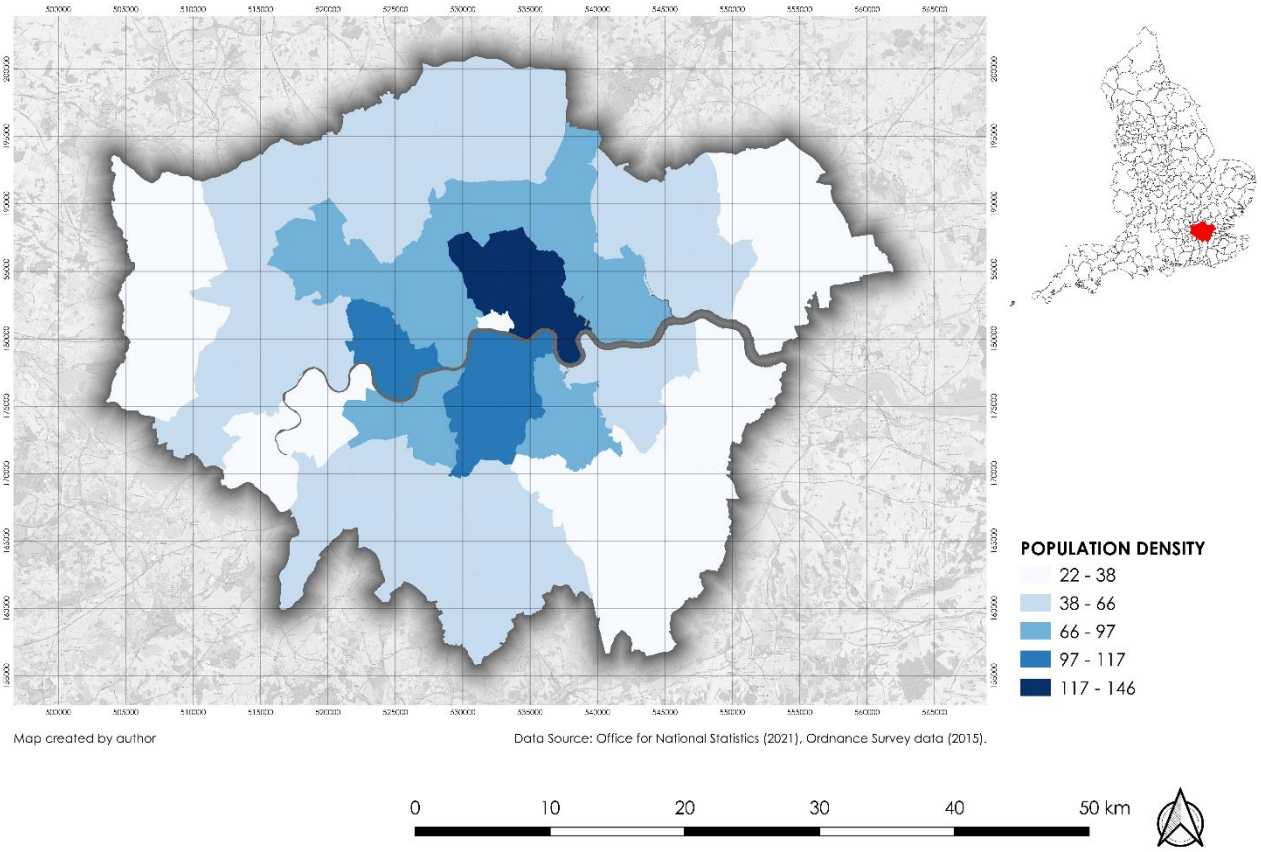

Figure 3: Population Density (usual residents per Hectare) of Greater London in 2021.

Figure 3 maps the population density of the Greater London borough. The population density was measured by the number of regular residents per hectare, and the data for 2021 were obtained from the Office for National Statistics. The map reveals that higher population density in central London, particularly North of the river Thames, and low population density in the southeast, northeast and northwest of Greater London. Comparing Figure 1 and Figure 3, higher crime rates support the structural perspective of crime in central London.

However, there are some limitations to consider. Relying solely on census data can distort the understanding of crime within a particular location. This is because crime is not restricted to residents alone, as cities often attract a significant influx of non-residents (Stults and Hasbrouck, 2015), including tourists, workers, and others.

Road Transport Noise and Schools in Sheffield

The urban environment is characterized by a growing and significant presence of transport noise. As the need for road travel continues to rise, a larger portion of the population is being exposed to transport-related noise, turning noise pollution into an increasingly crucial public health concern. The negative impact of high noise levels around schools on the performance of both teachers and students has been researched and acknowledged for a considerable period.

This is an interesting issue to address because many researchers have been able to relate high noise levels to school children's performance or concentration in class. Sanz, García and García, (1993) suggested a negative effect of high traffic noise levels and/or deficient acoustic conditions on pupils' attention, studying pupils in two public schools in Valencia, Spain.

The performance of both teachers and students can be negatively impacted by noise levels around educational centres. Using GIS, we can identify schools affected by road traffic noise in Sheffield and provide recommendations to reduce these effects.

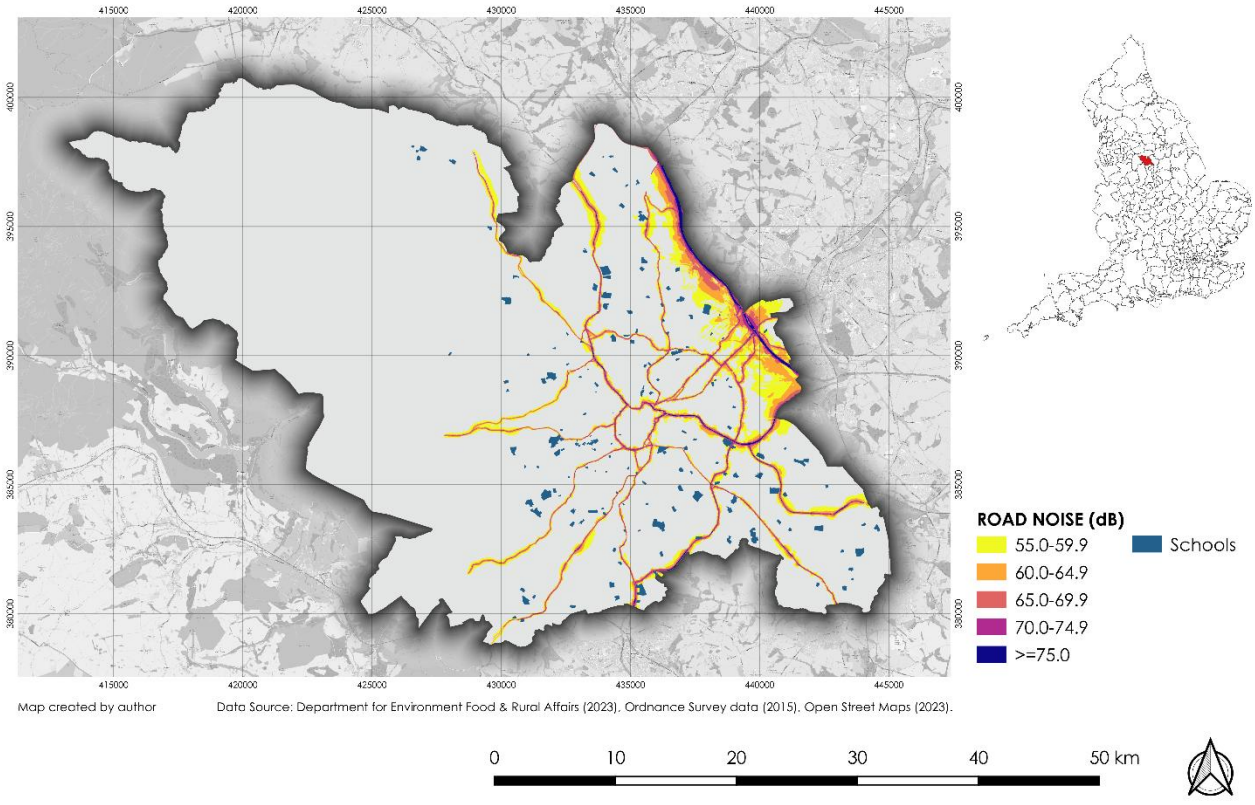

Figure 4: Road Noise Levels and Schools in Sheffield.

Data and Methods

Figure 4 maps the noise levels from the major road across Sheffield and the school's building footprint. Schools here are primary and secondary schools (pupils typically aged 6 to 18). Data on road noise is available from the UK Government (https://environment.data.gov.uk/DefraDataDownload/?mapService=DEFRA/RoadNoiseLdenRound3&Mode=spatial). This data provides a snapshot of the estimated road noise from major road and rail sources across England in 2017, within areas with a population of at least 100,000 people. The dataset used is the LAeq, 16h, indicating annual average noise levels for the 16 hours between 0700 - 2300 (DEFRA, 2019). This is relevant as this covers the hours when schools are open. Data on schools in Sheffield were gotten from Open Street Maps, and extracted using the 'tag:amenity=school' function.

Road noise is visualization using a graduated sequential to show the quantitative difference between noise levels. Buffer tool was used to identify school buildings whose footprints were within 50m of noise levels greater than or equal to 75.0 decibels (dB). It is assumed that schools within this distance would be affected by the noise levels from the motorway. Although many factors affected noise levels (topography, prevailing wind, etc), distance is assumed for this report.

Analysis and Interpretation

Figure 4 shows higher road noise levels in the northeast area of Sheffield. The M1 motorway runs along the edge of this area. A probable reason may be the higher travel speeds, of vehicles move at on the motorway since the national speed limit for vehicles is highest on the motorway in the UK (Government Digital Service, 2011). Also, road noise levels above 75 dB are observed on the A roads coming from east of Sheffield, around the city centre and moving up the north of Sheffield.

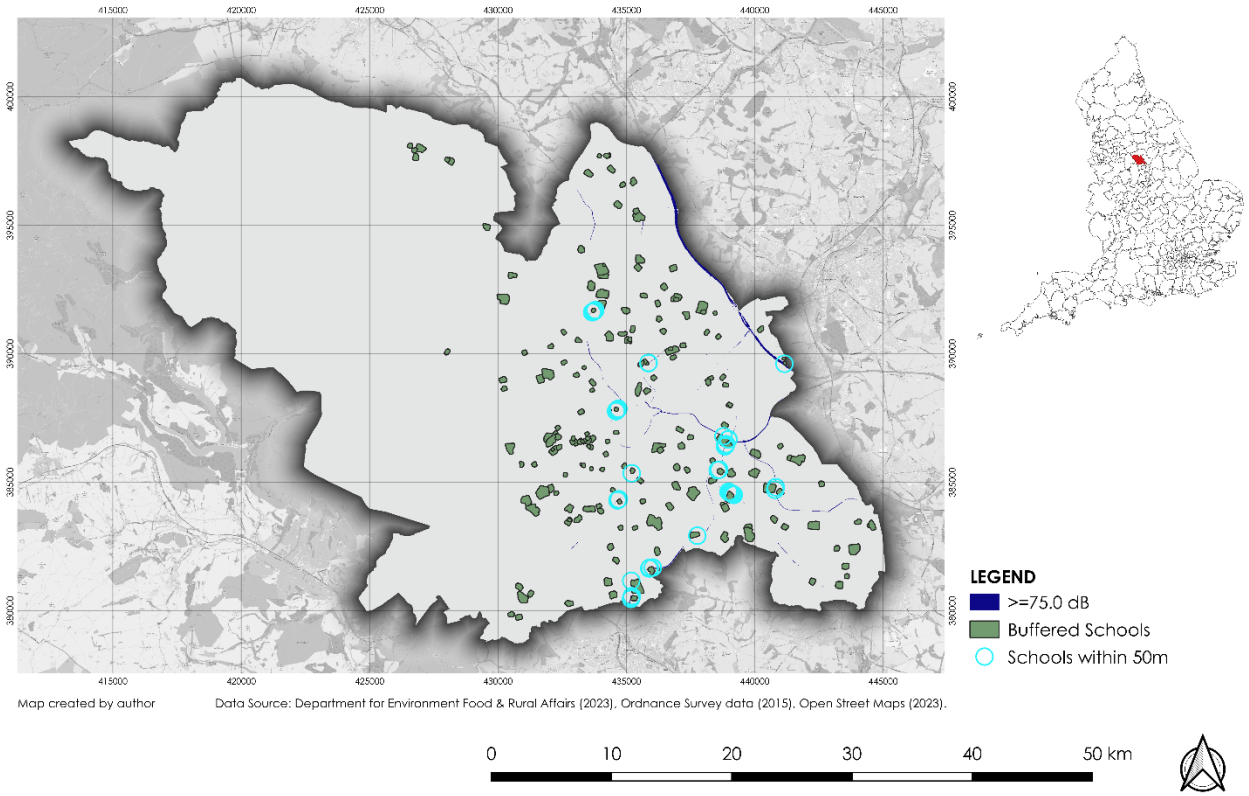

Figure 5: Schools with Building Footprint within 50 Metres of Areas Equal or Greater to 75 dB Noise Levels.

Figure 5 highlights schools whose building footprint is within 50 metres from noise levels greater or equal to 75.0 dB. Several schools are highlighted in the south, southeast area of and central areas of Sheffield.

Recommendations can be made to these schools to reduce their exposure to high levels of road noise. Building sufficient sound insulation can reduce levels of noise. Also, speed limits can be introduced in road areas around the school, or school signage to indicate to drivers the presence of a school nearby and for them to reduce their travel speeds.

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