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| UK crime statistics and bike crime: compound line graphs  |

**Overview**

This resource is designed to give you an overview of crime in the UK. Table 1 in Appendix C shows the UK crime statistics from January 2011 to December 2020.

In general, recorded crime has declined, year on year, since 2011, but withinthe data this assertion may hide some individual crimes which may not have changed. Therefore, a greater level of scrutiny is required. Additionally, it is valuable to identify geographical patterns to a particular crime (such as bike crime) i.e., if some Police Forces are seeing a greater level of bike theft than others.

One way to visualise, compare and analyse this amount of data is to create a compound line graph. This type of graph is very useful to see change in one or more quantities over time.

**The Thames Valley Police resource pack**

In partnership with Thames Valley Police (TVP), the Royal Geographical Society (with IBG) has created a resource pack for you to go out and collect your own bike crime data. Please only do so in a safe manner. The following resources are available for download to help:

* [A resource to help prepare a sophisticated crime investigation](https://www.rgs.org/schools/teaching-resources/investigating-the-geography-of-crime/), designed by Raphael Heath
* 1 UK crime statistics and bike crime: compound line graphs
* 2 Who is vulnerable to bike theft?
* 3 Chi-squared and bike theft patterns
* 4 Spearman’s Rank Correlation Coefficient and bike theft
* A selection of worksheets from the RGS-IBG to help you with [FSC statistical methods](https://www.rgs.org/schools/teaching-resources/fsc-statistical-methods/)
* 5 A focus on Iffley in Oxford by Thames Valley Police
* An online student bike theft quiz form (for students to answer)
* An online Survey123 observation form (for fieldwork data collection)

**Specification links**

AQA

GCSE 3.2.1. Urban Issues and Challenges *Urban change in cities in the UK leads to a variety of social, economic, and environmental opportunities and challenges.*

Edexcel

GCSE 4.5 Globalisation and economic change create challenges for the chosen UK city that require long-term solutions. *How economic change is increasing inequality in the city and the differences in quality of life.*

OCR

GCSE 1.2.3. There are different causes and consequences of development within the UK*. The causes of uneven development within the UK, including geographical location, economic change, infrastructure, and government policy*.

Eduqas

GCSE 2.2.2 What are some of the contemporary challenges facing UK towns and cities?

**Different data**

This resource will utilise data on bike crime from three different sources: the 2017 [An Overview of bike theft: England and Wales](https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/articles/overviewofbicycletheft/2017-07-20) and the 2020 [Nature of Crime: bike theft](https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/datasets/natureofcrimebicycletheft) both based on the Crime in England and Wales survey (CSEW), [official Police recorded crime](https://data.police.uk/data/) (specifically for Iffley, Oxford) and the BikeRegister database on bike registration and bike theft nationwide.

The CSEW refers to an annual victimisation survey in which a large representative sample of England and Wales are asked about their experiences of crime (amongst other things) in the past twelve months.

Official Police recorded crime only refers to all those incidents of bike theft which are reported to the Police.

You will need to pay close attention to which dataset is used, and when.

1. In the year ending March 2020, there were 84,545 police recorded bike thefts in England and Wales (excluding Greater Manchester Police) whilst according to the CSEW, there were 271,000 incidents of bike theft over the same period. This is clearly over three times greater than the number of cycle thefts recorded to the police.

Why do you think some statistics for the same metrics appear to have different values depending on whether the data was collected by the CSEW, the national Police Service or BikeRegister?

**Compound line graphs**

A compound graph is an extension of a simple line graph but with each value stacked on top of one another. This graph shows layered data allowing you to see what proportion one data layer is of the total. When you sum up all the data layers of the graph, this represents total data.

A stacked line graph looks like a cross-section of a layered cake, with each layer representing one part of the whole. The total height is the absolute value, the total figure.

The differences between the points on the adjacent lines give the actual values for each data layer. To emphasise the data layers, areas between the lines are usually coloured.

Three things to remember before you chose to draw a compound line graph:

* Time is always plotted along the horizontal axis
* The scale must be high enough to enable you to plot the full range of data for each variable
* The data is continuous

**What is continuous data?**

Continuous data is data which can take any value within a set range — on a graph it is data from all the points *and the points* in between. It can be measured as finely as possible i.e., including fractions and decimals.

Graph 1 in Appendix A shows the total crime across the UK from January 2011 to December 2020 in a compound line graph.

1. Explain how this is continuous data.
2. Think critically: what is the problem with displaying the data as a compound line graph? List 3 issues you can spot.
3. Identify 3 benefits of displaying data in a stacked line graph.
4. Which two crimes have consistently been the largest from 2011 to 2020?
5. Describe the trend in bike theft over this period (use Appendix B for greater clarity).
6. Access the excel spreadsheet titled *UK crime statistics breakdown*. This is the same data as Table 1 in Appendix C. Once the spreadsheet is open highlight the columns for anti-social behaviour and bike theft and create a stacked line graph.

**What we know about bike crime**

Bike theft is a relatively low-volume offence accounting for around 2% of all Police recorded crime.  Across the different Police Forces in England and Wales there is significant variation in the rate of bike thefts per 1,000 members of population. For example, in Dyfed-Powys (Wales) there are only 0.2 bike thefts per 1,000 population (the lowest) whereas in Cambridgeshire it is 5.1 bike thefts per 1,000 population (the highest). In Thames Valley the rate is 2.3 bike thefts per 1,000 population.

Glance at the [Overview of bike theft: England and Wales](https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/articles/overviewofbicycletheft/2017-07-20#:~:text=Bicycle%20theft%20is%20a%20relatively,covered%20by%20the%20CSEW1.) ONS report from 2017, in particular study *Figure 1: Trends in Crime Survey for England and Wales (CSEW) and Police recorded bike theft*, *year ending December 1981 to year ending March 2017.*

1. Describe the line depicting data from the CSEW on bike crime in Figure 1 (of the ONS report).

**Further work**

* Compound graphs in geography <https://www.internetgeography.net/compound-line-graphs-in-geography/>
* With bike thefts rife, cyclists reveal the true cost of crime <https://inews.co.uk/inews-lifestyle/money/bike-thefts-rife-cyclists-reveal-true-cost-crime-885103>
* Why the crime drop? From the University of Chicago Press Journals <https://www.journals.uchicago.edu/doi/pdfplus/10.1086/678081?casa_token=OXiqpVNI4WsAAAAA%3AVCj8T2cy62hYWgqB_WRbNXugZsg_zYPCYGLM3-jXzlvW49s0BITTFtqw1e9aZgoPRXJR4haLbvs&>
* Five tests for a theory of the crime drop <https://link.springer.com/article/10.1186/2193-7680-2-5>
* The Arizona State University guide for police officers summarising what is known about bike theft and bike theft prevention [https://popcenter.asu.edu/content/bike-theft-0](https://popcenter.asu.edu/content/bicycle-theft-0)
* An additional student activity as part of this project could be the following. Ask students to visit the [police.uk](https://data.police.uk/) data website, and:
	+ Assign each student a Police Force
	+ Ask students to download crime data for their allocated police force for the past 2 years
	+ Ask students to extract/filter only bicycle theft data from these data
	+ Ask students to produce a line graph showing the number of recorded bike thefts in their allocated force over this period?
	+ Answer: does bike theft in this police force area show an overall upward/downward trend, or have numbers stayed the same? Are there any seasonal patterns?

**Answers**

1. There are discrepancies between different data sets because not all crime is reported to the Police. A common reason for not reporting bicycle thefts to the police is due to victims’ belief that the police are unlikely to locate the stolen bicycle and/or catch the bicycle thief. Traditionally, there are higher crime figures (and some think more accurate) associated with the CSEW.

A major strength of a crime victims survey is that they overcome the problem of underreporting. Survey respondents are asked to report their experience of crime in the past 12 months regardless of whether they reported their victimisation to the police. For this reason, estimates produced by crime surveys are generally considered to be a more reliable estimate of the true extent of crime. By comparing survey estimates to police recorded crime figures, we can also determine the extent of the so-called ‘dark figure’ of crime; that crime which occurs but which is not reported to the police.

1. The data is continuous because it is possible to measure fine points between the different Police Forces for, say, anti-social crime.
2. The Metropolitan Police Service covers 620 miles² with close to 9 million people within its boundaries. Both the population and the amount of crime is much higher than other data layers. Therefore, the compound line graph is warped making it difficult to read data from the other Police services. Other problems are a lack of detail for low value data layers, such as Robbery, and general difficulty in calculating individual data layer values.
3. Compound line graphs are clear, colourful and catch the eye. They give an overview of a large amount of data. It is possible to analyse trends over time.
4. The two crimes which have consistently ranked in the top two crimes nationwide, across all Police Forces, are: anti-social behaviour and violent crime.
5. Appendix C shows that bike theft, like all crime, has declined between 2011 and 2020.
6. Graph drawing task.
7. Two main findings are apparent. First, levels of bike theft rose considerably during the 1980s and peaked in the 1990s. In 1996, for example, there were an estimated 660,000 incidents of bike theft according to the Crime Survey of England and Wales. Since then, bike thefts have shown a general downward trend. This overall pattern is seen in both sources of data. The second finding relates to the underreporting of cycle theft: for each year the number of cycle thefts as measured by the crime survey of England of Wales is at least double that recorded by the police.

**Appendix A**

Graph 1 a 2D compound line graph of UK crime from January 2011 to December 2020 for all Police Forces in England and Wales

**Appendix B**

Graph 2 a compound 2D stacked area chart of UK crime from January 2011 to December 2020 excludingMetropolitan Police Force data

**Appendix C**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Police Constabulary | Anti-Social Behaviour | Burglary | Robbery | Vehicle Crimes | Violent Crimes | Shoplifting | Criminal Damage & Arson | Other Theft | Drugs | Other Crimes | Bike Theft | Weapons | Order | Theft from Person |
| Greater Manchester Police | 948631 | 251705 | 41295 | 213271 | 531800 | 127610 | 263843 | 212965 | 52051 | 126558 | 27065 | 13259 | 158246 | 38357 |
| West Yorkshire Police | 723115 | 256634 | 25720 | 219616 | 652322 | 146526 | 265391 | 246433 | 60297 | 123105 | 17672 | 12731 | 146338 | 30227 |
| West Midlands Police | 659024 | 249200 | 65825 | 284011 | 595283 | 154030 | 233441 | 199663 | 55416 | 110518 | 23385 | 15246 | 93500 | 22544 |
| Lancashire Constabulary | 783921 | 118426 | 7697 | 89941 | 371055 | 77367 | 161596 | 136392 | 27325 | 56368 | 13577 | 4804 | 49016 | 9137 |
| South Yorkshire Police | 711968 | 143799 | 12747 | 122797 | 299281 | 96464 | 162546 | 132710 | 31512 | 66122 | 9506 | 8752 | 65632 | 13208 |
| Kent Police | 478938 | 114584 | 12558 | 107288 | 481082 | 103158 | 180045 | 141562 | 31284 | 73561 | 12727 | 7098 | 73400 | 8006 |
| Hampshire Constabulary | 563314 | 112337 | 9274 | 96659 | 363879 | 106829 | 164505 | 123420 | 43752 | 75232 | 27003 | 9366 | 95459 | 9627 |
| Thames Valley Police | 373418 | 130333 | 12838 | 144791 | 369387 | 129324 | 170270 | 195349 | 54832 | 86078 | 41965 | 9880 | 49184 | 25236 |
| Northumbria Police | 688781 | 84028 | 5868 | 67912 | 310828 | 103869 | 167595 | 121443 | 35375 | 60565 | 15012 | 8085 | 102706 | 10264 |
| Essex Police | 517890 | 125460 | 12787 | 131725 | 391545 | 89980 | 142920 | 126888 | 38635 | 60988 | 17277 | 10587 | 72848 | 11294 |
| Avon and Somerset Constabulary | 483093 | 107686 | 12949 | 106171 | 359699 | 102696 | 145223 | 135236 | 35950 | 66711 | 24313 | 5000 | 108649 | 10254 |
| Merseyside Police | 510601 | 110148 | 12297 | 89959 | 296069 | 80457 | 151572 | 94111 | 83716 | 59806 | 13991 | 6888 | 64674 | 14049 |
| Sussex Police | 505233 | 80608 | 8448 | 75987 | 301524 | 76493 | 127845 | 127512 | 36726 | 62171 | 18290 | 9381 | 63699 | 12627 |
| Police Service of Northern Ireland | 577939 | 70133 | 6932 | 40094 | 329647 | 56562 | 175580 | 121932 | 53636 | 29864 | 6388 | 7323 | 9355 | 3487 |
| South Wales Police | 418328 | 79670 | 4507 | 87028 | 282126 | 83227 | 124549 | 103432 | 41982 | 62214 | 15344 | 4323 | 71266 | 9374 |
| Devon & Cornwall Police | 456208 | 64281 | 4695 | 52039 | 317069 | 65193 | 133724 | 99074 | 39690 | 50127 | 6858 | 6232 | 47829 | 6190 |
| Nottinghamshire Police | 396367 | 81849 | 10365 | 75112 | 237397 | 79829 | 103717 | 94479 | 33460 | 49208 | 14033 | 6619 | 36658 | 9521 |
| West Mercia Police | 460594 | 75102 | 5073 | 58008 | 242869 | 61262 | 89782 | 81284 | 24013 | 42291 | 8212 | 4916 | 28689 | 4871 |
| Staffordshire Police | 339658 | 55897 | 6428 | 49783 | 247432 | 58000 | 97127 | 78808 | 21696 | 40616 | 7630 | 4384 | 25778 | 3715 |
| Derbyshire Constabulary | 433802 | 65541 | 6028 | 55732 | 174864 | 52218 | 81280 | 66459 | 23617 | 37911 | 7577 | 4094 | 23002 | 4828 |
| Hertfordshire Constabulary | 305595 | 61967 | 6550 | 74267 | 181389 | 64311 | 81802 | 79137 | 33771 | 45021 | 11080 | 10607 | 36510 | 9212 |
| Cheshire Constabulary | 352280 | 51582 | 2990 | 39224 | 190774 | 54787 | 79937 | 58479 | 18550 | 38386 | 9963 | 2561 | 66956 | 4872 |
| Humberside Police | 199689 | 90177 | 6428 | 52965 | 221642 | 72795 | 106426 | 76779 | 16163 | 50121 | 15709 | 3168 | 41294 | 4126 |
| Surrey Police | 322624 | 64403 | 3429 | 56010 | 173751 | 37849 | 85346 | 77592 | 26671 | 40242 | 9370 | 3601 | 45738 | 3529 |
| Cleveland Police | 405207 | 51128 | 4193 | 35174 | 144889 | 59106 | 83516 | 55498 | 16174 | 28299 | 7275 | 2855 | 24315 | 3297 |
| Leicestershire Police | 197724 | 77164 | 7698 | 78950 | 188494 | 52290 | 88412 | 81871 | 18847 | 41493 | 14581 | 4257 | 36245 | 7127 |
| Northamptonshire Police | 286338 | 57572 | 7576 | 55523 | 164776 | 40546 | 66544 | 51938 | 15566 | 32496 | 6761 | 3706 | 16270 | 4416 |
| Cambridgeshire Constabulary | 235922 | 54087 | 5275 | 49442 | 141180 | 39594 | 66298 | 69535 | 18197 | 30701 | 29233 | 3373 | 27328 | 6429 |
| Norfolk Constabulary | 236575 | 36028 | 3130 | 24619 | 175536 | 37463 | 68042 | 51585 | 21536 | 30612 | 9657 | 3311 | 35092 | 3667 |
| Dorset Police | 277728 | 45742 | 2659 | 40651 | 130652 | 35070 | 61457 | 58528 | 12121 | 24470 | 9663 | 2002 | 15483 | 4145 |
| Durham Constabulary | 259276 | 42306 | 1590 | 31072 | 150581 | 35812 | 75807 | 44613 | 12271 | 25768 | 4043 | 2022 | 26234 | 2100 |
| North Yorkshire Police | 312571 | 40174 | 1740 | 24712 | 114017 | 37842 | 54310 | 48253 | 16728 | 25207 | 9563 | 2058 | 14947 | 3487 |
| North Wales Police | 215877 | 38563 | 1639 | 20679 | 161033 | 36225 | 66844 | 44437 | 13092 | 24294 | 3833 | 1972 | 23786 | 1592 |
| Bedfordshire Police | 217390 | 51595 | 6913 | 54654 | 116273 | 32083 | 52143 | 46582 | 11428 | 23024 | 7620 | 2628 | 21860 | 4119 |
| Lincolnshire Police | 215661 | 49514 | 4620 | 30929 | 118113 | 43679 | 55161 | 49930 | 15774 | 26207 | 8702 | 3210 | 19054 | 2189 |
| Gwent Police | 234573 | 39819 | 2077 | 34964 | 109611 | 31354 | 57577 | 44707 | 17066 | 25795 | 2999 | 1444 | 33882 | 2175 |
| Suffolk Constabulary | 177431 | 39858 | 3118 | 33877 | 146264 | 33952 | 61002 | 46092 | 14688 | 29470 | 8317 | 2798 | 28773 | 3308 |
| Gloucestershire Constabulary | 242718 | 44282 | 2887 | 33325 | 82228 | 30215 | 43966 | 40516 | 11376 | 21915 | 7177 | 1576 | 11485 | 2461 |
| Wiltshire Police | 197373 | 36998 | 2297 | 29971 | 114773 | 33476 | 53849 | 43111 | 11287 | 19748 | 6089 | 2051 | 17589 | 2691 |
| Warwickshire Police | 172987 | 40036 | 3150 | 41877 | 98663 | 26608 | 40430 | 43992 | 9687 | 18310 | 5139 | 2366 | 12980 | 2661 |
| Cumbria Constabulary | 165885 | 20713 | 867 | 12400 | 98404 | 23327 | 49400 | 27873 | 11134 | 17080 | 2380 | 1589 | 18114 | 1128 |
| Dyfed-Powys Police | 174740 | 14917 | 469 | 9948 | 81840 | 14877 | 35146 | 25114 | 22448 | 13573 | 1275 | 1344 | 11056 | 611 |
| City of London Police | 12051 | 2706 | 669 | 1847 | 8804 | 6628 | 2213 | 17475 | 4364 | 5743 | 2994 | 366 | 2221 | 4150 |
| Metropolitan Police Service | 2875056 | 790442 | 301894 | 987378 | 1894475 | 385229 | 543163 | 1150928 | 387717 | 526690 | 149929 | 39482 | 342749 | 308958 |

Table 1 UK crime statistics breakdown from January 2011 to December 2020

