Delayed Responses

The impact of congestion on emergency vehicle response times in London

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Executive Summary

Using data from the periods of Covid-19 lockdowns - when congestion disappeared entirely from London's streets - this report looks into the impact of typical levels of road traffic in London on the travel times of emergency response vehicles, and finds that congestion has a serious adverse effect.

- Our analysis of the 2020 Covid-19 lockdowns finds that:
    - 999 London Ambulance Service average response times to the most serious medical emergencies fell by 47 seconds, with a much larger drop of 2 minutes 39 seconds for serious emergencies where patients were conveyed to hospital.
    - 999 London Fire Brigade average response times to the most serious fires fell by 40 seconds, and this reduction was exclusively in travel time.
    - Both drops in response times correlate closely with reductions in traffic congestion on London's roads during these periods.
    - Each percentage point increase in London's congestion levels is associated with a one second increase in fire service 999 response times.
- Whilst new traffic calming measures in the capital have generated controversy around accusations of delays to emergency services, the data from these services generally does not support these claims.
- Meanwhile the chronic problem posed to 999 response times by excess traffic and congestion on London's roads remains largely overlooked and unaddressed.
- Although many factors influence outcomes for Londoners who suffer medical or fire emergencies, these outcomes can be expected to improve in line with reductions in congestion levels in the capital.

Introduction

The coronavirus pandemic has had an enormous impact on the world's travel habits. In the UK there has been a radical shift in how (and whether) many of us travel to and for work, for shopping and for leisure. This shift has had a very visible impact on our towns and cities, with urban centres at times during 2020 appearing virtually empty and at other times hyper-congested as people have sought alternative means of transport in response to the evolving pandemic.

Each year the London Ambulance Service (LAS) typically attends around 1.1m incidents[1] while the London Fire Brigade (LFB) attends around 100,000 incidents[2]. In many cases the speed of these responses can mean the difference between life and death, so over the years, considerable effort and money has been invested to shave seconds off response times so that first responders are on the scene as soon as possible.

Much has been made of this fact during the recent debates over low traffic neighbourhoods (LTNs) and pop-up cycle lanes introduced as part of the government's response to the pandemic, with opponents of the changes - though typically not the emergency services themselves - routinely claiming that measures to reduce traffic could cost lives by causing delays to fire and ambulance response times. It is true that the response times of these emergency services are sensitive to changes in road conditions, and ambulance chiefs have recently reported that their in house SatNav systems[3] have sometimes not kept pace where changes to road layouts were made rapidly.[4] But there remains no evidence that London's new active travel measures have yet caused any measurable increase in overall emergency response times[5]. LFB records do show an increase in reported delays due to traffic calming measures in fire crew incident reports in areas where LTNs have been introduced but, crucially, any such impacts experienced and reported by crews were completely

[1] https://www.england.nhs.uk/statistics/statistical-work-areas/ambulance-quality-indicators/

[2] https://data.london.gov.uk/dataset/incident-response-times-fire-facts

[3] https://www.standard.co.uk/news/health/london-ambulances-need-new-live-data-systems-to-beat-traffic-jams-in-emergencies-report-claims-a3875251.html

[4] https://www.standard.co.uk/news/uk/low-traffic-neighbourhoods-ltns-999-calls-london-ambulance-b953716.html

[5] London's Police, Fire Brigade and Ambulance Service have all stated they have no records of increased 999 response times as a result of these measures.

offset by a concomitant decrease in other kinds of delays (likely, reduced overall traffic levels across the areas in question) so that the actual recorded response times in these areas have remained unchanged.[6]

While the novelty of new and unexpected road layouts and the rapid pace of recent changes have given rise to a mismatch between perceived and actual delays to 999 response times, there is another factor affecting these journeys which may suffer from the opposite effect. Traffic congestion is a daily fact of life in the UK capital - ranked as the 8th most congested city in the world in 2019[7] - that is so mundane as to be effectively invisible to its residents. Yet the resultant risk of delays to emergency vehicles has the clear potential to have a real impact on the outcomes for critically ill patients and people who are victims of fire and accidents.

Until the pandemic hit in 2020 it had been difficult to estimate the extent of the effect that congestion has on emergency service response times, or to separate this effect from other factors. But with traffic levels dropping sharply to unprecedented lows during the various lockdowns, an unplanned, living experiment was thrust upon us, allowing us to gain a fuller picture of how much typical congestion levels delay emergency service vehicles in London for the first time.

[6] https://findingspress.org/article/23568-the-impact-of-2020-low-traffic-neighbourhoods-on-fire-service-emergency-response-times-in-london-uk

[7] https://inrix.com/press-releases/2019-traffic-scorecard-uk/

Congestion Levels in London

In order to quantify the change in congestion levels experienced in London since the pandemic started, three sources of data on traffic levels in London were accessed.

The car navigation platform TomTom[8] uses their satellite navigation systems to gather data on congestion in cities around the world, including London. TomTom quantifies congestion by comparing the actual time taken by vehicle drivers in a given hour against an estimate of the time the same journey would take in the absence of any congestion. For example, a congestion level of 36% means that a trip will take 36% more time than it would have done in uncongested conditions.[9]

At the time of writing, the TomTom website hosted weekly congestion level data for London for the whole of 2021 to date. For 2020 only monthly data was available on the live TomTom website, however it was possible to access data for the first 41 weeks of 2020 by using archive.org's Wayback Machine.[10] The gap in the weekly data series from October to December 2020 has been bridged by using the monthly data (dashed lines in the chart below).

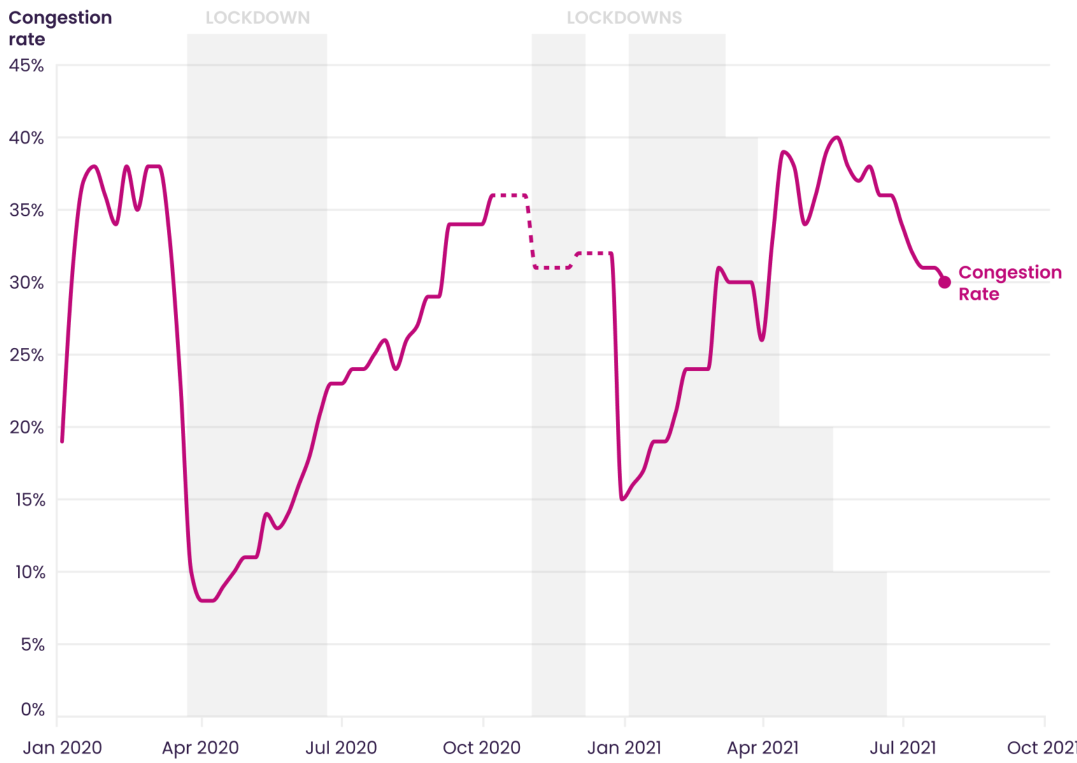
The TomTom data starts with the normal lull in congestion as Londoners return from their Christmas and New Year holidays, with levels rapidly returning to historical norms for the first two months of the year. It then shows a steep reduction in the level of congestion starting well in advance of the official announcement on 23rd March of the first lockdown. Congestion reduced from the peak in week 10 of 2020 (2nd March to 8th March) to a minimum in week 14 (29th March to 5th April) before starting to creep back up again early in the lockdown and gradually returning to levels similar to before the lockdown by November.

The monthly data for October to December (dashed lines) suggest a smaller reduction during the shorter second lockdown before a more substantial drop over Christmas and as the country entered the third lockdown. Congestion levels then resumed their upwards trend as the lockdown

[8] https://www.tomtom.com/en_gb/traffic-index/london-traffic/
[9] https://www.tomtom.com/en_gb/traffic-index/about/
[10] https://web.archive.org/web/20201115144731/https://www.tomtom.com/en_gb/traffic-index/london-traffic/

progressed and as it was gradually phased out starting in March 2021.

Figure 1: London congestion levels 2020-21 (Source: TomTom)



Another relevant source of data exists in the form of an ongoing programme of traffic counts at locations on major and minor roads across the country managed by the Department for Transport.[11] 149 of the traffic count points in the London region had one of these 12-hour vehicle counts take place in either 2018 or 2019 (mostly between April and June) and another during the first lockdown (all between April and June 2020). Comparing the count in 2018 or 2019, years which represent recent baseline traffic flows, with the count during the first lockdown gives an indication of how traffic flows changed during the pandemic.

In total nearly 2 million vehicles of all kinds were logged passing these 149 points during the counts undertaken in 2018 or 2019. At the same 149 points during the pandemic the number of vehicles logged had reduced by an average of 50%:

[11] https://roadtraffic.dft.gov.uk/downloads

Table 1: Overall traffic flows in London, 2018/19 vs 2020 covid lockdown (Source: Department for Transport road traffic stats)

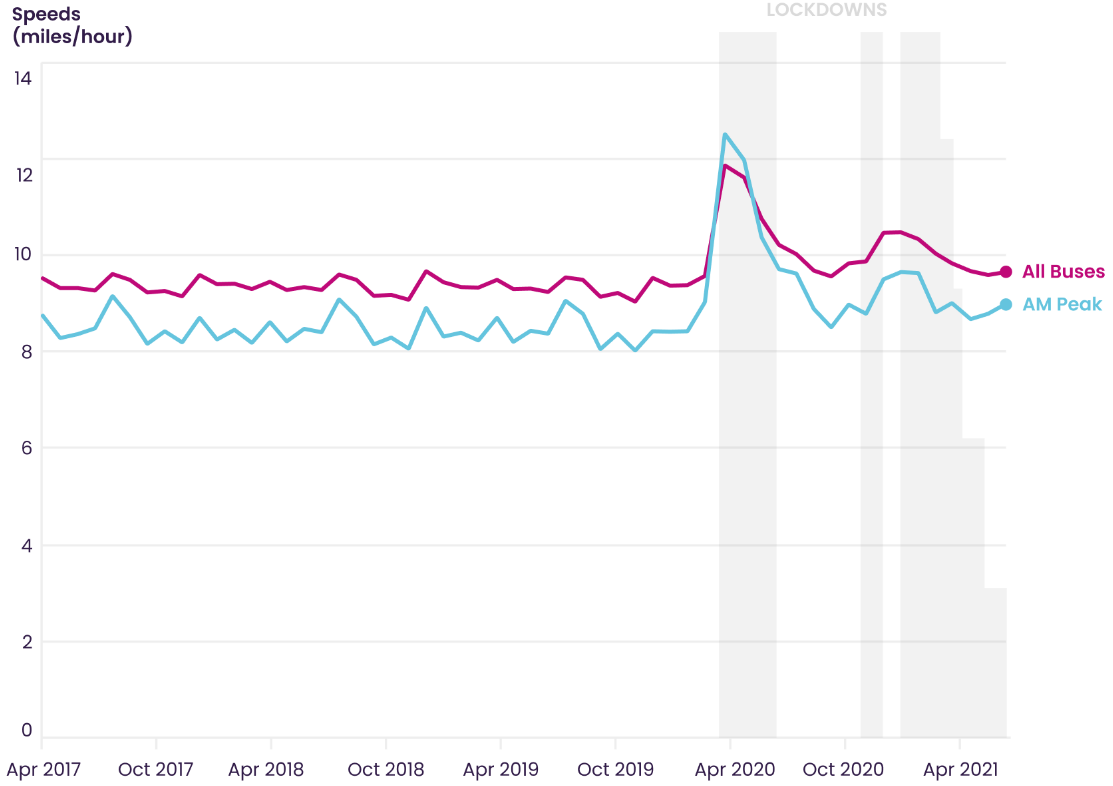
	2018 or 2019		First Lockdown		Change	
Vehicle Type	**Count**	**Share**	**Count**	**Share**	**Count**	**%**
Pedal Cycles	3,541	0.2%	6,354	0.6%	+2,813	+79%
Two Wheeled Motor Vehicles	6,645	0.3%	3,620	0.4%	-3,025	-46%
Cars and Taxis	1,481,960	74.4%	612,514	61.3%	-869,446	-59%
Buses and Coaches	10,188	0.5%	2,940	0.3%	-7,248	-71%
LGVs	281,344	14.1%	204,977	20.5%	-76,367	-27%
HGVs	207,715	10.4%	169,162	16.9%	-38,553	-19%
Total	1,991,393		999,567		-991,826	-50%
Total Excluding 2 Wheeled	1,981,207		989,593		-991,614	-50%

With the exception of pedal cycles, which saw an increase of nearly 80% as Londoners took to bikes to get around, all vehicle types saw a reduction. Passenger cars, which accounted for around 75% of vehicles counted pre-pandemic, saw an average reduction of nearly 60% during the pandemic and nearly 90% of the change in vehicle numbers counted can be attributed to this reduction in car and taxi traffic.

Finally, Transport for London tracks bus speeds across its network to monitor bus service performance[12] and this provides an indirect measure of congestion in London. The data shows a substantial increase in average bus speeds across London during the first and third lockdowns in particular as congestion dropped:

[12] https://tfl.gov.uk/corporate/publications-and-reports/buses-performance-data

Figure 2: London bus speeds, 2017-2021 (Source: Transport for London)

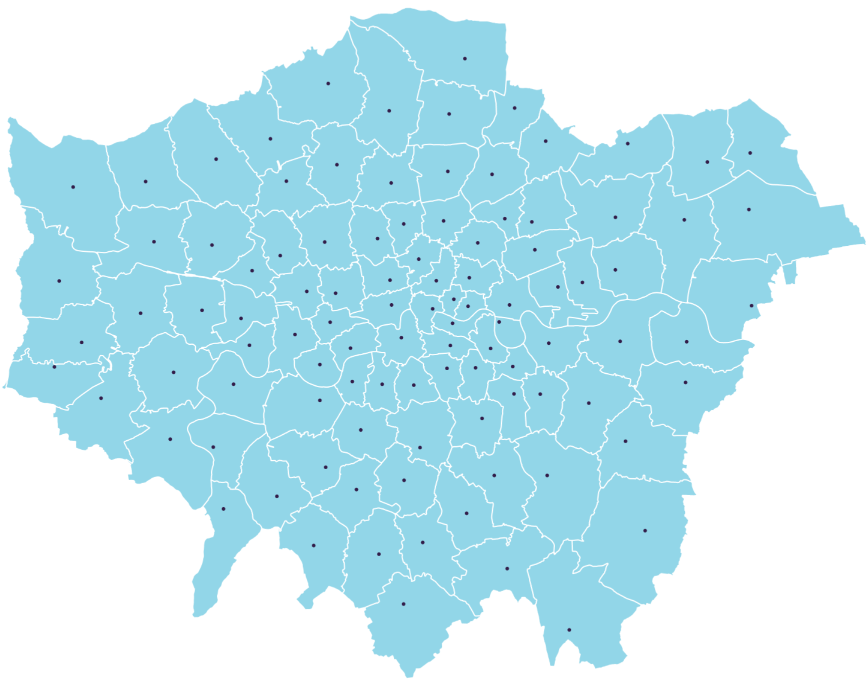


London Fire Brigade Travel Times

The London Fire Brigade responds to nearly 100,000 incidents each year (over 250 per day) and records data about the response times, including the time taken to travel from the station to the incident, for each of these.[13] It is therefore possible to build up a detailed picture of how response times have changed in the last few years, in particular during the pandemic.

The Greater London area is divided up into a number of station areas. The inner London stations typically cover an area ranging from under 1 square mile to around 6 square miles,[14] with outer London station areas being typically considerably larger, one of the reasons why average response times in outer London are over 30 seconds higher than response times in inner London.

Figure 3: London Fire station boundaries[15]



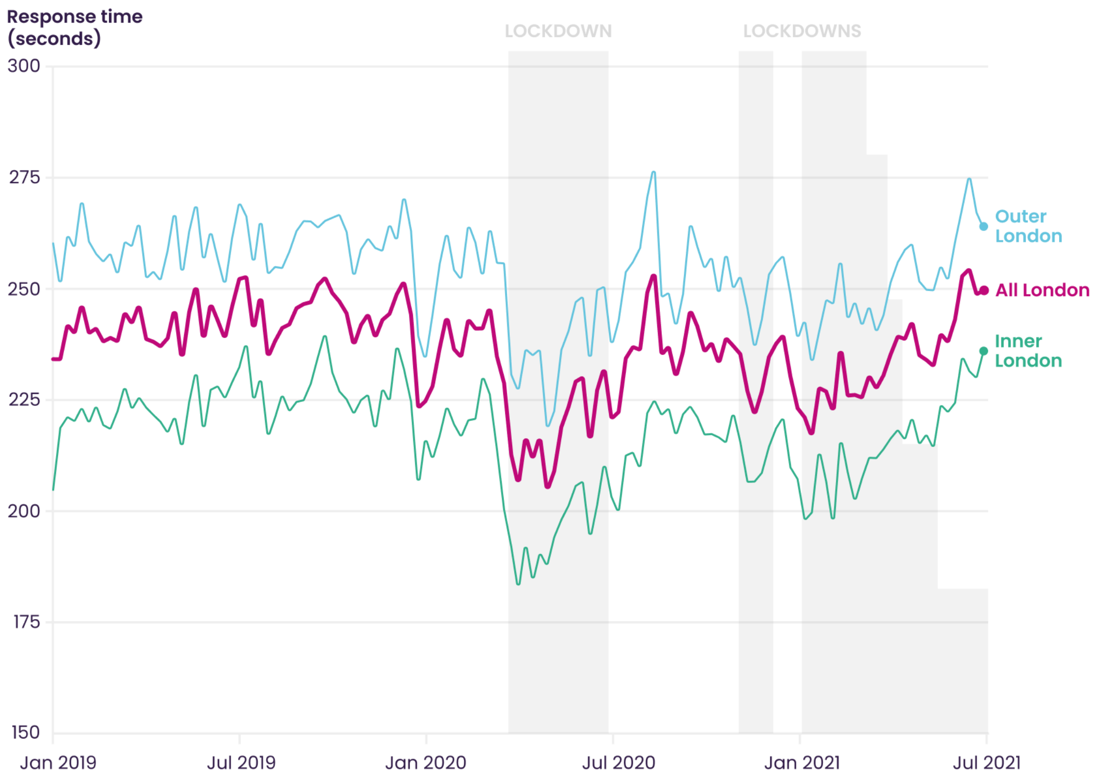
[13] https://data.london.gov.uk/dataset/london-fire-brigade-mobilisation-records

[14] https://www.whatdotheyknow.com/request/242506/response/597801/attach/2/LFB%20station%20boundaries.pdf

[15] https://www.whatdotheyknow.com/request/brigade_orders_and_ground_maps#incoming-597801

The chart below shows the average travel times between the station and the incident of the first appliance to arrive on the scene in each week from the start of 2019 to the end of June 2021, overlaid with the dates of the three lockdowns which had been imposed during the pandemic:

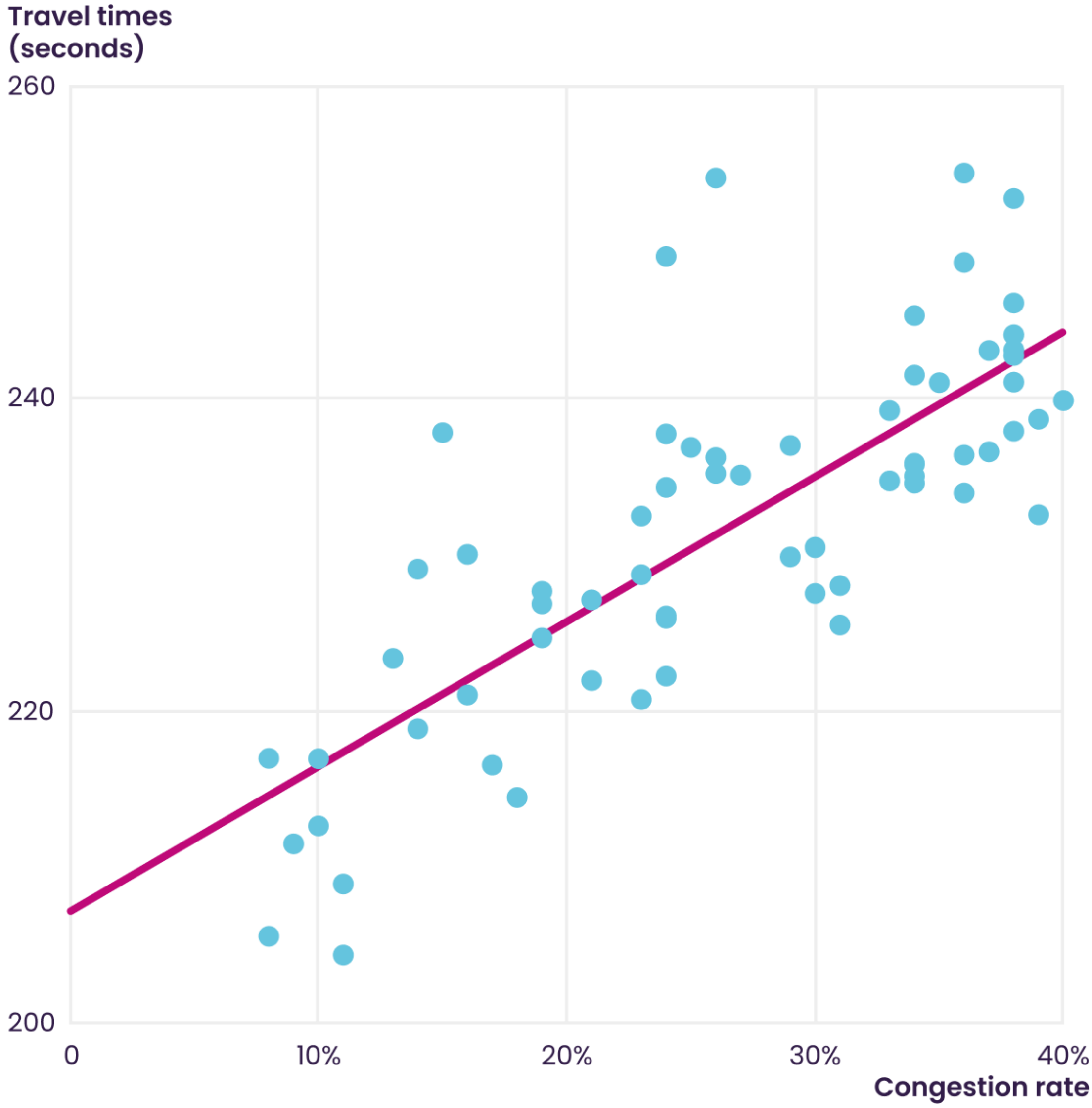
Figure 4: LFB 999 response travel times 2019-2021 (Source: London Fire Brigade, Fire Facts)



A pronounced reduction in travel times can be seen in the weeks running up to the first lockdown (starting in around week 10 of 2020) as Londoners started taking steps to reduce their movements and traffic levels reduced. Reductions in travel time were also seen during the second and third lockdowns although as congestion levels did not drop as far as during the first lockdown, these were not as pronounced.

The relationship between travel time and congestion level reveals that for each percent increase in congestion, the travel time by fire appliances increases by approximately one second:

Figure 5: LFB response travel times vs congestion metric.



Inner London fire stations saw a 44 second reduction (-20%) in mean travel times between week 10 and week 14 of 2020 while outer London fire stations saw a 38 second reduction (-14%) over the same period. Travel times in outer London dropped further as lockdown continued, reaching an 18% reduction in week 18 of 2020 compared with week 10.

Comparing April 2020 travel times with April 2019 shows that some inner London stations saw large improvements:

Table 2: London fire stations which saw the biggest reductions in 999 response times during April 2020 lockdown.

Station Name	Apr-19 Response Times (s)	Apr-20 Response Times (s)	Reduction	% Change
Soho	250	159	1m31s	-37%
Greenwich	204	148	0m56s	-27%
Deptford	228	169	0m59s	-26%
Shoreditch	211	157	0m54s	-26%
Tooting	246	189	0m57s	-23%
Paddington	233	183	0m50s	-22%
Lambeth	214	168	0m46s	-22%
Islington	233	187	0m46s	-20%
Peckham	215	173	0m42s	-19%
Euston	215	174	0m41s	-19%

Nationally, 999 response times to serious 'primary' fires have been rising inexorably since the 1990s. This rise is almost exclusively attributable to increases in travel time, since crew turnout times have fallen over this period, while call handling times flatlined or fell for protracted periods in which overall response times continued to increase[16]. Government analysis of the factors behind rising fire response times nationally from 1996-2006 concluded that rising traffic levels was the primary cause.[17]

Our analysis from the London lockdowns shows that when traffic levels fall, fire response times come down too - and that the most plausible explanation for this correlation is causal. To put it another way, the presence of 'normal' levels of motor traffic on the capital's streets are causing substantial delays to the London Fire Brigade's response times to the most serious incidents.

16 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/857924/response-times-fires-england-1819-hosb0120.pdf

17 https://webarchive.nationalarchives.gov.uk/ukgwa/20120919173844mp_/http://www.communities.gov.uk/documents/fire/pdf/frsresponsetimes.pdf

London Ambulance Service Response Times

NHS England publishes monthly data on average response times for each region of England, detailing the number of incidents and mean response times by incident category.[18] Unlike the fire brigade data, the ambulance data represents the total response time and not just the travel time to the incident. The clock starts when the call is coded as C1, when the first ambulance resource is assigned or 30 seconds after the emergency call connects, whichever is earliest.

As a result of this approach to reporting ambulance response times, and in contrast to London Fire Brigade response time datasets, it is not possible to fully disentangle the impact of congestion on ambulance journey times from other factors such as changes in call volumes (e.g. higher call volumes lead to longer call answer times) or changes in staffing levels, both of which are understood to have had a major impact on response times during the pandemic[19].

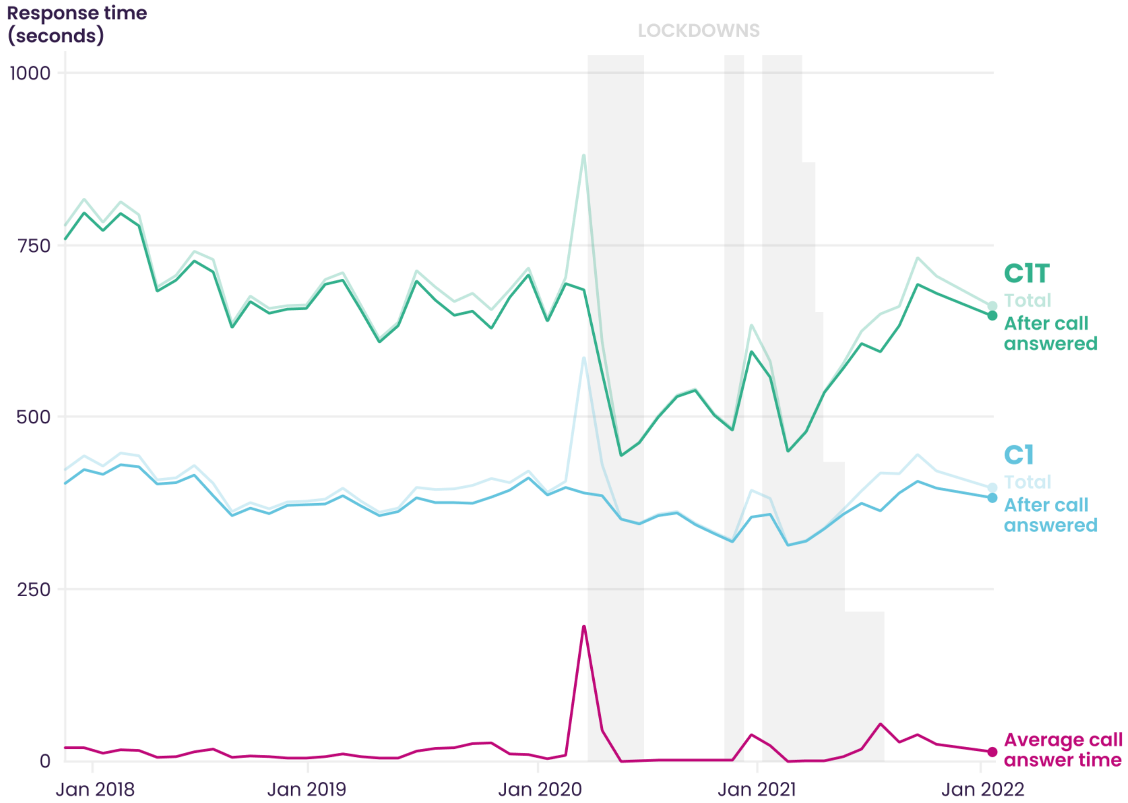
Incidents coded as C1 (Category 1) in the data are those that received a response on scene where life-threatening injuries and illnesses, specifically cardiac arrest, were involved. These incidents have a target mean response time of seven minutes. C1 incidents where any patients were transported by an Ambulance Service emergency vehicle are coded as C1T. C1T does not include incidents where an ambulance clinician on scene determines that no conveyance is necessary, or incidents with non-emergency conveyance. The C1T response time for an incident is the response time of the first vehicle which is capable of conveying the patient.

The NHS ambulance response data goes back as far as the end of 2017 when the C1 category was introduced, and shows the C1 target time of 7 minutes (420 seconds) being met since the summer of 2018. However, as the pandemic hit there was a substantial spike in total response times (see the dotted lines in Figure 6) as an exceptionally large volume of calls were received and the NHS was put under the immense

[18] https://www.england.nhs.uk/statistics/statistical-work-areas/ambulance-quality-indicators/
[19] Snooks et al, 2021: Call volume, triage outcomes, and protocols during the first wave of the COVID-19 pandemic in the United Kingdom: Results of a national survey https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8328888/

pressure of the pandemic.[20] This peak has since been confirmed as London Ambulance Service's busiest ever month[21] and during this surge, mean call answer times increased from a pre-pandemic average of around 12 seconds to 200 seconds.

Figure 6: Mean response times net of mean call answer time (solid lines) for C1 and C1T emergency, 2017-2021. The total response times have also been included along with the mean call answer time.[22]



By deducting the mean call answer time from the total response times we remove one of the major confounding factors (the time for the call to connect), leaving us with an estimate of the average time from the emergency call connecting to an operator through to the ambulance arriving on scene. However, substantial uncertainties remain in the extent to which the reduction in C1T response times which can be seen in the data can be attributed to reduced

[20] https://www.hsj.co.uk/ambulance-waiting-times-soared-in-march-as-calls-hit-record-high/7027368.article

[21] https://www.londonambulance.nhs.uk/2021/09/06/2021-summer-months-three-of-our-top-five-busiest-months-ever/

[22] https://www.england.nhs.uk/statistics/statistical-work-areas/ambulance-quality-indicators/

congestion (for example call duration, ambulance availability or crew turnout times may also have changed during this period).

As the ambulance data covers total response time, other factors beyond the level of congestion experienced travelling to an incident are also at play - as in the periods when surging Covid-19 cases overwhelmed the service, which were subsequently followed by a sustained drops in call volumes compared to the baseline.[23] Past NHS reviews of the factors behind geographical disparities in ambulance response times have found that these tend to be dominated by the overall workload in urban areas.[24] We therefore cannot state with complete confidence that reduced congestion explains the drop in response times seen during the Covid-19 lockdowns.

Nevertheless, the general trend in response times closely correlates with the congestion trends over the period in question. Moreover, there is no other plausible explanation for the substantially reduced *travel* response times experienced by the London Fire Brigade during the lockdown periods, and we therefore contend that it is reasonable to conclude that reduced congestion has played a dominant part in these faster response times. London's ambulances and fire appliances are using the same roads, after all.

This hypothesis is also supported by other circumstantial evidence. For instance, analysis of NHS England data by the Nuffield Trust has found a similar pattern in C1 response times since 2018 at the national level, with a spike at the start of the pandemic followed by a dip during lockdown;[25] but the national reduction in response time during this period was less pronounced than that seen in London - which in normal times is the most congested city in the UK.[26]

We were not able to determine why average response times between C1 and C1T calls have historically varied so widely. But we speculate that this may be explained by the fact that C1T includes only vehicles capable of conveying patients to hospital, and therefore excludes cycle and motorcycle paramedics, who are typically dispatched to life threatening incidents in parallel with ambulances, and are often first on the scene since they can "can get through the traffic faster

[23] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8328888/
[24] https://www.england.nhs.uk/wp-content/uploads/2018/10/ambulance-response-programme-review.pdf
[25] https://www.nuffieldtrust.org.uk/resource/ambulance-response-times#background
[26] https://inrix.com/press-releases/2019-traffic-scorecard-uk/

than a large ambulance".[27] This could also explain why the variance between C1 and C1T response times fell to under 100 seconds during lockdown, when it is typically over 300 seconds; perhaps "large ambulances" were no longer being held up by traffic? Further research would be needed to confirm this hypothesis however.

[27] https://www.londonambulance.nhs.uk/calling-us/who-will-treat-you/single-responder/

Implications

Although it is well established that there is a causal relationship between fire and ambulance 999 response times and fatality rates, this relationship is in most cases a highly complex one. For instance, the number and range of factors influencing whether a fire leads to fatalities is very large, and the non-linear relationship between fire spread and time elapsed makes it very difficult to draw any straightforward link between 999 response times and outcomes for victims of fires. Outcomes of delays for the diverse range of medical emergencies suffered by Londoners are perhaps even more challenging to quantify, and we were cautioned by clinical researchers that in practice patient outcomes are far too multi-factorial to be amenable to crude attempts at attribution.

Despite the confounding factors, the Department for Communities and Local Government has in the past used fire service data to develop a benchmark statistical model for planning fire service provision, in the form of the Fire Service Emergency Cover Toolkit.[28] "Fatality rate response time relationships" were developed which attempted to quantify the impact of different response times on fatality rates for a range of different incident types. There is no real question that Londoners are dying as a consequence of delays to 999 responses caused by congestion - even though it is not practicable to ascertain exactly how many and from what causes.

In the context of this report's focus it should also be noted that of London's 9,678 serious 'primary' fires in 2019, 1,925 of these involved motor vehicles - around 20% of the total.[29] Over 30,000 Londoners were casualties of road traffic collisions in 2019, nearly 4000 of whom were seriously injured or killed.[30] Motor traffic therefore not only impedes emergency service vehicles on their way to incidents; it also generates a high proportion of the most dangerous incidents being responded to.

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28 https://www.gov.uk/government/publications/2012-updates-to-the-fire-service-emergency-cover-toolkit-special-service-and-fire-fatality-rate-functions

29 https://data.london.gov.uk/download/lfb-fires-in-london-1966-2019---fire-facts/cfd2b25b-8014-436f-add2-a68ef9017bee/Fire%20Facts%20-%20Fires%20in%20Greater%20London%202019.pdf

30 https://tfl.gov.uk/corporate/publications-and-reports/road-safety - https://app.powerbi.com/view?r=eyJrIjoiNzgyZTc0ZmYtMjlmOC00ZGFmLWJmNzMtZWJkMjdhMDU4MGY1IiwidCI6IjFmYmQ2NWJmLTVkZWYtNGVlYS1hNjkyLWEwODljMjU1MzQ2YiIsImMiOjh9

Conclusion

The COVID-19 pandemic and the effects of its associated civil lockdowns offer an unprecedented 'living experiment' opportunity to assess the impact of typical congestion levels in London on the response times of its emergency services. This paper has shown that these effects are very substantial, and we believe that in practice they are likely to account for a significant number of excess deaths each year amongst Londoners requiring urgent assistance for both fires and medical emergencies.

Because traffic congestion has become an endemic feature of life in London, most residents, including emergency service crews, have become desensitised to its negative effects. Imaginary grievances about perceived acute impacts on 999 response times arising from new cycle lanes and low traffic neighbourhoods generate sensational headlines and fury on social media - despite not being detectable in official records. Meanwhile the real, chronic impacts of too many cars on the city's streets are demonstrably preventing life saving emergency services from getting to their destinations as quickly as they might, yet continue to go unremarked and unreported. We hope this short report will go some way towards rectifying this.