Cadent
Your Gas Network

Appendix 09.21

Cadent's Regional Factors

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1. Introduction and Summary

This appendix describes and quantifies the Regional Factors that we consider apply to Cadent's price-controlled activities.

We believe it is important that the cost assessment modelling takes appropriate account for valid Regional Factor claims, as this will improve the robustness of the modelling, not disadvantage individual GDNs, and ensure that customers in each GDN are funding a broadly efficient level of cost.

As noted in our response to the RIIO-2 Tools for Cost Assessment consultation paper dated June 2019, because Ofgem's Regional Factor adjustments are made pre-modelling, allowing Regional Factors does not increase costs to customers overall, it is the split between customers that is changed. Allowing an invalid Regional Factor means that customers in one GDN pay a little too much, and in the other seven not quite enough. Conversely, the impact of not allowing a valid claim is not only unfair to the GDN, but leads to customers in that GDN paying too little, and in the others too much. Consequently, it is as damaging to customers not to allow a valid Regional Factor, as it is to allow an invalid one.

Some of the proposed adjustments are one-way, others, such as regional pay, are two-way depending on the nature of the adjustment. We have not proposed making one-way adjustments two way artificially, by imposing arbitrary changes, as this would undermine confidence in the cost assessment models.

We wanted to be as thorough as possible in our assessment of potential Regional Factors for RIIO-2, which is why we have chosen not to include a significant number of potential claims. In addition, because the vast majority of potential Regional Factors are incurred in the London region, either through higher costs or environment related productivity impacts, we have taken part in a project run by NERA and Arcadis, together with Thames Water, UK Power Networks, and SGN, in order to try and identify common London factors across our Networks. The report, "Understanding the Baseline Level of Efficiency in London" was finalised on 31st October, and is submitted to Ofgem separately in our December Plan as Appendix 09.40. In this appendix we have included a comparison of its findings with our own.

Note that we run London network operations as a single network, even though it covers areas not only within London GDN but also those within East of England GDN, such as Tottenham. For RRP reporting purposes, we transfer 9% of the operations cost of London network to East of England GDN, reflecting our estimate of the proportion of London network's opex activities carried out there. For this reason, the calculations in this paper associated with additional opex incurred in London network are typically reduced by 9% to reflect the transfer of that element of cost to East of England GDN.

This appendix also contains our forecast of an efficient level of cost that Cadent will incur on Guaranteed Standards of Service. We have not included these costs within our totex forecasts as per the regulatory guidance. However, we disagree with this approach as it does not reflect the efficient level of costs for our networks. We set out in full why we believe an efficient level of cost should be funded, our assessment of what that level of costs should be, and the extent of the Regional Factor for London GDN.

We have divided this Appendix into eight sections covering:

- Section 2: Regional pay – to reflect the efficient level of pay costs in London region and the South East region.
- Section 3: Repex productivity – evidence for and calculations of additional costs in London region due to lower productivity in repex and similar i.e. connections and reinforcement activities.
- Section 4: Other Regional Factors evidenced – comprising the evidence for additional factors.
- Section 5: Regional Factors reconciliation - a reconciliation from the Regional Factors described in October to those set out in this document.
- Section 6: Potential Regional Factors not included – to summarise the items investigated but rejected.
- Section 7: Report comparison - a comparison of the London common factors report with this document.
- Section 8: Guaranteed Standard of Service costs.

The table below summarises the value of Regional Factors for 2018/19 set out in each section.

2018/19 prices per annum	EoE	Lon	NW	WM	Cadent
Regional Pay	£3.6m	-£17.0m	£3.7m	£2.7m	-£7.0m
Repex Productivity	-£0.6m	-£8.3m	-	-	-£8.9m
Other RFs evidenced	-£5.3m	-£18.5m	-£2.7m	-£0.9m	-£27.4m
Total	**-£2.3m**	**-£43.8m**	**£1.0m**	**£1.8m**	**-£43.3m**

Based on Ofgem guidance, we have structured each Regional Factor claim to address three issues as follows:

- The reason for the claim
- Calculation and materiality
- How Cadent manages the cost

We have also structured each section in descending order of value, so that the most material items are addressed first.

Each section and Regional Factor is considered separately below.

2. Regional Pay

Reason for claim

It has long been accepted by Ofgem that the efficient cost of labour in London, and to a lesser extent in the South East, is higher than that in the rest of the country. The more subjective part of this Regional Factor claim is how to perform the calculation to quantify the extent to which the efficient cost of GDN labour in London and the South East is higher than elsewhere.

Note that our claim covers not only London GDN but also East of England GDN in respect of that part of its area which falls within London region.

Calculation and materiality

In our calculation we have been guided by the calculations Ofgem performed at RIIO-1 and updated them using the latest data.

To recap on the approach used at RIIO-1, Ofgem:

1. Found a weighting of GDN labour (Direct and Contractor) by averaging GDN responses to a data request, where GDNs split their labour across 31 3 digit Standard Occupational Classification (SOC) codes.
2. Took the ONS Annual Survey of Hours and Earnings (ASHE) mean annual gross pay data for 2010/11, and calculated the additional cost of labour of two regions, London Region and the South East Region, relative to the remainder of the UK, using the weighted SOC code data. This resulted in GDN work in London Region being assumed to cost 29.4% more than, and South East Region 8.8% more than in the remainder of the UK.
3. Assumed that work fell pro-rata to population, then took data on resident population by Region and Local Authority as at mid-2010, and attributed these across each GDN. The result was that London GDN's work was assumed to be 75% in London Region, 13% in South East Region and 12% in the remainder of the UK.
4. Applied the result to labour which was assumed to be needed at a local level, which comprised all Emergency, Repair, Maintenance, Other Direct, Repex and Capex, and 40% of Work Management. For London GDN, this resulted in 95.5% of work for these activities assumed to be carried out locally.

The end result was that the efficient cost of labour in London GDN was assumed to be 22.1% above that in GDNs other than Southern GDN and East of England GDN.

In our calculation for RIIO-2 we have adhered to the approach adopted by Ofgem at RIIO-1 and updated the data, although we have also changed it in one respect.

The change we have made was to use the ONS ASHE data for gross hourly earnings, rather than gross annual earnings. We did this, although it reduces the scale of the London pay adjustment, because we believe the regional pay adjustment should represent the price of labour, and not be affected by people in some regions working more hours than in other regions.

We have also carried out four updates to the data as follows:

- First, we updated the date of the ONS ASHE data, using data for 2017/18.
- Second, we updated the population data to mid 2017, using the MYE2 data set from the ONS.
- Third, we updated the local labour content of Work Management from 40% to 44%, to reflect actual RRP data in RIIO-1
- Fourth, we updated the value of repex contractor labour to reflect the recategorisation of around 25% of repex termed labour in the RRP to Plant Hire, Materials and Other. This follows the completion of work flagged in October on the composition of repex contractor costs.

For the first update, we have used the ASHE data for 2017/18, rather than that for 2018/19, which has recently become available, because of concerns over the robustness of the most recent data, in particular, that of SOC code 531 Construction, which has a 32% weighting in the calculation. The ONS describes the accuracy of data using the Coefficient of Variation ("CV"), expecting the true value of pay data to lie within +/- twice the CV, so if there was a pay value of £200 with a CV of 5%, the ONS would expect the true value to lie between £180 and £220.

In 2017/18, for London region, the 531 Construction code had a coefficient of variation of between 5% and 10%, so the ONS would expect the true value to lie between +/- 10% and 20%. For 2018/19 however, the data had a CV of between 10% and 20%, so the true value could be up to 40% different.

Combined with the CVs of the other SOC codes with a 68% weighting in the calculation, the true value of GDN work for London region would be expected to lie within 20.0% of the reported result for 2018/19, as compared to 13.7% a year earlier. Therefore, given the significantly greater accuracy of the 2017/18 data, we have continued to use the pay data for the earlier year.

For the third update, the figure of 44% represents the local Operations Management proportion of relevant Work Management (i.e. Work Management less holder demolition and land remediation which are assessed separately by Ofgem). This was calculated as approximately 66% for all GDNs over the period from 2013/14 to 2018/19, reduced by one third to reflect Operations Management costs that are centrally incurred -a proportion that is based on actual data for 2018/19.

The results of the third and fourth updates together was to slightly reduce the proportion of London GDN's work (i.e. Work Management, Emergency, Repair, Maintenance, Other Direct Activities, Repex and Capex) since RIIO-1 which needs to be carried out locally to 95.3%.

The tables below summarise the results for London GDN and East of England GDN, comparing each to the results found by Ofgem for RIIO-1.

2017/18 - London GDN	ASHE indices for notional GDN	Population split by region		Composite ASHE index	Uplift on UK remainder
		Raw data	with 95.3% local work		
London Region	119.24	76.6%	72.9%	86.98	
South East Region	101.67	9.9%	9.5%	9.62	
Remainder of UK	**95.99**	13.5%	17.6%	16.88	
		100.0%	100.0%	**113.49**	**18.2%**
2010/11 comparative					*22.1%*

2017/18 - East GDN	ASHE indices for Notional GDN	Population split by region		Composite ASHE index	Uplift on UK remainder
		Raw data	with 93.8% local work		
London Region	119.24	5.2%	4.9%	5.79	
South East Region	101.67	0.0%	0.0%	0.00	
Remainder of UK	**95.99**	94.8%	95.1%	91.33	
		100.0%	100.0%	**97.12**	**1.2%**
2010/11 comparative					*1.3%*

The uplift for London pay has fallen since RIIO-1 principally because the ASHE indices show a reduced differential for pay between London region and South East region and the remainder of the UK for 2017/18 as compared to 2010/11. Using RRP data for 2018/19, as adjusted for the re-categorisation of around 25% of

repex, we estimate that the adjustment is worth around £17.0m p.a. for London GDN p.a., with an opposite two-way adjustment of £10.0m applied to our other GDNs, as shown below.

2018/19 Regional Factors	EoE	Lo	NW	WM	Cadent
	£m	£m	£m	£m	**£m**
Regional pay	3.6	-17.0	3.7	2.7	**-7.0**

Implicit in Ofgem's approach as updated above are the assumptions that:

- Workload between regions is pro-rata to population.
- All areas outside of London region and the South East region have the same levels of pay.

As we enter the later stages of the HSE-driven mains replacement programme, the population of available iron mains reduces, with the result that GDNs have less and less choice of where to work, and will therefore need to work in more costly parts than previously. Consequently, both of these assumptions are likely to be less valid in future than in the past, which is likely to lead to insufficient allowance for variations in regional pay levels.

How Cadent manages the cost

This Regional Factor claim is based upon the efficient price of labour, using external ONS benchmark data, rather than Cadent's and its contractors' own costs. Cadent does not impact the ONS benchmark, or at least not in a material, measurable way, so we cannot manage the extent of regional cost variations as shown by the ONS.

We manage our labour costs in several ways:

- First, through the GDSP contracts with Tier 1 Contractors, which cover the vast majority of mains and services replacement activity, connections and reinforcement activities. Under these contracts, the Tier 1 Contractors procure labour from sub-contractors, and are incentivised using a pain / gain sharing mechanism, under which variations from target prices are shared 50/50 with Cadent. Half of each Repair team is also typically sourced through the GDSP contracts.

- Second, for new starters joining the company from April 2019, we have used new terms and conditions, which reduce their remuneration package compared to existing employees.

- Third, we target market median levels of pay.

- Fourth, we have acted where we were aware that salaries were out of alignment. For example, for Business Support staff grades 6-8, we have applied a two year pay freeze.

- Finally, at the start of RIIO-1 we revised our Terms and Conditions of employment, introduced an RPI linked pay deal and revised our pensions arrangements. We have also frozen manager pay in 2018/19.

3. Repex productivity

Reason for claim

At RIIO-1 Ofgem recognised additional productivity impacts of underground working in London's very dense urban environment by assuming that the efficient level of productivity within the M25 for repex and repex type work (mains reinforcement and connections) was 15% less than elsewhere in the country. This was in addition to the Streetworks related productivity issues associated with permits placing restrictions on how work was done.

Difficulties in carrying out the repex programme centre around access and working difficulties, which interact with each other. To obtain access means that we need to plan 12 – 18 months in advance to obtain approval from the Local Authorities and keep those affected by our proposed work on-side, before and during the work. We have particular access difficulties where:

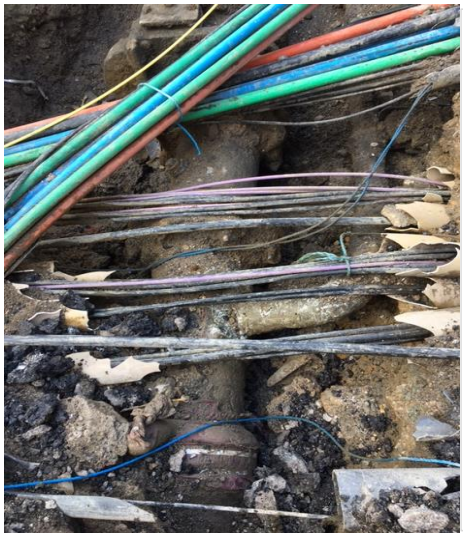
- We have narrow windows of time in which to work: local Authorities limit access and then divide it between utilities – we try to work with other utilities, but this is not always possible, for example, due to Health & Safety concerns.
- Our work will impact bus routes – in order to obtain permission from the Local Authority we have to provide analysis to show alternative bus (and HGV) routes, fund moving bus shelters and reprogramming traffic lights, and even fund additional bus provision if we block a route.
- Other projects have Development Consent Orders (DCOs) which give them priority – Tideway, Crossrail and HS2 all have DCOs, which remove or restrict our ability to work where these other projects are working.
- There are listed buildings – the relevant authority, such as English Heritage need to approve any planned work providing an additional hurdle.
- There are security concerns – especially in Westminster, to protect politicians and royalty certain roads are used as "escape" routes. We are not informed which roads are included in advance, and the roads we cannot access can change, depending for example, on the availability of other routes due to road works.

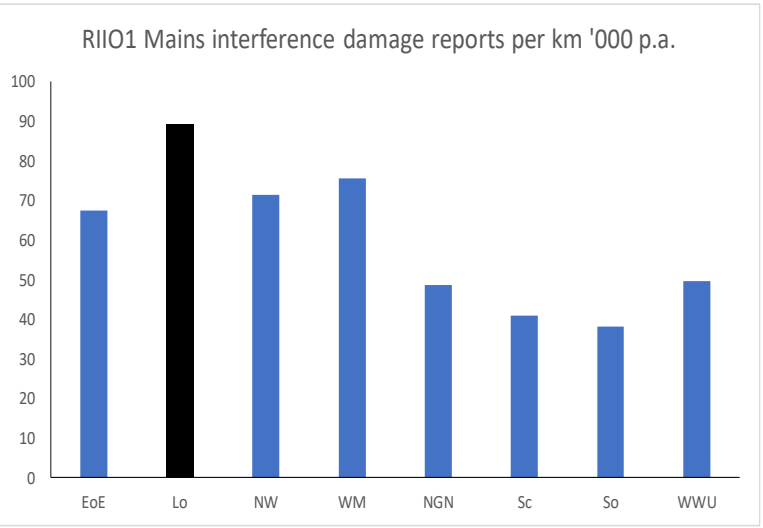
We have particular working difficulties due to:

- Lack of road space: in rural areas we might be allowed a wide strip to work in. In London, to avoid shutting roads, we typically are allowed a strip only 3 metres wide, which impinges work.
- Greater congestion, traffic and cycle routes make it more difficult to work safely and allow others to pass by.
- International visits and demonstrations, especially in Westminster, City of London, Camden, Islington and the Royal Borough of Kensington and Chelsea: we have to clear sites part way through jobs and leave, to return after the visit or demonstration has occurred. Sub-contractors still need to be paid during these periods.
- Events, such as Ride London or the London Marathon require us to stop work, carry out interim reinstatement, clear site, and return subsequently.
- In Inner London, there are significant restrictions on when we can work. For example, we need to deliver Tier 2 or 3 pipe at night because the lorries carrying the pipe would restrict access to the roads. This means teams have to be there to accept the pipe, which restricts the hours they can work the following day. Another example is in the City, we are not permitted to carry out noisy work between 10am and 12am, or between 2pm and 4pm.
- More investigation work being needed - if pressure readings are not quite right prior to work beginning, camera investigations may need to be undertaken which can find rubble in mains, or that the network is

not configured as we thought: this is an especial issue for London where WW2 bomb damage was repaired without records being updated at the time.

- Labour churn – we believe that there is greater churn of labour in London, impacting the continuity of resources available to our sub-contractors.
- Underground congestion - makes accessing mains and services far more difficult, especially in central London, as this picture below from Cannon Street shows. RRP data, highlighted in the chart, shows that there are more reports of mains interference damage per km of main in London than any other GDN in every year of RIIO-1 to date, supporting greater underground congestion in London GDN than elsewhere.





Calculation and Materiality

We have performed analysis using data from tRIIO - our GDSP contractor for London and East of England) - and the RRP in order to calculate a reasonable assumption for London's repex and repex type work productivity adjustment.

The basis of our analysis is tRIIO data on repex productivity by Local Authority over the period from April 2013 to December 2018, which we have summed to produce totals for East of England and London GDNs. However, this fails to take into account either:

- the different mix of diameter bands between GDNs, or;
- the fact that part of the productivity differential, that due to NRSWA, is already taken account of in the Streetworks adjustment, as set out in RRP table 3.13. Not reflecting this would be to "double - count" the required adjustment.

Therefore, our analysis consists of four steps:

- First, to sum the Local Authority data to produce productivity by GDN for the five and three quarter years from April 2013 to December 2018.
- Second, to adjust for diameter band differentials between GDNs.
- Third, to remove that element of productivity already taken account of as associated with NRSWA.
- Fourth, to combine the results of the first three steps.

Step one

The first step of the analysis is shown below.

April 2013 to December 2018	**Length laid**	**Productivity**
	km	m per man week
East of England	3,548	**34.9**
London GDN		
Non-London region	448	35.4
Outer London region	930	30.2
Inner London region	67	4.0
	1446	**30.6**
less:Non-London region	-448	
London region	997	**28.4**
London region v EoE		**-18.6%**

The calculation shows that, for the first five and three quarter years of RIIO-GD1, mains replacement productivity was nearly 19% lower in London region than East of England GDN.

Step two

The second step of the analysis is to calculate the extent to which the lower productivity in London region is due to laying larger diameter band pipe – because diameter band is taken account of in the Ofgem repex regression, it would be wrong not to remove this effect from the 18.6% calculated in step one above. The second step combines further data from tRIIO showing the difference in productivity per week for the three tier 1 diameter bands, with information on km laid taken from the RRPs for the first five years of RIIO-1, as shown below.

2013/14 - 2017/18	Length laid per RRP		Tier 1 productivity	
Tier 1	Km	%	m per man week	Weighted
EoE GDN				
mains <=75mm	1,243	44%	32.2	14.2
mains >75mm to 125mm	1,430	51%	28.1	14.3
mains >125mm to 180mm	141	5%	21.8	1.1
	2,814			**29.6**
Lo GDN				
mains <=75mm	549	33%	32.2	10.8
mains >75mm to 125mm	1,019	62%	28.1	17.4
mains >125mm to 180mm	76	5%	21.8	1.0
	1,643			**29.2**
Diameter band mix: productivity impact London v East (m)				**-0.4**
Impact of diameter band mix on London productivity v East (%)				**-1.4%**

The table above shows that, combining length laid by diameter band data from the RRP with productivity data by diameter band from tRIIO, it would be expected that London GDN's productivity would be around 1.4% less than East of England, due to London's larger diameter bands.

Step three

The third step is to take account of the productivity impact already included within the RRP Streetworks table, table 3.13.

2013/14 - 2017/18	East GDN	London GDN
2017/18 prices	£m	£m
Total Net Repex per RRP	540	560
less MOBs	-8	-46
less non mains replacement services	-45	-68
less Total Streetworks	-16	-33
Underlying mains replacement	**471**	**413**
Streetworks productivity impact RRP £m	8.5	16.9
Streetworks productivity impact %	1.8%	4.1%
London v EoE streetworks productivity variance		**-2.3%**

RRP data shows that the impact of Streetworks on mains replacement repex is around 1.8% in East of England, as compared to around 4.1% in London – consequently, around 2.3% of London's lower productivity is associated with NRSWA, already taken account of by Ofgem and so should be excluded.

Step four

Step four is to combine the results of the first three steps, that is to reduce the overall productivity differential between London and East GDNs by the amounts due to London GDN replacing mains with larger diameter bands than East, and by the impact of NRSWA on productivity as per the RRP, which is assessed separately by Ofgem. The results of the three steps are summarised below.

London region v EoE GDN	Productivity m per man week
Absolute differential - step 1	-18.6%
Of which diameter mix - step 2	-1.4%
Of which streetworks productivity - step three	-2.3%
Underlying differential	**-14.9%**

The table shows that, taking account of London's larger diameter bands, and productivity impacts already reported under NRSWA, within the M25 repex and repex type productivity would be expected to be around 15% less than that in East of England. Assuming that repex workload broadly matches population – which may not be reasonable going forward - with 74% of London GDN's population within the M25, the impact on London GDN would be around 11%, which is around £11m p.a.

The table below shows, for 2018/19, the value of productivity adjustments for repex and closely associated capital activities – connections and reinforcement which, given the closely related nature of the activities, would be expected to experience similar productivity effects.

Repex and associated productivity adjustments					
2018/19	**EoE**	**Lo**	**NW**	**WM**	**Cadent**
	£m	£m	£m	£m	**0.0**
Repex	-0.5	-7.5	0.0	0.0	**-8.0**
Capex	-0.1	-0.8	0.0	0.0	**-0.9**
	-0.6	**-8.3**	**0.0**	**0.0**	**-8.9**

The table includes the impact on East of England GDN in respect of that proportion of its activities that are assumed to take place in the Tottenham area of London.

How Cadent manages the cost

During RIIO-1 Cadent has delivered Repex efficiency through a combination of large scale, long-term contracts that created economies of scale and efficient labour and back office operations costs, including through efficient scheme design. These contracts include:

- target costs ratcheted down over the course of the contract;
- deviations from target costs being shared 50/50 with Cadent to share risk and keep both parties incentivised; and
- payment only being made once projects are completed as per the design and Cadent's systems are updated accordingly – this has led to the GDSP contractors holding several months' work in progress.

Elsewhere our Plan describes how we will be undertaking a more difficult mix of mains and services replacement work in RIIO-2 than RIIO-1, and how some of the additional costs will be offset by further efficiencies through a revised contracting strategy and innovation. At present, we envisage the net effect being broadly comparable across our GDNs, and consequently, that the 15% London productivity assumption should remain unchanged for RIIO-2.

4. Evidenced Regional Factors

This section comprises our proposed Regional Factors in addition to Regional Pay and Repex productivity, examined in Sections 2 and 3. The table below summarises the additional Regional Factors in order of size in 2018/19, and states which activity or activities they relate to.

Section	2018/19 impact	EoE	Lo	NW	WM	Cadent	Activities
		£m	£m	£m	£m	£m	
4.1	Cathodic Protection	-3.0	-0.5	-1.8	-0.7	**-6.0**	Maintenance, Wk Mgt
4.2	Thames Tunnel and IP	0.0	-3.5	0.0	0.0	**-3.5**	Reinforcement
4.3	Parking Bay suspension - investment	-0.1	-3.1	0.0	0.0	**-3.2**	Repex, connections
4.4	Reduced depth of cover	-1.6	-0.1	-1.1	-0.2	**-3.0**	Maintenance
4.5	Repex reinstatement	0.0	-2.9	0.0	0.0	**-2.9**	Repex
4.5	Emergency job times	0.0	-2.6	0.0	0.0	**-2.6**	Emergency
4.7	Plant hire - repex	0.0	-2.1	0.0	0.0	**-2.1**	Repex
4.8	Repair reinstatement	0.0	-1.6	0.0	0.0	**-1.6**	Repair, Maint, repex
4.9	Holford Salt cavity	0.0	0.0	-0.8	0.0	**-0.8**	Maintenance
4.10	Traffic Management Hire	-0.5	-0.3	0.0	0.0	**-0.8**	Repair
4.11	London depot rental costs	-0.1	-0.6	0.0	0.0	**-0.7**	Business Support
4.12	24 hour shift patterns	0.0	-0.5	0.0	0.0	**-0.5**	Emergency
4.13	Opex Parking Bays and TTROs	0.0	-0.5	0.0	0.0	**-0.5**	Repair
4.14	Sparsity	-0.1	0.3	0.2	0.0	**0.4**	Emergency
4.15	London congestion charge	0.0	-0.2	0.0	0.0	**-0.2**	Emergency, Repair
4.16	London Local Authority Tunnels	0.0	-0.2	0.0	0.0	**-0.2**	Maintenance
4.17	Locksmiths	0.0	-0.1	0.0	0.0	**-0.1**	Emergency
	Subtotal	**-5.3**	**-18.5**	**-3.4**	**-0.9**	**-28.2**	
less:	Holford in MEAV			0.8		**0.8**	Maintenance
	Total	**-5.3**	**-18.5**	**-2.6**	**-0.9**	**-27.4**	

The table includes an item, for Holford salt cavity for £0.8m, which we then deduct from the total. This has been deducted because the storage capacity of Holford is included in table 6.3 of the RRP, despite the site not being owned, which flows through into the MEAV calculation, used as a driver for both Maintenance and Totex at present. To include the rental as a Regional Factor would therefore represent a double count, as long as MEAV is used as a significant driver.

We have also made a number of changes to our Regional Factors since the October Plan. Section 5 below sets out a full reconciliation by GDN from the Regional Factors described in October to those set out in this document.

4.1 Cathodic Protection

Reason for claim

Steel is the most suitable material for transporting gas at higher pressures. However, steel is susceptible to corrosion. Protection against corrosion is primarily provided by a coating applied to pipelines, for new pipelines when they are made and for existing pipelines when a new connection is made. Secondary protection is provided by Cathodic Protection. For longer pipelines in rural areas this is achieved by applying an impressed electrical current provided by a transformer rectifier linked to a buried ground bed anode, with test posts showing above ground to assess whether the current is within acceptable limits for both “On” and “Off” readings. In more urban areas, where space is restricted, and to ensure that buried plant belonging to third parties is not affected by our Cathodic Protection, an alternative approach of sacrificial anodes is used.

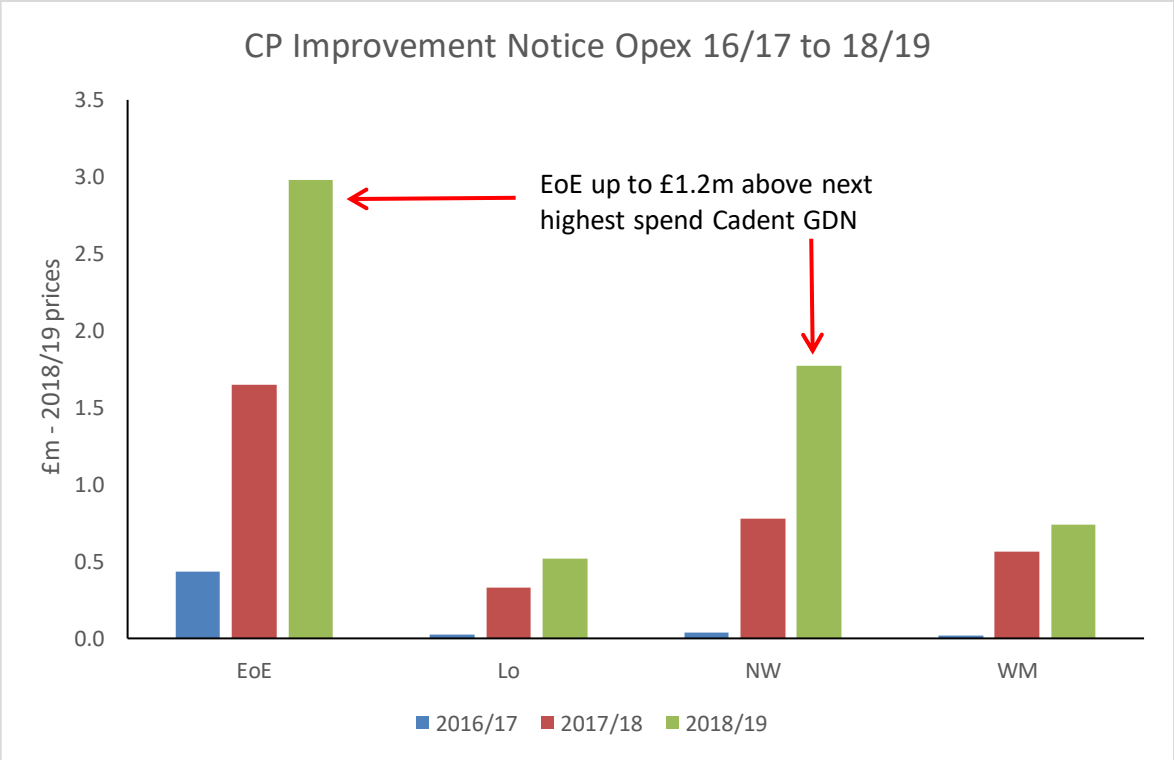
GDNs need to be able to check that the current flowing along the pipelines is within acceptable limits, which must be done either at two or five yearly intervals. If not, there could be an issue with the test post, the anode, the location where current is applied, or the pipeline itself. Cadent holds records of Cathodic Protection schemes, and all inspection results in a system called “Uptime”.

Cadent’s approach to maintaining the functionality of Cathodic Protection on all its steel pipelines is set out in a document known as ECP/2, and since 2018 ECP/4 for those operating at pressure of under 2 bar. In 2015 the HSE reviewed Cadent’s compliance with ECP/2 for Medium Pressure (MP) and Low Pressure (LP) pipelines, found it fell short, and consequently issued an Improvement Notice in November of that year, requiring us to put in place systems to plan and carry out remedial work, both on the records held in Uptime, and, where found to be necessary, on the physical assets providing Cathodic Protection.

The physical work required depends on the circumstances of each section of pipeline but include:

- broken test posts;
- depleted or faulty sacrificial anodes or anode beds;
- faults with transformer rectifiers;
- wiring faults; and
- faults with remote monitoring equipment.

Following the Improvement Notice, Cadent has incurred additional costs in RIIO-1 in 2016/17, 2017/18, and 2018/19, mainly in East of England GDN, as shown below.



We expect the backlog of work arising from the Improvement Notice to have been completed in West Midlands GDN by the end of RIIO-1, to carry on throughout GD2 in East of England GDN, and to finish during GD2 period in London and North West GDNs.

This issue is unique to Cadent and workload related, so we believe that an adjustment should be made to Ofgem's benchmarking in 2016/17, 2017/18 and 2018/19.

Calculation and Materiality

We have data on the Maintenance work execution and Work Management costs associated with the Cathodic Protection Improvement Notice for MP and LP pipelines for 2016/17, 2017/18 and 2018/19 as shown below.

	Maintenance work execution			**Work Management**			**Total**		
	2016/17	2017/18	2018/19	2016/17	2017/18	2018/19	2016/17	2017/18	2018/19
	£m	£m	£m	£m	£m	£m	£m	£m	£m
EoE	0.4	1.5	2.8	0.0	0.1	0.1	**0.4**	**1.6**	**3.0**
Lo	0.0	0.3	0.4	0.0	0.0	0.1	**0.0**	**0.3**	**0.5**
NW	0.0	0.7	1.6	0.0	0.1	0.1	**0.0**	**0.8**	**1.8**
WM	0.0	0.5	0.7	0.0	0.0	0.0	**0.0**	**0.6**	**0.7**
	0.5	**3.1**	**5.6**	**0.0**	**0.2**	**0.4**	**0.5**	**3.3**	**6.0**

In the above table, we identified Work Execution costs for all years, and Work Management costs for 2018/19. We then calculated Work Management costs for 2016/17 and 2017/18 using the Cadent ratio of Work Management to Work Execution for Cathodic Protection in 2018/19.

Because we believe that this workload issue is unique to Cadent, arising from the HSE Improvement notice, we consider that all the above costs should be adjusted for benchmarking purposes, and not only East of England, where the majority of the costs are.

In respect of materiality, the Opex element is treated as NRMP opex, part of Maintenance work execution. The largest impact is on East of England GDN, where the Opex element represents around 11% of normalised cost in 2018/19.

In respect of the RIIO-2 period, our Plan contains a lower level of spend that in 2018/19, but nonetheless a significant amount of spend, specifically in respect of the MP / LP pipelines, as set out in the table below.

RIIO2	2021/22	2022/23	2023/24	2024/25	2025/26	**RIIO2**
	£m	£m	£m	£m	£m	**£m**
EoE	2.3	2.2	2.2	2.2	2.2	**11.2**
Lo	0.9	0.9	0.9	0.4	0.0	**3.1**
NW	2.1	1.0	0.1	0.1	0.0	**3.3**
WM	0.0	0.0	0.0	0.0	0.0	**0.0**
Cadent	**5.3**	**4.0**	**3.2**	**2.8**	**2.2**	**17.5**

How Cadent manages the cost

In respect of the required workload, we inform the HSE every year at the Major Accident Hazard Pipeline meeting what work we aim to complete, to maintain their confidence that Cadent is making progress in fulfilling the requirements of the Improvement Notice.

In respect of the cost of carrying out the work, we set up a Framework agreement in 2016, under which five suppliers can carry out Cathodic Protection Improvement Notice related work, which could either be directly allocated or subject to mini-tender. For the first year's work we carried out a mini-tender, which two suppliers won. In subsequent years, we have directly allocated each year's work to these suppliers, using the Framework terms, because these contractors have performed well, and there would be a cost to Cadent in changing suppliers as we would need to assist them in obtaining Safe Contractor Operations certificates for relevant personnel.

Progress and performance is monitored at monthly review meetings between Safety, Network Strategy and Operations to ensure that costs and work delivery is on track.

4.2 Thames Tunnel and Intermediate Pressure Reinforcement – London

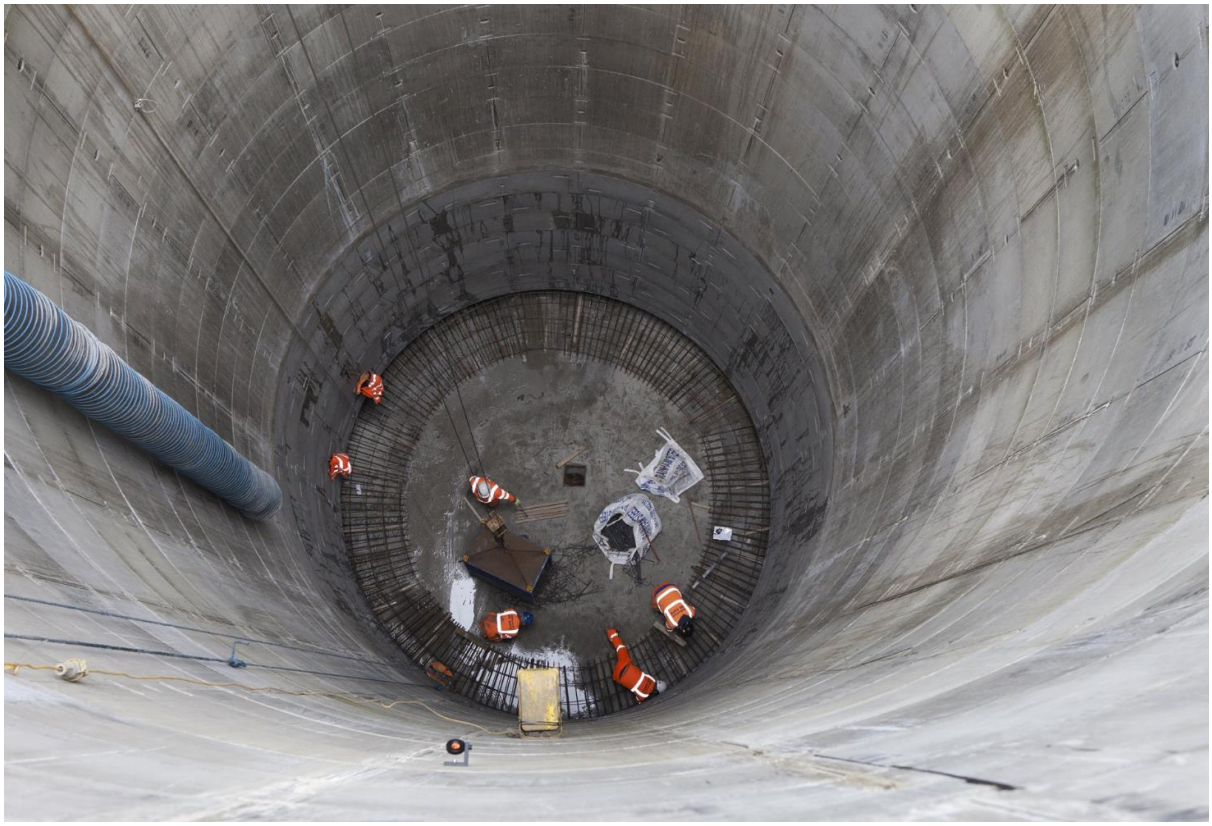
Reason for claim

To understand the context for this claim, two issues associated with how Ofgem assesses the cost efficiency of mains reinforcement are important to consider:

- There are relatively few reinforcement projects and these often straddle individual reporting years. As a consequence, Ofgem's Mains reinforcement regression takes the average of several years' costs and workloads, to smooth out timing differences between costs being incurred and work completed.

- Due to a lack of data, the regression at RIIO-1 used as a workload driver the kilometres of main laid split into two diameter bands, less than 180mm and greater than 180mm, rather than the far greater level of granularity used in the repex regression for example, where there is a much greater volume of work spread across diameter bands.

In that context, in 2016/17, 2017/18 and 2018/19 London GDN incurred a very high level of cost in respect of reinforcement in central London at an Intermediate Pressure (IP) tier, most noticeably in having to dig a tunnel under the Thames, for use by a 630mm main. The tunnel has cost around £41m per km thus far, and the rest of the IP project over £1m per km, as compared to the cost of around £0.5m per km for a typical reinforcement main of greater than 180mm diameter. The picture below gives an idea of the scale of one of the shafts for the Thames tunnel.



The cost of London's IP work needs to be adjusted as a Regional Factor in the mains reinforcement regression for two reasons. First, because otherwise London GDN's assessed efficiency would be significantly reduced due to the unique nature of this project, which has nothing to do with efficiency. **Second, because otherwise** the robustness of the regression is severely adversely affected, with the R^2 falling from around 0.81 to 0.26 in the regression using the average level of cost and workload for the five years to 2017/18.

In addition, our Business Plan for RIIO-2 contains significant levels of reinforcement cost for work to be undertaken in central London, for example, under Liverpool Street station, which is expected to have very much higher unit costs than most reinforcement. Similar to the central London IP work in RIIO-1, we propose that Ofgem should consider these costs separately from the remainder of mains reinforcement in RIIO-2.

Calculation and materiality

The calculation of the additional level of cost is set out below.

Chelsea to Battersea Tunnel IP	Year	Nominal	18/19 prices	Length	£ per km	Diameter
		£m	£m	km	£m	mm
	2016/17	4.2	4.5	0.0		
	2017/18	8.8	9.1	0.4		630
	2018/19	2.7	2.7	0.0		
		15.7	16.2	0.4	40.6	
Fulham / Hyde Park / Battersea IP	2016/17	0.9	1.0	0.7		630
	2017/18	1.4	1.4	1.8		630
	2018/19	0.7	0.7	0.0		
		3.0	3.1	2.5	1.2	
Combined London IP	2016/17	5.1	5.5	0.7		
	2017/18	10.2	10.5	2.2		
	2018/19	3.3	3.3	0.0		
		18.6	**19.3**	**2.86**	6.7	630
Average all GDN >180mm unit cost, 2014/15, 2015/16 (per RRPs table 4.4)					0.49	
Additional London unit cost					6.25	
Additional London cost (x 2.86 km) £m					**17.9**	
Top Down modelling approach - 7 year average					2.6	
Bottom Up modelling approach - 4 year average					4.5	
Average					**3.5**	

The calculation combines the costs of the Chelsea to Battersea Tunnel, £16.2m, and the cost of the Fulham / Hyde Park / Battersea IP main of £3.1m, to result in an IP cost of £19.3m for 2.9km of 630mm main, at a cost of £6.7m per km. This compares to an average cost for all GDNs (in 2017/18 prices) for mains greater than 180mm in 2014/15 and 2015/16 of £0.49m per km. We have compared against unit costs in the years 2014/15 and 2015/16 because they are before the cost of the London IP project was incurred. The additional cost of the London IP projects is £6.25m per km, which for 2.86km equates to £17.9m of additional cost in 2016/17, 2017/18 and 2018/19.

The level of materiality this represents depends upon the number of years' averaging the mains reinforcement regression contains. Under the Totex approach at RIIO-1, the average of seven years cost is £2.6m (£17.9m / 7), whereas under the Bottom Up approach, with four year averaging, the impact **is £4.5m (£17.9m / 4) for** 2018/19, which represents over 75% of the normalised cost of mains reinforcement for London GDN. The figure of £3.5m represents the average of the two approaches.

How Cadent manages the cost

We do not ask for a recurring Regional Factor for London IP work, rather we are suggesting that it be excluded from the historic Mains reinforcement regression in particular because this unique historic expenditure will heavily distort the regression, and so make it far less robust, and so less reliable for rolling forward into the RIIO-2 period.

In respect of how Cadent managed the cost of the Thames Tunnel:

- First, at budget stage, we appointed Gardiner & Theobold to assess the reasonableness of the cost of design and construction of the concrete tunnel. They reported that the budget cost was within 5% of their suggested cost.
- Second, we went out to tender for the construction of the concrete tunnel, resulting in the appointment of Barhale civil engineers.
- Third, part of the contract with Barhale was not fixed price, but contained a cost sharing mechanism.
- Finally, we engaged a Civils Quantity Surveyor specifically to manage the project for us.

The result has been a highly successful project that was shortlisted for two awards in the Institute of Civil Engineers London Awards 2018.

4.3 Parking Bay suspensions - investment

Reason for claim

GDNs have to request that Local Authorities suspend parking bays where work is to be carried out in particular for mains and services replacement activity, but also for Connections and Repair activities. Local Authorities are entitled to charge for the suspension of parking bays. This claim is for the Connections and Mains replacement element of that cost, the cost associated with Repair activities is detailed later in this document.

The quantity of cost incurred in each GDN is a function of:

- Whether the GDN's work takes place in a Local Authority with parking bays: around 75% of London region's population is covered by parking bays, whereas the figure for elsewhere in England and Wales is under 50%.
- If the Local Authority operates parking bays, whether they choose to charge utilities for suspending them – not all Local Authorities levy charges.
- The structure of charges in each Local Authority – some councils, such as Barnet, charge an administration fee per application, potentially covering multiple bays, as well as a daily charge per day as levied elsewhere.
- The level of charges in each Local Authority. For example, Islington charges £207 for the first day of suspension plus £32 per day thereafter. Sheffield charges a £25 administration fee, and either £15 in the city centre or £5 per day elsewhere. Consequently, a 5 day parking bay suspension would cost £335 in Islington, and £50 in most of Sheffield.

The result of the above is that the level of cost Cadent incurs in London GDN is far more than that experienced in our other GDNs. Note that the costs of parking bay suspensions are typically not included within Streetworks as reported in table 3.13 of the RRP because the charges are levied under NRSWA, rather than TMA.

Calculation and Materiality

Because the cost of parking bay suspensions is significant in London, these costs are recorded separately, so we have been able to obtain detailed information from tRIIO on the costs in 2018/19 and the activities on which the cost is incurred. The total cost is shown as £3.8m for London GDN divided between Connections and Repex, and £0.15m for East GDN Connections.

For North West and West Midlands GDNs, because the costs are far lower, Balfour Beatty does not record them separately, but they estimate that the costs would not exceed £100,000 per year in each GDN, and could be significantly less. That this is a prudent estimate is supported by the fact that only £56,000 of East of England's costs were incurred outside of London – the bulk of East's costs being incurred in those London Local Authorities that form part of the East of England.

To calculate the additional cost for London GDN, we have taken the estimated maximum cost of £100,000 for North West and West Midlands and spread it across Connections, Repex diversions and Other repex pro-rata to the pattern of costs in London GDN. We have not pro-rated across the cost of Repex MOBs because the volume of MOBs work is many times higher in London GDN than elsewhere.

When compared against the costs in London GDN, this results in additional costs of £2.5m in repex and £1.2m in Connections. However, around £0.6m of these are in non-regressed repex activities, especially MOBs, and so have been deducted from the table below, to leave additional costs in regressed activities of £3.1m in London GDN in 2018/19.

Parking Bay Suspension - investment					
	Known cost	Estimated cost in NW, WM	Excess London GDN cost	Excluded from regression	Additional regression cost
London GDN	£m	£m	£m	£m	£m
Repex MOBs	0.5		0.5	-0.5	0.0
Repex diversions	0.2	0.0	0.2	-0.2	0.0
Other repex	1.9	0.1	1.9		1.9
Total Repex	**2.5**	**0.1**	**2.5**	**-0.6**	**1.9**
Connections	**1.3**	**0.0**	**1.2**	**0.0**	**1.2**
Investment cost	**3.8**	**0.1**	**3.7**	**-0.6**	**3.1**

Although the difference between the cost of parking bay suspensions in East of England GDN and North West and West Midlands GDNs is only around £50,000, we have performed a similar calculation for East of England GDN, because East's costs are entirely in Connections, and given that East is high cost in Connections, adjusting for this additional cost should improve the repex regression. The calculation for East GDN is shown below.

Parking Bay Suspension - investment					
	Known cost	Estimated cost in NW, WM	Excess East GDN cost	Excluded from regression	Additional regression cost
East GDN	£m	£m	£m	£m	£m
Repex MOBs	0.00		0.00	0.00	0.00
Repex diversions	0.00	0.01	-0.01	0.01	0.00
Other repex	0.00	0.06	-0.06	0.00	-0.06
Total Repex	**0.00**	**0.06**	**-0.06**	**0.01**	**-0.06**
Connections	**0.15**	**0.04**	**0.12**	**0.00**	**0.12**
Investment cost	**0.15**	**0.10**	**0.05**	**0.01**	**0.06**

In respect of materiality, for London GDN the additional cost represents over 2% of normalised repex, and around 16% of normalised gross Connections costs. For East, it represents around 0.6% of normalised Connections costs.

We also consider that the level of cost in mains replacement in particular is likely to rise in RIIO-2 as compared to 2018/19, because:

- More mains replacement activity is due to take place in Inner London, rather than Outer London, where there is a higher concentration of parking bays and fees are typically higher.
- A higher proportion of work will be in the carriageway, rather than the footway or verge, driving more parking bay suspensions.
- Insertion rates will fall, with open cut working requiring more parking bay suspensions
- The diameter band of Tier 1 work will rise compared to RIIO-1, so work will take longer and more space needed to work in

For both repex and connections, we also expect Local Authorities to take the opportunity to raise their fees and the areas covered by parking restrictions. In the past, we have seen this in Authorities like Westminster, whose Annual Parking report 2017/18 shows that its revenue per suspension has risen from £370 in 2014/15 to £706 in 2017/18.

How Cadent manages the cost

There is a trade-off between the cost of parking bay suspensions and labour costs and the timely completion of work. tRIIO book parking bay suspensions so that they are confident that work can be completed within the specified time. If the work is not completed before the parking bay suspension expires, the team would need to pull out and then re-arrange completion of the work including a further parking bay suspension. Re-arranging work is costly and bad for customers, consequently tRIIO aim to avoid this by booking enough parking bay suspensions for a sufficient period to be confident that the work can be completed before the suspensions expire, even if this does, on occasion, lead to work being completed before the parking bay suspension expires. Consequently, tRIIO does not minimise the cost of parking bay suspensions, but rather the overall cost of work.

This approach is consistent with the terms of the GDSP contracts, under which tRIIO has target prices for each type of work carried out, and any deviation from those is shared 50/50 with Cadent. Consequently, tRIIO is incentivised to keep its total costs, including parking bay suspensions, as low as possible.

4.4 Reduced Depth of Cover

Reason for claim

Pipeline Safety Regulations state that pipelines must be designed to withstand, so far as is reasonably practical, the external forces and chemical processes to which they may be subjected. As a method of applying the Pipeline Safety Regulations, TD1, a technical document produced by the Institute of Gas Engineers, TD1 states that high pressure steel pipelines laid before 1984 should have a minimum depth of cover of 0.9m, and those laid after 1984 a minimum depth of cover of 1.1m.

Pipelines are typically laid under easements agreed when the pipelines were built, under which landowners can resume normal farming activities once the pipe has been laid. If they are unable to do so, then, compensation is due from Cadent under the Land Compensation Act.

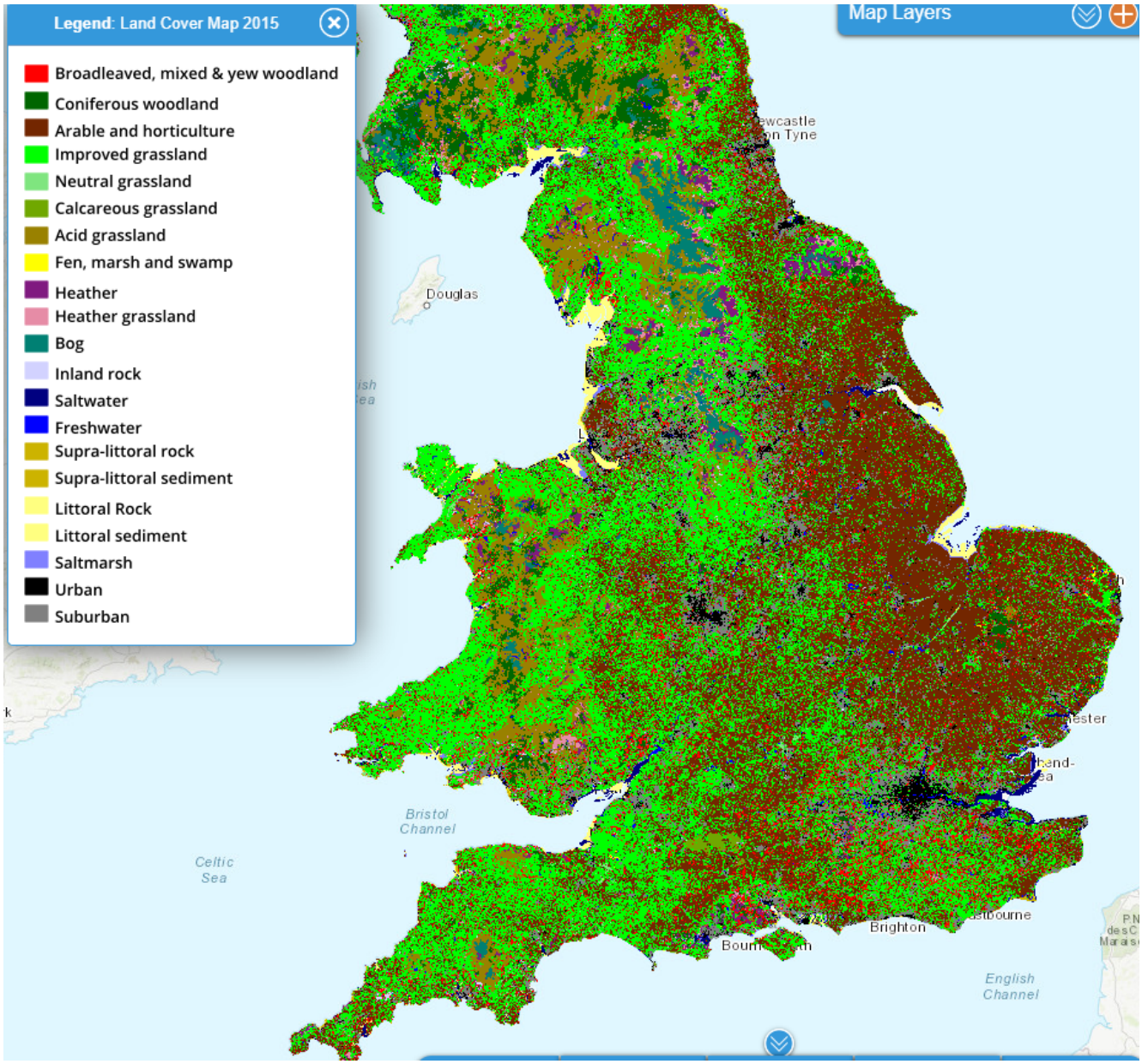
When line-walking was resumed in 2013/14, having stopped around 20 years previously, we observed that some LTS pipes, especially in the East of England GDN, had insufficient depth of soil coverage to comply with TD1, and therefore, if no action was taken, could represent a safety risk to the public and contravention of the Pipeline Safety Regulations.

The UK Onshore Pipeline Association (UKOPA), in its 2016 Guidelines to Good Practice, sets out four high level causes for reduced depth of cover:

- Natural erosion through water, wind, gravity or the natural oxidisation of organic soils such as peat.
- Human activity such as ploughing or laser levelling of soil to create a uniform depth of soil for improved moisture distribution.
- Construction under older pipeline standards with lesser coverage requirements.
- Failure or loss of anti-buoyancy systems used for pipelines laid in marsh land or peat bogs.

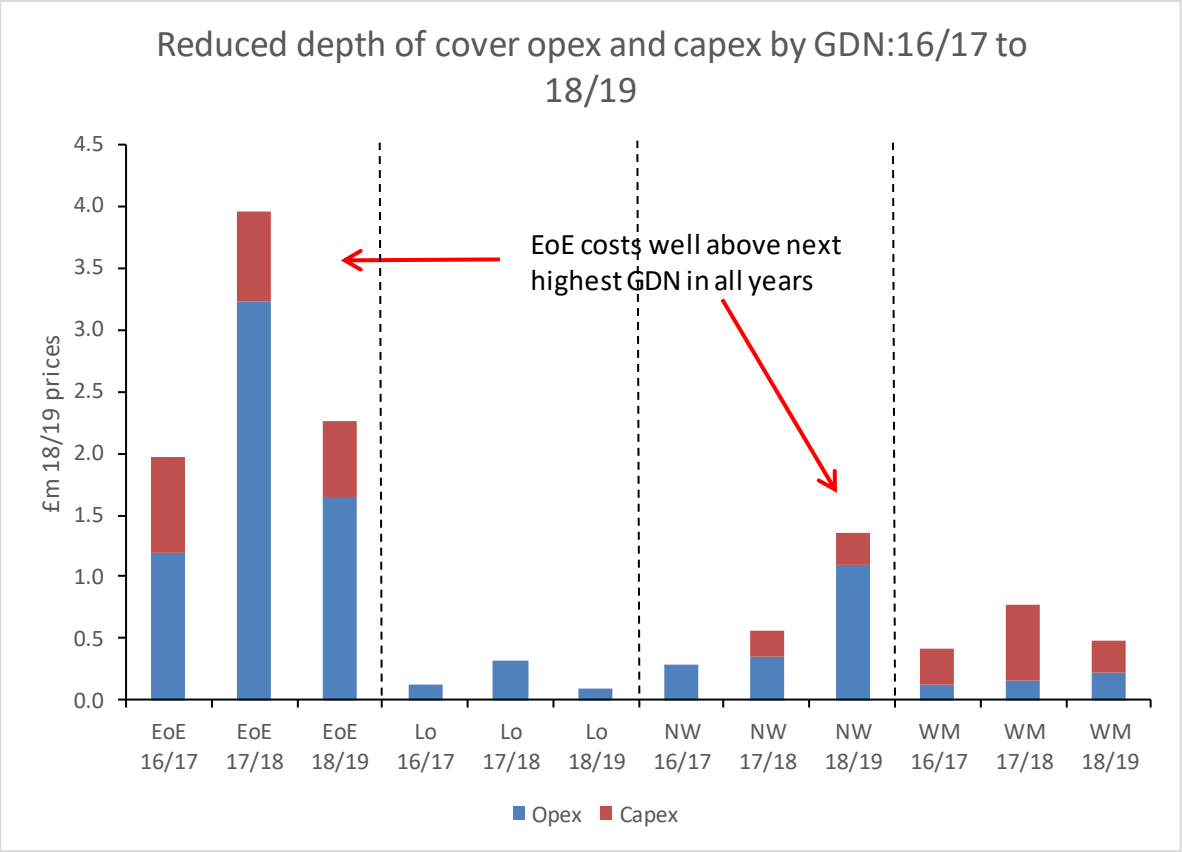
The older pipelines in our East of England GDN are especially affected by natural erosion and farming activity.

The diagram below, taken from the UK Soil Observatory, shows land use across England and Wales in 2015, with brown areas being arable / horticultural use, green being grassland, and black areas being urban.



The diagram shows how East Anglia and the East Midlands, which make up the vast majority of the East of England GDN, are far more arable than other regions of England and Wales, are subject to ploughing several times a year, and so would be expected to experience greater soil erosion. We have experienced particular problems in the sandy / loam soils of the East Midlands region.

Starting in 2016/17 we have carried out work such as soil importation, pipeline diversion, fencing or new easement agreements with farmers, with costs rising in 2017/18 and 2018/19 as the programme of work ramped up.



This is not a programme of work we anticipated in RIIO-1, and has particularly affected East of England, far more than our other GDNs. In respect of non-Cadent GDNs, we understand that WWU has incurred some cost, but we do not believe that it is to the scale of East of England.

We consider that costs associated with Reduced Depth of Cover should be removed from the Maintenance and Totex regressions and assessed separately by Ofgem, similar to land remediation or holder demolition, because the workload and associated costs arise from specific circumstances in each GDN, are low frequency but high cost, and specific to each location.

The costs are also expected to continue in RIIO-2, rising to the level of around £7m p.a. across our four GDNs in RIIO-1, with around two thirds to be incurred in East of England GDN.

Calculation and Materiality

We have data on Opex and Capex spend on Reduced Depth of Cover from the beginning of the programme in 2016/17, 2017/18 and 2018/19 by GDN, as set out in the table below, in 2018/19 prices.

	2016/17			2017/18			2018/19		
	Opex	Capex	Totex	Opex	Capex	Totex	Opex	Capex	Totex
EoE	1.2	0.8	2.0	3.2	0.7	4.0	1.6	0.6	2.3
Lo	0.1	0.0	0.1	0.3	0.0	0.3	0.1	0.0	0.1
NW	0.3	0.0	0.3	0.4	0.2	0.6	1.1	0.3	1.4
WM	0.1	0.3	0.4	0.2	0.6	0.8	0.2	0.3	0.5
Cadent	**1.8**	**1.1**	**2.8**	**4.1**	**1.5**	**5.6**	**3.1**	**1.1**	**4.2**

In respect of materiality, the Opex element is treated as part of Maintenance work execution. The largest impact is on East of England GDN, where the Opex element represents around 12.1% of normalised cost in 2017/18.

How Cadent manages the cost

From the start of the expenditure, in 2016/17, until 2017/18 we established a project team to manage the work efficiently, it being a new type of activity for the business. From spring 2018, with the experience gained, the project team shared its knowledge more widely so that each Network has had responsibility for managing its work, with support from Asset Integrity and Land and Building Services central teams.

Optioneering is carried out in order to decide the most suitable solution to Reduced Depth of Cover issues. For example, in the case of the £5.6m Ambergate to Papplewick scheme, approved in January 2019, six options were considered, including diverting 4.6km of HP pipeline, and buying land and implementing restrictive deeds of covenant. In this case the approved solution consists of soil importation, field boundary realignment plus fencing, so that the pipeline will be effectively outside the worked agricultural area.

4.5 Repex reinstatement

Reason for claim

Repex reinstatement comprises both reinstatement in respect of Other services, especially Relay After Escape, and also in respect of Mains Replacement, the second activity being much larger scale than the first. Our claim is that the cost of reinstatement is significantly higher in London GDN than elsewhere.

Calculation and materiality

For Repex relay after escape, we have already calculated the additional cost for London GDN as compared to East of England GDN in the Repair reinstatement calculation above, as being £0.5m in 2017/18 and £0.4m in 2018/19.

For repex mains replacement, sub-contractor costs typically include the cost of reinstatement within an overall cost per metre. Neither we, tRIIO, or Balfour Beatty typically receive separate bills for re-instatement for Mains replacement. Consequently, we need to apply a different approach both to:

- First, calculating the additional % reinstatement costs in London GDN as compared to East of England GDN.
- Second, finding the appropriate amount of reinstatement cost in 2018/19 in London GDN.

For the first calculation, we have the evidence from Repair of London's cost per unit being 21% above that of East of England. In addition, we have a sample of unit rates provided by tRIIO during the tender exercise, including for reinstatement. In tRIIO's tender, the cost per metre of reinstatement was between 14% and 27% greater in London GDN than East, depending on the surface type. For work in the verge, the differential was 14%, for work in the footpath 17%, and for work in the carriageway 27%.

Considering the balance of mains replacement work carried out in London GDN in RIIO-1 to date between the different work surfaces, combining this with the tender data, we can calculate the expected additional reinstatement unit cost in London GDN as compared to East of England GDN, as shown below.

London GDN Mains replacement	Proportion of work in	Tender cost premium	Weighted Additional cost
Carriageway	48%	27%	12.8%
Footpath	38%	17%	6.4%
Verge	12%	14%	1.7%
Other	2%	N/A	0.0%
	100.0%		**21.0%**

The calculation shows that London GDN's expected reinstatement costs are around 21% higher than those in the East of England GDN, based on work surfaces experienced in RIIO-1. This matches the figure calculated for Repair reinstatement (see Section 4.8), and so seems robust.

The second stage in the calculation is to find the amount of mains replacement reinstatement costs incurred in 2018/19.

tRIIO have told us that they assumed that 23% of their tender costs were in respect of reinstatement. In addition, from the small volume of mains replacement activity carried out by Cadent's own Repair teams in RIIO-1, our own cost data shows that around 24% of the cost is in respect of reinstatement. In this calculation we have assumed that 24% of GDSP costs comprise reinstatement, as these are actual costs, rather than a sample of tender projections.

From our actual data for 2018/19, we know that 90% of the cost of the mains replacement programme (excluding diversions) are from tRIIO, and around 10% costs from Cadent (for example, the cost of managing the GDSP contracts). We have multiplied the tRIIO cost by 24% to find the reinstatement amount, to which we have applied the 21% unit rate uplift found above for London GDN to calculate the additional cost in 2018/19. Finally, to avoid a double count, we have removed the labour element of reinstatement, which for London, following our review of GDSP repex costs, we have estimated at 31.6%. This final adjustment is required because we have already included the estimated labour element of reinstatement costs within the overall labour proportion of repex.

Mains and Services Replacement cost London GDN	
Excludes diversions: 18/19 prices	£m
Total cost	113.5
less: Cadent control and other costs	-11.7
tRIIO costs	101.8
Reinstatement @ 24%	24.1
At East GDN unit rates (21% less)	19.9
Additional London GDN cost	**4.2**
less: labour element @ 31.6%	-1.3
Non-labour additional London GDN cost	**2.9**

The table shows an additional cost of £2.9m in London GDN in 2018/19 arising from higher reinstatement unit costs than East of England GDN in respect of the Mains replacement programme. When added to the £0.5m additional cost from Other services, for example relay after escape (see Section 4.8), the Repex reinstatement Regional Factor amounts to £3.4m in 2018/19, which is around 3% of London GDN's normalised repex.

How Cadent manages the cost

The incentives for efficiency under the GDSP contracts are the same for Mains replacement as for Repair, in that target costs exist for Mains replacement, as per the tender exercise, and deviations from these are shared 50 / 50.

In addition, for any subcontractors which do not carry out their own reinstatement, the process of tRIIO checks and Cadent checks are the same as for Repair.

For those contractors carrying out their own reinstatement - the vast majority - Cadent does not carry out specific checks on reinstatement because it is buying the complete service rather than one element of it. tRIIO is incentivised to keep all Mains replacement costs down, including for the reinstatement element.

In addition, we make a number of checks when tRIIO make an application for payment, including checking that:

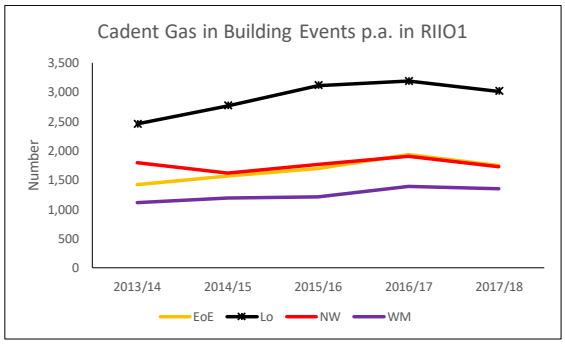
- The Application matches the sub-contractor account data.
- All necessary tRIIO data, including sub-contractor accounts, is present and mutually consistent.
- Cadent mains records have been updated correctly.
- Contra charges - for example where the subcontractor hires equipment from tRIIO - have been correctly reflected.
- Any compensation events (for additional costs) are allowed under the terms of the contract.
- Deductions are made for any inefficient costs incurred by tRIIO – for example due to multiple visits.
- We have recovered any costs, especially opex, incurred by Cadent as a result of tRIIO's actions, for example where Cadent incurs Emergency and Repair costs due to tRIIO's slowness in replacing a main that Cadent has specifically asked to be replaced.

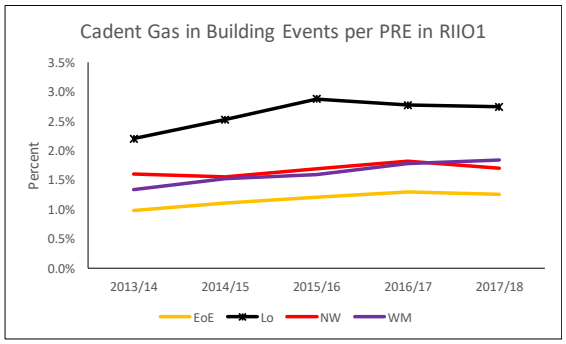
4.6 Emergency Job Times

Reason for claim

London is a difficult environment for Emergency work execution. It is far more densely populated than elsewhere in the UK and over half the housing stock consists of flats. Consequently, escaped gas may have travelled some distance underground, multiple properties are more likely to need to be accessed than elsewhere to properly check for evidence of gas and the sources of gas escapes, and there is limited room to park and work.

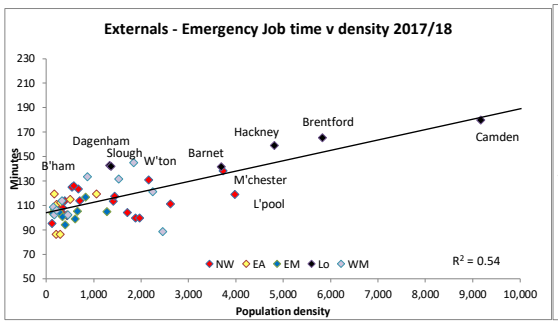
Some of these difficulties are evidenced by the number of Gas In Building (GIB) events in London GDN compared to our other GDNs, and compared to the number of PREs, taken from the RRP for the last five years, as shown below.

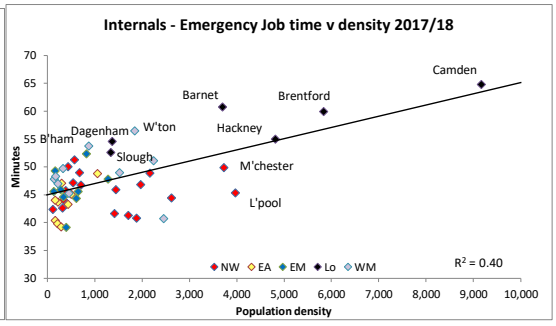




The charts show that, whether measured on an absolute basis, or relative to the number of PREs, London GDN has many more GIB events than our other GDNs, and our most rural GDN, East of England, has by far the least relative to scale.

To measure the impact of the difficulties of working in a very dense environment, we compared the average job times of internal and external PREs across the individual patches making up our Networks, and plotted this against the approximate population density in each patch, for each of the three years 2015/16, 2016/17 and 2017/18.

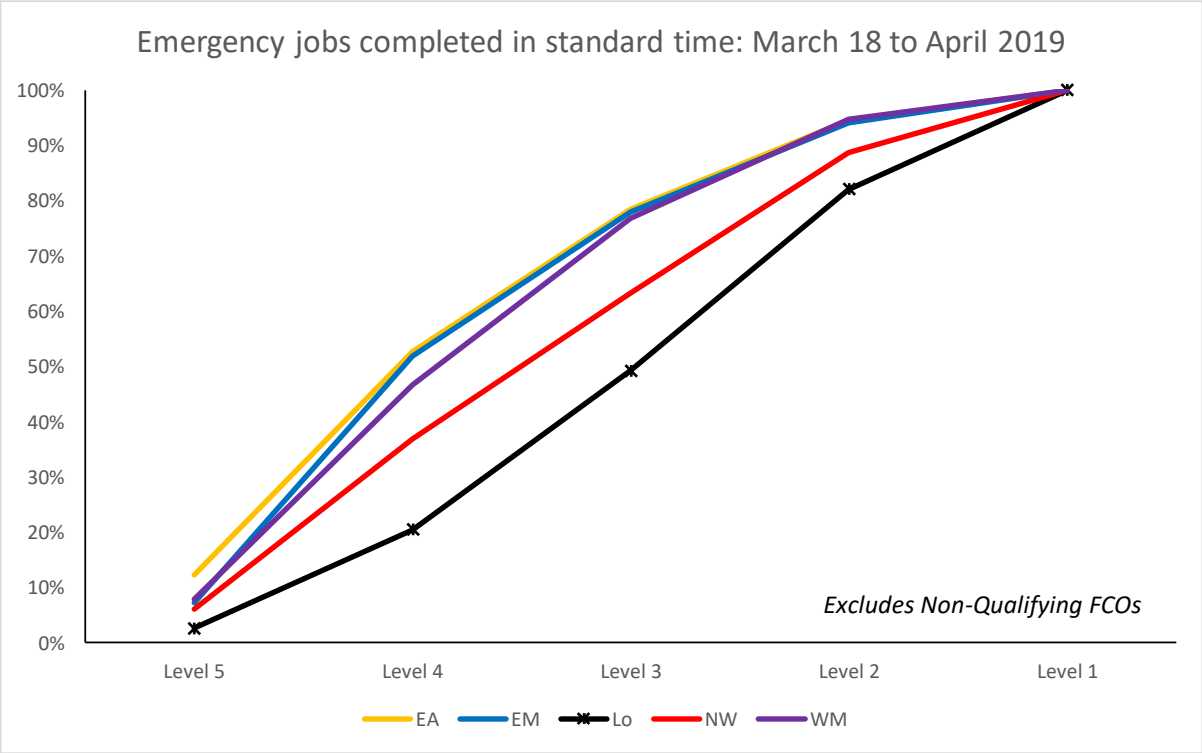




The data fit as shown by the R^2 is relatively consistent across the three years. For the external PREs, the R^2 was 0.52 in 2015/16, 0.59 in 2016/17 and 0.54 in 2017/18. For internal PREs, the R^2 was 0.39, 0.43 and 0.40 respectively. Consequently, there is reasonably strong, broadly consistent relationship between Emergency job times and population density – more urban areas having longer job times.

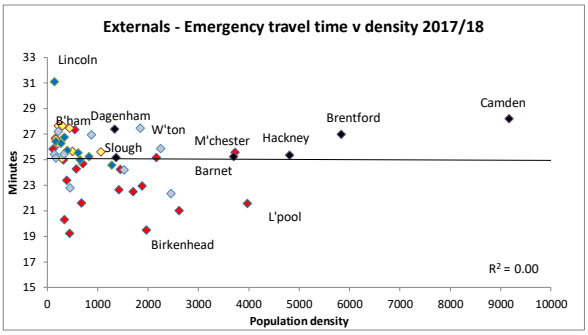
The hypothesis that Emergency work takes longer in more urban areas is supported by Cadent's performance bonus scheme data, one aspect of which has FCOs paid higher bonuses for completing work within the "standard time" – i.e. fixed target times for each job type across all Cadent networks. Under the scheme, level 5 is the highest bonus for the most jobs complete within the standard time, and level 1 the least bonus for the fewest jobs complete within the standard time. The graph below shows the performance level for FCOs across

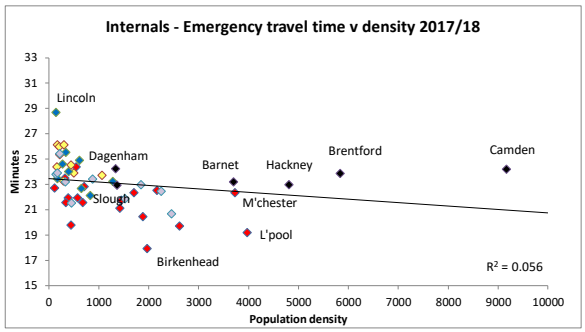
each of Cadent's networks for twelve months between March 2018 to April 2019 (we were keen to use 12 months data, but were unable to obtain data for September and November 2018 and so added data for March 2018 and April 2019).



The table shows that the higher level 4 and 5 bonuses for completing work in the standard time are in order of urbanity – East Anglia, East Midlands, West Midlands, North West then London. The incentive is the same for FCOs across Cadent, but it is striking how Emergency work takes longer to complete in London in particular.

We also tested travel times, to assess whether there was any relationship between population density and Emergency travel times. The results for 2017/18 are shown below for External and Internal PREs.





We found no meaningful relationship between Emergency travel times and population density.

Consequently, our Regional Factor claim is for additional job times for London's External and Internal PREs, associated with its high population density.

Calculation and Materiality

We have quantified the additional costs in two steps:

- First, we calculated how different London's External and Internal PRE times were to those of our other Networks for the three years 2015/16, 2016/17 and 2017/18.
- Second, taking the costs of productive labour time, excluding Smart metering related work, we used the result of step 1 to quantify London's additional cost for 2017/18.

For Step 1, aggregating the data for operational patches, the table below calculates the average additional time taken in London for Internal and External PREs for the period 2015/16 to 2017/18.

JOB TIMES - minutes								
	External PREs				Internal PREs			
	2015/16	2016/17	2017/18	3 yr average	2015/16	2016/17	2017/18	3 yr average
EA	101.3	124.8	106.2	**110.8**	42.6	43.1	43.5	43.0
EM	101.6	125.6	104.0	**110.4**	43.7	43.7	46.0	44.5
Lo	149.3	188.6	155.1	**164.3**	54.0	57.5	57.9	56.5
NW	117.5	134.4	113.6	**121.8**	43.5	44.8	45.8	44.7
WM	117.9	138.1	115.3	**123.8**	46.2	48.1	48.2	47.5
Average excl Lo	**109.6**	**130.7**	**109.8**	**116.7**	**44.0**	**44.9**	**45.9**	**44.9**
Compared to non-Lo average								
EA	-8%	-5%	-3%	-5%	-3%	-4%	-5%	-4%
EM	-7%	-4%	-5%	-5%	-1%	-3%	0%	-1%
Lo	**36%**	**44%**	**41%**	**41%**	**23%**	**28%**	**26%**	**26%**
NW	7%	3%	3%	4%	-1%	0%	0%	0%
WM	8%	6%	5%	6%	5%	7%	5%	6%

The result of Step 1 is that, for External PREs, London needs 41% more time than the average of our other Networks, and for Internal PREs, 26% more time.

For Step 2, we applied the results of Step 1 to the London's actual labour costs per table 3.3 of the 2017/18 and 2018/19 RRPs, stated in 2018/19 prices, excluding the entries for non-productive time and Smart metering related costs, neither of which are relevant to External and Internal PREs. The calculation for each year is shown below.

Emergency labour cost	**2017/18**				**2018/19**			
RRP table 3.3	RRP cost	Extra time	Normal cost	Extra cost	RRP cost	Extra time	Normal cost	Extra cost
18/19 prices	£m	%	£m	£m	£m	%	£m	£m
External	3.7	41%	2.7	1.1	3.7	41%	2.7	1.1
Internal	7.5	26%	6.0	1.5	7.4	26%	5.9	1.5
Combined	11.2		**8.6**	**2.6**	11.2		**8.6**	**2.6**

The result of Step 2 is that London GDN's labour costs are shown to be around £2.6m above those that would be expected, using the job times of our other Networks. This represents around 20% of London's normalised Emergency costs for 2017/18 and 2018/19.

How Cadent manages the cost

Because the additional costs result from environmental factors, and are consequently outside our control, there is no direct way of managing the cost. However, indirectly it is managed by:

- Performance management, with supervisors responsible for the efficiency and effectiveness of FCOs in their span of control.
- The performance bonus scheme described above, under which FCOs receive higher bonuses for carrying out work within standard job times.
- Innovative approaches such as the use of long probes, which are especially useful in reaching hard to reach flues when searching for the source of escaped gas, and tool carrying backpacks to free engineers' hands – both of which we began using in London GDN.

4.7 Plant Hire - repex

Reason for claim

Our claim is that Plant Hire costs per metre of mains replacement are higher in London than elsewhere. The reason for the claim is largely because of the lower level of productivity associated with mains replacement work in London. Given that the efficient level of mains replacement is around 15% less per person per week in London than elsewhere (see Section 3 above), the plant used in carrying out the work is also hired for longer in London than elsewhere, so the Plant Hire cost per metre of repex would be materially higher in London than elsewhere.

In addition, although we would expect the initial capital cost of the plant to hire companies to be the same in London as elsewhere, the companies need to store the plant when not in use, and use labour to deliver it, set it up on site, dismantle it and remove it when the job is finished. Due to additional storage costs (see Depot rentals Section 4.11) and labour costs in London, these add to the hire cost.

Calculation and Materiality

The two key elements to the calculation are to find:

- the element of mains replacement costs that are made up of Plant Hire; and
- the level of additional cost in London compared to elsewhere.

As part of the work to disaggregate the charge for mains replacement received from our contractors and subcontractors, we found that around 16.9% of the GDSP charge for London GDN was in respect of Plant Hire – including Plant carrying out reinstatement work. We have removed this element because we have a separate Regional Factor for London reinstatement costs (see Section 4.5 above) and we needed to avoid a double count. Removing the estimated Pant Hire element of reinstatement leaves a Plant Hire proportion of 12.2% for London GDN.

In respect of the additional level of cost in London compared to elsewhere, the tRIIO tender contains Plant Hire costs per metre for mains and per service for both East of England and London GDNs. The difference in Plant Hire unit rates is not uniform, with London mains replacement costs between 8% and 25% more per metre, and services between 4% and 18%, therefore, using projected workload we have calculated a weighted average of 19.7% additional cost, as shown below.

Plant Hire unit costs per Tender	London workload km / no.	Unit costs EoE £	Lo £	London workload at EoE unit cost £'000	Lo unit costs £'000	Additional London %
No Dig <75mm Mains in Road	5,482	12.21	15.10	67	83	24%
No Dig <75mm Mains in Footpath	102,014	10.62	13.24	1,083	1,351	25%
No Dig <75mm Mains in Verge	1,721	6.49	8.07	11	14	24%
Dig <75mm Mains in Road	964	17.04	21.26	16	20	25%
Dig <75mm Mains in Footpath	17,933	12.92	16.16	232	290	25%
Dig <75mm Mains in Verge	302	9.51	11.79	3	4	24%
No Dig 125-180mm Mains in Road	9,082	12.91	15.84	117	144	23%
No Dig 125-180mm Mains in Footpath	28,069	11.26	13.74	316	386	22%
No Dig 125-180mm Mains in Verge	1,178	7.57	9.27	9	11	22%
Dig 125-180mm Mains in Road	1,537	16.21	17.54	25	27	8%
Dig 125-180mm Mains in Footpath	4,749	13.56	14.84	64	70	9%
Dig 125-180mm Mains in Verge	199	11.55	12.51	2	2	8%
Tier 1 Domestic Relay	16,344	77.52	89.76	1,267	1,467	16%
Tier 1 Service Transfer	12,436	62.02	73.44	771	913	18%
Tier 1 Non-domestic service	397	193.81	201.94	77	80	4%
				4,061	**4,862**	**19.7%**

We have then brought the two elements of the calculation together, to calculate both the Plant Hire cost for London GDN for mains and service replacement in 2018/19, and what that cost would have been had East of England rather than London unit rates been applied.

Mains and Services Replacement cost London GDN	
Excludes diversions: 18/19 prices	£m
Total cost	113.5
less: Cadent control and other costs	-11.7
tRIIO costs	101.8
Plant hire @ 12.2%	12.4
Elsewhere cost (19.7% lower)	10.4
Additional London cost	**2.1**

The result of the calculation is that London GDN incurred around £2.1m of additional repex cost due to higher Plant Hire costs per metre, which represents around 2% of London's normalised repex costs.

How Cadent manages the cost

During RIIO-1 we have not dealt directly with Plant Hire providers for mains replacement. Instead, we have delivered Repex efficiency through a combination of large scale, long-term contracts that created economies of scale and efficient labour and back office operations costs, including through efficient scheme design. These contracts include:

- target costs ratcheted down over the course of the contract;
- deviations from target costs being shared 50/50 with Cadent to share risk and keep both parties incentivised; and
- payment only being made once projects are completed as per the design and Cadent's systems are updated accordingly – this has led to the GDSP contractors holding several months' work in progress.

Elsewhere our Plan describes how we will be undertaking a more difficult mix of mains and services replacement work in RIIO-2 than RIIO-1, and how some of the additional costs will be offset by further efficiencies through a revised contracting strategy and innovation. At present, we envisage the net effect being broadly comparable across our GDNs, and consequently, that the 20% London Plant hire Regional Factor should remain unchanged for RIIO-2.

4.8 Repair Reinstatement

Reason for claim

Our claim is for reinstatement costs that are higher in London GDN than elsewhere. Reinstatement includes removal of soil from site, backfill, reinstatement of surfaces, heavy lift operations (for Heras fencing, deep excavation shuttering, road plates, heavy paving) and also repairs to drains, ducts and sewers, the latter being added on after the unit rate. Under our GDSP contracts, the unit rate charge is levied by surface area, m^2 rather than m^3, and varies according to:

- location – footway, carriageway or verge;
- depth – with greater charges for a depth of greater than 1.2m;
- size of surface area – split into 2 or 3 bands e.g. carriageway up to 0.9m^2, 0.9-2.0m^2, >2.0m^2.

There are also additional "outsize" surface area categories, e.g. over 14.1m^2 for carriageway reinstatement in East, where there are no set unit rates.

For the year 2018/19, of the 12 unit rate charges, 9 are higher for London than the average of the other 3 GDNs, while 3 are lower.

However, variations in the cost of m^2 reinstated across Networks are driven not only by different labour and potentially materials costs, but on the balance of work across the footway, carriageway and verge, depth, size of surface area, and repairs to ducts etc that were needed.

Calculation and Materiality

So we can be confident that costs are compared on a like-for-like basis, we have compared the costs of reinstatement per m^2 for tRIIO for East GDN and London GDN – one supplier serving two GDNs, rather than using data from Balfour Beatty for North West and West Midlands GDNs.

We have compared the cost per m^2 for each of the years of RIIO-1 to date for Direct Labour Operations (typically repair and repex relay after escape), and then averaged the difference, as shown in the table below.

	East GDN			London GDN			London
	Cost £'000	M^2 '000	£ per m^2	Cost £'000	M^2 '000	£ per m^2	Premium
2013/14	4,195	35	119	6,283	39	160	34%
2014/15	5,413	41	133	5,537	40	138	4%
2015/16	5,141	37	137	6,534	43	152	11%
2016/17	6,601	45	146	8,414	46	185	26%
2017/18	6,784	45	151	8,486	46	183	21%
To Dec 18	4,463	31	145	6,310	32	195	35%
	32,598	**234**	**139**	**41,564**	**247**	**168**	**21%**

The table shows that, on average, Reinstatement costs in London GDN are 21% per m^2 more than those in East GDN. Applying this to Direct Labour Operations in 2017/18 and 2018/19 shows that the additional cost of reinstatement in London GDN as compared to East is around £1.6m p.a, split between Repair, Repex and Maintenance, as shown in the tables below.

Reinstatement for Direct Labour Operations	2017/18				2018/19			
	Repair	Maintenance	Repex	**Totex**	Repair	Maintenance	Repex	**Totex**
2018/19 prices	£m	£m	£m	**£m**	£m	£m	£m	**£m**
Cost per tRIIO				**9.0**				**9.3**
Opex reinstatement - RRP table 3.1	5.0	0.9		**5.9**	5.6	0.7		**6.3**
Repex cost by deduction			3.1	**3.1**			3.0	**3.0**
21% London premium value	0.9	0.1	0.5	**1.6**	1.0	0.1	0.5	**1.6**

In respect of materiality, the most material activity is Repair, for which the additional cost of around £1m in each year represents around 5% of normalised opex.

How Cadent manages the cost

We manage reinstatement costs for London GDN under both the general GDSP contract incentives, and also under monthly checks specifically for Reinstatement.

The GDSP contracts were agreed for the RIIO-1 period after a tender process, therefore the target costs contained in them should be seen as efficient. Under the contracts, variations from the target costs are shared 50/50 with Cadent. Consequently, the partners are incentivised to keep good control of costs they receive from their reinstatement contractors.

tRIIO check over half the applications for payment from its reinstatement contractors, with a particular emphasis on there being photographic evidence showing measuring sticks demonstrating reinstatement dimensions, surface type, kerbs and road markings, and evidence of Cadent requests for spoil removal and heavy lifting.

Cadent also applies its own controls to the monthly payment applications made by tRIIO for Reinstatement costs, on a sample basis, which is then extrapolated across the entire population. In addition to carrying out more of the photographic tests carried out by tRIIO, Cadent also carries out further checks, including that:

- The work is shown as being complete on Cadent's systems.
- That the claimed date of completion is when expected.
- That the job is not related to a defect.
- The reinstatement has been correctly classified as repair (e.g. is not part of the Mains replacement programme).
- There is not a large variance between the promoted area and the claimed area of reinstatement.
- For 285mm and 350mm blacktop, that this was really needed – inflexible concrete roads only need 100mm.
- Any abortive visit costs are not due to causes at tRIIO's risk.
- Any claims for interim reinstatement have been approved by a Cadent Band C Manager.

In 2018/19, Cadent's checks resulted in 29% of tRIIO's payment applications for reinstatement being withheld for at least one month and 3% rejected.

4.9 Holford Salt Cavity

Reason for claim

North West network rents a salt cavity at Holford, Cheshire providing storage in a similar way to a gas holder or pipeline. In the North West pipeline system, the ratio of line pack storage to peak day demand is low compared to other networks, which drives the need for additional storage to support speed of response to changes in demand.

All the equipment for conveyance to the site, filling and emptying the cavity belongs to and is maintained by Cadent. The only assets kept by the landlord are the "wellhead" on top of the cavity and the pipe down from this into the cavity.

We have not bought the cavity because the owner, Ineos Chlor, does not wish to sell it.

However, if we had previously bought the cavity, then the Opex rental would be removed, and instead, the RAV would have been increased by a much larger capital amount. If we did own the cavity, then any additional Opex costs would be expected to be minimal given that we own and maintain almost all the equipment on site anyway.

The salt cavity rental is unique to North West GDN, as no other GDN rents a similar facility. The only other GDN which rented a salt cavity, NGN, we understand stopped doing so in 2012/13.

The salt cavity represents an example of the Capex / Opex trade off. However, to the extent that MEAV is used as a regression driver for Maintenance and Totex, the cost of Holford does not need to included as a Regional Factor, because, although we do not own this asset, the storage it provides is included within the MEAV calculation in RRP table 6.3. In contrast, if MEAV is not used as a driver in the Maintenance and Totex regressions, the cost of Holford would represent a valid Network Specific factor for North West.

Calculation and Materiality

This rental agreement was renewed in October 2018 for a period of five years. The cost in 2018/19 was £859,000, which was made up of the following elements:

	£'000
Rental for year	778
Revalidation costs	23
Accrual re prior years	58
Accounting charge	**859**
less re prior years	-58
Ongoing cost	**801**

Revalidation occurred at the renewal of the lease, to ensure that the site was safe for future use. Cadent had to pay this cost, which is being spread over the five years of the lease within opex.

Removing the accrual in respect of prior years, the ongoing cost which we would claim as a Regional Factor is therefore £801,000, which represents around 4.2% of the normalised cost of North West GDN's maintenance work execution activity, and consequently represents a material amount.

Although Holford's cost is around £800,000 p.a. we have not included this cost within our cost assessment modelling for 2018/19 because the storage included within MEAV, as explained above. Consequently, as long as MEAV is used as a regression driver, there is no need to also include a Regional Factor for Holford rental costs.

How Cadent manages the cost

The rental period of five years gives Cadent protection against sudden changes in the terms of the rental, including the rental charge. There is also the option for Cadent to extend the lease.

The facility at Holford is our long-term solution to the issue of diurnal storage in North West GDN. At RIIO-2, we make the case for £2m of investment at Holford in RIIO-2 (investment line 155 in the Plan), which should enable the site to run for at least a further thirty years, subject to the shorter life Electrical & Instrumentation kit being replaced prior to that point.

In respect of alternatives to Holford, as noted in the investment case, additional NTS exit capacity may be able to replace Holford, but this would cost around £1.5m p.a – broadly twice the cost of the rental.

4.10 Traffic Management Hire

Reason for claim

Our Repair work execution activity requires Traffic Management equipment following the Safety at Streetworks and Road Works Code of Practice (the "Red Book"), published under NRSWA by the Department for Transport, and / or a Site Specific Risk Assessment carried out by the Repair team.

In addition, the attitude of the individual Highway Authority affects the level of traffic management hire. They may request that traffic lights are manually controlled for extended periods of time, which represents a significant labour cost.

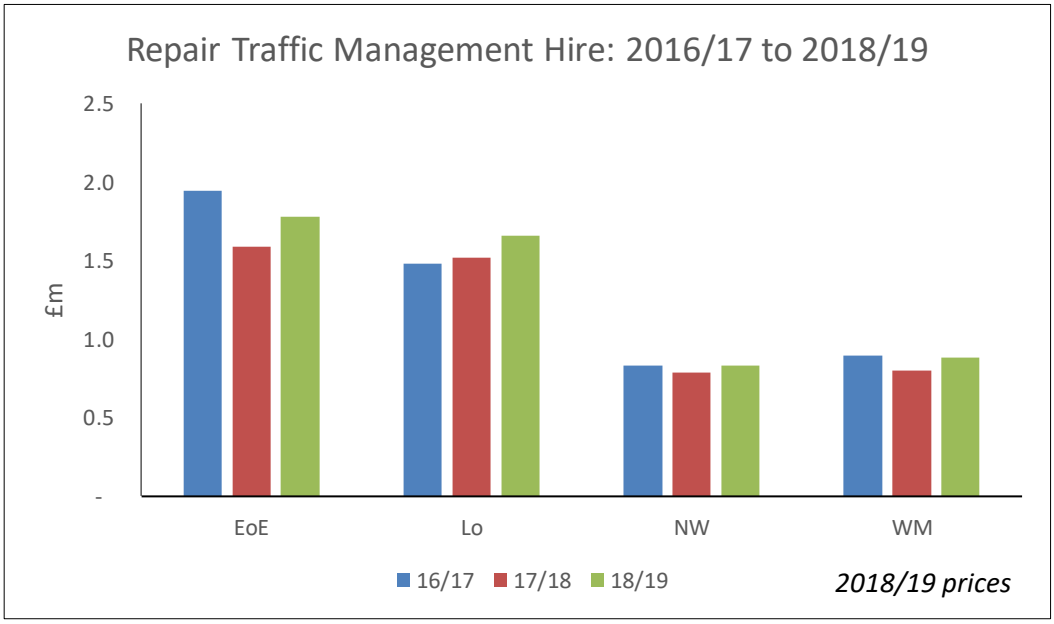
Consequently, Traffic Management Hire costs differ across Cadent's GDNs according to the physical characteristics of each site including road conditions, whether Highway Authorities request manually controlled traffic lights, and regional variations in the unit costs of hire – especially labour costs.

The Repair element of these costs is not currently reflected in Table 3.13 of the RRP, as it arises under NRWSA, rather than TMA.

The type of expenditure by network is shown for 2018/19 in the table below.

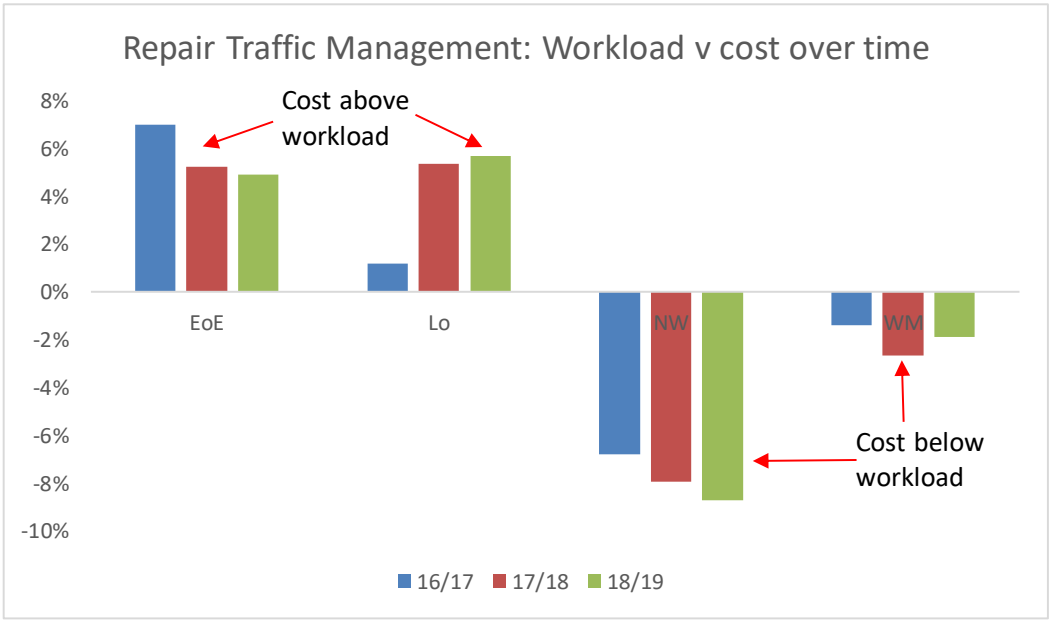
2018/19	**EA / EM**	**Lo**	**NW**	**WM**	**Cadent**
	£'000	**£'000**	**£'000**	**£'000**	**£'000**
Manual control	654	598	256	334	**1,841**
2-4 way traffic lights	426	218	239	310	**1,193**
Pedestrian crossings	126	237	31	70	**464**
Signage	365	455	224	130	**1,173**
Other	213	152	77	38	**479**
	1,783	**1,660**	**827**	**881**	**5,151**
Manual control	37%	36%	31%	38%	**36%**
2-4 way traffic lights	24%	13%	29%	35%	**23%**
Pedestrian crossings	7%	14%	4%	8%	**9%**
Signage	20%	27%	27%	15%	**23%**
Other	12%	9%	9%	4%	**9%**
	100%	**100%**	**100%**	**100%**	**100%**

Across Cadent, between 2016/17 and 2018/19 Repair activities incurred cost of between £4.7m and £5.2m in Traffic Management Hire costs. The costs were not spread evenly across GDNs, as shown below.



It is clear that, on an ongoing basis, East of England and London incur higher costs than our other networks. However, given that Ofgem's efficiency assessment of repair work execution uses a workload driver, it is important to understand whether the additional cost is driven by workload. If so, there would not be a justifiable claim for a Regional Factor.

The chart below compares, for 2016/17, 2017/18 and 2018/19 the split of cost and workload, as represented by our mains reports driver, across our GDNs.

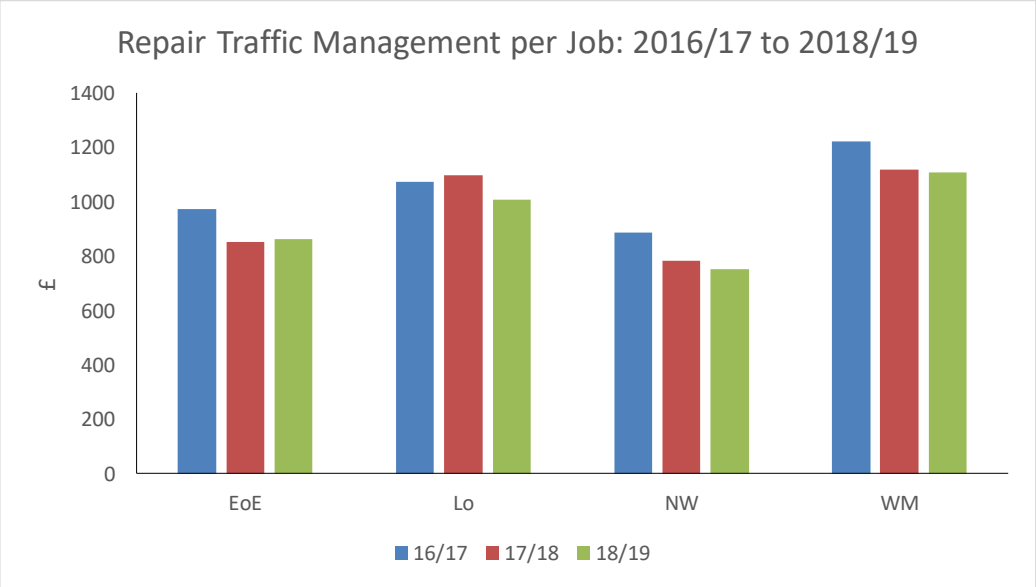


The chart shows that East and London GDNs have a disproportionate share of the cost of Repair Traffic Management hire relative to workload, whereas North West in particular but also West Midlands have a disproportionately low share.

Calculation and Materiality

Our calculation takes account of both variations in the level of unit costs and variations in the number of jobs, relative to Repair volumes.

Taking unit costs first, it is helpful to consider whether the unit costs per Repair job involving Traffic Management appear as expected.



For the first three GDNs, the unit costs follow the pattern that would be expected given regional pay data in particular, but also urbanity, London being highest cost, then East, then North West. What is unexpected is the relatively high cost per job of West Midlands, not a high pay area. Upon investigation, we found that West Midlands GDN's management consciously chooses relatively costly Traffic Management contractors because it considers they provide a significantly better service, which therefore keeps overall costs down.

It would not be right to calculate a Regional Factor for West Midlands high unit costs, because these are within management control. Therefore, we have calculated the Regional Factor for the GDN with the highest unit costs outside of management control – London GDN, and compared its unit costs with those of the other three GDNs, assuming that West Midland GDN's unit costs are the same as North West, the nearest GDN in respect of pay levels and urbanity.

2018/19	Cost per job	Number of jobs	Total cost
	£	No.	£'000
EoE	862	2,240	1,932
Lo	1,009	**1,499**	**1,512**
NW	753	1,101	829
WM	753	794	598
Cadent	**864**	**5,634**	**4,870**
Exclude London		-1,499	-1,512
Cadent non-London	**812**	**4,135**	**3,358**
Lo jobs @ non-London average unit cost	812	1,499	1,217
Actual London cost			1,512
London additional cost from price			**295**

The calculation shows that the additional cost to Repair in London GDN due to high unit costs is around £0.3m in 2018/19, which is over 1% of its normalised Repair work execution opex.

Turning to the variation in the number of Repair jobs requiring traffic management, the next calculation compares the actual costs shown above with the calculated level of cost that would be expected, if Cadent's traffic management hire costs fell pro-rata to repair workload, as represented by our mains reports Repair driver for 2018/19.

2018/19	Mains reports driver		Cadent cost	Calculated cost	Actual cost	Additional cost
	£'000	%	£'000	£'000	£'000	£'000
EoE	5,748	30%		1,445	1,932	**487**
Lo	5,148	27%		1,294	1,512	218
NW	4,808	25%		1,209	829	-380
WM	3,671	19%		923	598	-325
	19,374	**100%**	**4,870**	**4,870**	**4,870**	**0**
	A	B	C	D	E	F
			Ex table above	= B x C	Ex table above	= E - D

The table shows the largest additional cost due to volume of Repair jobs is in East GDN, at approaching £0.5m in 2018/19. This represents a materiality level of over 2.0% of normalised Repair work execution costs.

How Cadent manages the cost

There are three ways in which Cadent manages the costs associated with Traffic Management Hire.

First, we carried out a Tender Event among competing suppliers, which resulted in fourteen suppliers being appointed from 1st June 2017, and lower unit rates which saved around £100,000 p.a.

Second, we have a Streetworks Team which gives briefings to Repair Teams to ensure that an appropriate level of Traffic Control is provided, not too little or too much. Emphasis is placed on challenging Local Authorities if their requests for traffic control are unreasonable.

Third, we are conducting a trial to reduce the manual control of some 2 way traffic lights, by using intelligent lights. Their main benefit is to improve traffic flows through the use of radar to judge traffic density in order to adjust the timing of the traffic lights. Previously, temporary traffic lights were activated by the presence of a vehicle, not taking account of traffic density, with poor results on traffic flow, therefore driving the use of manual control, with associated labour costs.

Based on the results of the trial we have carried out between June and September 2019, mainly in East Anglia and East Midlands, we estimate that across Cadent as a whole we might save around £900,000 p.a. due to reduced costs of Manual Control, partially offset by increased hire costs for the more advanced traffic light technology, a saving of around 17%.

Consequently, for the RIIO-2 period, we believe it would be reasonable to reduce the Regional Factor for London GDN and East GDN by around 17%.

4.11 London depot rental costs

Reason for claim

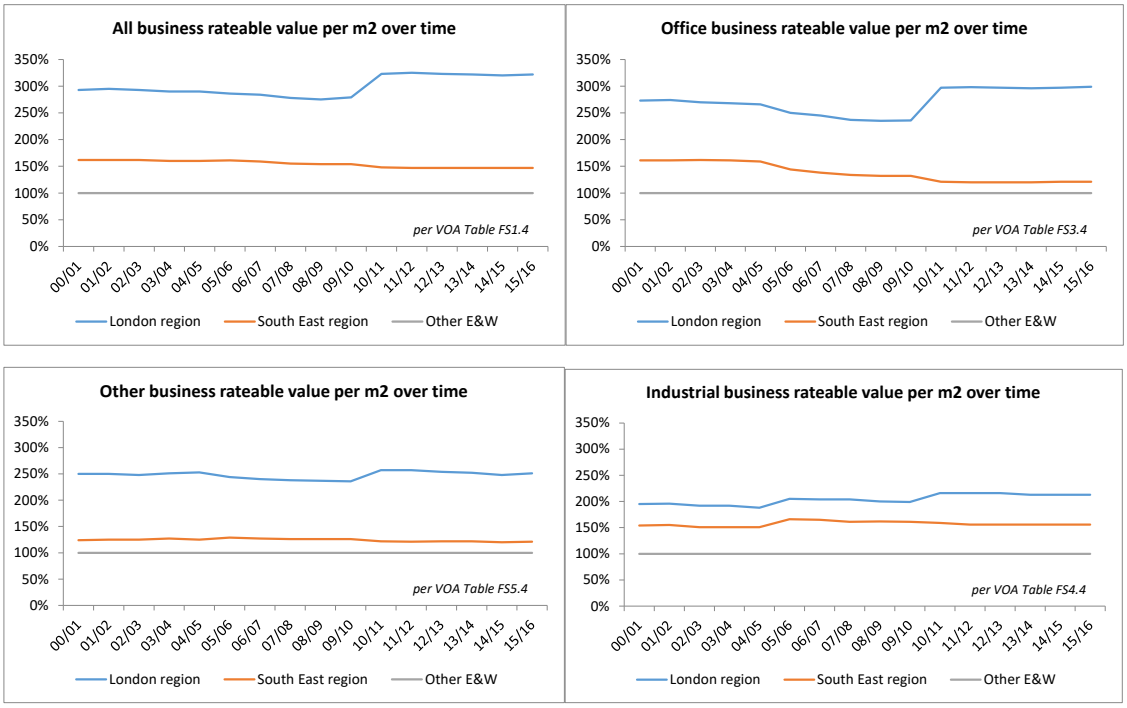
All GDNs require depot space in which to keep stores, plant and equipment, and to serve as operational bases. In London, because the cost of land and buildings is and has been for many years, far higher than elsewhere in the UK, rental costs are also significantly higher, which feed into Property Management opex.

To demonstrate that there are additional costs, we point to data from the Valuation Office Agency (VOA), a government agency, which calculates and publishes data by region of England and Wales, showing the rateable value for different types of property. Rateable values are relevant because they are calculated by the VOA based on its estimate of open market rental values, at a single point in time.

The VOA's Non-Domestic Rates Business Floorspace tables, which cover the period between 2000/01 and 2015/16, for the following property types which could be relevant to a gas distribution business depot:

- all business properties;
- office business properties;
- industrial business properties; and
- other business properties.

Charts comparing the rental costs per m^2 in London region and South East region to those recorded elsewhere in England and Wales are shown below, where elsewhere in England and Wales (Other England and Wales) is shown as 100%.



The charts show that the VOA's rental costs per m^2 in London region have consistently been between 2 and 3 times the level in England and Wales (excluding London and the South East), while rental costs in South East region have been between 1.2 times and 1.6 times that level.

The additional cost is mainly experienced by London GDN, although we would also expect Southern GDN to incur an element of additional cost also.

Calculation and Materiality

We have developed three different approaches to estimating the additional depot costs incurred by London Network, as follows:

- Approach 1: use the VOA's rateable value data for London and South East regions to find the appropriate differential compared to the remainder of England & Wales, and apply to Cadent's actual London depot costs.
- Approach 2: use the VOA's rateable value data by region to calculate expected London GDN depot costs, and compare to VOA rateable values for the remainder of England & Wales.
- Approach 3: compare actual depot costs per ft^2 in London with Cadent's other Networks, take the difference and multiply up by London Network's footage.

Approach 1

VOA data for the most recent year, 2015/16, for the 3 relevant business categories – Offices, Industrial and Other business, shows the extent to which rental values in London and the South are multiples of that other parts of England and Wales, as seen below.

Rateable values	London	South East	Other
Offices	299%	121%	100%
Industrial	213%	156%	100%
Other business	251%	121%	100%

We have actual cost data for the four largest depots in London Network, at Fulham, Islington, New Barnet, and Slough. Although New Barnet is physically in East of England GDN, because it falls with the "Tottenham area" of London, its costs are placed in London GDN, and 9% then of all property costs transferred to East of England GDN.

The actual rental cost of Cadent's London Network depots in 2017/18, stated in 2018/19 prices, is £1,340k. Dividing that by the VOA's rateable value multiples taken from the table above, calculates the expected level of cost outside of London and the South East, which can then be compared to the actual cost to show one view of additional cost.

Approach 1	**Actual rental by region - 4 sites**			**VOA rent multiple**		**Calculated rental by region - 4 sites**			**Additional**
London Network	London	South East	Total	London	South East	London	South East	Total	**cost**
2018/19 prices	£'000	£'000	£'000			£'000	£'000	£'000	£'000
Offices	418	261	679	299%	121%	140	216	356	323
Industrial	403	234	637	213%	156%	189	150	339	298
Other business	24	0	24	251%	121%	10	0	10	14
	845	**495**	**1,340**			**339**	**366**	**705**	**635**

Approach 1 shows that the additional rental cost of the largest depots in London Network is around £635,000 p.a, based on the VOA's estimate of how much higher rental costs are in London region and South East region than the rest of England & Wales, applied to the actual rental costs of the four largest London depots.

Approach 2

The total area of London Network's four largest depots is 682,000 ft^2 in 2017/18. We disaggregate that area between London region, Southern region and Other regions based on population data – Ofgem's approach to regional pay at RIIO-1 – and multiply up the VOA's expected rental cost per ft^2 for these areas (Approach 2a in the table below).

Approach 2a	Actual ft²	Ft² by region - split by population %			VOA rent by region: £/ft²			Calculated
London Network	4 depots	London - 74%	South East - 10%	Other - 16%	London	South East	Other	Cost £'000
Offices	57,548	42,586	5,755	9,208	26.0	10.5	8.7	1,248
Industrial	597,881	442,432	59,788	95,661	6.3	4.6	3.0	3,349
Other business	27,000	19,980	2,700	4,320	15.0	7.2	5.9	345
	682,429	**504,998**	**68,243**	**109,189**				**4,942**

The calculation shows that, using the VOA's rateable values for London, South East and Other regions produces an expected rental cost of £4,942k for the four depots. We can then substitute the VOA's expected rental cost elsewhere in England and Wales to find the additional cost (Approach 2b in the table below).

Approach 2b	Actual ft²	VOA rent: £/ft²	Calculated	Calculated cost from	Additional
London Network	4 depots	other E&W	cost £'000	Approach 2a	cost £'000
Offices	57,548	8.7	501	1,248	747
Industrial	597,881	3.0	1,794	3,349	1,555
Other business	27,000	5.9	159	345	186
	682,429		**2,454**	**4,942**	**2,488**

Approach 2b shows that applying VOA rental values from Other England & Wales to the four London depots produces an expected rental of £2,454k p.a. Compared to the expected value in London Network from Approach 2a of £4,942k p.a. shows an additional London Network cost of £2,488,000 p.a. Although this is well in excess of the actual cost to London Network, it demonstrates that the actual costs incurred are well below a third party benchmark, and so are efficient. This is without uplifting the VOA rateable values for inflation, as they date from 2015/16.

Approach 3

This approach does not use the VOA's data for rateable values, but instead compares the cost per ft² across Cadent's Networks, finding the additional cost in London Network.

We take the total area data for the four largest London depots, disaggregated into different types of land and buildings, multiply up by the average cost per ft² of the larger depots in our other Networks to calculate the cost of these depots if they were elsewhere, and compare against the actual cost of the London depots, as shown below.

Approach 3	Actual ft²	Cadent non London	Calculated cost	Actual cost	Additional cost
London Network	4 depots	Cost per ft²	£'000	£'000	£'000
2018/19 prices					
Offices	57,548	5.7	329	679	349
Store	16,320	1.1	19	80	61
Workshop	5,135	4.0	21	40	19
Yard area	442,926	0.3	145	311	167
Parking	27,000	N/A	23	23	0
Land	133,500	1.0	138	206	69
	682,429		**674**	**1,340**	**665**

Under Approach 3, there are no areas described as Parking areas in our larger depots outside of the London, so, this being a small category, we have assumed that the cost in London is the same that elsewhere. Approach 3 shows additional London depot costs of £665,000 p.a.

A summary of the three approaches is shown below.

Approach	Additional Cost £'000	Description
Approach 1	635	VOA % Uplifts applied to actual costs
Approach 2	2,488	VOA Rateable values applied to actual ft^2
Approach 3	665	Comparison of London and other Cadent £/ft^2

The first approach, based on the VOA multiple, can only approximately quantify the additional level of London cost, because it does not compare across gas Networks, but instead applies the VOA multiplier to London Network costs.

While the second approach demonstrates that London Network's rental costs for its four largest depots are efficient relative to the VOA benchmark, a Regional Factor adjustment based on that figure would be well above the actual costs incurred, which does not seem reasonable.

In contrast the third approach, comparing across gas Networks on a ft^2 basis, compares rentals across gas Networks, and so should be the most accurate. The fact that the first approach, using the VOA multiples, shows a similar answer, helps to support the third approach.

The Regional Factor claim is therefore £665,000 p.a., using Approach 3, which after the 9% Tottenham adjustment, becomes £605,000 p.a. in London GDN, and £60,000 p.a. in East of England GDN.

How Cadent manages the costs

Cadent takes a number of steps to manage costs associated with its London depots:

- We use undeveloped industrial land, typically the sites of former gas works, such as New Barnet and Slough, for as long as possible, as market rents are lower for these sites.
- Especially in high rental areas, we shrink the site footprint as far as possible. For example, our new Islington and temporary Fulham depots together occupy around 55,000 ft^2. Our older New Barnet and Slough depots occupy over 600,000 ft^2, but the total rental costs are similar.
- We use third party advisors, GVA, to advise on the optimal efficient site identification and valuations.
- We seek the most advantageous lease terms possible - at Islington:
    - We were able to agree a 25 year lease in 2011 which revalues in accordance with RPI every 5 years, rather than with open market valuation – the former, at present, being significantly less costly.
    - In exchange for agreeing to the landlord placing a roof over our depot – which enabled them to build over it – the landlord funded around £1.5m of depot refurbishment and temporary relocation costs.
- We seek to share depots:
    - We are in discussions with Hammersmith and Fulham Council with a view to sharing a new depot with them – the aim being to allow the council to redevelop its present site, close to Cadent's existing depot, by placing a new depot underground.
    - We allow the GDSPs and DHL (who manage pipe logistics for mains replacement) to share our largest depot sites at New Barnet and Slough. They are not charged rent, but this arrangement prevents them incurring rental costs with third parties, then recharging all or part of that cost as part of services to Cadent – a benefit which we have not sought to capture in our calculations above.

- We lobby influential groups - we have discussed with members of the London Infrastructure Group, a forum run by the Mayor of London's office, how government can support infrastructure providers, in particular to ensure that they are not driven entirely to the outskirts of London.

We believe that some of the other GDNs own many of their operational depots, rather than leasing them, in which case they avoid paying rentals and so have lower operating costs. We do not consider that this would represent a more efficient approach to property management, rather one that represents an example of the opex / capex trade-off. Indeed, we believe that paying market rentals not only lowers capex but also encourages the efficient use of space.

4.12 Twenty-four hour shift patterns

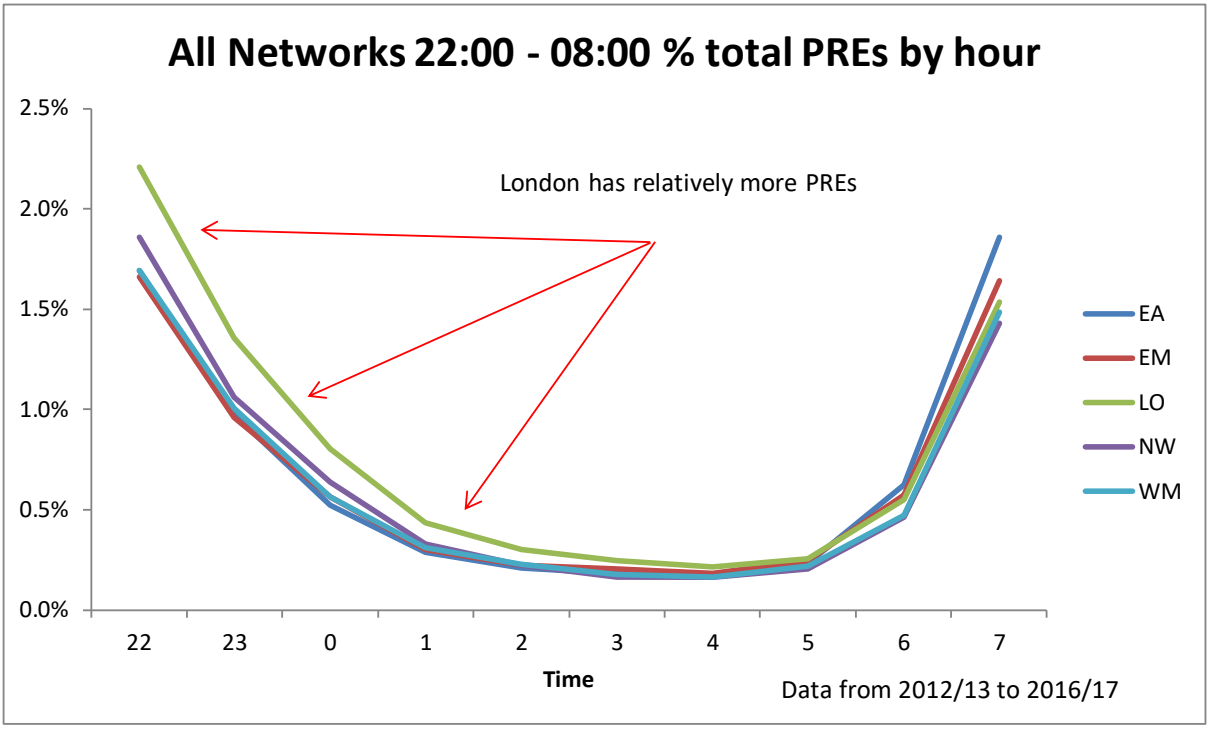
Reason for claim

All of our London patches, and four of the ten patches in West Midlands GDN operate a 24 hour shift pattern, with a low level of Call-Out and Standby. East Anglia, East Midlands, North West and six of the ten patches in West Midlands manage calls outside of normal working hours entirely using Call-out and Standby arrangements.

London GDN has a 24 hour shift pattern for a combination of two reasons:

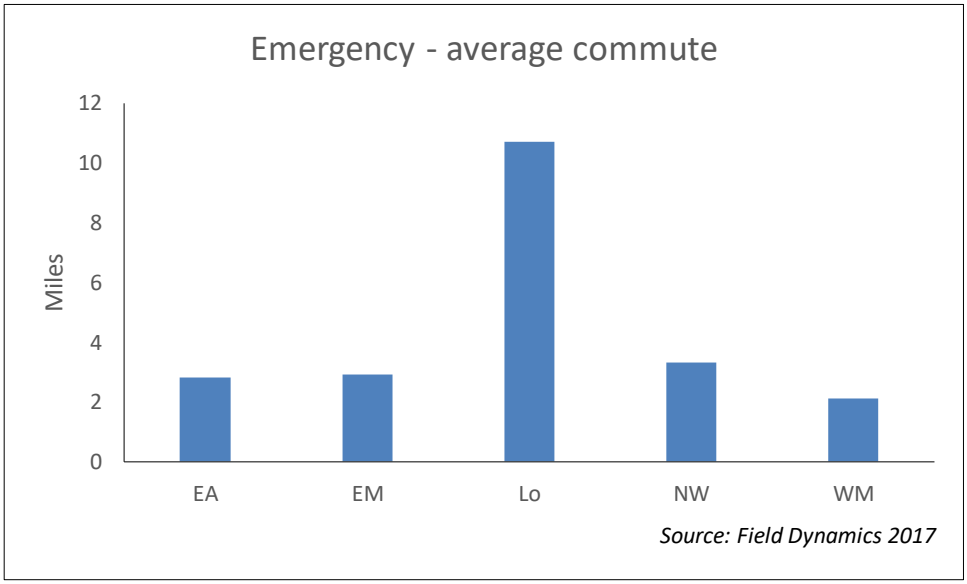
- The Network has a higher proportion of calls outside of normal working hours – being the "24 hour city".
- Given the prices of housing in London, travel distances from home for our engineers attending gas emergencies, are significantly greater in London than elsewhere, which would place people at risk and jeopardise the 97% response time requirement.

The chart below uses data from 2012/13 to 2016/17, showing the proportion of each network's PREs that are reported between 10pm and 8am.



When looking at the scale, bear in mind that if PREs were called in perfectly evenly across the day, slightly over 4% of calls would be received each hour. The chart shows that London has a significantly higher proportion of its PREs overnight than our other networks.

In respect of our FCOs in London living further away from their work than our other networks, we used Field Dynamics consultants in 2017 to look at how well aligned start locations were with the centre of work gravity for each network. They found that FCOs commuted far further in London network than elsewhere, as shown in the chart below.



Given the information on PREs and commuting distances, the evidence for West Midlands operating 24 hour shifts appears significantly weaker than for London, therefore we do not make a Regional Factor claim for that GDN.

Calculation and materiality

To calculate the additional cost of London's 24 hour shift patterns, we needed to find the additional net cost of these arrangements, that is the cost of the 24 hour shift payments plus the lower Call-out costs in London, compared to what would have been incurred if Call-out and Standby arrangements had been used, as in other networks. Using data for 2017/18, the calculation below compares the level of Basic pay including 24 hour shift allowance but excluding London pay uplift, and the level of Call-out / Standby payments in each network.

	Per average number FCOs					Number	Additional	Tottenham	Impact
	Basic £	Call-out & Standby £	Total £	Average excl Lo £	Additional London £	FCOs No.	Cost £'000	adjustment £'000	GDN £'000
EA	35,436	4,284	39,720					44	44
EM	35,620	3,829	39,449						
Lo	**38,518**	**1,634**	**40,152**	**38,456**	**1,696**	**289**	**490**	**-44**	**446**
NW	35,609	1,041	36,650						
WM	37,188	1,942	39,130						
Total excl Lo	*35,968*	*2,488*	***38,456***						
	A	B	C = A+B	D	E = C-D	F	G = E x F	H	I = G+H

The table shows an additional cost of £446,000 in London GDN, which represents around 3.5% of London GDN's normalised Emergency work execution opex.

In addition, the table shows a higher level of Call-Out and Standby in East Anglia and East Midlands than our more urban networks. We will review the need for and amount of any sparsity adjustments in our December Plan, including for these items.

How Cadent manages the cost

The shift allowance was part of the new pay arrangements negotiated with the Trade Unions in 2013, implemented after a ballot of union members and therefore reflects the balance between the company trying to

minimise costs, retaining its workforce and maintaining industrial relations. In addition, under the Terms & Conditions for new workers joining from April 2019, pay overall is reduced compared to people joining before that date, and this is likely to require workers to work a higher proportion of anti-social shifts in order to qualify for the 24 hour Shift premium payment.

To provide further context, in April 2019 the HSE issued an Improvement Notice on Cadent, number 309764674, in respect of field force working times, where some individuals were found to have worked excessive hours, with limited evidence of necessary risk assessment. This is much more likely to be an issue under Call Out and Standby arrangements, rather than London shifts, and could encourage a wider move towards 24 hour shift patterns.

4.13 Opex Parking Bay Suspension and Temporary Traffic Restriction Order costs

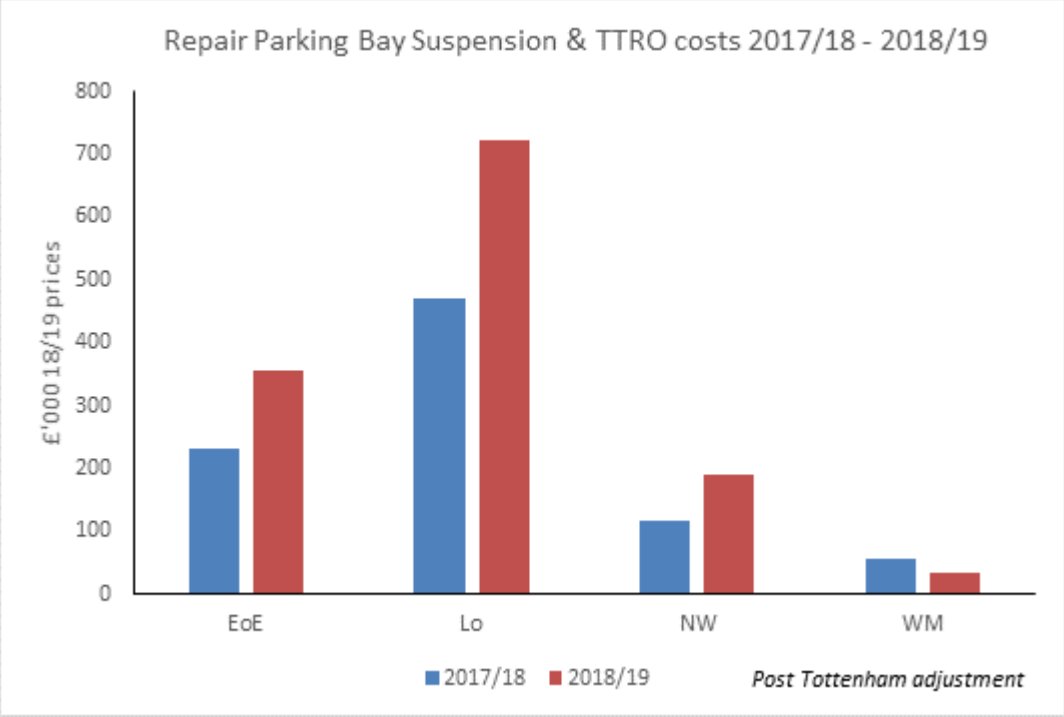
Reason for claim

We have demonstrated earlier in this document that the cost of parking bay suspensions is a Regional Factor with especial relevance for London GDN, in the context of Mains replacement and Connections.

We also incur parking bay suspension costs in Repair work execution, but these are very difficult to identify separately from the cost of Opex TTROs (Temporary Traffic Restriction Orders) – fees paid to Local Authorities for closing lanes or whole roads, and switching traffic signals on and off. Neither is currently reported within table 3.13 of the RRP, due to difficulties in identification.

We set out earlier that explained earlier that levels of cost for parking bay suspension depend on the number of parking bays in operation, whether Local Authorities choose to charge utilities for suspending them, the structure of charges and the level of charges in each Local Authority, with the overall result that costs in London were far higher than elsewhere. Similarly with TTROs, the attitude of the Local Authority in choosing whether and how much to charge utilities is a key factor in influencing the level of cost by GDN.

The data we have shows that the cost in Repair for TTROs and parking bay suspensions is significantly greater in London than in our other Networks. The chart below shows the relative scale of cost in each of our GDNs in 2017/18 and 2018/19, having made the Tottenham adjustment.



The table shows that the cost in London GDN, after making the Tottenham adjustment, is £723,000 in 2018/19 (£469,000 in 2017/18), far higher than any of our other GDNs. In London, the majority of the cost, around 70%, is in respect of parking bay suspensions.

Calculation and Materiality

The first step in the calculation is to work out the amount of cost in each GDN, from the sources used by the company to pay the cost. The majority of the costs are incurred using purchasing cards issued to Repair

supervisors and by Traffic Management Hire contractors for more complex situations. In North West call Off arrangements are used with local authorities, and a small amount of cost is incurred through the Hires Team. Having calculated the total, we need to make the Tottenham opex adjustment to move 9% of London's cost to East of England, which is shown below for the years 2017/18 and 2018/19, with the numbers for all our GDNs.

	2017/18			2018/19		
2018/19 prices	**Network cost**	**Tottenham adjustment**	**GDN cost**	**Network cost**	**Tottenham adjustment**	**GDN cost**
	£'000	£'000	£'000	£'000	£'000	£'000
EoE	184	46	230	286	72	357
Lo	516	-46	469	795	-72	723
NW	118		118	190		190
WM	57		57	33		33
Cadent	**875**	**0**	**875**	**1,303**	**0**	**1,303**

The second step is to work out how disproportionate this level of cost is to Repair activity. Our measure of Repair regression driver, based on Mains reports, with a weighting based on diameter of the main. We consider that Mains reports is the most accurate measure of Repair activity, but that it needs to reflect the additional time and therefore cost associated with working on larger diameter mains – which are disproportionately found in London. The table below compares actual cost to the activity driver for 2017/18 and 2018/19.

2017/18	Mains reports CSV	Cost	Average cost per CSV driver excl Lo	Reports x average cost excl Lo	Variance
2018/19 prices	£'000	£'000	Pence	£'000	£'000
EoE	5,582	230		159	72
Lo	5,258	469		150	**320**
NW	4,823	118		137	-19
WM	3,835	57		109	-52
	19,498	**875**		**555**	
Excl Lo	-5,258	-469			
	14,240	**405**	28.5		

2018/19	Mains reports CSV	Cost	Average cost per report excl Lo	Reports x average cost excl Lo	Variance
	£'000	£'000	£	£'000	£'000
EoE	5,748	357		234	123
Lo	5,148	723		210	**513**
NW	4,808	190		196	-6
WM	3,671	33		150	-117
	19,374	**1,303**		**790**	
Excl Lo	-5,148	-723			
	14,227	**580**	40.8		

The table shows that London GDN's Repair activity carried an additional cost of around £320,000 in Opex TTROs and Parking Bay Suspensions in 2017/18, which represents around 1.7% of London's normalised Repair opex, and around £520,000 in 2018/19, which represents around 2.5% of London's normalised Repair opex.

How Cadent manages the cost

We manage the cost of opex parking bay suspensions and TTROs by minimising our presence in the carriageway, because operating in the carriageway is expensive, operationally difficult and damages our relationship with Highway Authorities and road users.

The relationship with Highway Authorities is important not so much from a Repair perspective – where we have the legal right to access the carriageway in emergency situations – but also from a Mains replacement and Connections perspective, where we need to seek their permission to access the carriageway.

In London in particular Highway Authorities are likely to search for unattributed roadworks for which permits have not been obtained, and circulate an unattributed work report between the utilities operating in their area to track them down. Highway Authority Inspectors are also likely to inspect any presence in the carriageway, for example to check that any diversions are operating effectively.

We are aware of two circumstances where we intentionally may not act to minimise parking bay suspension costs, because of the adverse effect on traffic and our relationship with Highway Authorities. First, we could use Core and Vac machines more in London than we do. However, this equipment is large, so that we might occupy a carriageway for a whole day, shutting it to traffic, rather than only occupying a small proportion of the carriageway for several days, which would not shut it. In this case, we might suspend parking bays for several days, rather than one, and so incur greater parking bay suspension costs, (although we would avoid greater traffic management costs).

Second, we sometimes suspend parking bays on the opposite carriageway to where we are working, because this acts to increase the width of the road, offsetting the reduction in width caused by our activities – but again, this avoids greater traffic management costs, as well as protecting our relationship with Highway Authorities and road users.

4.14 Sparsity

Reason for claim

For the last two price control reviews, Ofgem has made allowance for sparsity, at GDPCR1 in respect of Emergency Work Execution, at RIIO-1 for Emergency and Repair Work Execution.

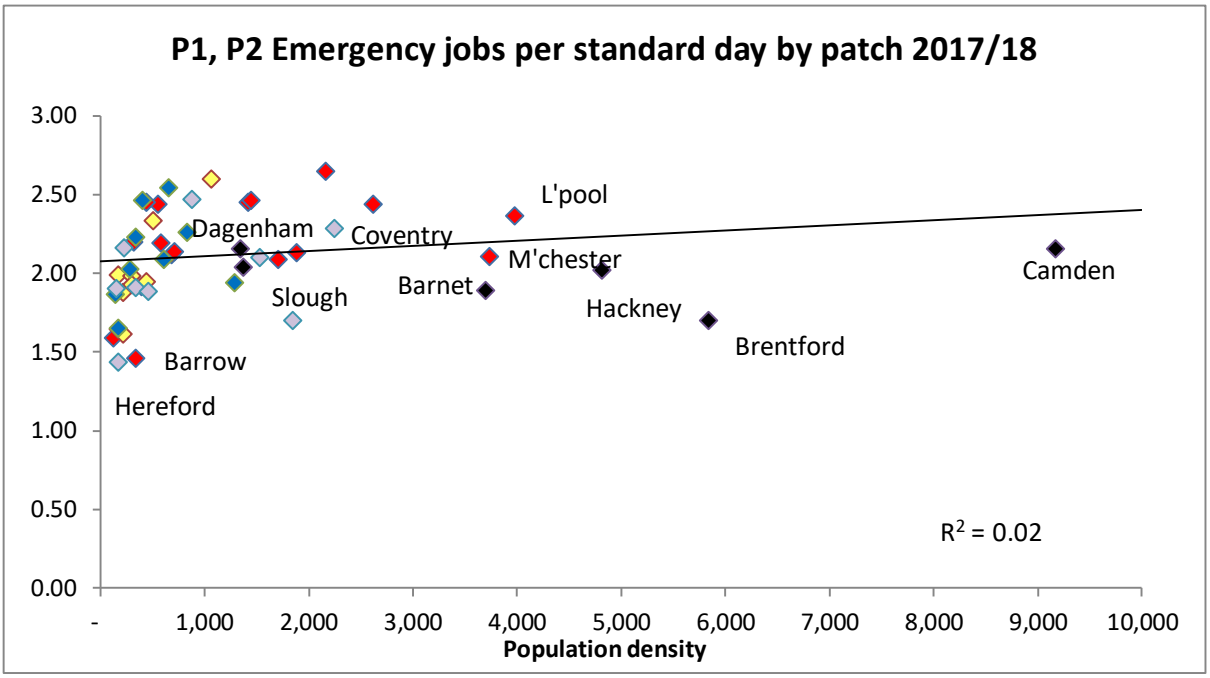
Emergency

In respect of Emergency, we believe that the evidence for making a sparsity adjustment is mixed. We have four elements of evidence:

1. The logic in principle
2. Patch level data on workload per FCO
3. Network level performance bonus data
4. Relative Ofgem regression performance

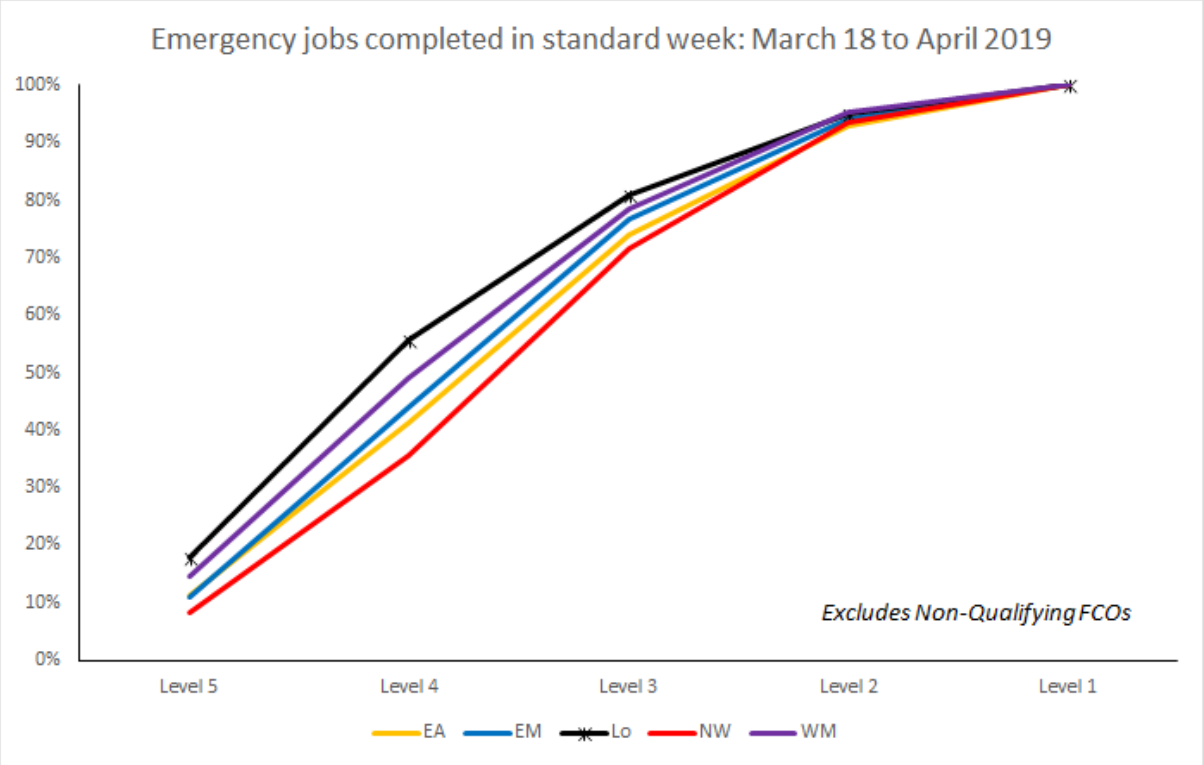
For the first piece of evidence, the logic is driven by the need to meet the 97% standards of performance. In all areas, FCOs have to be able to attend within one hour for an uncontrolled escape, or two hours for controlled escapes. To achieve this in more rural areas needs FCOs to be available even if the volume of work is significantly lower than in more urban areas. This logic has been accepted by Ofgem at the last two price control reviews.

For the second piece of evidence, we have used data for population density by patch, and compared it to a measure of busyness, jobs complete per standard day on attending PREs within one and two hours. The chart is shown below.



The chart shows no convincing relationship between population density and Emergency workload per standard day.

For the third piece of evidence, we have network level performance bonus data on the number of jobs completed per FCO in a standard week. The graph below shows the performance level for FCOs across Cadent for twelve months between March 2018 and April 2019, with Level 5 being the highest bonus for the most jobs completed, and level 1 the least bonus for the fewest jobs completed.



The evidence in the chart is mixed. FCOs in London achieve more of the higher level 4 and 5 bonuses for completing more jobs per week. However, there is little difference between East Anglia, East Midlands and West Midlands networks, which range from very rural to fairly urban. North West GDN is the bottom performing, but this is a largely urban network.

The fourth piece of evidence, the result of the Ofgem regression is shown below.

Per Ofgem Gas Distribution Annual Report 2017/18					
	Actual	Modelled	Gap	% Modelled	Rank
	£m	£m	£m	£m	No.
EoE	14.5	13.8	0.7	5%	5
Lo	10.2	8.6	1.56	18%	7
NW	10.6	10.1	0.53	5%	6
WM	7.3	7.2	0.13	2%	4
NGN	11.8	8.9	2.82	32%	8
Sc	4.7	5.8	-1.1	-19%	1
So	11.7	13.5	-1.83	-14%	3
WWU	6.9	8.5	-1.55	-18%	2

The highest ranked GDNs are Scotland and Wales and the West. However, these were considered to be the sparsest GDNs at RIIO-1, which therefore benefited most from the sparsity adjustment. In addition, the most urban Network, London, which has a negative sparsity adjustment, ranks seventh. The fact that Scotland and Wales and the West are the best performers in the Ofgem regression, and London one of the worst, suggests that either the sparsity adjustment is not needed, or the RIIO-1 adjustment is too large, or there are other more significant factors missing from the regression. This last consideration is supported by the fact that, in our own modelling, we have amended the original driver and made additional Regional Factor adjustments

In summary, the evidence for a sparsity adjustment for Emergency remains mixed. In support of an adjustment for Emergency, there is a logical argument behind it, and the performance bonus data shows more jobs per FCO per week in London. However, the workload by patch data does not support it, the performance bonus data for the non-London Networks is mixed, and the Ofgem regression as published in the Gas Distribution Annual Report shows that the two least cost GDNs are the two which benefited most from the RIIO-1 sparsity adjustment, although that regression has weaknesses.

On balance, we believe that, although not overwhelming, there is enough evidence to justify making a sparsity adjustment for Emergency. There is strong logic in principle and data supporting it.

Repair

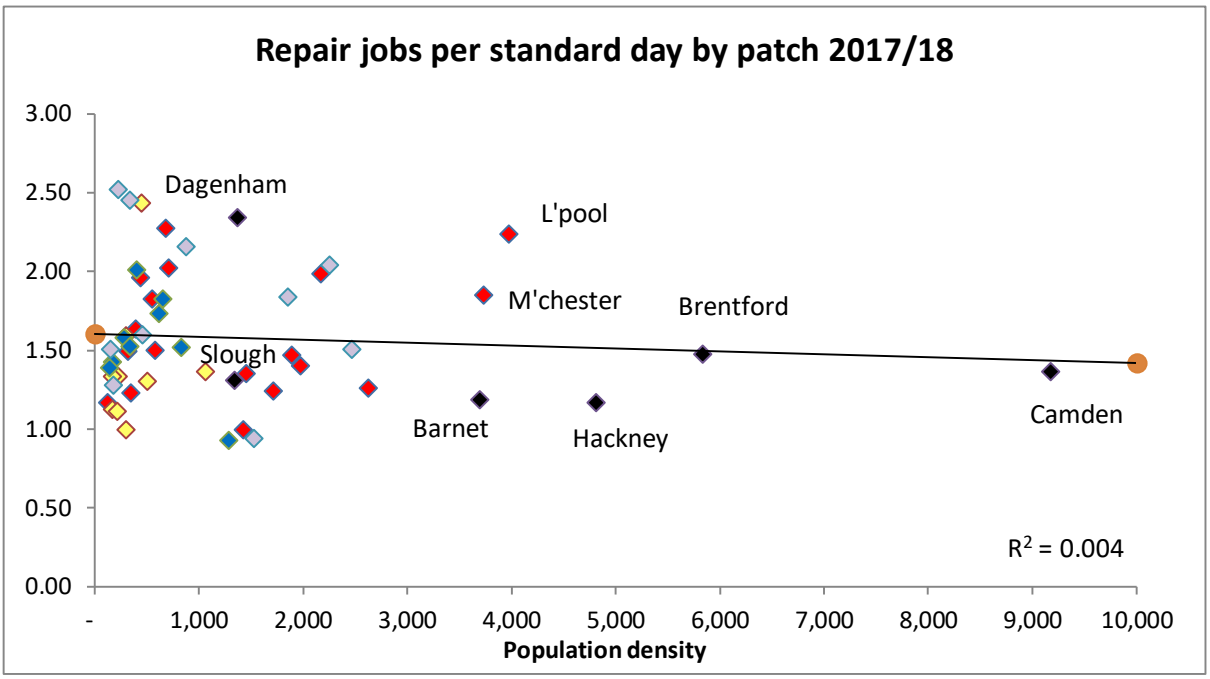
In respect of Repair Work Execution, we have four elements of evidence:

1. The logic in principle
2. Patch level data on workload per Repair team
3. Network level performance bonus data
4. Relative Ofgem regression performance

For the first piece of evidence, Ofgem's logic for the Repair adjustment at RIIO-1 was that Repair staff needed to be placed strategically because sometimes FCOs needed to hand over to Repair staff, in order to attain the 97% Standard of performance (Final Proposals, December 2012, Cost Efficiency Appendix, paragraph 2.13.).

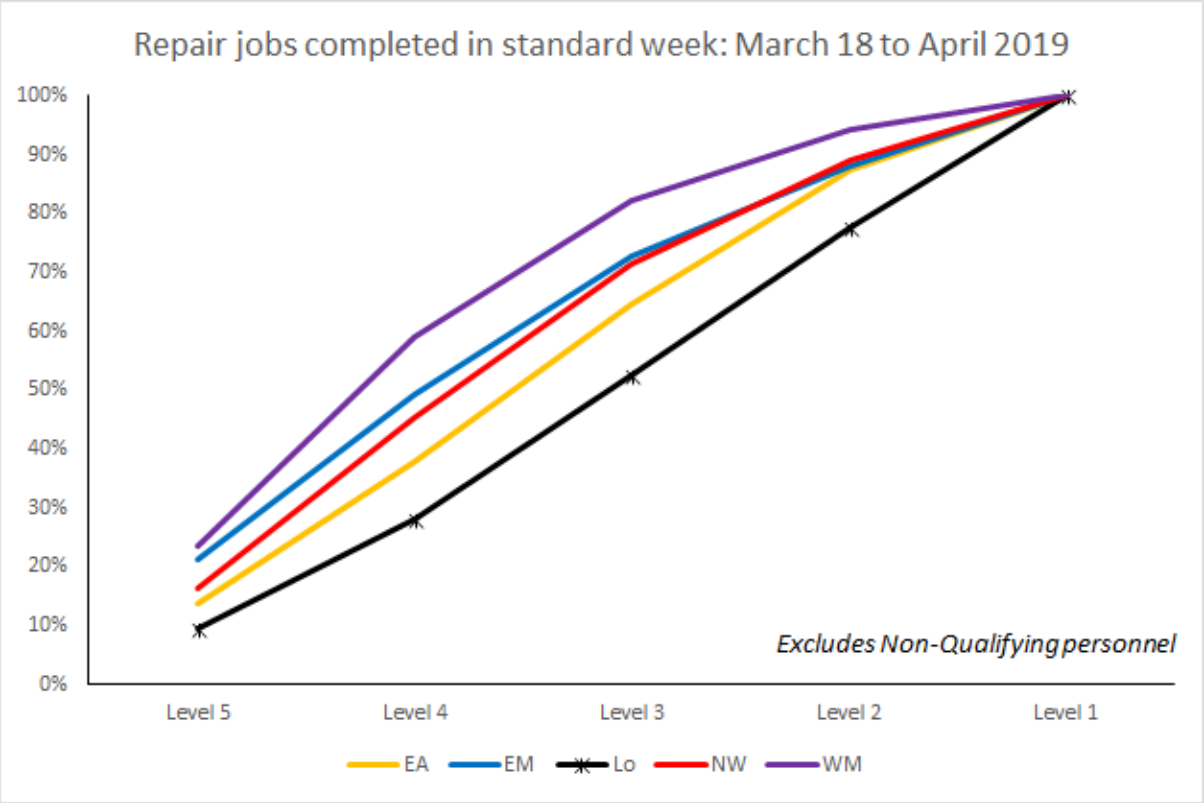
Cadent does not place Repair staff strategically with little to do in case of an urgent FCO request for attendance. The fact that we hit our 97% attendance targets for PREs without adopting this approach, suggests that it is not necessary.

For the second piece of evidence, workload per standard day by patch, the chart below shows the relationship between population density and busyness.



The chart shows no convincing relationship between population density and busyness for Repair.

For the third piece of evidence, we have network level performance bonus data on the number of jobs completed per Repair team in a standard week. The graph below shows the performance level for Repair teams across Cadent for twelve months between March 2018 and April 2019, with Level 5 being the highest bonus for the most jobs completed, and level 1 the least bonus for the fewest jobs completed.



While our most rural Network, East Anglia, has the second lowest level of level 4 and level 5 performance, London, our most urban Network, performs worse. In addition, East Midlands, our second most rural Network, is the second most busy. If there is a sparsity factor in Repair, it seems to be far outweighed by other factors.

The fourth piece of evidence, the result of the Ofgem regression is shown below.

Per Ofgem Gas Distribution Annual Report 2017/18					
	Actual	Modelled	Gap	% Modelled	Rank
	£m	£m	£m	£m	No.
EoE	17.6	15.6	2.0	13%	7
Lo	16.5	13.3	3.2	24%	8
NW	14.7	15.2	-0.5	-3%	3
WM	9.1	9.9	-0.9	-9%	2
NGN	11.5	10.8	0.8	7%	5
Sc	5.2	4.6	0.5	11%	6
So	13.0	12.7	0.3	2%	4
WWU	5.8	8.6	-2.9	-33%	1

The second most sparse GDN, Wales and the West ranks first by a large distance, while the most urban, London, ranks last. This suggests that either the sparsity adjustment is not needed, or the RIIO-1 adjustment is too large, or there is another more significant factor that is missing from the regression.

On balance, having reviewed the evidence, we see no justification for a sparsity adjustment in Repair work execution, either on the grounds of the logic in principle, or as suggested by numerical evidence. Consequently, in the modelling for our December Plan, we have not applied any sparsity adjustment for Repair work execution.

Calculation and Materiality

Our calculation for a sparsity adjustment for Emergency work execution is shown below, in two steps.

The first step is to compare productivity between our most dense and most sparse operational networks, London and East Anglia, to assess the scale of the productivity differential. We have done this using the data behind the chart on three pages above, to assess the difference in jobs per standard week between London and East Anglia, assuming that the actual level of performance for each Bonus Band lies at the midpoint of the range.

Jobs per std week			**East Anglia**		**London**		**East Anglia**
Bonus band	**Range**	**Midpoint**	**Bonus bands**	**Value**	**Bonus bands**	**Value**	**Sparsity adj**
Non Qualifying	0-50%	25%	2%	0.4%	1%	0.3%	
Level 1	50-60%	55%	7%	3.8%	5%	2.7%	
Level 2	60-70%	65%	19%	12.1%	14%	9.0%	
Level 3	70-80%	75%	32%	24.1%	25%	18.9%	
Level 4	80-90%	85%	30%	25.2%	37%	31.7%	
Level 5	90-100%	95%	11%	10.5%	18%	16.8%	
			100%	**76.1%**	**100%**	**79.4%**	**95.8%**
Column	A	B	C	D	E	F	G
Calculation				B x C		B x E	D / F

The result of the first step is that East Anglia is 95.8% as productive as London.

The second step is to calculate a workable adjustment across all eight GDNs, using Ofgem's sparsity calculations from RIIO1, which worked out the relative sparsity across all the GDNs. In performing the second step, we had to separate out the original Ofgem calculation for East of England into the two components of East Anglia and East Midlands. This was done because we needed to calibrate the productivity adjustment for all other networks relative to East Anglia, following the result of the first step. The end of the second step is to re-state the productivity adjustment relative to the GDN average, so the adjustment is broadly symmetrical.

	Ofgem RIIO1 Sparsity index	Productivity impact v Lo	Variance v average
EoE	0.18	96.2%	-0.9%
EA	***0.20***	***95.8%***	***-1.2%***
EM	*0.17*	*96.5%*	*-0.5%*
Lon	0.00	100.0%	2.9%
NW	0.04	99.1%	2.0%
WM	0.12	97.4%	0.3%
No	0.17	96.5%	-0.5%
Sc	0.24	95.1%	-2.0%
So	0.10	97.9%	0.8%
WW	0.27	94.4%	-2.7%
Average		**97.1%**	**0.0%**

The result of this second step is that the most urban GDN, London, has an adjustment of 2.9% to its labour costs, and the least urban, Wales and the West, a 2.7% negative adjustment. The total adjustment is therefore a maximum of 5.6% of cost.

How Cadent manages the cost

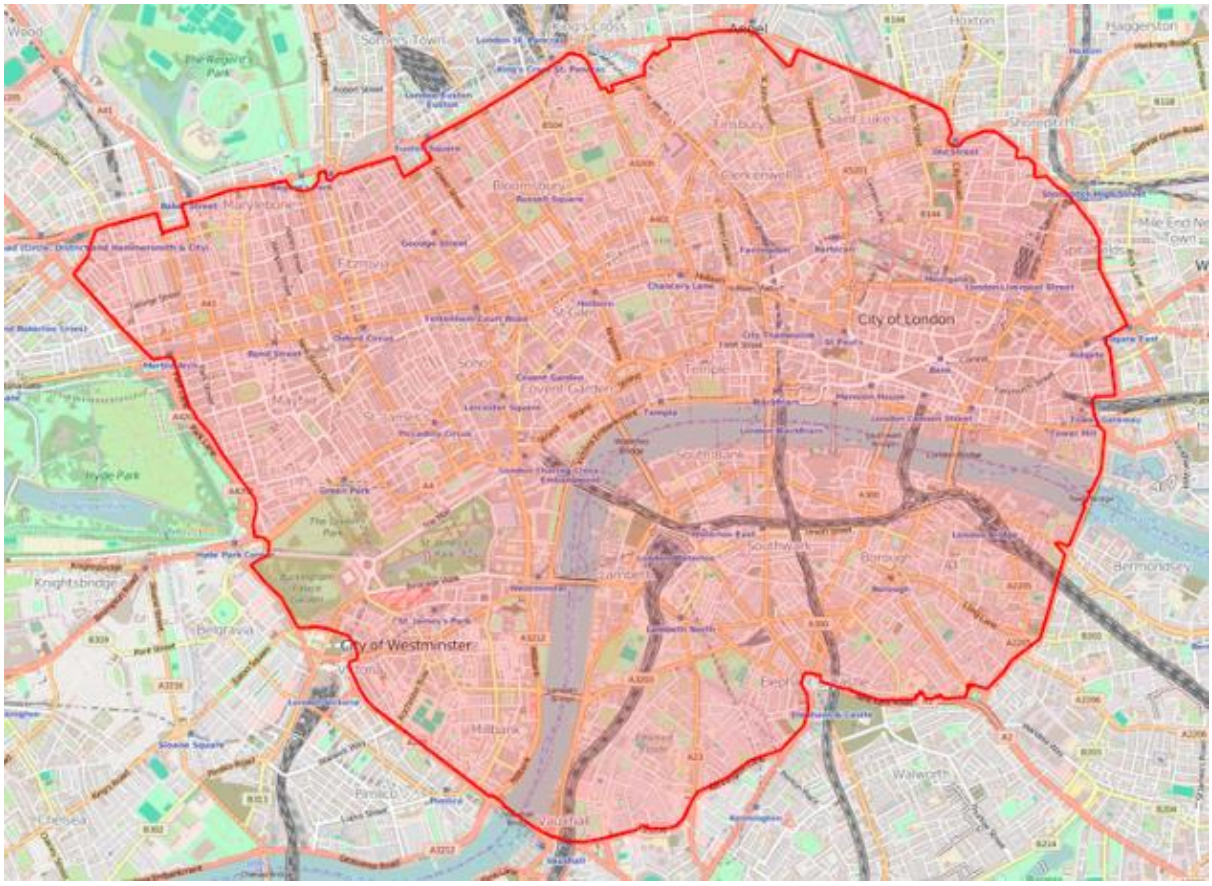
The calculation above implicitly assumes a similar level of operational efficiency in East Anglia and London, so that the observed difference in productivity between the networks arises from sparsity. Other than comparing one network against another, it is difficult to see how the sparsity effect could be quantified, and the fact that both networks are under common ownership and have so have common processes and procedures should alleviate concerns that there are major differences in efficiency between them.

The argument that Emergency FCOs in more rural areas should carry out more non-Emergency related work, and so fill their available time, is spurious. A sparse network reduces not just the quantity of Emergency work, but other work also. Moreover, any other work undertaken would need to be capable of being interrupted if necessary, given that Emergency work needs to take priority.

4.15 London Congestion Charge

Reason for claim

London's congestion charging zone operates between the hours of 7am and 6pm, Monday to Friday, within the area covered by the London Inner Ring Road, as shown in the diagram below.



Cadent's London Network covers the area north of the river, and consequently incurs costs for travel within the zone, for Emergency, Repair and Replacement activity.

The congestion charge is not unique to London GDN, as Southern GDN works in the area south of the river, but we would expect London GDN's charge would be significantly above that of Southern GDN, as it covers a far larger area. We envisage no reason why other GDNs would incur more than a trivial level of charge.

Calculation and Materiality

In both 2017/18 and 2018/19 London Network incurred a cost of £0.2m p.a. for Congestion charges, disaggregated between Emergency, Repair, Maintenance and Repex (other services) activities. The figures, compared against the normalised cost of each activity in 2018/19 to provide a measure of materiality, are shown below.

2018/19	London Network cost	Tottenham adjustment	London GDN cost	Normalised GDN cost	Materiality
	£	£	£	£	%
Emergency	69,947	-6,295	63,652	8,865,842	0.72%
Repair	73,681	-6,631	67,049	21,171,074	0.32%
Maintenance	4,192	-377	3,815	10,498,215	0.04%
Repex	41,669	0	41,669	98,700,295	0.04%
Total	**189,489**	**-13,304**	**176,185**		

The “Tottenham adjustment” is made because 9% of London Network’s opex is transferred to East of England GDN to reflect the fact that the Tottenham area, although operated by London Network, is physically within the boundary of East of England GDN.

We consider that a Regional Factor cost representing 0.7% of the total normalised cost for an activity is material, and that, having crossed that threshold for the Emergency activity, it is reasonable to make what is, in absolute terms, a larger Regional Factor adjustment for the other activities.

How Cadent manages the cost

By registering with Fleet Auto Pay, Cadent has reduced the cost from the standard £11.50 per day per vehicle detected in the zone to £10.50 per day.

Other steps that might be taken to reduce the cost of the congestion charge would have serious operational or financial consequences. For example, key Emergency work has a 97% attendance target within one or two hours, driven by safety – jobs could not be postponed to avoid the congestion charge, which also applies to unplanned Repair jobs.

Although other Repair, Maintenance and Repex work could be scheduled at the weekend, or late at night / early in the morning by moving resources from weekdays during the day, this would incur additional labour costs for unsociable hours which would significantly exceed the £10.50 per day congestion charge.

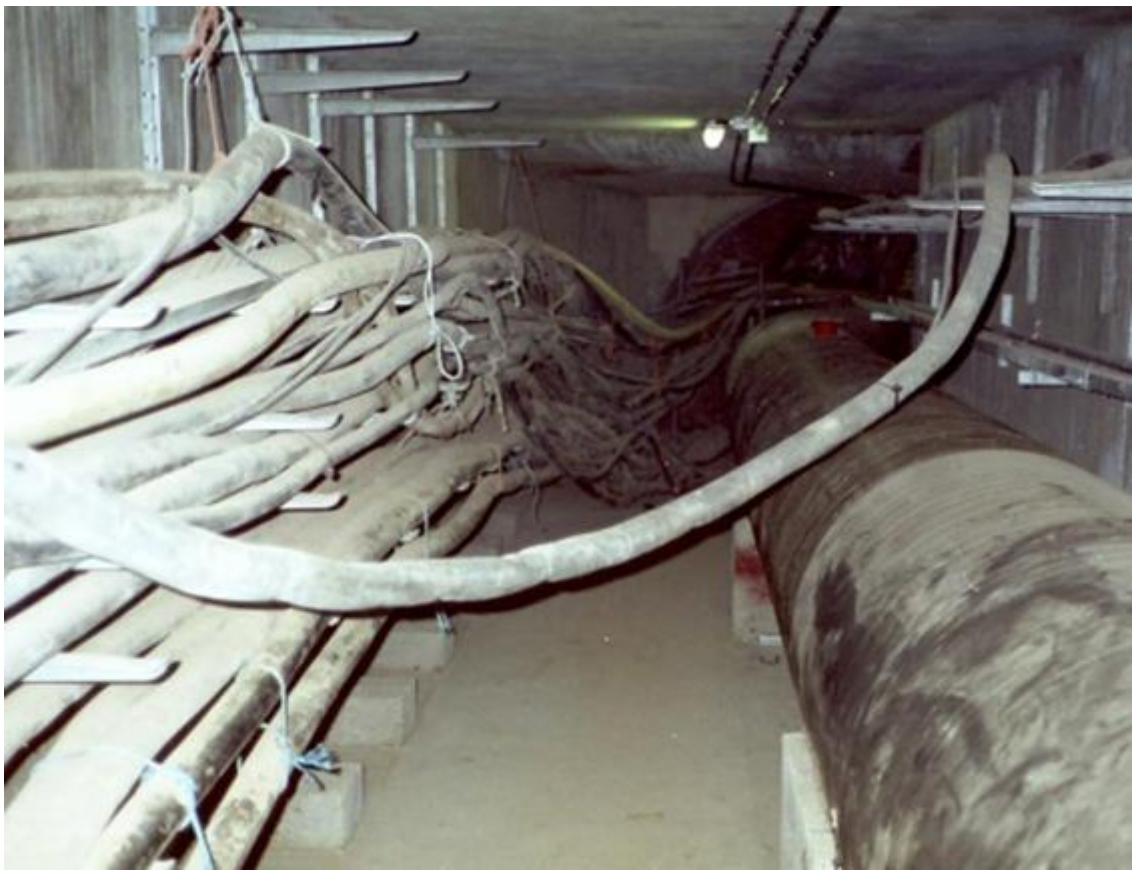
We note that fully electric vehicles, and hybrids that meet the Euro 6 standard, emit less than 75g of CO_2 per km, and have a zero emissions range of 20 miles or more are wholly exempt from the Congestion charge. In our Output Case: A Carbon Neutral Business (Appendix 07.04.04) we propose to trial electric vehicles for our Emergency FCOs in the first two years of RIIO2, which if successful, we will roll out across London GDN in full by the end of RIIO-2.

However, it would seem premature to assume that the cost presently borne by Emergency will cease during RIIO-2, as it depends both on the trial being successful, and the London Congestion charge not being extended to cover electric vehicles – once electric vehicles become widely adopted, it would seem likely that their exemption from the charge would cease.

4.16 London Local Authority Tunnels

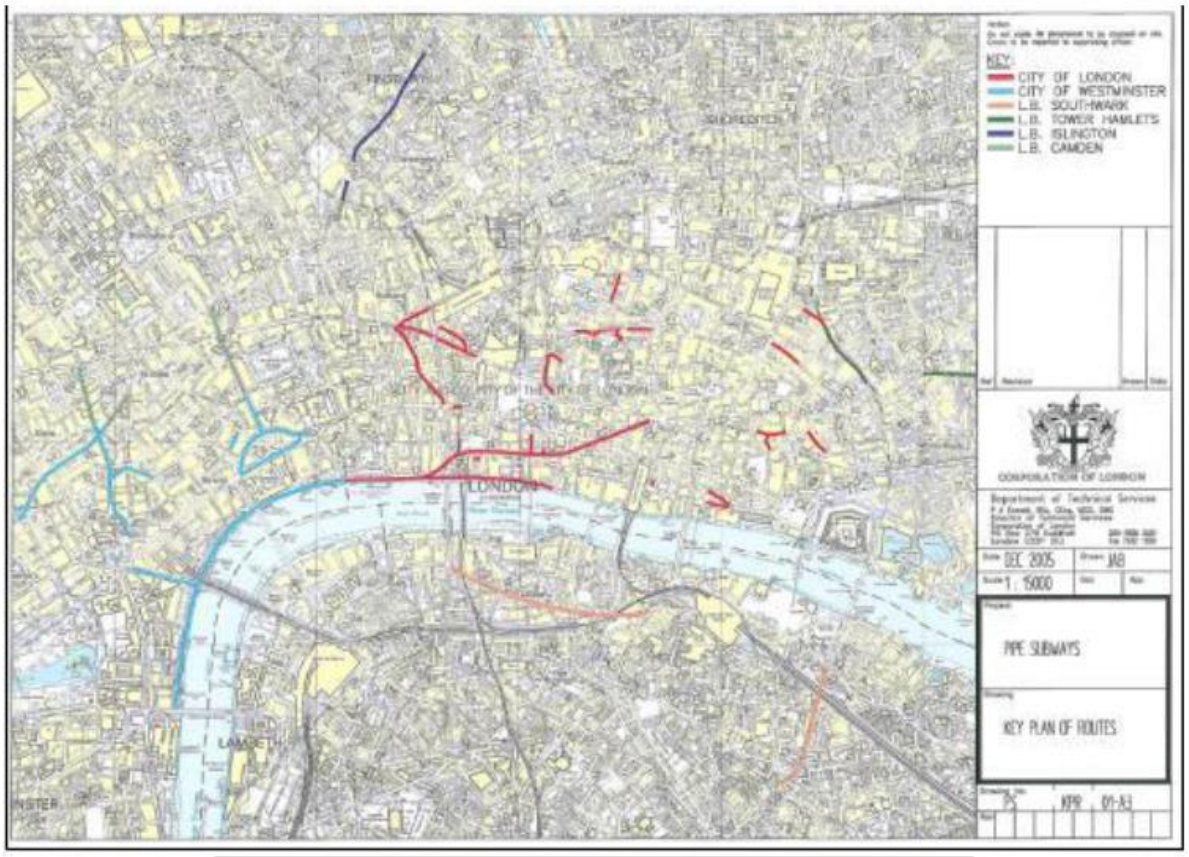
Reason for claim

There is a series of tunnels running under London streets containing gas, water, electricity, cable and telecommunications pipes and cables, which are owned and maintained by the London Boroughs of **Camden,** Islington, Tower Hamlets, Southwark, City of Westminster and City of London. Access is controlled via locked gratings, typically at main road junctions. Most of the tunnels are shallow and run parallel with main roads, but in places they descend to 30m to avoid shallow London Underground tube tunnels.



The Local Authorities charge the utilities using the tunnels for capital and maintenance costs and also access. Capital and maintenance costs are divided between the utilities the tunnels using pre-defined percentages. For example, Cadent is charged 28% of these costs in Tower Hamlets.

Cadent has approximately 18km of mains within these tunnels, most of which are located in Cadent's London GDN, as shown in the diagram below.



As far as we are aware, only London has a network of tunnels, the vast majority of which are within London GDN rather than Southern GDN. We have not sought to quantify the additional costs for Southern GDN, only for London GDN.

Although the Local Authority charge represents the majority of the cost, additional costs are incurred for:

- Training: Repair teams also need to be specially trained to be able to work in the tunnels, completing the "*High Risk Confined Space Entry and Emergency Rescue and Recovery course*" every three years.
- Lump sum payment: there is a lump sum payment of £1,500 per person for being available for working in the tunnels for the 3 year period, having completed the training course. Employers National Insurance, but not pension costs, are also payable on this.
- Breathing apparatus: we incur costs of around £21,000 p.a. for the hire of breathing apparatus equipment and safety checks on these.

Calculation and Materiality

Costs for tunnel charges for the last five years are shown by Local Authority in the table below, together with the additional costs described above.

2018/19 prices	2014/15	2015/16	2016/17	2017/18	2018/19	Average
LA charge	£	£	£	£	£	£
City of London	33,779	41,101	39,529	35,615	29,944	35,994
Westminster	84,280	33,203	82,564	40,249	66,460	61,351
Camden	39,664	44,173	25,043	27,653	28,132	32,933
Tower Hamlets	23,332	21,934	10,740	19,853	14,535	18,079
	181,055	**140,411**	**157,876**	**123,370**	**139,072**	**148,357**
Employee related cost						
Annualised lump sum payment for 40 people (20 teams) of £1,500 p.a.						20,000
Employers NI @ 13.8%						2,760
Training cost p.a.						5,833
Breathing apparatus hire and safety checks p.a.						21,000
						49,593
London Network LA and employee cost						**197,950**
Less 9% Tottenham adjustment						-17,816
Total London GDN additional cost						**180,135**

The level of the Local Authority cost varies year by year, mainly due to variations in the amount of maintenance work carried out by each Local Authority. The average cost over the last 5 years has been £148,000. Adding in the additional costs of around £50,000 p.a. increases the total cost to around £198,000 p.a, while making the Tottenham adjustment to transfer 9% of the cost to East of England, leaves a cost of £180,000 in London GDN, which represents over 1% of London GDN's normalised maintenance work execution costs.

How Cadent manages the costs

Under legislation such as the London County Councils Act 1893, where London Local Authorities provides a tunnel for utilities, we are obliged to use it. Even if this were not the case, were we able to move our mains out of the tunnels, diversions in Inner London would be extremely expensive and disruptive.

We manage the Local Authority tunnels costs in two ways:

- First, we hold engagement meetings with the London Pipe Subway group comprising the various Local Authorities and utilities, typically every 6 months, for all parties to share information on activities which could impact the tunnels and assets in them, raise issues any party might have, and for the Local Authorities to present budget information for the following year.
- Second, we challenge invoices if it appears they might be unjustified, for example, if they are unexpectedly high, relate to period already invoiced, or are for a period some time ago.

In respect of the additional costs, the calculation assumes that these are minimised in two ways. First, through putting the maximum number of eight people through each training course – these can run with as few as four people. Second, we aim to have twenty six teams able to work in the Local Authority tunnels. At present, we only have twenty, which is reflected in our actual costs, therefore the calculations above include the lower number of twenty teams.

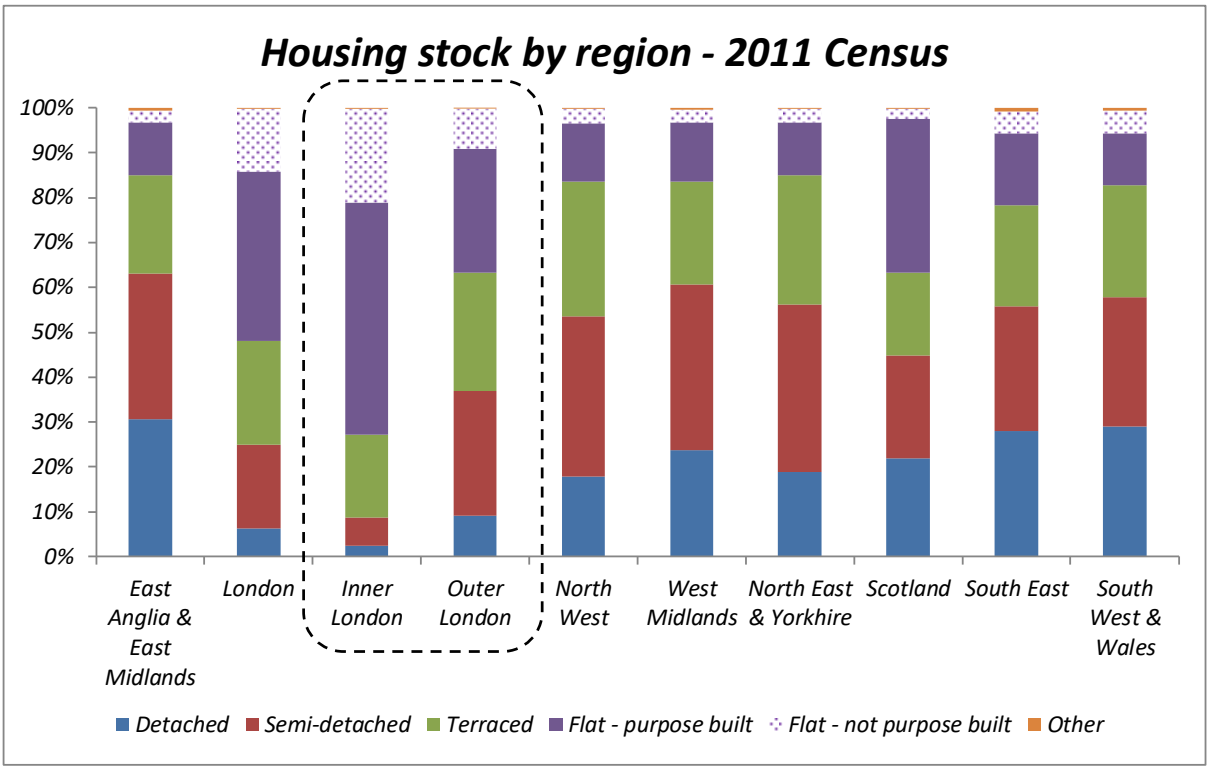
4.17 Locksmiths

Reason for claim

Cadent requires locksmiths for our Emergency activity. They are called, when, responding to a PRE, the FCO detects gas in a property where no one is present, either at the letterbox, or high enough on the external building line to give concern that the gas is regressing inside.

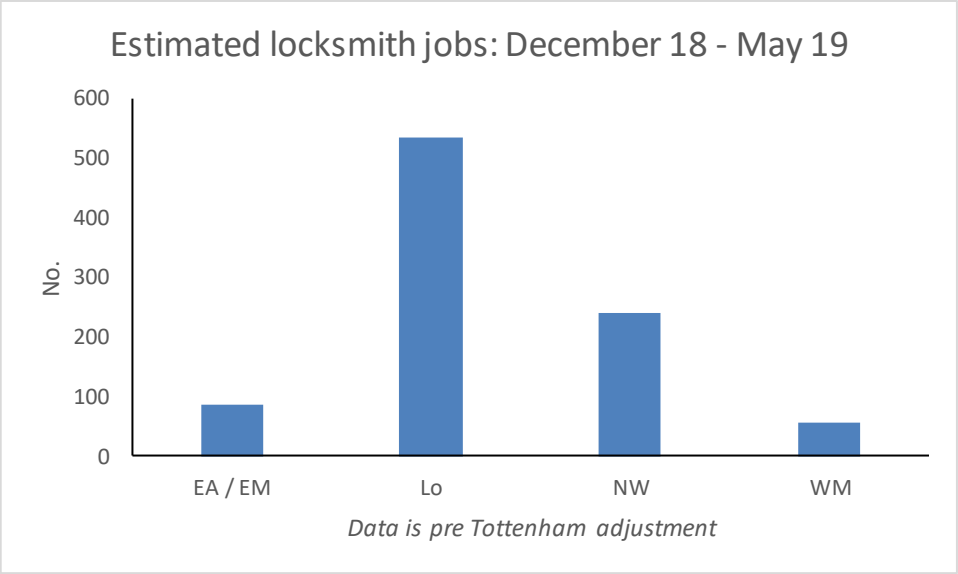
The situation is not unique to London, but the large number of flats, buildings in close proximity and underground ducts makes gas escapes likely to enter more properties than elsewhere.

The chart below shows the composition of housing stock in London compared to elsewhere in Great Britain, as per the 2011 census.



The chart shows that over half the housing stock in London comprises flats, and over 70% in Inner London.

The London environment causes there to be a far greater requirement for locksmith services than elsewhere. We have collected data on estimated locksmith use over the six months from December 2018 to May 2019, by Network, as shown below.



In addition to the volume of work being higher, the unit rate is higher in London, especially for out-of-hours working i.e. outside of 8.00am to 5.00pm, Monday to Friday. While the price for a within hours job is not very different, £100 in London, compared to £95 outside, out-of-hours, our London locksmiths are more expensive, for example, on weekdays between 5pm and midnight, there is a set charge in £190 in London, as compared to £110 per hour to 10.00pm and £120 per hour to 8.00am elsewhere.

Based on a sample of invoices between May and June 2019, over half of the work carried out by Locksmiths in London was out-of-hours, which helps to explain the additional cost in London. We consider the additional cost to be value for money because the London locksmiths operate a rota system whereby a locksmith is always on standby to be called out, so they almost always attend within two hours, which is especially important for flats in a highly urban environment. Outside of London, locksmith typically do not attend out-of-hours within two hours, but the volume of work is far less, the environment typically lower risk, and the impact on the 97% attendance requirement less.

Calculation and Materiality

Using data from Procurement, we can compare the level of spend on locksmiths in London to that elsewhere, after the Tottenham adjustment, as shown in the table below for the years 2016/17, 2017/18 and 2018/19.

Locksmiths	**2016/17**	**2017/18**	**2018/19**
In 2018/19 prices	**£'000**	**£'000**	**£'000**
East	77	44	47
London	243	290	201
North West	45	48	46
West Midlands	5	4	21
	369	**387**	**314**
Additional London GDN	**166**	**242**	**154**
less: new contract saving			-30
Net additional London GDN cost			**124**

The additional level of cost in London GDN for 2018/19, as compared to the next highest cost GDN is £154,000.

However, we note that the contract renegotiation referred to below with effect from October 2018 had the impact of significantly reducing out-of-hours charges, and slightly over half of London jobs occur out-of-hours, based on a review of RS Locksmiths invoices from mid-May to mid-June 2019. If in place 6 months earlier, we estimate that the additional cost for London GDN would have been reduced by around £30,000 for the half year.

Consequently, we estimate the locksmiths Regional Factor as around £124,000 for London GDN, which represents around 1.4% of London GDN's normalised controllable opex for Emergency work execution.

In addition, in our October Plan we noted that the cost for 2016/17 and 2017/18 for West Midlands in the table above appeared surprisingly low, in the context of a similar volume of work to East of England. While we have not found the reason for this apparent historic discrepancy, we note that the costs and workloads for 2018/19 look reasonable for this GDN, with, for example its workload being over 70% of that of East of England (before making the Tottenham adjustment). Furthermore, the data for West Midlands for previous years does not affect the size of the Regional Factor.

How Cadent manages the cost

Our Procurement team carried out an exercise in early 2018 which re-negotiated terms with RS Locksmiths, the main supplier in London, and reduced the charges outside of normal working hours by around 30% from October 2018, although charges in normal working hours were unchanged. We have reflected a whole year's reduction in cost in our Regional Factor claim.

The alternative supplier in London does not operate an out-of-hours rota and consequently cannot attend within two hours, which is a requirement in London given the volume of out-of-hours calls and the highly urban environment, and our need to protect customers from gas escapes.

5. Regional Factors reconciliation: October - December

We have made a number of changes to our proposed Regional Factors for 2018/19 between the October Draft Plan and this December Final Plan, some of which act to make them larger, others which reduce them.

The changes are summarised, by GDN and by cause, in the table below.

Regional Factor Reconciliation	EoE	Lon	NW	WM	Cadent
	£m	£m	£m	£m	£m
October Plan - Total Regional Factors	**-2.9**	**-47.1**	**2.6**	**2.5**	**-45.0**
Due to disaggregated GDSP costs					
- Pay	-0.8	4.8	-0.8	-0.7	**2.5**
- Productivity	0.3	3.5	0.0	0.0	**3.8**
New following disaggregated GDSP costs					
- Repex reinstatement	0.0	-2.9	0.0	0.0	**-2.9**
- Repex plant hire	0.0	-2.1	0.0	0.0	**-2.1**
Removed due to additional evidence					
- Tipping charges	0.0	0.6	0.0	0.0	**0.6**
Reduced due to additional evidence					
- Sparsity	1.0	-0.7	-0.5	-0.1	**-0.2**
Updated data for 2018/19					
- Cathodic Protection	0.1	0.2	-0.3	0.1	**0.1**
- Repair reinstatement	0.0	-0.1	0.0	0.0	**-0.1**
- Opex parking bays and TTROs	0.0	-0.2	0.0	0.0	**-0.2**
- Locksmiths	0.0	0.1	0.0	0.0	**0.1**
Total changes October - December	**0.6**	**3.3**	**-1.5**	**-0.7**	**1.7**
December Plan - Total Regional Factors	**-2.3**	**-43.8**	**1.0**	**1.8**	**-43.3**

The largest changes follow our disaggregation of GDSP costs, which was mentioned as being in progress at the time of the October Draft Plan. Now complete, it has reduced the labour element of repex by around 25%, leading to significantly reduced pay and repex productivity adjustments, the latter being calculated based on the labour element of repex. This especially affects London GDN, reducing its Regional Factors by around £8.3m in 2018/19 from the level in the October Plan.

The disaggregation of GDSP costs has also led to the identification of plant hire and reinstatement costs within repex, for which we have identified new Regional Factors reflecting the additional efficient cost per metre of mains replacement in London. These increase London GDN's Regional Factors by around £5.0m in 2018/19, which is around 60% of the value of its reduced Pay and Productivity Regional Factors.

We have also removed the Regional Factor for additional tipping charges in London GDN, having found evidence that the volumes we believed to be tipped were far less than previously thought.

In respect of sparsity, we have amended the RIIO1 adjustment to remove Repair activity, and recalibrate the value of the Emergency adjustment, in accordance with our evidence.

In addition, we have also made minor numerical adjustments to Cathodic Protection, Repair reinstatement, opex parking bays and TTROs, and locksmiths, in the light of updated data for 2018/19.

Finally, our October Plan also contained a Regional Factor, for additional GSOS re MOBs of £0.3m, which we then removed because the cost had already been deducted from Totex for 2018/19. Because it netted to zero, we have not shown it in the reconciliation above. In our December Plan, Section 8 of this document sets out why we consider an efficient level of GSOS costs should be allowed, what that level is, and quantifies the Regional Factor that results.

6. Potential Regional Factors not included

We have tried to be as thorough as possible in identifying and then investigating potential Regional Factors, a process which began nearly two years ago.

In addition to the twenty Regional Factors set out and where appropriate quantified in sections three to five of this document, we have chosen to exclude a similar number of other potential Regional Factors where we considered that:

- the evidence was not compelling;
- the item was immaterial; and
- the item should be within Management Control.

The table below summarises those potential Regional Factors that we consider are invalid and so did not include within our claim, and the reason for our treatment.

Potential Regional Factor investigated	Reason not adopted
Asbestos mains	Evidence not compelling
Core & vac servicing costs	Immaterial
Double staffing jobs (staff safety)	Evidence not compelling
Incident damage cost recovery	Within Management control
Incident hotel accommodation	Immaterial
Insurance costs	Evidence not compelling
JCB hire	Within Management control
Maintenance workloads	Evidence not compelling
Non-rechargeable diversions	Evidence not compelling
Norm dust disposal	Immaterial
Parking fines	Within Management control
Proportion of MP / IP repair jobs	Immaterial
Repair pipe depth	Evidence not compelling
Repair job times	Evidence not compelling
Safe Control of Operations costs	Evidence not compelling
Service cut-off jobs	Immaterial
Spoil recycling	Evidence not compelling
Thin-walled pipes	Evidence not compelling
Tipping charges	Immaterial
Underground governors	Immaterial
Vehicle servicing costs	Evidence not compelling

After submission of our December Plan, should we find fresh evidence on any of the above to suggest that the item has become material, the evidence compelling or that the item has become outside of management control, we will inform Ofgem of this.

7. Comparison with London factors external report

The vast majority of potential Regional Factors are incurred in the London region, either through higher costs or environment related productivity impacts. Therefore, we have taken part in a project run by NERA and Arcadis, together with Thames Water, UK Power Networks, and SGN, in order to try and identify common London factors across our Networks. The report, "Understanding the Baseline Level of Efficiency in London" was finalised on 31st October, and is submitted to Ofgem separately in our December Plan, as Appendix 09.40.

Section 7 of this appendix compares its findings with our own, as summarised in the table below.

Regional Factor reconciliation NERA to Cadent	**Nature of Streets**	**Permitting/ Traffic Mgt**	**Transport & Logistics**	**Network Specific**	**Labour costs**	**Property costs**	**Total**
	£m	£m	£m	£m	£m	£m	£m
Total per NERA report 17/18 prices	**-15.7**	**-5.4**	**-0.8**	**-8.4**	**-25.3**	**-0.6**	**-56.2**
Indexation to 2018/19 prices	-0.5	-0.2	0.0	-0.3	-0.8	0.0	-1.7
NERA total in 18/19 prices	**-16.1**	**-5.5**	**-0.8**	**-8.6**	**-26.1**	**-0.7**	**-57.9**
Remove: assessed separately by Ofgem							
- Streetworks		1.8					**1.8**
- MOBs				7.2	1.1		**8.3**
- Repex diversions					1.1		**1.1**
- Training & Apprentices					0.5		**0.5**
- GSOS				1.3			**1.3**
	0.0	**1.8**	**0.0**	**8.5**	**2.7**	**0.0**	**13.0**
Adjusted NERA figures	**-16.1**	**-3.8**	**-0.8**	**-0.2**	**-23.4**	**-0.7**	**-44.9**
Comparable Cadent figures	**-14.8**	**-3.6**	**-0.2**	**-0.2**	**-17.5**	**-0.6**	**-36.9**
Include: Cadent items not in NERA							
Relevant only to Cadent							
- Thames Tunnel and other IP				-3.5			**-3.5**
NERA suggest in model changes							
- Emergency job times and Sparsity				-2.3			**-2.3**
Multi GDNs issues to assess separately							
- Cathodic Protection / depth of cover				-0.6			**-0.6**
Item also impacting EoE							
- TM Hire				-0.3			**-0.3**
Item additional to NERA							
- locksmiths				-0.1			**-0.1**
	0.0	**0.0**	**0.0**	**-6.9**	**0.00**	**0.00**	**-6.9**
Cadent total	**-14.8**	**-3.6**	**-0.2**	**-7.1**	**-17.5**	**-0.6**	**-43.8**
Adjusted NERA v Cadent total	**-1.3**	**-0.1**	**-0.6**	**6.9**	**-5.9**	**-0.1**	**-1.2**

The table shows that, once items which are separately assessed by Ofgem are taken into account, NERA / Arcadis found Regional Factors for London GDN of around £45m p.a., which is around £8m more than Cadent found for the same items, but close to Cadent's total of £44m once additional items are taken into account. Using NERA's categorisation, the items shown in red are where the larger differences arise, which are explained below.

- Nature of Streets: NERA larger by £1.3m: NERA applied its London Region productivity adjustment at a high level i.e. to the whole of Repair, Repex, Connections and Reinforcement costs, whereas Cadent calculated the adjustments at a lower level.
- Transport & Logistics: NERA larger by £0.6m: the difference is largely due a tipping charges Regional Factor of £0.5m, for which we found additional evidence and consequently removed it from our assessment in the Autumn of 2019, after NERA's report was due to be finalised.
- Network Specific Factors: Cadent larger by £6.9m: the largest four elements of the difference are:
    - Thames Tunnel and associated IP work £3.5m: this was excluded from NERA's work because it is a specific Cadent project, not common across the other London networks
    - Emergency job times and sparsity £2.3m: NERA excluded these from its total of Regional Factors because they could be taken account of in modelling.
    - Cathodic Protection / reduced depth of cover £0.6m: these are not unique to Cadent but are common across all Cadent GDNs. We consider that the costs associated with this work should be removed from Maintenance and considered separately.
    - Traffic Management hire costs £0.3m: this Regional Factor also applies to East of England, and so is not unique to London, and so was excluded by NERA – we consider both GDNs should be subject to a Regional Factor adjustment.
- Labour costs: NERA larger by £5.9m: there are two main causes of this difference:
    - Nearly half of the difference is because, following our review of GDSP costs in the Autumn, we transferred around 25% of repex costs we had previously treated as labour, to other cost categories, an adjustment which was too late for the NERA report.
    - The NERA report uses the average of three years labour costs, whereas Cadent used 2018/19 data, which is typically lower: we also applied the adjustment after deducting our other Regional Factors as appropriate, and used the average of net and gross connections costs, rather than gross alone.

We consider that the most significant difference between our findings is for the Nature of Streets adjustment, where our figure is below that of NERA. It arises because, as requested by Ofgem, we have taken a prudent view of Regional Factors, and taken a bottom-up approach. In contrast, NERA / Arcadis, inevitably given the comparison across networks operating in different industries, have taken a higher level approach, for example by applying the "nature of streets" productivity effect to the whole of the costs for repair, reinforcement, capex, and repex rather than only the labour element.

We consider that our findings, taken together with the external review by NERA / Arcadis, validate that we have taken a prudent view of the additional costs of operating in London, which is reinforced by the fact that our benchmarking, after applying our view of Regional Factors, still shows London GDN as having our highest performance gap in 2018/19 (see Appendix 09.20, section 4), despite it being run using the same processes and procedures.

8. Guaranteed Standard of Service costs

For the first time, in RIIO-1 Ofgem decided that Guaranteed Standards of Service (GSOS) payments should not be included within totex, amended the RIGs accordingly, and required that our RIIO2 forecasts should be prepared on the same basis, such that GSOS payments are not included in Totex and are fully funded by shareholders.

However, we believe that for RIIO2, an efficient level of GSOS payments should be allowed within costs, for the reasons set out below. Consistent with that belief, we have calculated the efficient level of cost for each of our GDNs for the RIIO-2 period, including a Regional Factor for our London GDN, associated with the additional level of GSOS1 payments associated with its unique population of Multi Occupancy Buildings (MOBs).

To inform the remainder of the section, the table below provides a Cadent-level overview of the efficient level of GSOS costs for the RIIO-2 period.

GSOS summary	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**	**RIIO-2**
RIIO-2 Nominal	**£'000**	**£'000**	**£'000**	**£'000**	**£'000**	**£'000**
GSOS1	1,919	1,881	1,791	1,745	1,710	**9,045**
GSOS2-14	268	266	265	263	261	**1,322**
Total GSOS	**2,186**	**2,147**	**2,056**	**2,008**	**1,971**	**10,368**

It is clear that GSOS1 payments comprise the vast majority of efficient GSOS costs. These are examined in some detail in this section.

The remainder of this section is divided into three parts as follows:

- Why GSOS payments should be allowed
- The efficient level of GSOS cost in RIIO-2
- GSOS Regional Factor

Each is addressed in turn below.

Why GSOS payments should be allowed

For RIIO-GD2 we believe that there are five reasons why GSOS payments should be allowed in Business Plans, and also in the Totex Incentive Mechanism when incurred:

- **First, an efficient level of GSOS payments would be allowed in a competitive market**. Ofgem regulates revenues, using price controls, so that prices charged by monopoly energy networks are set to recover an efficient level of cost and no more. In a fully competitive environment, an efficient level of all costs, including those relating to failings or shortcomings, would be included within prices.

- **Second, the efficient level of GSOS payments is greater than zero**. No business, regulated or unregulated, operates perfectly with no shortcomings. As would be expected, all energy networks incur a level of GSOS payments, consequently, the efficient level of GSOS payments must be above zero. This has historically been accepted by Ofgem with explicit or implicit allowances since Guaranteed Standards were introduced for gas distribution in 2002. The alternative approach would be to fund licensees to have sufficient resources to never fail a standard. This would be economically incoherent as customers would pay excessive sums for such a service.

- **Third, treating GSOS payments differently to other costs encourages GDNs to act inefficiently**. One of the strengths of Ofgem's RIIO approach has been the equalisation of incentives across different categories of expenditure, encouraging GDNs to adopt the lowest cost solutions. In RIIO2, if GSOS payments are made entirely for the account of shareholders, with a maximum incentive of 50% on other costs, GDNs will be incentivised to spend up to £100 in other costs to avoid a GSOS payment of £50, which is not efficient, and undermines the RIIO approach.

- **Fourth, some payments are wholly due to factors outside the networks control**. It can take several weeks to restore supply to customers when we need to, on safety grounds, cut supply to a MOB as a consequence of a public reported escape – an unplanned interruption. Planning authorisation may be required from other organisations/authorities causing delay to supply restoration and as such GSOS1 payments to all affected customers in that building is inevitable. The recent work carried out by Ofgem's Interruptions Working Group into "clock-stopping" has highlighted factors outside GDNs' control.

- **Fifth, because the efficient level of GSOS payments is greater in some networks than others, not allowing them penalises some networks more than others**. Associated with the number of customers in MOBs in London, and the duration of interruptions in these buildings, our London GDN incurs a far higher level of GSOS payments than our other GDNs. We acknowledge that the service we have provided has not been as good as it should have been, which is why we have put forward an Improvement Plan for these customers, which Ofgem has accepted. However, under the Improvement Plan, the efficient level of GSOS payments will still be a significantly higher in London than elsewhere.

For all the above reasons, we believe that an efficient level of GSOS payments should be allowed in RIIO-GD2, and that such costs should be permitted in the Totex Incentive Mechanism.

The efficient level of GSOS cost in RIIO-2

There being no BPDTs for GSOS payments, we need to show how we have calculated the efficient level of cost for each GDN for every year of the RIIO-2 period.

The table above showed the importance of GSOS1 payments, which make up nearly 90% of the efficient level of cost of all GSOS for RIIO-2. Below we show how we calculated the efficient level of GSOS1 costs, before addressing the efficient level of costs for GSOS 2-14.

GSOS1 payments

Payments in respect of GSOS1 have three different causes, being:

- MOBs related;
- Non-MOBs related (excluding Incidents); and
- Incidents – a loss of supply to over 250 customers from a single cause.

The table below summarises the relative scale of each cause of GSOS1 by GDN.

RIIO-2 GSOS 1 summary		**21/22**	**22/23**	**23/24**	**24/25**	**25/26**	**RIIO-2**
Nominal		**£'000**	**£'000**	**£'000**	**£'000**	**£'000**	**£'000**
MOBs	East of England	122	119	117	106	104	**567**
	London	1,100	1,078	1,008	988	969	**5,142**
	North West	54	53	52	51	50	**260**
	West Midlands	62	61	55	53	52	**283**
		1,337	**1,310**	**1,231**	**1,198**	**1,175**	6,252
Non-MOBs	East of England	50	48	46	43	41	**229**
	London	80	77	73	70	67	**367**
	North West	54	51	49	46	44	**244**
	West Midlands	28	26	25	24	23	**126**
		212	**203**	**193**	**184**	**174**	**966**
Incidents	East of England	136	135	134	133	132	**671**
	London	77	76	76	76	75	**380**
	North West	91	90	90	89	89	**449**
	West Midlands	66	66	66	65	65	**328**
		370	**368**	**366**	**364**	**361**	1,828
Total GSOS1	**East of England**	**308**	**302**	**297**	**283**	**278**	1,467
	London	**1,257**	**1,231**	**1,158**	**1,133**	**1,110**	5,889
	North West	**199**	**195**	**191**	**187**	**183**	**953**
	West Midlands	**156**	**153**	**145**	**142**	**140**	**736**
		1,919	**1,881**	**1,791**	**1,745**	**1,710**	9,045

The table shows that we expect a significant majority of GSOS1 cost expected to be incurred in respect of MOBs, a particular issue for London GDN.

In respect of how we have calculated these numbers, for MOBs and Non-MOBs (excluding incidents) for London GDN we were able to use the data for the number of interruptions and the average duration directly from table 5.09 of the BPDTs. For our other GDNs, because the structure of their BPDTs is different, we needed to extract these numbers from data supporting table 5.09.

For MOBs, we then multiplied by Ofgem's proposed uplifted payment of £41 per day or part of day without gas, after the initial 24 hour period, with no cap to the maximum level of payment, as shown for the year 2021/22 below.

2021/22	**Interruptions**	**Average duration**			**Total days paid**	**Cost @£41 per day**
MOBs GSOS1	No. *	Minutes *	Days	Days paid	No.	£'000
EoE	212	21,109	14.7	14	2,968	122
Lo	1,219	32,302	22.4	22	26,818	1,100
NW	220	9,440	6.6	6	1,320	54
WM	126	17,858	12.4	12	1,512	62
	1,777				**32,618**	**1,337**

** Sourced from BPDT Interruptions Table 5.09 (London), supporting data (others)*

We consider the level of GSOS1 payments for MOBs interruptions to be efficient because the amount of time lost is forecast to reduce year-on-year over the RIIO-2 period for all our GDNs, and there is a significant reduction in both their number and average duration compared to RIIO-1, especially for London. The London projections are consistent with the Improvement Plan that Ofgem has accepted, with MOBs interruptions and their duration each reduced by around a third compared to the average between 2015/16 and 2018/19. London's higher cost should be seen in the context where London has many more MOBs than any other GDN, with Cadent also taking a different view to some other GDNs, and not "stopping the clock" in respect of interruptions where, for example, a landlord's permission is needed before work can start.

In respect of Non-MOBs interruptions the calculation of the efficient level of cost for RIIO-2 is more complex, because the average duration of these interruptions is well under a day, so for the average interruption no GSOS1 payment is made – but payments are made for that element of interruptions which lasts longer than a day.

Our approach was to scale the value of payments made between 2015/16 and 2018/19 pro-rata to the reduction in total minutes of interruption in RIIO-2, then to flex the answer to take account of the increase in the daily rate from £30 to £41. An example is shown for the year 2021/22 below, in two steps, the first to calculate the average time lost in interruptions in 2015/16 to 2018/19, the second to work out the time lost to interruptions in 2021/22, and scale up the GSOS1 payments from RIIO-1.

RIIO1 average	Interruptions 2015/16 - 2018/19 average p.a.				
	Number	Duration		Total days	GSOS1 Payments
Non- MOBs GSOS1	No.*	Minutes*	Days	No.	£'000
EoE	11,868	524	0.36	4,317	40
Lo	9,249	687	0.48	4,413	65
NW	10,937	624	0.43	4,739	43
WM	6,610	534	0.37	2,451	23
	38,664			**15,920**	**171**
	A	**B**	**C**	**D**	**E**
			= B / (60 x 24)	= A x C	

** Sourced from BPDT Interruptions Table 5.09 (London), supporting data (others)*

2021/22	Interruptions	Average duration		Total days	RIIO1 Proportion	Paid @ £30	Paid @ £41
Non- MOBs GSOS1	No.*	Minutes*	Days	No.	%	£'000	£'000
EoE	11,189	513	0.36	3,988	92%	37	50
Lo	8,487	673	0.47	3,969	90%	59	80
NW	10,218	611	0.42	4,338	92%	39	54
WM	5,891	523	0.36	2,141	87%	20	28
	35,785			**14,437**	**91%**	**155**	**212**
	F	**G**	**H**	**I**	**J**	**K**	**L**
			= G / (60 x 24)	= F x H	= I / D	= E x J	= K x (41/30)

** Sourced from BPDT Interruptions Table 5.09 (London), supporting data (others)*

We note the both the number of interruptions and their average duration are forecast to be lower in 2021/22 compared to those in RIIO-1, and to continue to reduce over the RIIO-2 period.

In respect of GSOS1 payments associated with Incidents, we have been unable to use forecasts contained in table 5.09 of the BPDTs or its supporting calculations, because these do not represent a central forecast suitable for use in setting a price control allowance, but rather are consistent with Ofgem's intent to protect customers against a significant deterioration in unplanned interruptions performance. Consequently, we needed to use alternative data to prepare a forecast for RIIO-2.

Incidents are volatile, a GDN could have none one year and three the next, and often they are caused by third parties. Consequently, our approach has been to find the average level of Incident related GSOS1 payments per customer in 2015/16 to 2018/19 for all eight GDNs, using source data from table 7.2 of the RRP, project allowances forward on that basis, update the allowance to reflect £41 payments rather than £30, then apply our ongoing efficiency assumption. Our calculations of the efficient cost of GSOS1 for Incidents for all years of RIIO-2 are shown below.

GSOS1 Incidents		Cost 15/16 - 18/19				
Pre efficiency	**Customer No.**	**Total**	**Average p.a.**	**Per customer**	**At £30**	**At £41**
	000	**£'000**	**£'000**	**£'000**	**£'000**	**£'000**
EoE	4,019	1,112	278		100	137
Lon	2,275	0	0		57	78
NW	2,691	0	0		67	92
WM	1,964	0	0		49	67
NGN	2,540	511	128			
Sc	1,832	130	33			
So	4,115	438	110			
WWU	2,537	0	0			
	21,973	**2,192**	**548**	**0.025**	**273**	**373**
	A	**B**	**C**	**D**	**E**	**F**
			= B / 4	**= C / A**	**= A x D**	**= E x (41/30)**

Apply efficiency	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**	**RIIO-2**
Efficiency	*99.1%*	*98.7%*	*98.1%*	*97.4%*	*96.6%*	***Row 1***
Post efficiency	**£'000**	**£'000**	**£'000**	**£'000**	**£'000**	**£'000**
EoE	136	135	134	133	132	**671**
Lon	77	76	76	76	75	**380**
NW	91	90	90	89	89	**449**
WM	66	66	66	65	65	**328**
	370	**368**	**366**	**364**	**361**	**1,828**
	G	**H**	**I**	**J**	**K**	**L**
	= F x Row 1					

GSOS2-14 Payments

As for GSOS1 Incidents, the BPDTs and their supporting data contain no forecasts in respect for GSOS2-14, therefore we needed an approach to calculating the efficient level of cost. Unlike for Incidents, the causes would seem entirely within GDNs' control, however, we would still expect some volatility year-on-year.

Consequently, our approach has been to take the average cost per customer over the period 2015/16 to 2018/19 for all eight GDNs, reflect the RIIO-2 uplift in daily payment rates – which are not uniform but vary by standard between 1.2 and 1.4 times - find the Upper Quartile cost per customer, then to roll-forward by applying our ongoing efficiency assumption. Two points in this calculation are of note:

- We calculated the average cost per customer for all thirteen GSOS together rather than each one individually to avoid cherry-picking the best of each GSOS and then finding a level of cost that was unachievable by even the most efficient GDN.
- We applied the RIIO-2 uplift in daily payment rates **before** striking the Upper Quartile per customer because the uplift in rates varies by standard – consequently it would be expected to change the assessment of the Upper Quartile, all else being equal.

Our calculations of the efficient cost of GSOS2-14 for all years of RIIO-2 are shown below.

GSOS2-14		Cost 15/16 - 18/19			
Pre efficiency	**Customer No.**	**Total**	**Average p.a.**	**Per customer**	**UQ cost**
	000	**£'000**	**£'000**	**£'000**	**£'000**
EoE	4,019	1,425	356	0.089	99
Lon	2,275	1,122	280	0.123	56
NW	2,691	1,186	296	0.110	66
WM	1,964	1,336	334	0.170	48
NGN	2,540	279	70	0.027	63
Sc	1,832	91	23	0.012	45
So	4,115	343	86	0.021	101
WWU	2,537	263	66	0.026	63
	21,973	**6,045**	**1,511**		**542**
Upper Quartile				**0.025**	
	A	**B**	**C**	**D**	**E**
			= B / 4	**= C / A**	**= A x UQ**

Apply efficiency	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**	**RIIO-2**
Efficiency	*99.1%*	*98.7%*	*98.1%*	*97.4%*	*96.6%*	***Row 1***
Post efficiency	**£'000**	**£'000**	**£'000**	**£'000**	**£'000**	**£'000**
EoE	98	98	97	97	96	**486**
Lon	56	55	55	55	54	**275**
NW	66	65	65	65	64	**325**
WM	48	48	48	47	47	**237**
	268	**266**	**265**	**263**	**261**	**1,322**
	F	**G**	**H**	**I**	**J**	**K**
	= E x Row 1					

The tables show that the efficient level of cost for GSOS2-14 for our GDNs is around £260,000 p.a. in RIIO-2.

Bringing the results of our analysis for GSOS1 and GSOS2-14 together, we summarise below by GDN the efficient level of GSOS payments for RIIO-2.

RIIO-2 GSOS		21/22	22/23	23/24	24/25	25/26	RIIO-2
Nominal		£'000	£'000	£'000	£'000	£'000	£'000
GSOS1 total	East of England	308	302	297	283	278	**1,467**
	London	1,257	1,231	1,158	1,133	1,110	**5,889**
	North West	199	195	191	187	183	**953**
	West Midlands	156	153	145	142	140	**736**
		1,919	**1,881**	**1,791**	**1,745**	**1,710**	**9,045**
GSOS2-14	East of England	98	98	97	97	96	**486**
	London	56	55	55	55	54	**275**
	North West	66	65	65	65	64	**325**
	West Midlands	48	48	48	47	47	**237**
		268	**266**	**265**	**263**	**261**	**1,322**
GSOS Total	**East of England**	**406**	**400**	**394**	**380**	**373**	**1,953**
	London	**1,312**	**1,287**	**1,213**	**1,188**	**1,164**	**6,164**
	North West	**264**	**260**	**256**	**251**	**247**	**1,278**
	West Midlands	**204**	**201**	**193**	**189**	**186**	**973**
		2,186	**2,147**	**2,056**	**2,008**	**1,971**	**10,368**

It is clear that most of our projected GSOS costs are in London GDN, largely arising from GSOS1.

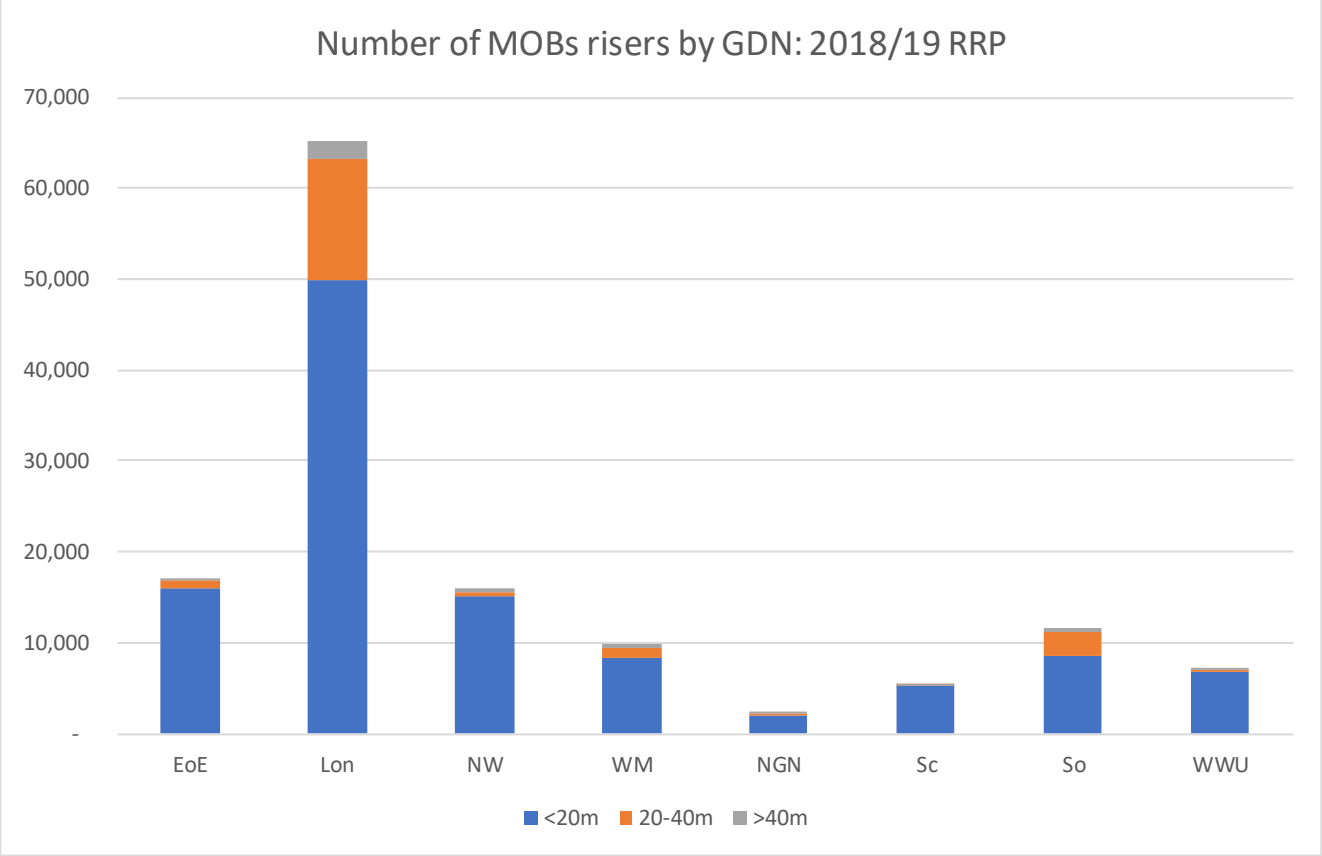
GSOS Regional Factor

Reason for claim

We calculated the efficient level of costs for GSOS above for each of our GDNs for the RIIO-2 period.

The only item where the efficient cost for any of our GDNs is materially different to the others is for GSOS1 interruptions payments in respect of MOBs, where the costs for London in RIIO-2 make up around 50% of our total projected GSOS costs for Cadent as a whole – far more than for any of our other GDNs.

These costs disproportionately arise in London because it has the vast majority of MOBs risers, both across Cadent's GDNs and across all eight GDNs, as shown in the chart below, using RRP data for 2018/19.



Furthermore, arising from the Interruptions Working Group, we and Ofgem are aware that other GDNs are "stopping the clock" for example, when a landlord's permission is required before we can start work – which will lead to Cadent, and in particular London's reported interruptions and costs being far higher than theirs.

We consider that the level of MOBs costs for London is efficient because it is consistent with our Improvement Plan to 2020/21 which has been agreed by Ofgem, with continuing improvements thereafter as we apply further efficiencies to the number of interruptions and their duration.

Calculation and Materiality

If Ofgem, as we have argued, decides to include GSOS payments within efficiency modelling, it will need a view of the efficient level of the historical Regional Factor as well as for that for the RIIO-2 period.

Following Ofgem's investigation is has become clear that the process around MOBs interruptions in London GDN has not been managed well in recent years by Cadent and that consequently, the historic additional cost incurred by London GDN could not be considered efficient.

Therefore, to assess the historic efficient level of the Regional Factor, we have assumed that the number of MOBs interruptions and their average duration is as per our forecasts for 2021/22 and is therefore at the efficient level, and then applied the RIIO-1 payment level of £30 per day. Using these assumptions, our calculation for the historic efficient Regional Factor for London MOBs interruptions is shown below.

London MOBs Regional Factor - 2015/16 to 2018/19 p.a.	**Efficient MOBs Interruptions**			
	Number p.a.	Average duration - days		Cost @ £30 per day
	No.	No.	With payment -No.	£'000 p.a.
East of England	212	14.7	14.0	89
London	1,219	22.4	22.0	805
North West	220	6.6	6.0	40
West Midlands	126	12.4	12.0	45
	1,777			**979**
Additional London cost p.a.				**716**

The historic additional cost for London GDN is shown as being £716,000 p.a., in nominal prices.

In respect of the London MOBs Regional Factor for the RIIO-2 period, using our forecast projections above, including the £41 payment per day, we can compare the efficient level of cost in London GDN with our other GDNs, as shown below.

London MOBs Regional Factor - 2021/22 to 2025/26 p.a.	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**
	£'000	£'000	£'000	£'000	£'000
East of England	122	119	117	106	104
London	1,100	1,078	1,008	988	969
North West	54	53	52	51	50
West Midlands	62	61	55	53	52
	1,337	**1,310**	**1,231**	**1,198**	**1,175**
Additional London cost	**978**	**959**	**892**	**882**	**865**

The additional London GDN cost is shown as being £978,000 in the first year of RIIO-2, falling to £865,000 by the final year, as our volume and average duration projections decrease.

How Cadent manages the costs

In recent years, Cadent has not managed the process around MOBs interruptions well.

However, Ofgem has accepted that disconnection times for blocks of flats would be expected to be significantly longer than for other types of buildings. Consequently, London GDN having many more MOBs than other GDNs, the efficient level of additional costs would seem a recurring feature.

The improvements set out in Cadent's Improvement Plan, which Ofgem has accepted and will monitor, includes a number of steps that have already been taken. Cadent has:

- Commissioned a cross-industry campaign to bring forward riser lining technologies to address inaccessible risers.
- Adopted a small-scale bypass solution so that inaccessible leaks can be isolated and bypassed.
- Created a MOBs SWAT team in London GDN, to deal with MOBs issues 24/7 as quickly as possible.
- With our GDSP partner, created a specialist replacement riser construction team, separate to planned work. Since 2018/19 this team has been working 7 days a week.