London Streets

Transport for London Lane Rental Scheme First Annual Monitoring Report 2012/13

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Contents

0. Document Control

0.1. Author(s)

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0.2. Document Summary

This document provides information on the impacts of the Transport for London Lane Rental Scheme since it was implemented in June 2012.

0.3. Document History

Version	Date	Changes since previous issue
0.1	07/11/13	First draft
0.2	29/11/13	Second draft – additional data
0.3	05/12/13	Third draft – minor changes
0.4	03/02/14	Fourth draft – minor changes
0.5	11/02/14	Fifth draft – additional data

0.4. Reference Documents

Transport for London Lane Rental Scheme fv Submission
TLRS Cost Benefit Analysis v2.1, January 2012

0.5. Distribution

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0.6. Document Quality Assurance

Step	Step Description	Undertaken by	Date	Remarks
1	First draft 0.1	LH & JC	07/11/13	
2	Second draft 0.2	LH, JC & GOT	29/11/13	
3	Third draft 0.3	LH	05/12/13	
4	Fourth draft 0.4	LH	03/02/14	
5	Fifth draft 0.5	LH	11/02/14	

1. Executive summary

The Transport for London Lane Rental Scheme (TLRS) was introduced on 11 June 2012. The TLRS applies to 57% of the Transport for London Road Network (TLRN) and is designed to minimise disruption due to road works and street works in specified traffic-sensitive locations by applying a daily charge for each day that the street is occupied by the works. The daily charge is not applied if the works take place outside traffic-sensitive times. The scheme therefore provides a mechanism for providing all activity promoters with an incentive to change behaviour and minimise their occupation of the street at traffic-sensitive times at the most traffic-sensitive locations.

As well as promoting behaviour change to minimise the duration of street works in TLRS segments, other key objectives of the scheme are to minimise the number of works taking place during traffic-sensitive times and the disruption caused to traffic in these locations, by reducing journey times and improving journey time reliability (JTR).

The introduction of the TLRS coincided with the Clearway 2012 works embargo which was implemented to restrict works taking place on the Olympic Route Network (ORN) and Paralympic Route Network (PRN). This had a huge impact on the number of works taking place inside TLRS areas during this period. As such all analysis described in this paper covers the year from 1 October 2012 to 30 September 2013. This has been compared with 1 October 2010 to 30 September 2011 in order to ensure the Olympic period is excluded from any analysis and to provide a direct comparison of the impact of the scheme.

During the period 1 October 2012 to 30 September 2013 99% of Transport for London (TfL) works and 89% of utility works avoided incurring a TLRS charge. It should be noted that some works were exempted from charges due to transitional arrangements. In other instances fees were waived when promoters agreed for the works to take place outside of ‘peak’ times during the year in order to reduce the impact on the network. Promoters have also increased the number of works undertaken outside of traffic-sensitive times, with a 20% increase in overnight works taking place.

Whilst there are encouraging signs of behaviour change on the part of utility companies, analysis shows that 69% of work days that were originally scheduled during traffic-sensitive periods were not approved. TLRS charges were avoided after early engagement between TfL and the utilities. This shows that TfL is taking an active role in ensuring that works promoters’ exposure to lane rental is minimised, whilst also minimising serious and severe disruption by ensuring the number of days that works take place during traffic-sensitive times is kept to a minimum.

The behaviour changes as a result of the scheme had a positive impact on the road network: serious and severe disruption associated with planned works fell by 46% in TLRS areas during the period monitored, and journey times were 4.4% better inside the TLRS in the AM peak and 2.1% in the PM peak than they were on the remainder of the TLRN. Customer satisfaction has also improved in all aspects since the implementation of the scheme.

As well as TLRS charges, the scheme has the potential to impact works promoters in other ways. Promoters were given the opportunity to provide TfL with information relating to the impact the scheme had had on them. Those that responded were positive about the impact of the TLRS stating that the impact has been minimal in terms of costs associated with moving works to outside of traffic-sensitive times.

Several case studies highlight the impact that the TLRS has had in particular areas. The Greenford Flyover and Seven Sisters case studies demonstrate that TfL can be flexible with regards to waiving fees in order to reduce the negative impact of certain roadworks as much as possible. By waiving the charges these works were moved to take place at less busy times in the year, and analysis shows that considerably less disruption was caused as a result.

The Bishopsgate case study exhibits how the TLRS could have been beneficial in improving both journey times and JTR in peak times in a relatively busy area. The number of carriageway works and the average duration of works have reduced here following the implementation of the scheme. In addition, when comparing two similar works in Bishopsgate, one before and one after the implementation of the TLRS, it was seen that the works after the implementation had less of a negative impact on journey times and JTR.

2. Introduction

The TLRS was introduced on 11 June 2012. The TLRS applies to 57% of the TLRN and is designed to minimise disruption due to road works and street works in specified traffic-sensitive locations by applying a daily charge for each day that the street is occupied by the works. The daily charge is not applied if the works take place outside traffic-sensitive times.

The TLRS therefore provides a mechanism for providing all activity promoters with an incentive to change behaviour and minimise their occupation of the street at traffic-sensitive times at the most traffic-sensitive locations. These locations were chosen primarily based on an algorithm which was designed to determine those areas on the TLRN which are the most susceptible to disruption from roadworks. The same permitting regime is applied to all works on TLRS and non-TLRS segments.

The TLRS charge bands are as follows:

- *Charge Band 1*: £800 a day; charging times typically are between 06:30-10:00 and 15:30-20:00 Monday to Friday and 12:00-18:00 Saturdays and Sundays
- *Charge Band 2 (segments)*: £2500 a day; charging times typically are 06:30-22:00 Monday to Friday and 12:00-18:00 Saturdays and Sundays
- *Charge Band 3 (pinch points)*: £2500 a day; charging times typically are 07:00-20:00 Monday to Friday and 12:00-18:00 Saturdays and Sundays

The introduction of the TLRS coincided with the Clearway 2012 works embargo which was implemented to restrict works taking place on the ORN and the PRN. This had a huge impact on the number of works taking place inside TLRS areas during this period. As such, all analysis described in this paper covers the year from 1 October 2012 to 30 September 2013. This has been compared with 1 October 2010 to 30 September 2011 in order to ensure the Olympic period is excluded from any analysis and to provide a direct comparison of the impact of the scheme. The TLRS covers 57% of the TLRN; the remaining 43% of the TLRN is categorised 'non-TLRS' in the analysis outlined below.

There are three major caveats to this analysis. Firstly, the analysis does not cover the first full year of operation and secondly, there is an assumption that all things apart from the implementation of the TLRS are equal across the TLRN in terms of network outcomes. Finally TfL also operates Congestion Management Areas (CMAs) where resources are concentrated as part of the 'smoothing traffic' agenda. As the CMAs are located on the same traffic-sensitive areas of the network as the TLRS, the relative contribution of the scheme as measured by journey times and JTR cannot be separated from CMA measures.

As part of the preparation for the launch of TLRS, TfL and the Department for Transport (DfT) jointly funded a research project into innovative methods of reducing the disruption from road works. The outputs of this project have included a faster curing concrete specification, improved plating products covering larger areas, promoting greater use of the "Core and Vac" technology which utilises keyhole surgery techniques to reduce works durations and investigation of bridging over large excavations. These were all shared with works promoters to assist in minimising the disruption on the network and reducing or avoiding TLRS charges.

3. Objectives of the TLRS

The TLRS seeks to contribute to JTR, by encouraging the undertaking of works at the least traffic-sensitive times, and an early completion of works. It also applies the following guiding principles:

- safety must be ensured;
- inconvenience to people using a street, including in particular people with a disability, must be minimised.

Other objectives of the TLRS are to:

- treat all activity promoters on an equal basis
- promote behaviour change to minimise the duration of occupation of the street at the busiest locations at traffic-sensitive times on the network
- minimise the number of works taking place during traffic-sensitive times, and
- contribute to JTR as required under the Mayor's Transport Strategy.

TfL will measure these objectives so as to evaluate whether they are being met[1]. This report sets out an overview of the impact that the TLRS has had since its implementation. The report scrutinises the effect of the scheme as a whole, and also looks at detailed case studies which focus on particular areas of the network.

4. Impact on the road network

An objective of the TLRS is to contribute to JTR as part of the Mayor's traffic smoothing initiative by improving travel conditions on the road network. Another benefit that we could expect is an improvement in journey times in TLRS segments.

JTR is measured as the percentage of nominal 30 minute journeys completed within 35 minutes. For example if a corridor can be managed such that nine out of ten journeys can be completed within the expected journey time then the corridor would be considered 90% reliable. TfL's approach to measuring JTR on the TLRN is based on using Automatic Number Plate Recognition (ANPR) camera data. The target for JTR on the TLRN was 89.5% between October 2012 and September 2013.

Journey time data for the TLRN is taken from London Congestion Analysis Project (LCAP) ANPR cameras. As the LCAP network primarily covers the TLRN, journey time data for the Borough Principal Road Network (BPRN) is derived from

[1] TfL Lane Rental Scheme fv Submission

TrafficMaster GPS data. This is delivered in arrears on a quarterly basis; as such analysis of journey times on the BPRN covers the periods 1 October 2010 to 31 March 2011 and 1 October 2012 to 31 March 2013.

4.1. Are the changes a result of the TLRS?

As shown earlier there are other influences on the TLRN which could impact on the TLRS segments. In order to show that the changes demonstrated within this report are a result of the TLRS, the periodic AM peak JTR for TLRS and non-TLRS segments has been examined.

Figure 1: Periodic AM peak JTR on TLRS and non-TLRS segments

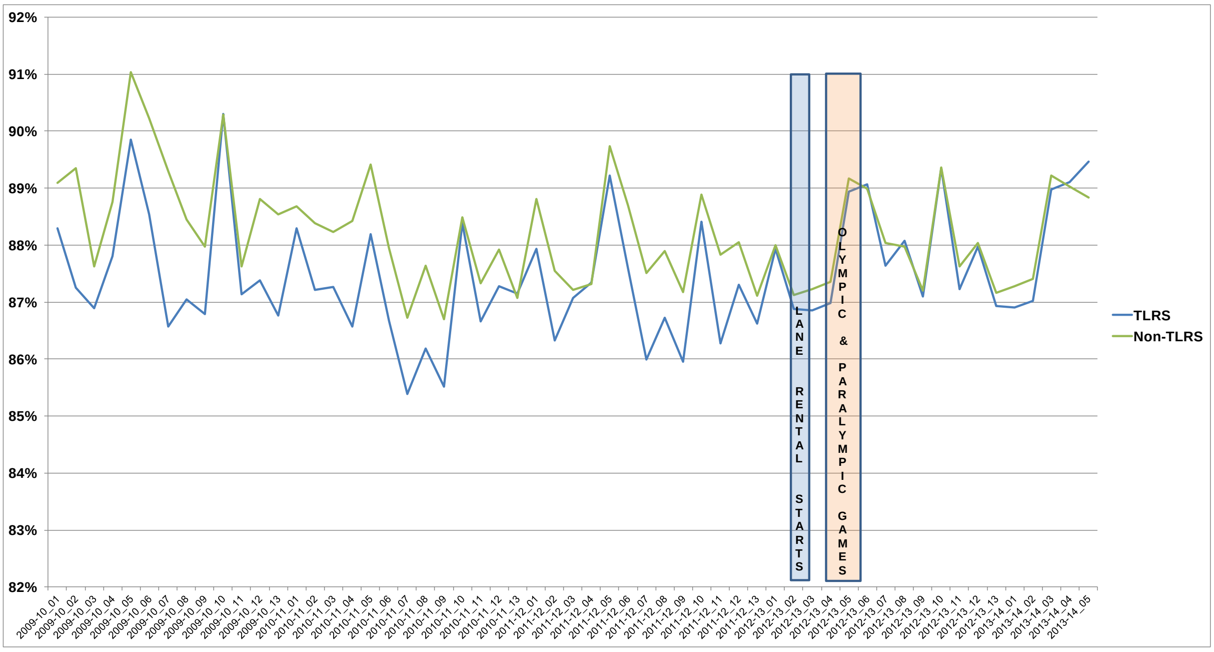


Figure 1 shows that prior to the implementation of the TLRS JTR was lower on TLRS segments illustrating that the scheme was applied to the most appropriate parts of the TLRN. The chart also shows that at the point the scheme was implemented JTR improved in the TLRS, increasing to same levels as non-TLRS segments. JTR has remained at a similar level in both sets of segments for the remainder of the monitoring period. This demonstrates that the TLRS has had a positive impact on the most sensitive parts of the road network.

4.2. TLRN journey time reliability

A comparison of JTR for the TLRS and non-TLRS segments of the TLRN has been performed. The results are summarised in Table 1.

Table 1: Change in JTR on the TLRN

Change in Journey Time Reliability												
	Oct 10 - Sept 11				Oct 12 - Sept 13				% Point Difference 11/12 to 12/13			
	AM Peak	Inter Peak	PM Peak	Over night	AM Peak	Inter Peak	PM Peak	Over night	AM Peak	Inter Peak	PM Peak	Over night
TLRS Segments	87.08%	87.61%	85.46%	93.02%	88.00%	88.16%	85.57%	93.39%	0.92%	0.55%	0.11%	0.37%
Non-TLRS Segments	87.78%	88.18%	86.85%	92.07%	88.15%	88.36%	86.85%	91.48%	0.37%	0.18%	0.00%	-0.59%
TLRS Impact									0.55%	0.37%	0.11%	0.96%

Table 1 shows that JTR improved in all time periods on the TLRS. This was also true for non-TLRS segments, other than overnight when JTR worsened slightly. Although the improvements were small in both areas, the key result is that the increase in TLRS segments was greater, showing that vehicle journeys were more reliable inside the scheme. This is especially true for the AM peak, where the improvement in JTR was 0.55% higher on TLRS segments.

4.3. TLRN journey times

A comparison of TLRS and non-TLRS journey times has also been performed. Data has been analysed for each time period throughout the day, and has been separated into TLRS and non-TLRS segments.

Table 2: Changes in journey times on the TLRN

Change in Average Journey Times (mins)												
	Oct 10 - Sept 11				Oct 12 - Sept 13				Change 10/11 to 12/13			
	AM Peak	Inter Peak	PM Peak	Over night	AM Peak	Inter Peak	PM Peak	Over night	AM Peak	Inter Peak	PM Peak	Over night
TLRS Segments	2.84	2.68	3.06	1.48	2.84	2.69	3.08	1.47	-0.10%	0.22%	0.71%	-0.61%
Non-TLRS Segments	2.65	2.76	2.83	1.47	2.77	2.77	2.92	1.53	4.38%	0.51%	3.13%	4.22%
TLRS Impact									-4.48%	-0.29%	-2.41%	-4.83%

Table 2 shows that journey times decreased marginally on TLRS segments, whilst increasing on non-TLRS segments, suggesting that the scheme has had a positive impact during chargeable hours. Assuming that all other things are equal in terms of network outcomes, it can be surmised that any difference in outcomes between the two groups of segments can be attributed to the implementation of the TLRS, or the TLRS impact. The TLRS ‘impact’ was 4.5% in the AM peak and 2.4% in the PM peak, showing the effect that the scheme had.

4.4. BPRN journey times

Journey times have also been analysed for the BPRN. This data is taken from TrafficMaster GPS data.

Table 3: Changes in journey times on the BPRN

Change in Average Journey Times (mins)												
	Oct 10 - Sept 11				Oct 12 - Sept 13				Change 10/11 to 12/13			
	AM Peak	Inter Peak	PM Peak	Over night	AM Peak	Inter Peak	PM Peak	Over night	AM Peak	Inter Peak	PM Peak	Over night
BPRN	2.74	2.64	3.03	1.70	2.65	2.53	2.91	1.66	-3.29%	-4.05%	-4.11%	-2.26%

Table 3 shows that journey times decreased during the AM, inter and PM peaks on the BPRN following the implementation of the TLRS. This may be as a result of traffic diverting from the BPRN to travel on the TLRN following an improvement in congestion, known as the induction phenomenon.

4.5. London-wide journey times

The TLRS Cost Benefit Analysis (CoBA)[2] showed that the short term journey time benefit of the TLRS would be wider than those segments of the TLRN on which the scheme operates. The change in average journey times during the day on both the entire TLRN and BPRN is shown in Table 4.

Table 4: Change in journey times on the London road network

	AM Peak	Inter Peak	PM Peak
London road network	-0.6%	-1.8%	-1.1%

The CoBA stated that there was an expected reduction in journey times of 0.61% across the whole road network in London before induction took place, and 0.18% after induction is taken into account. Table 4 shows that the expected decrease in journey times before induction was realised in the AM peak, and was exceeded in the inter and PM peaks. Earlier it was shown that there is some evidence that the induction phenomenon has taken place; if so then the results in Table 4 are far greater than we could expect, showing that the TLRS has had a greater impact than expected on journey times during these time periods.

4.6. Vehicle flows

Table 5 shows that average vehicle flows remained the same in each monitored period, both inside and outside of the TLRS. This indicates that any variations detected in journey times and JTR are not a result of changes to flows.

[2] TLRS Cost Benefit Analysis v2.1, January 2012

Table 5: Average vehicle flows on the TLRN

Average Vehicle Flows			
	Pre-TLRS	**Post-TLRS**	**% Change 10/11 to 12/13**
TLRS Segments	40,165	40,442	1%
Non-TLRS Segments	25,346	25,202	-1%
TLRN	30,709	30,749	0%

4.7. Serious and severe disruption

A reduction in the number of works taking place in traffic-sensitive times should lead to a reduction in the amount of disruption taking place on the road network. The number of hours of serious and severe disruption associated with planned road works has been obtained using incident data and is summarised in Table 6. The results have been separated into works undertaken by the highway authority (TfL) and those by utility companies for both TLRS and non-TLRS segments. Other causes of disruption such as accidents and congestion have been excluded from this analysis as the TLRS targets road works only. Data from unplanned works has also been excluded as the number of unplanned works was very small and considered to be unreliable.

The disruption data analysed below is taken from both the London Traffic Information System (LTIS) and the Traffic Information Management System (TIMS)[3]. Disruption data is only available periodically[4], therefore the period of analysis post-TLRS implementation runs from Period 8 2012 to Period 7 2013. The equivalent periods were also analysed in the 2010/11 baseline[5].

Table 6: Serious and severe disruption

Total Serious & Severe Disruption Associated with Planned Works (Hours)			
	P8 10/11 to P7 11/12	**P8 12/13 to P7 13/14**	**% Change**
TLRS	**426.8**	**229.6**	**-46%**
Highway authority	269.2	138.6	-49%
Utilities	157.6	91.0	-42%
Non-TLRS	**37.3**	**30.6**	**-18%**
Highway authority	13.3	16.7	26%
Utilities	24.0	13.9	-42%
TLRN-wide	**464.1**	**260.1**	**-44%**

The results show that serious and severe disruption associated with planned road works fell by 46% inside TLRS segments in the periods monitored. Disruption

[3] LTIS was replaced by TIMS in April 2013, therefore all data preceding this data is from LTIS
[4] TfL accounting period runs from 1 April to 31 March. Each year is divided into 13 four week periods
[5] Periods of analysis are: baseline – 17/10/10 to 15/10/11, post-TLRS – 14/10/12 to 12/10/13

associated with works fell for both those carried out by utility companies (42%) and by the highway authority TfL (49%).This suggests that these works have been moved to take place outside of traffic-sensitive times thereby causing less disruption.

Table 6 also shows serious and severe disruption associated with planned works in non-TLRS segments. Whilst disruption associated with utility works fell by 42%, it increased by 26% for highway authority works.

As shown above, the amount of disruption is directly associated with the number of works taking place. The works used for the analysis above are only those which resulted in serious and severe disruption, and they are therefore a subset of the works described later, in Table 9. Table 7 shows the changes to the numbers of works associated with serious and severe disruption only.

Table 7: Number of works causing serious and severe disruption

Total Number of Planned Works Resulting in Serious or Severe Disruption			
	P8 10/11 to P7 11/12	**P8 12/13 to P7 13/14**	**% Change**
TLRS	**78**	**47**	**-40%**
Highway authority	50	29	-42%
Utilities	28	18	-36%
Non-TLRS	**12**	**9**	**-25%**
Highway authority	9	7	-22%
Utilities	3	2	-33%
TLRN-wide	**90**	**56**	**-38%**

The number of works causing serious and severe disruption fell by 40% across the TLRS. This result is largely in line with the changes to serious and severe disruption shown in Table 6.

4.8. Customer satisfaction

TfL began measuring customer satisfaction with its road network in 2010 with an online survey conducted among people who use the TLRN. The most recent survey was undertaken in 2013 during Quarter 3 (autumn). Since this monitoring began, overall satisfaction has risen (from a score of 72 to 75) as well as improved satisfaction in the way customers think TfL manages congestion and traffic light timings, and with how easily they were able to estimate how long a journey would take.

The results shown below were taken from the 2013 Quarter 3 survey. Table 8 shows the percentage of customers who were surveyed who felt that they experienced disruption to their journeys as a result of roadworks.

Table 8: Percentage of customers disrupted by roadworks

	% Surveyed London Residents Experiencing Disruption Due to Roadworks				
	2010	2011	2012	2013	% points change 10-13
Customers disrupted due to roadworks	69%	57%	46%	51%	18

The figures show that the percentage of customers who felt that their journeys were disrupted as a result of roadworks fell by 18 percentage points between 2010 and 2013. Despite this fall it can also be seen that this percentage increased between 2012 and 2013. This is likely to be due to the timing of the 2012 survey, which coincided with the Olympic and Paralympic periods when special measures were in place on the road network.

Satisfaction scores were also measured for the time taken to deal with disruption. The survey shows that customer satisfaction has increased for both the time taken to complete roadworks (up 3 percentage points to 53%) and the frequency and number of roadworks (up 4 percentage points to 54%). These results have been very similar for each year of the survey.

In 2011 the user satisfaction survey started recording the most frustrating aspect of roadworks for TLRN users. The scores for all categories improved between 2011 and 2013 and are shown in Figure 2.

Figure 2: Roadworks related frustrations for TLRN users

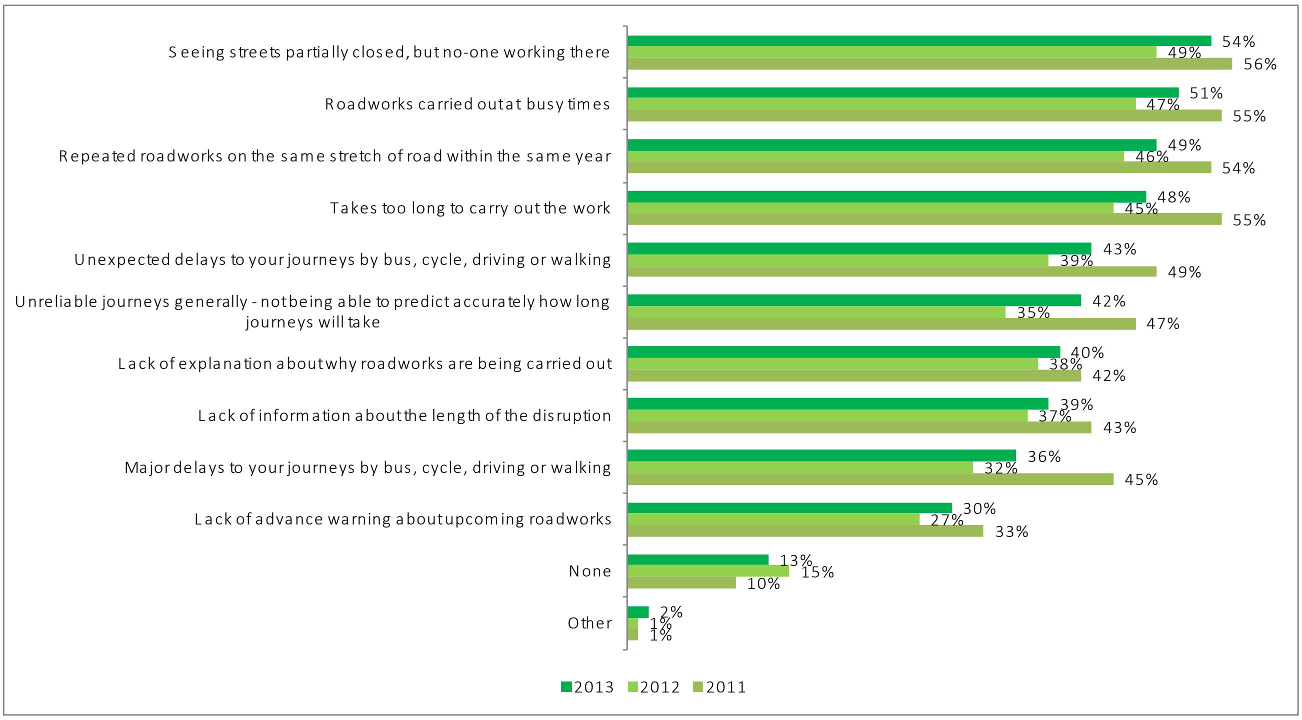


Figure 2 shows that customer satisfaction has improved in all areas since the survey began. Once again, there was a small deterioration in results between 2012 and

2013, likely to be a result of the survey taking place during the Olympic and Paralympic periods.

5. Has the TLRS changed behaviour?

One of the objectives of the TLRS is to promote behaviour change among works promoters in order to minimise disruption on the road network during traffic-sensitive times.

5.1. Number of works taking place

Using data obtained from the Local Streetworks Register (LSWR) a comparison of the number of works taking place inside and outside of TLRS segments has been performed and a summary of the data is provided below in Table 9. The results have been separated into works undertaken by the highway authority (TfL) and those by utility companies.

Table 9: Number of works on the TLRN

Number of completed works inside or outside of TLRS segments			
	Oct 10 to Sept 11	Oct 12 to Sept 13	% change
Transport for London Total	26,758	22,743	**-15%**
Transport for London – TLRS segments	17,763	16,192	-9%
Transport for London - Non-TLRS segments	8,995	6,551	-27%
Utility Total	10,848	10,264	**-5%**
Utility – TLRS segments	7,782	6,797	-13%
Utility - Non-TLRS segments	3,066	3,467	13%
Total TLRS segments	**25,545**	**22,989**	**-10%**
Total Non-TLRS segments	**12,061**	**10,018**	**-17%**
Grand Total	**37,606**	**33,007**	**-12%**

NB: Table 9 refers to activity inside/outside the TLRS area, regardless of time of day; it does not refer to activity inside/outside of traffic-sensitive times

It can be seen that the total number of works undertaken on the whole of the TLRN fell by 12% year on year for the period studied. The data shows that this was largely due to a reduction in works carried out by TfL, although works undertaken by utility companies also fell.

5.2. Changes to planned carriageway works

Information is also available on the total number of days that were approved for planned carriageway works undertaken by utilities in the period studied. This data comes from a subset of that used in Table 9 and does not represent all works which took place in TLRS areas. The number of 'Lane Rental' days applied for and approved is available and has been examined below. Lane Rental days are those where works took place during chargeable hours. As they are an accumulation of works by all utilities one day could be counted several times.

Table 10: Duration of planned works on TLRS segments

Duration of planned carriageway utility works on TLRS segments (days)	
	Oct 12 – Sept 13
Total requested Lane Rental days	3,815
Total agreed Lane Rental days	1,167
Proportion of approved Lane Rental days	31%
Total Lane Rental days saved	2,648
Proportion of Lane Rental days saved	69%

Table 10 shows that the number of 'lane rental days saved' in 2012/13 equated to 69% of all requested lane rental days. Approved lane rental days made up just 31% of all requested lane rental days. This shows that TfL is taking an active role in ensuring that works promoters' exposure to lane rental is minimised, whilst also minimising serious and severe disruption by ensuring the number of days that works take place during traffic-sensitive times is kept to a minimum. This mirrors the actions that TfL takes on proposed works across the whole of the TLRN on both TLRS and non-TLRS segments.

There have also been times when TfL has been flexible with regards to TLRS charges. One such example relates to Thames Water which was undertaking works on Brompton Road. TfL agreed to waive TLRS charges if they agreed to reschedule the works to take place during the school summer holidays thereby reducing any disruption caused by the works. Thames Water also moved works that took place on Seven Sisters Road to the school Christmas holidays. These works were scheduled to take eight days, however TfL agreed to waive TLRS charges if the works were reduced to four days with peak hour works. Once again, disruption to the road network was minimised. Another example involved TfL works on Greenford Flyover. TLRS charges were waived to enable the works to take place over the Christmas period. Whilst the road network was still disrupted, this was at a much lower level than it would have been at any other time of the year due to reduced traffic flows during this period. Further information on all these examples is available in the *Case Studies* section at the end of this report

TfL has also taken a flexible approach to the areas of the network where TLRS charges apply in order to reflect how dynamic the road network is in London. For example, whilst TLRS charges apply to St Thomas Street in Southwark, this road is now closed as a result of The Shard being built. Therefore it is no longer justifiable to charge promoters to implement works here and consequently charges are waived. The conversion of Tottenham Hale Gyratory to two-way operation has opened up capacity at certain sections of the gyratory and therefore these segments are no longer considered justifiable for inclusion in the TLRS. Therefore charges for undertaking works here are now waived. As part of the ongoing review of the scheme, TfL will be undertaking periodic refreshes of the TLRS.

5.3. Changes to works in traffic sensitive times

Although the results in Table 10 show that the number of lane rental days fell, that does not mean that the works did not take place at all as they may have been moved to non-chargeable hours. Analysis has been undertaken on any changes to the time of day that the works shown in Table 10 took place.

TfL has been proactive in approaching borough Environmental Health teams to allow extended working at night time periods and has already reached agreement with a number of boroughs. The proportion of works taking place during the day or overnight can be seen in Table 11. These figures are based on a sample of the subset for each monitoring period shown.

Table 11: Proportion of day time or night time planned utility works

Proportion of planned utility works taking place during the day or at night			
	Oct 10 – Sept 11	**Oct 12 - Sept 13**	**% points difference**
TLRS segments - Day time	88%	68%	-20%
TLRS segments - Night time	12%	32%	20%
Non-TLRS segments - Day time	88%	74%	-14%
Non-TLRS segments - Night time	12%	26%	14%

Table 11 shows that the proportion of works taking place at night increased by 20% in TLRS areas following the implementation of the TLRS. Now, nearly one third of all works take place at night in these areas, reducing the impact that works have on the TLRN during the day. Night time works also increased in non-TLRS areas, suggesting that there has been a shift to night time working by utility companies across the whole TLRN. As the increase was larger in TLRS areas this suggests that the TLRS has had an impact on the times of day that works took place. Despite the increase in the number of night time works, there have been no reported increases in the proportion of noise complaints from the borough Environmental Health teams.

6. Other benefits of the scheme

As shown above the TLRS has had a positive impact since its implementation. As well as the benefits to JTR and journey times on the road network and the reduction in the number of works taking place, the scheme has influenced wider ways of working.

6.1. Collaborative working amongst promoters

As shown earlier, the TLRS encourages works promoters to minimise the duration of the occupation of the street. One of the ways this can be achieved is through collaborative working, where promoters work within the same traffic management footprint or share trenches in order to avoid having to dig up the road a number of times. By doing this the amount of disruption on the road network is minimised.

Collaborative works that have taken place across the whole of the TLRN have been examined and are shown in Table 12. Whilst it is not possible to separate out the numbers for the TLRS, these figures give a good indication of changes which have occurred in these segments. Like disruption, this data is available on a periodic basis.

Table 12: Collaborative working

Collaborative Working			
	P8 10/11 to P7 11/12	P8 12/13 to P7 13/14	% Change
Average number of collaborative work sites	11	23	106%
Average number of days of joint site working	74	289	289%
Average number of days of disruption avoided	71	195	173%

Table 12 shows that the average number of collaborative works taking place in each period increased by 106% in the year following the implementation of the TLRS. This demonstrates that works promoters are starting to undertake more works in this way. Analysis shows that in Period 6 2013/14 a total of 95 collaborative work sites were recorded.

The average number of days of joint site working also increased, rising by 289% in the periods monitored.

Finally, Table 12 also shows that the number of days of disruption that were avoided as a result of collaborative working increased by 173%, demonstrating the positive impact that this way of working has.

6.2. Use of new technology

The TLRS has also been influential in promoting the use of new trenchless technology techniques which reduce the impact of roadworks on traffic congestion. Two examples of such technology being used on London roads are the ‘core and vac’ technique and CISBOT.

6.2.1 ‘Core and vac’

The ‘core and vac’ technique can be viewed as keyhole surgery of roadworks. Requiring specialist equipment, it enables underground apparatus to be accessed by drilling a hole in the road, removing a cylindrical core of bound road material and then using vacuum extraction to remove any unbound material. The necessary work can then be carried out using specialised tool from the surface, before the unbound material and the bound core are replaced, leaving a finish that is flush with the road surface.

Whilst the ‘core and vac’ method had been used before the implementation of the TLRS, it is felt that the scheme has provided an additional incentive to utilise the technology fuelled by a desire for utility companies to occupy the carriageway for the shortest time possible in an effort to reduce TLRS charges.

‘Core and vac’ offers the following benefits over traditional excavation and reinstatement methods:

- Reduced traffic disruption – National Grid estimate that when using ‘core and vac’, the average duration of their works are reduced from 5 days to just ½ a day. There are the additional advantages of the width of the works area being generally reduced, and the contractor is able to leave the site more quickly should the road require immediate reopening.
- Less material excavated – Using the ‘core and vac’ technique, excavations are 80% smaller than those needed by traditional methods, with the amount of material, fill and lorry movements required being reduced by the same amount. National Grid estimates that when using ‘core and vac’ in London, the amount of materials required has fallen by 350 tonnes.
- Less pavement damage – A ‘core and vac’ excavation affects a much smaller area of pavement, is easier to compact, and by not having the corners of a traditional rectangular excavation, reduces the issue of damage from structural stresses.
- Improved reinstatement and surface finish – The core is returned flush with the road surface, retains its matching appearance to the surrounding road, its anti-skid properties and ‘directionality’, meaning the reinstatement is more robust than conventional backfills.

6.2.2 CISBOT

CISBOT (Cast Iron Sealing Robot) is a pioneering system that has been developed by American company ULC Pipeline Robotics. In partnership with ULC, Scotia Gas Networks (SGN) has adapted the technology for use on UK roads. CISBOT enables joint repairs to large iron gas mains by using a robotic arm and without the need for multiple excavations, which can offer huge benefits by causing significantly less disruption in traffic-sensitive areas.

The technology was used in a live test for the first time in London in October 2013, near Woolwich Barracks, where the system fixed the leaking joints of a live 24 inch gas main, making use of just one excavation, being operated from the back of a nearby truck, and without the need for the gas main to be taken out of service.
The use of CISBOT offers the following benefits over traditional leaking gas main repair methods:

- As well as sealing leaking joints, it prevents future leaks – every joint has a 50 year effective life;
- Requires a small site footprint with only one excavation, eliminating the need for road or footway closures and reducing permit, excavation and reinstatement costs;
- CISBOT gives the ability to seal up to 1,000 feet of pipeline from just one excavation;
- The entire joint sealing process can take place without the need to shut down the pipe, maintaining a constant service to customers.

It is thought that should such technology be adopted for use on a wider scale throughout London, it can have significant benefits in reducing the number of excavations needed for gas pipe repairs, and therefore the area of the carriageway affected, which in turn could lead to a reduction in roadwork related congestion. SGN hope to share what they have learnt from using CISBOT with the UK's other gas distribution companies, in an effort to maximise the benefits of trenchless technology industry-wide.

7. The financial impact of the TLRS

Although TLRS charges do not apply 24 hours a day, the scheme has increased the cost of carrying out works on the TLRN. This can be in the form of charges for undertaking works during traffic-sensitive times in TLRS areas or as a result of changing working practises to avoid working during these periods of the day.

7.1. Number of works avoiding TLRS charges

The number of works taking place within TLRS segments has been examined. These are works which could have been subject to TLRS charges.
Table 13 shows the proportion of works which took place within TLRS locations but avoided attracting a TLRS charge.

Table 13: Proportion of works avoiding TLRS charges

Proportion of works avoiding TLRS charges	
Promoter	**Total October 12 to September 13**
Transport for London	99%
Utilities	89%

It can be seen that 89% of utilities works and 99% of TfL works did not attract a TLRS charge during the period examined. The interim TLRS report[6] showed that between June 2012 and March 2013 92% of utility works avoided a TLRS charge. The increase in the percentage of utility works incurring these charges is considered to be as a result of the low numbers of utility works undertaken during the Olympic

[6] Transport for London Lane Rental Scheme Monitoring Report 2012/13

period and the numbers of works which qualified for exemption from charges under the transitional arrangements of the scheme. Note that the transitional arrangements of the scheme required TfL to exempt works from charges where those works were originally proposed to start prior to the introduction of the scheme but the start of the works were delayed for co-ordination reasons. TfL's own roadworks have remained consistent, with just 1% of works incurring a charge.

Works attracting TLRS charges are examined below. Works promoters may incur particular costs associated with avoiding TLRS charges such as additional overtime for staff working at night. These costs and the impact they have had on promoters is also examined in below.

7.2. TfL works incurring TLRS charges

Section 7.1 shows that 1% of TfL works attracted TLRS charges in the period monitored.

Table 14: TfL works attracting TLRS charges

Sector	Total	Number of Works in LR Locations	Number of Works Attracting a LR Charge	% of Works Attracting a LR Charge
TfL	£ 295,000	16,192	81	1%

Table 14 shows that 81 works incurred TLRS charges between October 2012 and September 2013 out of a potential 16,192. This shows that the remainder of these works were undertaken in a manner which avoided TLRS charges.

The CoBA estimated that TfL would pay £3.4m in TLRS charges in the first year of the scheme. This figure was not realised suggesting that the scheme has had a greater impact on behaviour change than expected. It should be noted that TfL has an increased investment programme for the next three years which may see an increase in the number of chargeable works.

Analysis shows that of the 81 TfL works incurring TLRS charges, 51% took place in high charge bands resulting in £205,000 in charges. The remaining 49% resulted in £90,000 in low rate charges.

7.3. Utility works incurring TLRS charges

As shown previously, 11% of utility works incurred TLRS charges in the period monitored. The proportion of works that attracted a TLRS charge in each industry sector is shown below, along with the total charges.

Table 15: Works attracting TLRS charges, split by sector

Sector	Total TLRS Charges	Number of Works in LR Locations	Number of Works Attracting a LR Charge	% of Works Attracting a LR Charge
Water	£ 944,500	2,537	262	10%
Gas	£ 854,800	662	159	24%
Electric	£ 542,850	1,017	133	13%
Telecoms	£ 483,600	2,524	161	6%
Network Rail - Promoters National	£ 2,400	57	1	2%
Total	**£ 2,828,150**	**6,797**	**716**	**11%**

Table 15 shows that works undertaken by water companies attracted the highest TLRS charges. This is not surprising as this sector also had the largest number of works that were chargeable, at 262. Despite that, this figure represents just 10% of all water works undertaken in TLRS areas, suggesting that the remainder of these works were carried out in a manner which avoided TLRS charges.

The highest proportion of works which attracted TLRS charges were those in the gas sector, with a quarter incurring fees. It is worth noting that the gas and water sectors have the most plant in the carriageway compared to other sectors.

The CoBA estimated that utility companies would pay £6.5m in TLRS charges in the first year of the scheme. This figure was based on the number of works previously taking place in what were to become TLRS areas. In reality utility companies have paid out less than half this figure, showing that behaviour change has been greater than expected.

The proportion of utility works which incurred TLRS charges in each charge band has been examined and is shown in Table 16.

Table 16: Proportion of charges in high and low charge bands

Sector	% Works Incurring High/PP Charges	% Works Incurring Low Charges
Water	23%	77%
Gas	20%	80%
Electric	23%	77%
Telecoms	22%	78%
Network Rail -Promoters National	0%	100%

The table shows that, in contrast to TfL works, the majority of utility works which incurred charges took place inside low charge bands across all sectors. This may be due to companies focussing their efforts to avoid working inside traffic-sensitive times in those areas where they will incur the highest charges. As a result more off peak and overnight working may take place in high charge band segments, reducing the overall charges sustained by utility companies.

7.4. Impacts on works promoters

Works promoters may incur costs as a result of moving works to take place outside of traffic sensitive times. Promoters were asked to provide TfL with information relating to the impact the implementation of the TLRS on their organisations. Thames Water responded positively to this and the information they provided is outlined below. Virgin Media stated that the TLRS has had minimal impact on their organisation. Other companies were either unable to provide the required information, or were not prepared to.

i. Impacts felt by Thames Water

Thames Water estimates that it incurs £140,000 per annum in costs associated with avoiding TLRS charges. This cost was split as £80,000 for north London and £60,000 for south London and includes:

- the micro management of works
- liaising with Environmental Health Officers
- regular briefings to gain a better understanding of the TLRS including gaining advice and guidance regarding materials and techniques from TRL
- increased Contract Rates for out of hours works and/or double gangs at site

Thames Water also estimate that the average total cost for a typical repair and maintenance activity of 2m x 1m x 1m excavation/reinstatements is now 2.75 times higher per job. This includes the over and above cost of opening a “Material Plant”, traffic management planning and preparation, provision of signing and support vehicles. Repair and maintenance works account for approximately 61% of Thames Water’s street works activities.

Despite these additional costs, Thames Water have realised savings of £19,000 by not working during chargeable hours by deploying out of hours or extended shifts for Capital Delivery works. This has also lead to a reduction in the duration of works of 15-20% along with the need and costs of any associated plant. Works are also planned in order to minimise un-productive time on site as far as possible. This better planning of initial works and any subsequent reinstatement ancillary/related activities means that works are now carried out more efficiently. Options for the use of alternative methodologies and materials are now being considered and adopted for use in non-TLRS areas as well. Through planning, co-ordination and consultation, the potentially negative impact upon Thames Water customers by virtue of out of hours working and any noise/dust/light issues have been minimal.

However customers requisitioning new services have been affected by the introduction of TLRS charges. During the period monitoring TLRS charges of £170,000[7] were invoiced to customers requiring new services. In some instances new connection works have been cancelled once the customer was aware of the application of TLRS charges.

[7] TfL figures show that Thames Water incurred £99,800 of TLRS charges during this period for customer connections

ii. Impacts felt by TfL

TfL makes every attempt to avoid working during traffic-sensitive hours in order to avoid incurring charges. As shown earlier, just 1% of works attracted a charge in period analysed.

Major works are currently underway at Euston Circus, including the installation of a bus lane and junction modifications. TfL aims to avoid TLRS charges for these works by working outside of chargeable hours. This area is in Charge Band 3 and TLRS charges apply 07:00-22:00 in weekdays and 12:00-20:00 on weekends. This means all works must be undertaken overnight to avoid charges. Avoiding charges has resulted in an additional eight weeks being added onto the works programme, leading to higher supervision and traffic management costs. Along with other additional costs including extra labour the total impact of the TLRS on this scheme is approximately £394,847, representing approximately 3% of the overall project cost.

The redevelopment of Tottenham Hale Gyratory is another scheme which is currently being undertaken and is aiming to avoid all TLRS charges. The works involve removing the current one-way system, allowing traffic to flow in both directions, as well as improving facilities for pedestrians and cyclists. Throughout the duration of the works most highway works will be undertaken overnight thereby not incurring any TLRS charges. However, any works deemed noisy must take place in the daytime, and various restrictions remain in place at all other times. The gyratory itself in is Charge Band 1 of the TLRS, with charges applying from 06:30 – 10:00 and 15:30 – 20:00 on weekdays, and 12:00 – 18:00 on weekends, allowing TfL to undertake day time works between 10:00 and 15:30 without incurring charges. However the Seven Sisters junction is classified as a Band 3 area, with charges applying on weekdays from 06:30 – 22:00 and from 12:00 – 20:00 on weekends and therefore all works here must take place overnight so that charges are not incurred.

As with Euston Circus, avoiding TLRS charges does cost money. It is estimated that avoidance of charges has added approximately £341,148[8] onto the costs of the Tottenham Hale Gyratory scheme.

8. Enforcement of the scheme

It was anticipated that the number of non-compliances would increase on the TLRN as a result of promoters seeking to avoid TLRS charges by not applying for a permit in the first place, or not providing the correct information on permit applications. The CoBA estimated that the number of potential offences based on site evidence would be approximately ten per day.

The total fixed penalty notices (FPNs) given by TfL across all of the TLRN, as a result of on-site evidence, for the period analysed was just 383. This equates to an average of approximately one per day which is significantly less than anticipated. Whilst these

[8] Please note that this figure was derived from the tendered sum issued by Balfour Beatty which is undertaking the Tottenham Hale Gyratory works. As this is a commercial position it does not necessarily reflect the full costs of avoiding TLRS charges and they may be much higher.

figures do not isolate TLRS areas they do show that the scheme has not led to an increase in the number of FPNs issued.

9. Summary

The TLRS provides a mechanism for behaviour changes amongst works promoters in order to minimise the occupation of works at traffic-sensitive times in TLRS segments. The analysis outlined in this report demonstrates that the scheme has been successful in achieving this goal.

Following the implementation of the TLRS 99% of TfL works and 89% of utility works avoided incurring a TLRS charge. It is important to note that the transitional arrangements of the scheme required TfL to exempt some works from charges despite them taking place in TLRS areas. In other cases works were exempted from charges as promoters agreed to undertake them outside of 'peak' times during the year, thereby lessening the impact that these works had on the road network. Analysis has also shown that nearly one third of works took place at night in TLRS areas, up by 20% from before the scheme was implemented. This shows that promoters are actively avoiding traffic-sensitive times, and therefore avoiding charges.

Analysis also shows that the number of days where works were requested to take place during traffic-sensitive times totalled 3,815. Just 31% of these days were approved showing that TfL is taking an active role in ensuring that the number of days that works take place during traffic-sensitive times is kept to a minimum.

Collaborative working increased during this time which led to a decrease in the number of days of disruption associated with these works.

This behaviour change amongst works promoters has contributed to improved conditions on the road network. Serious and severe disruption associated with planned works fell by 46% in TLRS areas between October 2010 to September 2011 and October 2012 to September 2013.

Journey times were also impacted positively by the scheme: journey times were 4% better inside the TLRS in the AM peak and 2.1% in the PM peak than they were on the remainder of the TLRN. Journey times also improved on the BPRN, with vehicles experiencing a 3.3% decrease in travel times in the AM peak and 4.1% in the inter and PM peaks. Analysis shows that when the whole road network is taken into account, journey times improved by 0.6% in the AM peak and 1.1% in the PM peak. This matches the predictions outlined in the TLRS CoBA.

Customer satisfaction has also improved following the implementation of the scheme, with overall satisfaction rising to 76%. The number of customers stating that they had been disrupted due to roadworks fell by 23% in 2012, and more people were happy with the time taken to complete roadworks, and the frequency and number of works taking place.

Works promoters were given the opportunity to provide TfL with information relating to the impact the scheme had had on them. Those that responded were positive about the impact of the TLRS stating that the impact has been minimal.

Annex 1: Case Studies

The previous section analysed data for the whole of the TLRS. Whilst it was vital to undertake a scheme-wide study it is also useful to consider individual areas and works, and the impact that they have had on the road network. This section outlines three case studies which do this.

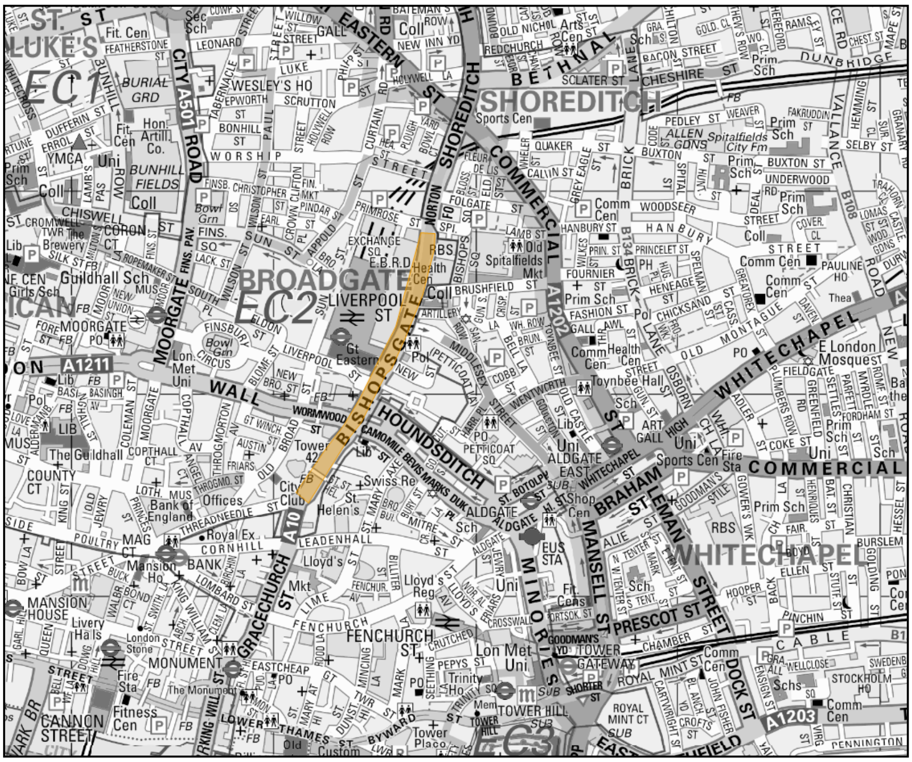
A. Case Study 1: Bishopsgate

Bishopsgate forms part of the A10 corridor in the City of London. It was chosen as a case study area because a relatively large number of works have taken place there in recent years, both before and after the implementation of the TLRS. In addition to this, there is a good number of monitoring data sources available for the area. Bishopsgate is a relatively important road, being the location of Liverpool Street Station, the offices of several major banks and a number of prominent skyscrapers. It has two lanes in each direction, although north of the junction with Liverpool Street, one of the two lanes in each direction is a bus lane. The entirety of Bishopsgate is currently in band 1 of the TLRS, with charges applying between 06:30–10:00 and 15:30–20:00 on weekdays, and from 12:00–18:00 on weekends.

A baseline period of October 2010 to September 2011 was compared against October 2012 to September 2013 to ascertain what impact, if any, the TLRS has had on Bishopsgate.

Figure 3 shows the location of Bishopsgate in the context of its surrounding area, as well as the monitoring area for which data was captured.

Figure 3: Bishopsgate monitoring area



i. Number of works

The information on the nature of the works which had an impact on the carriageway on Bishopsgate was taken from the LondonWorks system.

Table 17: Change in total number of works

Change in Number of Works with a Carriageway Impact			
	Oct 10 - Sept 11	Oct 12 - Sept 13	Change 10/11 to 12/13
Major	9	17	88.9%
Standard	9	7	-22.2%
Minor	103	73	-29.1%
Immediate - Emergency	188	191	1.6%
Immediate - Urgent	28	3	-89.3%
Total	**337**	**291**	**-13.6%**

Figure 4: Total number of works

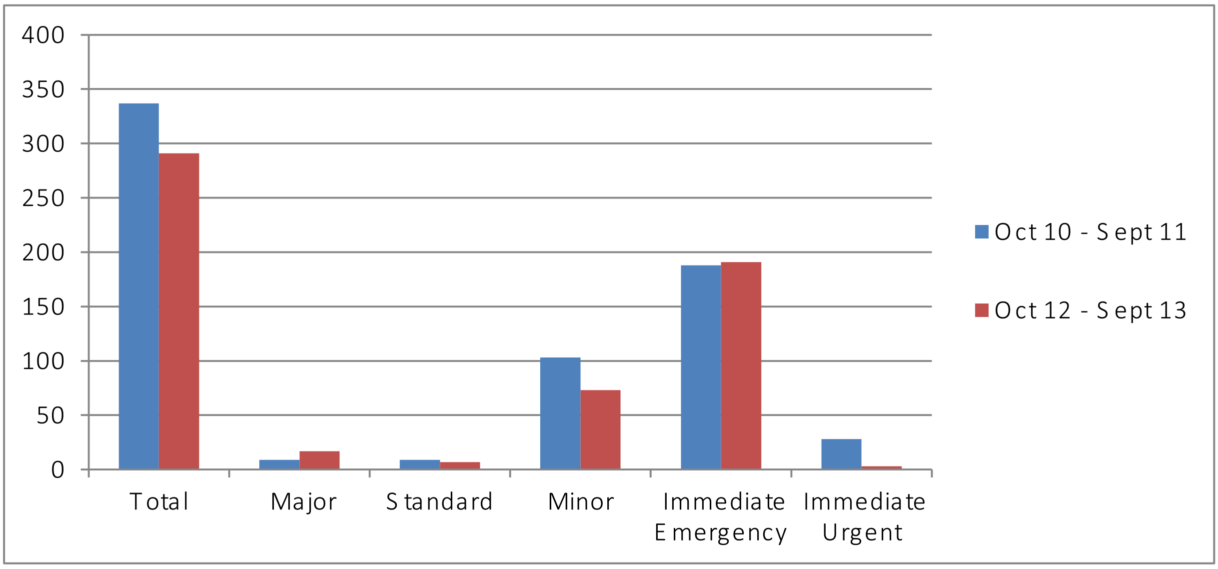


Table 17 and Figure 4 show that the overall number of works taking place has fallen by over 13%. The most significant changes were in the number of major works, which rose by 89%, and the number of immediate urgent works, which fell by nearly 90%, with only 3 taking place in the entire TLRS year. The number of immediate emergency works stayed nearly the same.

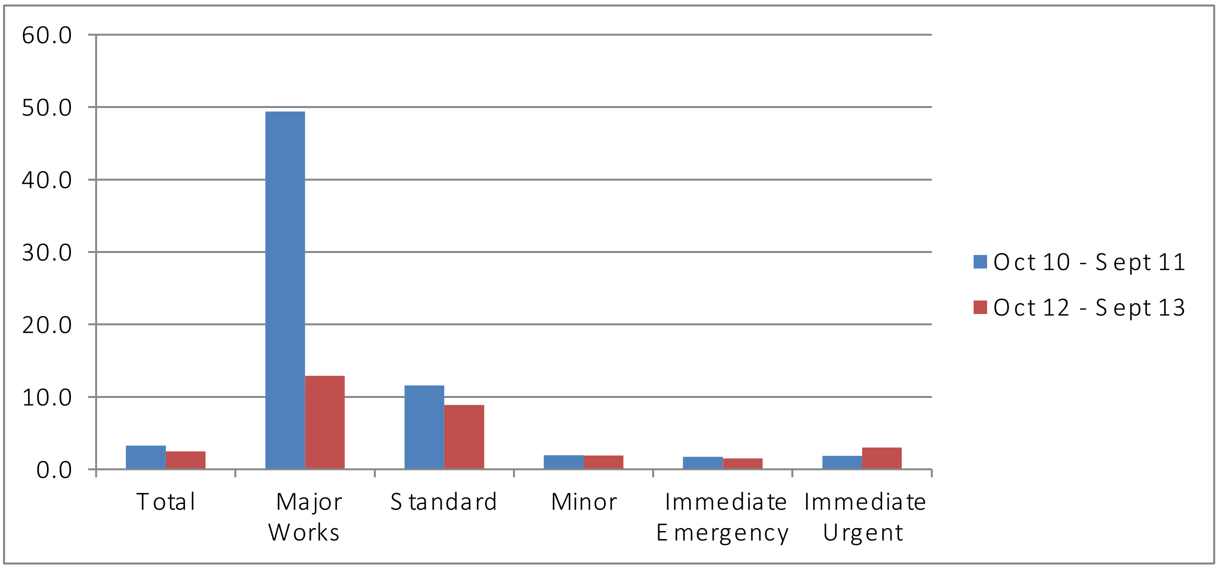
ii. Duration of works

The average duration of these works has also been examined.

Table 18: Change in average duration of works

Change in Average Duration of Works with a Carriageway Impact (days)			
	Oct 10 - Sept 11	**Oct 12 - Sept 13**	**Change 10/11 to 12/13**
Major	49.4	12.9	-73.9%
Standard[9]	11.6	8.9	-23.3%
Minor	2.0	1.9	-3.1%
Immediate - Emergency	1.7	1.5	-12.2%
Immediate - Urgent	1.9	3.0	58.7%
Average	**3.3**	**2.5**	**-24.2%**

Figure 5: Average duration of works (days)



Comparing Table 17 and Table 18, it can be seen that, whilst the actual number of major works talking place increased by 90%, the average duration of major works fell by 74%, from an average of 49 days to just 13 days per works. This suggests that whilst more cases of major works took place following the implementation of the TLRS, on average they were of a shorter duration and so may have impacted the carriageway for a shorter amount of time.

Conversely, whilst the number of immediate urgent works taking place fell by 89%, the average duration increased by 59%. Regarding standard works, the average duration more than doubled. Despite this, overall the average duration of all works on Bishopsgate fell by 19% following the implementation of the TLRS.

[9] Once a works has been entered into the street works register it remains classified as per the original permit application even if the actual duration of the works changes. Therefore some works are shorter or longer than their classification i.e. some standard works were longer than the expected ten day duration.

iii. Average journey times on Bishopsgate

The average journey time over the two periods was measured using LCAP data.

Table 19: Change in average journey time

Change in Average Journey Time (mins/km)						
	Oct 10 - Sept 11		Oct 12 - Sept 13		Change 10/11 to 12/13	
Direction	North bound	South bound	North bound	South bound	North bound	South bound
AM Peak	4.2	6.8	4.2	5.7	-0.4%	-16.4%
Inter Peak	4.1	5.6	4.3	4.9	2.7%	-11.8%
PM Peak	4.5	6.3	4.5	5.3	0.2%	-16.4%
Overnight	2.1	2.4	2.2	2.4	4.2%	-0.4%

Table 19 shows the average journey times in both directions on Bishopsgate. Whilst there was little change in the northbound direction, the most noticeable changes were small increases in journey time in the inter peak and overnight, indicating that working patterns may have shifted to taking place in these times (outside of TLRS charging hours), instead of in the AM and PM peaks.

The southbound direction however saw much larger changes. Here, journey times fell in all periods of the day, most significantly in the AM and PM peaks which both decreased by 16.4%, equating to a journey times being around 1 min/km shorter. This indicates that there might be a lot less work activity taking place in the AM and PM peak, due to TLRS charges applying at these times, thus improving journey times. The inter peak also saw a significant reduction in journey times, although not as high as the AM and PM peaks.

iv. Journey time reliability on Bishopsgate

The JTR over the two periods was measured using LCAP data.

Table 20: Change in journey time reliability

Change in Journey Time Reliability						
	Oct 10 - Sept 11		Oct 12 - Sept 13		% Point Difference 10/11 to 12/13	
Direction	North bound	South bound	North bound	South bound	North bound	South bound
AM Peak	90%	83%	89%	86%	-1.0%	3.4%
Inter Peak	90%	85%	88%	88%	-2.1%	3.1%
PM Peak	90%	84%	90%	88%	-0.6%	4.2%
Overnight	91%	90%	90%	90%	-0.6%	0.1%

Table 20 shows that since the implementation of the TLRS on Bishopsgate, JTR has slightly fallen in the northbound direction, but has improved southbound. The greatest drop in JTR was northbound in the inter peak, suggesting that more works may be taking place at this time of the day. The greatest improvements in JTR were southbound in the AM and PM peaks, which could indicate that less works are now taking place at these times of day.

v. Flows on Bishopsgate

Table 21 shows the weekday average hourly flow for both September 2011 (before the TLRS was implemented), and September 2013 (after the TLRS was implemented). Data was collected from an ATC conveniently located on Bishopsgate, between the junctions with Liverpool Street and Houndsditch.

Table 21: Average flows per hour

Change in Average Hourly Flow			
Bishopsgate	**Sept 11**	**Sept 13**	**Change Sept 11 to Sept 13**
Average Flow	1,098	1,125	2.5%

The figures in Table 21 indicate that the average hourly flow on Bishopsgate has slightly increased by 2.5% since the implementation of the TLRS.

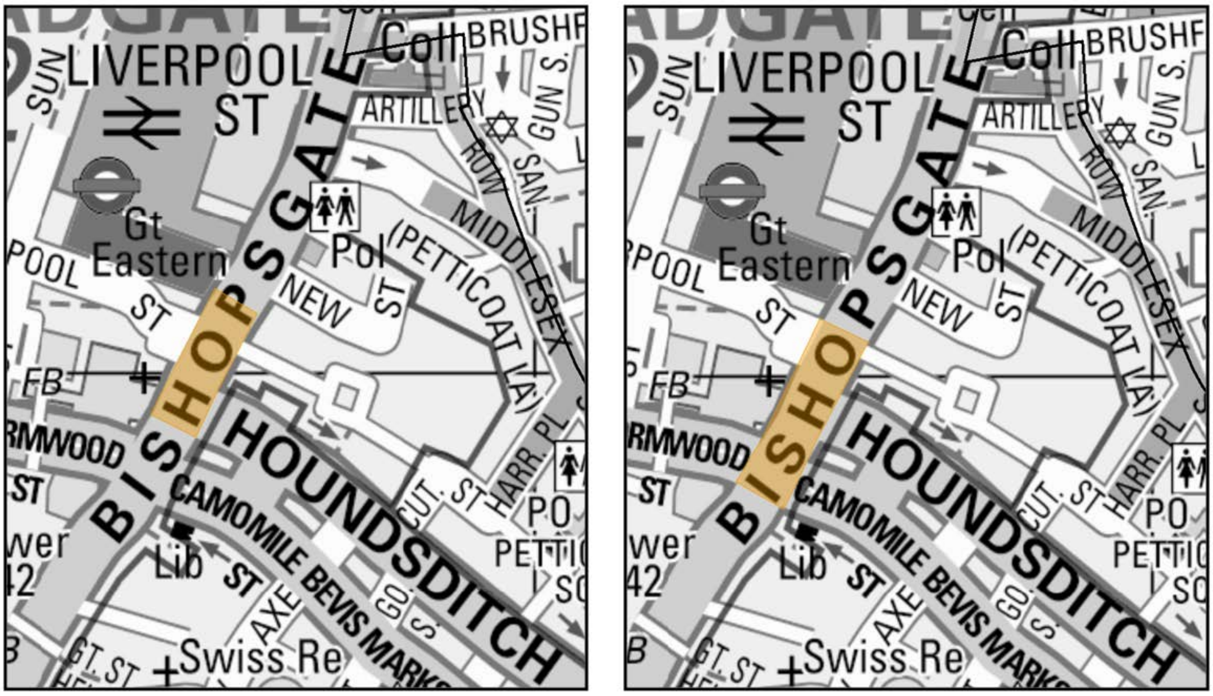
vi. Analysis of individual works

It was decided to analyse the effects on traffic of two similar and therefore comparable works on Bishopsgate – one before the implementation of the TLRS and one after. The two works chosen are outlined in Table 22 below, and the extent of each of the works is shown in Figure 6.

Table 22: Details of works

	Works Promoter	Works Description	Works Location	Start Date	End Date	Duration	Category
Pre-TLRS	COLT	Installation of telecom ducts and chambers in the carriageway	Bishopsgate (*170 Bishopsgate to junction with Houndsditch*)	07/05/2011	15/05/2011	9 days	Major
Post-TLRS	euNetworks	Installation of telecom ducts and chambers in the carriageway	Bishopsgate (*junction with Liverpool St to junction with Camomile St*)	06/04/2013	16/04/2013	11 days	Major

Figure 6: Location of monitored works on Bishopsgate



Pre-TLRS: 170 Bishopsgate to Houndsditch

Post TLRS: Liverpool Street to Camomile Street

i. Average journey times

The average journey times for the respective months in which the works took place were taken from Traffic Master data. The area for which the journey times were measured is shown in Figure 7.

Figure 7: Journey time monitoring area

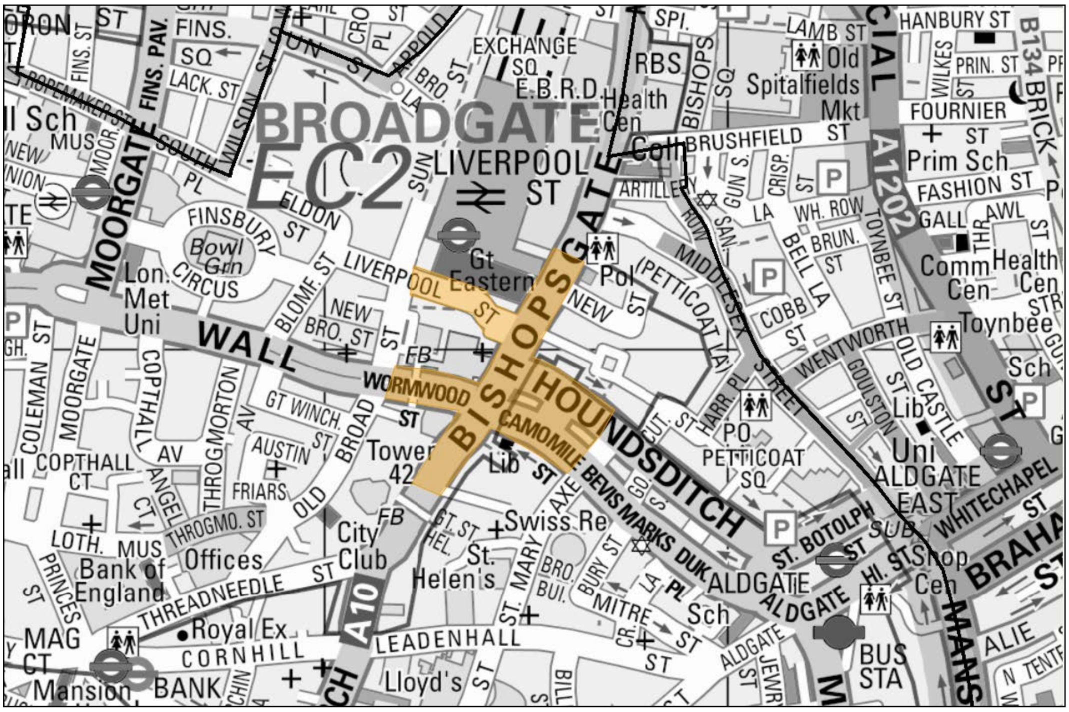


Table 23: Average journey times during works periods

Change in Average Journey Times (mins/km)			
	May 2011	April 2013	Change May 2011 to April 2013
AM Peak	6.7	6.4	-5.0%
Inter Peak	6.9	6.7	-2.3%
PM Peak	6.9	5.5	-20.4%
Evening	6.4	5.5	-14.3%
Overnight	4.3	4.7	10.1%

Table 23 shows that the average journey times over the periods the works were taking place in improved in the day time during the TLRS period, but worsened overnight. The journey time improvements were most significant in the PM peak, being 20% faster, an average saving of 1.4 minutes per km. These results suggest that before the TLRS, major works with a carriageway impact may have taken place throughout the day, but since the TLRS has been in force, working patterns could have changed to predominantly overnight working, highlighted by the significant improvement in PM peak journey times, and the worsening of journey times overnight.

ii. Average flows

The average flows over the works period was measured from an ATC on Bishopsgate between the junctions with Liverpool Street and Houndsditch, and are shown in Table 24 below.

Table 24: Average hourly flows during works periods

	07/05/11 to 15/05/11	06/04/13 to 16/04/13	% Change
AM Peak	1,117	1,088	-2.6%
Inter Peak	1,217	1,125	-7.6%
PM Peak	1,311	1,191	-9.2%
Overnight	989	955	-3.4%

Table 24 shows that the average hourly flows decreased across all times of the day on Bishopsgate over the TLRS works period. The most significant drop in flow occurred in the PM peak, a fall of 9%.

vii. Bishopsgate Summary

Whilst the overall number of works that have taken place since the TLRS was introduced has fallen, this can be largely attributed to the vast reduction in the proportion of immediate – urgent and minor works taking place. The number of major and standard works has actually increased on Bishopsgate. Similarly, whilst the average duration of all works taking place has decreased, this is not true for all types of works. Whilst less immediate – urgent works took place, they tended to be longer on average, the average duration of standard works doubled, but the average duration of major works fell by around 70%.

Whilst northbound journey times have not changed much since the start of the TLRS, southbound journey times have reasonably improved. JTR also improved in the southbound direction, however northbound they got very slightly worse.

As Table 21 shows, the number of vehicles has not increased very much on Bishopsgate, and so it is possible that the southbound improvements in journey times are as a result of works generally occupying the carriageway for less time and being managed more efficiently at peak times of day as a result of the TLRS. This is reinforced by the analysis undertaken in vi, which shows that when looking at two fairly comparable works, one before the TLRS started and one after, and at similar times of year, the journey times did improve whilst the latter set of works were taking place, most significantly in the PM peak. It can also be seen in Table 23 that journey times worsened by 10% overnight, strongly suggesting that the works taking place after the TLRS was introduced made more use of night time working.

B. Case Study 2: Greenford Flyover Essential Maintenance

Greenford Flyover forms part of the A40 corridor in the London Borough of Ealing. This case study explores the impacts of major maintenance works that took place there over the Christmas 2012 period.

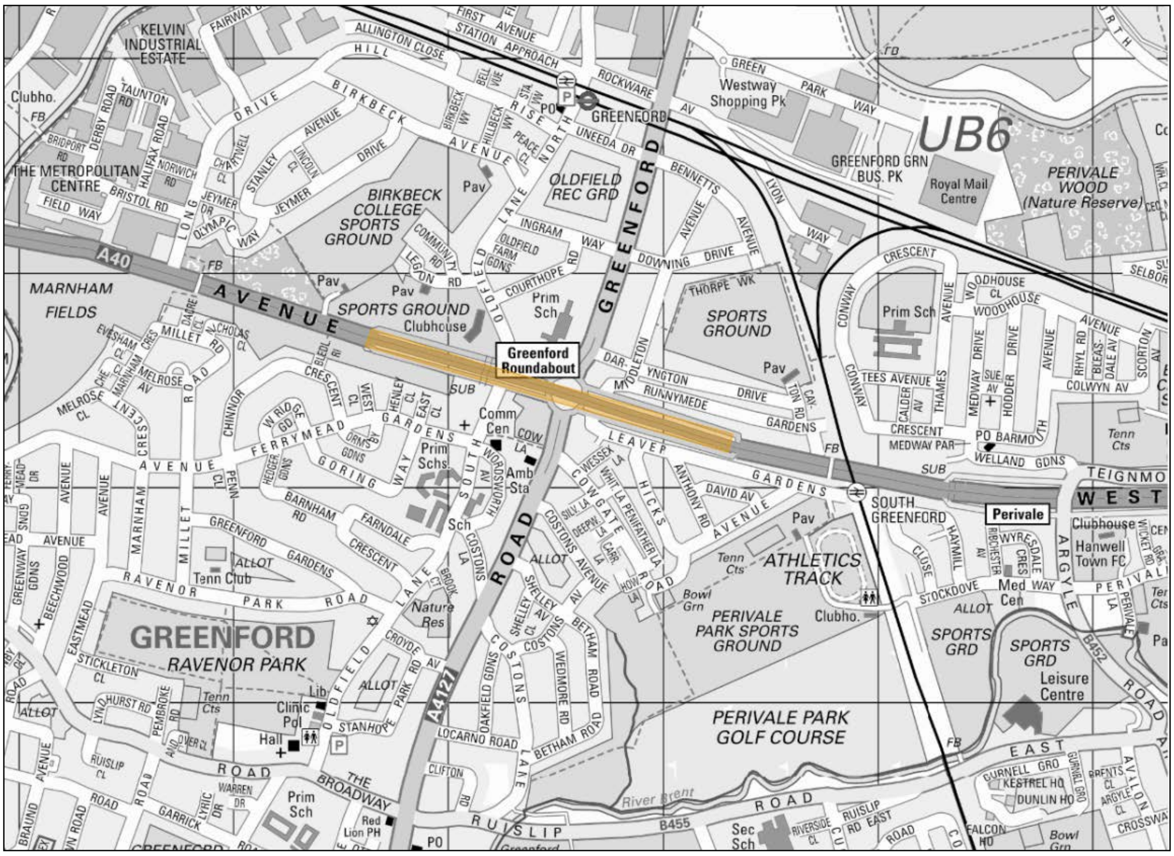
Greenford Flyover is within Band 2 of the TLRS, with the high charge applying to works from 06:30–19:00 on weekdays and 12:00–18:00 on weekends.

TfL needed to carry out essential maintenance on the flyover to make the structure safe. This involved replacing expansion joints across the flyover and carrying out resurfacing works around the new joints. Due to the nature of the works it was necessary to fully close the flyover whilst the works were taking place, with traffic being diverted via the roundabout underneath the bridge.

It was decided to carry out the works during the Christmas/New Year period, when traffic levels are significantly lower, with the intention of reducing the negative impact that the works would have. In order to get the works completed on time during the festive period, TfL waived the TLRS fees for the duration of the works, with engineers working around the clock to make the deadline.

The works started at 01:01 on 25 December 2012 and the flyover was reopened at 01:27 on 2 January 2013. For this reason, the period monitored was 25 December 2012 to 1 January 2013. Figure 8 shows the location of Greenford Flyover in the context of its surrounding area.

Figure 8: Greenford Flyover



i. Average journey times at Greenford Flyover

To get an understanding of the impact that the closure of the flyover had on the journey times of vehicles travelling on the A40 through the Greenford area, these were measured on the affected dates using LCAP data, and compared with the journey times on the same dates in the baseline year, 2010/2011. The average journey times are shown in Table 25 below

Table 25: Change in average journey times

Change in Average Journey Times (mins/km)						
	25 Dec 2010 to 1 Jan 2011		25 Dec 2012 to 1 Jan 2013		% Change	
Direction	East bound	West bound	East bound	West bound	East bound	West bound
AM Peak	0.7	0.9	1.0	1.0	44.8%	18.5%
Inter Peak	0.7	0.8	1.9	2.1	173.8%	149.0%
PM Peak	0.7	0.8	1.9	2.2	161.9%	157.6%
Overnight	0.6	0.7	0.7	0.7	8.0%	4.1%

As can be seen, the closure of the flyover had a severe impact on journey times on the A40, with vehicles having to be diverted around the roundabout underneath the bridge. This was felt most prominently in the Inter and PM peaks, with journey times being as much as 174% longer than they were over the same period two years beforehand.

ii. Journey time reliability at Greenford Flyover

The JTR over the two periods was also measured using data from LCAP.

Table 26: Change in journey time reliability

Change in Journey Time Reliability						
	25 Dec 2010 to 1 Jan 2011		25 Dec 2012 to 1 Jan 2013		% Point Difference	
Direction	East bound	West bound	East bound	West bound	East bound	West bound
AM Peak	100%	81%	74.1%	69.4%	-25.9%	-12.0%
Inter Peak	100%	94%	34.3%	20.8%	-65.7%	-73.1%
PM Peak	100%	100%	23.1%	32.4%	-76.9%	-67.6%
Overnight	100%	100%	98.6%	97.2%	-1.4%	-2.8%

JTR was relatively bad whilst the works were taking place, especially during the Inter and PM peaks, where it was as much as 77% points worse than the baseline period.

iii. Flows at Greenford Flyover

The eastbound and westbound flows at Greenford Flyover were measured from two ATCs on the A40 just to the east of the flyover.

Table 27: Change in average hourly flows

Average Hourly Flow at Greenford Flyover						
	Yearly Average (Oct 12 to Sep 13)		25 Dec 12 to 1 Jan 13 Average		% Change	
Direction	East bound	West bound	East bound	West bound	East bound	West bound
AM Peak	4,728	3,609	1,167	1,117	-75%	-69%
Inter Peak	3,810	3,863	1,576	1,453	-59%	-62%
PM Peak	4,189	4,962	1,578	1,492	-62%	-70%

The hourly flow over the Christmas/New Year period was down significantly from the average hourly flow at Greenford Flyover, generally 60-75% lower than the average. This shows lower vehicle numbers than what might be expected over the Christmas period, indicating that people may have been taking alternative routes. Despite this, the high drop in flows suggests that the impact would have been considerably worse at an alternative time of year when flows were at higher levels.

iv. Disruption due to Greenford Flyover closure

The closure of Greenford Flyover resulted in 34 hours of serious disruption, 39 hours of severe disruption and 125 hours of minimal and moderate disruption. These values were obtained from LTIS.

v. Cost of disruption due to Greenford Flyover closure

The impact of the delay to vehicles using this section of the A40 caused by the closure of the flyover is estimated to have been around £700,000. This is using an approximate average cost per vehicle delay per hour of £17, with delay figures coming from LCAP and flows from the ATCs used above. The incident lasted eight days and data for this period has been compared with an average eight day period. Applying the same parameters to the average yearly journey time profile and flow, it is estimated that had the works taken place at a normal time of year, over the same length of time, the cost of the delay would have been more in the order of £2,880,000.

Table 28: Estimated financial benefit of the Greenford Flyover closure taking place over Christmas period

Estimated impact of Greenford Flyover closure			
	Average 8 day period	**25 Dec 2012 to 1 Jan 2013**	**Benefit of works taking place over Christmas period**
Impact	£2,880,000	£700,000	-76%

This assumes that the flyover would have been shut for the same amount of time, and the closure would have had the same negative impact on journey times. It should be noted however that the data available only enables a journey time and a cost analysis on vehicles using the A40. It is likely that the closure would have also affected local roads in the Greenford area and beyond. Furthermore, it is thought that many drivers took alternative routes and so they too would have experienced longer journey times. Given this, the estimated cost of the closure to the wider network is likely to be higher than the numbers in Table 28, however, the benefit of the works taking place over the Christmas period would still likely be around 76% in this instance.

vi. Greenford Flyover summary

Table 25, Table 26, Table 27 and Table 28 highlight the benefits of carrying the work out over the festive period – the closure had an effect of up to 174% worse journey times and 77% worse JTR when flows were 60-75% lower than normal. If the works had been carried out at any other time of year it is likely that journey times and JTR would have been even worse than this, and the impacts would have affected tens of thousands of more vehicles each day of the works, being felt over a significantly wider area. Add to this the extremely high levels of disruption that occurred (73 hours of serious and severe disruption over the course of 8 days, when traffic volumes were already much lower than normal) and it is clear to see that had the works would have had a much greater impact had they taken place at a busier time of year.

Indeed, it is estimated that the cost of the impact was around 76% than it would have been had the works not taken place over the Christmas period.

Due to the nature of the maintenance taking place, there would never have been a good time for them to be carried out, but by waiving the TLRS charge and thus encouraging the works to be carried out over Christmas and the New Year, the severe impacts were considerably mitigated.

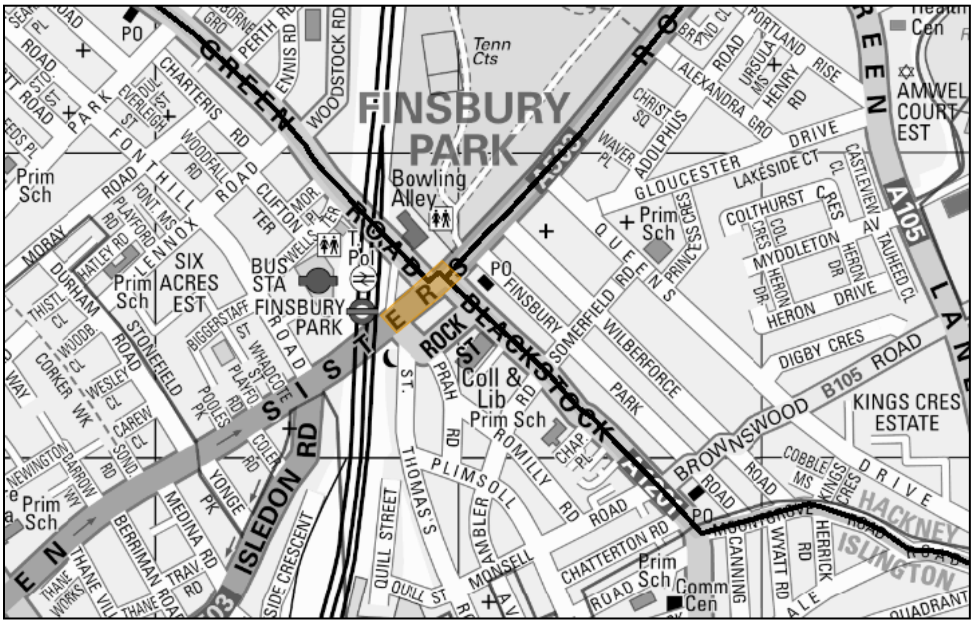
An alternative to entirely closing the flyover for the duration of the works would have been to carry out night time works and plating the works during the day time to enable the road to remain open. However, this was not a feasible option, since the Maurer plates appropriate for this scenario had not been tested by Transport Research Laboratory (TRL) at the time for use on the TLRN. However, the money that has been raised by the TLRS so far is being used to fund the research and development of such technology, so that methods such as plating at major works would be a viable option for similar cases in the future. Had the Maurer plates been available when the works were undertaken at Greenford Flyover they would have been in use for seven days and resulted in an additional cost of around £50,000. This can be broken down as £10,000 for carriageway resurfacing, £5,000 for plate installation, £14,000 for daily maintenance, removal and replacement of plates and £20,000 for speed enforcement whilst they were in use.

C. Case Study 3: Seven Sisters Road / Finsbury Park

Seven Sisters Road forms part of the A503. This case study explores the impacts of major works undertaken by Thames Water on Seven Sisters road near the junction with Stroud Green Road in the Finsbury Park area around the Christmas 2012 period.

The works were to repair a trunk main leak and were initially estimated to take 8 days to complete. However, TfL decided to waive the TLRS charges in order for Thames Water to complete the works over the Christmas period, where traffic volumes are normally considerably lower, working in peak hours in order to get the works completed in just 4 days. The agreed traffic management was for Seven Sisters Road to be under alternate single lane working, with a banned left turn into Stroud Green Road. The junction of Seven Sisters Road and Stroud Green Road is shown in Figure 9 below.

Figure 9: Seven Sisters Road location of works



This section of Seven Sisters Road is a band 3 pinch point, with a high charge applying from 07:00-22:00 on weekdays and 12:00-20:00 on weekends.

i. Average Journey Times on Seven Sisters Road

The westbound journey times on Seven Sisters Road through the Finsbury Park area were measured using data from LCAP. Eastbound journey times were not analysed as there is no LCAP link for that direction.

Table 29: Change in average journey times

Change in Average Journey Times (mins/km)			
	27 Dec to 2010 30 Dec 2010	27 Dec 2012 to 30 Dec 2012	% Change
AM Peak	1.9	3.0	54.0%
Inter Peak	2.2	3.3	49.6%
PM Peak	2.4	4.1	67.6%
Overnight	1.6	1.6	0.0%

Table 29 shows that the works had a considerably detrimental effect on journey times in the area throughout the day time, most significantly in the PM peak where they were nearly 68% worse than in the baseline period. However, there was no effect on journey times in the overnight period.

ii. Journey Time Reliability on Seven Sisters Road

The westbound JTR on Seven Sisters Road through the Finsbury Park area was measured using data from LCAP.

Table 30: Change in journey time reliability

Change in Journey Time Reliability			
	27 Dec 2010 to 30 Dec 2010	27 Dec 2010 to 30 Dec 2012	% Change
AM Peak	100%	50%	-50.0%
Inter Peak	100%	69%	-30.6%
PM Peak	94%	65%	-30.9%
Overnight	97%	97%	0.0%

It can be seen from Table 30 that the westbound JTR dropped by as much as 50% in the AM peak. However, just as with the journey times, JTR was not affected at all in the overnight period showing that the works only had a negative impact on traffic in the daytime.

iii. Flows on Seven Sisters Road

The eastbound and westbound flows were measured from an ATC on Seven Sisters Road around a mile to the east of the works.

Table 31: Change in average hourly flows

Average Hourly Flow on Seven Sisters Road						
	Yearly Average (Oct 12 to Sep 13)		27 Dec to 30 Dec 2012 Average		% Change	
Direction	East bound	West bound	East bound	West bound	East bound	West bound
AM Peak	476	763	334	521	-30%	-32%
Inter Peak	612	668	499	635	-18%	-5%
PM Peak	645	695	543	660	-16%	-5%

Flows were down significantly from the yearly average in the AM peak, and to a lesser extent in the Inter and PM peaks. This would be expected, as the roads are generally quieter over the Christmas period. Table 31 therefore indicates that the impact of the works would have been much worse had they taken place at a normal time of year, particularly in the AM peak.

iv. Disruption due to Seven Sisters Road works

The works on Seven Sisters road resulted in a total of 88 hours of moderate disruption between 27 December 2012 and 30 December 2012.

v. Cost of disruption due to Seven Sisters Road works

The cost of the delay to vehicles using Seven Sisters Road caused by the roadworks is estimated to have been around £29,000. This is using an approximate average vehicle delay per hour of £17, with delay figures coming from LCAP. The incident lasted four days and data for this period has been compared with an average four day period. Applying the same parameters to an average yearly journey time profile and flow, it is estimated that had the works taken place at a normal time of year, over the same length of time, the cost of the delay would have been more in the order of £56,000.

Table 32: Estimated financial benefit of the Seven Sisters Road works taking place over Christmas period

Estimated impact of Seven Sisters Road works			
	Average 4 day period	**27 Dec 2012 to 30 Dec 2012**	**Benefit of works taking place over Christmas period**
Impact	£56,000	£29,000	-48%

This assumes that the works would have taken the same amount of time, and would have had the same negative impact on journey times. It should be noted however that the data available only enables a journey time and a cost analysis on vehicles using Seven Sisters Road. It is likely that the closure would have also affected local roads in the Finsbury Park area and beyond. Furthermore, it is thought that drivers may have taken alternative routes and so they too may have experienced longer journey times. Given this, the estimated cost of the closure to the wider network is likely to be higher than the numbers in Table 32, however, the benefit of the works taking place over the Christmas period would still likely be around 48% in this instance.

vi. Seven Sisters Road / Finsbury Park Summary

This case study shows the benefits to the network of carrying out works at times when traffic volumes are significantly lower than normal. Journey times were as much as 70% worse in the PM peak, and JTR was 50% worse in the AM peak. Given that the volume of vehicles on the road was significantly less over this period it is fair to say that the works would have had a much worse effect had they been carried out at a busier time of year. Table 32 shows that by carrying the works out at a less busy time of year, the cost of the delay caused by the disruption was 48% less than what it would have been in normal traffic conditions.

This highlights TfL’s flexibility in being accommodating with regards to the TLRS, by being willing to waive the charges associated with working at peak times so that the works could take place over a quieter period and thus being less disruptive, as well as a good level of cooperation from the utility company, Thames Water, by going the extra mile in terms of how and when the works took place.

D. Case Studies Summary

The Bishopsgate case study exhibits how the TLRS could have been beneficial in improving both journey times and JTR in peak times in a relatively busy area. In addition, it has shown how the overall number of carriageway impacting works taking place there and the average duration of these works has reduced. This could be attributed to less work taking place during peak hours as a result of the TLRS, a change in promoter behaviour in order to avoid occupying the carriageway in chargeable hours and more efficient working practices in order to occupy the carriageway for the minimum possible time. In addition, when comparing two similar works, one before and one after the implementation of the TLRS, it was seen that the works after the implementation had less of a negative impact on journey times and JTR.

The Greenford Flyover and Seven Sisters case studies demonstrated that TfL can be extremely flexible with regards to waiving TLRS charges for both TfL and utility companies in order to reduce the negative impact of certain roadworks as much as possible. By waiving the charges, these particular works were able to take place over the Christmas period, where traffic volumes are significantly lower. The case studies showed that, even though the works caused considerable disruption and cost, there would never have been a good time for them to take place, and by managing them in this way the cost, disruption and effect on journey times was substantially lower than what it would have been at any other time of the year.

Overall, these case studies indicate that during the first year of its operation, the TLRS has had a positive impact on improving journey times and JTR, reducing the number of works taking place in the carriageway and the duration of these works, and minimising the cost of disruption when major works have taken place.

Annex 2: Financial Summary

Table 33: Financial Summary

£m	1 Apr 2013 - 15-Sep-13	1 Apr 2012 - 31-Mar-13
Income	1.4	1.9
Scheme implementation & running costs	(0.6)	(1.6)
Net income from street works	0.8	0.3
Opening reserve	0.3	-
Net income from street works	0.8	0.3
Closing reserve	1.1	0.3