

## Air Quality

- i. Air quality has been monitored along the corridor and in surrounding streets by diffusion tubes, automatic air quality monitoring stations and AQ Mesh monitors over several years. Some sites have been surveyed since 2010 with additional sites introduced more recently. Diffusion tube data is preferred in this analysis because of proximity to the corridor, the practicality of this method for measuring ambient NO<sub>2</sub> and the improved data continuity of this method in comparison with others such as AQ Mesh monitors.
- ii. Sites within the area that have monitored for a period of more than 12 months (to allow for seasonal variation) with diffusion tubes have been used to assess the current conditions for air quality within the area (see Figure 1 below).

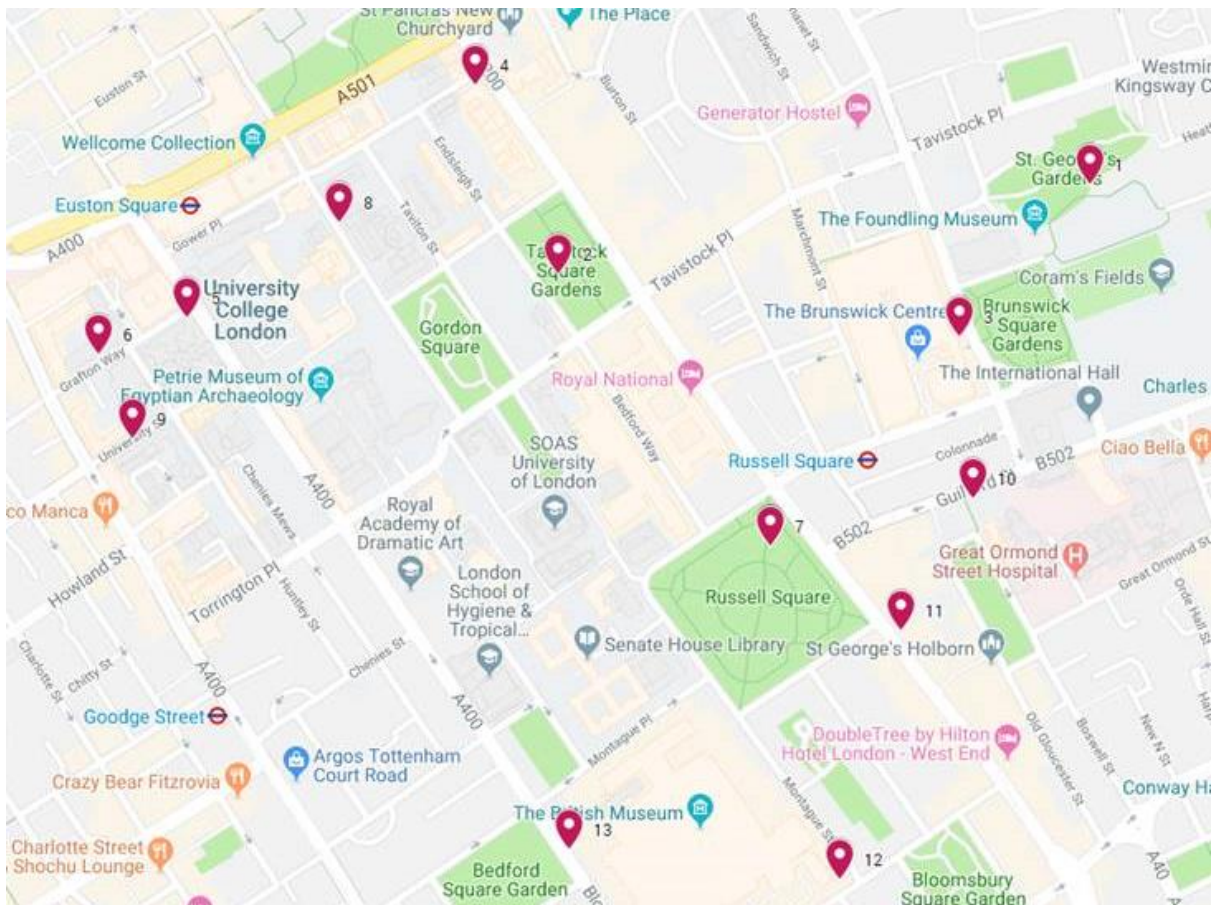


Figure 1 Diffusion tube monitoring station locations

- iii. Diffusion tube data is generally reported as an annual mean NO<sub>2</sub> concentration calculated from 12 separate month-average values. Because the most recent 12 months' of data from the various monitoring locations in Figure 1 includes part of both 2017 and 2018, it is necessary to adjust the 2018 month-averages to represent 2017 months so that the 2017/2018 dataset in Table 1 below can be reported as a 'proxy' for a 2017 annual mean concentration. The 2018 months are adjusted using 'roadside projection factors' provided by Defra, which account for general changes in traffic activity and emission factors for NO<sub>2</sub>. By adjusting from 2018 to 2017 this effectively increases the reported NO<sub>2</sub> concentration and produces a 'high-end' estimate of 2017 annual mean concentration.
  
- iv. For diffusion tube monitoring sites where there are fewer than nine month-average values within a 12-month period, it is also necessary to 'annualise' the data to take account of seasonal variability. This is done by comparing the available diffusion tube data to one or more nearby continuous NO<sub>2</sub> monitoring 'urban background' sites and applying an adjustment factor depending upon the observed seasonal variation.
  
- v. Finally, all diffusion tube data is 'bias adjusted' which counteracts tendencies in particular laboratory analysis methods to overestimate or underestimate diffusion tube NO<sub>2</sub> concentrations. These factors are produced annually for each analytical laboratory and are published by Defra. The 2017 bias adjustment factor (0.96 for Gradko diffusion tubes using 50% TEA in acetone, and 0.87 for Gradko diffusion tubes using 20% TEA in de-ionised water) has been applied when calculating the adjusted annual mean concentrations as described above and set out in Table 1.

| Map ID | Location                                             | µg/m <sup>3</sup> |
|--------|------------------------------------------------------|-------------------|
| 1      | LB Camden St. George's Gardens                       | 31.0              |
| 2      | LB Camden Tavistock Square Gardens                   | 44.1              |
| 3      | Brunswick Square                                     | 43.6              |
| 4      | Junction of Endsleigh Gardens and Upper Woburn Place | 56.2              |
| 5      | Junction of Gower Street and Grafton Way             | 47.3              |
| 6      | Grafton Way                                          | 47.5              |
| 7      | Russell Square (HS2 triplicate)                      | 38.3              |
| 8      | Gordon Street                                        | 43.6              |
| 9      | University Street                                    | 41.5              |
| 10     | Great Ormond Street Hospital                         | 45.7              |
| 11     | Southampton Row                                      | 53.9              |
| 12     | Great Russell Street/Montague Street                 | 54.6              |
| 13     | Bloomsbury Street                                    | 53.2              |
| 14     | Russell Square (OSE triplicate)                      | 37.4              |

*Table 1 Proxy diffusion tube data 2017/18*

- vi. It can be seen from Table 1 that of the 14 sites monitored, three of the locations demonstrate lower NO<sub>2</sub> concentrations than the EU legal limit of 40µg/m<sup>3</sup>. The remaining 11 sites demonstrate NO<sub>2</sub> concentrations above 40µg/m<sup>3</sup>, seven of which with readings between 40µg/m<sup>3</sup> and 48µg/m<sup>3</sup> and four of which with readings above 48µg/m<sup>3</sup>.
- vii. Survey data from 2010 to 2012 shows the AQ trends in the area (as set out in Table 2 below).

| Monitoring location                                                       | 2010 annual mean ( $\mu\text{g}/\text{m}^3$ ) | 2011/12 average annual mean ( $\mu\text{g}/\text{m}^3$ ) | 2017 annual mean ( $\mu\text{g}/\text{m}^3$ ) | Change 2010 - 2017 | Change 2011/12 - 2017 |
|---------------------------------------------------------------------------|-----------------------------------------------|----------------------------------------------------------|-----------------------------------------------|--------------------|-----------------------|
| St. George's Gardens                                                      | 34.0                                          | 42.5                                                     | 35.2                                          | +3.5%              | -17.1%                |
| Tavistock Square                                                          | 52.0                                          | 43.8                                                     | 46.7                                          | -10.3%             | +6.4%                 |
| <b>Average near scheme</b>                                                | -                                             | -                                                        | -                                             | <b>-3.4%</b>       | <b>-5.3%</b>          |
| Euston Road                                                               | 82.0                                          | 87.6                                                     | 85.8                                          | +4.7%              | -2.0%                 |
| Tottenham Court Road                                                      | 92.0                                          | 87.5                                                     | 74.8                                          | -18.7%             | -14.5%                |
| Bloomsbury Street                                                         | 41.0*                                         | 74.2                                                     | 71.9                                          | 75.4%              | -3.1%                 |
| <b>Average further from scheme</b>                                        | -                                             | -                                                        | -                                             | <b>+20.5%</b>      | <b>-6.5%</b>          |
| <b>Average elsewhere in Camden (eight locations unaffected by scheme)</b> | -                                             | -                                                        | -                                             | <b>-7.2%</b>       | <b>+8.9%</b>          |

\*Bloomsbury 2010 annual mean is likely to be erroneous

Table 2 Diffusion tube air quality data with 2010, 2011 and 2012 comparison

- viii. Analysis of diffusion tube air quality data shows that generally the NO<sub>2</sub> concentrations measured by the diffusion tubes closer to the scheme (not on the corridor itself) experienced a greater reduction from 2010 to 2017 whilst those located further away from the scheme saw an increase. Further analysis, using a more representative baseline (omitting erroneous data observed in the 2010 monitoring) from averaging the annual mean NO<sub>2</sub> concentrations from 2011 and 2012, shows that both the diffusion tubes located close to the scheme and those located further away recorded improvements in air quality. Borough-wide diffusion tube monitoring data shows that NO<sub>2</sub> concentration increased at sites in the north of the borough (those unaffected by the scheme) from the 2011/2012 baseline to 2017, with an average increase of 8.9%. This is in contrast to the average 5.3% reduction in NO<sub>2</sub> concentrations measured close to the corridor and the average 6.5% reduction in the more distant (but still affected) areas, over the same time period.

- ix. In addition to the diffusion tubes (passive monitoring), there is an automatic air quality monitor (continuous monitoring) in Russell Square. Recent data observed at this site suggests an improvement in 2017 when compared to data collected in 2010. Comparing 2017 data with the same average 2011 / 2012 data baseline also confirms that there has been an improvement in the air quality at this location in 2017 compared with data collected prior to the implementation of the trial. Automatic air quality monitoring stations elsewhere in the borough on Euston Road, and in Holborn and Swiss Cottage also showed similar improvements in 2017.
- x. Whilst this analysis primarily focuses on diffusion tube data, it is noted that there are a number of AQ Mesh monitors within the area that are still capable of providing useful data to indicate recent NO<sub>2</sub> concentrations along the corridor and the in surrounding areas. In mid-April 2018, the AQ Mesh at Endsleigh Gardens underwent maintenance to upgrade its NO<sub>2</sub> sensor and was recalibrated against a reference-equivalent NO<sub>2</sub> analyser. From mid-April to early November, the average NO<sub>2</sub> concentration measured by the Endsleigh Gardens AQ Mesh monitor was 39.1µg/m<sup>3</sup>. Whilst this cannot be taken to indicate annual mean NO<sub>2</sub>, it does suggest that NO<sub>2</sub> concentrations on Endsleigh Gardens so far in 2018 are lower than in previous monitoring periods (previous, indicative data shows that month-average NO<sub>2</sub> concentrations were higher than 60µg/m<sup>3</sup> for each month during the June 2016 to July 2017 monitoring period). It should also be noted NO<sub>2</sub> concentrations are generally lower in the summer months.
- xi. To give a broader understanding of the air quality in the surrounding area, diffusion tube monitoring at an additional 14 sites were installed in August 2018 as part of the Torrington Place / Tavistock Place scheme. Three diffusion tubes were installed at each of the sites to account for possible erroneous data where it is envisaged that the monitoring will continue into January 2020 in line with other monitoring within the area. Further air quality data is also available from other nearby schemes making the area the most monitored in Camden.

