

## CLEAN AIR ZONES PILOT – THE OUTDOOR ENVIRONMENT

As well as increasing biodiversity and absorbing nitrogen, plants can play a role in trapping fine particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) found in the air we breathe. Research by Imperial College London indicates that plants with small leaves (which disrupt the flow of air) and fine hairs on their surface work best; however, leaves which cover a large surface or are grooved also provide surfaces upon which particles can be trapped. It is therefore thought that to help improve air quality, trees and plants which have these characteristics can be planted.

### WHAT COULD BE DONE?

- ❖ Installation of green screens (pre-grown hedges/screens or plants trained to climb fences) and plants around the school to create 'air quality gardens' which can trap PM<sub>10</sub> and NO<sub>2</sub>
- ❖ Air quality monitoring before and after the installation to see the effect of planting and for the monitoring results to be used as a pupil engagement tool
- ❖ Outdoor air quality engagement projects such as monitoring, planting and designing signs to raise awareness regarding air quality matters (see The Learning Environment)

### CASE STUDIES

#### BOTWELL HOUSE RC PRIMARY SCHOOL, HAYES

- ☞ **NO<sub>2</sub> Monitoring** - Air quality modelling data from CERC indicated nitrogen dioxide (NO<sub>2</sub>) levels at the school are over the EU limit value. NOx tubes were used to monitor the air quality on Botwell Lane and at the boundary of the infants' playground; this monitoring is ongoing



- ☞ **Green screen** - a mature hedge was planted at the front of the school along the stretch of the infants' playground, adjacent to a busy main road and near a junction. Available monitoring data indicates green screens reduce PM<sub>10</sub> levels compared to roadside levels and whilst Hillingdon does not have PM<sub>10</sub> levels above the EU limit value, no level of PM is considered *safe*.

☞ **Green screen and planters** - A planted 'quiet area' was created in the rear playground, to replace the previous one that would be lost as part of the school redeveloped. Climbing plants, including *ivy* and *Virginia creeper*, were planted in the quiet area along the fence line adjacent to residential garages and creates an attractive green screen. Lost seating was replaced and the greening included raised planters with 'air quality' plants such as *lamb's ear* and *wild geranium*.

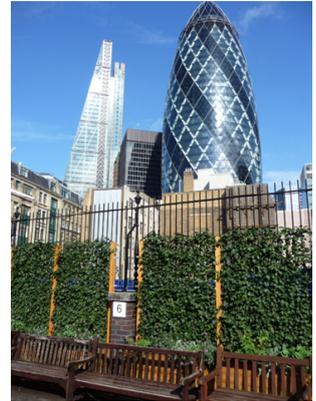


**WHAT WAS THE OUTCOME:** Monitoring data collected indicates the NO<sub>2</sub> annual mean may just exceed at the roadside, although it is likely to drop a little under the limit value by the boundary to the infants' playground. The EU limit value (NO<sub>2</sub> annual mean) is set for the facade of buildings with a sensitive use and the results indicate it is unlikely the EU limit value will be exceeded at the school building. It is hoped the hedge adjacent to the main road and the green screen in the rear playground will be effective in reducing the PM reaching the playground once they have fully matured. Once it fully grown, the hedge will have the additional benefit of providing some visual screening to the infants' playground. The 'quiet area' provides much needed greening for the school and an attractive environment for the children to learn about air quality and enjoy.

## SIR JOHN CASS'S FOUNDATION PRIMARY SCHOOL, CITY OF LONDON

☞ **Monitoring and Alerting** - The school already had a continuous air quality monitoring system, but the Clean Air Zones project allowed a diffusion tube monitoring network to be set up in the school. The pupils are also able to use the results to look at how levels vary in and around the school. Additional particulate monitoring equipment was also installed in the front playground to look at the effects of changes to the road system outside the school. An air quality reporting and alerting system was established and using the Defra Daily Air Quality Index, the school are notified when pollution is predicted to be moderate or above.

☞ **Planting:** 45m<sup>2</sup> of pre-grown green ivy screens were installed in the rear playground and roof garden. Pupils also planted 170 'air quality' plants with the help of a local community group. Six mobile green ivy screens with chalkboards were made to create unique play areas within the playground. In addition, the shed roofs in the front and rear playground had sedum roofs containing *succulents* installed.



**WHAT WAS THE OUTCOME:** The screening in the back playground has turned a concrete, unwelcoming



area into a green vibrant space which is engaging for the children. The mobile screens are used in the front playground to create a unique sheltered space for the children to play and plant vegetables. Monitoring as part of the wider project indicates that greening improves air quality and with monitoring at the school demonstrating that the NO<sub>2</sub> annual mean EU limit value is exceeded, it is hoped that simple greening measures will help with improvements and raise awareness. Monitoring

will continue, providing data for the alerting system, for the children to use and for the effectiveness of the planting and road changes outside the school to be monitored.

## OXFORD GARDENS SCHOOL AND ST CUTHBERTS WITH ST MATTHIAS, KENSINGTON AND CHELSEA

☞ **Green Screen Installation** - *Oxford Gardens School:* An elevated series of pre-grown green screens were installed to a wall in the rear playground, adjacent to the Westway dual carriageway (A40), an area where NO<sub>2</sub> is shown to exceed the EU limit values. PM<sub>10</sub> is also in high concentrations around major road sources.



*St Cuthberts with St Matthias:* A 51 metre pre-grown green screen was installed to a wall in the front playground area adjacent to a busy road where NO<sub>2</sub> has been shown to exceed the EU limit values and roadside levels of PM<sub>10</sub> have been shown to be high. The green screens comprised of built-in benching and a drip feed irrigation system to ensure appropriate plant maintenance. Plant species within the green screen were selected for their air quality improvement properties.



A planter bed was also installed to the rear playground area to facilitate the teaching of planting and the benefits of certain plant species to the reduction of air pollutants.

☞ **Monitoring-** At *St Cuthberts with St Matthias* school a temporary (12 months) air quality monitoring station was installed into the school playground with continuous NO<sub>x</sub> and PM<sub>10</sub> monitors positioned either side of a green screen located between the school playground and

busy roadside location. Results from the monitoring station were used in teaching sessions to demonstrate how effective the green screens were at reducing NO<sub>2</sub> and PM levels in the school playground environment.

At *Oxford gardens school*, NO<sub>2</sub> diffusion tubes were deployed by the children during a practical exercise followed by the collection of tubes and analysis of results. Sample location maps were created and graphs of results used to demonstrate changes in NO<sub>2</sub> in the local environment.

- ☞ **Surface wipe test** - A surface wipe test experiment was undertaken in a practical exercise to demonstrate PM<sub>10</sub> and PM<sub>2.5</sub> air pollution. The exercise was used to demonstrate the difference between particulate pollution at roadside locations in comparison to locations away from roadside locations. A traffic count was undertaken to demonstrate the volume of traffic along the busy road outside the school and the different types of vehicles contributing the poor air quality.
- ☞ **Gardening Sessions** - To continue the legacy of air pollution teaching, existing gardening sessions run at St Cuthbert with St Matthias school will use the green screen installation and planter beds and plants with air pollutant trapping properties to explain what air pollution is and demonstrate how plants can be used to improve local air quality.

**WHAT WAS THE OUTCOME:** The creation of an aesthetically pleasing environment with the addition of plant species with NO<sub>2</sub> absorption and particle trapping, air quality improving properties. Transformation of a bare stark tarmac and brick playground area into a green area with benching and planter bed space to facilitate a continued legacy of air pollution teaching.

## ACTION PLANS

### Green screen benefits claimed

Monitoring of pollutants near a playground suggests a green screen may be reducing pollution.

A green screen was installed on the boundary wall along the Warwick Road at St Cuthbert with St Matthias Primary School in Kensington and Chelsea.

This is one of the busiest and most congested roads in the borough and has been identified as an area that has high background levels of NO<sub>2</sub> and PM<sub>10</sub> pollution.

A temporary air quality monitoring station was also installed into the school comprising two NO<sub>2</sub> analysers and two PM analysers. The analysers have provided concentration data for NO<sub>2</sub> and PM on the road side of the green screen and the



Before and after: the green screen is being monitored

playground side of the green screen installation.

The monitoring so far has shown early indications that the concentrations of NO<sub>2</sub> and PM on the playground side of the green screen are “markedly” lower than concentrations on the road side of the green screen.

An air quality education programme was also designed and delivered to year 5 and 6

pupils within the school in conjunction with the installation of the green infrastructure and monitoring station.

The project was funded by the GLA receiving funding through INTERREG IVB, the Royal Borough of Kensington and Chelsea Council and Defra and was run in collaboration with King's College London and the Transport Research Laboratory.

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and planter bed space to facilitate a continued legacy of air pollution teaching.

The 12 month monitoring programme enabled the scientific assessment of the effectiveness of the green installation to reduce local air pollution in a school environment. Results were presented in a poster presentation at the AAMG Monitoring Ambient Air 2014 conference and a research paper produced to promote the benefits of greening to the wider scientific community.

Articles were also published in the Air Quality Bulletin in

October 2014 and January 2015. Once the green screen foliage had matured the difference between the roadside and playground side of the screen was 35% for NO<sub>2</sub> and 30-40% for PM<sub>10</sub>.

<i>Do's</i>	<i>Don'ts</i>
<ul style="list-style-type: none"> <li>✓ ensure the screening is located where it will be of most benefit, including for non-air quality reasons</li> <li>✓ ensure the planting is attractive, and includes 'air quality' plants which can be used to educate children about air quality</li> <li>✓ as tailored planting will be required, do undertake a site visit with green infrastructure contractors and site maintenance staff and school representatives at the design stage to assess suitability</li> <li>✓ ensure that the plant species selected to make up the green infrastructure have known NO<sub>2</sub> absorption and particle trapping properties</li> <li>✓ seek permissions from all levels of the school such as head teacher, diocese, school/parent governors</li> <li>✓ identify water and electrical sources early on in programme of works and decide with the school the best solution to the provision of water for the planting</li> <li>✓ include a minimum of 12 months green infrastructure maintenance into the contract for the installers, to include cut back, soil fertilising and irrigation system servicing and ensure the school agree (at the design stage) to take on the work after this time</li> <li>✓ ensure adequate parking is available for the green infrastructure installer vehicles and ask for low emission, if possible</li> <li>✓ work closely with school site maintenance staff and teachers to schedule the green infrastructure installation during school holidays or when children are least present</li> <li>✓ ensure the green installation is a manageable size and design for the school to be able to maintain</li> <li>✓ compile a green infrastructure care plan for the school to follow when they take over the maintenance programme</li> </ul>	<ul style="list-style-type: none"> <li>✗ Don't implement a greening scheme without ensuring the school is able to maintain it in the long term</li> <li>✗ Don't forget to check if it is feasible to plant straight into the ground, where a suitable depth of soil is available or can be created</li> <li>✗ Do not forget to check with the planning department (and others, e.g. Building Control) whether permissions are required for the intended installation</li> <li>✗ Do not forget to keep school site maintenance staff updated of changes to the installation schedule / design</li> <li>✗ Do not forget to ensure the school site maintenance staff are available during installation works to assist with any queries</li> <li>✗ Do not forget to keep the school children informed of the proposed installation through updates in the school newsletter and by teachers at whole of school assemblies</li> <li>✗ Do not forget to maintain contact with the school after installation is complete to assist with any queries, problems or alterations</li> <li>✗ Don't forget to get the relevant health and safety documentation and insurance information from the installers</li> <li>✗ Don't forget to get a competent person to pre-approve installations where there are potential structural and weight restriction issues e.g. roof garden additions or sedum roof tile installation</li> <li>✗ Don't forget to engage the children with the installation design, where possible, and advertise the work conducted</li> </ul>