Environmental considerations in street design, 11th February 2014

Speakers at the event outlined current thinking on rainwater management, urban microclimates and air/noise pollution, which they illustrated with best practice case studies focusing on design, construction and maintenance. Later, industry experts gave a live demonstration of the latest sustainable option for street lighting - LEDs controlled by a central management system (or CMS). This technology is being adopted by TfL and is already used by a number of London boroughs.

Presentation summaries:

1. Why Good Environmental Design is Important & Challenges in Achieving It
   Giovanni Nacci, Environmental Manager, TfL

   In his job, Giovanni encourages projects that reduce carbon footprint, air pollution and transport related noise and vibration. He also seeks to enhance the natural environment while reducing waste and resource consumption. It can be difficult to successfully embed these sustainability principles in London’s built environment. He attributed this to the dominance of an anthropocentric worldview privileging human activity (see above)

   Modern urban planning originated from the need to improve polluted cities for slum-dwellers in the industrial revolution, but the discipline’s link to the environment has since disappeared. This should be acknowledged and the link re-established. However, cities today are extremely complex. Giovanni identified and explained various ‘urban dimensions’ that must always be considered. These included cultural characteristics, available technical expertise, the local political context and others.

   He stressed the importance of setting environmental objectives early as costs increase if they are added later. Crucially, he believes that sustainability often suffers due to practitioners’ failure to engage with environmental perspectives at the design stage rather than unavoidable financial and programme constraints (ie. because it is too impractical or expensive). Sustainability should be a core concern
of any project from the outset. To achieve this, we should think of cities like ecosystems - sets of complex interlinkages in which everything is connected to everything else.

2. Managing Surface Water  
Derek Drew-Smith, Flood and Surface Water Manager, LB Haringey

Derek also supported an approach based on intervening early in his presentation on water sensitive urban design and sustainable surface water management. London’s current drainage system is not fit for purpose and suffers from a longstanding lack of innovation. Derek illustrated this by highlighting the progression of motorcars to today’s energy efficient, hybrid models. In the same period, drains have remained essentially Victorian except for transitioning from brick to concrete. Currently, drainage involves no treatment; water is attenuated or detained before diversion elsewhere but no hydrocarbons, turbidity or silts are removed during its journey. Drainage networks also carry a finite volume of water and are under pressure caused by climate change, urbanization and urban creep. Rainfall is increasing and development increases surface runoff.

Sustainable Drainage Systems (SuDS) are the best response and use measures like ponds, green roofs and block paving with nodular sides to create gaps for infiltration. However, developers currently prefer cheap underground tanks that simply store water to delay its return to the drainage system. Derek drew attention to two particularly innovative measures - porous resin bound aggregates for surfacing (although these are unsuitable for roads) and underground filter drains, which begin water treatment on site (see above). He encouraged attendees to visit www.susdrain.org

Under the Flood and Water Management Act 2010, local authorities will soon become SuDS Approving Bodies. They will review and approve drainage plans for development sites before any construction can start. This requirement is expected in Autumn 2014 and will be separate from planning permission. Derek explained the key legislation that relates to SuDS:
- **Flood Risk Regulations 2009**
  - Transposed Directive 2007/60/EC of the European Parliament, which aims to provide a consistent approach to flood risk management across the EU
  - this requires publication every 6 years of Preliminary Flood Risk Assessments (PFRAs) [now available from here], Hazard and Risk Maps [now available here] and Flood Risk Management Plans (due for publication by 22nd December 2015)

- **Flood Water Management Act 2010**
  - implemented recommendations from the Pitt Review 2008 [available here]
  - designated London Boroughs, Unitary Authorities and County Councils as Lead Local Flood Authorities (LLFAs) for their municipal areas

- **LLFAs must:**
  - act as SuDS approval bodies
  - communicate and co-operate with the relevant external organisations to prevent flooding
  - publish a Surface Water Management Plan and Flood Risk Management Strategy
  - investigate floods and maintain a register of events
  - maintain a register of local flood risk management structures
  - produce action plans for critical drainage areas
  - manage ordinary watercourse consenting (such as where water companies want to exploit a river)
  - they also now have power to designate features of the built environment as essential for flood resilience so that they cannot be removed

- **EU Water Framework Directive 2003**
  - obligated EU member states to aim for good chemical and ecological status of all inland and coastal waters by 2015
  - this includes promoting sustainable use of water, reducing water pollution and safeguarding aquatic ecosystems
  - the duty for compliance for this rests with the Environment Agency and LLFAs must assist them in achieving compliance

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3. **The SuDS Manual; Design Details & Case Studies**

*Owen Davies, Flood Risk Manager, LB Greenwich and LoDEG*

London Drainage Engineers Group (LoDEG) was created in January 2012 and will soon publish guidance for all London boroughs (and TfL) on drainage challenges caused by soil, utilities/obstructions, density and pollution. This document is due in April 2014 (draft). It will also form part of a SuDS manual published by the Construction Industry Research and Information Association (CIRIA) in Spring 2015, which will explain the benefits of SuDS in the hope of increasing uptake amongst built environment professionals.

LoDEG is also developing FloodStation, a drainage asset management system and London-wide flood register. The system will record information about assets, maintenance requirements, critical infrastructure and flood incidents. It will contribute to the evidence base for SuDS’ potential impact and act as a tool to help quantify savings. FloodStation will be available from March 2014.
Owen explained that SuDS has multiple cost benefits (including reduced energy use, reduced water treatment, reduced spending on flood damage). LoDEG wants to publicize these to assist with funding bids. He also shared his experiences of implementing SuDS principles in a number of street schemes, many of which reinstated grassy verges or rain gardens in the pavement. He argued that this is achievable with common, inexpensive materials and that concerns about maintenance, especially litter and dog excrement, are overhyped. He also presented the results of mathematical models from three of the sites, which showed that runoff was massively reduced and attenuation had increased, often to 100%. This improved drainage during storm events, saving millions of pounds.

4. Sustainable Road Construction
Herbert Micallef, Senior Technical Specialist, TfL

Herbert gave a presentation on the asphalt used for London’s roads. Most UK roads are surfaced with close graded (or ‘dense macadam’) asphalt. This is a tight aggregate mass held together by bitumen binder. It has low porosity of less than 3%. Herbert questioned whether it was time to re-examine this and turn to open graded (or ‘porous’) asphalt, which has porosity of 20 - 25%. Porous asphalt seems like an attractive option; the lower density aggregate leaves tiny gaps in the surface that let in water, sound and light. This reduces spray, glare and noise pollution. It also improves drainage by reducing runoff. Porous asphalt has lower rolling resistance and higher skid resistance, which saves petrol, reduces emissions, and prevents accidents. It is used extensively in continental Europe.

However, porous asphalt has disadvantages. It is more prone to create ice meaning that it requires more salting in winter. It also loses porosity over time as it fills with debris, which hardens and expands inside. This can cause it to age rapidly through stripping. For example, porous asphalt at Newbury Bypass lasted only 6 months. Herbert has selected a section of the A127 dual carriageway to test 6 asphalts of varying density over the next 4 years. The noise levels, skid resistance and ageing/stripping of each will be periodically measured.

He is optimistic that a porous, low noise asphalt and concrete compound will prove more durable than expected and could provide a more sustainable option for resurfacing London’s roads in future. However, he believes it is unlikely that a long-term solution will come from tinkering with the design of close graded asphalt, which was not invented with porosity or noise reduction in mind. Herbert argued for value engineering principles to be applied to road surfacing with alternative asphalts used where they are appropriate for specific requirements. Expensive new super asphalts created by polymer modification may be economical for certain sites due to their long-term resilience. Materials should be selected on a case-by-case basis rather than the blanket approach currently applied to ease maintenance.

He also suggested that CO2 emissions from transportation and production of asphalt could be reduced if authorities sought to buy back their own planings in recycled asphalt made locally. It is likely that contractors already re-use planings taken up
from London roads during highway maintenance as aggregate elsewhere, thereby profiting.

5. Green Walls: design, construction and maintenance
Mark Laurence, Mark Laurence Design

Mark emphasized that green walls provide ‘ecosystem services’ as well as being aesthetically attractive. He acknowledged that the majority built at the moment are included in developments for aesthetic reasons but argued this should change due to the range of sustainability benefits that green walls can provide. 80% of the world’s population will live in urban areas by 2050 and studies have demonstrated strong psychological benefits associated with nature and greenery. In this context, the biggest available surface for urban greening is the vertical.

Green walls on glass buildings can reduce air conditioning bills by providing shade in summer and reduce heating bills by providing thermo-insulation in winter. They also absorb sound, which is often amplified as it echoes around urban ‘canyons’ created by tall buildings. Mark suggested that green walls help to mediate the urban heat island effect and contribute to the battle against climate change. TfL took an interest in the potential of green walls to counteract air pollution and has constructed a large green wall at Edgware Road (see photo). Mark explained that as a rule of thumb, smaller and hairier leaves are the best at absorbing particulate matter from the air. Unfortunately, it is difficult to judge the wall’s success in this regard as measurements were taken solely at the base rather than all the way up. Despite this, green walls in Germany and elsewhere have been shown to reduce particulate air pollution significantly.
Mark explained the technology behind green walls and acknowledged that it needs to get simpler and cheaper in order to achieve greater popularity. He suggested that green walls will eventually help move buildings to a cyclical water system that re-uses the majority of water on site. His presentation also raised interesting questions around native plant species and greenwashing. Currently, the only contribution a green wall can make to a Building Research Establishment Environmental Assessment Methodology (BREEAM) score is if native plant species are included. Mark questioned this, as he believes green walls should exploit the urban heat island effect and utilize more warm weather species. In addition, because developers are sometimes keen to build green walls for purely aesthetic reasons, there is danger that they become part of greenwashing. They should not be accepted as a substitute for more mature and effective sustainability measures.

6. Street Trees
John Parker, Arboriculture & Landscape Manager, TfL

John's two main points were that it is important to involve an arboricultural specialist in any development decision related to trees and that tree aftercare tends to be neglected. Problems that are costly to sort out could usually have been dealt with easily and cheaply if they had been identified earlier by a qualified professional. For example, unwanted young branches can be removed with secateurs rather than taking a chainsaw to more mature branches. Like Mark Laurence, he alluded to the possibility of planting species from warmer climates, citing the example of olive trees, which could thrive in London.

John talked about the appropriateness of certain tree species for certain places and the best locations for street trees. He explained that planting in the central reservation has become a popular choice but is shortsighted as it means roads must be closed once a year for cutting. He showed examples of poorly located trees and repeated that it is better to seek advice from a tree officer as soon as possible. He also pointed out that trees are often forgotten immediately after planting. Some are even killed by plastic ties that were initially protecting their growth. TfL has a robust inspection regime that enables problems to be identified early.
The surface material of a tree pit is very important. Ideally it will stop competing vegetation growing close to the roots, allow water and air in, and provide protection from animals and humans - bark mulch and unbound gravel are very good. John showed examples of best practice from abroad and of poor tree pit surfacing that he has encountered during his career, which included concrete and corduroy paving directly over roots. Porous resin bound aggregates are also sometimes used but John warned that these can quickly fill with debris, cutting off the moisture and oxygen supply. In closing John invited contributions and comments for a guidance document on tree pit surface materials that is being written by the London Tree Officers Association.

7. Energy Efficiency Planning
Daren Horobin, Senior Technical Specialist, TfL
8. Central Management System for Lighting
James Quinn, Harvard Engineering
9. Innovations in LED technology
Graham Skinner and Paul Carter, CU Phosco Lighting

The afternoon focused on LED street lighting, which is being rolled out as part of TfL’s Surface Transport Energy Efficiency Plan. Currently, TfL’s transport network is lit by high intensity discharge sodium lamps, which are less efficient than LEDs. Sodium lamps have a life span of approximately 3 years after which they have to be replaced whereas LED life expectancy is approximately 50,000 hours (over 12 years). The light emitted by LEDs is also whiter and clearer with less glare. LED light is easier to see due to better colour rendering and gives out more lumens (brightness) per watt (lm/w). As a result it is cost efficient as well as energy efficient. TfL are replacing around 25,000 sodium lamps with LEDs over the next 3 years, which should save £1.6m per year from 2016. This will also help to reduce greenhouse gas emissions in line with the Climate Change Act 2008 and the Mayor of London’s transport strategy.

The LEDs will be controlled by a Central Management System (CMS), an IT system that enables remote management of each individual lighting point or groups of lighting points. This will enable brightening and dimming. Street conditions will also be profiled and light deployed accordingly. The British Standard for road lighting was revised and lowered in December 2012 in acknowledgement of the need to save
energy and the development of new technologies such as LEDs and Central Management Systems. Additionally, public perceptions surveys indicate there is almost no public reaction to reductions in street lighting of up to 50% after LEDs have been installed. The new system will facilitate adaptive lighting and hopefully reduce crime and road accidents. For example, it will allow for visibility to be increased temporarily at road accident sites and in town centres when pubs and clubs close. Going forward, accident and crime statistics will continue to inform future lighting strategy.

Savings from the switch to LEDs will help TfL to pay the new CRC Energy Efficiency Scheme, a carbon tax designed to encourage large public and private sector organisations to reduce their carbon dioxide (CO2) emissions. From April 2014, this will charge £16 per tonne. Energy prices are also predicted to rise by at least 10% by summer 2016. TfL has awarded a contract to Harvard Engineering to install a CMS and will procure 35,000 LED street lamps made by CU Phosco Lighting. The companies gave a demonstration of the lights and control system, which showed the pleasantness of LED light and how a command sent via GPS to a lamp works almost instantaneously. This technology is already in use in Westminster, Barnet & Enfield, Luton and Barking & Dagenham. Attendees were very interested in the technology. They asked questions about the practicalities of installing it in their boroughs and the possibility of powering LEDs with solar panels.

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Disclaimer: Informal intern notes. Any errors and omissions are my own. Please email any corrections to gavinmclaughlin@tfl.gov.uk.