The importance of keeping tunnels clean

Road tunnels play a major role in the highways network and cleaning is essential to ensure lighting levels remain efficient and road safety is not compromised. Andrew Back, managing director of Avondale Environmental Services, looks at the reasons why tunnels need to be washed

Few, if any, motorists take notice of tunnels; their prime objective is to get to the other end as quickly and safely as possible and fewer still reflect on the construction and maintenance that is required to keep them at the right standard.

A high standard of lighting is a priority: too bright, and the lamps or lights may dazzle or distract drivers; too dim, and the tunnel can seem claustrophobic and daunting, as well as increase dangers from obstructions and other hazards. The solution, which is designed-in by the architect and civil engineer, is to use the walls of the tunnel to reflect artificial light and create a 'false' ambient lighting effect.

Reflectivity uses all surfaces of the tunnel, including the roadway, but by far the most important are the walls, which is a reason for painting them in light colours and keeping them clean. Highways England calls for a minimum LUX lighting level of reflectivity of 0.6 on the walls, which must be at least four metres high. Reflectivity on the roof can be 0.3.

The interior surfaces of the tunnel are exposed to pollutants including: carbon monoxide, diesel smoke, particulates, oxides of nitrogen, sulphur dioxide, hydrocarbons, cadmium, chromium and even arsenic that build up and solidify over time. This patina of grime coats all surfaces greatly reducing their ability to reflect light and hence reduce light levels. In addition, these corrosive, toxic and flammable deposits combine with dust, road salts and other contaminants to make routine inspections and maintenance difficult and hazardous.

On open roads, street lamps are at their brightest when it is darkest; in tunnels the opposite is true. Motorists' eyes must adjust to the dark and therefore at the entrance and exit to the tunnel lighting is at its brightest, diminishing in intensity as the tunnel progresses. Anything that compromises this clever engineering in turn compromises road safety.

A clean comparison

G. Stotz and Ch. Holldorb's paper to the 11th International Conference on Urban Drainage in 2008 compared the East and West bores of the Engelberg tunnel on the A81. One bore was washed with clean water and the other using a cleaning agent (detergent) to improve the efficiency of the brushes. The runoffs from both bores were analysed and not surprisingly the detergent enhanced runoff contained higher concentrations of pollutants leading the authors to conclude that detergents should be avoided to prevent the wash from polluting the general drainage systems. However, unfortunately this means the tunnel surfaces should be washed more frequently to make it easier to keep clean and maintain the levels of reflectivity.

The frequency of washes should be driven by the time available to deliver an efficient clean in one operation. If too much grime is allowed to build up then one cleaning pass may not do the job leading to a requirement for more time. This interval will be determined by the throughput of traffic, length of the tunnel and efficiency of the ventilation systems amongst other factors.

What is required is an efficient frequent cleaning service using high technology to create a purpose-designed procedure that can provide a fast and productive cleaning operation reducing tunnel closure downtime and inconvenience to motorists.

Not only does frequent cleaning maintain lighting levels at an optimum it also helps to prolong structural life.

Prolonging structural benefits is only part of the big picture. Millions of pounds are spent creating tunnels and inner-city underpasses of stature and character featuring decorative murals and frieze to make a tunnel individual and attractive. However the desired effect is soon hidden by a film of dirt and grease from a constant flow of heavy traffic building up deposits very quickly. If the tunnel is not cleaned frequently then the wall staining will not be suppressed allowing it to get increasingly worse, reducing the reflectivity of all the tunnel surfaces and the appearance of any art works.

Road tunnels and underpasses are significantly more than uninviting holes in the ground: they are vital components of a busy highways network. If that light at the end of the tunnel is brighter then the designer's walls, then light reflections are simply not working safely and efficiently.