RETEXTURING TO RESTORE SKID RESISTANCE

Phil Mason Chartered Engineer makes the case for retexturing methods as a sustainable solution to restoring skid-resistance

With the setting up of the Road Safety Authority (RSA) in 2006, Ireland has seen significant improvements in tackling its road safety performance. In a recent report, published by the Brussels-based European Transport Safety Council (ETSC), Ireland was ranked the sixth safest country out of the 27 EU Member States in terms of road safety. But further challenges undoubtedly lie ahead in maintaining and improving on this position as funding comes under pressure in the current economic downturn.

The work of road safety organisations like the RSA necessarily focuses on the human factors that contribute to road crashes, such as reckless driving, driving under the influence and road safety awareness for children and teenagers.

Equally, the physical condition of the road network has an important role to play in reducing 'loss of control' incidents. Potholes, ruts, broken ironwork and poor surface skid-resistance can add to the risk of a crash, as well as poor layout, inadequate signage, worn road markings, and so on. This places a huge responsibility on road agencies and local authorities to ensure roads are maintained to safe standards.

Key consideration

Keeping road surface skid resistance above investigatory levels is a key consideration for the highways engineer. But budgetary constraints mean that surface treatment work to remedy wet weather skidding is often reactive and focused on crash hotspots. While funding remains a stumbling block, engineers are left to find effective methods of restoring skid

As well as restoring skid-resistance, bush hammering has been found effective in removing hydrocarbon deposits from road sections through tunnels. Photo shows the Pen-Y-Clip tunnel on the A55 in North Wales. Photo courtesay of North Wales Trunk Road Agency.

resistance which will treat more square metres of road surface for the same cost.

Traditionally, overlaying has been the prevalent choice for restoring pavement texture and therefore skid resistance. The application of high friction dressings, either thermoplastic-based screeds or two-part epoxy resins with bauxite, is a well-proven method, effectively creating a brand new surface and fresh skid-resistance.

But, as pressure builds to find more economical solutions to road maintenance with reduced environmental impact and carbon footprint, retexturing methods are now coming to the fore as a sustainable solution to restoring skid-resistance.

Pavement retexturing

In contrast to overlaying, pavement retexturing re-works an existing surface to improve its frictional characteristics and, therefore, skid resistance.

Pavement surface micro-texture, the microscopic roughness of the aggregate surface, interacts with vehicle tyres to generate the required forces to provide friction. In wet conditions, the micro-texture also has to penetrate the film of water, which acts as an additional barrier to contact with the tyre. If not, the risk of wet skid crashes increases, and with it, the risk of injury and fatalities.

At higher speeds (over 64km/hr or 40mph), the larger, visible texture of a pavement – the projections, depression and grooves known as the macro-texture or texture depth – becomes significant as it provides escape paths for surface water from the tyre-pavement contact area to prevent aqua-planing.

There are three main methods for retexturing pavements, listed below, the first two being mechanical. They all work by restoring micro-texture to varying degrees, with some also improving macro-texture:

- impact methods, such as bush hammering and shot blasting, where the surface is pounded by hard tipped tools or particles;
- cutting and flailing, such as diamond grinding and grooving, combining a cutting action and impact on the cutting heads; and,
- fluid action, such as high or ultra-high pressure water jetting.

While there are finer differences between these processes which affect their relative benefits and suitability for different applications, retexturing as a generic approach to restoring skid-resistance offers some distinct advantages.

Reduced environmental impact is a major benefit. Retexturing does not involve the planing off of existing

(Above) Retexturing processes are generally not plant and process-intensive, producing a smaller carbon footprint. Traffic management is less onerous and there is less disruption to motorists.

(Left) The effect of bush hammering treatment on a road surface.

materials. This saves on the spiralling cost of waste disposal, or, where the waste is to be saved for recycling, eliminates the cost and logistics of transport and storage off-site. The process does not use new materials either, saving on the use of finite resources.

In addition, retexturing generally is not plant and material-intensive, producing a smaller carbon footprint. It typically involves a single process to produce the required skid resistance level without the need for subsequent operations to be carried out once sections have been treated. Traffic management is less onerous and there is less disruption to motorists.

Ireland is particularly susceptible to variations in energy prices due to its dependence on imported fossil fuels. So, construction processes that reduce dependence on fuel-powered plant should be more closely considered.

Reducing carbon footprint

With road transport accounting for 97 per cent of Ireland's transport emissions, highway departments can help to alleviate the problem by reducing the carbon footprint of their road construction and maintenance activities

Retexturing does not require any preparation of the road surface, or the raising of ironwork, cats' eyes or kerbs. Once the treatment is carried out, the road is ready for use. There is no lengthy cure time or post-application finishing involved. The elimination or reduction of plant and processes, of materials and energy consumption, and of attendant waste disposal, makes retexturing very viable economically as well as a very sustainable choice.

In terms of pavement condition, the aggregate remains visible with retexturing, so that defects are not masked and skid-resistance values at the surface are not affected by underlying deterioration.

Bush hammering and shot blasting are the more common choice for retexturing in the UK and Europe. The principle of bush hammering, in particular, has lent itself to more variation and sophistication in its application for road surface retexturing.

More advanced systems for road surface bush hammering have been adapted to overcome some of the inherent difficulties and irregularities of typical roads.

Bush hammering plant that provides controlled retexturing typically uses a large series of impact heads that are engineered to adapt to the contour of the road surface – bumps, undulations, ruts – to ensure consistent treatment. This control means that even surfaces with deformation or wheel track rutting can be effectively treated.

The Klaruwtex190 (K190) Controlled Mechanical Retexturing (CMR) Process

The K190 CMR process was designed and engineered by Dutchman, John Klaassen, in the 1980s. It uses tungsten carbide tips mounted on pneumatic bush hammers to improve micro-texture, and, therefore, restores skidding resistance to all natural aggregate surfaces. According to Klaruw RMS which provides direct contracting of the K190 treatment in the UK and now the Republic, surface materials successfully treated include concrete, friction course/porous asphalt, hot rolled asphalt (HRA), Marshall asphalt (including grooved), surface dressing (all aggregate sizes), thin surface course or Stone Mastic Asphalt (SMA).

The 336 independent computer controlled treatment tips are free to rotate and move within their housing, following the pavement surface profile exactly, Klaruw RMS states. Each K190 machine is capable of treating a width of up to 1.90m (75in), working at typical forward speeds of 4.0m (13ft) to 8.0m (26ft) per minute for optimum results, depending upon the surface type. Up to 3,200m or two miles of lane can be treated in a day by two machines working in echelon.

The company says it is quicker than overlaying (completes up to two miles of lane per day), less expensive (about 20 per cent of the sq/m cost of surface replacement) and leaves a far lighter carbon footprint than applied materials (generates less than seven per cent of the CO_2 per lane km of hot laid overlay).

The treatment is well established in Holland and the UK, where more than 15m sq/m of treatment has been carried out on roads, runways, racetracks and even cycle tracks. According to a spokesperson for Klaruw RMS, the process attracted strong interest at the Road Expo exhibition in Dublin earlier this year, leading to enquiries for a number of contracts in Ireland for the company.

Plant that also allows individual working heads to be switched on or off provides the flexibility for full or partial width coverage without the risks associated with double treatment. This allows non-trafficked areas to be left and also ensures white lines, detector loops and other markings can be avoided, saving the cost of their replacement following treatment.

Wet conditions

Bush hammering is not dependent on weather, and can be carried out in wet conditions. Depending on the sophistication of the plant, treatment is usually carried out with simple, progressive 'stop/go' traffic control, with treated sections of road being immediately open to traffic. If an emergency arises, the machines can be removed from the road mid-treatment and then resume work later without affecting the success of the process.

The flexibility and efficiency of the operation ensures that works can be programmed with confidence within tight operational windows and in any season, to reduce delays and disruption.

Answering today's cost and sustainability needs, retexturing, and bush hammering in particular, could make wider, all-year-round programmes of surface skid-resistance work possible for hard-pressed road authorities and councils in Ireland. Φ

Phil Mason, Chartered Engineer, MICE FIHT, has been involved with highways maintenance for practically all of his professional life, from his work as a local authority divisional engineer, including trialling safety innovations for primary route applications, to his current role as technical consultant and manager of the retexturing specialist, Klaruw RMS. As divisional engineer for motorways with Cheshire County Council, he successfully introduced new technologies, such as rolling closures, ribbed edge markings, recycling and proprietary equipment for road surface retexturing to restore skid resistance. He serves on a number of Institution of Highways and Transportation committees and is chair of the Allied Industries Sector of the Road Surface Treatments Association.