The benefits of implementing a network skid resistance policy

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Introduction
In Great Britain there has been significant progress in addressing reported road casualties. Compared to a 1994-98 base line, the 2010 returns indicated that:

- The number killed was 48 per cent lower; The number of reported killed or seriously injured casualties was 49 per cent lower;
- The number of children killed or seriously injured was 64 per cent lower; and
- The slight casualty rate was 32 per cent lower.
- In contrast traffic rose by an estimated 13 per cent over this period.

This is attributed to a combination of Engineering, Enforcement and Education programmes. One aspect of Engineering involves the implementation of a skid resistance policy within national and local highway authorities.

Typical skid resistance policies involve establishing testing regimes, determining desirable levels of skid resistance, a materials policy and an investigation protocol applied to specific sites.

Research has demonstrated that through implementing a skid resistance policy significant reductions in the number of accidents can be achieved. The TRL Molasses project, run during the 1990’s which collates data from UK local authorities, showed the provision of ‘anti skid’ surfaces achieved a 31% reduction in accident numbers.

Regular SCRIM® surveys, together with a skid policy based on the current standards, help authorities achieve and maintain reductions in road casualty rates. Where WDM® has been working in partnership over long periods, notably in New Zealand, there has been a 40% drop in skid related fatalities.

The UK led the world in research and policies that have led to the improvement of skid resistance of roads, overcoming the dual problems of providing skid resistance through appropriate material properties and developing measurement techniques.
This has made it possible to introduce a national policy, setting standards for skid resistance supported by routine monitoring on the most heavily trafficked roads to help reduce accidents and save lives.

**The Economic Benefits of applying a skid policy**

Highway maintenance budgets are under significant pressure and investment needs to be justified through the achievement of social, environmental and economic benefits. A recent ‘before and after’ study undertaken by Cornwall Council in the UK was reported at the 2011 Safer Roads conference.


Using UK standard costs for accident prevention this demonstrated a targeted intervention programme across the network could achieve a benefit cost ratio of 3.2; with greater benefits achievable at high risk sites including approaches to junctions and roundabouts and <100m radius bends. A detailed review of 9 maintenance schemes treated in 2007/08 indicated that the number of accidents occurring on all the sites fell from 36 per year to 24, all accountable to the reduction in wet accidents. A secondary benefit is the number of killed/ seriously injured accidents reduced from 3 per year before to 0.

In economic terms, accounting for the severity of recorded accidents the annual savings were £1.876m, against an expenditure of £0.707m.

**Providing skid resistance**

Skid resistance is a measure of the road surface’s contribution to the friction developed between the tyre and the road. Maintaining this is an important part of the asset management process, but in the final analysis it is the friction available to vehicles in specific conditions that is of primary importance in potential accident situations.

It is widely acknowledged that a road provides skid resistance through a combination of Microtexture and Macrotexture. Figure 1 illustrates the difference between micro and macro texture.
Microtexture refers to the small scale texture on the surface of a stone particle (Figure 1). It is an inherent characteristic of the aggregates and is thus determined by the aggregate source. It is accepted that microtexture controls the amount of skidding resistance available for any road surface.

Macrotexture refers to the large scale texture defined by shape and size of aggregate presented on the road surface (Figure 1). The level of macrotexture (i.e. texture depth) can initially be controlled by the surfacing type selection and further controlled by the mix/dressing design. Macrotexture becomes increasingly important at higher speeds, and plays an important role in ensuring that road/tyre contact is maintained, thus maximising the available skid resistance. Macrotexture is also known as ‘texture depth.’

On ‘in service’ roads it is understood that over time microtexture is influenced by the number and type of vehicles passing over the surface, and climatic influences. Macrotexture also changes over time with embedment of chippings resulting in a reduction, or possibly fretting causing an increase in measured texture depth.

It is therefore important to specify surfacing material/treatments that will provide acceptable levels of skidding resistance for the predicted life of the treatment. This requires monitoring both during construction and also during the life.

The UK practice is through the specification of materials and compliance testing ensure that the newly laid materials are acceptable, and through a regular survey regime to monitor performance through the life of the treatment.

**Skidding resistance measurement**

There are a number of methods for measuring skid resistance of road surfaces. The most widely used in Europe is a Sideways Force technique, and the UK standard; HD28/04 Skid Resistance (http://www.dft.gov.uk/ha/standards/dmrb/vol7/section3/hd2804.pdf), are based on the Sideways force Routine Investigation Machine (SCRIM®), which was developed at TRL (then the Road Research Laboratory) in the late 1960s.

WDM® is the sole licensed manufacturer worldwide of the SCRIM® device, working under license to the UK Transport Research Laboratory (TRL). Its manufacture complies with current British Standard BS 7941-1:2006 and it is ideal for network skidding resistance surveys with a daily capacity of 200-300 km’s, depending on road type.

The concept combines the well-established side-force coefficient principle with a large capacity on-board water supply and electronic data recording. Both network and site specific surveys can be undertaken, which provide a repeatable measure of skid resistance.

Skid resistance measurements are compared to Investigatory Levels which are set to represent the different risks on a typical network. Typically the highest IL’s are used for approaches to crossings and junctions, and tight radius bends.
**Macrotecture measurement**

It is widely recognised that pavement macrotexture is an extremely important factor in the provision of surface friction and subsequent road safety. It is also an important parameter influencing other factors, such as rolling resistance and noise emission from vehicle tyres.

Historically texture depth was measured using a volumetric test, where a known quantity of sand/glass beads are spread on the road surface and the area covered is used to determine ‘texture depth.’

This testing method, however, is time consuming and can be influenced by the technician undertaking the test. It also relies upon lane closures so can cause delays and disruption. Specifications of surface courses require a specified texture depth, and can require a ‘retained’ texture depth after 2 years.

Alternatively the Mini Texture Meter, TM2, measures the macrotexture of a road surface transversely over a width of 100mm in real time and has already been approved as the definitive test for macrotexture in Australasia. It is now undergoing assessment for the British Standard.

It uses laser technology to measure the road surface, calculating and storing Square Mean Texture Depth (SMTD) and Mean Profile Depth (MPD) to provide 10m and 50m averages.

**Routine Monitoring: Skidding Resistance**

Materials specifications typically detail the type of aggregate required to provide the required skidding resistance through the use of Polished Stone Value measurements, which are used as a proxy for microtexture. After approximately a year in service the skid resistance begins to be subject to seasonal variation; typically with lower values obtained in the summer than during the winter.

To implement a skid resistance strategy annual SCRIM® testing is undertaken and the results compared to Investigatory Levels and sites below the IL are identified and on site investigation undertaken.

In the UK a SCRIM® survey can be undertaken between 25 and 85 Km/h and normalised to 50Km/h. Skid resistance data is recorded continuously and averaged over 5, 10 and 20m sections of road. The survey season runs from May – September to ensure that the lower summer skid resistance is measured.

Detailed procedures are available to apply seasonal correction to survey data to take account of variations through the year, but also between years.

**Routine Monitoring: Texture depth**

Ensuring contract compliance through monitoring texture depth at the time of construction can be achieved with TM2.
Over time texture depth can vary due to traffic and it important to monitor texture depth (and other condition data) on a regular basis during the surfaces life. WDM® operate a fleet of high speed survey vehicles which collect over 40 condition parameters including texture depth.

SCRIMTEX is a development of the SCRIM® and supplements the wet road skidding resistance by measuring simultaneously, the surface macro-texture in front of the test wheel. This can be achieved in both wheel tracks of a double sided SCRIM® device and provides, in conjunction with air and surface temperature, the ultimate requirement for assessment of road surface condition monitoring for network surveys.

**Conclusion**

The UK has implemented skid resistance policies since the late 1980’s and achieved significant improvements in the management of skid resistance on national and local networks. An ongoing research and development programme has lead to refinements in measurement techniques used, and the analysis of data. This has contributed to a sustained reduction in road accidents reported. The principles applied have been adapted in other countries, such as New Zealand with significant success in reducing accident numbers.

A skid policy relies upon a regular testing regime, defining standards and an investigatory process to determine priorities for investing in surface treatment programme. Case studies have demonstrated that a well implemented strategy can achieve savings through the reduction in accident numbers.