SCI_{TSD} NEW

- the most accurate index and cost-effective solution for optimizing road and airfield maintenance

Predictive maintenance of roads and airfields requires recorded data on various surfaces, subsurfaces and structural parameters. One device for providing quality structural data on network and projekt level is the Traffic Speed Deflectometer (TSD). The TSD is a non-destructive device, using Doppler lasers to measure pavement response at traffic speed.

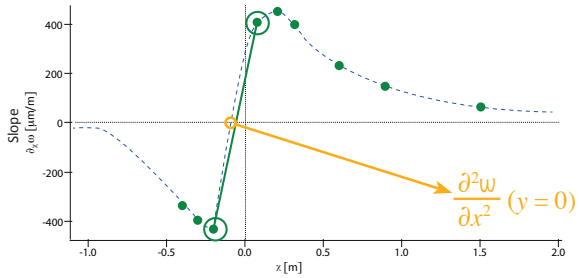
When the full picture is known for every part of the road network, it is possible to plan pavement maintenance without any unknowns and to use maintenance funds in a truly smart way.

SCI_{TSD} is the NEW structual curvature index for strain analysis of large road networks and airfields developed by Greenwood Engineering. It is well suited for rolling wheel deflection (RWD) experiments as performed by the Traffic Speed Deflectometer.

The SCI_{TSD} index is mathematically derived from same principles as classical Surface Curvature indices but using the information about the actual response the road provide when loaded with real truck tires.

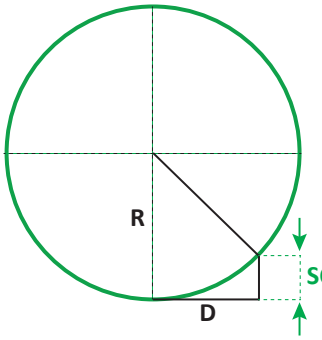
As curvature is proportional to strain with half the layer thickness, SCI_{TSD} can capture effects as debonding and very weak upper layers. Further, when discontinuities occur the movement of the road on each side is amplified making it suitable for characterizing joints, cracks and more, even when covered by layers of asphalt.

Surface Curvature (SC)



$$\frac{\partial^2 \omega}{dx^2} = \frac{1}{R} \approx \frac{S_{130} - S_{-200}}{0.33\,\mathrm{m}}$$

SCI_{TSD} Index



$$\frac{1}{R} = \frac{2\,SCI}{D^2} \qquad SCI << D$$

For $D = 0.33\mathrm{m} \implies SCI_{TSD}$

$$SCI = \frac{1}{R}\frac{D^2}{2}$$

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RESULTS - real life data with SCI_{TSD}

The results from comparisons of back-calculated top layer strain on real life data with SCI_{TSD} are shown with high agreement. Such an example is shown in Figure 1, where the proportionality of the top layer strain to SCI_{TSD} is clear. It is further shown with examples, that this index is particularly good at detecting features under the upper layer, e.g., as in Figure 2, where the joints between concrete slaps underneath asphalt are clearly shown. Another example in Figure 3, shows high repeatability of detecting drainpipes under asphalt.

SCI_{TSD} is calculated directly on TSD measurements without the necessity of model fits or complicated processing. It can be applied fast to fine grained TSD data on a large scale. It is therefore highly suitable for helping road authorities select which road sections to focus on. SCI_{TSD} is thereby increasing the efficiency of road maintenance procedures.

Benefits of using SCI_{TSD}

- Locates weaknesses
- Indicates load transfer between concrete slaps
- Detects cracks between joints
- Easy and fast to calculate
- Good repeatability
- High resolution (5 cm)

Top layer tensile strain and SCI_{TSD}

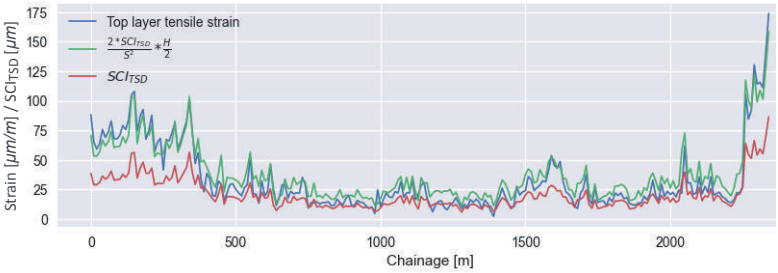

Figure 1. SCI_{TSD} vs. tensile strain at the bottom of the top layer. SCI_{TSD} is proportional to the strain, since they are both derived from the curvature of the deflection bowl, this means that the tensile strain can be calculated directly from SCI_{TSD} shown as the green curve.

SCI_{TSD} from concrete road section

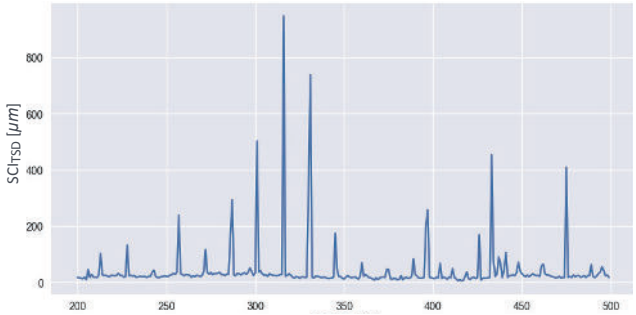

Figure 2. SCI_{TSD} from a concrete road section. The joints between the concrete slabs are very visible as evenly spaced-out spikes in SCI_{TSD}.

SCI_{TSD} on Section 1 East

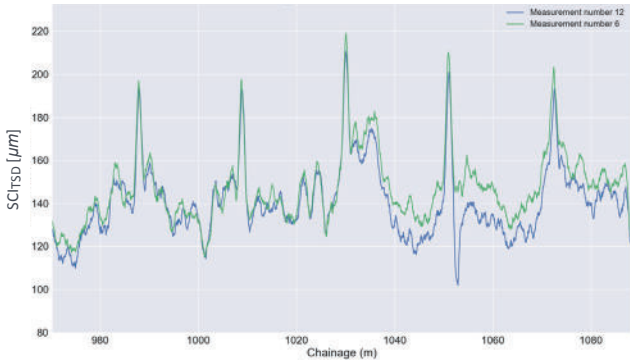

Figure 3. Drainpipes hidden under asphalt clearly show out as peaks in SCI_{TSD} data due to the pipes effect on the structural behaviour of the road.

SCI_{300} VS SCI_{TSD}

	SCI_{300}	SCI_{TSD}
Calculated on:	Deflection	Slopes
Shape assumption	Symmetric	Symmetric + Asymmetric
Circular curvature assumption	600 mm	330 mm
Discontinuities	-	Strong indicator
Model Dependency	Yes (for integration to slopes)	None

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