

# Abstract

Ageing of bituminous binder over its service life results in distresses. Pavement temperature, traffic intensity, mix properties and climatic conditions are key factors. Solar ultraviolet radiation is known to degrade building and construction materials which are organic in nature. The accelerated ageing methods being used for bitumen do not include the solar UV element. The significance of UV radiation ageing of bitumen was studied by comparing the field samples collected from inside a tunnel in J&K with those collected from outside the tunnel. Also, the variation in UV intensity at higher altitudes was studied with the help of samples collected from Leh, J&K. Secondly, the accelerated ageing methods do not consider the rest periods that are part of the cycle in case of natural ageing conditions. Whether the rest periods have any impact as compared to the continuous ageing method, was studied by artificially ageing a bitumen binder in a UV radiation chamber under different exposure cycles. Naturally aged as well as artificially aged samples were characterized using FTIR tests, Dynamic Shear Rheometer tests and AFM tests. It is observed that solar UV ageing plays a significant role in ageing of the bitumen. Ageing occurred at higher rate at higher altitudes because of the harsher irradiance of sunlight. Under artificial UV ageing, the samples provided with rest in between exposures showed lower ageing parameters than those aged continuously. Waxes in bitumen seem to have affected the stiffness of bitumen differently at different prevalent temperatures.

**Keywords:** Long term ageing, Solar UV radiation, Irradiance, Fourier Transform Infrared Spectroscopy (FTIR), Spectrometric indices, Dynamic Shear Rheometer (DSR), Complex modulus, Phase angle, Bitumen waxes.