The feasibility laboratory and in-situ study of repairing cracks and potholes by the innovative Asphalt Concrete Bricks

Moisture susceptibility is a major issue pertaining to Hot Mix Asphalt (HMA) pavement. The moisture can infiltrate and diffuse to the structure of asphalt mixture. The excessive moisture causes degradation of cohesive strength of asphalt binder and loss of the adhesion bond between aggregate and binder. As such deterioration progress, it results in distresses of stripping, cracks, and potholes.

In Taiwan, moisture susceptibility is identified as the primary pavement distress, owing to the hot and humid climate in summer. Monsoon (Plum) rainfalls, typhoons, and thunder storms provide more than 2000 millimeters in terms of precipitation every year which worsen the moisture damages on the roadways. Potholes can be developing after the extensive rainfalls. The emergency patching tasks are usually applied quickly by the contractors. However, poor patching can induce more cracks and potholes and it endanger the safety of motorists.

Engineers and professionals in the Directorate of General Highways, MOTC stride to mitigate hazards and improve safety for every districts. DGH has been trying to find a better way to repair cracks and potholes effectively and a research project was commissioned to carry out feasibility of utilizing the innovative "Asphalt Concrete Bricks" to be tested and evaluated in the laboratory and in the field, since 2014.

Firstly, the process of manufacturing was investigated to ensure how to produce the ACB in the laboratory. It was found that the regular concrete compression machine can be employed to compact the ACB. Regular 100, 150, and up to 300mm in diameters of ACB can be produced with regular dense-graded asphalt concrete mixtures in the laboratory. The process involves putting in suitable amount of HMA mixtures into the designated mold, compacting on one side with a fixed rate 50mm/min of displacement control, and repeat the same compacting process on the other side.

Secondly, the compacted ACB specimens were tested by the Hamburg Wheel Tracking Testing in accordance with AASHTO T324, or the rutting test apparatus, in the asphalt laboratory located in the Material Testing Institute of DGH. With the nominal rut depth 20 millimeter, it required more than 20,000 times of wheel runs for ACB, while it took only about 500 wheel runs for regular patching materials to achieve the designated depth. It unveiled significant rutting resistance for ACB in comparison with that of regular patching materials in the laboratory.

Thirdly, the ACB specimens were also installed in the field to evaluate the onsite performance. The drilled QA/QC cores were selected and repaired with ACB and patching materials. It showed that the cores repaired by ACB kept better smoothness and more durable than those installed by the regular patching materials. For some sites, the cores repaired by ACB stay intact and well performed even when it has been installed onsite for more than three years.

To sum up, the utilization of asphalt concrete brick is an innovative way to repair the potholes and cracks on the roadways which not only improve the serviceability but also safety for the motorists.