Environmental Research, Technology Demonstration and Conference Project

Project Number:	ECF 84/2017
Project Title:	Value-added collective recycling of waste plastic and waste tyre rubber into durable asphalt pavements
Principal Investigator:	Dr LENG Zhen, Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University
Total Approved Grant:	$1,273,240
Duration:	1/2/2018 to 31/10/2020
Project Status:	Completed
Project Scope:	This project aims to develop a novel method to collectively recycle waste plastic and waste tyre rubber into durability-enhancing modifiers for asphalt pavements. The study scope of this project mainly includes the following: · Development of new bi-functional additives from waste plastic which are suitable for waste plastic and rubber modified asphalt (WPRMA); · Rheological properties of WPRMA binders with different waste rubber and bi-functional additive (derived from waste plastic) compositions; · Storage stabilities of WPRMA binders with different waste rubber and bi-functional additive (derived from waste plastic) compositions; · Engineering properties of WPRMA mixtures; · Optimum composition of WPRMA; and · Optimum production procedure and conditions of WPRMA mixtures.
Summary of the Findings/Outcomes:	Waste plastics and waste rubber tyres are two major municipal solid wastes which may cause various environmental problems if not appropriately managed. This project aimed to develop a novel method to collectively these two waste materials into durability-enhancing modifiers for asphalt pavements. In this method, scrap tyre rubber was used as elastomer to improve the rutting and cracking resistance of asphalt, while the bi-functional additives derived from waste plastic served as the compatibilizers to enhance the rubber-asphalt and asphalt-aggregate bonding in rubber modified asphalt. The optimum chemical treatment method to produce waste plastic derived additives and the optimum composition of the WPRMA were determined through comprehensive chemical, rheological and mechanical tests in the laboratory, followed by a field construction trial. Guidance on producing WPRMA pavements was also developed as the reference for local industry and Highways Department. The project concluded that the appropriately designed WPRMA could provide better overall performance than the conventional asphalt mixture without causing any construction problem. The impact of this project is broad because it not only creates a new outlet for recycling both waste plastic and waste tyre, but also develops a new technology to produce high-performance asphalt pavement.