

## Optimisation of Recycled High Density Polyethylene Pallet as Aggregate Replacement for Road Pavement

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### Abstract

The primary objective of this study is to investigate the optimum usage recycled High Density Polyethylene (HDPE) as aggregate replacement in modified asphalt. The modified asphalts were evaluated by engineering properties of asphalt such as stiffness, permanent deformation and fatigue behaviour. The aggregate substitution with recycled HDPE in asphalt ranges from 5 to 25% of asphalt with sieve size from 3.36mm to 1.18mm and optimum bitumen content as follow hot mix asphalt wearing course 14 (ACW14) in Standard Specification of Road Work in Malaysia. The Repeated Load Axial Test (RLAT), Indirect Tensile Stiffness Modulus Test (ITSM) and Indirect Tensile Fatigue Test (ITFT) were used to evaluate the permanent deformation, stiffness and fatigue properties of asphalt, respectively. The density-void analysis indicates that the optimum bitumen content is 5.5% of weight of bitumen content. The result also shows that the HDPE modified asphalt could enhance the stiffness of asphalt at 15% and 20% aggregate replacement. This asphalt modification also improves permanent deformation at 1800 cycles. Finally, the HDPE modified asphalt also increase fatigue life of asphalt except 5% aggregate replacement. Therefore the HDPE modified asphalt found suitable to used for road pavement in term of environmental and economical aspects.

**Table 1:** Summary of Density-Void Analysis and Stiffness Modulus

Bitumen Content (%)	$G_{mb}$	$G_{mm}$	VTM (%)	VMA (%)	VFA (%)	Stiffness Modulus (MPa)
5	2.36	2.47	4.39	15.41	71.63	2894
5.5	2.37	2.45	3.52	15.71	77.62	3227
6	2.36	2.43	2.98	16.30	81.71	1962
6.5	2.35	2.42	2.69	17.10	84.30	1079
7	2.34	2.40	2.33	17.83	86.94	918

**Table 2:** Stiffness Modulus of Modified Asphalt

Percentage of Plastic Replacement (%)	Stiffness Modulus (MPa)	
	HDPE	
5	2275	
10	2548	
15	5743	
20	3356	
25	1894	

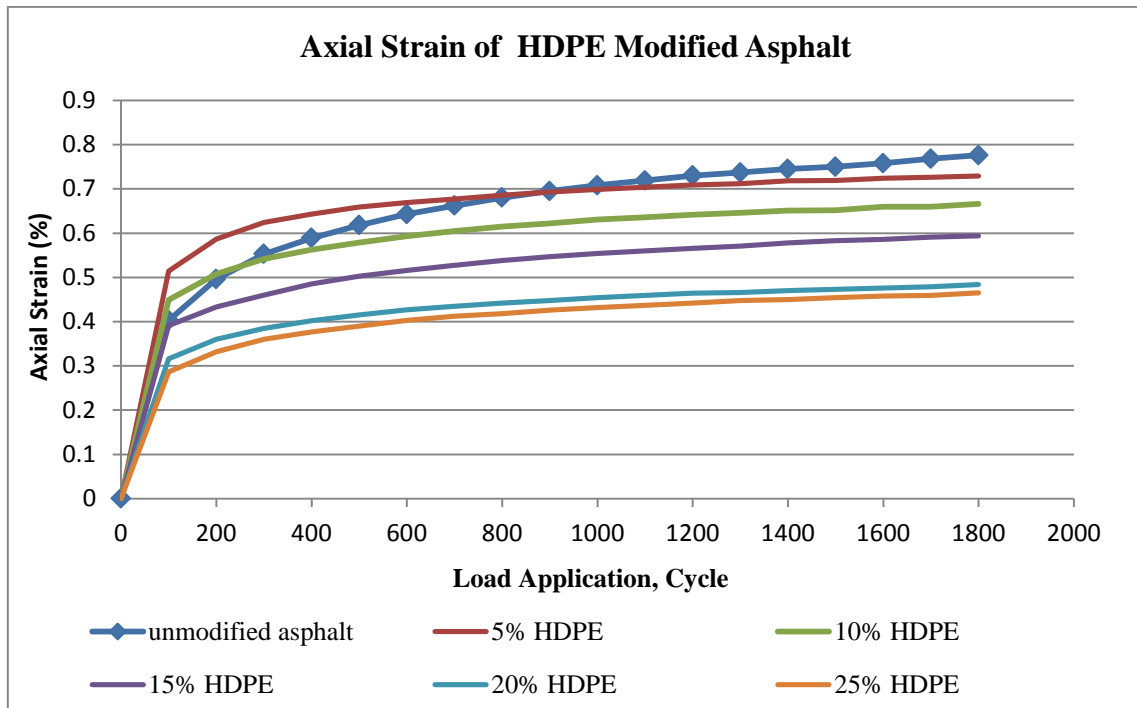


Figure 1: Axial Strain of HDPE Modified Asphalt

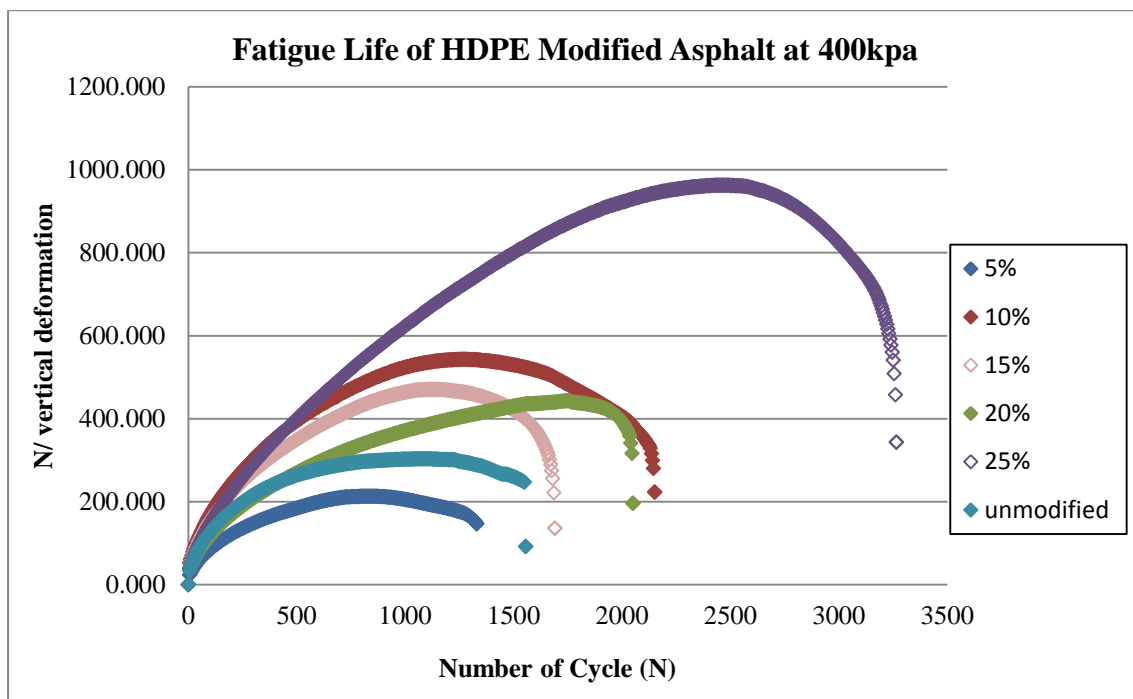


Figure 2: Fatigue Life of HDPE Modified Asphalt at 400kpa

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