

List of Figures

	Page
Figure 1.1: Flow Chart of the Thesis Structures	...6
Figure 2.1: Refinery Operation of Petroleum Bitumen	...8
Figure 2.2: Occurrence of Natural Bitumen	...9
Figure 2.3: Schematic representation of typical bitumen structure	...12
Figure 2.4: Effect of cross-link density on some mechanical properties of rubber	...18
Figure 2.5: Schematic diagram of a typical truck tyre cross-section	...22
Figure 2.6: Flow Chart of Service Life of a Tyre	...25
Figure 2.7: Crumb Rubber Particles	...27
Figure 3.1: Microscopic Examination	...45
Figure 3.2: Penetrometer	...46
Figure 3.3: Ring and ball Softening Point Test	...47
Figure 3.4: Ductility Test	...48
Figure 3.5: Cleveland Open Cup Flash Point	...49
Figure 3.6: Los Angeles Machine	...51
Figure 3.7: ACV apparatus & Aggregate Crushing Test Machine	...52
Figure 3.8: Aggregate Impact Test Machine	...53

	Page
Figure 3.9: Flakiness Sieves	...56
Figure 3.10: Length Gauge	...57
Figure 3.11: Sieve Analysis Test	...58
Figure 3.12: Aggregate Gradations for all Test Series	...60
(Upper, lower, mid and design Limits)	
Figure 3.13: Marshall Machine	...61
Figure 4.1: Microscopic Appearance of 15% Rubber Blended with Asphalt	...64
Figure 4.2: Microscopic Appearance of 25% Rubber Blended with Asphalt	...65
Figure 4.3: Property Curves of Hot Mix Asphalt Design	...68
Figure 4.4: Property Curves of Asphalt Rubber Hot Mix Design (15% Rubber)	...71
Figure 4.5: Property Curves of Asphalt Rubber Hot Mix Design (20% Rubber)	...72
Figure 4.6: Property Curves of Asphalt Rubber Hot Mix Design (25% Rubber)	...73
Figure 4.7: Optimum Bitumen Content for HMA &ARHM	...74
Figure 5.1: Effect of Crumb Rubber Percentages on the Bitumen Specific Gravity	...76
Figure 5.2: Effect of Crumb Rubber Percentages on the Bitumen Penetration Value	...77
Figure 5.3: Effect of Crumb Rubber Percentages on the Bitumen Softening Point	...78
Figure 5.4: Effect of Crumb Rubber Percentages on the Bitumen Flash Point	...79

	Page
Figure 5.5: Effect of Crumb Rubber Percentages on the Bitumen Fire Point	...80
Figure 5.6: Effect of Crumb Rubber Percentages on the Bitumen Ductility	...80
Figure 5.7: Variation of Marshal Stability by using different Rubber Percentage	...82
For asphalt 60/70 penetration	
Figure 5.8: Maximum Asphalt Mixture Stability by Rubber Modifier Percentage	...82
Figure 5.9: Variation of Flow by using different Rubber Percentage	...84
For asphalt 60/70 penetration	
Figure 5.10: Minimum Asphalt Mixture Flow by Rubber Modifier Percentage	...84
Figure 5.11: Variation of Unit weight with different Rubber Percentage	...85
For 60/70 Asphalt grades	
Figure 5.12: Variation of Air voids with different Rubber Percentage	...86
For 60/70 asphalt grades	
Figure 5.13: Minimum Asphalt Mixture Air void Percentage	...87
By Rubber Modifier Percentage	
Figure 5.14: Variation of Void of Mineral Aggregate with different Rubber %	...88
Modified 60/70 asphalt grades	
Figure 5.15: Minimum Void of Mineral Aggregate Percentage of	...88

	Page
Asphalt mixtures by Rubber Modifier Percentage	
Figures 5.16: Variation of Voids Filled with Bitumen VFB% with Different Rubber Contents Modified 60/70 asphalt grades	...89
Figure 5.17: Minimum Voids Filled with Bitumen VFB% by Rubber Modifier Percentage	...90