

CRUMB RUBBER DIGESTION POTENTIAL



Investigate the impacts of crumb rubber source, size, mixing temperature and time on the engineering properties and chemical and physical composition of crumb rubber modified binders

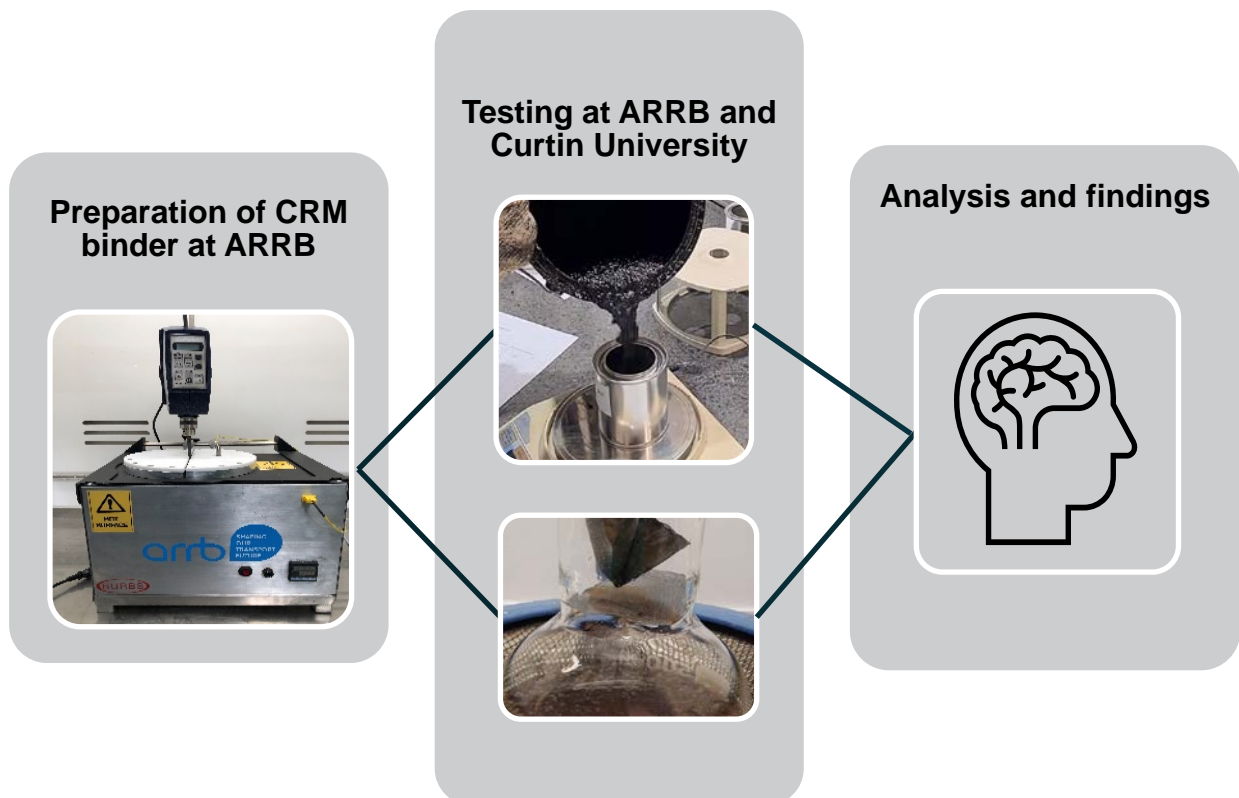
Main Roads, ARRB and Curtin University have collaboratively delivered this project under WARRIP.

Background

Crumb rubber modified (CRM) binders are manufactured by adding crumb rubber to bitumen. When CRM binders are used in spray seals and asphalt, the highly elastic crumb rubber particles result in improved performance of the binder.. With time the crumb rubber begins to reduce in size and “dissolve” into the bitumen. The mixing of crumb rubber and bitumen is typically referred to as digestion. The properties of the CRM binder change during the digestion and therefore identifying the optimum point to use the CRM binder is of great benefit.












This project seeks to understand the digestion of crumb rubber in bitumen not only in terms of engineering properties but also chemical and physical changes.

Method





What have we learned?

We examined:	We found:	
 <p>Two different sources of crumb rubber:</p> <ul style="list-style-type: none"> • Truck tyres • Passenger tyres 	<p>CRM binder manufactured using passenger car tyres resulted in similar conventional Australian binder properties as truck tyres.</p> <p>Although the properties of the CRM binder appear similar between the two sources, the advanced testing indicates that the digestion of truck and passenger tyres differ.</p> <p>Passenger tyres may be an alternative source of rubber for us in binders. However further validation is required.</p>	  
 <p>Two different crumb rubber gradings:</p> <ul style="list-style-type: none"> • 30 mesh (typical grading used by Main Roads WA) • 16 mesh (larger grading) 	<p>The advanced testing indicated that larger crumb rubber “dissolved” slower than the typical grading, this could be beneficial for extended storage periods.</p> <p>The advanced testing also indicated that portions of the crumb rubber reduced in size significantly and dispersed into the bitumen.</p>	 
 <p>Two different mixing temperatures:</p> <ul style="list-style-type: none"> • 165 °C • 190 °C 	<p>The changes in properties at a mixing temperature of 165 °C were less with time as compared to 190 °C. The advanced testing confirmed that the digestion was less at 165 °C as compared to 190 °C. This could be a consideration for extended storage periods.</p>	
 <p>Mixing times from 1 to 36 hours</p>	<p>Advanced testing indicated that it is predominantly the natural rubber that dissolves into the binder for the temperatures and mixing times examined.</p>	

FUTURE CONSIDERATIONS

Investigate the performance of asphalt manufactured with alternative sources and sizes of rubber

Investigate if increased amounts of crumb rubber can be added based on the findings of this project

Investigate other possible sources of crumb rubber and their impact on the CRM binder

