CHAPTER 1

INTRODUCTION

1.1 Background Study

Binder is a general description for the glue used in asphalt pavements. These liquid binders can be call as tars or asphalt binder or bitumen. The terms “asphalt binder” has been selected to more specific describe the asphalt material and any modifiers or ingredients. The terms asphalt, asphalt cement, and asphalt binder referring more specifically to their petroleum origins and asphalt binder referring to the asphalt to the asphalt cement and any other added ingredient that provides the engineering adhesive used in asphalts pavements. Characteristic of asphalt is sticky, black and highly viscous liquid or semi-solid of petroleum. In pavement structures, asphalt is very importance in road because wearing coarse and base course need asphalt to mix in aggregate. Asphalt use in road pavement because it’s very economical and fulfill the roadway design requirements such as good ride quality, skid –resistance surface, quiet surface and low maintenance. However, consumption of the asphalt has some weaknesses, and of them is it become brittle and hard in cold environments and soft in hot environments hence easy to crack when the weather change from hot to cold. Moreover, today capacity or volume of the road user that increases year by year is one of the factors that make the road pavement prone to defect or damagesuch as cracking. Hard traffic and high loading weight also one of the factors affecting the quality of
performance pavement as it becomes worst because of overloading on the road. Hence, to reduce damage and defect, an improvised is needed in the road pavement structures. In worldwide, it has many additives material such as Styrene Butadiene Styrene (SBS), Synthetic Rubber-Styrene-Butadiene (SBR), natural rubber, and Crumb Rubber Modified (CRM) to make it a strength the road pavement increased. The use of commercial polymers such as SBS and SBR is very expensive materials than crumb rubber very economical.

Crumb rubber very suitable to be the additives in pavement because it has the characteristic that can support the weakness of asphalt. Not only that, increase than that in tyres waste could be eliminated thus environmental problem can be avoided. The use of crumb rubber in asphalt materials became of interest to the paving industry because in the crumb rubber it has an elastic property which had the potential to improve the skid-resistance and durability of asphalt. The usage of crumb rubber is proving to be good and reliable. Besides that, crumb rubber can reduce the issue of fatigue or cracking occur on most pavement. At once, it can solve the damage and defect. Moreover, it can save the cost for the maintenance roadway pavement because ingredients in crumb rubber more benefits to solve the problem and also can solve environmental problem from waste tyres. Figure 21 show the pavement layer which is crumb rubber will include in binder course only. The thickness of the overall layer is similar with normal asphalt pavement using asphalt as binder. The constant layer is sub-base and sub-grade. The crumb rubber only in surface coarse and binder coarse because to avoid the pavement to crack on the surface or has a defect caused by heavy traffic loading.

Figure 1: The Pavement Layer
Crumb rubber modified (CRM) is a rubber from waste tyres which is truck tyres, car tyres, motorcycle, bicycle or automotive tyres. The crumb rubber contains synthetic rubber, natural rubber, total rubber hydrocarbon and acetone extractable, which make a crumb rubber have high durability, viscosity, high softening point and better resilience. This due to the different portion of natural rubber synthetic rubber, and other components between truck tyres, passenger car tyres, and motorcycle tyre, bicycle tyres and others automotive tyres. A truck tyre has 80 per cent natural hydrocarbon and 18 per cent natural rubber compared 9 percent in an others automobile and 2 per cent in tyre treads. For truck tyres, it must separate between steel and fibres in tyres. Tyre rubber will be liquid nitrogen and is easily fractured in a hammer mill. While, ambient temperature produces sponge-like crumb rubber with big surface area.

Figure 2: Transformation of the waste tyre to Crumb rubber

Figure 2 shows from the waste tyres become crumb rubber using ambient grinding process. This is one of the processes to produce crumb rubber. This mechanical process will produce an irregularly shaped particle with a large surface area and varies from size 0.425mm to 4.75mm. After, this processes, it will produce the shape or crumb rubber or the specifically known particle morphology such as Figure 2. The ambient grinding will produce rough irregular shape with high surface area. Crumb rubbers have five grading:

1) Tire granule shall consist of granule tire crumb, black only guaranteed, and metal, free sized. Magnetically separated materials are not acceptable. Fluff from tire cord removed.