

EXTENDED ABSTRACT

Field and Laboratory Study of the Effect of Type of Emulsion Bitumen and Chip Seal Aggregate Size Applied on Roller Concrete Pavement

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1. Introduction

The pavement engineering approach in recent decades has been to develop the use of cement in pavements, including concrete pavement, in particular roller concrete pavement. Some problems with the implementation and application of this type of procedure have led researchers to focus on the subject matter of this type of pavement. In this respect, one of the problems with the level of roller concrete, which, in technical terms, is "surface wear" known as surface abrasion and surface cracks. Surface abrasion, in addition to reducing the thickness of the pavement layer and defective bearing capacity, in the amount of surface friction and creating a driver safety problem due to the dispersion and throwing of aggregates, it also has a negative effect on the surrounding and passing vehicles. Repair and maintenance is an optimal and economical solution in road pavement management. The use of Chip Seal as preventive maintenance is a two option maintenance for low-volume traffic in highway pavements (Vaitkus et al., 2018, Khabiri, 2005). In previous studies, micronutrient aggregate has been used more than usual, as an example of research on the effect of surface aggregates and bitumen on the performance of peeled aggregates in chip seal (Aktas et al., 2013). The main purpose of this research is to use a fine grading and emulsion bitumen with a rubber powder additive in roller compacted concrete pavement.

2. Methodology

Previous scientific documentation has been investigated, they have used various methods for laboratory investigations. The purpose of this study is to provide suitable surface materials for improving the performance of concrete roller applications, therefore, the study of the amount of aggregates drying on roller concrete steps is one of the important stages of this research. In this regard, one of the most operative tests for this research is a sweeping test. In this test method, to evaluate emulsion bitumen and aggregates as variables are using a 3-samples surface sweep in the laboratory. One of the important parameters in rubber bitumen is its adhesion. In this regard, a ductility test has been carried out. In this experiment, the quantity of energy necessary to remove aggregates from the surface of the chipseal is obtained. The sand patch test was also used to check the macrotecture of the chip seal. It should be noted that three of the trials mentioned above are the three main tests in this study, and other experiments have been carried out to prepare the materials, which have been considered further. The use of emulsion bitumen with an optimal or higher percentage reduces the removal of aggregate. The reason is that with increased consumption of bitumen, more depth of aggregate is placed inside the bitumen, resulting in an increase in the amount of strength necessary for the aggregate to be removed.

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2.1. Evaluation of field performance results of chip seal

The loss of pavement surface aggregates, in addition to accelerating the destruction and reduction of pavement life, leads to a reduction in friction between tires and roads and also causes discomfort among users of the road. In the field test and on a real scale; after the samples were made, images were taken on site after 4 months. Unfortunately, due to the destruction that was carried out at the site for the overall repair of the existing pavement and the overall reconstruction route, it was not possible to produce images of a longer period of time. In Fig. 1, the processed images of the Chip Seal layer are shown for two types of coarse aggregates (a) and fine grains (b), respectively.

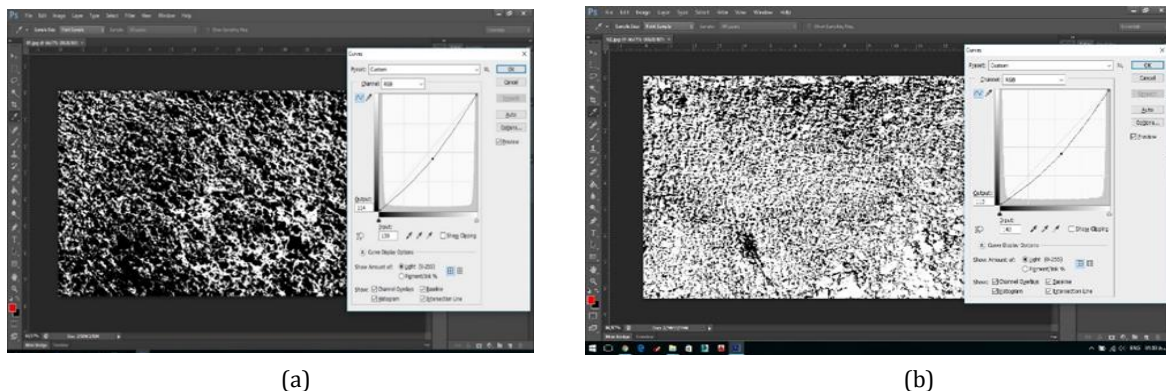


Fig. 1. Chip Seal tissue made with coarse aggregates: a) and after 4 months b)

2.2. Results of laboratory test on Chip Seal samples

As previously mentioned, this experiment is conducted to evaluate the amount of aggregate leaching. In this research, the specimens were swept for 60 seconds. In this test, the speed of the sweeper was set to 0.83 rpm. In relation to the amount of bitumen used, the type (a) was 1.29 lit/m² for the type and (1.2) lit/m² for the type of grading. The use of bitumen emulsion with rubber powder reduced 17 to 25 percent of aggregate raveling. Due to the fact that the surface of the chip seal applied to roller concrete samples is equal to 0.05 m², it was used for making 0.046 liters for prepared samples, 0.06 for type (a) and lit (0.15 lit) for type (b) grading. To study the effect of bitumen, the above values were reduced and increased by 10%. Another aspect taken from tests is that the depth of the macrotexture decreases by a change of gradient from type (a) to type (b) to an approximate value of 11%. The reason for this factor is that in the type (a), the maximum nominal size is 9.5 and in the type of aggregate (b) the maximum nominal size is (5.6) mm.

The use of chip seal in both types of aggregates increases the depth of the texture in both types of roller concrete. Comparing these results with the results of chipset execution on American steel deck bridges, it can be concluded that the use of chips can improve the skid resistance of concrete. The chip seal used in these bridges has a maximum aggregate consumption of 3.2mm, while the type (a) and (b) of the aggregates used in this study have the maximum aggregate consumption of 9.5 and 5.6mm (Yuan, et al., 2018).

3. Results and discussion

In this research, Chip Seal performance was studied using two types of granulation and three percent bitumen and two types of bitumen. The results of this study are as follows:

- With the addition of rubber powder, the amount of aggregates in the Chip Seal is reduced. This amount is 23% for type (a) and 20% for type (b) aggregates.
- With the fineness of aggregation, the amount of aggregate fell down by about 14%. The cause for this is that due to the smoothness of the surface of the concrete pavement, the finer the aggregate, the better the locking and the bond between the aggregate and the existing treatment. Also, in Fine-grained, the amount of aggregates per unit area of the aggregate is reduced in smaller aggregates.
- Use of bitumen with an optimum or higher percentage reduces the amount of aggregate raveling. With increased consumption of bitumen, more volumes of aggregates fall into the bitumen, resulting in an increase in the amount of aggregate ductility required. Of course, the use of bitumen increases the possibility of blending.
- With the increase in bitumen, the depth of the texture in Chip Seal decreases by 2%.

- The use of rubber powder in bitumen emulsion increases the amount of elasticity and ductility is obtained by increasing by 2.5 times.
- The sweep test on the roller concrete pavement indicated that the type of gradient (Fine) is better than type (Coarse), and reduces the amount of gravel felling to 5 to 20 depending on the type of bitumen and its amount.

4. References

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