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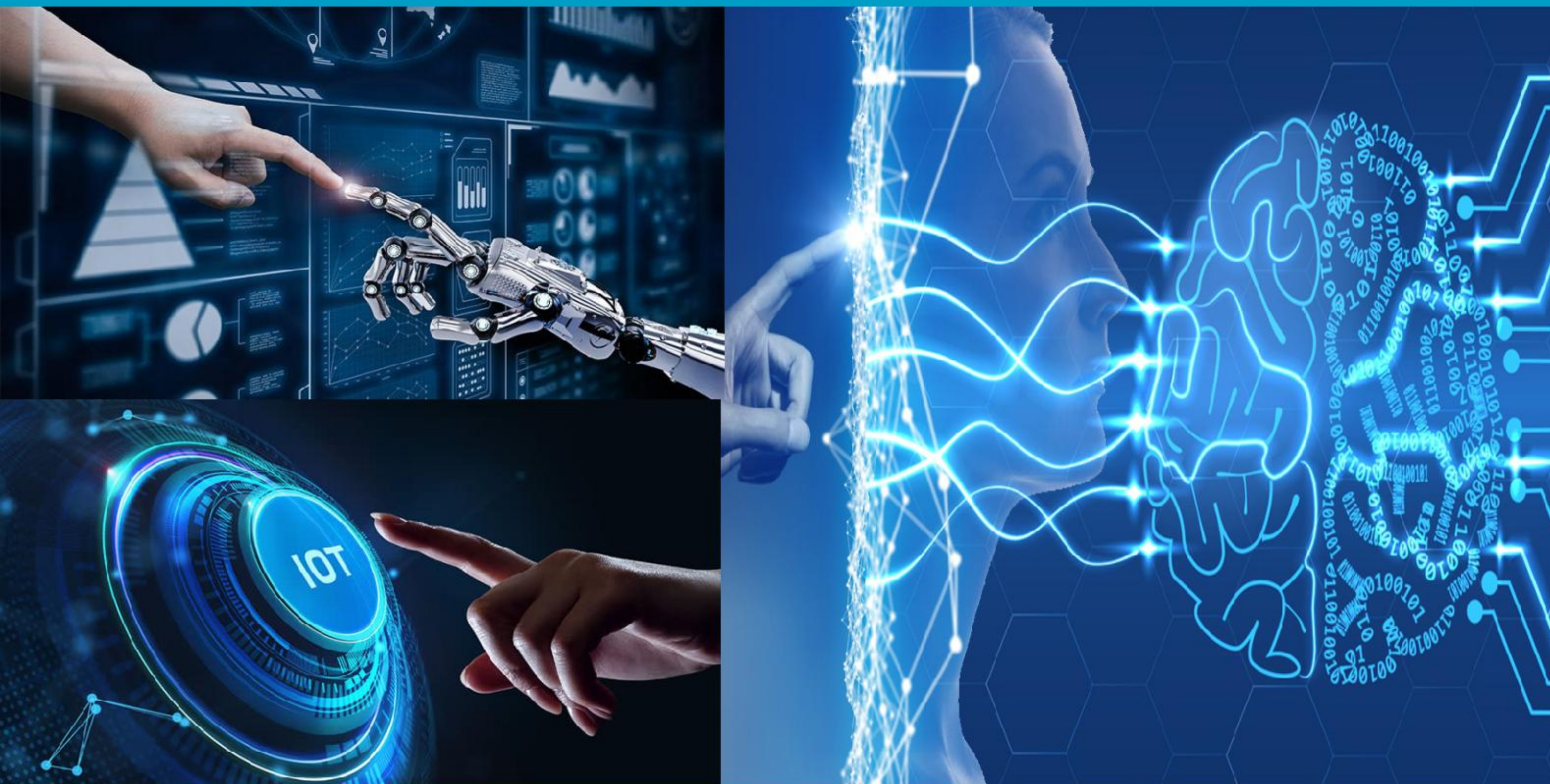

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Experimental Analysis for Strengthen the Bituminous Mixtures Based on Iron Wire Fibre Reinforced Asphalt Mixes to Improvise the Flexible Pavement

Chinmaya Kumar Mallick, Minakshi

Transportation Engg, CBS Group of Institutions, Jhajjar, India

A.P Civil Dept., CBS Group of Institutions, Jhajjar, India

ABSTRACT: It was extra challenging to compress the samples when there was a larger concentration of iron wire fiber present in the material being tested. Once again, the size of the air gaps shown an increase in proportion to the growing values of the fibre addition. As a direct result of this, an abnormally large amount of binder was required for the samples, which had the potential to cause some severe consistency issues. Additionally, since the combination has an unusually high number of air voids, it is prone to having problems with its durability. This is because the combination is vulnerable to having problems with its durability. The values of the samples' indirect tensile strength were about the same whether they were wet or dry up until there was a content of 4% iron wire fibre. This was the case even when the samples included iron wire fiber. After this limit was exceeded, there was a discernible rise in the Fig. s describing the indirect tensile strength. It was discovered that the control specimen had the highest level of resistance to the deterioration brought on by water. This demonstrates that the incorporation of fiber into the mixture helps to reduce the bleeding phenomena as well as the drainage of the mixture. To put it another way, iron wire fiber shows promise as a stabilizing agent, which means its potential may be investigated further. This is a conclusion that can be reached with complete and utter self-assurance. The incorporation of fibers into the surface course layers of flexible pavement increases the likelihood that drivers may experience an increase in their level of unease while driving, which has the potential to result in a reduction in the level of overall road safety. A rise in the number of accidents is one of the potential repercussions of this. Because of this, there have been discussions on the possibility of embedding the fibers into the lower layers of the pavement, such as the base course.

KEYWORDS: bituminous mixtures, iron wire fibre, flexible pavement, rubber, waste plastics

I. INTRODUCTION

The technique or methodology that will be used for this study will consist of adhering to the criteria that have been outlined by a variety of Indian standard codes, as well as AASHTO and MORTH requirementsso that their individual properties may be analyzed alongside those of other raw materials. The research results will be used to the creation of best practices and utilized as a benchmark against which the current asphalt blend may be improved. Once the iron wire fiber has been included into the mixture, the studies will determine whether or not the combination is enough to produce a road surface that is suitable for safe and pleasant traffic operations.

II. METHODOLOGY

During the course of the research work, various methodologies and experimental works will be carried out. This section will discuss those methodologies and experimental works. The Hot-Mix Asphalt, often known as HMA, is a combination that consists of coarse and fine aggregates, bound together with asphalt. HMA is a mixture that is then subjected to greater temperatures once its name has been given to it. The selection of the materials and the aggregate gradations were carried out in accordance with the criteria that were outlined in the requirements. Extensive experiments and investigations were performed on a bituminous mix that was reinforced with iron wire fibre dosed at 0%, 1%, 2%, 4%, 6%, and ultimately 9% by weight of aggregates. The results of these tests and investigations were thoroughly analysed.

The flow diagram that is given in Fig. 1.provides an illustration of the technique that was used for the experimental programme.

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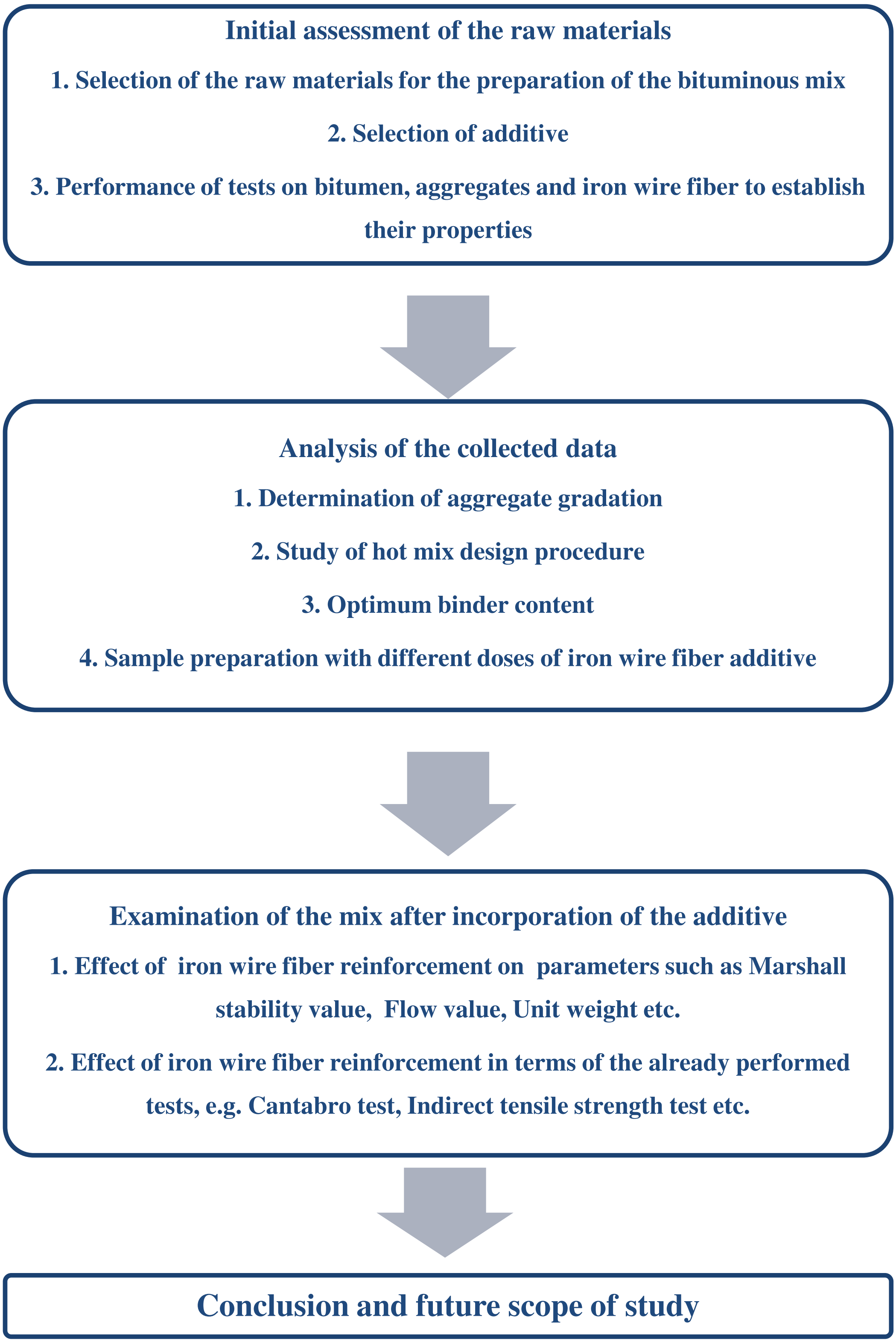

Fig. 1: Flow diagram of methodology

III. RESULTS AND IDISCUSSION

i) Marshall Stability test results:

Marshall stability tests were performed to acquire stability values for the samples (and have been addressed earlier), therefore their impact on the range of those values was studied. These results were achieved for both control and reinforced specimens made with iron wire at percentages of 1%, 2%, 4%, 6%, and 9% by weight of aggregates. The mixtures were labeled with the same names as the samples they were created from (Mixture Contents , Test mix 1, Test mix 2, and so on up to TM9).

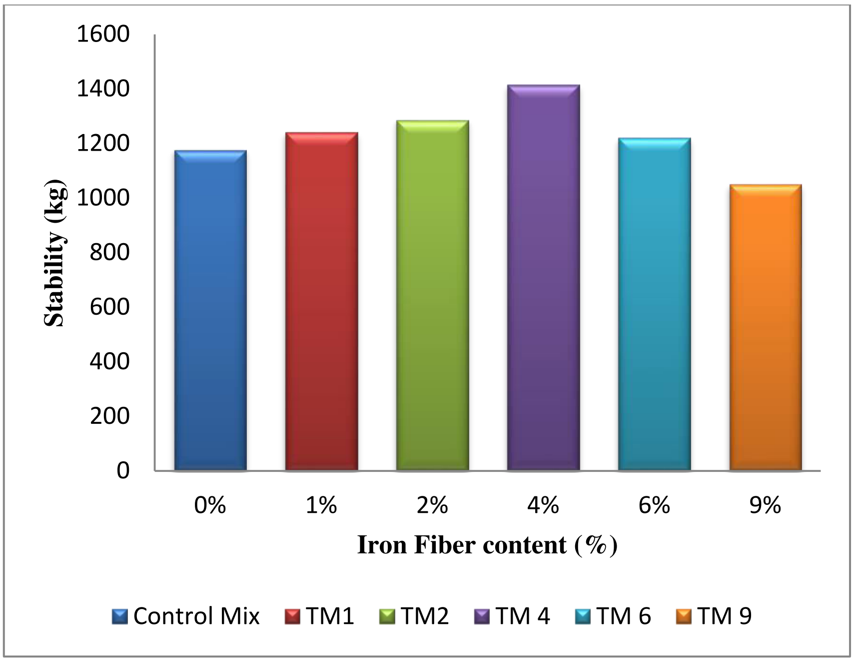

Fig. 2: Stability values against iron wire fiber content

When iron wire fibre was introduced into the bituminous mixture, a subtle improvement in the material's stability occurred almost immediately. This rise continued until the weight of the mixture's iron wire fibre component was reduced to 4% of the total. The levels of the stability then began to decrease. In other words, the optimal level of stability is reached when there is a composition of 4% iron wire fibre. The highest level of stability that could be achieved was 1415 kg.

The tendency of the fibres to cluster together is the most important factor in understanding why there is a subsequent decline in density once a specific peak has been reached. The non-homogenous distribution of fibres throughout the mixture causes the contact points in the aggregate mass to disintegrate. These contact points are crucial for absorbing the loads that are given to the aggregate. After reaching the point where there is an optimal increase in the amount of iron wire contained, this ultimately causes the mixture's stability to decrease.

ii) Flow Value:

The value of the Marshallaflow was the next piece of real estate that was taken into consideration.

Fig. 3 presents a graph that compares flow value to the percentage of iron wire used in the reinforcement. This graph shows that as the percentage of iron wire used in the reinforcement steadily increases, the flow value steadily decreases, reaching its highest point in the Mixture Contents , which contains no iron wire fibre at all. To put it another way, flow values dropped as the quantity of fibre in the mixture increased. This indicates that when the quantity of fibre in the combination was increased, it got stiffer and less flexible. The rigidity of the fibres is responsible for causing this phenomena to occur.

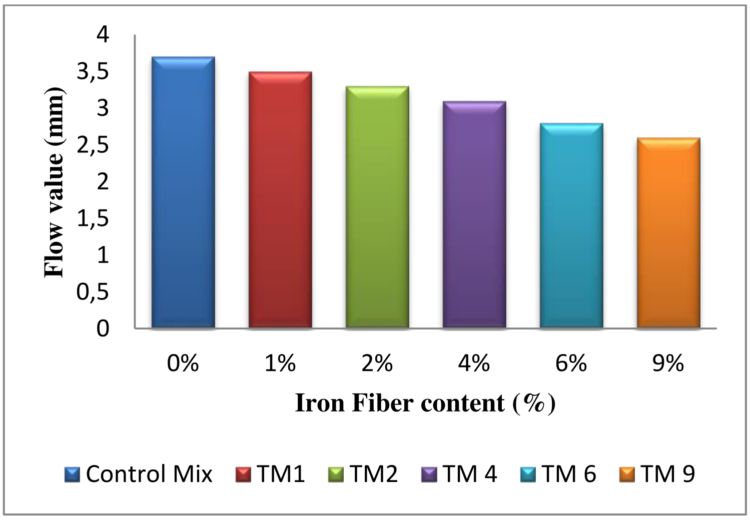

Fig. 3: Flow values against iron wire fiber content

iii) Marshall Quotient:

Values of the Marshall Quotient were computed by dividing the mixture's stability by its deformation value and then dividing that number by 1. The findings are shown in the following Fig.4 , which is numbered 5.3.

The Marshall Quotient values improved as a result of the addition of iron wire fibre as an ingredient to the mixture, as can be seen from the bar chart. When compared to the baseline mix, this represents a near-1.4-fold improvement. There is a notable increase in the mix's resistance to permanent deformation and stiffness when iron wire fibre is added at a concentration of up to four percent. After 6%, structural fragility was evident in the samples, and the Marshall Quotient values dropped as a result.

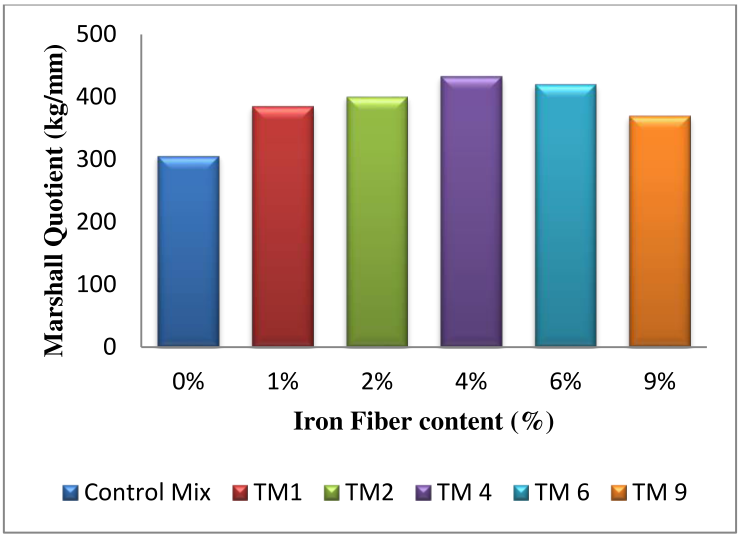

Fig. 4: Marshall Quotient values against iron wire fiber content

iv) Unit weight:

The addition of iron wire fibre reinforcement was seen to result in a reduction of the unit weight, as this was observed to record a lower value after the addition of the reinforcement. Fig. 5 illustrates the variation in unit weight values that occurs with varying amounts of iron wire fibre composition.

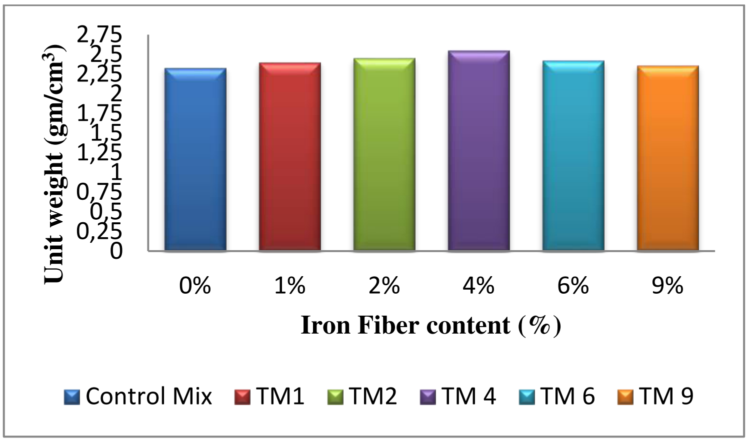

Fig. 5: Unit weight against iron wire fiber content

After an initial rise, there is a subsequent decrease in the unit weight of the mixture. This can take place due to the fact that the fibres like to cluster together. When there is a greater concentration of iron fibre, the clump of fibre has a greater propensity to exhibit segregation, and as a result, the unit weight begins to decrease.

v) Air voids:

The proportion of air spaces in the binder course must be between 4% and 6% in order to meet the specifications of the Indian standard. Fig. 6 demonstrates how the addition of a certain amount of iron wire fibre reinforcement increased the number of air gaps. Observing the graph makes this clear. Air gaps in the samples equaled up to 4% of the total iron wire fibre content, as specified in the requirements. The samples showed an unacceptably high number of air gaps beyond 4%, which might reduce the mixture's overall performance. Because more open regions in the atmosphere means less durability.

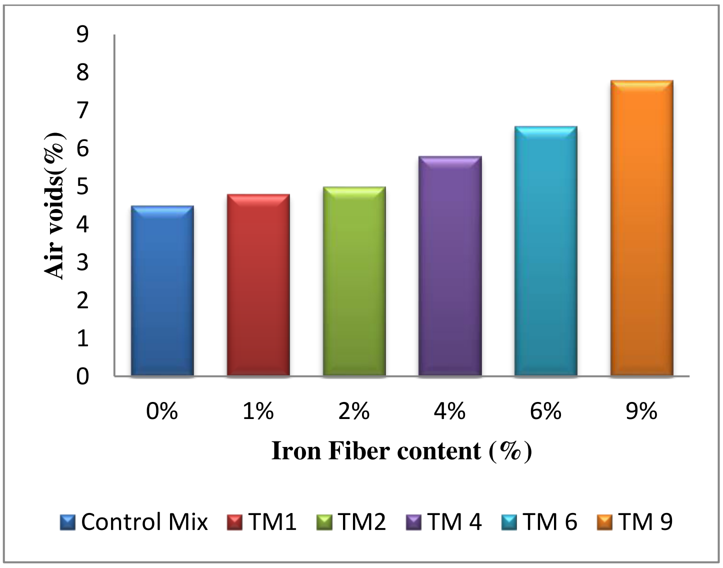

Fig. 6: Percent air voids against iron wire fiber content

Nevertheless, an increase in the number of air spaces is thought to be beneficial for the design of pavement in warm regions where the bituminous mix is prone to bleeding. An enhanced void ratio may be a potential solution to these issues under weather conditions like these. In spite of this, appropriate precautions need to be taken to guarantee that the air gaps will fall within the specified parameters.

It is clear from looking at the Fig. that the air void values rose as the quantity of iron wire fibre added to the mixture grew. An increase in the air void values might have implications for the mixture's compression, which would clearly become more difficult as the air void values rise.

IV. CONCLUSION AND RECOMMENDATIONS

When the pavement will be exposed to heavy traffic, it is highly advised to strengthen the asphalt mixtures. utilizing affordable iron wire fibre as reinforcement in the bituminous mixture rather than utilizing other, more costly reinforcing additives is very advantageous for the society as a whole since it is a financially realistic solution. The current study aims to characterize bituminous mixtures that have been strengthened by the addition of iron wire fiber.
The optimal binder percentage for the bituminous mixes was found to be 4.5% by weight of aggregate. Bitumen mixture was averaged out to get this number based on the mix's best stability, highest unit weight, and 4% air voids. This led to the discovery of this value. The findings of the Marshall stability test showed that there was an increase in stability values of up to 4% when the additive level was raised. When this threshold was exceeded, the concoction took on an unfavourable quality. The fact that the fibres are not dispersed in a same manner throughout the mixture is the primary factor that may be credited with explaining this behaviour (decreasing stability particularly at high ratios). Because of this, clustering occurs, which is one factor that leads to the decline in stability. This finding is supported by the flow values that were measured.
When there was a higher concentration of iron wire fibre in the samples, it was additionally difficult to compress them. Again, the extent of the air spaces indicated a rise in proportion to the rising values of the fibre addition. As a consequence of this, an excessively high quantity of binder was necessary for the samples, which might lead to some significant consistency problems. In addition, Because the combination has an abnormally high percentage of air voids, it is susceptible to having difficulties with its durability.

Until there was a 4% iron wire fibre content, the values of the samples' indirect tensile strength were about the same whether they were wet or dry. The values of the indirect tensile strength increased dramatically after this limit was passed. The control specimen was determined to be the most resistant to the degradation caused by water.

This illustrates that including fiber into the mixture helps prevent the bleeding phenomenon and the drainage of the mixture. That is to say, iron wire fibre shows promise as a stabilizing agent that may be fully explored.

This is a conclusion that can be made with 100% confidence. The inclusion of fibers into the surface course layers of flexible pavement raises the chance that drivers may feel more uneasy on the road, which might lead to a decrease in overall road safety. One possible consequence of this is an increase in accidents. This fact has led some to propose incorporating the fibers into the pavement's lower layers, such as the base course.

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