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Editorial

Technique to convert Industrial Waste into Worth by using it in Road Construction

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India has one of the largest road networks in the world comprising about 5.5 million kilometers as of April 2018 (MoRTH, 2018). During the previous few years, there has been an enormous growth in the development of the road network due to which connectivity between cities, towns, and villages in the country has improved. Indian road infrastructure is undergoing phenomenal growth and will continue to grow at higher rates in coming years too. In most cases, flexible pavements are being constructed at a rapid pace due to the advantages they provide over rigid pavements. The flexible pavements can be strengthened with the increasing amount of traffic at a later stage and are less expensive in regards to initial cost and maintenance. With the increase in traffic volume and climatic variations, the damage is being caused to the roads. It has been observed that the roads start developing cracks after the initial few years which further progress into a pothole and later a distressed patch is formed. Another factor is the poor-quality control during construction which renders the road unserviceable before its design life. Therefore, we must come up with a different approach to the improvement of pavements.

A new technology dealing with an old problem and a big idea can turn into innovation in road construction. Innovation also offers benefits as it is capable of reducing the initial cost without compromising the quality of the road. The depletion of numerous naturally occurring materials used to construct roads and other infrastructures is being caused by their extensive use. The cost of acquiring and processing such materials is rising daily. In addition, the large volume of home and industrial trash is posing major environmental challenges for proper storage or disposal. In this context, road investigations have been looking into potential applications for some of the waste products as alternative resources for road construction (with proper processing). The proposed material(s) must be secure, environmentally responsible, and economical for the effort to succeed. A brief overview of the potential use of waste sludge containing CaCO3 in road construction is discussed in this article.

In the present research work, to modify the bituminous binder, waste lime sludge from the paper and toothpaste industries has been utilized. Generally, unmodified bitumen has a limited capacity over the life of pavement at a variety of loads and temperatures; whereas the use of modified bitumen satisfies the demands for strength and affordability. The use of sludge will not only improve the binder properties but will also cater to the environmental problems of disposing of the waste material. The production of millions of non-biodegradables in households, businesses, and manufacturing processes has resulted in a large amount of waste in recent years, as is well known. If left unattended, they will continue to exist in the same condition for a long period and pose a risk to both the environment and human life.

The production of waste is comparable to the increase in the global population. Sludge is produced in significant amounts by the toothpaste and paper industries. The garbage generated will cause problems for the environment and public health for hundreds of thousands or even millions of years. Utilizing these wastes in road construction is the most effective approach to recycling them. Therefore, two waste sludge samples were taken, one from the toothpaste industry and another from the paper industry as sludge coming out from the toothpaste and paper industry contains a lot of calcium carbonate and is important for Civil Engineers. What is done is no invention but just a simple innovation. From the findings of the toothpaste industry, it has been noticed that in India one toothpaste industry spends about 1 million USD for its safe disposal.

The study focuses on the addition of lime sludge produced in large quantities by the paper and toothpaste industries. Waste Lime sludge was blended in various amounts with bitumen VG 10 grade. Various bitumen tests were conducted such as Penetration, Viscosity, Ductility, and Softening point test. Locally available coarse aggregates were used. Tests including the Aggregate Crushing Test, Los Angeles Abrasion Test, Impact Test, and Water Absorption Test were conducted to evaluate the qualities of aggregates. Sludge powder was added after bitumen was heated to a temperature of 120oC. The mixture was manually blended evenly for 5 to 10 minutes. Thus, before conducting additional testing, the modified bitumen was warmed to room temperature. The strength of the bituminous mix is determined by performing Marshall Test. The results of the Marshall Test showed that with the value of strength improved by 26 percent as sludge's percentage raised by up to 20% in the bitumen and the optimum bitumen content was found to be 5.5%. The penetration results depicted that the increase in added sludge reduces the penetration which proves that it was transformed from soft bitumen to hard bitumen. The stretching ability of the bitumen was also found to decrease. Lime sludge also demonstrates anti-stripping properties by stiffening the HMA and binder to withstand rutting. Rutting, which occurs when elasticity is exceeded, is a permanent deformation of the asphalt. The superior functionality of hydrated lime as an active mineral filler is demonstrated by its capacity to make an asphalt mixture stiffer, tougher, and rut-resistant. Lime is chemically active as opposed to inert, unlike the majority of mineral fillers. It reacts with the bitumen, eliminating unwanted elements while also dispersing its tiny particles throughout the mixture, strengthening the pavement against rutting and fatigue cracking. It also improves the toughness and resistance of the mix. The addition of lime also reduces the age hardening of the bitumen.

From the above it can be concluded that there are solutions for every problem provided a proper approach is followed. Waste can be converted into worth with a proper engineering solution.

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