ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANIZATION OF ISLAMIC COOPERATION (OIC)
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Report Title

Use of Waste Paint Scrapings as Asphalt Filler

This report has been submitted for partial fulfillment of the degree of Bachelor of Science in Civil and Environmental Engineering.

Course Title

Project and Thesis

Presented By

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PROJECT REPORT APPROVAL

The thesis titled "**Use of Waste Paint Scrapings as Asphalt Filler**" was successfully submitted by **Md. Fyad Irfan** (180051232) and **Rashid Mahmud Emon** (180051237) have been found satisfactory and accepted as partial fulfillment of the requirement for the Degree Bachelor of Science in Civil Engineering.

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DECLARATION OF CANDIDATE

We hereby declare that we have performed the undergraduate research work reported in this thesis under the supervision of Dr. Nazmus Sakib, and this work has not been submitted elsewhere for any purpose.

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Dedication

THIS STUDY IS DEDICATED TO
OUR PARENTS AND BELOVED TEACHERS

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Abstract

Some of the materials that were once deemed trash, such as waste oils, plant-based additives, sulfur, etc., are now being included in the asphalt as extenders and additives. Wall paint scrapings from homes, construction sites, and repainting shops were collected for this research and used in Hot Asphalt Mix (HMA) as a filler and/or extender. Although it is advised that paint scraps be collected through a closed cycle system where dust containment is assured, this is not done in practice. Plastic-based paints can be heated and added to bitumen as a filler. Filler materials can be made from melting enamel-based paints. Paint scrapings were gathered from homes, paint stores, and construction sites, then pulverized to the appropriate fineness for the investigation. Some paints, especially those made of plastic or enamel, proved difficult to pulverize. These types of paints were shredded into thin strips and blended with hot bitumen (Pen 60-70 grade). Using stone dust as a standard, powdered paint scrapings were applied to asphalt at varying replacement rates (from 0% to 100%). Marshall stability data show a little increase due to powered paint waste relative to the baseline. However, when Indirect Tensile Test (IDT) is used to measure Tensile Strength Ratio (TSR), moisture resistance both improves and degrades for different filler percentage replacement cases. Some improvement in stability values was seen after both variants of paints were added to bitumen. In conclusion, a slight increase in the strength of the asphalt mix can be attributed to paint-based filler and/or extenders, which can be compensated by the increase of moisture resistance in some cases and excellent economic prospects. In addition, certain paints may include carcinogenic or heavy metal ingredients. Since these materials may or may not leach into the environment if they wind up in a landfill, their incorporation into pavement construction while encased in a water-resistant bituminous matrix may or may not be the best option depending on the filler replacement percentage.

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Chapter 1: Introduction

Chapter 1.1: Background

Natural resources are being depleted as the global population rises. In recent decades, research has focused on recovering useful minerals and energy from the trash in an effort to discover a long-term answer to the problems of the over-mining of natural resources and over-reliance on landfills (Cremiato et al., 2018). Today, sustainability is one of the most rapidly growing academic disciplines (Kuhlman & Farrington, 2010). To maintain sustainability, the world must save its resources and find new methods to recycle garbage (Aziz et al., 2015). Since the idea of recycling trash has been introduced, a whole new field of study has opened up. Researchers from a wide range of institutions have looked at the potential of green material technologies for recycling a wide variety of building debris and lowering the sector's environmental effect (Abu-Lebdeh et al., 2011; Hamoush et al., 2011).

In any infrastructure development, the first thing that needs to be developed is a road network. An ideal road network can't be developed without pavement work. So, pavement road plays a vital role in developing any type of infrastructure and communication. On the other hand, it should be noted by everyone that pavement degrades over time by using it for any sort of natural or artificial reason. So, effective control strategies should be taken for pavement improvement, and it should be cost-efficient. A country like Bangladesh, known as a developing country, can't always afford to fix pavement roads that are harmed for various reasons. Even if the government of Bangladesh takes the initiative to improve the roads, they may give priority to the mainstream pavement roads, which may be identified as national highways and state highways. Sometimes district roads and rural roads may not get the importance due to budget issues. So, modifying asphalt mixture components might help to reduce such situations for the time being. Modifying asphalt filler may play a big vital role in this case.

Chapter 1.2: General

An asphalt Mixture can be defined as a viscoelastic material composed of materials such as asphalt, coarse and fine aggregates, and fillers, which are mixed in specific proportions. Many studies have shown that these compositions can affect and influence the performance of pavements in different ways (Wu et al., 2021).

Asphalt filler may be defined as particles that are termed "fine particles" and have a diameter less than or equal to 0.075 mm. Typically, cement, stone dust, lime, and granite powders are used for fillers, but unfortunately, they are pretty much costly in every aspect. To save costs, fine sand, waste concrete & brick dust, and ash was used previously in different types of works (Sutradhar et al., 2015).

The asphalt pavement gets different types of distress over time. Some strategies can solve these issues. Filler materials can help to solve the above issues. Filler materials can improve the strength and performance of the pavement. Additionally, it helps to improve plasticity, porosity, water resistance, and weatherability (Bi et al., 2020).

Till now, there is no solid evidence found that people are using recycled paint waste as asphalt fillers. Every day different types of paint waste are generated all over the country, and all of these are dumped away by the workers. Nobody gave attention to these types of wastes over the years and thought about them using as filler materials on asphalt pavement.

Chapter 1.3: Different types of Paints

There are different types of paints. Some are used on walls, while others are used on the metallic surface. Based on the surface and material types, paints can be identified as:

1. Oil paint
2. Emulsion Paint
3. Plastic Paint
4. Enamel Paint
5. Lime Paint / Cement Paint
6. Bituminous Paint
7. Aluminum Paint
8. Synthetic Rubber Paint
9. Anti-Corrosive Paint

These are some well-known types of paints that are used daily on different types of materials for different reasons (*Types of Paint and Their Uses & Applications for Home Owners - Nerolac*, n.d.).

For this research study following paint scrap wastes were chosen:

1. Plastic
2. Enamel

Lime paint scrap waste was the primary priority for this research work, but due to inadequate waste materials, this waste was omitted from the list. If there is an opportunity in the future, the study will also be conducted on the Lime paint waste material.

Chapter 1.4: Scope of Study

This study will help to understand whether paint-scrapped wastes can be used as asphalt filler or not. Since asphalt filler materials are pretty much costly, on the other hand, it is a necessary material for gaining strength and performance of roads; it is high time to review alternate materials for the improvement of pavements. If the results give a positive indication, then the usage of costly filler materials will be minimized, and it would help the advancement of pavements, on the other hand.

Chapter 1.5: Aims and Objectives

Chapter 1.5.1: Aims

This research aims to look at the potential use of paint scrap wastes as pavement fillers. If the result gives a positive output, then there is a considerable possibility to use these wastes as fillers and save a lot of expenses annually. Also, to focus on the problems, analyze them, and provide a possible solution with additional suggestions that would benefit the investors looking for economic pavement construction for longevity.

Chapter 1.5.2: Objectives

The main objectives of this research are that:

- To look for new types of waste materials as filler materials
- To replace traditional filler materials
- To help investors to look for economic solutions
- Investigate the difference in results between traditional fillers and paint waste fillers

Chapter 2: Literature Review

Chapter 2.1: Paint

Chapter 2.1.1: Enamel Paint

A study revealed that having several XRF readings with four countries (Armenia, Brazil, India, Kazakhstan) has shown that Enamel Paints mainly have "Lead" as constituents. These Lead constituents have significant variations. Out of 98 samples, 34 samples had ≤ 15 ppm Lead constituents. 4 samples had a range of 16-90 ppm of Lead Constituents. 5 samples had a range of 91-600 ppm of Lead Constituents. 52 samples had a range of 601-100,000 ppm Leads. And around only 3 samples contained ≥100,000 ppm of Lead Samples. (Clark et al., 2014)

Another Study revealed that paint samples collected from Argentina, Brazil, Chile, Ecuador, Paraguay, Peru, and Uruguay countries having an average range of 0-90% of ≥ 90 ppm are Leads; additionally, the study revealed that an average range of 0-90% of ≥ 600 ppm are Leads. Lastly, an average content of 0-60% of ≥ 10,000 ppm contains Lead. On the other hand, some other countries like Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, and Russia have an average range of 77-81% of ≥ 90 ppm Leads. Additionally, the study revealed that an average range of 57-77% of ≥ 600 ppm are Leads. Lastly, an average content of 7-38% of ≥ 10,000 ppm contains Lead. Lastly, countries like Azerbaijan, Egypt, Lebanon, and Tunisia have an average range of 69-87% of ≥ 90 ppm are Leads; additionally, the study revealed that an average range of 48-83% of ≥ 600 ppm are Leads. Lastly, an average content of 7-53% of ≥ 10,000 ppm contains Lead. Most of the countries have a minimum of ≤10 ppm and a maximum of ≥100,000 ppm of Lead values, respectively (Clark et al., 2015).

Another study reveals that Enamel Paint has constituents like Petroleum spirit, oil, white Lead, and resinous materials. Additionally, enamel paint is resistant to acids, alkalis, and water (Srikanth & Asmatulu, 2013).

Chapter 2.1.2: Plastic Paint

Plastic paint has constituents like acrylic resin (55-60 wt.%), acetyl-butyl cellulose (4-6 wt%), Aldon resin (2-4 wt%), alkyl resin (5-8 wt%), plasticizer (2-4 wt%), diluent (25-30 wt%), levelling agent (0.2-0.4 wt%) and pigment (3-6 wt%). Some of the advantages of Plastic Paints are that it has high adhesion as well as good toughness; additionally, it contains excellent chemical properties and high lustre (*CN1397614A - Plastic Paint and Its Preparing Process - Google Patents*, n.d.).

In another study, it was revealed that the advantage of plastic paint is that it is insoluble in water, extremely fast drying, and nontoxic (Hunter, 1960).

Chapter 2.1.3: Paint Thinner

During the painting process, thinner is used to reduce the thickness of the paint. It means that thinner is used to dilute the existing liquid in paint and adjust its liquidity according to the usage required. For plastic paint, water is used, but for Enamel Paint, commercially named "T-6 Thinner" is used (*What Is a Paint Thinner? - Definition from Corrosionpedia*, n.d.).

Chapter 2.1.3.1: T-6 Thinner

T-6 thinner is made of organic solvents. It was produced with thin epoxy-based paints and primer (*Master Paints T6 Thinner - 5 L - Master Brand*, n.d.).

The common ingredients of thinners are Acetone, benzene, methanol, naphthalene, toluene, turpentine, and xylene. These ingredients are hazardous (*Paint Thinners | Metro*, n.d.).

Another research study reveals that thinner has the following characteristic and concentrations of thinner components;

Components	Concentration
m-xylene $C_6H_4(CH_3)_2$	60 %
Solvent Naphtha	10 %
Light Aromatic (Benzene)	7 %
Polyamine (triethylenetetramine)	23 %

Table 1: Characteristics and Concentration of Thinner Components

Source/Credit: (Hadi et al., 2013)

Chapter 2.2: Moisture Content in Pavement

It is a known fact that aggregates are porous to some extent and can absorb and contain moisture. Normally it is not a concern for Hot Mix Asphalt as the aggregates are dried beforehand. There are four aggregate moisture conditions, namely, Oven-dry, Air-dry, Saturated Surface Dry, and Wet. Pores that are not connected to the surface are not considered for any further calculations.

Typically, the known moisture tests that are conducted:

- **ASTM C-70:** Surface Moisture in Fine Aggregate
- **AASHTO T-85 and ASTM C-127**: Specific Gravity and Absorption of Coarse Aggregate
- **AASHTO T-84 and ASTM C-128:** Specific Gravity and Absorption of Fine Aggregate
- **AASHTO T-255:** Total Evaporable Moisture Content of Aggregate by Drying
- **ASTM C-566:** Total Moisture Content of Aggregate by Drying
- **AASHTO T-283:** Standard Method of Test for Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage

Source/Credit: (*Moisture Content – Pavement Interactive*, n.d.)

According to a short summary from (Svensson, 1997), water content has a great influence on unbound road construction materials, as well as the technical properties, that are from the subgrade soils. It has an influence that can be listed like:

- It has reduced bearing capacity when it is seen with increased water content, having a tendency lower internal friction among the material particle,
- The frosting process,
- The material that requires migration in connection with thawing,
- Weathering and Leaching.

The most common causes of high moisture in lower levels of pavement construction are changes in the groundwater table, faulty drainage systems, or water soaking into the pavement through cracks, voids, and unpaved shoulders. (McInnes et al., 1986)

A recent study explained that; for example, a high GWT level might substantially elevate moisture in the road structure, which creates poor working conditions for the pavement. Unbound base layers seem to be especially vulnerable to high moisture levels, where their bearing strength may be severely reduced. (Rokitowski et al., 2021)

Chapter 3: Methodology

Chapter 3.1: Gradation Selection

The pavement gradation was followed according to a local project Project Stone Aggregate Gradation, and gradation was again done in the lab. The final gradation selection was made as follows;

Particle Size	Percentage
10 mm – 20 mm	42%
5 mm – 10 mm	14%
0 mm – 5 mm	20%
200 µm (Filler)	24%
Bitumen	4.9%

Table 2: Gradation According to Local Project

This chart was followed to prepare samples for **heavy traffic** conditions**.**

Chapter 3.2: Sample Collection and Preparation

The paint waste samples were collected from repainting shops or construction sites. Around 4-5 kg of each sample were collected. The samples were crushed and pulverized using the "Los Angeles Abrasion" machine.

For preparing the samples, the "Marshall Mix Design" method was followed as the samples are mainly filler materials, so the fillers were replaced with traditional fillers as follows 0%, 20%, 40%, 60%, 80%, and 100%.

The samples were prepared solely by free hand mixing; no job mixing machines or other sorts of machines were used while preparing the samples. While hammering, a total of 75 blows were given to each site as the gradation and workflow will be based on heavy traffic.

Figure 1: Construction Site (Plastic Paint)

Figure 2: Repainting Shop (Enamel Paint)

Figure 3: Loss Angeles Abrasion Machine

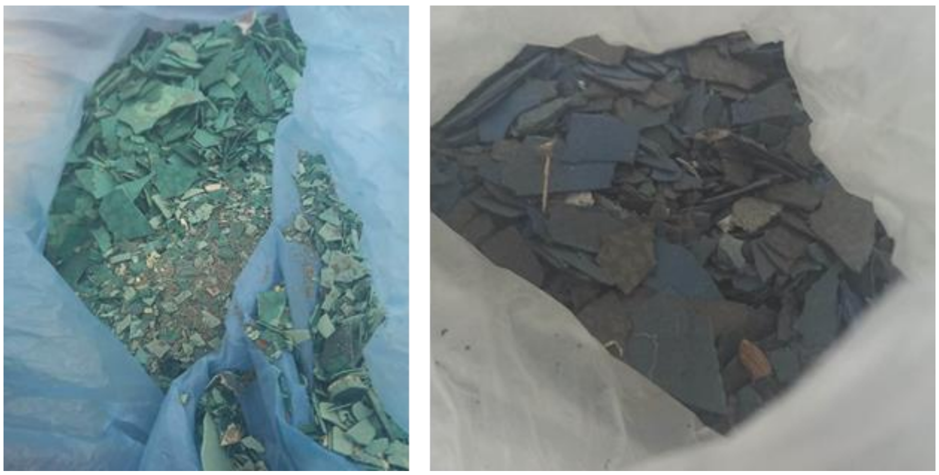

Figure 4: Before Pulverization

Figure 5: After Pulverization (Fines)

Figure 6: Sample Mixing Process

Figure 7: Samples-1

Figure 8: Samples-2

Chapter 3.3: Sample Test

The Marshall Stability Test and Tensile Strength ratio testing method were followed for sample testing.

Chapter 3.3.1: Marshall Stability

The Marshall stability test gives helpful information on the performance of asphalt mixes when they are subjected to load. This information is used in the design of asphalt pavements that can survive the loads caused by traffic as well as the conditions of the environment. It is a crucial piece of equipment for guaranteeing the integrity and endurance of asphalt materials utilized in building roadways.

In the realm of asphalt pavement, the Marshall Stability Test is essential for assurance of quality, performance speculation, optimization of design, choice of materials, compliance with regulations, and research objectives. It is vital in guaranteeing road pavement's long-term viability and durability, which it plays a critical part in assuring.

Figure 9: Marshall Stability Test Machine

Chapter 3.3.2: Tensile Strength Ratio

It is standard practice to subject pavement samples to the Tensile Strength Ratio (TSR) test to evaluate the overall structural integrity of the samples and determine how resistant they are to cracking. An instrument applies a controlled tensile force on the specimen until it cracks to determine a pavement sample's tensile strength ratio. The sample is tested to determine the maximum amount of tensile stress it can sustain before it breaks. Typically, one would represent this stress as a ratio that compares the pavement material's tensile strength to the design mix's tensile strength. The TSR is the abbreviation for the resultant ratio. When evaluating the resistance of pavement to cracking when subjected to traffic loads, the TSR is the method of choice. Higher TSR values imply a stronger resistance to cracking, while lower values reflect a higher possibility of fracture initiation and propagation. TSR values may be found in the material's microstructure. The test assists engineers and researchers in understanding the performance characteristics of various pavement materials and designs, which is helpful in the selection of and effort put into optimizing pavement structures.

Figure 10: TSR Machine

Chapter 4: Evaluation of Results

Chapter 4.1: Material Evaluation

Chapter 4.1.1: Bitumen

Origin	Malaysian Bitumen
Grade:	60/70
Sp. Gravity	1.03
Ductility	150 cm+ (not broken)
Softening Point	48.35º C
Flash Point	312º C
Fire Point	317º C
Loss on Heating of Asphaltic Compound	0.4%

Table 3: Bitumen Characteristics

Chapter 4.1.2: Aggregate

Origin:	Dubai Aggregates
AIV	15%
Elongation Index	12.42%
Flakiness Index	23%

Table 4: Aggregate Characteristics - 1

Sp. Gravity of Aggregates	
Particle Size	**Sp. Gravity**
10 mm – 20 mm	2.7
5 mm – 10 mm	2.68
0 mm – 5 mm	2.52
200 µm	2.48

Table 5: Aggregate Characteristics - 2

Chapter 4.1.3: Plastic Paint Waste

Origin	Construction Site
Sp. Gravity	2.122

Table 6: Plastic Paint Characteristics

Chapter 4.1.4: Enamel Paint Waste

Origin	Repainting Shop
Sp. Gravity	1.5

Table 7: Enamel Paint Characteristics

Chapter 4.2: Prepared Sample Evaluation

Chapter 4.2.1: Marshall Stability Test

Paint	% Filler	Stability (KN)
No Replacement	0	9.33682
Enamel	20	14.36422
	40	17.45516
	60	9.97029
	80	12.9536
	100	17.83328
Plastic	20	25.05512
	40	23.28454
	60	23.29371
	80	27.32296
	100	22.66987

Table 8: Marshall Stability Test Data

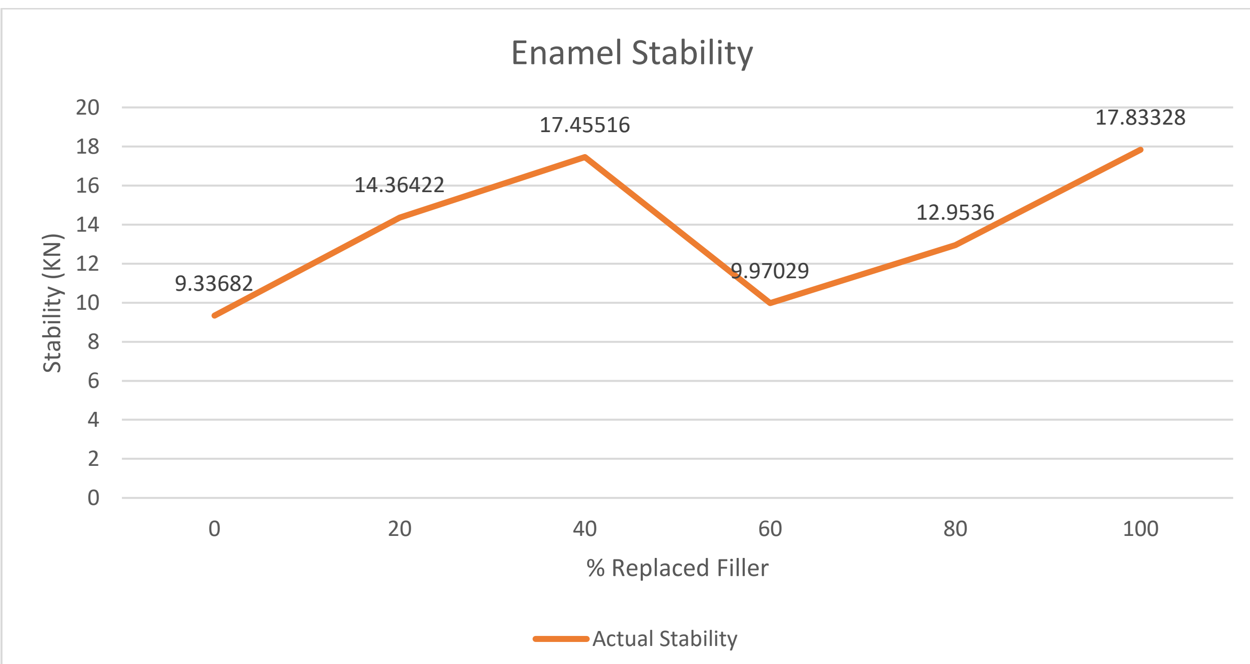

Figure 11: Enamel Paint Marshall Stability Graph

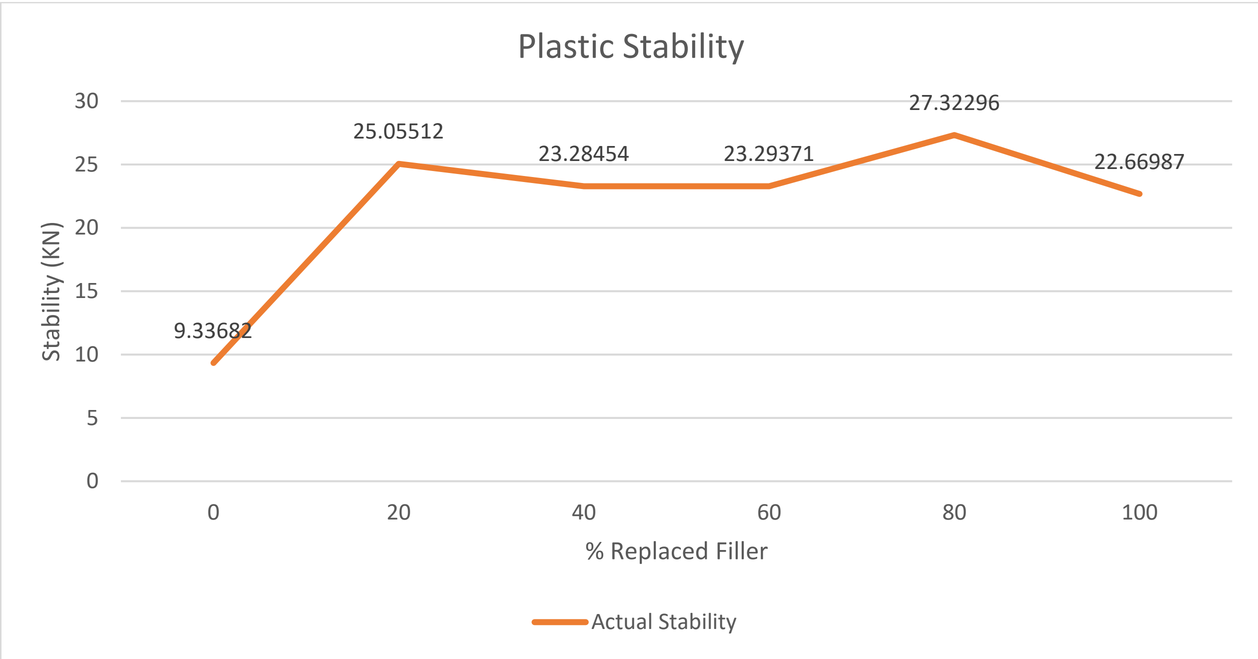

Figure 12: Plastic Paint Marshall Stability Graph

Figure 13: Sample After Stability Test

Chapter 4.2.2: Tensile Strength Ratio Test

Paint	% Filler	Tensile Strength (Unconditioned) (KN)	Tensile Strength (Conditioned) (KN)	TSR
No Replacement	0	8.01649	4.70357	0.586737
Enamel	20	12.625	2.09432	0.165886733
	40	11.24052	2.07082	0.20436638
	60	10.13288	2.00126	0.197501599
	80	13.34932	2.74896	0.205925096
	100	11.275	0.987	0.087538803
Plastic	20	9.69099	6.09838	0.629283489
	40	10.33154	6.65478	0.644122754
	60	7.87696	3.29868	0.418775771
	80	8.89975	1.29895	0.145953538
	100	8.13664	1.54593	0.189996116

Table 9: TSR Test Data

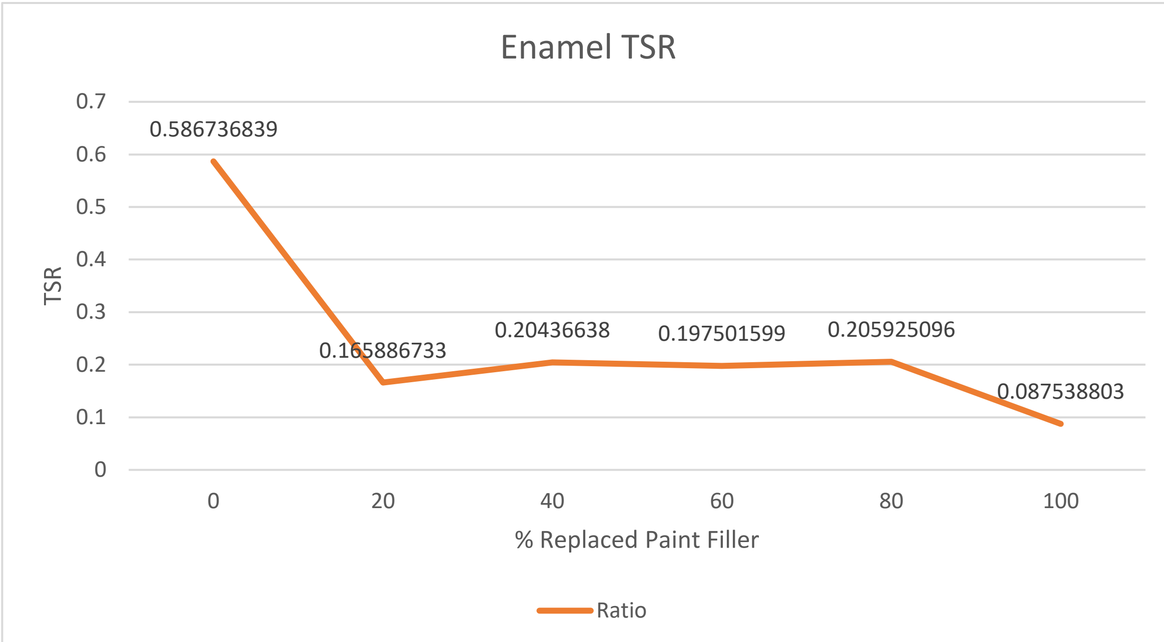

Figure 14: Enamel Paint TSR Graph

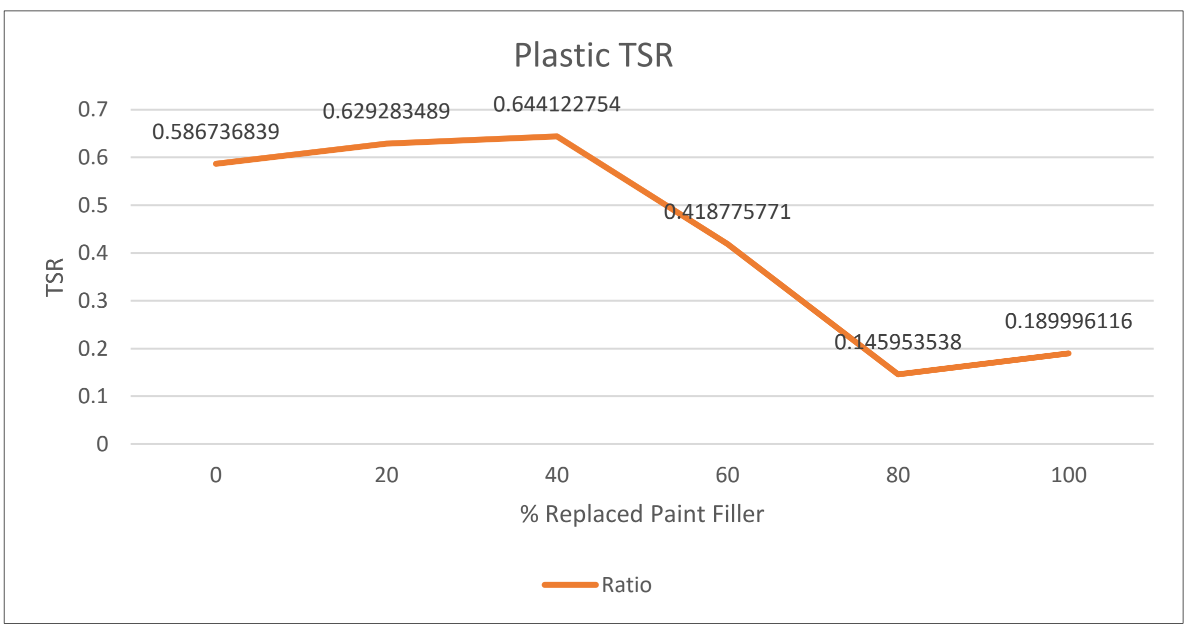

Figure 15: Plastic Paint TSR Graph

Figure 16: Sample AFter TSR Test

Chapter 5: Experimental Data Discussions & Limitations

Chapter 5.1: Enamel Paint Waste as Filler

Chapter 5.1.1: Enamel Paint Waste as Filler: Marshall Stability

The Marshall Stability for Enamel Paint gave the best result when it was replaced by traditional filler by 40% and 100%. Other variations give lower results comparatively. But overall, the stability values are higher than 0% replacement.

Chapter 5.1.2: Enamel Paint Waste as Filler: TSR

Compared to 0% replacement, the TSR for other replaced variations gives worse results.

Chapter 5.1.3: Final Comment on Enamel Paint Waste as Filler

Since TSR at 0% gives the best result compared to the other variants, we may reject this waste using asphalt filler.

Chapter 5.2: Plastic Paint Waste as Filler

Chapter 5.2.1: Plastic Paint Waste as Filler: Marshall Stability

The Marshall Stability Value for Plastic Paint replacing traditional filler by 20% to 100% can be considered almost the same, and all of them give better stability value than the 0% replacement.

Chapter 5.2.2: Plastic Paint Waste as Filler: TSR

Compared to 0% replacing the traditional filler with 20% and 40% of Plastic Paint Waste Filler gives better results. But, again, the TSR drops drastically from 60% to 100% replacement.

Chapter 5.2.3: Final Comment on Plastic Paint Waste as Filler

Plastic Paint Waste replacing traditional filler by 20% & 40% can be an option for consideration for pavement work.

Chapter 5.3: Limitations

Limited Availability of Paint Wastes: The present research may have been limited by the constrained availability of paint wastes, which could have implications for the scope and generalizability of the findings. Acquiring a satisfactory amount of paint waste for experimentation and analysis may have presented difficulties.

Freehand Mixing: The current research investigation investigated the freehand mixing process conducted without adherence to strict guidelines or standardized procedures. The mixing process is subject to a lack of control, resulting in significant variability. This variability poses a challenge to achieving uniformity in the mixed materials' composition and properties.

Influence of Room Temperature: The present study investigates the impact of room temperature on the experimental setup. Specifically, the study was conducted during a summer heatwave, which led to room temperatures exceeding 30 degrees Celsius. The present study highlights the significance of elevated temperatures in modifying the attributes of paint waste, encompassing chemical properties, consistency, and viscosity. The alterations in temperature that occur have the potential to affect the outcomes derived from the investigation.

Impact of Aggregate and Bitumen Quality: The present study aims to investigate the effects of aggregate and bitumen quality on the outcomes of experimental mixtures. It is hypothesized that the quality of the aggregate and bitumen can significantly affect the properties of the mixtures. This thesis will explore the relevant literature and present the findings of the experimental investigation to support the hypothesis. The results of this study will contribute to understanding the importance of aggregate and bitumen quality in the design and production of asphalt mixtures. The present study aims to investigate the impact of aggregate properties, including particle size distribution, shape, and composition, as well as bitumen quality, such as viscosity and adhesion properties, on the behavior and performance of mixed materials. The findings of this research will provide valuable insights into the role of these factors in determining the characteristics and properties of the mixed materials, which can have significant implications for their practical applications.

Loss of Filler Materials During Mixing: This study addresses the loss of filler materials during the mixing process. The filler materials utilized in this research are composed of dust particles, which are susceptible to loss during mixing. The dispersion or escape of filler materials from a mixture can be attributed to various factors, including but not limited to heat and airflow. In addition, the impact of material loss on the composition and proportions of mixed aggregates and bitumen can lead to a modification of the intended properties of the final mixture.

Melting Tendency of Enamel Paint Waste: The current research investigates the melting tendency of enamel paint waste, a commonly utilized material. Enamel paint waste has been observed to exhibit a propensity for melting upon exposure to heat. The present study aims to investigate the potential effects of elevated room temperature on the melting process of mixed materials. Specifically, the experimental setup may have accelerated the melting process, which could have resulted in alterations in the composition and behavior of the materials under investigation.

Different Constituents of The Paints: This study addresses the differential constituents in two types of paints. The constituents of interest include pigments, solvents, binders, and additives. It is hypothesized that the two types of paints may contain varying levels of these constituents, which could impact their overall performance and properties. By analyzing and comparing the constituents present in each paint, this study aims to understand better the factors contributing to the differences observed between the two paint types. The current investigation seeks to explore the impact of diverse constituents on the performance and attributes of composite materials. Including different elements in the mixture introduces additional variables that may affect the experimental outcomes. Therefore, this research is devoted to investigating the distinct effects of varying components on the characteristics of mixed materials.

Conclusion

The Novelty of Paint Waste Materials: This study explores the originality of utilizing paint waste materials that have not been previously recycled or are being investigated for alternative applications. The present study investigated the feasibility of using said waste products as fillers. This study seeks to make a contribution to the advancement of sustainable and eco-friendly practices within the construction industry by examining the effectiveness and appropriateness of fillers.

Evaluation of Paint Waste as Filler Materials: The study evaluated paint waste for its potential use as a filler, and the results showed that the paint waste components had desirable qualities for this purpose, according to experimental studies and observations. Physical and chemical attributes were characterized, and other experiments were conducted to demonstrate that the materials were, in fact, good candidates for use as fillers in asphalt.

The Optimal Percentage of Paint Waste Filler: The study found that using either 20% or 40% plastic paint waste fillers in place of conventional filler materials produced satisfactory results. The identification of optimal percentage ranges for achieving optimal performance and characteristics in asphalt mixtures is a crucial aspect of asphalt engineering. This study has determined that the percentages as mentioned above are the most effective in achieving these goals. This study presents evidence that waste materials from the paint can serve as a suitable filler component in asphalt mixtures. The results suggest that this alternative filler option can be a viable substitute for traditional fillers.

Rejection of Enamel Paint Waste as Filler: Experimental results showed that enamel paint waste fillers performed poorly in the TSR (Tensile Strength Ratio) test. Evaluating asphalt mixtures' resistance to moisture damage is a common application of the TSR test. Because of their unsatisfactory results in this test, fillers made from enamel paint waste are not recommended for use in asphalt. Therefore, the need to cautiously choose and assess paint waste materials for certain applications is shown by this refusal.

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