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# Development of Porous Asphalt Pavement using Recycled Surface Dressed Pavement Materials (RSM)

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**Abstract**

The study aims to create sustainable porous asphalt by integrating recycled surface-dressed pavement materials (RSM) instead of traditional dense asphalt mixes. Experiments show RSM meets eco-friendly pavement construction standards, with mixtures ranging from 0% to 80% RSM. Physical properties like Aggregate Impact Value (AIV), elongation, flakiness, 6water absorption, and specific gravity differ between virgin aggregates (VA) and RSM. Despite flow and stability issues, the Marshal quotient meets industry standards. Permeability studies reveal a link between RSM percentage and porous asphalt permeability, highlighting the need for material optimization. The research emphasizes the cost-effectiveness and performance of recycled materials in porous asphalt, offering a practical solution for managing runoff water and promoting sustainable infrastructure. Utilizing RSM in porous asphalt provides sustainability and cost benefits.

## Introduction

It is crucial to use sustainable paving materials while building and maintaining roads, highways, and other transportation systems in order to minimize the environmental effects of infrastructure development. Utilizing resource- and environmentally-conscious materials that encourage long-term sustainability and reduce environmental harm is central to the idea of sustainable pavement materials.

Reclaimed and recycled asphalt from previous or current asphalt pavements is referred to as "Recycled surface dressed pavement material," or RSM. Old asphalt is milled or removed during road or pavement rehabilitation or repair, and the recovered material is then gathered and processed for use in new pavement construction. [1] Laboratory testing on virgin mixes and mixes with 20% RSM revealed that adding RSM enhances all the bituminous mixes' properties, suggesting that mixes with 20% RSM would function better than the virgin mixes in comparable circumstances.

The performance and longevity of asphalt pavements are largely dependent on bitumen, an essential component of asphalt mixes. The impact of bitumen content on several mechanical, rheological, and environmental aspects of asphalt mixes is examined in the literature.
[2], The ideal amount of bitumen in the mixture is defined as such that the porosity and water saturation are outside of the GOST 9128–97 requirements while the strength of the asphalt concrete is at its highest. The excessive amount of bitumen in the mixture lowers the asphalt concrete's strength, shear stability, and fluidity, which causes shears to form in hot weather. Excessive bitumen in asphalt concrete is indicated by a low water saturation value. The strength and frost and corrosion resistance of asphalt concrete are diminished when bitumen is absent.

A special kind of pavement known as permeable or porous pavement serves as a structural surface for cars and pedestrians as well as a tool for managing storm water runoff and lowering surface runoff. Although there are many unique choices and associated technologies available, the most popular permeable pavements include plastic grid-stabilized systems, porous asphalt pavement (PAP), pervious concrete (PC), and permeable interlocking concrete pavement (PICP). PAPs have a number of positive environmental and sustainable effects, including as lowering storm runoff volumes, replenishing groundwater, enhancing water quality, and improving driving quality and safety by lowering noise levels and hydroplaning tendencies, [3].

## Material and Method

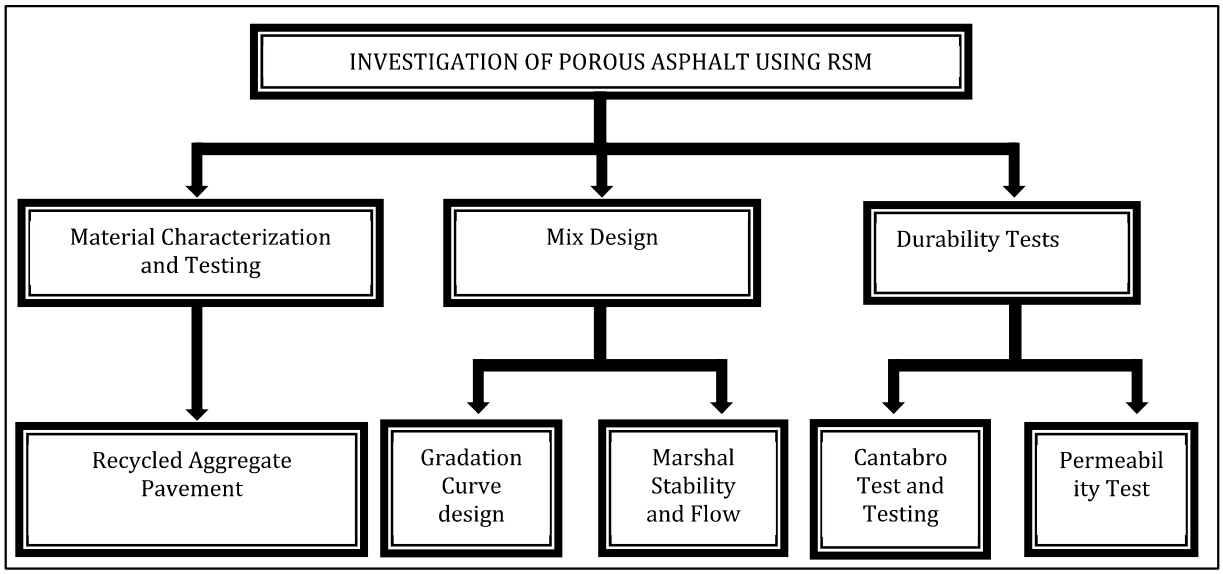


**Figure 1.** Investigation of porous asphalt containing RSM

The kinds of materials consider are as follows:

1. Aggregates
   i. Recycled surface dressed pavement material (RSM)
   ii. Virgin aggregates
2. Bitumen 60/70

## Results

**Table 1.** Physical properties of Virgin aggregates and RSM

| Test | Virgin Aggregates | Recycled surface dressed pavement material |
|---|---|---|
| Specific gravity | 2.64 | 2.45 |
| Water Absorption | 5.03 | 4.30 |
| Aggregate Impact Value | 8.77 | 14.10 |
| Flakiness | 10 | 5 |
| Elongation | 44 | 15 |

**Table 2.** Percentage passing of Virgin and RSM aggregates

| Sieve | 100% RSM | 100% VA | 80% VA & 20% RSM | 60% VA & 40% RSM | 40% VA & 60% RSM | 20% VA & 80% RSM |
|---|---|---|---|---|---|---|
| Pan | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 5.00mm | 9.33 | 34.83 | 19.70 | 18.67 | 23.78 | 17.59 |
| 6.30mm | 13.14 | 40.23 | 24.80 | 21.78 | 27.66 | 21.23 |
| 10mm | 26.58 | 53.67 | 40.99 | 34.96 | 39.45 | 34.63 |
| 14mm | 54.16 | 70.77 | 71.44 | 57.19 | 57.36 | 60.04 |
| 20mm | 86.96 | 81.67 | 81.93 | 79.26 | 82.34 | 84.80 |

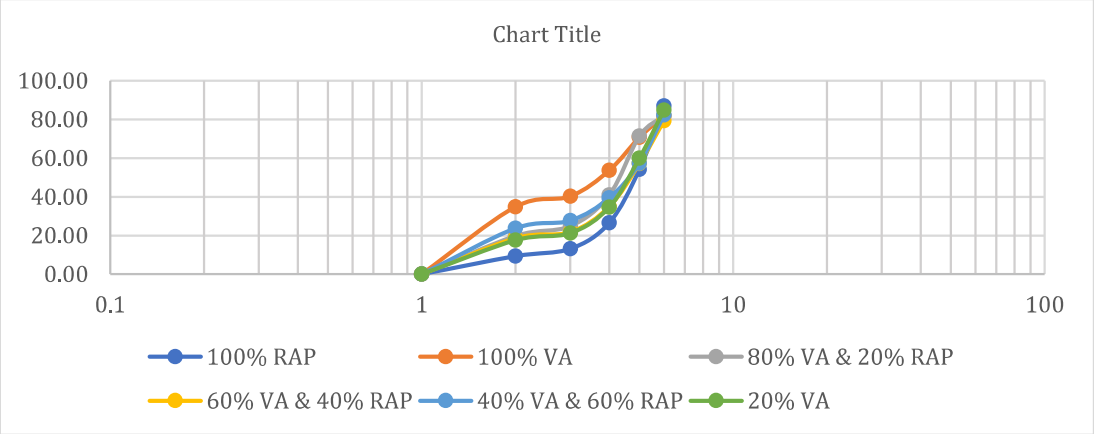


**Figure 2.** Percentage passing of Virgin and RSM aggregates

**Table 3.** Porous Asphalt properties

| SN | Stability (kg) | Flow (mm) | Permeability (mL/s) | Drain down (%) | Cantabro (%) | RSM (%) | VA (%) | BC (%) | MQ |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 650 | 9.3 | 449 | 0 | 6.94 | 0 | 100 | 5 | 69.9 |
| 2 | 370 | 7.3 | 413 | 0.8 | 8.14 | 20 | 80 | 5 | 50.7 |
| 3 | 360 | 7.6 | 278 | 5.5 | 11.42 | 40 | 60 | 5 | 47.4 |
| 4 | 290 | 9.9 | 275 | 9.4 | 14.52 | 60 | 40 | 5 | 29.3 |
| 5 | 285 | 9.6 | 222 | 28.9 | 14.7 | 80 | 20 | 5 | 29.7 |

## Discussion

Models were developed from the experimental data to show the relationships between measured responses and variables, and among measured responses. Excel package was used for this purpose and only one parameter was considered at this stage model. Some of the relationships were linear and nonlinear models such as polynomial equations with higher degrees were used. This is to allow validation of the models through statistical analysis since the excel package can only perform linear regression. The regression was done at 95% confidence interval.

## Conclusion

The experimental results from the porous asphalt gradation show that the creation of Porous Asphalt Pavement using Recycled surface dressed pavement material (RSM) has been a promising undertaking. The project's aggregates have proven to follow the recognized guidelines for porous asphalt pavement, highlighting the practicality of using recycled resources in building.

The utilized Recycled Aggregates Pavement (RSM) has desirable characteristics, including a specific gravity of 2.45, a water absorption of 4.3, and an Aggregate Impact Value (AIV) of 14.1.

## References

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