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Beeline for making flexible pavement by using discarded plastic and quartz stone powder

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ABSTRACT

Every day, the discard waste plastics and many other mineral wastes like quartz powder, stone dust, marble waste etc., are dumped in the earth surface. It may cause environmental pollution. Nowadays, many engineer and industries are investigating the possibilities of waste plastics and mineral waste in flexible pavement. An attempt has been made to use the plastic as aggregate coating in order to increase road performance and durability. Plastic wastes like low density polythene, polypropylene, polythene, Terephthalate are used. These waste plastics are cut into small pieces. Aggregate are heated to a certain temperature and the spread over the heated aggregate. Due to heating this plastic gets softened and forms a coating as layer over these aggregate. The result indicates that the 10% of plastic coated aggregate doesn't disqualify the material and no negative influence on the quality asphalt mixture. Even-though quartz stone powder used as filler material in asphalt mixture because they fill voids and enhances the cohesive property. Quartz is a mineral, which composed of sio_2 (silicon dioxide). It is the second most adopted mineral in earth continental crust. The durability of the asphalt pavement is related to the appropriate proposing of mineral materials. Quartz mineral materials are used to enhance the asphalt mix quality. Bituminous mixtures are basically composed of aggregate of different sizes, fillers and bitumen. Fillers consist of mineral grain most of which 2.75mm sieve. Quartz powder may be of naturally available materials when derived from the crushing if quartz rocks. Discard waste plastics, quartz stone powder and a type of asphalt binder on the properties of asphalt mixture were investigated in this project. The result indicates positive influence on the quality of asphalt mixture. We use discarded waste plastic and quartz stone powder in more innovative and contributing in order to reduce negative impact of waste on environmental.

Keywords: *Waste Plastics, Bitumen, Aggregate, Quartz stone, plastic road*

INTRODUCTION

One of the most important infrastructures is Flexible Pavement. If there is any damage to this structure cause inconvenience to the traffic, which ultimately affect future scenario of countries. Simultaneously, waste plastic disposal is extremely severe nowadays. In order to improve the performance of the road surface. The plastic will be used for aggregate coating in order to increase road performance and durability.

Due to the excessive usage of the plastic materials, the availability of waste plastic is enormous, as the plastic waste become part and parcel of daily life. Plastic wastes like Low Density Polyethylene, Polypropylene, polyethylene Terephthalate, Polystyrene are used. These waste plastics are shredded into small pieces. Dry process is followed here. Aggregates are heated to a certain temperature, and the shredded plastics are spread over these heated aggregate. These plastics gets softened and forms a coating as a layer over these

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aggregates. Aggregates are coated with waste plastics up to 45% and tested. A property of aggregates gives good response to these coating. It shows better resistance to abrasion, Crushing, Impact, Water absorption test.

Bituminous mix is prepared and stirred well in order to get uniform mix, then quartz stone powder is weighted and added to the hot bitumen in different percentages. This quartz stone powder is used as a filler material. Until now, various fillers like cement, fly ash, eggshell powder, coconut shell powder, etc., are used. In the present study, an attempt has been made to use waste plastics as coat over aggregate and as quartz stone powder filler in bituminous mix. This mixture is laid on the road surface like a normal tar road.

One of the major concerns amongst these is safe and sound disposal of solid wastes. Bituminous mix is prepared with quartz stone powder waste up to 50% and plastic coated aggregates. Marshall Method is adopted for the mix design. India consumption of plastics grew every year and is set to be the world third largest consumer of plastic in this world.

Modified bitumen acts as multi grade due to their low susceptibility to daily and seasonal temperature variations.

- Higher resistance to deformation at elevated pavement temperature and resistance to brittle cracking at low pavement temperature.
- Better adhesion between aggregate and binder, higher fatigue life of mixes under heavy axle loads and better resistance to ageing.
- Overall improved road performance in extreme climatic conditions and heavy traffic conditions.

Objective of present study

- To utilize the discard plastics materials as a pavement ingredients.
- To study the quartz stone powder and fillers mixed with bitumen.

LITERATURE REVIEW

Rokade S (2012) suggested that Use of Waste Plastic and Waste Rubber Tyres in Flexible Pavements. Plastics are user friendly but not eco-friendly as they are non-biodegradable. The better binding property of plastics in its molten state has helped in finding out a method of safe disposal of waste plastics, by using them in road laying. The rubber which is obtained from the waste tyres of Vehicles, in the construction of sourced from disposed waste plastic and crumb rubber. Two types of polyethylene were added to coat the aggregate: High Density Polyethylene (HDPE) and Low Density Polyethylene (LDPE). The crumb rubber was added to 60/70 grade bitumen in varying percentage of 8%, 10%, and 12%. The mix was prepared with 5% bitumen and varying percentage of crumb rubber. It is observed that the Marshall Stability Value are increased from 8% to 10% Crumb Rubber and then it is decreased. i.e., 10% of Crumb Rubber of weight of bitumen is the optimum dose for getting enhanced strength characteristics of mix. The bulk density also shows increasing trend from 8 to 12% in mix.

Rema Devi M, Lena Stephen, Mini M I (2013) suggested Reduction of Optimum Bitumen content in Bituminous mixes using plastic coated aggregates. Use of plastic in road construction is gaining importance these days because plastic roads perform better than ordinary roads and the plastic waste, otherwise considered to be a pollution menace can find its use. This deals with the investigations of the use of waste plastic for coating of aggregates in the bituminous mix. Optimum bituminous mixes are designed using ordinary aggregate and plastic coated aggregate. The properties like water absorption, stripping value and soundness are improved using plastic coated aggregates. The optimum Binder content value for the ordinary aggregate mix is 4.658% and for the plastic coated aggregate mix is 4.583% which is obtained from the test mix results.

MATERIALS USED

Bitumen

Bitumen is a sticky, black and highly viscous liquid or semi-solid, in some natural deposits. It is also the residue or by product of fractional distillation of crude petroleum. Bitumen composed primarily of highly condensed polycyclic aromatic hydrocarbons, containing 95% carbon and hydrogen (± 87% Carbon and ±8% hydrogen), up to 5% sulphur, 1% nitrogen, 1% oxygen and 2000 ppm metals.

Aggregate

Natural aggregate

Coarse aggregate is one of the most important materials used for flexible pavement construction. The coarse aggregate should be screened crushed rock, angular in shape, free from dust particles, clay, vegetation and organic matters.

Plastic coated aggregate

Aggregate coatings 10% plastic mixture are great strength obtain. it should be increase the percentage of plastic coating up to 10% the value of strength will be reduced. Since it is a thermoplastic polymer, is widely used in construction because it is cheap, durable and easily worked. The PVC wastes are collected from domestic wastes, mineral water bottles, credit cards, toys, pipes and gutters, furniture, pens etc.,

Quartz stone

Quartz, most common of all mineral is compost of silicon dioxide, or silica siO_2.It is an essential component of igneous rock and metamorphic rock. Quartz is colourless, but commonly colour by impurities..

TESTS TO BE CONDUCTED

Test on Bitumen

The various tests that have to be conducted on bitumen are

- Ductility test
- Softening point test
- Penetration test
- Viscosity test

Ductility test

The ductility test is used to measure the distance in centimetres for which the bitumen sample can be stretched before it tears.

Penetration test

The bitumen hardness can be determined by penetration test. It involves measuring depth a tenth of a millimetre to which a standard needle penetrate vertically under specified conditions of standard load and temperature

Viscosity test

Property that retards its flow due to internal friction and it is a measure of resistance to flow of the liquid

Softening point test

In this method, ring ball or ball test method is preferred.

Tests on Aggregate

- Crushing test
- Abrasion test
- Specific gravity test
- Impact test

Crushing test

Aggregate crushing value is nothing but gradually applied compressive load over the aggregate sample. In this, values generally shall not exceed 45% by weight.

Los Angeles Abrasion Test

Resistance to wear or hardness is essential properties for road aggregate.

Water absorption of aggregate

A moisture content of an aggregate is defined as the weight of surface moisture (i.e., the moisture in excess of that held by aggregate in a saturated surface dry condition), expressed as a percentage of the weight of the aggregate in saturated surface dry condition.

Specific gravity test

The specific gravity of an aggregate is considered to a measure of the quality or strength of materials. Stones having low specific gravity values are generally weaker than those having the higher value.

Impact test

Aggregate impact value is nothing but resistance to sudden impact or shock load.

Natural aggregate

Plastic coated aggregate

Ductility Test

Viscosity Test

Softening Point Test

Crushing Test

Los Angeles Abrasion Test

Water Absorption test

Specific Gravity

Impact Test

RESULTS

The comparative results for bitumen with quartz stone powder fillers and Natural & Plastic Coated aggregates

S.NO	TEST ON AGGREGATE	NATURAL COARSE AGGREGATE (0%)	PLASTIC COATED AGGREGATE (10%)	PERMISSIBLE VALUE AS PER MORTH
1.	Impact value	13.80%	12.02%	24%
2.	Los angeles	18.34%	16.32%	30%
3.	Water absorption	2%	1%	2%
4.	Average specific gravity	2.85%	2.78%	2-3%
5.	Crushing strength	26.91%	24.71%	30%

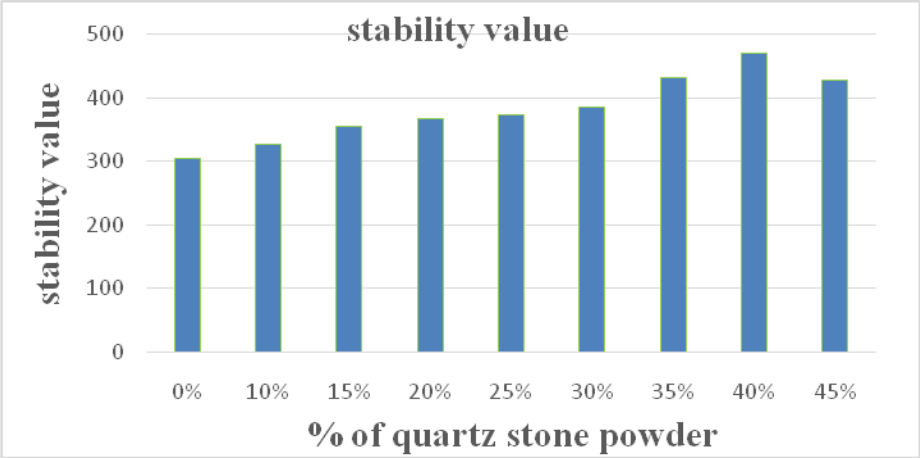
5.2 Test on bitumen

S.NO	TEST ON BITUMEN	TESTED VALUE
1	Ductility test	69.3cm
2	Penetration test	41.8%
3	Softening test	48°C
4	Viscosity test	33sec

Marshall Stability Value On Bituminous Mix

S.NO	BITUMEN%	QP (%)	PLASTIC	AGGREGATE	DIA(MM)	HEIGHT	STABILITY
1	5%	0%	0%(0 g)	1140 grams	100 mm	64 mm	304.83kg
2	5%	5%	10% (6 g)	1134grams	100mm	64mm	326.54kg
3	5%	10%	10% (6 g)	1134 grams	100 mm	64 mm	354.47kg
4	5%	15%	10% (6 g)	1134grams	100 mm	64 mm	367.47kg
5	5%	20%	10% (6 g)	1134 grams	100 mm	64 mm	373.37kg
6	5%	25%	10% (6 g)	1134 grams	100 mm	64 mm	385.17kg
7	5%	30%	10% (6 g)	1134 grams	100 mm	64 mm	430.80kg
8	5%	35%	10% (6 g)	1134 grams	100 mm	64 mm	469.73kg
9	5%	40%	10% (6 g)	1134 grams	100 mm	64 mm	527.067kg
10	5%	45%	10% (6 g)	1134grams	100 mm	64 mm	438.17kg

Comparison of Stability different percentage in mix Value



CONCLUSION

- The fillers quartz stone powder waste used in this experiment have give the good result and the less penetration value with low grade bitumen to withstand high grade.
- The fillers are mainly used to fill the voids between the aggregate and used to reduce the cost of the materials, increase stiffness.
- From the above study it is observed that they are being a waste product is effectively used to enhance the properties of bitumen.

REFERENCES

[1]. International Journal of Engineering and Advanced and Technology (IJEAT). ISSN: 2249-8958, 2(3), 2013 on Pavement Performance with Carbon Black and Nature Rubber (latex).
[2]. International Journal of civil engineering and technology (IJCIET) ISSN: 0976-6308, ISSN: 0976-6316 5(10), 2013, on Effects of natural rubber on the properties of bitumen and bituminous mixture.
[3]. Study on Effect on Waste plastic and crumb rubber on physical properties of bitumen, 2(5), 2013, ISSN : 2277-8179
[4]. Effects of Waste PVC on the Properties of Bituminous mixes, Volume 4(1), 2012, 77-84.
[5]. Application of Waste plastic as an Effective Construction material in Flexible pavement, 2(3), 2015
[6]. International Journals of the Physical science, 7(2), 2012, 166-170, 9 ISSN 1992-1950, An Overview of Crumb rubber modified Latex.