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A study of GFRA products made with scrap plastic and glass for asphalt pavement road in Mongolia

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***Abstract*-The world's population grows day by day, the technological developments and people's needs are increasing environmental issues are increasing. Recycling and production of waste products in recent years is highly demanded. In this study commonly used in our country, absorbed in the environment for long periods of time, recycling of scrap glass and plastic was studied and the possibilities for producing roads and construction materials were studied. PEGS (PolyEthylene glass scrap) and PPGF (Polypropylene glass fiber) picked, the tests were carried out to improve the properties of the asphalt mixtures, the main material of the road construction. The hot asphalt mixture added the additives, then will determine the physical and mechanical characteristic of the additive and non-additive asphalt mixtures laboratory test by Marshall method. Then observations will determine the rutting 3m width and 50m length at the test area for 6 months. Further, it is necessary to develop a detailed analysis using modern laboratory tools to improve testing methods.**

***Keywords* – Fiberglass, asphalt, concrete, binder, polypolymer.**

I. INTRODUCTION

In foreign countries recycling the waste raw materials, product processing plant technology is growing rapidly. However, in Mongolia, this sector is not well-developed, so the materials are being imported. Glass and plastic waste were recycled and will study the use of filler and adhesive in road and construction materials. In our country, using the addition of polymers to asphalt mixtures is very rare in the field. The use of field experiments in combination with laboratory experiments is innovative and advantageous.

II. LITERATURE REVIEW

In our country, there are 20 000 tons of plastic waste annually. Its 15,000 tons beverage container and water tank, PET, 4.5 tons plastic household LDPE, PE plastic bags of 0.5 tons. Source: Mongolian National Recycling Association, Therefore, it is necessary to recycle these wastes internally. Currently, a study has been carried out to increase the use of polymer materials in roads and buildings.

In particular, Americans, Australians, Indonesians, and Indians have developed rapidly into this field of study and have succeeded in achieving this.There are many plastic materials types. Suitable for our country's climate, will find and creating additive materials is essential. The object I chose 50m length, 3m width in the direction of "Jukov bus station / Khan Bank center / - East 4 road intersection". In there, PEGS (Polyethylene glass scrap) and PPGF (Polypropylene glass fiber) additives were used.

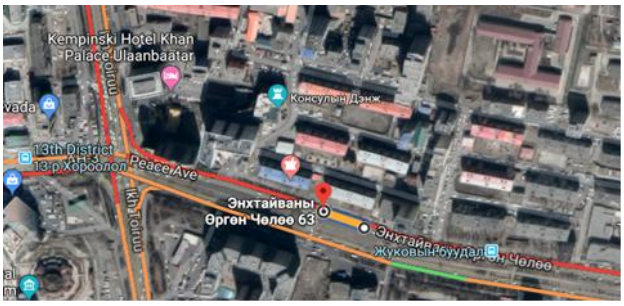

Fig.1. "Jukov bus station /Khan Bank center/ - East 4 road intersection"

III. METHODS AND RESEARCH DATA

1. Research methodology

Other countries used various additives to lengthen the useful life of the asphalt mixtures and minimize the disturbance and injuries of the road. Under the study, PEGS and PPGF products will be added to the hot asphalt mixtures and observe changes in their physical and mechanical characteristics. Also, perform observation experiment on road construction the square. In the laboratory shall determine the composition of the asphalt mixtures and determine the physical and mechanical characteristics. The asphalt mixtures have been preparing by composition in the asphalt factory. Then it will make

asphalt pavement concrete. Asphalt concrete tested in the laboratory, asphalt pavement concrete in the field there will compare indicators of physical and mechanical properties. Conducting a rutting experiment by observing a new asphalt concrete for a certain period of time.

2. Test of asphalt mixtures with fiberglass additive and non-additive

In recent years, the PEGS and PPGF products introduced in Korea have been added to the hot asphalt concrete and laboratory experiment has been done. Fig.2. shows the filler materials.

Fig.2 Fiberglass (PPGF and PEGS).

Table 1 shows the components of the hot asphalt concrete mixtures with fiberglass additive

Table 1 Hot asphalt concrete mixtures with fiberglass additive

S/n	Material /quarry/	Component of Material (%)
1	Aggregate (10-20) mm	39.0
2	Aggregate (5-10) mm	19.0
3	Crushed sand (0-5) мм	36.0
4	Mineral fines	6.0
5	Bitumen	5.3
6	Additives (PEGS, PPGF)	1.5

The asphalt concrete mixture was prepared by the component above-mentioned in the factory. Was created 3m width, 50m length test area. Results testing drilled cored from the newly created asphalt pavement are shown in Table 2 According to AASHTO T 24 standard.

Table 2 Physical-mechanical characteristics of asphalt pavement

Indicators	Unit of measurement	Results
Average density	g/cm	2.320
Durability of binder	kg	1606.66
Elasticity 1/100 cm	cm	21.0
Porosity of mixtures	%	4.08
Percentage of completion	%	72.49

The physical and mechanical characteristics of the asphalt mixtures with fiberglass additive and non-additive are summarized in table 3.

Table 3Hot asphalt mixtures with fiber glass additivie and non-additive

Indicators	Unit of measurement	Laboratory		Field
		Non-Additive + Asphalt concrete	Asphalt concrete + Fiber glass	*Asphalt concrete + Fiber glass
Average density	g/cm	2.308	2.311	2.320
Durability of binder	kg	1359.85	1438.57	1606.66
Elasticity	cm	27.0	23.0	21.0
Porosity of mixtures	%	3.36	3.75	4.08
Percentage of fill	%	71.03	73.10	72.49

Explanation:

Laboratory – the results of the asphalt mixtures tested by the laboratory

Field – The result of the testing drilled cored from the new asphalt pavement

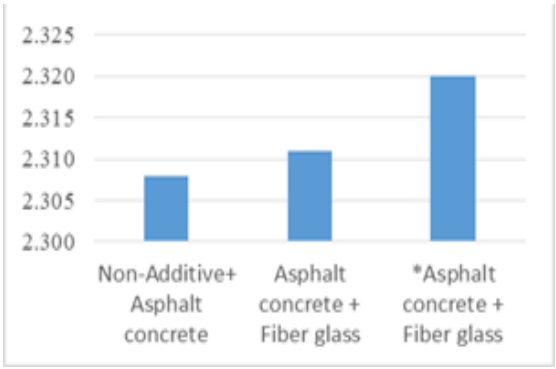

Fig.3(a)Average density.

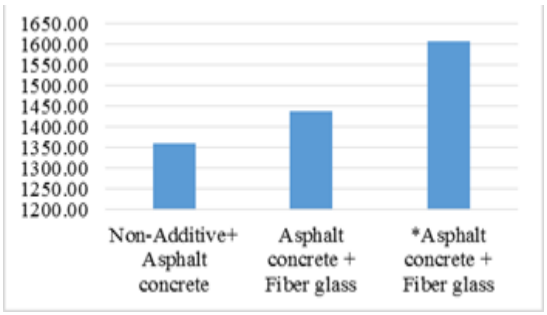

Fig.3(b)Durability of binder.

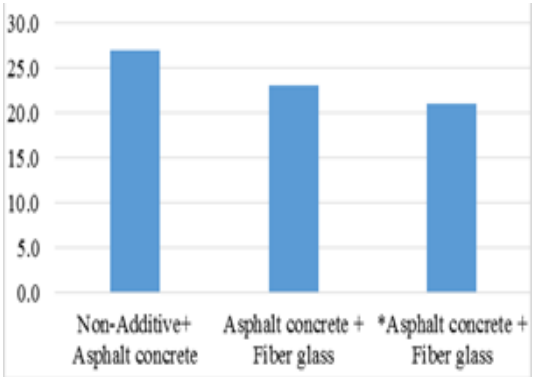

Fig.3(c)Elasticity.

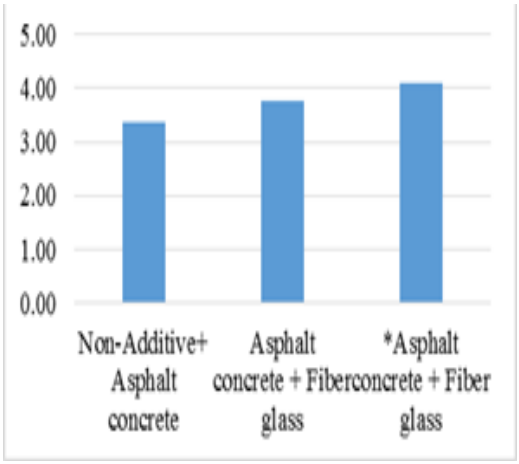

Fig.3(d)Porosity of mixtures.

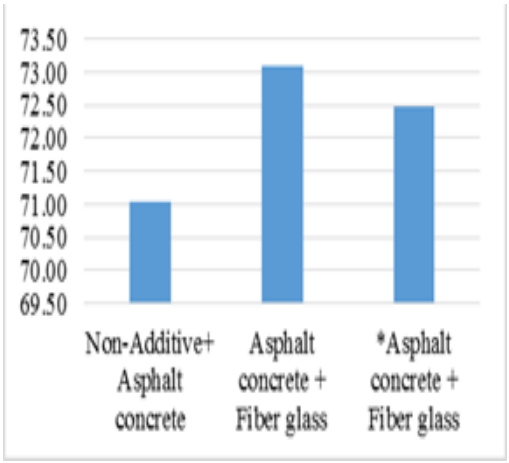

Fig.3(e)Percentage of fill.

In the field, the measured the deep of rutting use of direct line. Method of measurement /Standard Test Method for Measuring Rut-Depth of Pavement Surfaces Using aStraightedge/ According to MNS ASTM E 1703: 2007 standard.The first experiment to determine rutting after 3 days after treads the hot asphalt pavement with fiberglass additive.

Table 4 Measurement deep of rutting.

Date	Section, ПК	Deep of rutting, mm					Max deep mm	Results
17.06.14	0+20	0.0	2.0	1.0	1.0	0.0	2.0	Normal
	0+50	1.0	2.0	0.0	2.0	0.0	2.0	Normal
17.07.06	0+20	2.0	4.0	1.0	1.0	1.0	4.0	Normal
	0+50	1.0	3.0	1.0	2.0	1.0	3.0	Normal
17.08.07	0+20	2.0	5.0	1.0	2.0	2.0	5.0	Normal
	0+50	1.0	4.0	2.0	2.0	1.0	4.0	Normal
17.09.07	0+20	2.0	7.0	1.0	3.0	2.0	7.0	Normal
	0+50	2.0	4.0	2.0	3.0	2.0	4.0	Normal
17.10.26	0+20	3.0	8.0	2.0	4.0	2.0	8.0	Normal
	0+50	3.0	5.0	2.0	3.0	2.0	5.0	Normal
18.04.16	0+20	4.0	9.0	3.0	5.0	2.0	9.0	Normal
	0+50	3.0	7.0	2.0	5.0	2.0	7.0	Normal

This experiment of observation was performed for 6 months. Here is the graph below for how the test results changed after 6 months.

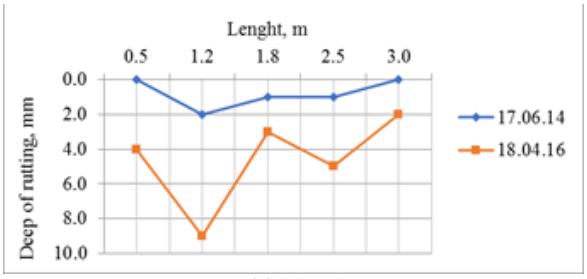

Fig.4(a)S0+20 Rutting.

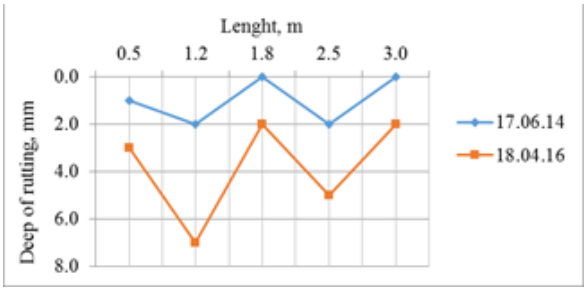

Fig.4(b)S0+50 Rutting.

IV. RESULT AND DISCUSSIONS

In this study, only used the Marshall method when will determine the physical and mechanical characteristic of the asphalt mixtures. Also, the experiment of rutting has been observed for 6 months continuously. However, these methods cannot adequately define the difference between asphalt mixtures with fiber glass additive and non-additive. Therefore, there is a need to improve the use of laboratory test methods such as AASHTO T-283-07 and AASHTO T 324-11. /Standard Method of Test for Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage, Standard Method of Test for Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)/The importance and innovation of the study are the few numbers of cases of asphalt mixtures with additives tested in the field and laboratories.

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