International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 05 | May-2018 www.irjet.net p-ISSN: 2395-0072

Surveillance of Elvaloy-5170 as a modifier in BC Grade 1 mix design

Rachana Patel[1], C. B. Mishra[2]

[1]P. G. Student, Department of Civil Engineering, BVM Engineering College, V.V.Nagar, Anand, India
[2]Associate Professor, Department of Civil Engineering, BVM Engineering College, V.V.Nagar, Anand, India

---

Abstract - *Bitumen got from Indian refineries meets the current particulars, however the writing thinks about have demonstrated that the untimely disappointment of adaptable bitumen pavement in India is primarily happening because of failure of customary black-top blends to maintain rehashed use of wheel load and significant variation in day by day and occasional temperature of the bitumen in India. The nature of bitumen can be enhanced by adding added substances to the bitumen. The present paper plans to feature this fluctuation associated with the polymer altered mix configuration process and build up a system to discover ideal bitumen content by Marshall Mix outline strategy which accomplishes most stability. It was observed for with ELVALOY modified specimens that the Marshall Stability values increased and most noticeable fruitful values recorded is at 5.2% optimum bitumen content with 1 % ELVALOY. The change of the properties of bituminous mixture shows the constructive outcome of ELVALOY. In this manner, it is presumed that the utilization of 1% ELVALOY fibers changes the attributes of VG30 bituminous mixtures in an exceptionally helpful manner.*

Key Words*: *Marshall Mix design, ELVALOY 5170, Optimum bitumen content, Percentage air voids

1. INTRODUCTION

The economy of a country is predominantly administered by the transportation part. In India, there has been a penetrating upturn in the masses bringing about expanded activity which likewise builds the stacking on the adaptable asphalt Due to that interest for better asphalt to withstand all the more terrible condition additionally expanded. Here substances are added to enhance the properties of the bituminous solid blend. In this the entangled microstructure of black-top cement is identified with the degree of total, the properties of total fastener interface, the void size dissemination, and the interconnectivity of voids. For exceptional applications where movement is to a great degree overwhelming, stiffer blends are required. At first in the endeavour, an undertaking has been made to perceive the building properties of materials and focus the impacts of ELVALOY on VG 30 bituminous mixes for BC review 1 with and without it, as showed by the guidelines as decided in MoRTH (territory 500 conditions 507).

2. OBJECTIVES OF THE PRESENT WORK:

The objectives of the present work involves

1. To study basic properties of aggregates and plain bitumen.

2. To evaluate the engineering properties using Marshall Stability, Marshall Flow, Voids in mix, Voids filled with bitumen and. The Optimum bitumen Content for the mix with and without Elvaloy 5170 chemical is determined.

3. LITERATURE REVIEW:

Szabolcs Biro, Bence Fazekas (2005) conveys that Elvaloy came about a moderately high entrance and low softening point contrasted with different modifiers. The connected fixation ought to be expanded to acquire higher execution.

Kishan K.Vachhani (2014) all together accomplish wanted designing properties, it is most extreme critical to change the folios by including added substances for use of road bituminous blends with higher execution. The science of folio is extremely perplexing and is significantly more intricate after the admixture of modifier. In the present examination, physical properties of VG 30 review bitumen with and without responsive ethylene Terpolymer (Elvaloy® 4170) is found.

Kinjal Surti1, Prof. C.B.Mishra (2017) uncovered that ETP-5170 are utilized as a modifier to frame an enduring asphalt which has a least effect of the climatic condition and therefore withstand against maturing process which happens in the bitumen.

Kamran Muzaffar Khan, Hanifullah, Mujaddad Afzal, Faizan Ali, Afaq Ahmed, Tahir Sultan (2013) expressed that assess the adequacy of Polyethylene changed, Lime adjusted and Elvaloy altered black-top blends in enhancing the execution of asphaltic cement in regards to rutting opposition and to contrast it and the execution of regular NHA.

Yetkin Yildirim (2007) additionally put his endeavors in polymer adjusted blend and plan details for Elvaloy, elastic, SBS and SBR and attempt to relate versatile recuperation of polymer changed blend of research centre to field.

4. MATERIALS AND METHODOLOGY:

MATERIAL:

Aggregates:

Squashed stone aggregate (coarse, fine and filler) is of fundamental noteworthiness as the stock is traded from stone to stone; moreover key interlocking is of essential legitimacy in the level of mix design after the examinations of physical necessities for bituminous strong mix. In perspective of the degree unobtrusive components decided

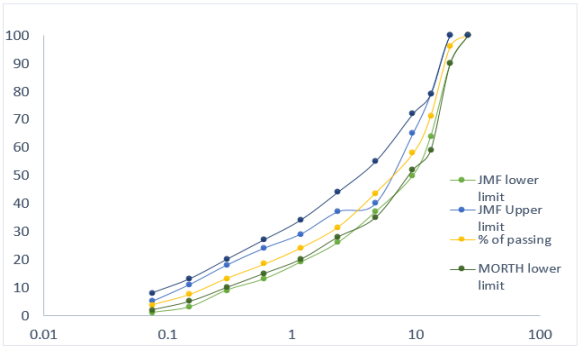
in MoRTH, aggregates were sieved, cleaned and stove dried by singular sizes. A couple of tests were driven on coarse aggregates to find their physical properties and the results are differentiated in the going with table and MoRTH points of interest for BC grade 1.

Table-1: Physical properties of Aggregate

Sr. No.	Name of Test	Test result	Requirements as per MORT&H Table-500-16
1	Combines F.I & E.I Agg.	24.70%	Max 35%
2	Agg. Impact Value	16.91%	Max 24%
3	Los Angeles Abrasion Value	14.36%	Max 30%
4	Specific Gravity	2.840 2.817 2.636 2.427	Not Specified
5	Water Absorption	1.0	Max 2%
6	Stripping of bitumen Agg. Mixture	More than 95%	Min retained coating 95%

GRADATION OF AGGREGATE:

The molecule size dispersion is a standout amongst the most powerful total attributes in deciding how it will execute as an asphalt material degree and aids focus on each imperative property including stiffness, stability, toughness, permeability, workability, fatigue resistance, frictional resistance and moisture susceptibility. For this reason sieve investigation of total has been carried out of BC grade 1, for this study to fulfill the MoRTH prerequisite. It is clear from the above table that the limits are within the Upper and Lower limits satisfying JMF & MoRTH section500 table 500-17. The graph shows the upper limit, obtained value and lower limit (as shown in Graph 1).



Graph 1: Gradation of aggregate chart

Viscosity Grade – 30 (VG-30) Plus Modifier:

Bitumen is a thermoplastic material and its firmness is reliant on temperature. Higher is the review of bitumen, the stiffer the bitumen. VG-30 level bitumen in lieu of 60/70 entrance level bitumen is essentially used to build additional overwhelming obligation bitumen asphalts that need to persevere through generous activity loads. Thickness tests are directed at 60˚C and 135˚C, which speak to the temperature of road surface amid summer and blending temperature individually. This gives an edge for more prominent blend of simplicity outline and better road execution. The asphalt designers, temporary workers and advisors can profit the advantage of such folios as determined in MoRTH particular. For the examination VG-30 level bitumen is gotten from Unique Construction Plant, Surat.

ELVALOY as Modifier for VG 30 review Bitumen:

Elvaloy® 5170 is a Reactive Elastomeric Terpolymer (RET) that can be used to modify the properties of asphalt binder used in paving. It is effective when used with a wide range of asphalts. Resulting polymer modified asphalt (PMA) is very stable, and can be stored for extended periods. Elvaloy® 5170 copolymer delivers high temperature SHRP properties and low temperature flexibility that is locked into asphalt binders. Once mixed the Elvaloy® reacts and never separates or segregates. Properties remain similar top, middle, and bottom no matter how long the binder is stored.

METHODOLOGY:

The Bitumen tests for VG30 (4.8%, 5.2% and 5.6%) with & without ELVALOY (1.0 %, 1.5 %, and 2.0 %) are perform which includes the Penetration test, Viscosity test, Softening Point test, Ductility test, which are as per IS standard and all results satisfied the IS specification.

Table-2: Physical property of VG30 with and without ELVALOY

Characteristics of tests	VG-30	VG30+1.0% ELVALOY	VG30+1.5 % ELVALOY	VG30+2.0% ELVALOY	Min. limit	IS Code
Penetration (mm)	57	53	50	46	45	IS 1203
Softening point (C°)	52	61	65	69	47	IS 1205
Ductility (cm)	94	90	83	74	40	IS 1208
Absolute Viscosity at 60 (C°)	2497	2539	2580	2640	2400 - 3600	IS 1206 (part 2)

The properties of any bituminous blend like strength, mass thickness, air voids, are essentially reliant on the degree of aggregates, binding substance and its compose, the sort of compaction and compaction temperature. Marshall's Method of blend outline according to MS - 2 was embraced for this examination. The Marshall Test examples were set up by including 4.8, 5.2 and 5.6 for each penny of bitumen by weight of totals. Compaction is finished by conferring 75 blows (Modified Marshall) each side according to MS-2 of the example BC review 1 area 500 statement 507. Satisfying the standard criteria's the examples are arranged and tried according to the arrangements of codal practice to decide Marshall soundness, stream esteem, voids loaded with bitumen, air voids and voids in mineral total. The ideal folio content is worked out as 5.2% and is as appeared in table 3.

Table-3: Properties of Marshall Mix Design for BC Grade I as per MoRTH

Bitumen %	Bulk Sp. Gr. (Gmm)	stability (KN)	Flow (mm)	Air voids %	VMA%	VFB%
4.8	2.363	1282	2.2	6.03	17.59	65.7
5.2	2.377	1448	3	5.45	17.45	68.83
5.6	2.368	1343	3.9	5.35	18.12	68.17
Limit (MoRTH-507)	-----	Min 9 KN	2 to 4 mm	Min 3 -5%	Min 14%	65 to 75%

Marshall Mix Design for VG30 (5.2 % OBC) plus ELVALOY 5170 for optimum dosage and optimum Percentage (1.0 %, 1.5%, and 2.0 % of ELVALOY). All properties of each mix are as shown in Table 4.

Table-4: ABSTRACT OF MARSHAL MIX DESIGN TEST VALUES

	1.0 % ELVALOY			1.5 % ELVALOY			2.0 % ELVALOY		
BITUMEN %	4.8	5.2	5.6	4.8	5.2	5.6	4.8	5.2	5.6
DENSITY(gm/cc)	2.451	2.465	2.454	2.455	2.48	2.427	2.457	2.475	2.433
STABILITY (KN)	1622	1666	1572	1555	1704	1610	1414	1448	1434
FLOW (mm)	3.13	3.2	3.23	3.23	3.27	3.33	2.9	3.0	3.1
AIR VOIDS %	4.62	4.09	4.14	5.22	4.61	5.12	4.77	4.45	4.94
VMA %	14.52	14.4	15.14	14.39	13.87	16.09	14.32	14.07	16.15
VFB %	68.18	71.62	72.68	63.77	66.80	67.69	66.74	68.36	69.51

5. CONCLUSION

The key conclusion is that for VG 30 Marshall Mix Design BC Grade I, the optimum binder content comes out to be 5.2 % satisfying the permissible limits as per the MoRTH section 507. The properties of VG30 grade + % ELVALOY is investigated like penetration test, viscosity test, softening test, and Ductility test fulfilling the criteria as laid down in codal provisions for bituminous surface also Marshall Mix design VG 30 as 5.2 % by weight of bitumen with 1.0 %, 1.5 % and 2.0% ELVALOY as Modifier added substance demonstrates that VG 30 with 1.5 % ELVALOY fulfils the criteria's set down in codal MoRTH procurement at 160°C, likewise it is seen that at this rate huge change in flow values, stability, and unit weight are watched for improving the compaction and increasing the workability conditions.

REFERENCES

[1] Kishan K.Vachhani, C.B. Mishra, "Influence of VG30 Grade Bitumen with and without reactive Ethylene Terpolymer (Elvaloy® 4170) in short term aging.", International Journal of Current Engineering and Technology, Vol.4, No.6 (Dec 2014)

[2] Kamran Muzaffar Khan 1, Hanifullah 2, Mujaddad Afzal 3, Faizan Ali 4, Afaq Ahmed 5, Tahir Sultan (2013), "Rutting performance of Polyethylene, Lime and Elvaloy modified Asphalt Mixes", Life Science Journal 2013;10 (7s) http://www.lifesciencesite.com

[3] Szabolcs Biro, Bence Fazekas, "Asphalt rubber versus other modified bitumens." Volume X -2005

[4] Y. Yildirim (2007), Polymer modified asphalt binders, Construction and Building Materials, Page no 66–72.

[5] IRC: SP: 53(2002), "Guidelines on Use of Polymer and Rubber Modified bitumen in road construction", First Revision, Indian Road congress, New Delhi.

[6] IS: 1202- 1978, "Methods for testing tar and bituminous materials: determination of specific gravity".

[7] IS: 1203- 1978, "Methods for testing tar and bituminous materials: determination of penetration".

[8] IS: 1205- 1978, "Methods for testing tar and bituminous materials: determination softening point".

[9] IS: 1206- 1978, "Methods for testing tar and bituminous materials: determination of viscosity"

[10] IS: 2386 (Part 1) - 1963, "Methods of test for Aggregates for concrete: Particle size and shape".

[11] IS: 2386 (Part 3) - 1963, "Methods of test for Aggregates for concrete: specific gravity, density, voids, absorption and bulking".

[12] IS: 2386 (Part 4) - 1963, "Methods of test for Aggregates for concrete: Impact value and Abrasion value".

[13] IS: 15462- 2004, "Polymer and Rubber Modified Bitumen- Specification".