

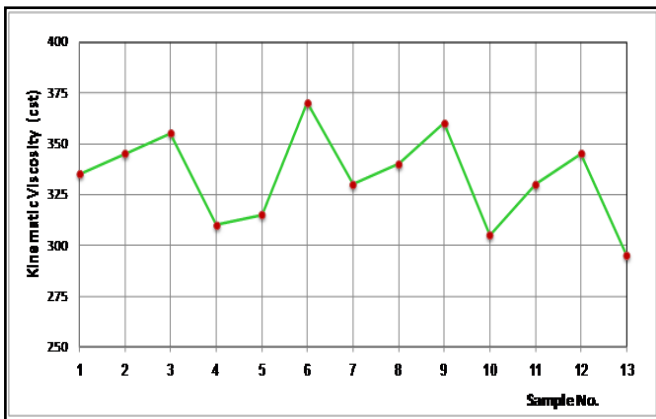
Table 6: Physical properties of asphalt cement samples

Sample	Penetration, 0.1mm	Ductility (cm)	Viscosity (cst)	Flash Point (°C)	Fire Point (°C)	Softening Point (°C)
A1	62	103	335	311	315	52
A2	66	100	345	239	262	50
A3	67	87	355	248	267	48
A4	62	100	310	264	290	51
A5	68	100	315	281	295	49
A6	63	105	370	260	295	48
A7	64	106	330	276	290	49
A8	65	103	340	239	258	47
A9	59	100	360	292	354	51
A10	66	105	305	245	268	49
A11	61	101	330	276	295	53
A12	64	100	345	295	304	55
A13	66	102	295	243	304	48
B1	85	100	300	258	276	51
B2	80	88	305	248	276	49
B3	82	102	280	246	290	49
B4	97	104	250	225	280	47
B5	88	103	260	241	275	48
B6	85	101	265	242	285	49
B7	87	95	285	264	300	52

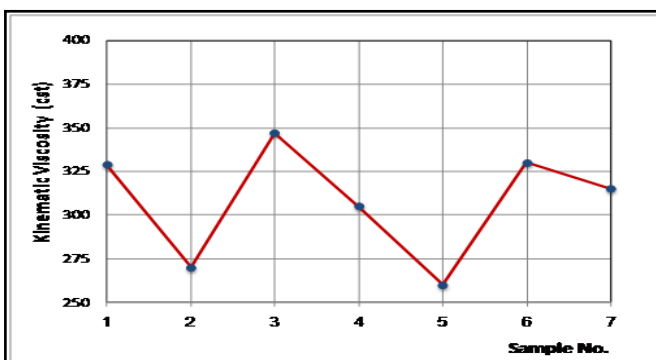
60/70. Similarly, for penetration grade 85/100, 4 samples belong to AC20 and 3 samples belong to AC10. It is clear from this observation that two asphalts may be of the same penetration grade and yet have substantially different viscosities. This problem is illustrated in Figure 5. In this figure the tests data were plotted in histograms to compare the results of the asphalt binders. The viscosity grading (AC10, AC20, and AC30) criteria for the asphalt binders are given in Table 3.

Table 7: The viscosity grading and the corresponding penetration grading for asphalt samples studied.

Sample	Viscosity Grading		Penetration Grading	
	Kinematic at 135°C, CTS	Viscosity grade	Penetration, 0.1mm	penetration grade
A1	335	AC-30	62	60 - 70
A2	345	AC-30	66	60 - 70
A3	355	AC-30	67	60 - 70
A4	310	AC-20	62	60 - 70
A5	315	AC-20	68	60 - 70
A6	370	AC-30	63	60 - 70
A7	330	AC-30	64	60 - 70
A8	340	AC-30	65	60 - 70
A9	360	AC-30	59	60 - 70
A10	305	AC-20	66	60 - 70
A11	330	AC-30	61	60 - 70
A12	345	AC-30	64	60 - 70
A13	295	AC-20	66	60 - 70
B1	300	AC-20	85	85 - 100
B2	305	AC-20	80	85 - 100
B3	280	AC-20	82	85 - 100
B4	250	AC-10	97	85 - 100
B5	260	AC-10	88	85 - 100
B6	265	AC-10	85	85 - 100
B7	285	AC-20	87	85 - 100



(a) Asphalt samples A1 to A13 [grade 60/70]



(b) Asphalt samples B1 to B7 [grade 85/100]

Figure 4: Kinematic viscosity values for asphalt samples of grade 60/70 and 85/100

The viscosity grading for the samples of grade 60/70 and 85/100 asphalt binders were identified and presented in Table 7 for comparison of the results. It can be observed that out of 13 samples, 9 samples belong to AC30 and 4 samples belong to AC20, though their penetration grade lies between

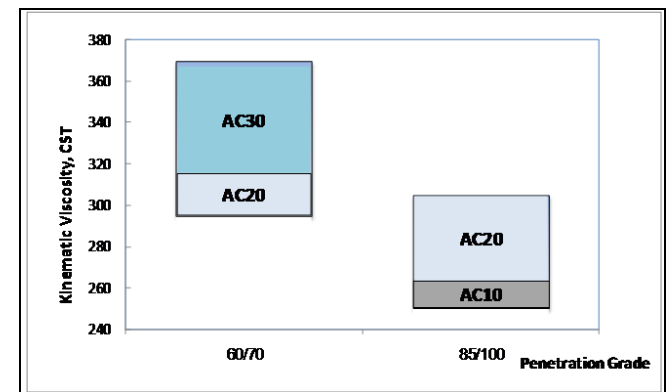


Figure 5: Comparison of the viscosity grading system with the penetration grading system for the samples tested

4. Conclusions

The quality of asphalt used for construction and maintenance of flexible pavements is an issue of vital concern to the highway engineers. The need to adopt a reliable asphalt grading system for long term performance and durable roads drew attention of professionals. This research has been undertaken to review the important role of adopting viscosity grading systems for selection of asphalt binder in Sudan. The results and the conclusions drawn as follows:

- The experimental results clearly demonstrated that asphalt cement of same penetration grade show different

viscosity grades. Thus, any asphalt binder of same penetration grade may give different performance at high and low temperatures. For this reason, the existing penetration grading system of bitumen must be replaced by viscosity grading system for real improvement in the highway performance and durability.

- Obviously, the old penetration grading system is still being practiced in Sudan is archaic. It is also clear that many advantages accrue from the viscosity grading. The viscosity grading system is more realistic, reliable and practical than the penetration grading system. Since the testing procedure is carried out at three different temperatures; viscosity at 60 °C and 135 °C and penetration at 25 °C, which relate to the properties of asphalt at high pavement temperature, mixing temperature and average pavement service temperature.
- Penetration test was developed in times of significantly lower pavement loading. Today there is a massive increase in pavement loading which contributes to increase in stresses applied to pavements and further heavy traffic and change in weather conditions. Therefore to cope up with the change, there is need to shift from penetration to viscosity grade. This change did not result in any significant price increase for paving bitumen in the US. The same is expected in Sudan.
- The complexity of testing, lack of instruments and knowledge, and high cost are some of the restraints to adopt the latest Superpave performance grading system. Moreover highway engineers would also need to be trained for its implementation. The adoption of Superpave performance grading system can be considered as a long-term goal or for use on very important, large projects if needed at the present time.

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Author Profile



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