Internal Assessment Test2–DEC-2022

(Solution and scheme of valuation)

Sub:	Pavement Materials and Construction					SubCode:	**18CV733**	Branch:	Civil	
Date:	21/10/2022	Duration:	90min	MaxMarks:	50	Sem/Sec:	VII–A	Marks	CO	RBT

1. List out the desirable properties for subgrade soil in highway construction

Subgrade Soil: Soil is the ground support on which roads are built. The subgrade, which is the bottom-most layer of a pavement, is made up of compacted soil. Road embankments are built with soil. Soil is sometimes used as one of the ingredients in the base/sub-base layer of a pavement. The soil is therefore considered as one of the principal highway material.

The desirable properties of sub grade soil as a highway material are

- Stability: Minimum changes in volume and stability under adverse conditions of weather and ground water
- Incompressibility: soil should be incompressible. It should be compacted to it's maximum dry density
- Permanency of strength: black cotton soils can be stabilised with moorum and lime to retain it's strength permanently.
- Good drainage: soil should not absorb water. If water is absorbed it should be drained out as early as possible.
- Ease of compaction: compaction increases dry density of soil. The best results of compaction is achieved when the soil is compacted at optimum water content.

[10] CO1 L2

2. Compare the salient characteristics of cutbacks and emulsions and describe under what circumstance each one is used?

Emulsions: An emulsion is a two-phase system consisting of two immiscible liquids (un mixable or unbendable). The dispersed or internal phase is the liquid that is broken up into globules and the surrounding liquid is known as the continuous or external phase. Oil-in-water emulsions have the oil as the dispersed phase and water as the continuous phase. The reverse occurs when the emulsion is of water-in-oil type. Oil phase consisting of bitumen or tar. In the preparation of emulsion of asphaltic bitumen or tar, emulsifiers have to be added in small proportions both to facilitate the formation of dispersion and to keep the globules of dispersed binder in permanent suspension. If no emulsifier is present, a dispersion of oil droplets in water brought about by stirring will rapidly separate into 2 layers. With emulsifier present, an adsorbed film of the emulsifier is formed round each globule in the emulsion.

Emulsion are classified in to 3 types based on setting time

1. Rapid setting: If the bitumen emulsion is intended to break rapidly, the emulsion is said to possess rapid-set quality and this type is used in surface dressing & penetration macadam.
2. Medium setting: Emulsion which does not break spontaneously on contact with stone but break during mixing or by fine mineral dust are MC. Used in premixing with coarse aggregate.
3. Slow setting: When specified type of emulsifying agent is used to make the emulsion relatively stable, they are called slow setting grade. Used in surface course along with the coarse aggregate.

Emulsifiers for road emulsions may be divided into four main groups:

a) Anionic emulsifiers
b) Cationic emulsifiers
c) Non-ionic emulsifiers
d) Colloidal emulsifiers

Uses of Emulsions:

*They are more tolerant than penetration grade bitumen, of the presence of dampness, although they should not be used in the presence of free water on the road surface or on aggregate.

[10] CO1 L2

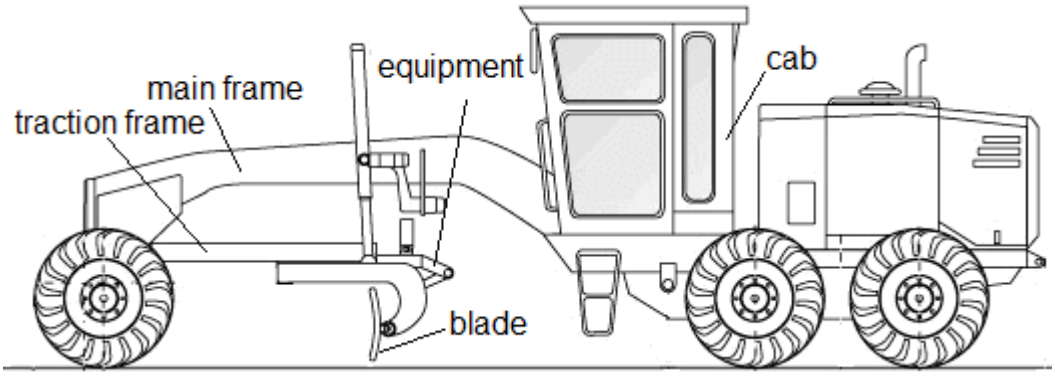
	* Because emulsion is of relatively low viscosity at normal temperature, they eliminate the need to heat the aggregate and binder and thus they conserve energy. * They can be used when the weather is relatively cold *They are ideal for patching and repairing work, particularly they do not require heating before use. *They are used for surface dressing, grouting, pre-mixing, sealing, and soil stabilization with cement. Disadvantages *Emulsions are however, costly. * Since they contain a substantial quantity of water, the transportation coat is higher. **Cutback Bitumen** Cutback bitumen is defined as the bitumen, the viscosity of which has been reduced by a volatile diluents. For use in surface dressings, some type of bitumen macadam and soil-bitumen stabilization, it is necessary to have a fluid binder which can be mixed relatively at low temperatures. Hence to increase the fluidity of the bituminous binder at low temperatures the binder is blended with volatile solvent. After the cutback mix is used in construction work, the volatile gets evaporated and the cutback develops the binding properties. The viscosity of cutback and rate of which it hardens on the road depend on the characteristics and quantity of both bitumen and volatile oil used as the diluents. Types of Cutback Bitumen and Uses Cutback bitumen is available in three types, namely: a) Rapid Curing (RC) b) Medium Curing (MC) c) Slow Curing (SC) This classification is based on the rate of curing or hardening after the application. Rapid Curing Cutbacks (RC): These are bitumens, fluxed or cutbacks with a petroleum distillate such as naphtha or gasoline, which will rapidly evaporate after using in construction, leaving the bitumen binder. The grade of the RC cutback is governed by the proportion of the solvent used. The penetration value of residue from distillation upto 360°C of RC cutback bitumen 80 to 120. Medium Curing Cutbacks (MC): This bitumen fluxed to greater fluidity by blending with a intermediate boiling-point solvent like kerosene or light diesel oil. MC cutbacks evaporate relatively at slow rate because the kerosene-range solvents will not evaporate rapidly as the gasoline-range solvents used in the manufacture of RC cutbacks. MC products have good wetting properties and so satisfactory coating of fine grain aggregate and sandy soils is possible. Slow Curing Cutbacks (SC): These are obtained either by blending bitumen with high-boiling-point			
3.	What is stripping of bitumen? What are its adverse effects? How is the extent of bitumen stripping estimated in the lab? How can it be treated?	[10]		
	Stripping is the displacement of the binder from the surface of aggregates by water. The process of displacement depends on the viscosity of the binder. The binders of high viscosity resist displacement by water than those of low viscosity. It has been shown practically that water may penetrate through a film of binder and reach the stone surface. The transfer of water to the stone surface may occur with water in liquid or vapour form. The speed with which water can penetrate and detach the binder depends on: a) Type and viscosity of the binder b) Thickness of binder film c) Nature of road stone Stripping was found throughout the length of the surface but failure was observed only on the parts of the flexible base. If the failure occurs it may be due to the following ways: a) The binder is undetached and hence unstripped b) The binder is partially detached but unstrapped c) The binder is attached but unstripped d) The binder is detached and stripped leading to the disintegration and failure. **Static immersion tests** This is the simplest type of test and consists of aggregate being coated with bitumen that		CO1	L2

	is then immersed in water. The degree of stripping is estimated by a visual inspection after a period of time. For example, in the total water immersion test, 14mm single-size chippings are coated with a known quantity of bitumen. The coated aggregate is then immersed in distilled water at 25ºC for 48 hours. The percentage of bitumen stripped off the aggregate is assessed visually. The fundamental problem with this method is its subjective nature, resulting in poor reproducibility. However, the experienced operator may be capable of ranking the aggregates in relation to their performance in situ. It must be recognised that in some cases, an aggregate with good laboratory performance may perform poorly occasionally on the road and those with poor static immersion test results may perform satisfactorily in			
4.	Briefly explain the various factors affecting the selection of road construction equipment. i. Suitability for job conditions: type of job, climatic condition etc ii. Size of the equipment: Size should be compatible with other units such that it should not remain idle iii. Standardization: it should be easily understood by operators, easilt repairable, spare parts should be easily available. iv. Availability of the equipment: it should be available in market easily, and should be of standard repute v. Availability of spare parts: spare parts should be easily available vi. Multipurpose equipment's (versatility): it should be able to perform more than one function to improve versatility vii. Availability of know-how: Highly sophisticated equipment's may not be easily understood by operators though they give excellent performance. viii. Use in future projects: Should be such that it should be used in future projects and should not become obsolete after one project. ix. The economic aspects: The cost of unit production should be minimum. x. Reliability of the equipment: should be reliable xi. Service support: Service after sales is a major consideration. xii. Operating requirements: Less fuel consumption should be easy to operate and maintain. xiii. Past performance: Past performance should be evaluated before its purchase. xiv. Size and number: this is important such that the equipment should not remain idle. xv. Reputation of the manufacturer: xvi. Warranty/guarantee offered by the manufacturer xvii. Use of standard components in the equipment xviii. Adequacy of driving mechanism	CO3	L2	
5.	Explain the working principle and application of following equipment with line diagrams a) Graders b) Smooth wheeled roller	CO3	L2	
	A) GRADERS It principally consist a blade below a framework. The blade be lowered, lifted or rotated. Graders are used for a number of purposes: 1. For spreading heaped earth into layers. 2. For shaping the cross-section during construction. 3. For maintaining the cross-section of embankment. 4. For maintaining gravel surface.			

Graders are of two types Towed and Motorized. The towed grader is by a tractor and is usually made in small size. Motor grader has a blade of about 3.5m, but its effective length during spreading becomes 2.75m.The blade can be set at any angle (360_0 horizontal) and some time vertically tilted depend upon work. A 100-110HP motor grader is a popular size. The normal grading speed is 3kmph. The output of a grader for spreading the earth, which is achieved generally in 4 passes, is about 1300sqm per hour, assuming 65% operating efficiency and a 50min working hour. Assuming a normal compacted thickness of layer of 15cm, the output in terms of compacted volume becomes about 200cum per hour.

APPLICATION

1. Used for leveling or finishing earth work, making and maintaining project roads, construction of air fields and land reclamation.
2. The rollers can be attached to the rear, to compact the graded surface.
3. used in material mixing, hard surface cutting and snow clearance.
4. Used particularly base course spreading, leveling bank cutting etc.



B) Three-wheeled road roller

This is the most common rolling equipment and is versatile in applications. It is diesel powered; the diameter of the front roll is around 105cm, its width being around 100cm. The diameter of the rare roll is around 145cm, its width being around 50cm. The rolling width is around 2m. The front roll gives a load of around 35-40 kg/cm width and the front roll gives a load of 70-80kg/cm width. The speed of rolling is in the range 1.5-6.0kmph. The output of a three wheel roller, 8-10 T, for various jobs. The smooth wheel roller is suitable to roll a wide range of soil, preferably granular soil and pavement materials for the various layers. Generally 6-12 passes are needed.