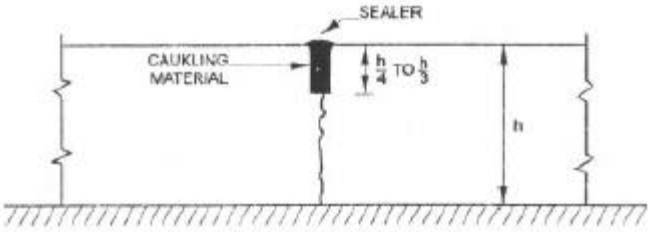
Internal Assessment Test 3–DEC-2022

(Solution and scheme of valuation)

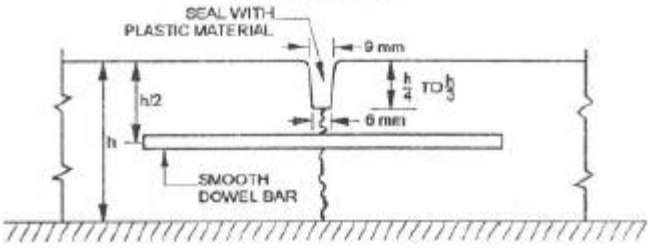
Sub:	Pavement Materials and Construction					SubCode:	**18CV733**	Branch:	Civil	
Date:	27/12/2022	Duration:	90min	MaxMarks:	50	Sem/Sec:	VII–A	Marks	CO	RBT

1	Discuss the materials required and construction steps for the construction of bituminous concrete (BC) pavement.	[10]	CO4	L2
	Crushed aggregates and bituminous binder heated - mixed in a hot mix plant at specified temperature – transported to the construction site – laid by mechanical paver – compacted by rollers. • Laid in 50 to 100mm compacted thicknesses. Materials • Bitumen binder – Viscosity grade VG – 30. • Aggregates – same as specification given for base course - water absorption < 2 %, minimum bitumen coating – 95% Construction steps 1. Preparation of surface is done by patching the pot holes, filling depressions and making profile corrections 1. Dust and other loose material are cleaned 2. Prime coat and tack coat are applied . 3. BM mix is prepared in hot mix plant at specified temperature using specified bitumen grade. 1. Hot mix is transported to the construction site. 2. BM mix is spread on dry prepared surface using mechanical paver. 3. Rolling is started soon after laying of mix and compaction is to be completed before the mix cools down. Quality control test 1. Test on CA to be done. 2. Stripping value test on bitumen coated aggregates and water sensitivity test on bituminous mix 3. Bitumen – viscosity, ductility etc., 4. Temperature of aggregate and binder are checked at time of mixing – BM mix temperature to be checked at regular interval 5. Binder content and grading of aggregate – two test per day 6. Thickness of the BM layer is checked at regular interval 7. Density of the compacted BM layer is checked 8. Finished surface level is checked – tolerance +6mm and – 6mm.			
2	Write a brief note on the construction of dense bituminous macadam (DBM) pavement	[10]	CO4	L2
	Functons:- 1. To serve as an effective drainage layer. 2. To serve as a structural component. Materials:- i) Crushed stone aggregates ii) Gravel iii) Coarse sand iv) Selected soils – moorum with less fines and very low plasticity. Material should be free from organic matter or other deleterious constituents Material Specification (MORTH) a) Passing 0.425mm sieve – LL < 25% and PI < 6% b) Fines passing 0.075mm sieve < 10% c) CBR value >30% - important highways with heavy traffic d) CBR value > 25 to 20 % other types. Based on studies – i. Fines passing 0.075mm sieve < 5% ii. PI = 0 (preferably)			

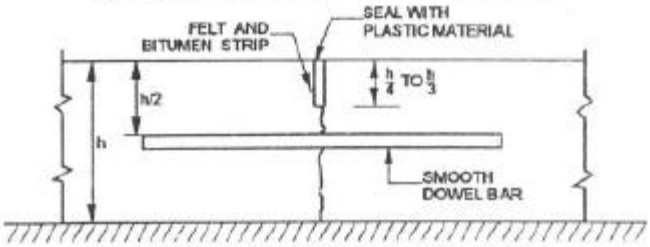
	iii. Coefficient of permeability of coarse graded material > 30 m/day Construction steps i. Sub-base material is spread to uniform thickness and specified cross slop – motor grader. ii. Moisture content is checked – water added if required – truck mounted sprinkler. iii. Material mixed well - disc horrows and rotavators. iv. Spread to the desired thickness, grade and camber v. Compacted i. Compacted layer – <=100mm – ordinary smooth wheeler roller ii. Compacted layer – 100mm to 225 mm– Vibratory roller iii. Else Pneumatic tyred roller Rolling form lower edge towards the centre (one third overlap – rolling speed < 5 kmph) vi. Rolling done - 98 % of maximum density is achieved.			
3	List the quality checks on cement concrete pavement, carried out both laboratory and on the field. Quality Control during construction of CC Pavements 1. Sample of CA – specified tests in the laboratory to decide suitability 2. Grading of CA and FA for the PQC mix – checked 3. Cube and beam specimen of CC mix – tested for 7 days and 28 days strength 4. Workability of CC mix – checked 5. Honeycombed surface on sides of laid CC pavement slab are checked and finished with cement mortar 6. Regularity of finished surface is checked 7. CC pavement cured for 7 days – core samples taken to check density, degree of compaction and voids content 8. Sealant materials – specified tests are done 9. Presence of different types of cracks and their locations – checked and recorded.	[10]	CO4	L2
4	Explain the various types of joints used in cement concrete road. Why are they provided?	[10]	CO4	L2
	Different types of joints provided in CC pavements are:- 1. Longitudinal joints 2. Transverse joints Longitudinal joints • Shrinkage cracks during initial period of curing - length or width of slab > 4.5m to 5m • Lane width are 3.5 to 3.75 - provided between each lane • Function:- i) Contraction joints – prevent shrinkage cracks in longitudingal direction i) Warping joints and relieve part of warping stresses ii) Lane demarcation/markings • Tie bars – to prevent opening up of the longitudinal joints Transverse joints 1. Contraction joints 2. Expansion joints 3. Construction joints Contraction joints • Initial period of curing – shrinkage and contraction of concrete • Fine shrinkage cracks – start from the bottom of the slab and progress upward To prevent development of shrinkage cracks in an irregular pattern. • Construction joints at intervals of 4.5m or closer • Dummy joints – cutting narrow grooves on the top pavement in transverse direction • One –fourth to one- third depth of slab thickness • Shrinkage cracks develop only at these pre determined locations • Constructed with or without steel dowel bars • Prevent widening of the fine shrinkage cracks • Decrease the magnitude of warping stresses			



(a) DUMMY JOINT

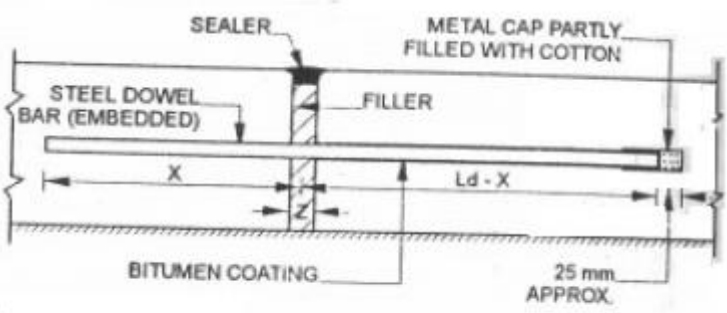


(b) CONTRACTION JOINT WITH DOWEL BAR



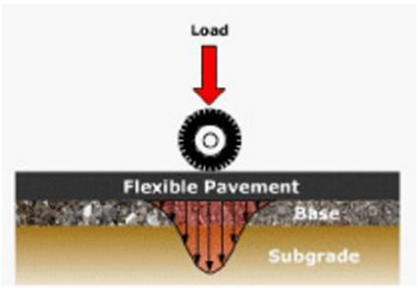
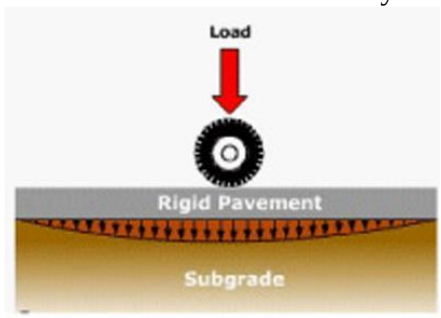
(c) CONTRACTION JOINT WITH DOWEL BAR

Expansion joints
- Through transverse joints – 20 to 25 mm pre determined gap between two slabs
- Space for pavement to expand longitudinally
- Preventing buckling of long CC slabs
- Provided at intervals of 60 to 120 m.
- Steel dowel bars – load transfer from one slab to the adjoining one. Construction joints
- Full depth joints – concrete construction operation stopped after the day's work.
- Transfer dowel – to facilitate load transfer



EXPANSION JOINT

5	Compare flexible and rigid pavements.				[10]	
	S. N	**Particulars**	**Flexible pavement**	**Rigid pavement**		
	1	Cross section	It consists of a series of layers with the highest quality materials at or near the surface of pavement.	It consists of one layer Portland cement concrete slab or relatively high flexural strength.	CO4	L2
	2	Characteristic	It **reflects the deformations of subgrade** and subsequent layers on the surface.	It is able to bridge over localized failures and area of inadequate support.		

	3	Load transfer	Its stability depends upon the **aggregate interlock, particle friction and cohesion** or by **means of grain to grain contact**	Its structural strength is provided by the pavement slab itself by its **beam action**.			
	4	Design parameter	Pavement design is greatly influenced by the **subgrade strength.**	**Flexural strength of concrete** is a major factor for design.			
	5	Distribution of load	It functions by a way of **load distribution through the component layers**	It distributes load over a **wide area of subgrade** because of its rigidity and high modulus of elasticity.			
	6 Distribution of stresses 						
	7	Design life	15-20 years	20-40 years			
	8	Temperature stresses	**No thermal stresses** are induced as the pavement have the ability to contract and expand freely	Thermal stresses **are more vulnerable** to be induced as the ability to contract and expand is very less in concrete			
	9	Deformations	Flexible pavements have self healing properties. **Settlements due to heavier wheel loads are recoverable** to some extent.	Any excessive deformations occurring due to heavier wheel loads are not recoverable, i.e. **settlements are permanent.**			
	10	Overall cost	Have **low completion cost** but repairing cost is high	Have low repairing cost but **completion cost is high**			
	11	Maintenance cost	Have low life span (**High Maintenance Cost)**	Life span is more as compare to flexible (**Low Maintenance Cost**)			
	12	Effect of oil spills	**Damaged by Oils and Certain Chemicals**	**No Damage** by Oils and Greases			
	13	Curing period	Road can be used for traffic **within**	Road cannot be used **until 14 days**			

			24 hours	**of curing**			
	14	Colour and visibility	**Poor visibility** at night due to its black colour	**Better visibility** at night owed to its white/gray colour			
	15	Design parameter of subgrade	**CBR value**	**Modulus of subgrade reaction (k)**			