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Subject: Foundation and Pavement

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Foundation

Q 1

Pavement Distress

Def:

=> Distress: is a condition of the Pavement structure that reduce serviceability or leads to a reduction in service life.

=> Distress Manifestations:

=> Are the visible consequences of various distress mechanisms, which usually Lead to a reduction in serviceability.

=> Structural Failure: is a fracture or Distortion that may or may not cause an immediate reduction in serviceability but leads to a future loss of serviceability.

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Fracture: is the state of a Pavement material that is breaking.

(1) Pavements causes

Fatigue cracking (Alligator cracking)

=> Fatigue cracking is commonly called alligator cracking. This is a series of interconnected cracks creating small irregular shaped pieces of Pavement. It is caused by failure of the Surface Layer or Base due to repeated traffic Loading (fatigue)

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(2) Longitudinal cracking.

=> Longitudinal cracks are long cracks that run parallel to the center line of the the road way. These may be caused by Frost heaving or joint failures. or they may be load induced understanding the cause is critical to selecting the proper repair.

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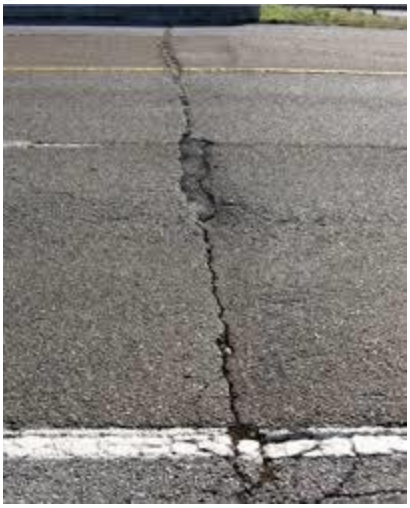
(3) Transverse cracking:

=> Transverse cracks form at approximately right angles to the centerlines of the roadway.

=> They are regularly spaced and have some of the same causes as Longitudinal cracks.

Transverse cracks will initially be widely spaced (over 20' apart). They usually begin as hairline or very narrow cracks and widen with age



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(54) Block cracking:

=> Block cracking is an interconnected series of cracks that divids the pavement into irregular pieces. This is sometimes the result of transverse and longitudinal cracks intersecting. They can also be due to lack of compaction during construction. Low severity block cracking may be repaired by a thin wearing course.

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⑤ Edge Cracking

=> Edge cracks typically start as crescent shapes at the edge of the pavement. They will expand from the edge until they begin to resemble alligator cracking. This type of cracking result from lack of support the shoulder due to weak material or excess moisture.

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(6) Ruttins:

=> Ruttins is the displacement of Pavement material that creats channel in the wheel Path. very severe rutting will actually hold water in the rut. Rutting is usually a failure in one or more Layers in the Pavement. The width of the rut is a sign of which layer has failed. A very Narrow rut is usually a surface failure. While a wide one is indicative of a Subgrade failure.

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(7) Potholes:

=> Potholes are bowl-shapped holes similar to depressions. They are a progressive failure First small fragments of the top layer are dislodged. over time, the distress will progress downward into the lower layers of the pavement. potholes are often located in areas of poor drainage, as seen in Figure Potholes are formed when the pavement disintegrates under traffic loading. due to inadequate strength in one or more layers of the pavement. usually accompanied by the presence of water.

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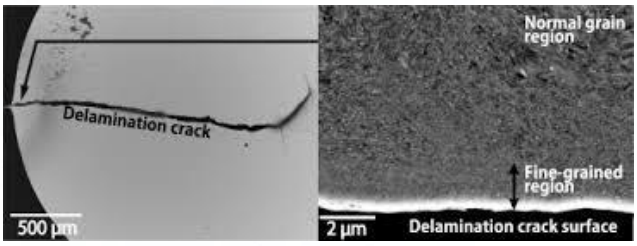
(8) De-lamination:

=) De-lamination ~~is~~ is a failure of an overlay due to a loss of bond B/w the overlay and the older pavement Common causes of de-lamination include wet or dirty surface during paving of the overlay. failure to use a tack coat. or Poor compaction of the overlay. Proper paving techniques including cleaning the surface and use of tack coat, will reduce the chances of de-lamination.



Ans

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Ans

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Sub-Grade:

=> **Def:** The sub grade preparation is the process through which a surface is prepared on which the sub base is placed or, in the absence of sub base, act as the base of the pavement structure. It shall extend to the full width of the Road Bed including the shoulders.

=> Preparation of the subgrade for construction usually involves digging, in order to remove surface vegetation topsoil and other unwanted material, and to create space for the upper layer of the pavement. This process is known as "Subgrade formation" OR "Reduction to level"

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Construction Requirement

=> All materials down to a depth of 30cm below the sub grade level in earth cut or Embankment shall be compacted to at least 95% of the max-dry density as determined according to AASHTOT-180 method. The Road geometric should be Established and finalized on the top of sub grade.

Sub grade preparation Measurmant for Earth.

=> In case bottom of Sub grade level is within (30cm) of the natural ground, the surface shall be scarified, brokenup, Adjusted to Moisture content and compacted to Min-density of 95% of the max-dry density as determined by AASHTO T-180. Sub sequent Layer

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of approved material shall be incorporated to ensure that depth of Sub grade Layer is 30 cm.

=> The Natural ground is more than 30 cm of Sub-grade.

Subgrade Level in Existing Road

=> The Existing Road Surface is to be used as the Sub grade, the correct Elevation on which the Base or Sub Base is to be laid shall be obtained, where necessary, either by means of leveling course or by Excavation. The leveling course shall be constructed to the requirements of the Engineer and Paid for under the appropriate Pay item involved.

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Sub Base.

Def:

The work is consist of spreading and compacting subbase constructed on a prepared bed in accordance with the specification in conformity with the lines, grade thickness and typical cross-section shown on the drawing. The material shall consist of sand gravel mixture obtained from the source approved by the Engineer.

Material Requirements.

=> Granular subbase shall consist of natural or processed aggregates such as gravel, sand or stone fragment and shall be ~~of such~~ clean and free from dirt, organic matter and other deleterious substances, and shall be of such nature that it can be compacted easily under watering and rolling to form a firm, stable pavement layer. The material shall comply to the following grading and quality requirement.

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(4) The Sub Base material shall have a gradation curve within the limits for gradings A, & B given on the next slide. However grading A may be allowed by the Engineer in special circumstances

Gradings Req of Sub base material			
Sieve Designation		Mass % Passing Grading	
mm	inch	A	B
60.0	(2.1/2)	100	--
50.0	2	40-100	100
25	1	50-80	55-85
9	3/8	--	40-70
4.75	No.4	35-70	30-60
2.0	No.10	--	20-50
0.425	No.40	--	10-30
0.075	No.200	2-8	5-15

The material shall have a CBR value of at least 50%. determined according to AASHTO T-193. The CBR value shall be obtained at a density corresponding to 98% of Max dry density determined according to AASHTO T-180.

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=> The coarse aggregate material retained on Sieve No. 4 shall have a % of wear by the Los Angeles Abrasion (AASHTO T-96) of not more than 50 %.

Construction Requirement.

Spreading: Granular Sub base shall be spread on approved sub grade layer as a uniform mixture segregation shall be avoided during spreading and the final compacted layer shall be free from concentration of coarse or fine materials.

=> Granular sub base shall be deposited on the road bed or shoulders in a quantity which will provide the required compacted thickness without resorting to sporting, picking up or otherwise ~~mod~~ shifting the sub base material. In case any material is to be added to compensate for levels, the same shall be done after scarifying the existing material, to ensure proper bonding of additional material.

thickness = 15cm, less 7.5cm

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Compaction Trials

=> The granular sub base operation ~~cons~~ contractor shall construct a Trial length not to Exceed 500m. and not less than. 200m.

The relationship B/w the number of compaction passes and the resulting density of the material

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Bituminous prime Coat

Def: This work shall consist of furnishing all plant, Labor, Equipment, Material and performing all operations ~~in Pre~~ applying a liquid asphalt prime coat on a previously prepared and untreated. Earth Sub grade, water bound base course, crushed aggregates base course, tops of roadway Shoulders.

Material Requirements

=> prime coat shall be applied when the surface to be treated is dry. The application is prohibited when the weather is Foggy or rainy, or when the atmospheric temperature is below 15 degree c unless otherwise directed by the Engineer

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=) Prior to the application of the prime coat, all loose materials shall be removed from the surface and the same shall be cleaned by means of approved mechanical sweepers or blowers & or hand brooms. ~~until~~ until it is as free from dust as it deemed practicable. No traffic shall be permitted on the surface after it has been prepared to receive the Bituminous material.

=) primed surface shall be kept undisturbed for Least 24 hrs, so that the bituminous material travels beneath and leaves the top surface in non-tacky condition. No asphaltic operations shall start on a ~~toac~~ tacky condition.

=) The rate for application of asphaltic material shall be as under

Types of surface

~~Liter~~

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=

(1) Subgrade, Subbase. — — — L/sqm, Mater
Min – Max

=> water bound ~~ce~~ courses and crushed stone base course — 0.65 – 1.75

(2) Bridge / wearing, surface.

=> Concrete pavement — 0.15 – 0.4

however the Exact rate shall be specified by the Engineer determined from field trials

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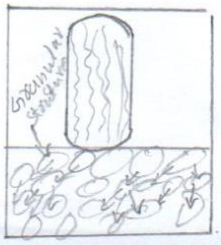
Q4 Types of Pavements

=> The Pavements can be classified Based on the structural performance into two,

1. Flexible Pavements
2. Rigid Pavements.

1. Flexible Pavements.

=> Flexible Pavements will transmit Wheel load stresses to the lower layers by grain-to-grain transfer through the points of contact in the granular structure



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Types of Flexible Pavements

1. Conventional Layered Flexible Pavements

=> Are Layered systems with high Quality expensive materials are placed in the top where stresses are high, and low Quality Cheap materials are placed in lower layers.

2. Full-depth asphalt Pavements

=> Are constructed by Placed Bituminous layers directly on the soil-sub-grade.

=> This is more suitable when there is high traffic and local materials are not available.

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(3) Contained Rock asphalt mats:

=> Are constructed by placing dense/open graded aggregate layers in Blw two Asphalt layers. Modified dense graded asphalt concrete is placed above the sub-grade will significantly reduce the vertical compressive strain on soil sub-grade and protect from surface water

Typical layers of a flexible Pavements

=> Typical layers of a conventional flexible Pavement includes. Seal coat, surface course, tack coat binder course, prime coat, Base course, Sub-Base course, sub-grade and natural sub-grade.

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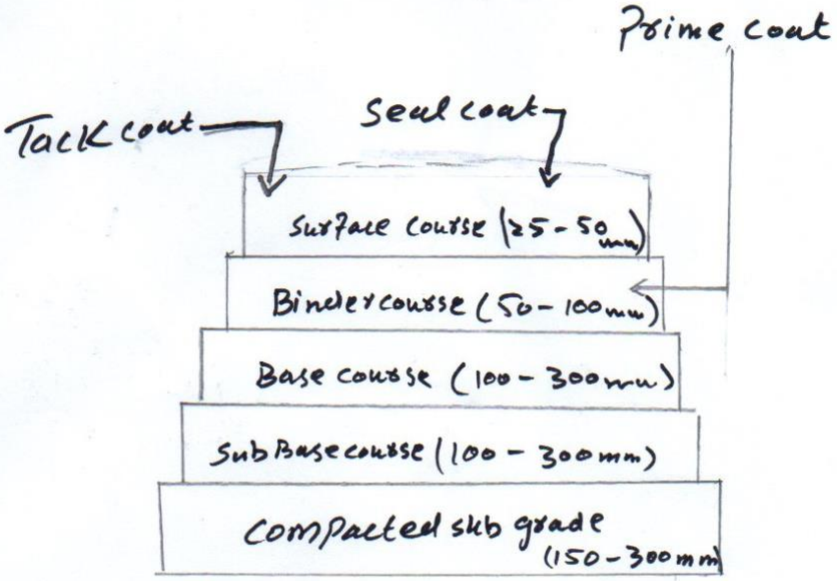

Typical cross-section of Flexible pavement