Nilachal Polytechnic

Bhubaneswar

[redacted]

Sem. : 4th Subject : Highway Engg.

Branch: Civil Engineering

Name of the Faculty : Sweta Sarangi

Text Book to be followed by Student / Faculty

Book- : Khana & Justo

Chapter- 7 : Road Maintenance

1.Learning Objectives

Student will learn –

About how to maintain the pavements.

About the failures in Rigid Pavement and Flexible Pavement

About the traffic signals and controls

2. Essential Questions

What are the failures of rigid pavement

What are the requirements of traffic control devices?

Write down the maintenance of rigid pavement?

Briefly explain the types of road failures.

3. Hours Required

Theory	3 hrs
Problems	nil
Question & Answer Theory	2 hrs
Total	**5 hrs**

4. Question for Teaching / Assignment / Self Practice

Question sets	02 Marks	05 Marks	10Marks
Teaching	3	1	1
Assignment	2	1	1
Self Practice	1	1	1

Total	6 no.s	3 no.s	3 no.s

Lesson Description:-

Road maintenance is essential in order to

preserve the road in its originally constructed condition,

protect adjacent resources and user safety, and

provide efficient, convenient travel along the route.

Unfortunately, maintenance is often neglected or improperly performed resulting in rapid deterioration of the road and eventual failure from both climatic and vehicle use impacts. It follows that it is impossible to build and use a road that requires no maintenance

Course Material

CHAPTER - 7
Road Maintenance

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It follows that it is impossible to build and use a road that requires no maintenance.

Preserving and keeping each type of roadway, roadside, structures as nearly as possible in its original condition as constructed or as subsequently improved and the operation of highway facilities and services to provide satisfactory and safe transportation, is called Road Maintenance or maintenance of highways.

Road Maintenance Components

The various road maintenance function includes:

Surface maintenance

Roadside and drainage maintenance

Shoulder and approaches maintenance

Snow and ice control

Bridges maintenance

Traffic service

Highway maintenance is closely related to the quality of construction of original road. Insufficient pavement or base thickness or improper construction of these elements soon results in expensive patching or surface repair. Shoulder care becomes a serious problem where narrow lanes force heavy vehicle to travel with one set of wheels off the pavement. Improperly designed drainage facilities, mean erosion or deposition of material and costly cleaning operation or other corrective measures. For regular highways maintenance and repair sharp ditches and steep slopes require manual maintenance as compare to cheap repair of flatter ditch and soil by machine.

COMMON TYPES OF ROAD FAILURES –

THEIR CAUSES AND REMEDIES

Failures may be:-

Failure in sub grade

Inadequate Stability

Excessive application of stresses

Plastic deformation

Failures in sub base or Base course

Inadequate stability

Loss of binding action

Loss of bearing course materials

Inadequate wearing course

Causes of premature failures:-

Rutting due to high variation in ambient temperature.

Uncontrolled heavy axle loads.

Limitation of pavement design procedures to meet local environmental conditions.

Common Flexible Pavement Failure/ Distresses:-

Cracking

Deformation

Deterioration

Mat problems

Problems associated with seal coats

Depending upon the degree of deterioration of the highway facility, the nature of the maintenance operations for bituminous pavements could be:

Patch repair

Surface treatment

Resurfacing

Patch Repair:

This consists of patching up of pot-holes and localised failures, and may be up to about 25 per cent of the surface area annually. For patching, sand premix, open-grade premix, dense-graded premix, or penetration patching may be adopted.

Surface Treatment:

The aim of surface treatment may be renewal of the surface course when patch repair becomes uneconomical; it may also be to improve skid resistance when the surface is worn out badly. Standard specifications for tack coat, prime coat and seal coat, along with surface dressing/premix carpet should be used.

Resurfacing:

This is taken up when the pavement has deteriorated badly. When the pavement is of inadequate thickness, an ‘overlay’ of adequate thickness should be designed and provided. A brief description of the defects, symptoms, probable causes, and possible treatment is given in the Table 10.3, extracted from “IRC; 82-1982: ‘Code of Practice for maintenance of bituminous surfaces’, Indian Roads Congress, New Delhi, 1982”: Defects, Symptoms, Causes and Treatment of Defects in Bituminous Surfacings.

Maintenance of concrete roads – filling cracks, repairing joints, maintenance of shoulders (berm), maintenance of traffic control devices

A cement concrete pavement needs very little maintenance if it is well-designed and properly constructed. In fact, this is considered to be the most important advantage which offsets the high initial cost.

However, defects are likely to occur due to ingress of water, especially through ill-maintained joints and cracks, inadequate pavement thickness and poor workmanship.

Cracks:

Appearance of cracks, which may be shrinkage cracks or warping cracks due to temperature changes. Cracks which appear in the corner and edge regions are called ‘structural cracks’ as they are due to the excessive stresses caused by wheel loads.

They indicate inadequacy of the pavement thickness and should be viewed seriously and treated differently. Hair cracks are not harmful, but medium and wide cracks allow water to seep through and cause progressive loss of subgrade support.

Such cracks should be filled up with low-viscosity epoxy grout, after cleaning the cracks of dust. Compressed air is used for effective cleaning.

The material is topped up with sand or fine aggregate chips to prevent the disturbance of the material under traffic.

Joints:

Joint maintenance consists of replenishing lost sealant, removal of deteriorated joint filler, and introduction of fresh filler material.

The sealant is then poured to an excess height of about 3 mm and sand sprinkled for it to be compressed by the traffic to the level of the pavement surface.

Patch Repair of Slabs:

Sealing, spalling, depressions and irregularities can occur in a slab locally. Immediate patching up of such defective slabs can arrest further deterioration. Premix bituminous materials are commonly used for this purpose, but they do not provide a satisfactory result.

The best materials are epoxy resin mortars and concrete for such patch repair work. The sides of the area of the slab to be patched are trimmed, made vertical, and fresh concrete is laid and tamped; the areas are usually made of regular geometrical shapes like rectangles.

Mud-Pumping:

When water gets collected in the subgrade, heavy axle loads cause ejection of mud through joints, cracks and edges. This phenomenon is commonly known as mud-pumping and blowing. When this is observed, defective joints and wide cracks should be refilled and sealed. To prevent further damage and recurrence, grouting of the slab is done through holes drilled in it; the grout can be of cement mortar (1:3.5 mix) or of bituminous material (the latter is preferred since it is effective in filling the void spaces between the slab and the subgrade), and raising the slab to the desired level. This process is called mud-jacking and is popularly used in advanced countries.

Restoration of Anti-Skid Surface:

When the surface becomes smooth and slippery, anti-skid surface can be restored by cutting grooves by grooving machines or by grinding machines.

Crack Repair:

A patching mix of epoxy mortar can be filled and compacted after chipping off the area and cleaning it thoroughly by using compressed air. This is adequate only when the crack depth is not more than one-third of the depth of the slab.Mechanised Maintenance of Roads: In India, road maintenance is mostly labour-oriented; however, mechanical maintenance of roads also can be practised with indigenous equipment for speedy implementation and better quality control.

Traffic safety and traffic control signal

Traffic control device is the medium used for communicating between traffic engineer and road users. Unlike other modes of transportation, there is no control on the drivers using the road. Here traffic control devices comes to the help of the traffic engineer. The major types of traffic control devices used aretraffic signs, road markings , traffic signals and parking control.

Types of traffic control Devices are as follows. 🌧

Signs 🌧

Signals

Markings

Islands

Requirements of traffic control devices

The control device should fulfil a need :

Each device must have a specific purpose for the safe and efficient operation of traffic flow. The superfluous devices should not be used.

It should command attention from the road users:

This affects the design of signs. For commanding attention, proper visibility should be there. Also the sign should be distinctive and clear. The sign should be placed in such a way that the driver requires no extra effort to see the sign.

It should convey a clear, simple meaning:

Clarity and simplicity of message is essential for the driver to properly understand the meaning in short time. The use of colour, shape and legend as codes becomes important in this regard. The legend should be kept short and simple so that even a less educated driver could understand the message in less time.

Road users must respect the signs:

Respect is commanded only when the drivers are conditioned to expect that all devices carry meaningful and important messages. Overuse, misuse and confusing messages of devices tends the drivers to ignore them.

The control device should provide adequate time for proper response from the road users:

This is again related to the design aspect of traffic control devices. The sign boards should be placed at a distance such that the driver could see it and gets sufficient time to respond to the situation. For example, the STOP sign which is always placed

at the stop line of the intersection should be visible for atleast one safe stopping sight distance away from the stop line.

Question set

Classroom Teaching

Group A

Write any two type of failure in flexible pavement?
Write down any two causes of pavement failure?
What are the failures in rigid pavement?

Group-B

1.Give brief description of patch repairing process.

Group-C

Write the general causes of pavement failure.

Assignment Questions

Group-A

1.Write down two methods of maintenance of flexible pavement?
2. Enumerate different types of traffic signals.

Group-B

1.What are methods used for maintenance of bituminous road? Write each in brief.

Group-C

What are the various types of failure in flexible pavement? Explain the causes of failure? (2015w)

Self Practice

Group-A

1. Write down two methods of maintenance of rigid pavement?

Group B

1.How the cracks are treated in rigid pavement?

Group C

1.What are the maintenance process of a cement concrete pavement?

Faculty **HOD** **Principal**