TRAINING NOTE

on

Rigid Pavements: Design, Construction and Quality Control Aspects

MR ABANIKANTA DAS
ASST ENGINEER (WBP), PO3.
NOVEMBER, 2011

केन्द्रीय सड़क अनुसंधान संस्थान

नई दिल्ली (भारत)

Central Road Research Institute

New Delhi (India)

Training Programme on "Rigid Pavements: Design, Construction and Quality Control Aspects" from 14th November to 18th November-2011 at CRRI New Delhi.

The Government Of Odisha in Works Department vide works Department Letter No.EAP(Cell)-121/2011 9733/w Dt. 22nd September, 2011 had deputed the following officer of Project Management Unit, Odisha State Roads Projects to attend the Training Programme on **"Rigid Pavements: Design, Construction and Quality Control Aspects"** being held from 14th November to 18th November-2011 at Central Road Research Institute(CRRI) in New Delhi.

1. Er. Abanikanta Dash, Assistant Engineer,PMU

Brief Notes

The Central Road Research Institute (CRRI) carry out researches for investigation, construction and maintenance of different types of roads and runways with a view to effecting economy and achieving greater serviceability. It also carry out researches and developments in all respect of traffic and transportation engineering including training programme to engineers for wide application of indigenously developed technologies. In this regard CRRI had organized 5 days training programme from 14th November to 18th November -2011 regarding design, construction and quality aspect of rigid pavement. The course details of the training programme are as listed below

Training programme on Rigid Pavements;
Design, Construction & Quality Control Aspects
November 14 – 18, 2011

14.11.2011
(Monday) 9:30 AM – 10:30 AM ILT
Registration

Inauguration 10:30 AM - 11:30 AM
Dr. S. Gangopadhyay
Director, CRRI.

11:30 AM – 11:45 AM Tea

Date/Day	Time	Topic	Name of Lecturer
14.11.2011 (Monday)	11:45 AM – 01:15 PM	Design and construction of Rigid Pavements	**Dr. Rakesh Kumar**
	01:15 PM – 2:15 PM	**Lunch**	

	02:15 PM – 03:15 PM	Constituents of concrete and specifications	Sh. Binod Kumar
	03:15 PM – 03:30 PM	**Tea**	
	03:30 PM – 05:00 PM	Construction and Quality Control of Cement Concrete Roads.	Sh. Binod Kumar
15.11.2011 (Tuesday)	09:30 AM – 10:45 AM	Design & construction of Drylean concrete layer	Dr. Rakesh Kumar
	10:45 AM – 11:00 AM	**Tea**	
	11:00 AM – 01:00 PM	Techno-economic feasibility of cement concrete roads.	Dr. L.R. Kadiyali

Date/Day	**Time**	**Topic**	**Name of Lecturer**
	01:00 AM – 02:00 PM	**Lunch**	
	02:00 PM - 03:00 PM	Roller Compacted Concrete	Sh. J.B. Sengupta
	03:00 PM – 04:00 PM	Construction of Granular Sub-Bases	Sh. Satish Panday
	04:00 PM – 05:30 PM	**Lab Demo**	Sh. Dinesh Ganvir Sh. Pankaj Goel Sh. Ashok Pant, Sh. Manoj Kumar
16.11.2011 (Wednesday)	09:30 AM – 05:00 PM	**Site Visit**	Sh. J.B. Sengupta Dr. Rakesh Kumar Sh. Binod Kumar Sh. Dinesh Ganvir Ms. Aashia

17.11.2011 (Thursday)	09:30 AM – 11:30 AM	Ready mix concrete and use of admixtures in cement concrete	Dr. Rakesh Kumar
	11:30 AM – 11:45 AM	**Tea**	
	11:45 AM – 01:00 PM	Design of Concrete Overlay over Distressed Pavements	Sh. Dinesh Ganvir
	01:00 PM – 02:00 PM	**Lunch**	
	02:00 PM – 03:00 PM	CRRI Visit	ILT
	03:00 PM – 04:00 PM	Concrete Pavements Distresses: Maintenance/Repair Strategies	Dr. A.K. Misra

Date/Day	**Time**	**Topic**	**Name of Lecturer**
	04:00 PM – 05:30 PM	**Lab Demo**	Sh. Dinesh Ganvir Sh. Pankaj Goel Sh. Ashok Pant Sh. Manoj Kr. Singh Ms. Aashia
18.11.2011 (Friday)	09:30 AM – 11:00 AM	Structural and Functional Evaluation of Pavements	Sh. Y.V. Rao
	11:00 AM – 11:15 AM	**Tea**	
	11:15 AM – 01:00 PM	**Library Visit**	ILT
	01:00 PM – 02:00 PM	**Lunch**	
	02:00 PM – 03:00 PM	Accelerated Pavement Testing Facility (APTF)	Sh. M.N. Nagabhushan
	03:00 PM – 03:15 PM	**Tea**	
	03:15 PM – 04:30 PM	Concluding session & certificate distribution	DRRI/Faculty Members & ILT Div.

TRAINING REPORT

Pavement is the durable surface material laid down on an area intended to sustain vehicular or foot traffic. Generally there are 2 types of pavements such as Rigid pavement and Flexible paverment.In rigid pavement concrete play the key role where as in flexible pavement asphalt/maxphalt plays the key role.

Concrete surfaces (specifically, Portland cement concrete) are created using a concrete mix of Portland cement, coarse aggregate, sand and water. In virtually all modern mixes there will also be various admixtures added to increase workability, reduce the required amount of water, mitigate harmful chemical reactions and for other beneficial purposes. In many cases there will also be Portland cement substitutes added, such as flyash. This can reduce the cost of the concrete and improve it's physical properties. The material is applied in a freshly mixed slurry, and worked mechanically to compact the interior and force some of the cement slurry to the surface to produce a smoother, denser surface free from honeycombing. The water allows the mix to combine molecularly in a chemical reaction called hydration. To obtain a good quality of concrete with available materials, we should mix the ingredients in such a way that concrete is economical, durable and gives maximum strength and this process is called mix design of concrete. The quality of concrete depends on the following parameters.

- **Quality of cement**
- **Water cement ratio**
- **Grading of aggregates**
- **Degree of compaction**
- **Efficiency of concrete**
- **Age of concrete**

A mix design undergoes a number of steps and these are

- **Select cement content for required strength**
- **Select aggregate – cement ratio**
- **Calculate quantity of aggregates**
- **Select fine aggregate percent**
- **Calculate quantity of fine aggregate**
- **Calculate quantity of coarse aggregate**
- **Prepare mixes with different water content**

- **Prepare blocks, cure & test at 7 & 28 days**
- **Adjust the mix proportions if required**

Rigid pavements are of 3 types .They are

1. **Jointed Plain Concrete Pavements (JPCP)**
2. **Jointed Reinforced concrete Pavements (JRCP)**
3. **Continuous Reinforced Concrete Pavements (CRCP)**

Jointed Plain Concrete Pavements (JPCP) contain enough joints to control the location of all the expected shrinkage cracks. The concrete cracks at the joints and not elsewhere in the slabs. Jointed plain pavements do not contain any steel reinforcement. However, there may be smooth steel bars at transverse joints and deformed steel bars at longitudinal joints. The spacing between transverse joints is typically about 4.5 to 5.0 meter for slabs 150 mm to 150 mm thick.

Jointed Reinforced Concrete Pavements (JRCP) contain steel mesh reinforcement (sometimes called distributed steel). In jointed reinforced concrete pavements, designers increase the joint spacing purposely, and include reinforcing steel to hold together intermediate cracks in each slab. The spacing between transverse joints is typically9-10 meter. In the past, some agencies used a spacing as great as 30 m. Today only a handful of agencies employ this design, and its use is generally not recommended as JPCP and CRCP offer better performance and are easier to repair.

Continuously Reinforced Concrete Pavements (CRCP) do not require any transverse contraction joints. Transverse cracks are expected in the slab, usually at intervals of 1-1.5 meter. CRCP pavements are designed with enough steel, 0.6–0.7% by cross-sectional area, so that cracks are held together tightly. Determining an appropriate spacing between the cracks is part of the design process for this type of pavement.

Continuously reinforced designs may cost slightly more than jointed reinforced or jointed plain designs due to increased quantities of steel. Often the cost of the steel is offset by the reduced cost of concrete because CRCP is nearly always significantly thinner then a JPCP designed for the same traffic loads. Properly designed JPCP and CRCP should demonstrate similar long-term performance and cost-effectiveness. A number of agencies have made policy decisions to use CRCP designs in their heavy urban traffic corridors.

One advantage of cement concrete roadways is that they are typically stronger and more durable than asphalt roadways. They also can be grooved to provide a durable skid-resistant surface. However, the cost of grooving can be quite high depending on the hardness of the aggregates in the concrete pavement. Disadvantages are that they typically have a higher initial cost, can be rougher to drive on if surface smoothness is not a contract requirement, are susceptible to cracking if underdesigned, and can be more difficult to repair in a satisfactory manner. A sampling of interstate highways recently found that some concrete roads are in sufficiently poor condition that they cause damage to freight carried by

truck. Repairs can be expensive and time consuming,[1] thus are often delayed until the road becomes quite unsatisfactory for travel.

The first street in the United States to be paved with concrete was Court Avenue in Bellefontaine, Ohio in 1891. The first mile of concrete pavement in the United States was on Woodward Avenue in Detroit, Michigan in 1909.

Concrete pavement construction involves following steps.

1. **Preparation of the sub grade and sub base**
2. **Placing of dowels and tie bars**
3. **Choice and handling of materials**
4. **Development of concrete mix design**
5. **Production and transportation of the concrete**
6. **Placing, compaction , finishing, curing and jointing.**

In rigid pavement Dry Lean Concrete (DLC) functions as sub base/ base course.It

- provide uniform and strong support to construction equipment and pavement slab
- prevents underneath pumping
- High resistance to deformation
- Controls the volume changes in expansive soils underneath
- Provides platform for form work for PQC

Construction procedure of DLC layer

- DLC shall be laid by a paver
- DLC sub base shall extend beyond the pavement edges by 500mm
- A thickness of 100 mm-150 mm is commonly followed.
- Thorough compaction should be ensured by using double drum smooth wheeled vibratory roller of 80 to 100kN on the full width.
- Spreading ,compacting and finishing of DLC should be carried out as quickly as possible
- Level of rolled surface should be checked for compliance p-32
- Curing shall be done by covering the surface by wet gunny bags/Hessins in minimum 3 layers for at least & days.

Construction procedure of Pavement Quality Concrete(PQC) slab

- **Mixing, Hauling, and Placing of Concrete**
- **Spreading & Compaction**
- **Insertion of Dowel & Tie Bars**
- **Floating & Finishing**

- **Texturing**
- **Curing**
- **Sawing of Joints**
- **Filling of Joints with Sealant**

PQC can be prepared either in commercial batching plant or temporary batching plant. Then it is carried to the site through transit mixer where it is spread by the paver. Then it is laid through semi mechanized or fully mechanized paver. In semi mechanized paver insertion of dowel bars and tie bars are done manually where as in fully mechanized paver the same is done through paver.Then it is compacted either with a vibratory screed or with roller screed. Then the surface is finished with drag float or longitudinal float or with roller float and final finish is obtained by straightedge finish or power trowel or hand trowel. Then the texturing is done either by carpet dragging or by brush dragging to make the surface antiskid. The concrete surface is then cured by water curing (Ponding water on top or covering with retaining materials)or by sealed curing(Placing a waterproof covering or curing compound to form impermeable membrane). Then the surface is saw cut in transverse direction to a depth of 1/3 to1/4 of total slab depth in right time to prevent joint raveling . Then the cut joints are sealed by sealants either by neoprene compound or silicon polymer compound to minimize the entry of water.

Dry Lean Concrete Paver

DLC laid and Compacted

Laying, Compaction & finishing of Concrete

Vibrators Attached to Paver

Automatic dowel bar inserter

Tine Texturing Machine

Brooms for Texturing

Manual Finishing Touches

Tine Textured Surface

Protection of pavement using a movable tent &
Curing with Wet Hessian Cloths

Curing compound on freshly laid concrete

Joint Cutting

Proper Joint Cutting without Spalling

The concrete surface due to prolonged use detoriates which needs rehabilitation. Pavement rehabilitation is a structural or functional enhancement of a pavement which produces a sustainable extension in service life, by substantially improving pavement condition and riding quality.The overlaying of concrete over distressed surface is also known as "White Topping"

White topping is defined as a portland cement concrete (PCC) overlay constructed on the top of the existing distressed bituminous pavement.It is a PCC resurfacing (overlay) as a rehabilitation or structural strengthening alternative on bituminous pavement

Advantages of White Topping

- Long life, low maintenance, low life cycle cost, improved safety and environmental benefits
- Bituminous overlay exhibits a more rapid loss of serviceability as compared to concrete whitetopping
- Deformation like rutting and cracking predominant in case of bituminous pavement which is normally absent with concrete surfaces of whitetopping
- Long life, low maintenance, low life cycle cost, improved safety and environmental benefits
- Bituminous overlay exhibits a more rapid loss of serviceability as compared to concrete whitetopping
- Deformation like rutting and cracking predominant in case of bituminous pavement which is normally absent with concrete surfaces of whitetopping
- Conventional Whitetopping improves structural capacity of existing bituminous pavement, if built on strong base course, and it impedes structural distresses.
- Whitetopping requires much less maintenance as compared to bituminous pavement
- Whitetopping is quite cost effective to tackle annual budget constraints and high traffic levels
- Whitetopping can uniformly fill ruts in the wheel path of bituminous pavements more effectively because concrete is far more stiff and consistent at high temperature than bituminous mixes

Types of White Toppings

1) Conventional Whitetopping (200mm or more)
2) Thin Whitetopping (TWT) (100-200mm)
3) Ultra-Thin Whitetopping (UTWT)(≤ 100 mm)

Conventional Whitetopping (CWT)

- A PCC overlay of thickness 200mm or more designed and constructed without consideration of any bond between the concrete overlay and underlying bituminous layer
- It is constructed as a new rigid pavement without assuming any composite action
- CWT treats the existing bituminous surface as a subbase i.e dry lean concrete (DLC)
- Bituminous surface should not suffer from any isolated damages like subsidence or material related problems

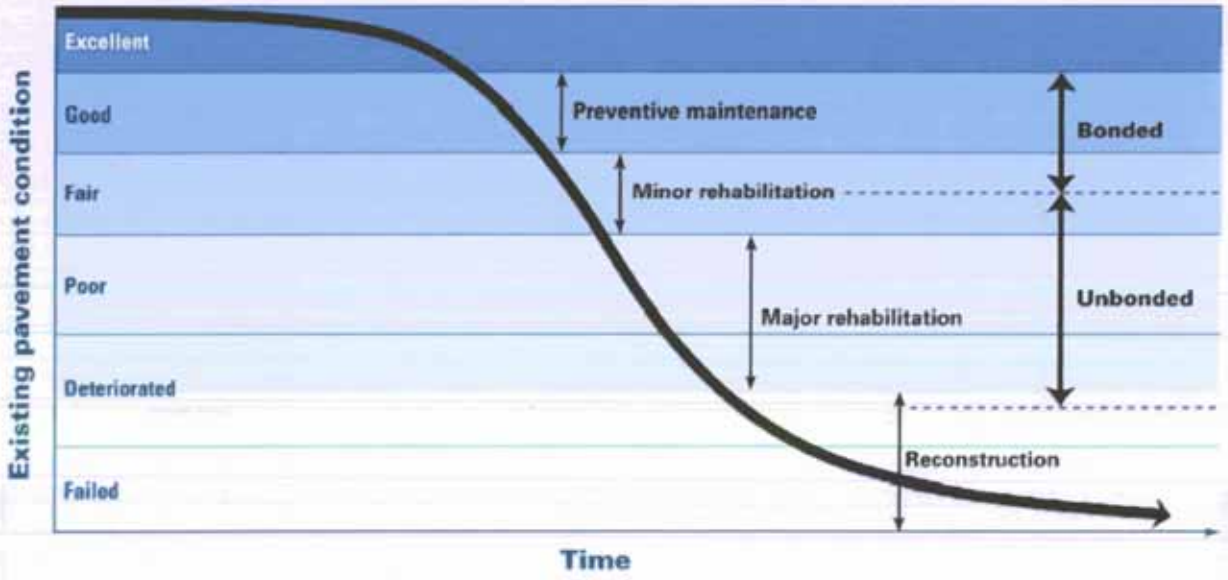
Thin Whitetopping (TWT)

- PCC overlay thickness greater than 100 and less than 200 is known as Thin Whitetopping(TWT)
- The bond between the overlaid PCC and underlying bituminous layer is often a consideration but not mandatory
- High strength concrete with fibres are commonly used
- Joint spacing – 0.6 to 1.25m

Ultra Thin White topping

- PCC overlay Thickness equal to less than 100 mm is known as Ultra Thin Whitetopping(UTWT)
- Bonding is mandatory in between the underlying bituminous layer and overlaid PCC layer.
- Bonding is achieved by milling the existing bituminous surface upto 25mm depth.
- Joint Spacing – 0.6 to 1.25 m

OVERLAY FOR REHABILTATION AND MAINTENANCE



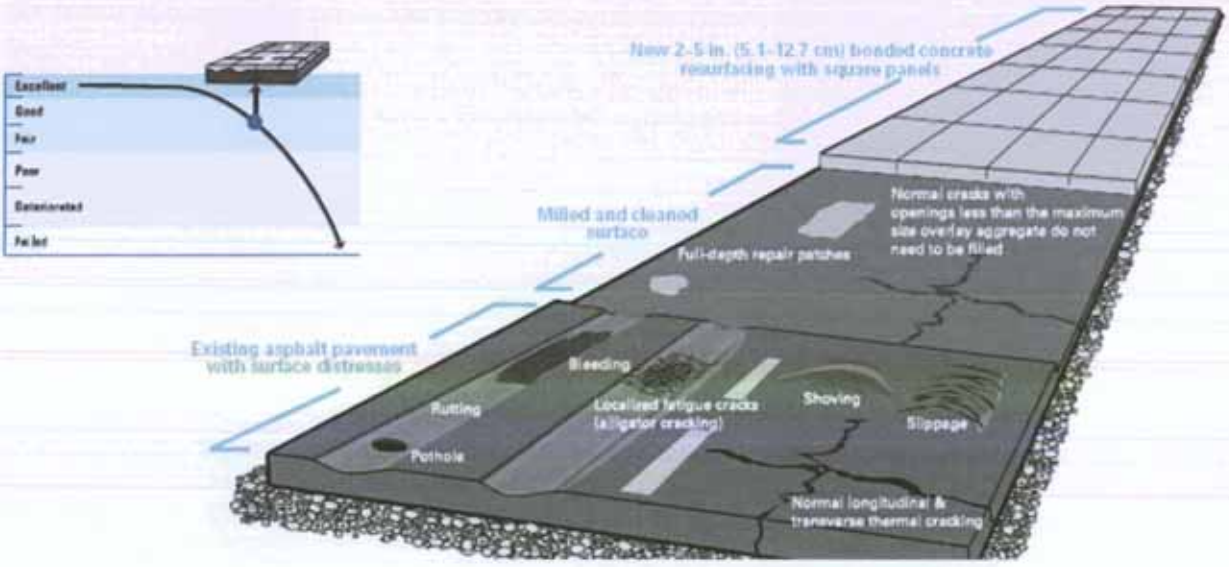
Evaluation of existing pavement

- A detailed evaluation is required to establish the best overlay strategy
- The ultimate goal is to access the stability and structural capacity of the existing pavements
- The survey information is also used to determine if pre-overlay repairs are required and to what extent. (rarely necessary except in isolated locations)

Pavement Evaluation

On high-volume roads, falling weight deflectometer can provide subgrade k-values and variability, concrete modulus, load transfer efficiency, and the presence of voids.

BONDED CONCRETE RESURFACING OF ASPHALT PAVEMENTS
-ULTRA THIN WHITE TOPPING(UTWT)

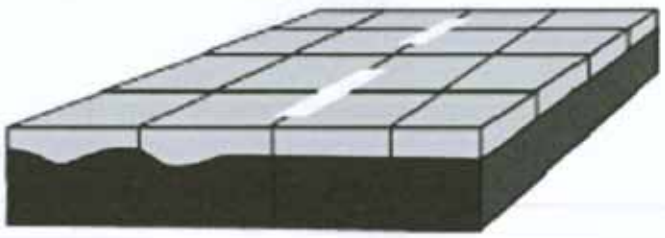


- Localized distress can be determined through a visual distress , coring , deflection testing and other methods
- Isolated weak zones can be strengthened by patching. Milling can be used to remove a number of asphalt surface distress

Elements of bonded concrete over Asphalt

Bonded concrete overlays of asphalt pavements- Ultra thin whitetopping, UTWT

- Small square panels reduces curling, warping, & shear stresess.
- Mill if necessary to correct crown, remove surface distress, improves bonding. Insure to leave 3" min. HMA after milling
- HMA surface temperature below 35^{0} C before paving.
- UNBONDED CONCRETE RESURFACING OF ASPHALT PAVEMENTS
- -CONVENTIONAL WHITETOPPING/ THIN WHITE TOPPING



UNBONDED CONCRETE RESURFACING OF ASPHALT PAVEMENTS-CONVENTIONAL WHITETOPPING/ THIN

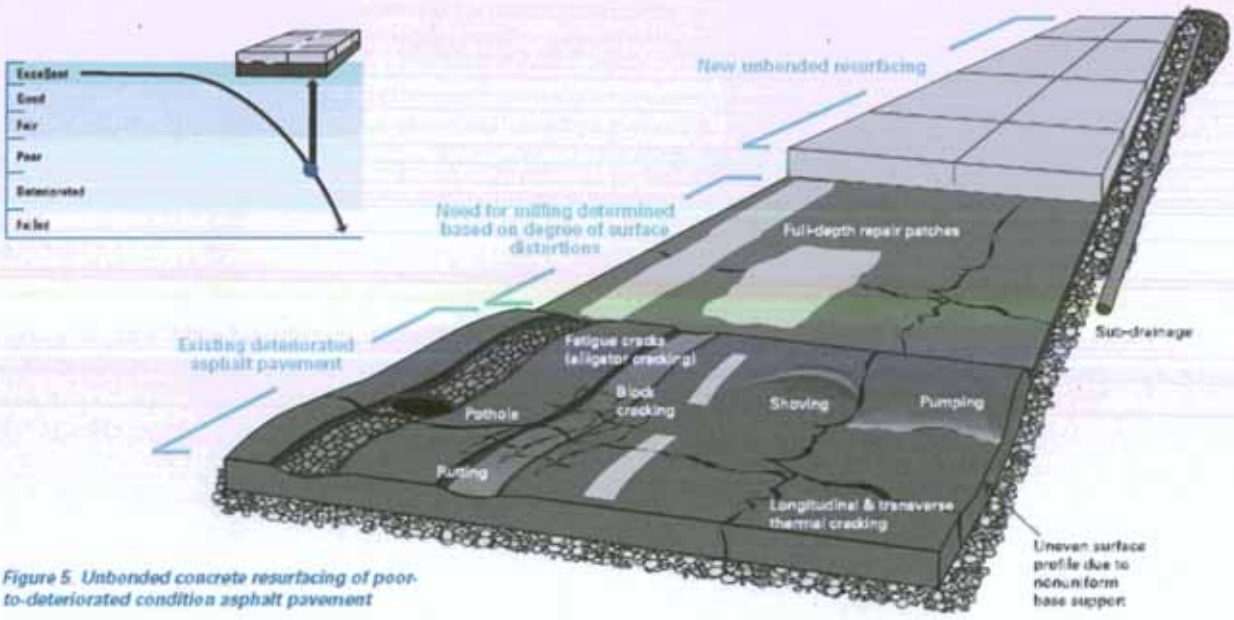


Figure 5. Unbonded concrete resurfacing of poor-to-deteriorated condition asphalt pavement

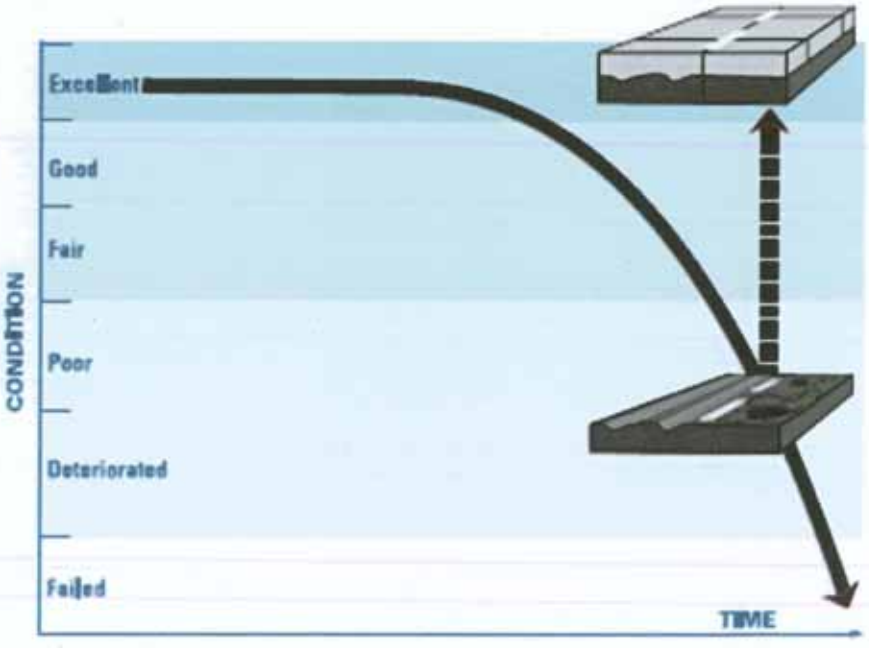
WHITE TOPPING

Localized areas of weakness can be strengthened through patching. Milling can remove a number of asphalt surfaces distresses.

Uses and Advantages – Unbonded overlay

Thickness more than 5"

- Use when existing pavement is deteriorated and when sub base is stable
- Use to restore structural capacity of the existing pavements and increase pavement life equivalent to full depth pavement



- Longer Design life than rehabilitation with asphalt
    - Typically used when existing pavement is significantly deteriorated
    - Severe rutting
    - Potholes
    - Alligator cracking
    - Shoving and pumping

UTWT Overlays Applications

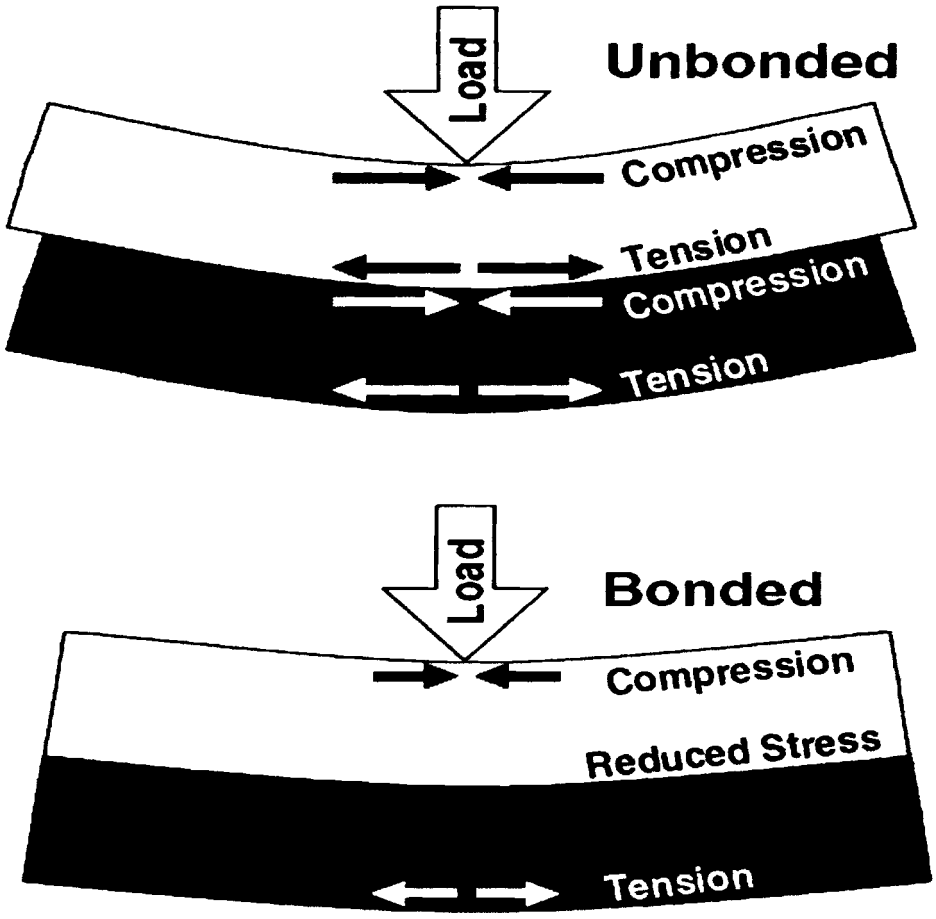
- Low Volume Roads (Urban Streets, village roads)
- Parking lots
- Footpaths
- Residential Streets
- Intersection

TWT Overlays Application

More Heavy Loaded Routes

- Rural Roads
- Medium to Moderately Heavy Volume Roads(e.g MDR, SH, Low Traffic NH)
- Intersections
- Minor Airports Pavements

Effect of Composite action of UTWT and TWT behavior under Flexural loading



Construction Steps

- Mill and clean surface.
- Place concrete, finish and cure
- Early sawing is required
- Opening to traffic.

Mill Surface

- Milling can remove significant surface distortions that likely contain poor quality asphalt material.
- Milling is used to reduce high spots and help ensure desired overlay depth and reduce the quantity of concrete needed to fill low spots
- Milling roughtens the surface to enhance the bond between the new concrete overlay and the asphalt
- Direct placement without milling is recommended when rutting in the existing asphalt pavement does not exceed 2".
- Any ruts in the existing pavement are filled with concrete, resulting in a thicker concrete overlay above the ruts

CLEANING OF SURFACE

- Air Blasting/vacuum cleaner
- Power Brooming
- Water Blasting

- Sand Blasting

Placement using Vibrating Screed

Placement using Slipform paver

Finishing

Curing (High Rate)

Opening to Traffic

USE OF ADMIXTURE IN CEMENT CONCRETE

Concrete should be workable, finish able, strong, durable, watertight, and wear resistant. These qualities can often be obtained easily and economically by the selection of suitable materials (except air-entraining admixtures where needed). However, admixtures are sometimes beneficial.

Admixtures should be used in conjunction with, and not a substitute for, good concreting practice.

Admixtures are used for one purpose: to improve some characteristics of the concrete. This section will include admixtures that can be used to provide the following results:

- Protect Against Freeze Thaw Cycles Improve Durability
- Water Reduction in the Mix
- Mid-Range water reducers
- High-Range water reducers superplasticizers
- High Strength Concrete
- Corrosion Protection
- Set Acceleration
- Strength Enhancement
- Set Retardation

- Crack Control (shrinkage reduction)
- Flowability
- Finish Enhancement
- Fly Ash- Making Concrete Stronger, More Durable, and Easier to Work With
- Silica Fume: Early Strength and Reduced Permeability
- Produce a fluid backfill, which flows easily and is self leveling

Permeability-reducing admixtures reduce the rate at which water under pressure is transmitted through concrete. One of the best methods of decreasing permeability in concrete is to increase the moist-curing period and reduce the water-cement ratio to less than 0.5. Most admixtures that reduce water-cement ratio consequently reduce permeability. Some supplementary cementing materials, especially silica fume, reduce permeability.

Some admixtures act to block the capillaries in concrete. These are also effective in reducing corrosion of steel reinforcement. Waterproofing admixtures can create built-in waterproofing that does not require the additional cost of a waterproofing membrane. Since it is part of the concrete, it cannot be punctured, torn or damaged in the construction phase, in service, or deteriorate with age. These can be used for concrete basements, tunnels, roofs, floors, and foundations.

Types of Admixtures

- Chemical Admixtures
- Mechanical Admixtures

Chemical Admixtures

The chemical admixtures are Calcium chloride, Nitrates, Alkali sulphates,sugar.carbohydrates

- Added in very small quantity
- Increases the rate of hydration
- Achieve certain workability in lower W/C
- Economy
- Enhance durability
- Reduction in capillary porosity

All admixtures to be used in concrete should meet specification. Test should be carried out to evaluate how the admixtures will affect the properties of concrete

STRUCTURAL EVALUATION OF PAVEMENTS USING *FALLING WEIGHT DEFLECTOMETER (FWD)*

- Pavement evaluation, in its most common connotation, implies the assessment of residual or available structural strength of the pavement.

- Evaluation is normally required either in connection with checking the adequacy of the existing pavements for increased design loads, or working out suitable overlay designs to restore or enhance their structural capacity.
- Evaluation is also needed to check the quality of a new construction.

Purposes

- Technique of assessing structural and functional condition
- Assess maintenance needs
- Suggesting remedial measures (patch repairs, renewals and resealing)
- Assessing remaining life
- Determining strengthening requirements
- Predictive modeling

Pavement Evaluation

1. **Condition Assessment**
2. **Structural Evaluation**
3. **Functional Evaluation**

Condition Assessment

Distress of pavements

a) **Deficiencies of materials used**

Use of soft aggregates - cracking & disintegration of CC

Poor workmanship in construction of joints - Dev. of cracks

Use of poor filler and sealer - spalling of joints

Poor surface finish - poor riding surface and slippery surface

Inadequate curing - deterioration in the strength of concrete - shrinkage cracks

b) Structural inadequacy (pavement-base-subgrade structure)

Inadequate pavement thickness - cracking at corners

Inadequate subgrade - settlement of pavement

- Poor soil subgrade - widening of joints
- Incorrect spacing of joints - mud pumping and blowing

Scaling of CC pavements

-Chemical impurities in the mix or due to poor mix design

-Mortar comes to the surface

- Surface gets abraded -Rough surface
- **Shrinkage cracks**

- During curing period, water enters inside
- -Disintegration of CC

Warping cracks

- Faulty design of joints (Long. And Trans. Reinforcements)

Structural cracks

-Due to inadequate thickness

Spalling of joints

-Concreting on fillers (Overhang layer of concrete on top of filler)

Mud Pumping

Ejection of soil slurry due to repeated loads

Structural Failures

Collapse of the pavement structure or a breakdown of one or more of the pavement components

Cracking & breakdown due to overloading (complete rebuilding, repair)

Functional Failure

Development of rough spots as a result of break up in the bituminous overlay (Resurfacing to restore RQ)

No structural breakdown of the overall structure

Falling Weight Deflectometer

- Non-destructive, fully micro-processor based system used for determining the structural
- Trailer with sensors and a falling weight assembly
- Simulates heavy moving wheel load
- Produces load effect ranging from 24 to 240 kN
- Impulse load created by dropping a variable weight mass from different heights
- Produces deflection bowl / shape of the pavement
- Transient pavement surface deflections at 7 sensors

Why FWD?

- Load pulse generated by the impact of falling weight causes a deflection closely simulating the one caused by a normal traffic / wheel load
- Deflection measurement is the easiest

- FWD is the most advanced of all NDT devices
- Loading condition close to field conditions – magnitude and time of loading
- Measured deflections used for back-calculation of pavement layer properties

Principle and Functions of FWD

Principle

Impulsive load applied by the Falling weight Loading capacity:

- 30 to 240 kN for KUAB Heavy Falling Weight Deflectometer
- *Upto 120 kN for Dynatest FWD*

Process

·Mechanical transfer of K.E of the falling weight at a point of impact to the work done in deforming the pavement

· Depends on model parameters(Modulus, thickness, Poisson's ratio of each layer)

Functions

· Measures pavement deflections (deflection basin) under pre-determined load

· Air temperature

· Pavement temperature

· Controls are monitored through PC installed inside the vehicle

FWD Output

- Transient Deflections at seven different points
- Layer Moduli
- Overlay design
- Remaining life of the pavement
- K-value
- Load transfer efficacy
- PCN value

- ***Airport Pavements***

To increase structural capacity

In-place strength tests

Falling Weight Deflectometer (FWD)

- **ACN: Number which expresses the relative effect of an aircraft on a pavement for a typical specified category of foundation**
- **PCN:Number which expresses the bearing capacity of a pavement for unrestricted operation**

CSIR- CENTRAL ROAD RESEARCH INSTITUTE

New Delhi – 110 025

CSIR CRRI

This is to certify that

Mr. Abanikanta Dash

Assistant Engineer
World Bank Project, Bhubaneswar, Orissa

has successfully attended Training Programme on ***"Rigid Pavements: Design Construction & Quality Control Aspects"*** from November 14-18, 2011 organized by CSIR-Central Road Research Institute, New Delhi.

November 18, 2011
CSIR-CRRI, New Delhi

Director

CENTRAL ROAD RESEARCH INSTITUTE,
DELHI-MATHURA ROAD, P.O. CRRI,
NEW DELHI – 110 025

QSP/HRP/01/1A(9) November. 18, 2011

Sub: **Training Programme on "Rigid Pavements: Design,Construction and Quality Control Aspects" from November 14 - 18, 2011**

A statement of trainee - officers from various Department, who had attended the above said training programme is given below :

S. No.	Name of the Trainees	Date of Joining the Course	Details of (Fee recd.)
1.	Col. Ravinder Kumar Sharma Director, Comb Engrs – 4, Room No. 119, Kashmir House, Ministry of Defence, Rajaji Marg, E-in-C's Branch, New Delhi – 11. Phone. – 011-23019132/ 690	14-11-2011 (F.N.)	to be paid
2.	Mr. Sanjeev Kumar EE, DCWE (B/R), HQ CWE Kanpur, No. 1 Wheeler's Barracks Kanpur Cantt – 04 Email: sanjeev.kumar977@gmail.com	14-11-2011 (F.N.)	to be paid
3.	Mr. Akhalesh Kumar Gupta EE, GE(AF) Panagarh, Air Force Station Panagarh, Post – Birudiha, Distt.- Burdwan, West Bengal – 713148 Mob. – 09732380295 Email: akhalesh_gupta1980@yahoo.com	14-11-2011 (F.N.)	to be paid
4.	Mr. S.R. Agrawal Joint Director, Chief Engineer (MES), Bathinda Zone, Bathinda Cantt – 151003 Phone – 0164-2246223 Email: sraggy@rediffmail.com	14-11-2011 (F.N.)	to be paid

5.	Mr. Pankit R. Patel Deputy Manager, B/36, Gauri Nagar Society, NR. Chandlodia Rly. Stn., Ghatlodia, Ahmedabad – 380061, Gujarat Email: justpankit@gmail.com	14-11-2011 (F.N.)	to be paid
6.	Sub. Chandran M.K. JE (Civil), GE (AF) Maharajpur Air Force Station Maharajpur, Gwalior, MP – 474020 Phone. – 0751-2479492 Mob. – 09685126978 Email: chandranmk09@rediffmail.com	14-11-2011 (F.N.)	to be paid
7.	Mr. Sindhuraj D Assistant Director Kerala Highway Research Institute, Kariyavattom, P.O.-Thiruvananthapuram, Kerala Email: sindhuraaj@gmail.com	14-11-2011 (F.N.)	DD – 588827 dated 8-11-2011 SBT - Trivandrum Rs.7000/-
8.	Mr. Abanikanta Dash Assistant Engineer, World Bank Project, Bhubaneswar, Orissa Mob. – 9438041199 Email: akdash@pmuosrp.org	14-11-2011 (F.N.)	DD – 599912 dated 10-11-2011 SBI, Bhubaneswar
9.	Mr. D. K. Chandrakar Dy. Manager (FQA) FQA_Department, NTPC Sipat, Phone. – 07752-246561, Mob. – 9425215788 Email: dilipchandrakar@yahoo.com	14-11-2011 (F.N.)	to be paid
10.	Mr. Rajeev Sharma Assistant Engineer (D) O/o Chief Engineer (Kangra Zone), HP PWD, Dharamshala (H.P) Mob. – 9418066271 Email: rkspwd@gmail.com	14-11-2011 (F.N.)	to be paid
11.	Er. Umesh Sharma Assistant Engineer O/o E-in-C, HP.PWD, Nirman Bhawan, Nigam Vihar, Shimla Mob: 9418062620 Email: chhhotumesh@gmail.com	14-11-2011 (F.N.)	to be paid

12.	Mr. M. R. Negi Assistant Engineer, O/o E-in-C, HP.PWD, Nirman Bhawan, Nigam Vihar, Shimla, Distt.-Shimla (H.P.) Email: cr.mr.negi@gmail.com	14-11-2011 (F.N.)	to be paid
13.	Mr. R. Sudhakar Manager ICT Ltd., A-8, A-9, Green Park, New Delhi - 16. Email: r.sudhakar@ictonline.com	14-11-2011 (F.N.)	to be paid
14.	Mr. Ram Kumar Suryawanshi, SE (NF) Jt. Dir (Design) Chief Engineer (AF) Military Engineer Services No. 2 DC Area, MES Road, Yeswanthapur, Bangalore – 560022.	14-11-2011 (F.N.)	to be paid
15.	Mr. N. Srinivas SE (NF) CWE (AF) Secunderabad, New Bowenpally, Secunderabad – 500011 Phone – 040-27759911/22	14-11-2011 (F.N.)	to be paid
16.	Mr. Prakash Agrawal AGE B/R, GE(I) FD, INV, DIV, SEMT Wing, CME Pune – 31 Phone. – 020-27146842	14-11-2011 (F.N.)	Ch. -919666 dated 12-11-2011 SBI, Pune Rs.7000/-
17.	Mr. Phurpa Tsering AE, District Programme Implementation Unit, DPIU-II, Jang, Rural Works Division, Tawang, Arunachal Pradesh – 790104, Mob. – 09436630379 Email: tseringphurpa1111@yahoo.co.in	14-11-2011 (F.N.)	Rs.7000/- Cash Received Vide Recpt.13/1267 dated 15-11-2011
18.	Mr. Mukling Tayeng Executive Engineer Rural Works Division, Yingkiong, Upper-Siang, Dist.-Arunachal Pradesh, Phone. – 03777-222229 Mob. - 09436838407 Email: muklingtayeng@yahoo.in	14-11-2011 (F.N.)	DD – 650977 dated 11-11-2011 SBI, Itanager Rs.7000/-

19.	Mr. Hangtim Rekhung District Programme Implimentation Unit (DPIU), Basar RWD, West Siang, Arunachal Pradesh Mob. – 09436049098 Email: hangtimrekhung@yahoo.co.in	14-11-2011 (F.N.)	DD – 650967 dated 11-11-2011 SBI, Itanagar Rs.7000/-
20.	Mr. Tanga Kena Executive Engineer, RWD P.O & P.S. Khonsa Tirap Dist. Arunachal Pradesh. Mob. – 9436228089 Email: tangakenaeerwd@yahoo.co.in	14-11-2011 (F.N.)	DD – 650978 dated 11-11-2011 SBI, Itanagar Rs.7000/-
21.	Mr. Jimmy Vanlalsiama Sub-Divisional Officer, PWD Office of the Executive Engineer, PWD Aizawl Road North Division, Aizawl, Laipuitlang Phone. – 0389-2341079 Mob. – 9436147400	14-11-2011 (F.N.)	Rs.7000/- Cash Received Vide Recpt.13/1265 dated 15-11-2011
22.	Mr. Lalngaisanga Sub-Divisional Officer, PWD Aizawl Road South Sub-Division-III, Public Works Department, Treasury Square, Aizawl – 796001 Phone. – 0389-2323670, 09436143061 Email: clalngaisanga@yahoo.com	14-11-2011 (F.N.)	Rs.7000/- Cash Received Vide Recpt.13/1266 dated 15-11-2011
23.	Mr. Anurag Sharma Manager, Isolux Corsan (India) 12th Floor, Tower – C, Building No. 10, DLF Cyber City, DLF Phase-II, Gurgaon Phone – 0124-4823200 Email: anuragsharma18@refiffmail.com	14-11-2011 (F.N.)	DD – 016565 dated 20-09-2011 HDFC Bank, Gurgaon Rs.7000/-
24.	Mr. Mithilesh Kumar Customer Relation Manager, Ultra Tech Cement Ltd., 12th Floor, Ambadeep Building, K.G. Marg, New Delhi Mob. – 9990202159 Email: mithilesh.k@adityabirla.com	14-11-2011 (F.N.)	Rs.7000/- Cash Received Vide Recpt.13/1268 dated 15-11-2011

25.	Mr. P.S. Bassi Superintending Engineer, CPWD O/O CE, NZ III, CPWD Sector-10, Vidyadhre Nagar, Jaipur Email: psbassicpwd@rediffmail.com	14-11-2011 (F.N.)	DD – 461043 dated 4-102011 SBI, Jaipur Rs.7000/-
26.	Mr. M.S. Hashmi EE CME Dapodi, Pune	14-11-2011 (F.N.)	to be paid
27.	Col M.S. Deol Director (Design) Room No. 167A, Kashmir House, E-in-C's Branch, Rajaji Marg, New Delhi – 110011	14-11-2011 (F.N.)	to be paid
28.	Mr. B.R. Kapoor Executive Engineer Haryana State Roads and Bridges Development Corp, Panchkula Email: baldevkapur@gmail.com	14-11-2011 (F.N.)	to be paid
29.	Lt Col Nitin Kumar GE(I) (P) AF Tezpur Dist.-Sonit pur, Assam Email: nitin.kumar1975@gmail.com	14-11-2011 (F.N.)	to be paid
30.	Lt Col Subin Krishnan GE (I) (P) South Prothrapur, Port Blair – 744103 Phone. – 03192-286527 Email: subin68@rediffmail.com	14-11-2011 (F.N.)	to be paid
31.	Lt Col Sandeep Bist GE (AF), Puddukottai Road Thanjavur – 5, Tamil Nadu Phone. – 0436-2226936 Email: sandeep_53er76@yahoo.com	14-11-2011 (F.N.)	to be paid
32.	Mr. Brajendra Kumar Mathur Sub Divisional Officer PWD, Bridge Construction Sub Division Datia (M.P.) Mob. – 9424511963 Email: bkmathur--0007@yahoo.com	14-11-2011 (F.N.)	to be paid
33.	Mr. Kanti Prasad Gupta A.E. (Civil), AGE (MES) Varanasi T-L Old MES Colony, Varanasi Cantt., Varanasi Mob. – 09911956513	14-11-2011 (F.N.)	to be paid

34.	Mr. Rajeev Jain Manager, HSRDC, Sonepat O/o Deputy General Manager Haryana State Roads & Bridges Development Corporation Ltd. Phone. – 0130-2200346 Email: rajeevjain92@gmail.com	14-11-2011 (F.N.)	DD – 210054 dated 13-10-2011 ICICI Bank Ltd., Panchkula Rs.53000/-
35.	Mr. Bharat Bhushan Jindal Addl. S.D.E. O/o DGM-II, HSRDC, Near PWD Rest House, Gurgaon Phone. – 0124-2224519	14-11-2011 (F.N.)	- do -
36.	Mr. Omprakash Nehra AE(Civil), AGE B/R, GE(1) AF, 8 FBSU, Awantipora, Srinagar Phone.- 01933-286945	14-11-2011 (F.N.)	to be paid
37.	Mr. Krishna Mohan Meena Asst. Prof. Survey Block, Faculty of Civil Engg. College of Military Engg. Dapodi, CME PO, Pune – 411031 Email: kmohanmeena@gmail.com	14-11-2011 (F.N.)	to be paid

All the participants were relieved after completion of the training programme in the afternoon of November 18, 2011.

It is certified that no free boarding, lodging and transport facilities were provided to the participants by the Institute during the programme.

(T. K. AMLA) 18/11/2011
Head
Information, Liaison & Training