Advance Technologies for Highway Pavement on Going in Vietnam

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1. Advance Technologies for Highway Engineering ongoing

1.1. Repairing work of Thang Long Bridge pavement

1. History

➢ Project of Repairing of Thang Long Bridge pavement performed from October 2009 to December 2009. Technology transfer by Striling Lloyd polychem Ltd-UK& VIPEXIM, JSC (UK).

➢ Structural consist of (from up to down):

- SMA, NMAS=12,5, 4cm.
- SMA, NMAS=9,5, 3cm.
- Bound coat (adhesion) layer.
- Eleminator (waterproofing) layer.
- ZED S94 paint (protect the steel deck).

1. Advance Technologies for Highway Engineering ongoing

1.1. Repairing work of Thang Long Bridge pavement

1. Advance Technologies for Highway Engineering ongoing

1.1. Repairing work of Thang Long Bridge pavement

- **After 3 month, appear damaged**

1. Advance Technologies for Highway Engineering ongoing

1.1. Repairing work of Thang Long Bridge pavement

2. Damaged repairing work:

- Performed by Hall Brothers Ltd company (USA).
- Repairing method:
  - Remove 7 cm SMA by machine.
  - Paving 7 cm PAC. Novabond adhesive layer to be sprayed the same time when paving PAC.
- Progress:
  - Almost entire damaged have been repaired.
  - Continue to repair 12.000 m2 SMA pavement remaining (including SMA locations not yet damaged). Intended to complete before December 2013.

3. Assessment:

- Almost of the repaired position after 14 months are stable, not yet appear damaged again, better for vehicle traffic.

4. Direction of Ministry of Transport of Vietnam (MOT):

- Implement new projects, using Japanese technology to construction of new pavement on Thang Long Bridge.
- The project will be implemented when Nhat Tan Bridge Project finished.

1. Advance Technologies for Highway Engineering ongoing

1.2. Porous Asphalt (Japan)

1. Materials: Aggregate, Polymer Modified Asphalt (Asphalt with TAFPACK-SUPER TPS)

Gradation Range for Porous Asphalt		
Sive Size (mm)	Passing (%)	
	#20	#13
26.5	100	
19.0	95-100	100
13.2	64-84	90-100
4.75	10-31	11-35
2.36	10-20	10-20
0.075	3-7	3-7

High-Viscosity Asphalt (with TPS modifier)			
	Test Items	Results	Requirements
1	Penetration (25 de.C,1/10 mm)	46	Min. 40
2	Softening Point (de. C)	92.5	Min.80
3	Ductility (15 de. C, cm)	322	Min. 260
4	Loss on TFOT (%)	0.06	Max.06
5	Toughness (Nm)	23.8	Min.20
6	Tenacity (Nm)	16.1	Min. 15
7	Viscosity at 60 de.C (Pa.s)	250.000	Min.20.000

2. Mix Design Criteria

Target Values for Porous Asphalt Mixture		
	Items	Target Values
1	Marshall Stability (KN)	Min.5
2	Air Void (%)	About 20
3	Cantabro (%)	Max.20
4	Permeable (cm/s)	Min. 10^{-2}
5	Dynamic Stability	Min. 3000 pas/mm

1. Advance Technologies for Highway Engineering ongoing

1.2. Porous Asphalt (Japan)

3. Laboratoty Testing: Finished (Accepted by VN Ministry of Transport - MOT).

Test Items	Unit	Test Results				Requirement by Japan
		Aggregate in North area		Aggregate in South area		
		PA 13	PA 20	PA 13	PA 20	
Asphalt Content	%	5.0	4.8	4.4	4.2	
Unit Weight	g/cm^3	2.172	2.232	2.006	1.996	-
Air Void	%	20.74	19.52	19.83	20.81	~ 20
VMA	%	29.68	27.71	28.69	29.25	-
Permeability	cm/s	-	-	-	-	$\geq 1.0\times10^{-2}$
Interconnected porosity	%	15.39	14.48	14.99	16.36	-
Marshall Stability at 60^0C	KN	4.97	6.63	7.07	5.92	≥ 3.5
Marshall Flow at 60^0C	mm	2.49	2.60	2.61	3.20	2 - 4
Marshall Stability Loss	%	82.03	85.11	85.21	85.48	-
Cantabro Test	%	9.43	10.53	14.53	17.73	≤ 20
Dynamic Stability-DS	cycle/ mm	5727	6300	-	10500	≥ 3000

1. Advance Technologies for Highway Engineering ongoing

1.2. Porous Asphalt (Japan)

4. Paving and Testing on Site:

- Experiment section at CauGie-NinhBinh Expressway: ongoing
- Experiment section: Using PA 13
  - Thickness: 5cm on existing pavement
- Length: 300 m; With: 30 m.
- Ongoing survey the existing pavement, preparation materials…

5. Further work:

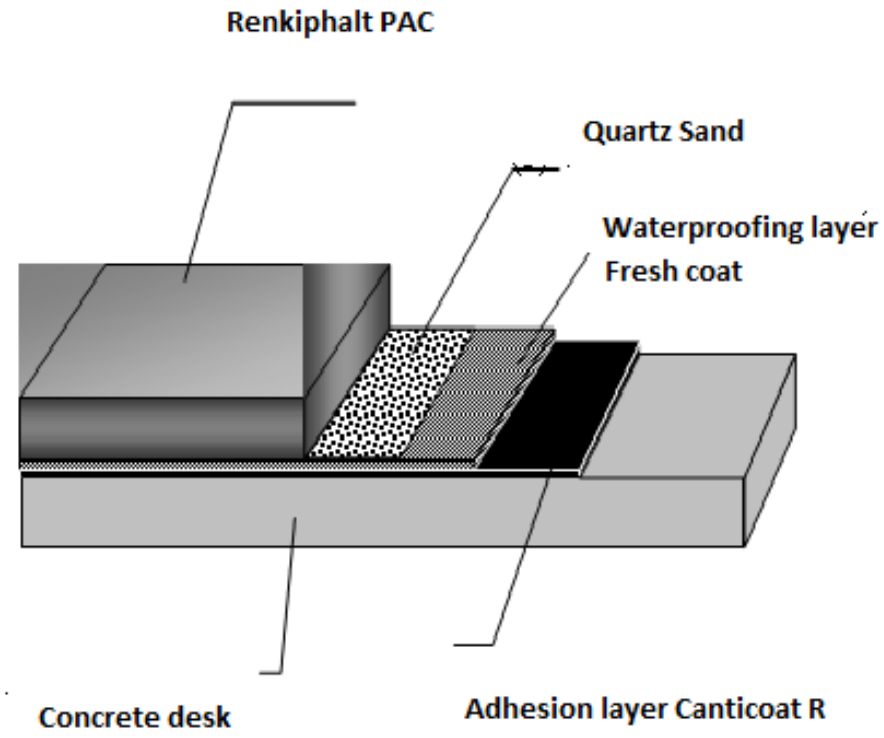
- Paving PA 13 (performed by Taiyu Kensetsu Co.Ltd -Japan and Vietnam joint venture).
- Testing and assessment by ITST (expected to in approximately 12 months).
- Make report for technology assessment (by ITST) submitted to the MOT.
- Science and Technology Council of MOT (STC) will appraises and assesses the Porous Asphalt Technology base on the reports of ITST.
- MOT decision to allow technology applications in Vietnam (if successful)

1. Advance Technologies for Highway Engineering ongoing

1.3. Modified Asphalt Concrete using Rekiphalt (Japan)

1. Purposes

- Repair Thanh Tri concrete bridge damaged pavement by permanent deformation



1. Advance Technologies for Highway Engineering ongoing

1.3. Modified Asphalt Concrete using Rekiphalt (Japan)

2. Materials

- Aggregate, Modified Asphalt

Aggregate	
Sive Size, mm	**Passing, %**
19	100
12,5	95-100
4,75	55-70
2,36	35-50
0,6	18-30
0,3	10-21
0,15	6-16
0,075	4-8
Asphalt Content	**5-7**

Modified Asphalt	
Test Items	**Requirement**
Penetration at 25^{O}C, 0.1mm	≥ 40
Softening Point, ^{o}C	≥ 70
Ductility ở 15^{O}C, cm	≥ 50
Flash Point, ^{O}C	≥ 280
TFOT, %	≤ 0.6
Toughness at 25^{O}C, Nm	≥ 16
Coating	≤ 5%

1. Advance Technologies for Highway Engineering ongoing

1.3. Modified Asphalt Concrete using Rekiphalt (Japan)

2. Materials

- Adhesion layer, Water proofing layer

Adhesion layer –Caticoat R	
Test Items	**Requirement**
Penetration at 25 deg.C, 0.1mm	≤ 60
Softening Point, deg. C	≥ 20
Ductility ở 15C, cm	Pass
Flash Point, deg. C	Pass

Water proofing layer Fresh coat	
Test Items	**Requirement**
1. Penetration at 25 deg.C, 0.1mm	1-5
2. Softening Point, deg. C	≥ 80
3. Tensile strength, 23 deg C, N/mm2	≥ 0.35
4. Percent deformation, %	≥ 300
5. Alkali resistance, 23℃ (a)	Normal
6. Salt resistance, 23℃ (b)	Normal
7. Print resistance, 60℃	Normal

1. Advance Technologies for Highway Engineering ongoing

1.3. Modified Asphalt Concrete using Rekiphalt (Japan)

3. Mix Design Criteria

No.	Test Items	Requirement
1	Blow Number	75 x 2
2	Marshall Stability at 60^0C, kN	min. 10
3	Flow, mm	2 - 4
4	Air Void, %	3 - 6
5	VFA, %	70 - 85
6	Dinamic Stability (1.12 MPa, 60^OC) (Wheel Tracking Test),	min. 3000
7	Imersion Wheel Tracking Test, peeling area, %	max. 5

1. Advance Technologies for Highway Engineering ongoing

1.3. Modified Asphalt Concrete using Rekiphalt (Japan)

4. Laboratoty Testing: Finished (Accepted by MOT).

5. Paving on site: Finished

- Experiment section at ThanhTri Bridge
- Consist of 3 adjacent sections :
  - (1) Renkiphalt: 200m x 4m, (2) PAC (by VN Standard, PMB 3): 100m x 4m, (3) AC (bitumen 60/70 pen.): 50m x 4m
  - Thickness: 7 cm (Two layer, 3cm and 4cm)

1. Advance Technologies for Highway Engineering ongoing

1.3. Modified Asphalt Concrete using Rekiphalt (Japan)

6. Testing and assessment on site: ongoing (by ITST)

- After 3 days of construction finished: Pavement of 3 sections is good
- After 1 month of construction finished: Pavement of 3 sections is good
- After 3 months of construction finished: Pavement of 3 sections is good
- After 6 months of construction finished: 3 sections permanent deformation appear

1.3. Modified Asphalt Concrete using Rekiphalt (Japan)

7. Solutions:

- Doro Kogyo Co.Ltd – Japan have been determinning the reasions

2. Necessary Advance Technologies for Highway Engineering in Vietnam

1. Solutions, advance technologies for limited the permanent deformation.
2. Advance technologies for pavement maintenance: (Micro Surfacing, Fog Seals, Cape Seals…).
3. Semi-Flexible pavement technology.
4. Polyme modified asphalt emulsion technology.
5. Adhesion-water proofing material for concrete desk.

Some words from ITST:

- **We hope Japanese companies bring new technologies early on Vietnam.**
- **The scientific collaboration between NILIM, Nippon Road Co. Ltd with ITST creates many opportunities for improving our knowledge of science and technology, of Japan's culture.**
- **Thanks for these feelings of You and of Japanese people for us.**

ISO 9001 : 2008

Thanks for the attention!