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A Trial with Simplified Semi-Rigid Pavements in Developing Countries

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1. Introduction

❑ Typical Pavement Design For Road Construction :

- **Flexible pavement**
  - asphalt concrete pavement
- **Rigid pavement**
  - cement concrete pavement
- **Semi-rigid pavement**
  - porous asphalt concrete filled with cement mortar

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1. Introduction

❑ Comparison of Three Types of Road Pavements:

Compared properties (selected properties)	Flexible Pavement	Rigid Pavement	Semi-Rigid Pavement (SRP)
1. Resistance to rutting/deformation	Poor	Good	Good
2. Skid resistance properties	Good	Poor	Good
3. Resistance to petroleum products, oil and chemical	Poor	Good	Good
4. Resistance to moisture damage	Poor	Good	Good
5. Maintenance and repair	Easy	Difficult	Easy
6. Life span	Short	Long	Long
7. Flexural strength properties	Low	High	High
8. Expansion joint	Not required	Required	Not required
9. Installation and open to traffic	Within hours	0.5-3.0 months	Within 24 hours
10. Construction and maintenance costs	Lower const. cost; High maint. cost	Higher const. cost; Low maint. cost	Low const. cost; Low maint. cost

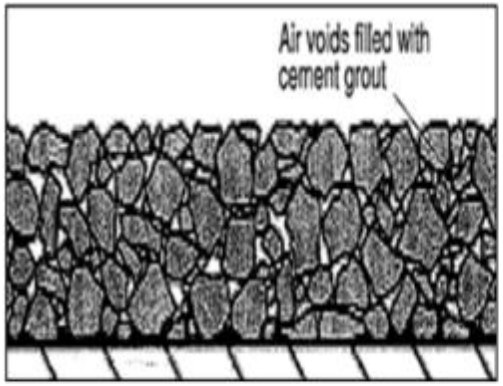
❑ Semi rigid pavement has been widely used in developed countries

1. Introduction

❑ Composition of semi rigid pavement:

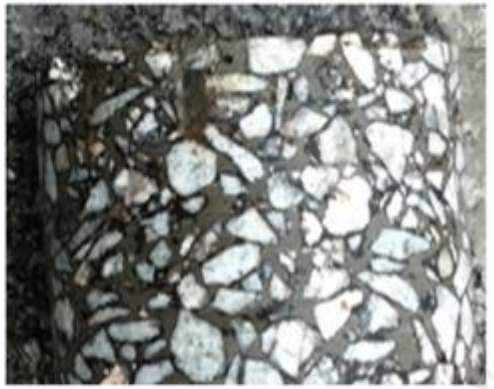
Porous Asphalt Concrete (PAC)(void content: 25-30% by volume) +

high strength high fluidity polymer modified cement mortar



(a) Porous Asphalt Concrete (PAC)

(b) Polymer Modified Cement Mortar



(c) Semi-Rigid Pavement (Cored Sample)

2. Component of Semi-Rigid Pavement

❑ 2.1 Component of Semi-Rigid Pavement

Porous Asphalt Concrete (PAC) (void content: 25-30% by volume) & high strength high fluidity polymer modified cement mortar

❑ 2.2 Component of Porous Asphalt Concrete (PAC)

Components	Percentage by weight
Aggregates	92.9%
Filler	3.0%
Polymer modified bitumen (PG76)	3.6~4.6%

2. Component of Semi-Rigid Pavement

❑ 2.3 Aggregate Gradation

Sieve Size in mm	0.075% Passing	
	Min	Max
19.0	100	100
13.2	85	100
9.5	27	53
6.3	1	15
2.36	1	10
0.600	0	8
0.300	0	5
0.075	0	3

2. Component of Semi-Rigid Pavement

❑ 2.4 Aggregate properties

Property	Requirement	Method of Testing
Impact Value	≤25%	B.S.812 Part 112:1985
Crushing Value	≤25%	B.S.812 Part 110:1985
Water Absorption	≤1%	B.S.812 Part 2:1975
Flakiness index	≤25%	B.S.812 Part 105:1:1985
Elongation Index	≤30%	B.S.812 Part 105:2:1985
L.A. Abrasion Value (500rev)	≤20%	S.S 73:1974
Silt Content of Aggregate in Hot bin (by weight)	≤0.3%	B.S.812 Part 1:1975

3. Simplified Semi-Rigid Pavement

❑ 3.1 Porous Asphalt Concrete With Low Bitumen Content Filled With Chemilink SS-141

Loose PAC before compaction

- ❑ Aggregate size range: 4~20mm
- ❑ Bitumen content: 3.0%
- ❑ Bitumen: no polymer modified

3. Simplified Semi-Rigid Pavement

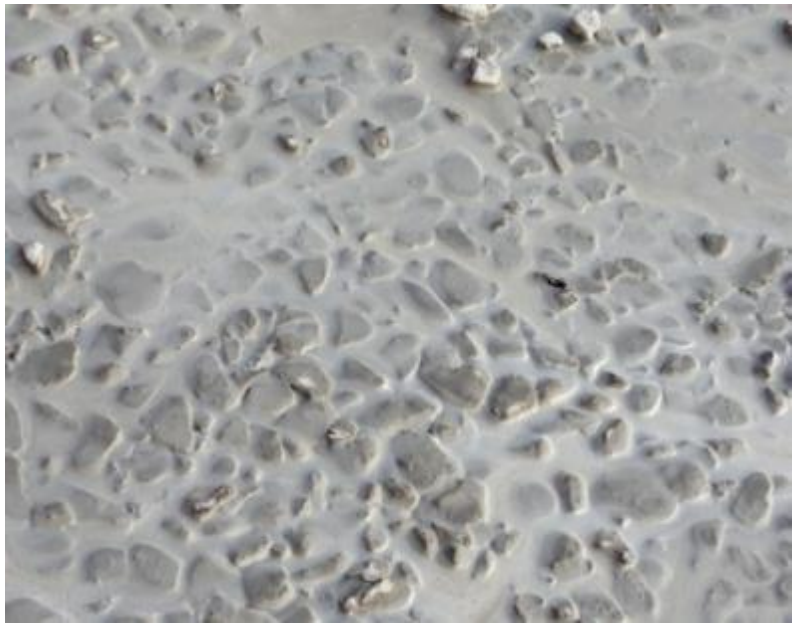
❑ 3.1 Porous Asphalt Concrete With Low Bitumen Content Filled With Chemilink SS-141

Compacted PAC

Porosity is around 28.6%

3. Simplified Semi-Rigid Pavement

❑ 3.1 Porous Asphalt Concrete With Lower Bitumen Content Filled With Chemilink SS-141



wet surface

hardened surface

Note: Surface texture looks very good and thus skid resistance will be sufficient.

3. Simplified Semi-Rigid Pavement

❑ 3.1 Porous Asphalt Concrete With Lower Bitumen Content Filled With Chemilink SS-141

Cored samples

Note: It shows that voids in porous asphalt concrete are fully filled by SS-141

3. Simplified Semi-Rigid Pavement

❑ 3.1 Porous Asphalt Concrete With Lower Bitumen Content Filled With Chemilink SS-141

Compressive Strength Testing

Compressive Strength: 6.50~10.50MPa

Average: 9.00MPa

3. Simplified Semi-Rigid Pavement

❑ 3.2 Porous Asphalt Concrete With Higher Bitumen Content Filled With Chemilink SS-141

Loose PAC before compaction

- ❑ Aggregate size range: 4~20mm
- ❑ Bitumen content: 4.5%
- ❑ Bitumen: no polymer modified

3. Simplified Semi-Rigid Pavement

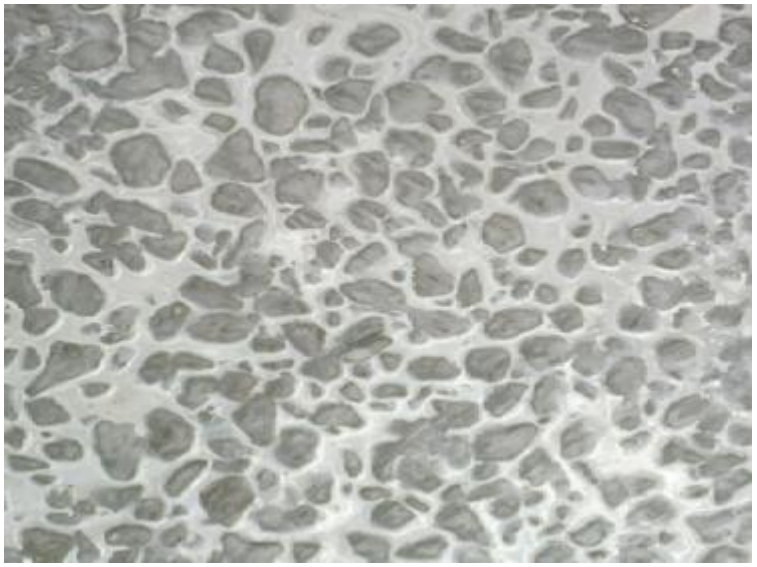
❑ 3.2 Porous Asphalt Concrete With Higher Bitumen Content Filled With Chemilink SS-141

Compacted PAC

- Porosity is around 29.0%

3. Simplified Semi-Rigid Pavement

❑ 3.2 Porous Asphalt Concrete With Higher Bitumen Content Filled With Chemilink SS-141



hardened surface

cored sample

Note: Surface texture looks quite good and voids in porous asphalt concrete are fully filled by SS-141

3. Simplified Semi-Rigid Pavement

❑ 3.3 PAC Formed By Selected Coarse Particles From Normal Asphalt Concrete Filled With Chemilink SS-141

Normal Asphalt Concrete

Selecting Corse Particles From Normal Asphalt Concrete to form PAC

3. Simplified Semi-Rigid Pavement

❑ 3.3 PAC Formed By Selected Coarse Particles From Normal Asphalt Concrete Filled With Chemilink SS-141

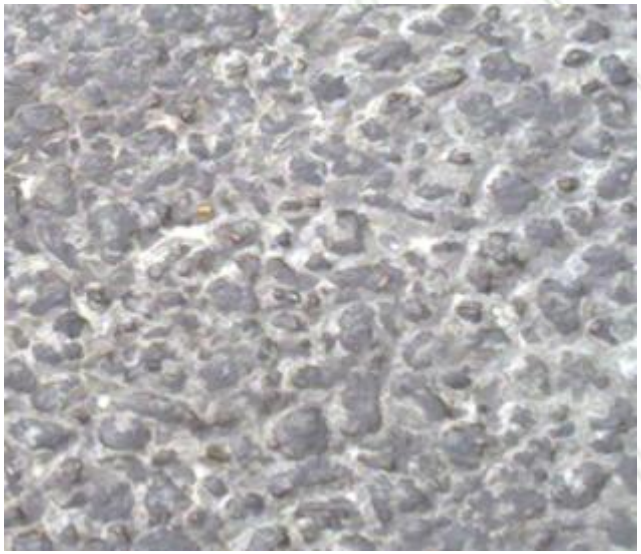
Heating

Compacted

3. Simplified Semi-Rigid Pavement

❑ 3.3 PAC Formed By Selected Coarse Particles From Normal Asphalt Concrete Filled With Chemilink SS-141

Surface Just Filled With Chemilink SS-141



Hardened Surface

Note: Surface texture looks quite good and thus skid resistance should be high enough.

3. Simplified Semi-Rigid Pavement

❑ 3.3 PAC Formed By Selected Coarse Particles From Normal Asphalt Concrete Filled With Chemilink SS-141

Cored Sample

Note: the voids in porous asphalt concrete are fully filled by SS-141

3. Simplified Semi-Rigid Pavement

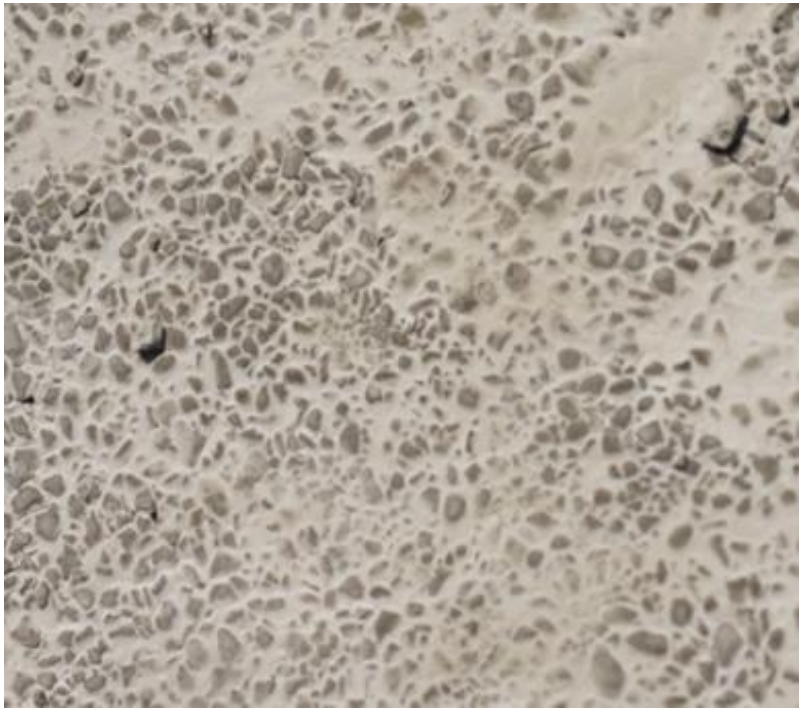
❑ 3.4 Pure Aggregate Filled With Chemilink SS-141

Loose aggregate

Compacted aggregate

3. Simplified Semi-Rigid Pavement

❑ 3.4 Pure Aggregate Filled With Chemilink SS-141



Hardened Surface

Cored Sample

Note: Surface texture looks good and voids in aggregate are fully filled by SS-141

4. Conclusions

- Semi rigid pavement has advantages of rigid pavement and flexible pavement, so it starts to attract attentions of developing countries.

- Due to limitations of Porous Asphalt Concrete (PAC) technology in developing countries and their lower requirements, various simplified semi rigid pavements are required to be developed to meet their local special requirements.

- Further trials and studies are needed, including flexural strength analysis, to comprehensively compare the differences between the simplified and standard semi rigid pavements, in order to find out the right ways for applying the local simplified semi rigid pavement in different developing countries.







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Thank You for Your Attention!