Local pavement materials in Western Downs using Glassy Basalt source rock

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About us
Types of pavement materials available in Western Downs

1. Glassy Basalt source rock – Type 2, Type 3 and sealing aggregate
2. White Rock – Type 3 and Type 4
3. Ridge Gravel – Type 3 and Type 4
4. Black Soil – lime stabilised subgrade
5. Other.
**Quarry Registration Certificate**

<table>
<thead>
<tr>
<th>Rock/Material Types</th>
<th>Glassy Olivine Basalt</th>
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</thead>
<tbody>
<tr>
<td>Rock Material Group</td>
<td>Basic Igneous</td>
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<td>Nominated Products:</td>
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<tr>
<td>Unbound Paving Material (Types 1, 2 &amp; 3)</td>
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<tr>
<td>Cover Aggregate (Types A, B, C &amp; D)</td>
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<tr>
<td>Concrete Aggregate (Coarse and Fine)</td>
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<tr>
<td>Asphalt Aggregate (Coarse and Fine)</td>
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</table>

The petrographic and XRD test reports submitted indicate the source rock has:
- 17.3% amorphous matrix of disordered kaolinite and smectite, 13% black and brown mesostasis glass and opaque oxide microlites, 7% smectite clay; 5% iddingsite, 4% late reddish glass, 4% olivine, 2% calcite.
- potential for deleterious alkali-silica reactivity in concrete (refer to 11.1 of MRTS70).

2). The source rock does not comply with the default minimum PAFV requirement for Asphalt Surfacings (Refer to Table 7.1 of MRTS101 for details).
3). The test reports submitted indicate high water absorption values that exceed the TMR specification limit. (Refer to Note 4 of Table 7.1.3 of MRTS22, for aggregates with water absorption greater than the specified limit).
Glassy Basalt source rock – Type 2 and Type 3
Glassy Basalt source rock

Material testing

• Grading – Main Roads Technical Specification 05 (MRTS05) Clauses 7.2.4 (Type 2) and 7.3.4 (Type 3)
• Linear shrinkage
• Liquid limit
• Degradation factor
• Optimum Moisture Content (OMC) %
• California Bearing Ratio (CBR).
Glassy Basalt source rock

Moisture sensitivity

- CBR affected by small changes in moisture content
- Pavement material tends to act like a sponge – drawing moisture in
- Fines proportion tends to be at the lower bound of the grading envelope – may create extra pathways for moisture migration
- Less moisture susceptibility when blended with insitu material (generally ridge gravel)
- Capillary rise testing
- Repeat Load Triaxial (RLT) testing – Degree Of Saturation (DOS) limit changes.
Permanent Strain
Subbase Type 2.3

Permanent strain (%) vs Cycles

- 61% DoS 100.3%
  RDD (BS16-167(60))
- 65% DoS 100.4%
  RDD (BS16-167(65))
- 68% DoS 100.3%
  RDD (BS16-167(70))

Tentative Strain Limit for 1000 cycles
Tentative Strain Limit for 50000 cycles

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RLT testing

Permanent Strain
Base Type 2.1

Permanent strain (%)

Cycles

65% DoS 100% RDD (BS16-166(65))

69% DoS 100.4% RDD (BS16-166(70))

76% DoS 100% RDD (BS16-166(75))

78% DoS 100.4% RDD (BS16-166(80))

Tentative Strain Limit for 1000 cycles

Tentative Strain Limit for 50000 cycles
Moisture issues

- Warrego Highway Upgrade (Brigalow to Chinchilla)
- Moisture ingress cause not agreed
- Failures occurred under traffic
- How do we fix the problem?
Glassy Basalt source rock

Additives

- General Purpose (GP) cement
- Lime/flyash blend (60/40)
- Unconfined Compressive Strength (UCS) testing.
28 day UCS results for different material blends with GP Cement additive

- Type 3.3 Only
- Type 3.3/Insitu blend 50/50
- Type 3.3/Insitu Blend 80/20

UCS (Mpa)
UCS results

28 day UCS results for different material blends with 60/40 Lime/Flyash additive

- Type 3.3 Only
- Type 3.3/Insitu blend 50/50
- Type 3.3/Insitu Blend 80/20

UCS (Mpa)

- 5% Additive
- 3.5% Additive
- 2% Additive
Capillary Rise results

Capillary Rise results for different material blends with 60/40 Lime/Flyash additive

- Type 3.3 Only
- Type 3.3/Insitu blend 50/50
- Type 3.3/Insitu Blend 80/20

Time (hours)

5% Additive  3.5% Additive  2% Additive

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Glassy Basalt source rock

Use in Foam Bitumen Pavements –
Warrego Highway Upgrade (Brigalow to Chinchilla)

• GP cement
• Lime/flyash blend (60/40)
• MRTS08 re-written (December 2015)
• Stockpile management
• Technical Note (TN) 150 issued (July 2017)
TN 150 Testing of Materials for Foamed Bitumen Stabilisation

General properties

- Initial modulus 500-700 MPa
- Three day cured modulus 2500-4000 MPa
- Three day soaked modulus 1500-2000 MPa
- Retained modulus >0.5 (soaked/cured) – moisture resilience of material

Refers to Pavement Rehabilitation Manual

- Insitu vs Plant mixed
- Laboratory mix trial vs Production plant mix trial
- Three day, seven day and 14 day soaked modulus minimum requirements
TN 150 Testing of Materials for Foamed Bitumen Stabilisation

Mix Design requirements
- Lime
- Additive
- Bitumen
- Water
- Testing and analysis

Field Testing
- Mixing Uniformity (Segregation)
- Relative Moisture Ratio (feed/production stockpiles)
- Relative Compaction
- Resilient Modulus
- Working Time.
Glassy Basalt Source Rock

Unbound pavements

• Should not be used on its own without some additive

• Consider using Lime/Flyash additive instead of GP cement to reduce moisture sensitivity

• Blending with existing/insitu pavement material (ridge gravel) will generally reduce moisture sensitivity

• Needs to be placed fairly wet and sufficient dry back time allowed for, prior to trafficking/sealing.
Other materials

- White rock
- Ridge gravels
- Black soil
- Other
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