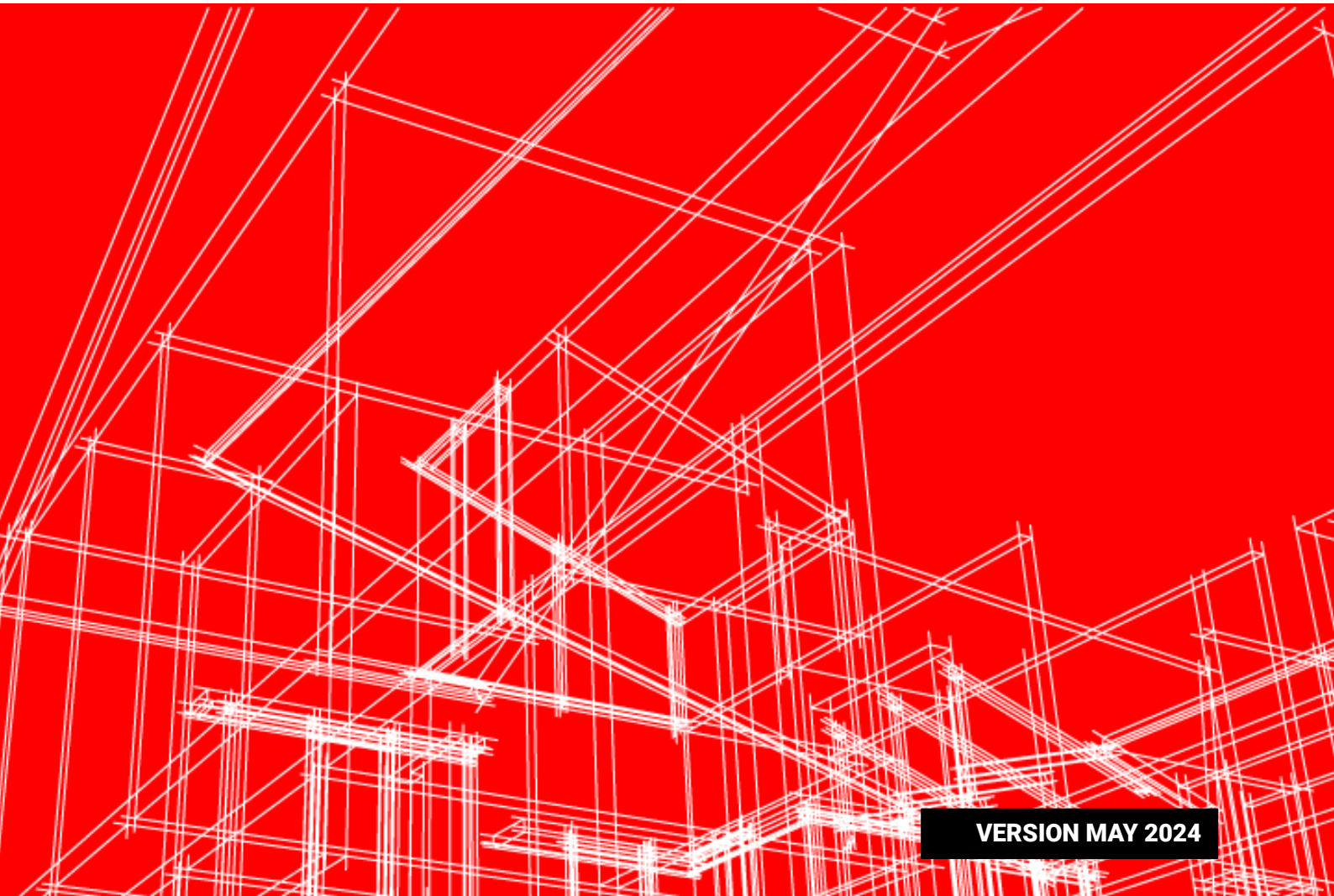




Introducing AXION innovative products for road and building construction



VERSION MAY 2024

ABOUT US



Axion Nigeria, a subsidiary of Axion Canada is the leader in the development, distribution and application of organic liquid monomer formulations for the global road and building construction industries.

Axion Technologies' products, initially developed by the U.S. military for swiftly deploying airstrips during the Gulf War, have transitioned to commercial use, maintaining their military-grade standards.

25 YEARS

We have been in operation for 25 years, and over 20 years in Africa.

75 COUNTRIES

We have presence in over 75 countries in the world.

99%

of our products have been tested and certified for quality

OUR VISION AND MISSION

Our vision is to be a leading, cutting-edge and innovative engineering company, supplying the building/civil engineering industry (governments, real estate developers, oil & gas sector) with efficient and cost-effective construction materials for buildings and roads.

Our mission is to continuously provide our customers with high quality, cost-effective, efficient and environmental-friendly products to solve problems facing the global building and construction industry.

WHAT WE DO

We provide environmentally friendly construction technologies.

- Road base stabilizer and polymer modified bitumen.
- 100% waterproof concrete technology.
- Engineered precast and specialized concrete products.
- Our products are made of high-quality innovative road and building construction materials, which ensure durable and cost-effective construction.

OUR PRODUCTS

- AXION SOLID BASE STABILIZER (SBS)
- AXION BITUMEN BOOSTER (PMB)
- AXION TUFFCRETE ORGANIC POLYMER
- AXION TUFFCRETE CEMENT
- AXION TOTAL-CRETE CEMENT
- HYDROSHIELD POLYMERIZED SCREEDING BOND
- AXTRA QUICK FIX ASPHALTIC CONCRETE LIQUID BINDER (COLD ASPHALT)



AXION SOLID BASE STABILIZER (SBS)



This is a powerful molecular binding agent used in soil stabilization and earth-work installation. It does not require coarse aggregate as it merely strengthens and improves the natural soil enabling it to achieve load bearing capacities that meet and exceeds international compaction requirements. The Axion solid base stabilizer results in approximately 60% cost savings in construction and maintenance costs.

PRODUCT FEATURES/ ADVANTAGES

- Strengthens and improves the natural soil enabling it to achieve higher load bearing capacity.
- Eliminates the cost of removing and replacing the topsoil.
- Eliminates the use of expensive aggregate, plus the cost of compacting it.
- Simply stabilizes the natural soil to achieve CBR levels of up to 200%.

AXION BITUMEN BOOSTER REFINER (PMB)

Bitumen is the preferred glue that holds aggregate together in road construction, the higher the quality of the glue, the greater adhesiveness. Axion bitumen booster (PMB) increases the bitumen by 30% and the asphalt by 20% while stabilizing and improving the elasticity from 6% to 79% over a wide range of temperature that allows the asphalt to withstand temperatures ranging between -22°C to +82°C. The benefit of this is that the thickness of asphalt can be reduced from the standard 6cm to 3cm, producing the same strength and yielding cost savings in the construction.



PRODUCT FEATURES/ADVANTAGES

- Eliminates hairline cracks.
- Increases bitumen volume by over 30%.
- 350% increase in the asphalt layers' life expectancy.
- Solution to rutting problem as it reduces it by up to 84.8%.
- Water resistant.
- Reduces execution time.
- 100°C effective range.

AXION TUFFCRETE & LIQUID POLYMER COMBO



This is a chemical resistant formulation that offers high tensile strength, with great adhesion to essential construction materials (steel, traditional concrete etc.) yielding roads with a load-bearing capacity of 4,000 tons per square meter. Axion Tuffcrete Combo provides cost saving of about 30% compared to conventional concrete and is 100% waterproof, fireproof, anti-fungal, damp-proof and prevents capillary actions. It can also be used for the construction of concrete roads, swimming pools, flooring, water treatment tanks, sewage tanks, oil and gas pipeline and gas stations. Overall Tuffcrete has proven to be efficient and cost effective.

PRODUCT FEATURES/ADVANTAGES

- Waterproof & fireproof.
- Longer life expectancy.
- Neutralizes salinity in sea water (salt resistant).
- More load bearing capacity.
- Save on steel reinforcement costs.
- Asphalt layers can be added to it.
- Not affected by oil and fuel spillage.
- Repair old, damaged concrete.
- Flexibility.

AXTRA QUICK FIX ASPHALTIC CONCRETE LIQUID BINDER (COLD ASPHALT)

Axion introduces Axtra Quick Fix Asphaltic Concrete Liquid Binder (Cold Asphalt), a revolutionary technology designed for the construction of long-lasting and stable roads.

This innovative product is used as a super binder in making cold asphalt for patching of potholes. It can also be used in stabilization of all types of soil.



PRODUCT FEATURES/ADVANTAGES

- It does not require construction professionals or expensive contractors to implement.
- Creates job opportunities for youths just after a day's training.
- It does not require any special material or design to make an asphaltic concrete road.
- Must not use expensive construction equipment (asphalt plant) for mixing.
- Hot asphalts are quite hazardous and requires lots of workers and machineries to implement.
- It is cost effective.

TUFFCRETE/TOTAL-CRETE CEMENT & HYDROSHIELD POLYMERIZED SCREEDING BOND

INTERIOR SCREEDING



EXTERIOR SCREEDING



This product combination is a chemical formulation specially designed for tiling and screeding. It is 100% waterproof and does not require the addition of any other product (tile gum, cement or top bond) for its application.

Axion Total-Crete cement & Hydroshield Polymerized Screeding Bond combo can also be used for all-in-one screed plastering, water proofing, antifungal, crack proof, fireproof, foundation protection (DPC), swimming pools, outside decks, tile gum, grouting, damp treatments, etc.

PRODUCT FEATURES/ ADVANTAGES

- 100% waterproof, damp-proof & anti-fungi.
- Longer life expectancy.
- Does not require any other products for its application (tile gum, cement, or top bond).
- Covers an area of over 30 square meters per bag.
- Saves cost.

Request no : DS1C1378
Client : Axion Africa
Dei-Dei International Building
Material, Market Abuja.
Opposite Panteka
Attention : **Axion Africa**

Date reported : 10-05-2024

Project : DANGOTE FERTILIZER TO ELEKO JUNCTION

Compressive Strength of Concrete Cubes [TMH1 - D1, D3, ASTM C293]

| | | | |
|----------------------------|------------|---------------------------|------------------------|
| Date Received : | 05-04-2024 | Structure / Element : | CRCP |
| Date in Water : | 06-04-2024 | Location : | CH 15+831 - 16+029 LHS |
| Cubes Made By : | | Concrete Supplier : | ITB BATCH PLANT |
| Cubes Tested By : | | Delivery Note No : | WB 7444 |
| Specified Strength (MPa) : | C35 | Truck Reg. Number : | TTV 32 |
| Specified Slump : | 60 mm | Environmental Condition : | SUNNY AND HOT |
| Measured Slump : | 65 mm | Curing Tank Temp : | 26 °C |
| Engineer's Specification : | | Press Serial No : | |
| Balance Number : | | Correction Factor : | 1.000 |

3 Day Compressive Strength

| Lab Number | Cube Mark | Date Cast | Date Tested | Age Days | Break Pattern | Flatness | Mass | Apparent Density | Dimension | | Load | Compressive Strength |
|--------------------|-----------|------------|-------------|----------|---------------|----------|------|------------------|-----------|--------|--------|----------------------|
| | | | | | | | | | Length | Width | | |
| A | 1 | 05-04-2024 | 08-04-2024 | 3 | A | | 8144 | 2413 | 150.00 | 150.00 | 535 | 23.8 |
| B | 2 | 05-04-2024 | 08-04-2024 | 3 | A | | 8185 | 2425 | 150.00 | 150.00 | 607 | 27.0 |
| Average | | | | | | | | | 150.00 | 150.00 | 571 kN | 25.0 MPa |
| Standard Deviation | | | | | | | | | 0.0 | 0.0 | 50.8 | 2.3 |

7 Day Compressive Strength

| Lab Number | Cube Mark | Date Cast | Date Tested | Age Days | Break Pattern | Flatness | Mass | Apparent Density | Dimension | | Load | Compressive Strength |
|--------------------|-----------|------------|-------------|----------|---------------|----------|------|------------------|-----------|--------|--------|----------------------|
| | | | | | | | | | Length | Width | | |
| C | 3 | 05-04-2024 | 12-04-2024 | 7 | A | | 8172 | 2421 | 150.00 | 150.00 | 724 | 32.2 |
| D | 4 | 05-04-2024 | 12-04-2024 | 7 | A | | 8159 | 2417 | 150.00 | 150.00 | 699 | 31.1 |
| E | 5 | 05-04-2024 | 12-04-2024 | 7 | A | | 8193 | 2428 | 150.00 | 150.00 | 686 | 30.5 |
| Average | | | | | | | | | 150.00 | 150.00 | 703 kN | 31.0 MPa |
| Standard Deviation | | | | | | | | | 0.0 | 0.0 | 19.2 | 0.9 |

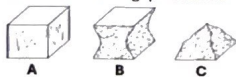
14 Day Compressive Strength

| Lab Number | Cube Mark | Date Cast | Date Tested | Age Days | Break Pattern | Flatness | Mass | Apparent Density | Dimension | | Load | Compressive Strength |
|--------------------|-----------|------------|-------------|----------|---------------|----------|------|------------------|-----------|--------|--------|----------------------|
| | | | | | | | | | Length | Width | | |
| F | 6 | 05-04-2024 | 19-04-2024 | 14 | A | | 8124 | 2407 | 150.00 | 150.00 | 788 | 35.0 |
| G | 7 | 05-04-2024 | 19-04-2024 | 14 | A | | 8173 | 2422 | 150.00 | 150.00 | 814 | 36.2 |
| H | 8 | 05-04-2024 | 19-04-2024 | 14 | A | | 8152 | 2415 | 150.00 | 150.00 | 813 | 36.1 |
| Average | | | | | | | | | 150.00 | 150.00 | 805 kN | 36.0 MPa |
| Standard Deviation | | | | | | | | | 0.0 | 0.0 | 14.6 | 0.6 |

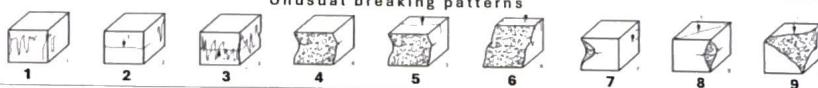
28 Day Compressive Strength

| Lab Number | Cube Mark | Date Cast | Date Tested | Age Days | Break Pattern | Flatness | Mass | Apparent Density | Dimension | | Load | Compressive Strength |
|--------------------|-----------|------------|-------------|----------|---------------|----------|------|------------------|-----------|--------|--------|----------------------|
| | | | | | | | | | Length | Width | | |
| I | 9 | 05-04-2024 | 03-05-2024 | 28 | A | | 8199 | 2429 | 150.00 | 150.00 | 882 | 39.2 |
| J | 10 | 05-04-2024 | 03-05-2024 | 28 | A | | 8178 | 2423 | 150.00 | 150.00 | 906 | 40.3 |
| K | 11 | 05-04-2024 | 03-05-2024 | 28 | A | | 8184 | 2425 | 150.00 | 150.00 | 871 | 38.7 |
| L | 12 | 05-04-2024 | 03-05-2024 | 28 | A | | 8190 | 2427 | 150.00 | 150.00 | 892 | 39.7 |
| Average | | | | | | | | | 150.00 | 150.00 | 888 kN | 39.0 MPa |
| Standard Deviation | | | | | | | | | 0.0 | 0.0 | 15.0 | 0.7 |

Standard breaking patterns



Unusual breaking patterns



Deviation from test method :

Remarks and notes : NORMAL CRCP MIX DONE FOR THE SITE ON 05-04-2024

The samples were subjected to analysis according to (COLTO) (TMH1) (BS) (ASTM) (TMH5)

The test results reported relate to the sample tested.

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Report compiled by : Christiaan Jordaan

Signature

Christiaan Jordaan
Ground / Field Manager



Request no : AXION A4
Client : Axion Africa
Dei-Dei International Building
Material, Market Abuja.
Opposite Panteka

Date reported : 10-05-2024

Project : DANGOTE FERTILIZER TO ELEKO JUNCTION

Attention : **Axion Africa**

Compressive Strength of Concrete Cubes [TMH1 - D1, D3, ASTM C293]

| | | | |
|----------------------------|------------|---------------------------|-------------------------------|
| Date Received : | 05-04-2024 | Structure / Element : | CRCP |
| Date in Water : | 06-04-2024 | Location : | REFINERY SECTION 1 LABORATORY |
| Cubes Made By : | | Concrete Supplier : | ITB BATCH PLANT |
| Cubes Tested By : | | Delivery Note No : | |
| Specified Strength (MPa) : | C35 | Truck Reg. Number : | |
| Specified Slump : | 60 mm | Environmental Condition : | SUNNY AND HOT |
| Measured Slump : | 15 mm | Curing Tank Temp : | 26 °C |
| Engineer's Specification : | | Press Serial No : | |
| Balance Number : | | Correction Factor : | 1.000 |

7 Day Compressive Strength

| Lab Number | Cube Mark | Date Cast | Date Tested | Age Days | Break Pattern | Flatness | Mass | Apparent Density | Dimension | | Load | Compressive Strength |
|---------------------------|-----------|------------|-------------|----------|---------------|----------|------|------------------|---------------|---------------|---------------|----------------------|
| | | | | | | | | | Length | Width | | |
| C025 | 1 | 05-04-2024 | 12-04-2024 | 7 | A | | 8148 | 2414 | 150.00 | 150.00 | 679 | 30.2 |
| C026 | 2 | 05-04-2024 | 12-04-2024 | 7 | A | | 8264 | 2449 | 150.00 | 150.00 | 610 | 27.1 |
| C027 | 3 | 05-04-2024 | 12-04-2024 | 7 | A | | 8275 | 2452 | 150.00 | 150.00 | 629 | 28.0 |
| Average | | | | | | | | | 150.00 | 150.00 | 640 kN | 28.0 MPa |
| Standard Deviation | | | | | | | | | 0.0 | 0.0 | 35.4 | 1.6 |

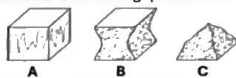
14 Day Compressive Strength

| Lab Number | Cube Mark | Date Cast | Date Tested | Age Days | Break Pattern | Flatness | Mass | Apparent Density | Dimension | | Load | Compressive Strength |
|---------------------------|-----------|------------|-------------|----------|---------------|----------|------|------------------|---------------|---------------|---------------|----------------------|
| | | | | | | | | | Length | Width | | |
| C028 | 4 | 05-04-2024 | 19-04-2024 | 14 | A | | 8233 | 2439 | 150.00 | 150.00 | 791 | 35.1 |
| C029 | 5 | 05-04-2024 | 19-04-2024 | 14 | A | | 8199 | 2429 | 150.00 | 150.00 | 731 | 32.5 |
| C030 | 6 | 05-04-2024 | 19-04-2024 | 14 | A | | 8257 | 2447 | 150.00 | 150.00 | 771 | 34.3 |
| Average | | | | | | | | | 150.00 | 150.00 | 764 kN | 34.0 MPa |
| Standard Deviation | | | | | | | | | 0.0 | 0.0 | 30.6 | 1.4 |

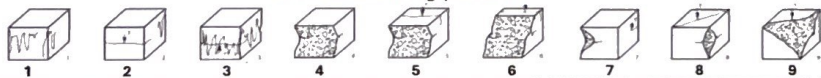
28 Day Compressive Strength

| Lab Number | Cube Mark | Date Cast | Date Tested | Age Days | Break Pattern | Flatness | Mass | Apparent Density | Dimension | | Load | Compressive Strength |
|---------------------------|-----------|------------|-------------|----------|---------------|----------|------|------------------|---------------|---------------|---------------|----------------------|
| | | | | | | | | | Length | Width | | |
| C032 | 7 | 05-04-2024 | 03-05-2024 | 28 | A | | 8229 | 2438 | 150.00 | 150.00 | 778 | 34.6 |
| C033 | 8 | 05-04-2024 | 03-05-2024 | 28 | A | | 8261 | 2448 | 150.00 | 150.00 | 796 | 35.4 |
| C034 | 9 | 05-04-2024 | 03-05-2024 | 28 | A | | 8192 | 2427 | 150.00 | 150.00 | 790 | 35.1 |
| C035 | 10 | 05-04-2024 | 03-05-2024 | 28 | A | | 8240 | 2441 | 150.00 | 150.00 | 817 | 36.3 |
| Average | | | | | | | | | 150.00 | 150.00 | 795 kN | 35.0 MPa |
| Standard Deviation | | | | | | | | | 0.0 | 0.0 | 16.1 | 0.7 |

Standard breaking patterns



Unusual breaking patterns



Deviation from test method :

Remarks and notes : CRCP MIX DONE WITHOUT ANY CHEMICALS ADDED FOR STRENGTH COMPARISON

The samples were subjected to analysis according to (COLTO) (TMH1) (BS) (ASTM) (TMH5)

The test results reported relate to the sample tested.

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Report compiled by : Christiaan Jordaan

Signature

Christiaan Jordaan
Ground / Field Manager

Request no : AXION A5
Client : Axion Africa
Dei-Dei International Building
Material, Market Abuja.
Opposite Panteka

Date reported : 10-05-2024

Project : DANGOTE FERTILIZER TO ELEKO JUNCTION

Attention : **Axion Africa****Compressive Strength of Concrete Cubes [TMH1 - D1, D3, ASTM C293]**

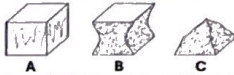
| | |
|--------------------------------|---|
| Date Received : 06-04-2024 | Structure / Element : CRCP |
| Date in Water : 07-04-2024 | Location : REFINERY SECTION 1 LABORATORY |
| Cubes Made By : | Concrete Supplier : MIXER AT LABORATORY |
| Cubes Tested By : | Delivery Note No : |
| Specified Strength (MPa) : C35 | Truck Reg. Number : |
| Specified Slump : 60 mm | Environmental Condition : SUNNY AND HOT |
| Measured Slump : 40 mm | Curing Tank Temp : 26 °C |
| Engineer's Specification : | Press Serial No : Correction Factor 1.000 |
| Balance Number : | |

7 Day Compressive Strength

| Lab Number | Cube Mark | Date Cast | Date Tested | Age Days | Break Pattern | Flatness | Mass | Apparent Density | Dimension | | Load | Compressive Strength |
|---------------------------|-----------|------------|-------------|----------|---------------|----------|------|------------------|---------------|---------------|---------------|----------------------|
| | | | | | | | | | Length | Width | | |
| A | 1 | 06-04-2024 | 13-04-2024 | 7 | A | | 8211 | 2433 | 150.00 | 150.00 | 859 | 38.2 |
| B | 2 | 06-04-2024 | 13-04-2024 | 7 | A | | 8175 | 2422 | 150.00 | 150.00 | 840 | 37.3 |
| C | 3 | 06-04-2024 | 13-04-2024 | 7 | A | | 8130 | 2409 | 150.00 | 150.00 | 845 | 37.5 |
| Average | | | | | | | | | 150.00 | 150.00 | 848 kN | 38.0 MPa |
| Standard Deviation | | | | | | | | | 0.0 | 0.0 | 10.2 | 0.5 |

28 Day Compressive Strength

| Lab Number | Cube Mark | Date Cast | Date Tested | Age Days | Break Pattern | Flatness | Mass | Apparent Density | Dimension | | Load | Compressive Strength |
|---------------------------|-----------|------------|-------------|----------|---------------|----------|------|------------------|---------------|---------------|----------------|----------------------|
| | | | | | | | | | Length | Width | | |
| D | 4 | 06-04-2024 | 04-05-2024 | 28 | A | | 8194 | 2428 | 150.00 | 150.00 | 1021 | 45.4 |
| E | 5 | 06-04-2024 | 04-05-2024 | 28 | A | | 8205 | 2431 | 150.00 | 150.00 | 995 | 44.2 |
| F | 6 | 06-04-2024 | 04-05-2024 | 28 | A | | 8169 | 2420 | 150.00 | 150.00 | 997 | 44.3 |
| Average | | | | | | | | | 150.00 | 150.00 | 1004 kN | 45.0 MPa |
| Standard Deviation | | | | | | | | | 0.0 | 0.0 | 14.4 | 0.6 |

Standard breaking patterns**Unusual breaking patterns****Deviation from test method :****Remarks and notes :** CRCP MIX DONE WITH AXION AFRICA LIQUID POLYMER ADDED

The samples were subjected to analysis according to (COLTO) (TMH1) (BS) (ASTM) (TMH5)

The test results reported relate to the sample tested.

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Report compiled by : Christiaan JordaanChristiaan Jordaan
Ground / Field Manager

Solid Base Stabilizer (SBS) Test Result



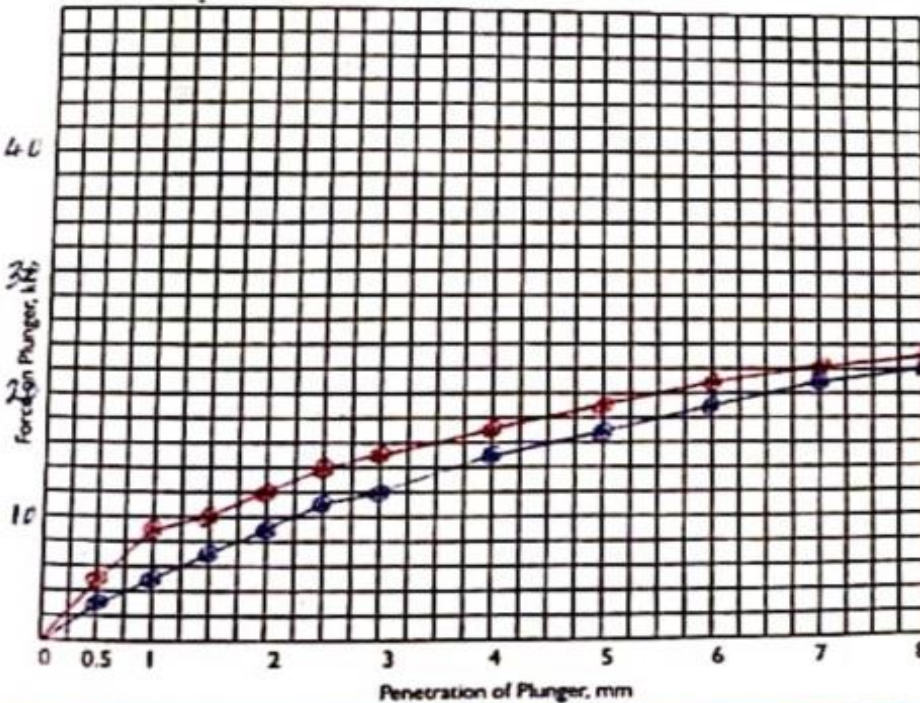
CALIFORNIA BEARING RATIO TEST

Project: Watermark Site Location: _____
 Character: _____ Boring No.: _____ Sample No.: _____
 Description of Soil: Stabilized material with Axion Stabilizer
 Test performed by: _____ Date of Test: 31-5-2013

TEST DATA

| Density Determination | | Moisture Content | | Proctor Information | |
|------------------------------------|-------|-----------------------|------|---------------------|-------------|
| Mold No. | 11 | Can No. | 47 | 69 | Method |
| Wt. of Wet Soil + mould (g) | 12537 | Wt. of Soil + Can | 95.1 | 95.4 | O.M.C |
| Wt. of Mould (g) | 5686 | Wt. of Dry Soil + Can | 86.8 | 82.1 | MDD |
| Wt. of wet sample (g) | 4821 | Wt. of Water | 8.3 | 8.3 | PRF |
| Volume of Mould (cm ³) | 2302 | Wt. of Can | 36.1 | 36.3 | Piston Area |
| Wet Density (g/cm ³) | 2.29 | Wt. of Dry sample | 50.8 | 50.8 | 0.222 |
| Moisture Content % | 16.3 | Moisture content | 16.3 | 16.3 | 19.4 |
| Dry Density (g/dm ³) | 1.50 | | | | |

| Penetration mm. | | 0.5 | 1 | 1.5 | 2 | 2.5 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------------|--------------|------|------|------|------|------|------|------|------|------|------|-------|
| Top | Dial Reading | 13.5 | 22.4 | 31.2 | 40.0 | 49.9 | 59.6 | 66.1 | 76.4 | 84.6 | 92.5 | 99.6 |
| | Force KN | 3.00 | 4.97 | 6.53 | 8.59 | 11.1 | 12.3 | 14.7 | 17.0 | 18.9 | 20.5 | 22.1 |
| Bottom | Dial Reading | 21.3 | 35.4 | 45.6 | 55.0 | 63.5 | 68.9 | 77.4 | 85.5 | 92.4 | 98.0 | 105.0 |
| | Force KN | 4.39 | 8.52 | 10.1 | 12.2 | 14.1 | 15.3 | 17.2 | 19.0 | 20.5 | 21.9 | 23.3 |



| Expansion After Soak | |
|------------------------|--|
| Initial Reading | |
| Final Reading | |
| Expansion | |
| Expansion After Soak % | |

Period of Soaking

| Results | |
|-------------------------------|--------------|
| Moist. Cont. before Soaking % | |
| Moist. Cont. after Soaking % | |
| Dry Density g/cm ³ | |
| Expansion after Soaking % | T.P |
| C.B.R @ 2.5 mm | 43.9 / 106.5 |
| C.B.R @ 5.0 mm | 85.2 / 215.2 |
| Ave C.B.R | 166.5 |

Date: 6/1/13
Tested by: ADS
Checked by: _____
Client Rep.: _____

Solid Base Stabilizer (SBS) Test Results by Dantata & Sawoe Construction Company

| TYPE OF MATERIAL | SAMPLED AT | LL | PI | SIEVE 200 | Soil Class | CBR UNSOAKED | | % Increased | CBR UNSOAKED AFTER 7 DAYS (with Stabiliser) |
|------------------|------------|------|------|-----------|------------|--------------------|-----------------|-------------|---|
| | | | | | | WITHOUT STABILISER | WITH STABILISER | | |
| BASE COURSE | BORROW PIT | 28 | 6.6 | 18 | A-2 | 88.7 | 104.5 | 15.8 | |
| FILL MATERIAL | SITE | 30.2 | 11.7 | 30.6 | A-2 | 11 | 42.1 | 31.1 | 109.7 |

- Two types of materials were tested to determine the effect of Base stabiliser in CBR. One is base and the other is fill quality.
- CBR of these materials were determined in Unsoaked condition since the intended usage of the materials are for Base layer.
- As shown in the table above, the CBR value of the base material without Stabiliser already met the required CBR value of base course which is min of 80% whilst the Fill material has 11% only.
- After treating both materials with Base Stabiliser with a dosage of 1liters Stabiliser to 300liters of water, CBR value increased by 16% to 31%.
- Manufacturer gave instruction that material treated with stabiliser must be tested for CBR at 28days in unsoaked condition which we deemed too long that's why we come up testing it after 7days

Note:

- 1.) No doubt that there is positive effect in CBR after treating the materials with Base stabiliser, even achieving more than 80% CBR after 7 days in unsoaked condition. However, testing CBR after 7days in unsoaked condition is not part of Nigerian Specification unless it is required by Engrs or recommended by the manufacturer with written approval of Engr representative

D & S Kano
 Quality Check: Pass

Axion Bitumen Booster (ABB) Test Results

CMT ENGINEERING
LABORATORIES

Construction * Materials * Technologies
Geotechnical, Environmental, & Materials Engineering/Testing/Research

CMT ID: AE 448

Patrick O'keke, Esq.
Axion Global Engineering Ltd/
Federal ministry of works,
Mabuchi, Abuja. Nigeria

Project Info: Rheological property determination of different blends of PG 64-22 with given polymers

Gentlemen,

CMT Engineering Laboratories was requested to perform a binder design utilizing Axion Bitumen Booster (P) and (L). The intent was to design a binder with a top end PG grading on 64 minimum, an elastic recovery of 50% minimum and to pass a Hamburg Rutting test on 10mm maximum. An unmodified binder was selected from a local supplier to begin this process, please reference the test data for the material performance.

Test Required:

1. Prepare Polymer Modified Blends of Unmodified PG 64-22 with Axion Bitumen Booster (P) and (L) in following proportions;
 - A. PG 64-22 + 3% Axion Bitumen Booster (P)
 - B. PG 64-22 + 3% Axion Bitumen Booster (P) + 0.25% Axion Bitumen Booster (L)
 - C. PG 64-22 + 3% Axion Bitumen Booster (P) + 0.50% Axion Bitumen Booster (L)
2. Perform DSR Original (AASHTO T 315) on PG 64-22 and three Polymer modified blends
3. Perform Elastic Recovery (AASHTO T301) on RTFO Aged Residues (AASHTO T 240)

| TEST | Temp | Method | SPECIFICATION | REPORT | RESULT |
|---|-------------------|--------|---------------|--------|--------|
| <u>ORIGINAL BINDER</u> | | | | | |
| <u>BASE ASPHALT PG 64-22</u> | | | | | |
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 64 ⁰ C | T315 | Min. 1.0 kPa | 1.25 | Pass |
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 70 ⁰ C | T315 | Min. 1.0 kPa | 0.592 | Fail |
| Tc (High) Original = 65.8⁰ C | | | | | |
| <u>PG 64-22 + 3% AXION BITUMEN BOOSTER (P)</u> | | | | | |
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 64 ⁰ C | T315 | Min. 1.0 kPa | 3.17 | Pass |
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 70 ⁰ C | T315 | Min. 1.0 kPa | 1.64 | Pass |
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 76 ⁰ C | T315 | Min. 1.0 kPa | 0.887 | Fail |
| Tc (High) Original = 74.8⁰ C | | | | | |
| <u>PG 64-22 + 3% AXION BITUMEN BOOSTER (P) + 0.25% AXION BITUMEN BOOSTER (L)</u> | | | | | |

| | | | | | |
|---|-------------------|------|--------------|-------|------|
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 64 ⁰ C | T315 | Min. 1.0 kPa | 3.89 | Pass |
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 70 ⁰ C | T315 | Min. 1.0 kPa | 2.09 | Pass |
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 76 ⁰ C | T315 | Min. 1.0 kPa | 1.16 | Pass |
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 82 ⁰ C | T315 | Min. 1.0 kPa | 0.676 | Fail |

Tc (High) Original = 77.7 °C

PG 64-22 + 3% AXION BITUMEN BOOSTER (P) + 0.5% AXION BITUMEN BOOSTER (L)

| | | | | | |
|---|-------------------|------|--------------|-------|------|
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 64 ⁰ C | T315 | Min. 1.0 kPa | 4.77 | Pass |
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 70 ⁰ C | T315 | Min. 1.0 kPa | 2.60 | Pass |
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 76 ⁰ C | T315 | Min. 1.0 kPa | 1.46 | Pass |
| Dynamic Shear, $G^*/\sin \delta$, 10 rad/sec | 82 ⁰ C | T315 | Min. 1.0 kPa | 0.843 | Fail |

Tc (High) Original = 80.1 °C

ROLLING THIN FILM OVEN(T240)

BASE ASPHALT PG 64-22

| | | | |
|---------------------|-------------------|------|-----|
| Elastic Recovery, % | 25 ⁰ C | T301 | 6.0 |
|---------------------|-------------------|------|-----|

PG 64-22 + 3% AXION BITUMEN BOOSTER (P)

| | | | |
|---------------------|-------------------|------|------|
| Elastic Recovery, % | 25 ⁰ C | T301 | 75.0 |
|---------------------|-------------------|------|------|

PG 64-22 + 3% AXION BITUMEN BOOSTER (P) + 0.25% AXION BITUMEN BOOSTER (L)

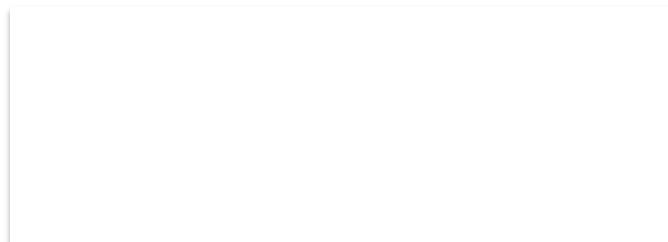
| | | | |
|---------------------|-------------------|------|------|
| Elastic Recovery, % | 25 ⁰ C | T301 | 79.0 |
|---------------------|-------------------|------|------|

PG 64-22 + 3% AXION BITUMEN BOOSTER (P) + 0.5% AXION BITUMEN BOOSTER (L)

| | | | |
|---------------------|-------------------|------|------|
| Elastic Recovery, % | 25 ⁰ C | T301 | 79.0 |
|---------------------|-------------------|------|------|

REPORT AND ANALYSIS:

1. Based on Original DSR,
 - a) PG 64-22 is graded at PG 64-XX. The True Grade is 65.8⁰C
 - b) PG 64-22 + 3% Axion Bitumen Booster (P) is graded at PG 70-XX. The true grade is 74.8⁰C
 - c) PG 64-22 + 3% Axion Bitumen Booster (P) + 0.25% Axion Bitumen Booster (L) is graded at PG 76-XX. The true grade is 77.7⁰C
 - d) PG 64-22 + 3% Axion Bitumen Booster (P) + 0.50% Axion Bitumen Booster (L) is grade at PG 76-XX. The true grade is 80.1⁰C.



The finished blend was delivered to the laboratory to be blended into asphalt for Hamburg testing, the following is an outline of the material properties:

A local aggregate was selected that has failed the Hamburg test in the past, this aggregate was chosen because we wanted to avoid an asphalt mixture which would have passed without any modification.

The following is an outline of the asphalt properties as tested:

| | | |
|-----------------------|---------------------|------|
| Blender Content | =5.3% by wt. of mix | |
| RAP Content | =None | |
| Air Void Content | =7.3% | Pass |
| Average Rutting Depth | =3.10mm | Pass |

Gradation

| Screen | Percent Passing |
|--------|-----------------|
| 3/4" | 100 |
| 1/2" | 99 |
| 3/8" | 82 |
| #4 | 48 |
| #8 | 34 |
| #16 | 17 |
| #30 | 11 |
| #50 | 9.1 |
| #100 | 7.7 |
| #200 | 5.3 |

If you have any questions, please don't hesitate to contact me.

Sincerely



Douglas Wolf
President

Axion Tuffcrete Cube Compression Test Results



LAFARGE READY MIX NIGERIA CUBE COMPRESSION TEST REPORT

(Method:BS EN 12390-2000)

| | |
|---|---|
| Project: Trail mix | |
| Client: | Site: |
| Contractor: | Location: |
| Date of Pour: 11-Feb-21 | |
| Mix No.: Black Axion Powder | Mix Grade: C30 |
| Placing Method | Cube curing |
| <input type="checkbox"/> Pump <input type="checkbox"/> Chute <input type="checkbox"/> Bucket <input type="checkbox"/> Others | <input type="checkbox"/> Curing agent <input checked="" type="checkbox"/> Water cured <input type="checkbox"/> Dry cured <input type="checkbox"/> Others |

SLUMP (mm):

7 Days AREA (mm²):22500

| Mark on cubes | Date of Testing | Age (Days) | Size of cube(mm) | Weight (Kg) | Density (Kg/m ³) | Load (KN) | Strength (N/mm ²) |
|---------------|-----------------|------------|------------------|-------------|------------------------------|-----------|-------------------------------|
| 1 | 18-Feb-21 | 7 | 150x150x150 | 8.15 | 2415 | 418.5 | 18.6 |
| 2 | 18-Feb-21 | 7 | 150x150x150 | | | | |
| 3 | 18-Feb-21 | 7 | 150x150x150 | | | | |
| Average | | | 150x150x150 | 8.15 | 2415 | 418.5 | 18.6 |

28 Days

| Mark on cubes | Date of Testing | Age (Days) | Size of cube(mm) | Weight (Kg) | Density (Kg/m ³) | Load (KN) | Strength (N/mm ²) |
|---------------|-----------------|------------|------------------|-------------|------------------------------|-----------|-------------------------------|
| 4 | 11-Mar-21 | 28 | 150x150x150 | 8.23 | 2439 | 738.0 | 32.8 |
| 5 | 11-Mar-21 | 28 | 150x150x150 | | | | |
| 6 | 11-Mar-21 | 28 | 150x150x150 | | | | |
| Average | | | 150x150x150 | 8.23 | 2439 | 738.0 | 32.8 |

Cube Cast by:
Mr Ogunjobi

Axion Products Approval by Federal Ministry of Works

THIS DAY MONDAY OCTOBER 20, 2014

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FEDERAL MINISTRY OF WORKS

COMMUNIQUE OF THE 21ST NATIONAL COUNCIL ON WORKS HELD AT THE DELTA STATE GOVERNMENT EVENT CENTRE, ASABA, DELTA STATE FROM OCTOBER 12 TO 17, 2014

- (20) Council approved the use of stabilizers and bitumen booster already being implemented by the Federal Ministry of Works as a means of improving the durability of road pavement, as well as reducing cost of road construction in the country.
- (21) Council directed Ministries in charge of roads to collaborate with universities and Research centres towards utilization of research findings as well as to consciously refer to the office of the Surveyor General of the Federation and State Surveyor-General for permanent data, being the repository for such data.

The 21st Meeting of the National Council on Works with the theme "Funding Road Development in Nigeria: A Paradox for Economic Transformation" was held at the Delta State Government Event Centre, Asaba, Delta State, from Sunday 12th to Friday 17th October, 2014. The meeting was declared open by His Excellency, the Deputy Governor of Delta State, Prof. Amos Utunnio (SAN) on behalf of His Excellency, Dr. Emmanuel Eweta Uduaghan CON, Executive Governor of Delta State.

Meeting of the Technical Committees, as well as a meeting of the Permanent Secretaries preceded the Council Meeting which was presided over by Arc. Mike Oziegbe Onolemenem, CON.

Present at the Council meetings were distinguished members of the National Assembly led by the Chairman, House Committee on Works, Hon. Ojuweli Ozoigbochi, the Honourable Minister of Works, Arc. Mike Oziegbe Onolemenem, CON; Permanent Secretary, Federal Ministry of Works, Dr. A. K. Muhammad, OON; Honourable Commissioners of Works and their Permanent Secretaries from the 36 States of the Federation. Others were the Directors in the Federal Ministry of Works; Directors/Officials of other Federal and State Ministries, Departments and Agencies (MDAs), as well as Stakeholders in the Road Sector.

- (17) Council noted that the Contractor-Financed Model of funding road infrastructure has not been fully developed in the country and urged the use of this model for road projects and directed for the review of the provisions of the Construction Policy to promote greater participation of indigenous contractors in the road sector in line with the Local Content Policy.
- (18) Council recognized the importance of data to planning for road development, and accordingly adopted the creation of Road Asset Management System (RAMS) as a tool for project planning, budgeting and prioritization.
- (19) Council recognized tolling of roads and bridges as a veritable source of funding Road Development and noted that the Federal Ministry of Works had already carried out series of sensitization workshops to elicit stakeholders buy in.
- (20) Council approved the use of stabilizers and bitumen booster already being implemented by the Federal Ministry of Works as a means of improving the durability of road pavement, as well as reducing cost of road construction in the country.
- (21) Council directed Ministries in charge of roads to collaborate with Universities and Research Centres towards utilization of research findings, as well as to consciously refer to the Office of the Surveyor General of the Federation and State Surveyors-General for permanent data, being the repository for such data.

Thank You

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Chat with us now!

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