Title

Renolith 2.0 Product Sample Kit Instructions

Context

Renolith 2.0 is a nanopolymer admixture conforming to standard *EN 934-2: Admixtures for concrete, mortar and grout*. In chemical terms, it is a colloidal suspension comprising a latex emulsion and stable colloidal dispersion of nanosilica and nanocellulose. It is compatible with ordinary Portland cement and with binder blends containing supplementary cementitious materials (SCMs). It is most often used for creating high performance bound layers from in-situ soils and/or recycled aggregates in flexible pavement applications.

A substantial body of evidence characterizes the efficacy of Renolith in pavement and concrete nanoengineering applications. However, there are myriad variables and potential applications. Accordingly, samples are provided to allow interested parties to test the utility of the product.

Aim

The purpose of this document is to convey key information for the safe and effective use of the Renolith 2.0 product sample.

Safety information

Renolith 2.0 is non-hazardous. Prior to handling, please review the Renolith 2.0 Safety Data Sheet available at https://renolith.com.au/resources/

Laboratory tests

For pavement applications, The AustStab Pavement Recycling and Stabilisation Guide [1], NZ Transport Agency Best practice guide for pavement stabilisation [2] and AustRoads Guide to Pavement Technology Part 4D: Stabilised Materials [3] provide guidance on mix design and laboratory testing. The table below indicates the expected laboratory test results (per AustStab Guide Ch4) that will result from adding Renolith 2.0 admixture to the mix at 5% w/w binder, compared to binder-only mixes.

Test	Expected test result / notes
4.2.2. Unconfined Compressive Strength (UCS) Test	50%-80% increase
4.2.3. Triaxial Compression test	50%-80% increase
4.2.4. Permeability test	Decrease by 1-2 orders of magnitude
4.3.1. Particle size distribution (grading)	No impact. Note: poorly graded soils may become viable.
4.3.2. Atterberg tests (liquid limit and plastic limit)	Slight reduction in plasticity. Note: AustStab Guide [1] states that a plasticity index (PI) range of 2-6 is typically specified for base material. A much broader range can be viable with Renolith.
4.3.3. California Bearing Ratio (CBR) and percentage swell	Soaked & unsoaked CBR: increase – results vary by soil and binder type. Swell %: Reduced

4.4. Maximum Dry Density (MDD) and Optimum Moisture Content (OMC)	Suggested water content in mix design is slightly on the wet side of OMC at 98% MDD.
4.5. Particle size distribution (PSD) plasticity, reactivity	Standard PSD, plasticity and reactivity envelopes can be expanded.
4.6. Compaction	Required compactive effort is slightly reduced.
4.7. Capillary rise	Reduced – results will vary by soil and binder type.
4.8. Vertical saturation	Improved performance
4.9. Lime demand	No impact
4.10. Resilient modulus	Significant improvement
4.11. Fatigue characterisation	Significant improvement
4.12. Working time	Reduced.
4.13. Erodability	Reduced. Erodability can be reduced by adding more binder, but drying shrinkage problems often limit the maximum binder content. With Renolith, drying shrinkage is not a concern, so binder content can be increased if required.
4.14. Leaching	Reduced. Contaminant immobilisation via micro-encapsulation is often viable due to the reduced porosity & permeability of the bound material.

AustStab Pavement Recycling and Stabilisation Guide [1] table 3.3 and Austroads AGPT04D-19 [3] table 8.1 list appropriate laboratory test methods for stabilised materials.

Tips

- **Tests focus.** Compared to cement-only mixes, Renolith 2.0 admixture effects on shrinkage, porosity, permeability, tensile strength and fatigue performance are remarkable. Consider testing for these parameters.
- **Binder.** Renolith 2.0 admixture is compatible with Cement, Lime and Cementitious binders per Austroads AGPT04L-09 [4].
- **Mix design**
    - For stabilisation applications, refer to AustRoads and AustStab guidance. See also Renolith Pavement Design Guide.
    - For most applications, optimal dosing of Renolith 2.0 admixture is 5% w/w binder
    - Renolith 2.0 admixture is suitable for Modified, Lightly Bound and Bound stabilisation mixes. Greatest utility is in Bound (UCS >2MPa) designs. Due to the much reduced susceptibility to shrinkage cracking, conventional upper bounds on binder content may be exceeded.
    - Example mix design for testing (concrete application)
        - Dry concrete: 1kg
            - Cement content: 100g (10-15% is typical)
        - Renolith 2.0 admixture: 5g (optimum 5% w/w cement)
        - Water: per concrete manufacturer recommendation
- **Storage and shelf life.** Store sample in a cool place out of direct sunlight. Shake well before use. Use by the retest date on the label – efficacy may diminish beyond this date.

Standards

Due to the numerous beneficial effects and potential applications of the product, no single standard or test method is applicable. Certain standards from the following series may useful:

AS 1012	Methods of testing concrete
AS 1141	Methods for sampling and testing aggregates
AS 1289	Methods of testing soils for engineering purposes
AS 1478	Chemical admixtures for concrete, mortar and grout
AS 3582	Supplementary cementitious materials
AS 5101	Methods for preparation and testing of stabilized materials

General information

- Homepage: https://renolith.com.au/
- About page: https://renolith.com.au/about/
- Product page: https://renolith.com.au/product/
    - Includes introduction videos
- Resources page: https://renolith.com.au/resources/
    - Includes PDS, SDS, case studies, testimonials, videos
    - Business Case
        - Summarises the case studies and research to support the benefits & cost savings claimed.
    - Pavement Design Guide
        - Provides guidance on mix design, pavement thickness and construction process.
        - Supports pavement evaluation and design.
- Brand History
    - Summarises the complicated history of the Renolith brand.
- Suggested articles, available via: https://renolith.com.au/news-media/
    - Overview of Renolith nanochemistry
    - Recycled Concrete Aggregate (RCA) with Renolith and binder in pavements
    - Reducing greenhouse gas emissions in road construction
    - Flood-proof roads
    - Sustainable road solutions presentation
    - Nano-engineered concrete
- Research Summary
    - Summarises the evidence (research, tests, case studies, patents, investigations) that characterises the product and supports the performance claims.
    - Available on request

References

[1] AustStab, Pavement Recycling and Stabilisation Guide, Cherrbrook NSW: AustStab, 2015 2nd Ed.

[2] W. Gray, "Best practice guide for pavement stabilisation," NZ Transport Agency, Wellington, 2017.

[3] Austroads AGPT04D-19, "AGPT04D-19, Guide to Pavement Technology Part 4D: Stabilised Materials," Austroads, Sydney, 2019.

[4] AustRoads AGPT4L-09, "AGPT4L-09 Guide to Pavement Technology Part 4L - Stabilising Binders Ed1.1," AustRoads, Sydney, 2018.

Change History

Date	Version	Notes / changes
03 Jul 23	1.0	Initial release