BRANZ Appraised
Appraisal No.661 [2009]

BRANZ Appraisals

Technical Assessments of products for building and construction

BRANZ APPRAISAL No. 661 (2009)

KRYSTOL INTERNAL MEMBRANE - HS (KIM-HS)

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Product

1.1 Krystol Internal Membrane – HS (KIM-HS) is a chemical admixture used to reduce the water permeability of concrete.

KRYTON®
At the Lab. In the Field. By Your Side.

Scope

2.1 KIM-HS is a permeability-reducing admixture used to assist with the waterproofing of concrete for structures of importance level 1 - 5 as defined by AS/NZS 1170.
2.2 Structures with concrete containing KIM-HS must be the subject of specific design in association with Fraser Brown & Stratmore Ltd.
2.3 Concrete containing KIM-HS admixture must be supplied by a ready-mixed concrete supplier trained and approved by Fraser Brown & Stratmore Ltd.

Building Regulations

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, Krystol Internal Membrane – HS (KIM-HS) if designed, used, installed and maintained in accordance with the statements and conditions of this Appraisal, will contribute to meeting the following provisions of the NZBC:
Clause B2 DURABILITY: Performance B2.3.1(a) not less than 50 years. Concrete incorporating KIM-HS will meet this requirement. See Paragraphs 9.1 and 9.2.
Clause E2 EXTERNAL MOISTURE: Performance E2.3.2 and E2.3.3. Concrete incorporating KIM-HS will meet these requirements. See Paragraphs 11.1 and 11.2
Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. KIM-HS meets this requirement and will not present a health hazard to people.

3.2 This is an Appraisal of an **Alternative Solution** in terms of New Zealand Building Code Compliance.

Technical Specification

General

4.1 KIM-HS is a chemical admixture used to reduce the water permeability of concrete and aid the production of watertight concrete. KIM-HS produces concrete with enhanced durability and improved protection against reinforcement corrosion by providing a physical pore-blocking action that protects resulting concrete against water ingress via hydrostatic pressure. The use of KIM-HS will therefore produce a concrete with the following properties relative to a control concrete:

- Reduced porosity
- Increased water resistance
- Reduced permeability
- Increased corrosion resistance.

KIM-HS has no detrimental effect on the properties of the concrete.

4.2 Krystol Internal Membrane - HS (KIM-HS) is a powder admixture, consisting of Portland cement and proprietary chemicals and is manufactured by a blending process. It is supplied in 5, 25 kg pails or 5-10 kg mixer-ready bags. Each container bears the name of the manufacturer and the product, the batch number, and health and safety information.

4.3 Fraser Brown & Stratmore Ltd also supply Krystol Waterstop Grout, Krystol Waterstop Treatment and Fibermesh. These materials may also be used to provide specific design solutions but have not been assessed by BRANZ and are outside the scope of this Appraisal.

Handling and Storage

5.1 KIM-HS must be stored in sealed containers in a dry environment and protected from rain or other sources of moisture. KIM-HS has a shelf-life of two years, when stored under these conditions.

Technical Literature

6.1 Refer to the Appraisal listing on the BRANZ Website for details of the current Technical Literature for KIM-HS. The Technical Literature must be read in conjunction with this Appraisal. All aspects of design, use, installation and maintenance contained within the scope of this Appraisal and the Technical Literature must be followed.

Design Information

Use

7.1 Concrete containing KIM-HS must be the subject of specific design when intended to provide resistance to water penetration and/or resistance to water vapour. The building structure design must also incorporate waterstops and other appropriate means to waterproof joints, penetrations and formwork ties. The critical aspects of concrete design containing KIM-HS are:

- Minimum cement content
- Water/cement ratio
- Minimum concrete thickness
- Methods of crack control, and
- Curing.

Design must be carried out in association with Fraser Brown & Stratmore Ltd.

Water penetration

7.2 Concrete containing KIM-HS has greater resistance to water penetration than the equivalent plain concrete. Subject to proper design, concrete containing KIM-HS can provide watertight concrete for basements, pools, tanks, tunnels, culverts and the like.

Water vapour permeability

7.3 Concrete containing KIM-HS has a lower permeability to water vapour than the equivalent plain concrete. Subject to proper design concrete containing KIM-HS can provide water vapour resistant concrete for slabs and walls in damp proofing situations.

Additional

7.4 KIM-HS may be used in concrete, including concrete that does not meet the specific design criteria of this Appraisal, in addition to damp-proof membranes, e.g. as specified in NZBC Acceptable Solution E2/AS1 Paragraph 10.3.3 and Paragraph 12.2, as an additional protection should the DPM fail.

Concrete

7.5 Concrete containing KIM-HS must be supplied as ready-mixed concrete in accordance with NZS 3104, NZS 3109, the instructions of Fraser Brown & Stratmore Ltd and this Appraisal.

KIM-HS is added to concrete mixes at a rate of 2% by weight of the total cementitious content up to a maximum rate of 8 kg/m^3.

7.6 The concrete must have a minimum cementitious material content of 325 kg/m^3 and a minimum Portland cement content of 250 kg/m^3, and be batched with a maximum water/cementitious material ratio of 0.45 for critical applications subject to hydrostatic pressure. For some less critical applications, a maximum water/cement ratio of up to 0.5 may be used.

7.7 Where the control of water vapour is required it will be necessary to provide a mix with sufficiently low vapour permeability in combination with adequate section thickness.

7.8 Concrete mix design must be in accordance with the instructions of Fraser Brown & Stratmore Ltd. Once mixed further materials must not be added to the fresh concrete.

Structure

8.1 Concrete structures must be designed in accordance with NZS 3101, NZS 3106 or other suitable design standard.

8.2 The reinforcement of structures incorporating KIM-HS for critical applications must be detailed to limit the maximum crack width in the concrete to 0.3 mm.

8.3 The mechanical properties of concrete incorporating KIM-HS will not be adversely affected by its inclusion. Due to the set retarding nature of KIM-HS, early age concrete strengths may be slightly lower than the equivalent plain concrete, but final strengths will be higher.

Durability

9.1 KIM-HS will not adversely affect concrete in which it is incorporated, and concrete containing KIM-HS will have its expected durable life.

9.2 Concrete incorporating KIM-HS, if properly mixed, placed and cured, will have improved properties that are likely to extend the life of the concrete. Incorporation of KIM-HS in concrete will reduce its permeability relative to an equivalent concrete at the same water/cement ratio. Possible benefits include:

- Greater freeze/thaw resistance
- Increased reinforcement protection for the same depth of reinforcement cover
- Increased carbonation resistance.

Maintenance

10.1 No maintenance is required to concrete containing KIM-HS provided that significant building movement or cracking does not occur. Regular checks must be made for cracks or damage, and Fraser Brown & Stratmore Ltd consulted regarding waterproofing related repairs.

External moisture

11.1 Concrete containing KIM-HS can provide watertight concrete for structures and can provide water vapour resistance for concrete slabs and walls when designed and used in accordance with the instructions of Fraser Brown & Stratmore Ltd and this Appraisal.

11.2 The building structure design must incorporate details for waterstops and waterproofing of joints, junctions, penetrations and the like. These details have not been assessed and are outside the scope of this Appraisal.

Installation Information

12.1 Concrete containing KIM-HS must be batched by ready-mixed concrete plants approved by Fraser Brown & Stratmore Ltd.

12.2 The KIM-HS admixture must be mixed into the concrete for a timed minimum of 10 minutes to ensure the admixture is uniformly distributed prior to discharging.

12.3 Concrete containing KIM-HS will be a Special Concrete as defined by NZS 3104, and as such, any testing requirements and compliance tolerances must be defined by the purchaser or designer in collaboration with Fraser Brown & Stratmore Ltd. Methods of sampling must be in accordance with NZS 3109.

12.4 As concrete containing KIM-HS will be used for watertight or low vapour permeability concrete, special care must be taken during placing, compaction, finishing and curing, and these actions must be in accordance with NZS 3109.

12.5 Common defects found in typical concrete cannot be tolerated. Poor consolidation, unplanned cold joints, random cracking, penetrations, contaminations, etc. will all result in a leaking structure if not accounted for in the design and installation.

12.6 Fraser Brown & Stratmore Ltd must be consulted before concrete is placed regarding the inclusion of cold joints, penetrations and control joints for methods of dealing with these. These methods have not been assessed and are outside the scope of this Appraisal.

12.7 Compaction of concrete is best achieved by internal vibration. Where this is not practical, external vibration or vibrating screeds should be used. Compaction is important as improperly compacted concrete is much more likely to leak.

12.8 Freshly placed concrete must be protected from extreme temperatures or drying conditions.

Inspections

12.9 The contract documents must be referred to during the installation of concrete containing KIM-HS by building consent authorities or territorial authorities. Critical areas of inspection are:

- KIM-HS admixture is added at the specified dosage.
- Concrete containing KIM-HS is batched, placed, consolidated, protected and cured according to accepted concrete practices, instructions from Fraser Brown & Stratmore Ltd and the relevant sections of NZS3109.
- Construction joints are prepared and waterproofed according to the guidance of Fraser Brown & Stratmore Ltd.
- Control joints are suitably spaced to prevent random cracking, and are waterproofed as per the guidance of Fraser Brown & Stratmore Ltd.

12.10 The KIM-HS Quality Assurance check sheets and supporting documentation must be completed and returned to Fraser Brown & Stratmore Ltd as required by contract.

Health and Safety

13.1 When handling KIM-HS, the normal health and safety procedures associated with cementitious materials should be observed.

Basis of Appraisal

The following is a summary of technical investigations carried out.

Tests

14.1 The test results carried out as part of the BBA Certification of KIM-HS were reviewed as part of the assessment. They were results of comparison tests with control concrete and included the following:

- Slump
- Plastic density
- Air content
- Setting times
- Water permeability
- Drying shrinkage
- Wetting expansion
- Freeze/thaw expansion
- Compressive strength
- Flexural strength
- Modulus of elasticity
- Water vapour permeability

Other Investigations

15.1 A durability opinion has been provided by BRANZ technical experts.

Quality

16.1 Kryton International Inc. has a quality system in place that meets the requirements of Acceptance Criteria AC10 of the ICC Evaluation Service. This has been reviewed and found to be satisfactory.

Sources of Information

- AS/NZS 1170 Structural design actions.
- NZS 3101:1995 Concrete structures standard - The design of concrete structures.
- NZS 3104:2003 Specification for concrete production.
- NZS 3106:1986 Code of practice for concrete structures for the storage of liquids.
- NZS 3109:1997 Concrete construction.
- AC10 Acceptance criteria for quality documentation. ICC Evaluation Service, February 2009.
- New Zealand Building Code Handbook, Department of Building and Housing, Third Edition May 2007.
- The Building Regulations 1992 up to, and including, August 2008 amendment.

BRANZ

In the opinion of BRANZ, the Krystol Internal Membrane - HS (KIM-HS) is fit for purpose and will comply with the Building Code to the extent specified in this Appraisal provided it is used, designed, installed and maintained as set out in this Appraisal.

The Appraisal is issued only to Fraser Brown & Stratmore Ltd, and is valid until further notice, subject to the Conditions of Appraisal.

Conditions of Appraisal

1. This Appraisal:
a) relates only to the product as described herein;
b) must be read, considered and used in full together with the technical literature;
c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
d) is copyright of BRANZ.
2. Fraser Brown & Stratmore Ltd:
a) continues to have the product reviewed by BRANZ;
b) shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
c) abides by the BRANZ Appraisals Services Terms and Conditions.
3. Warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal of the product.
4. BRANZ makes no representation or warranty as to:
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b) the presence or absence of any patent or similar rights subsisting in the product or any other product;
c) any guarantee or warranty offered by Fraser Brown & Stratmore Ltd.
5. Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.
6. BRANZ provides no certification, guarantee, indemnity or warranty, to Fraser Brown & Stratmore Ltd or any third party.

For BRANZ

P Burghout
Chief Executive

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