Annual Concrete Seminar 2008

Renovation and Repair of Concrete Structures Based on Dry Mortar Technology

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Presentation Outline

- What is Dry Mortar?
- Applications in Repair & Renovation for
  - Wall Finishes
  - Waterproofing
  - Flooring
- Innovative “Green” Applications
What is **Dry Mortar**?

- Pre-blended dry powdery materials
  - binders + fillers + additives + pigments
- Just add water and mix
  - good quality fresh mortar for immediate use

**High Performance Mortars for Wide Range of Applications**
Premixed **Dry Mortar** Ingredients

Blended Dry Powder Packed in a Bag (Prebagged Mortar)
Polymer-Modified Cementitious Mortar
Dry Mortar Technology

- Use of specific binders & polymers
- Incorporate various types of fillers
- Adopt advanced chemical additives
- Formulations for designated properties
- Blending of powdery materials
- Controlled production process

Dry Mortars → Advanced Construction Materials with Superior Performance Properties
## Premixed Dry Mortar
### Typical Product Range

<table>
<thead>
<tr>
<th>Category</th>
<th>Product Code</th>
<th>Description</th>
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<tr>
<td>Plaster</td>
<td>OPTIMIX BP113</td>
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<td>Base Render - Coarse</td>
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<td>OPTIMIX FH910</td>
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Common Problems of Wall Finishes

Render and Tile Failure

Patch Repair or Complete Façade Renovation
Typical Wall Finishes System

1. Spatterdash
2. Render
3. Tile Adhesive
4. Tile Grout
5. Tile
Spatterdash / Render Failure

Spatterdash / Render Failure

Spatterdash

Render

Tile Adhesive

Tile Grout

Tile
Render Failure

Spatterdash

Render
Tile Failure

- Render
- Tile
- Spatterdash
- Render
- Tile Adhesive

Adhesive Failure
Tile Failure
Tile Grout Failure

- Spatterdash
- Render
- Adhesive
- Grout
- Tile

Water Ingress
Via Tile Joints
Lime Leaching Efflorescence

Tile / Grout Failure
Efflorescence of Tile Grout

Leaching Lime
Via
Porous Cracked Tile Joints
Repairs for External Wall Finishes

Weak bond between wall finish layers under cyclic movements

Debond
Wall
Finishes
Materials

Materials Aging and Cracks
Traditional Repair to Wall Finishes

Materials

Deficiencies

Poor Water Retention

High Shrinkage

Stiff & Rigid

Low Early Strength

Weak Bond

1

Bond Coat

2

Ready Mixed Mortar Sand/Cement Render

3

Tile Adhesive

4

Tile Grout

Tile
Potential Problems of Traditional Repairs

**Bond Coat (SBR Slurry)**
- Premature dry out → not effective adhesion or potential debond layer

**Render (Ready Mixed or Cement / Sand Mortar)**
- Extremely low early strength → weak bond & poor sag resistance
- High long term shrinkage → cracks & movement

**Adhesive**
- Stiff material → less deformable to accommodate movements

**Grout**
- Rigid & porous material → cracks with risk of water seepage

Repair materials of questionable properties and performance
Movements within Rigid Materials

Stiff / Rigid Layer
(Undesirable)

Shrinkage of Substrate

Expansion of Tiles

Tile debond and popping out

Other movements: creep, moisture, thermal, wind suction, structure swing, … etc.
Movements within Deformable Materials

Deformable Materials (Preferable)

Substrate

Tile

Shrinkage of Substrate

Expansion of Tiles

Deformation of Adhesive Mortar

Deformation of Adhesive Mortar

Expansion
Preferred & Suggested Repair Materials

**Bond Coat**
- Use either premixed key coat or system without bond coat

**Render**
- Higher early bond *(not compressive)* strength (e.g. >0.5MPa at 7 days)
- Moderate compressive strength (e.g. <20MPa at 28 days)
- Lower long term shrinkage (e.g. <0.04% at 7 days & <0.08% at 28 days)

**Adhesive**
- Flexible material \(\rightarrow\) deformable to accommodate movements
  (e.g. to EN12004 Class C1 or C2)

**Grout**
- Waterproof material \(\rightarrow\) reduce cracks improved water resistance
  (e.g. to EN13888)

Dry Mix Materials of enhanced properties and performance for repair
High Performance Dry Mix System

Durable and Safe System

- Good Water Retention
- Shrinkage Compensated
- Flexible & Deformable
- Good Bond
- Water Resistant

Key Coat
Premixed Mortar
Flexible Tile Adhesive
Waterproof Tile Grout
Tile

An enhanced system of guaranteed quality for effective and long lasting repair
Alternative External Wall Renovation Method

External Tiled Wall Renovation

Semi-Flexible Premixed Mortar Over Tiles

Tile Filler
Alternative External Wall Renovation Method

Original

Tile Filler

Finished
Innovative Enhanced Development for External Tile Façade Refurbishment

Move Forward → Apply One Single Product for Secure Renovation Works

Good Bond Strength
On Tile Surface > 1MPa

High Elasticity – Accommodate Movements

Waterproof & Seal Cracks

Safe – Prevent Sudden Tile Fall

Easy to Use – Apply by Brush or Trowel

Stable Colour and Durable

Non-Toxic & VOC-Free Environmentally Friendly
Common Problems of Waterproofing

Leakage and Seepage

Complete Removal & Re-install
Common Sign of Water Seepage

Waterproofing Failure
Common Sign of Water Leakage

Waterproofing Failure
Traditional Waterproofing Sheet Membrane

Seam & Joints
Poor Adhesion

Water Ingress

Sheet Membrane

Leakage

Seepage

Weak Seam $\rightarrow$ Poor lapping joints between sheetings

Poor Adhesion $\rightarrow$ Incompatible of adhesive and substrate

Leakage Remedial $\rightarrow$ Difficult to locate source and repair

Bitumen Based $\rightarrow$ Aging & degrade under ambient air, UV, heat
(Loss of elasticity, disintegrate, cracks, etc.)

Note: Some commercial products marketed as PU products consist of significant amount of bitumen (or tar). They are also subject to natural degradation.
Failure of Waterproofing Membrane

- Seepage via Cracks
- Drips along Cracks

Roof Top

Roof Slab Under Side
Failure of Waterproofing Membrane

- Roof Tiles Removed
- Poor Joint Lappings Exposed
- Water Seepage via Loose Seam
- Weak Adhesion
- Cracked Membrane
Suggested and Improved Waterproofing

Polymer Modified (Cementitious Based)
Flexible Waterproofing
Durable and More Secure System

No Seam ➔ Brush / trowel apply, easy to control thickness and quality

Good Bond ➔ Full compatible with concrete substrate, no adhesive

Flexible ➔ Stable and durable, no aging problem under UV & weather

Easy to Maintain ➔ Easy to locate fault and carry out remedial work
Restoration of Waterproofing with Premixed Dry Mortar System

Application by Trowel
Can be Applied on Damp Substrate
Seamless Finish
Ponding Test
Common Problems of Flooring

Uneven, Cracks and Dusting

Complete Removal & Re-install
Common Floor Defects & Damages

- Weak
- Dusty
- Uneven
- Crack
- Epoxy Peeling & Wear Out
Cementitious Self Levelling Floor

Simple & Speedy Renovation / Re-surfacing

Car park

- Foot Traffic: 2 hours
- Vehicle Traffic: 8 hours

Unteven Concrete Floor

Self Levelling Floor (5-8mm)
Cementitious Self Levelling Floor

Speedy Renovation / Re-surfacing

Damaged Screed

Self Levelling Floor – Overlayment
Simple and Efficient Renovation
Cementitious Self Levelling Floor

Speedy Renovation / Re-surfacing

Before

Damaged Floor

After
Cementitious Self Levelling Floor

Damaged Epoxy Floor

Durable Re-surfacing

Self Levelling Floor – Overlayment
Simple and Efficient Renovation
Cementitious Self Levelling Floor Colour Finishes

Worn & Damaged Tiled Floor

Coloured Floor

Finished Smooth Flat Floor
Cementitious Self Levelling Floor

Damaged Tiled Floor

Durable Re-surfacing

Self Levelling Floor – Overlayment
Simple and Efficient Renovation
Cementitious Self Levelling Floor

Beijing National Stadium “Bird Nest”

Internal Self Levelling Floor: ~40,000 m²
Cementitious Self Levelling Floor

Beijing New CCTV HQ

Internal Self Levelling Floor: 1st Phase ~20,000 m², 2nd Phase ~180,000 m²

(Completed) (To Be Started Soon)
Dry Mortar Systems
Innovative Green Applications

- Low VOC Finishes
- Thermal Insulation
- Sound Deadening
- Anti-Radon
- Photo Catalyst
- …… …… ……

Green and Healthy

Exterior Insulation and Finish System
Exterior Insulation & Finish System

Shield External Heat in Summer, Keep Interior Warm in Winter

- Adhesive for Insulation Board
- Polystyrene Insulation Board (EPS / XPS)
- Base Coat for Reinforcing Mesh
- Alkali Resistant Glass Fibre Reinforcing Mesh
- Flexible Tile Adhesive
- Low Water Absorption Tile Grout
- Decorative Finishes (Coating / Tile)

Efficient energy saving on air-conditioning
Exterior Insulation & Finish System

System used extensively in Europe and America for decades

1. Substrate
2. Base Adhesive
3. EPS/XPS Board
4. Top Coat
5. Glass Fibre Mesh
6. Decorative Finish

Mandatory installation in Major Cities in China since 2007
Exterior Insulation & Finish System

Can we contribute and play our role on Energy Saving in building design?

To Save Fuel & Minimize Pollutants → Environmentally Friendly

Green Buildings

Oil Crisis!

Fuel Shortage!

Can we adopt similar system for buildings in Hong Kong?
Closing Up & Comments

- Based on dry mix technology, premixed products of superior properties are made possible for a wide range of applications in construction.

- With the use of advanced powdery chemical additives, cement based products can be developed with specific and outstanding properties.

- Dry mix systems can replace plenty of traditional construction materials or methods to enhance performance and extend durability.

- Dry mortars may not be able to solve all the construction problems but they can always provide effective solutions to minimize potential problems.

- Dry mix systems can play vital roles in structural or architectural designs for achieving greener and healthier buildings / structures.

The End  Thank You!