Terrazzo Tile Flooring Solutions & Specification Guidance
CPD 2012
Learning Objectives

- Demonstrate an awareness of different applications for Terrazzo
- Select appropriate approaches to bespoke designs of Terrazzo
- Demonstrate an understanding of different fixing methods for Terrazzo
- Gain new perspectives into environmental aspects of Terrazzo
Contents

- Introduction - Quiligotti
- Section 1 - Features of Terrazzo & Typical Applications
- Section 2 - Slip Resistance
- Section 3 - Environment & Sustainability
- Section 4 - Components and Manufacturing
- Section 5 - Sub Floors & Fixing Methods
- Section 6 - Cleaning & Maintenance
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Introduction to Quiligotti
Introduction to Quiligotti

- Quiligotti established in 1948 in Stockport, Manchester.
- Quiligotti has since re-located its factory at Clifton Junction, Manchester.
- Quiligotti is a leading manufacturer of terrazzo tiles and precast terrazzo solutions offering innovative, design, manufacturing capabilities.
- The Quiligotti brand is recognised worldwide.
Today, Quiligotti is recognised as a market leading manufacturer of specialist durable flooring solutions.

Terrazzo is known for its durability.

Quiligotti Terrazzo tiles are available in a range of contemporary and natural colours, and bespoke colours can be achieved for larger projects, where Terrazzo is specified.
Section 1 - Features of Terrazzo & Typical Applications
Terrazzo

- Terrazzo is a hard floor covering which has been used since the Roman times.
- Terrazzo is used in large areas where durable, long lasting floor covering is required.
- Usually specified in mass transit areas

Grand Arcade, Wigan
Durability

- Resistant to
  - Impact
  - Fire
  - Frost
  - Abrasion
  - Wheeled traffic
  - Damage
- Will outlast most other types of floor
- Requires little maintenance
- Can withstand intense traffic and spillages

Waterloo Station Concourse
Smooth Level Floor

- Monolithic surface
- No lipping
- Suitable for wheeled and trolley traffic
- Seamless appearance

Manchester Airport
Pre-Cast Options

- Can be formed into
  - Stair cases
  - Skirtings
  - Column bases
  - Other bespoke designs pre-cast
- Terrazzo can be made in almost any shape depending on complexity and application
- Pre-cast options are usually finished, polished and delivered to site ready for installation
- Pre-cast units are manufactured to BS 5385 Part 5 2009

The Potteries, Hanley
Bespoke Design Options

- Selection of materials allows bespoke colours to be created
- Bespoke designs can be created with water jet cutting and patterns

Cleveland Centre, Middlesbrough
Fire Proof

- Non-combustible Class A1 – does not contribute to fire
- Does not give off dangerous fumes if exposed to extreme high temperatures or fire
- Compliant with London Underground Engineering Standard 1-085 'Fire Safety Performance of Materials'.

Westminster Station, Jubilee Line, London
Anti-Static

- Can be used in operating theatres
- Conforms to BS ISO 2878 2011 and DHSS Technical memorandum HTM:2
Typical Applications

- Shopping Centres
- Railway Stations
- Underground
- Airports
- Mass Transit Areas
- Light Industrial
- Restaurants
- Cafes
- Retail
- External Areas

Grand Arcade, Wigan
Section 2 - Slip Resistance
Slips & Trips - The Facts From HSE

- Slips and trips are the most common cause of major injuries at work and account for 40% of all reported accidents to members of the public.
- 95% of reported slips and trips results in broken bones.
- Slips are estimated to cost over £1billion a year in terms of staff replacements, claims and lost business.
- Slips and trips at work accounted for in excess of 1.2 Million days lost work in 2010 – 2011.
The Law

- The law requires that walking surfaces are safe
- Main legal requirements are set out in the Workplace (Health, Safety and Welfare) Regulations 1992
- Other legal requirements apply, such as Building Regulations and Health & Safety Regulations
Requirements

- According to the Health & Safety Executive, flooring must be:
  - Suitable
  - Kept clean and dry where possible
  - Cleaned correctly
  - Fitted correctly
  - Maintained in good order
  - Ramps, raised platforms and other changes of level should be avoided, if they cannot they must be highlighted

Leeds Law Courts
Introduction

- There is no one common standard for slip resistance
- HSE provides guidance for
  - Flooring manufacturers
  - Architects and designers
  - Employers
  - Workers
  - Footwear manufacturers
- Flooring manufacturers use a range of test methods to assist
Terrazzo tiles are tested using the Pendulum Test Method BS EN 13036-4:2011.

Used for determining the coefficient of friction under wet and dry conditions using using a 96 (formerly Four S) Rubber Slider.

When using the pendulum method the following slip resistant values are achieved on the standard Terrazzo Tiles and Slip-Resistant Terrazzo Tiles:

<table>
<thead>
<tr>
<th>Slip Potential</th>
<th>Pendulum Test Value (PTV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Slip Potential</td>
<td>24 and Below</td>
</tr>
<tr>
<td>Moderate Slip Potential</td>
<td>25 to 35</td>
</tr>
<tr>
<td>Low Slip Potential</td>
<td>36+</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standard Tile</th>
<th>Slip Resistant Tile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry 65</td>
<td>Dry 65</td>
</tr>
<tr>
<td>Wet 35</td>
<td>Wet 40+</td>
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</table>
Section 3 - Environment & Sustainability
Environment & Sustainability

- Natural ingredients
- Aggregates
- Stable long lasting product
- Refurbishment
- Does not require use of harmful chemicals
- PH7 neutral cleaning agent can be used
Life Cycle Costs

<table>
<thead>
<tr>
<th>Flooring Material</th>
<th>£ m²/Year</th>
<th>Life Span</th>
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</thead>
<tbody>
<tr>
<td>Ceramic Quarry</td>
<td>1.70</td>
<td>50</td>
</tr>
<tr>
<td>Terrazzo Quarry</td>
<td>3.41</td>
<td>50</td>
</tr>
<tr>
<td>Exposed Concrete</td>
<td>4.50</td>
<td>50</td>
</tr>
<tr>
<td>Linoleum</td>
<td>7.49</td>
<td>50</td>
</tr>
<tr>
<td>Laminated Wood</td>
<td>19.32</td>
<td>50</td>
</tr>
<tr>
<td>Epoxy Resin</td>
<td>21.86</td>
<td>50</td>
</tr>
<tr>
<td>Carpet (Cushion)</td>
<td>31.16</td>
<td>25</td>
</tr>
<tr>
<td>Carpet (Hard)</td>
<td>33.40</td>
<td>10</td>
</tr>
<tr>
<td>Carper Plank</td>
<td>38.23</td>
<td>6</td>
</tr>
<tr>
<td>Vinyl Comp</td>
<td>40.74</td>
<td>25</td>
</tr>
<tr>
<td>Vinyl Sheet</td>
<td>47.63</td>
<td>25</td>
</tr>
<tr>
<td>Bamboo</td>
<td>51.09</td>
<td>10</td>
</tr>
<tr>
<td>Cork</td>
<td>51.32</td>
<td>10</td>
</tr>
<tr>
<td>Rubber Sheet</td>
<td>58.23</td>
<td>50</td>
</tr>
<tr>
<td>Tile (Hard)</td>
<td>78.08</td>
<td>50</td>
</tr>
<tr>
<td>Tile (Cushion)</td>
<td>130.06</td>
<td>15</td>
</tr>
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</table>

Section 4 – Components and Manufacturing
## Terrazzo Tile Components

### Typical aggregate sizes
- Z0 (Micro)
- 2-4mm
- 0-5mm
- 4-6mm
- 3-8mm
- 6-9mm
- 9-12mm
- 12-18mm
- 12-20mm

### Aggregates – UK
- Hillhead Limestone
- Devon Red
- Silver Grey Granite
- Derbyshire Spar

### Aggregates – Overseas
- Spanish Beige
- Spanish Grey
- Spanish Dolomite
- Polar White
- Turkish White
- Zandobbio
- Black
- Botticino
- Breccia Aurora
- Italian White
- Red Verona
- Rosa Corallo
- Verdi Alpi
- Yellow Sienna
- Nordic White

### Cement Colours
- White Cement
- Portland Grey
- + Colour Pigments

### Slip Resistant Materials
- Silver Grey Granite
- Flyntag
- Carborundum
- Aluminium Oxide
Manufacturing Process

- Marble aggregates are sourced from material waste from a quarry and made to suitable size.
- Aggregates and cements are automatically weighed out into the tile press mixer where water and pigments are added.
- The mix is dosed into a tile press and the material is vibrated to ensure that the mix is evenly spread in the mould.
- The tile backing made from a mixture of Portland cement and limestone aggregate is applied on top of the face mix in the mould and the tile is pressed.
- The pressed tiles are removed and put in a curing chamber where the tile gains strength and cure overnight.
- The tiles go through a grinding machine which produces a smooth even surface to the tile and exposes the aggregate in the face of the tile.
Section 5 - Sub-Floors & Fixing Methods
Sub-Floors

Light Tamped Concrete
Uneven / rough surface

Power Floated Concrete
Smooth tight, finish
Sub-Floor & Bedding

Terrazzo Floor Slab:
300 x 300 28mm.

Sand & Cement Bed:
Minimum 25mm,
Maximum 72mm
from highest point of sub-floor
Cement. Sand 1:3 mixed with
water to "semi-dry" consistency.

Base:
Tamped Concrete. Level
and true but "never"
smooth. Concrete cured
for 42 days.
Partially or Semi-Bonded Fixing Method

Base
Base is usually light tamped concrete, which is prepared by simple stiff brushing prior to the start of the screeding operation.

Process
The concrete base is thoroughly wetted and the cement/sand bedding is laid directly onto the concrete substrate. The water acts merely to prevent undue suction and leaves a weak bond between the existing concrete and the new screed.

Movement
If any subsequent movement occurs in the concrete structure, the floor finish system will tend to shear along the weak bonding point between the concrete and tile bed rather than transferring any movement through the tiles.
Fully Bonded Fixing Method

Base
Usually light tamped concrete which is either mechanically scabbled or shotblasted to remove any surface laitance and expose more aggregate in the concrete to achieve a better key.

Process
A bonding agent is applied directly to the slab. This is usually a slurry coat of neat cement, water and polymer additive brushed onto the slab with the sand/cement bedding then applied on top.

Movement
If any subsequent movement occurs in the concrete base structure this will be reflected through the monolithic structure. Well designed movement joints are essential.
De-Bonded Fixing Method

Base
- Often on suspended concrete floor liable to deflection
- Where it is not possible to follow joints in the concrete sub-floor
- Variations in type of concrete slab onto which can be tiled

Process
The principle is to isolate the floor finish (terrazzo tile and bed) from the concrete slab so that movement is not transferred into the tiles and bedding. The floor is normally isolated (de-bonded) using, for example, a layer of polythene lapped at the edges.

Movement
Because the sub-floor and terrazzo tile and bed are de-bonded movement is not transferred into the tiles and bedding.

Leeds Law Courts
Typical Installation Method

**Preparation**: Concrete floor is swept and the floor is damped down with water

**Laying of tiles**: The semi-dry cement:sand screed, typically 1:3-4 is placed on the concrete and spread to the correct level. Tiles are laid with joints 2mm-3mm

**Grout**: Grout is neat mix of cement, water and colour pigments to either match the colour of the tile or offer a contrast grout line

**Grouting**: The flood grouting method is more efficient than traditional cement grouting as it ensures better penetration of joints

**Grinding & Finishing**: Mechanically ground and polished on site

**Sealing**: Tiles can be sealed using penetrating sealer
Section 6 - Cleaning & Maintenance
Cleaning & Maintenance

Day To Day

- Effective cleaning and maintenance regime is essential in keeping the flooring in good condition and to prevent slips and trips
- Entrance matting and air curtains help in preventing slips
- Close off and clean up contaminations
- Train the cleaning staff to use correct detergents
- Effective maintenance prevents slip and trip hazards

Long Term

- Using a penetrative sealer with Terrazzo can help keep floor in good condition
- Refurbishment is possible on most standard Terrazzo products
Section 7 - Technical Characteristics
## Technical Data

<table>
<thead>
<tr>
<th>Technical Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sizes and Typical Weights</td>
<td></td>
</tr>
<tr>
<td>300 x 300 x 28mm = 66 kg/m²</td>
<td></td>
</tr>
<tr>
<td>297 x 297 x 28mm = 66 kg/m²</td>
<td></td>
</tr>
<tr>
<td>397 x 397 x 33mm = 78 kg/m²</td>
<td></td>
</tr>
<tr>
<td>400 x 400 x 18mm = 78 kg/m²</td>
<td></td>
</tr>
<tr>
<td>497 x 497 x 38mm = 90 kg/m²</td>
<td></td>
</tr>
<tr>
<td>500 x 500 x 38mm = 90 kg/m²</td>
<td></td>
</tr>
<tr>
<td>597 x 597 x 42mm = 99 kg/m²</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical Dimensional Tolerances</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length &amp; Width</td>
<td>300mm to 400mm +/- 1.0mm</td>
</tr>
<tr>
<td>Thickness</td>
<td>30mm to 35mm +/- 2.0mm</td>
</tr>
<tr>
<td>Thickness</td>
<td>38mm to 42mm +/- 3.0mm</td>
</tr>
</tbody>
</table>
Pre-Cast Stair Units

<table>
<thead>
<tr>
<th>Technical Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riser Height</td>
<td>Maximum 200mm</td>
</tr>
<tr>
<td>Going</td>
<td>Maximum 400mm</td>
</tr>
<tr>
<td>Tread Thickness</td>
<td>Minimum 40mm</td>
</tr>
</tbody>
</table>
| Length                     | Up to 1.5m in length – 40mm thick  
                            | Between 1.5m – 2m – 50mm thick  
                            | Above 2m – depends on specification |
| Non-slip Nosings or Inserts| Usually cast in during manufacture, can provide contrasting features in line with DDA requirements |
| Tolerances                 | Allow a minimum of 18mm for sand/cement bed over and above concrete tolerances |
## Pre-Cast Skirting Units

<table>
<thead>
<tr>
<th>Technical Characteristics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>Maximum length 906mm</td>
</tr>
<tr>
<td>Adhesives</td>
<td>Allow 5mm over tolerances for fixing to wall with thin bed adhesive. Allow 12mm over tolerances for fixing to wall with sand / cement adhesive mix.</td>
</tr>
<tr>
<td>Thickness</td>
<td>Often determined by the size of the aggregate used. The aggregate would not normally exceed 15mm.</td>
</tr>
<tr>
<td>Projection</td>
<td>If the skirting is to project in front of the general wall lining, the top of skirting should have a pencil round arris.</td>
</tr>
<tr>
<td>Flush</td>
<td>If the skirting is to be flush with the wall lining, then the top of the skirting should be left square.</td>
</tr>
<tr>
<td>Pre-Cast</td>
<td>Different designs can be manufactured</td>
</tr>
</tbody>
</table>
Section 8 – References & Summary
Advice & References

- NBS M41 Specification
- BS EN 13748-1:2004 - ‘Standard for Terrazzo Tiles for internal use’
- BS 5385 : Part 5 2009 - ‘Code of practice for the design and installation of terrazzo, natural stone and agglomerated stone tile and slab floorings’
- BS 8000 Part 11 2011 - ‘Code of practice for internal and external wall and floor tiling. Ceramic and agglomerated stone tiles, natural stone and terrazzo tiles and slabs, and mosaics’
- BS ISO 2878 2011 Rubber, vulcanised or thermoplastic. Antistatic and conductive products. And DHSS Technical memorandum HTM:2’
Summary

- Terrazzo is a hard wearing flooring which can be used indoors and outdoors and in many applications.
- HSE believes that by getting the correct flooring specified many accidents would be eliminated.
- Ideal base for Terrazzo is light tamped concrete.
- Ideal bedding for Terrazzo is a semi-dry mix of sand and cement 1:3-4.
- Terrazzo is normally ground on site producing a monolithic surface which is suitable for a variety of applications.
- Terrazzo can be supplied as a finished tile eliminating the need for post-grinding on site.