Utilization of Scrubber Waste in Dry Cast Concrete Products

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Company:
Brampton Brick Limited
Presentation Outline

Background
Purpose
Batch Design

• Mix Design
• Materials
• Machinery

Physical Properties Measured

• Colorimeter
• Compression
• Absorptions
Plant Locations

- Brampton Brick
- Peel Block
Background

Brampton Brick Scrubber Limestone Waste

• 100 Tons per Month

Peel Block Concrete Plant Raw Materials

• 1280 Tons per Month

Substituting Raw Material

• 7%–8%
• 89.6 Tons–102.4 Tons
Purpose

To manufacture a durable concrete product using limestone waste from a scrubber, as a substitute for a portion of the aggregates.
Sieve Analysis Raw Material

Sieve Size (µm) vs. Amount Retained on Sieve (%)

- Scrubber Limestone
- Coarse
- Fines
Median Particle Diameter

Median Particle Diameter (µm)

Sample Date

0.4 0.42 0.44 0.46 0.48 0.5 0.52 0.54 0.56 0.58 0.6

Experimental Results of Scrubber Limestone Addition Sieve Analysis

Cumulative Amount Retained on Sieve (%)

Sieve Size (µm)

- 0% Limestone
- 2% Limestone
- 4% Limestone
- 6% Limestone
- 8% Limestone
- 10% Limestone
- 12% Limestone
## Laboratory Batch Design

Table 2: Laboratory Batch Design

<table>
<thead>
<tr>
<th>Product</th>
<th>Total Cementitious Material (g)</th>
<th>Total Fines (g)</th>
<th>Total Coarse (g)</th>
<th>Total Aggregates (g)</th>
<th>Batch Total (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masonry</td>
<td>315</td>
<td>2100</td>
<td>2700</td>
<td>5000</td>
<td>5315</td>
</tr>
</tbody>
</table>
# Batch Design

Table 1: Peel Block Aggregate Percentages

<table>
<thead>
<tr>
<th>Product</th>
<th>Fines in Batch (%)</th>
<th>Coarse in Batch (%)</th>
<th>Cementations Material in Batch (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masonry</td>
<td>54.6</td>
<td>39.1</td>
<td>6.3</td>
</tr>
</tbody>
</table>
Final Product

Concrete Puck
Physical Properties of the Final Product

- Colorimeter Data
- Compressive Strengths
- Water Absorptions
Colorimeter Data

Diagram 1: 3-D Colorimeter Wheel

**Lightness**
- Measure of brightness.
- Represented as “L”.

**Hue**
- Measure of colour.
- Represented as “a”.

**Chroma**
- Measure of intensity or charity.
- Represented as “b”.

- +L: White
- -L: Black
- +b: Yellow
- -b: Blue
- +a: Red
- -a: Green
Color Difference

Absolute Error = $\Delta E$

$\Delta E = \sqrt{(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2}$
Color Difference Between Samples

Absolute Error ($\Delta E$)

Amount of Limestone Added (%)
Compressive Strength vs Limestone Addition

Compressive Strength (mPa)

Amount of Limestone Added (%)
24 hr Cold Water Absorption

Amount of Limestone (%) vs. Water Absorption (%)
5 hr Boil

Water Absorption

Water Absorption (%)

Amount of Limestone (%)
Saturation Coefficient

C/B Ratio

Amount of Limestone (%)
Future Trials

- Replace Screening with the Sand
- Freeze - Thaw
- Plant Trial
Acknowledgements

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Questions

Comments