

Tarmac Cement National Laboratory
 Yelsway Lane
 Waterhouses
 Staffordshire
 ST10 3AZ

31.07.2020

Composition of Ground Granulated Blastfurnace Slag

**Tudela EN 15167-1 GGBS
 (0099/CPR/B34/0001)**

Based on the **May 2020** monthly composite sample:

| Property | | | Value | BS EN 15167-1 Limit |
|--------------------------------------|---------------------------------|--------------------|-------|--------------------------|
| Magnesia | MgO | % | 7.57 | ≤ 18.0% |
| Sulfate | SO ₃ | % | 0.22 | ≤ 2.5% |
| Sulfide | S ²⁻ | % | 0.76 | ≤ 2.0% |
| Chloride | Cl ⁻ | % | 0.02 | ≤ 0.1% |
| Alkalis | Na ₂ O _{eq} | % | 0.60 | - |
| Alumina | Al ₂ O ₃ | % | 10.53 | ≤ 14%* |
| Fineness | SSA | m ² /kg | 491 | ≥ 275 m ² /kg |
| 7 Day Activity Index – April Sample | | % | 60 | >40% |
| 28 Day Activity Index – April Sample | | % | 81 | >65% |
| Declared Mean Alkali Content | Na ₂ O _{eq} | % | 0.70 | - |
| Declared Maximum Chloride Content | Cl ⁻ | % | 0.05 | - |

**Upper limit in BS 8500 for use in '+SR' combinations*

For and on behalf of Tarmac Cement:

S. Chudley

Simon Chudley

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29.07.2020

Conformity of Ground Granulated Blast Furnace Slag to BS 8500-2: Annex A

**Tudela EN 15167-1 GGBS
 (0099/CPR/B34/0001)**

Based on the **May 2020** monthly composite samples of:

| Constituent | Source |
|-----------------|----------------------|
| EN 15167-1 GGBS | Tudela |
| EN 197-1 CEM I | Aberthaw CEM I 52,5N |

The results of compressive strength testing (in accordance with BS EN 196-1) on a 50:50 blend of CEM I with GGBS were:

| | |
|-----------------------|------|
| 7 Day Strength (MPa) | 32.7 |
| 28 Day Strength (MPa) | 54.5 |

Based on equivalent results obtained for the last 1 month, the permitted proportions of combinations conforming to the requirements of Annex A of BS 8500-2 are:

| Strength Class of Combination | GGBS Content (%) | |
|-------------------------------|------------------|-----|
| | Min | Max |
| 32,5L | 56 | 80 |
| 42,5L | 6 | 67 |
| 52,5L | 6 | 29 |

| BS 8500-2 Combination Designation | GGBS Content (%) | |
|-----------------------------------|------------------|-----|
| | Min | Max |
| CIIS | 6 | 35 |
| CIIIA | 36 | 65 |
| CIIB | 66 | 80 |

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Conformity of Ground Granulated Blast Furnace Slag to BS 8500-2: Annex A

**Tudela EN 15167-1 GGBS
 (0099/CPR/B34/0001)**

Based on the **May 2020** monthly composite samples of:

| Constituent | Source |
|-----------------|---------------------|
| EN 15167-1 GGBS | Tudela |
| EN 197-1 CEM I | Cauldon CEM I 52,5N |

The results of compressive strength testing (in accordance with BS EN 196-1) on a 50:50 blend of CEM I with GGBS were:

| | |
|-----------------------|------|
| 7 Day Strength (Mpa) | 34.8 |
| 28 Day Strength (MPa) | 58.2 |

Based on equivalent results obtained for the last 1 month, the permitted proportions of combinations conforming to the requirements of Annex A of BS 8500-2 are:

| Strength Class of Combination | GGBS Content (%) | |
|-------------------------------|------------------|-----|
| | Min | Max |
| 32,5L | 70 | 80 |
| 42,5L | 31 | 77 |
| 52,5L | 6 | 54 |

| BS 8500-2 Combination Designation | GGBS Content (%) | |
|-----------------------------------|------------------|-----|
| | Min | Max |
| CIIS | 6 | 35 |
| CIIIA | 36 | 65 |
| CIIB | 66 | 80 |

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Conformity of Ground Granulated Blast Furnace Slag to BS 8500-2: Annex A

**Tudela EN 15167-1 GGBS
 (0099/CPR/B34/0001)**

Based on the **May 2020** monthly composite samples of:

| Constituent | Source |
|-----------------|--------------------|
| EN 15167-1 GGBS | Tudela |
| EN 197-1 CEM I | Dunbar CEM I 52,5N |

The results of compressive strength testing (in accordance with BS EN 196-1) on a 50:50 blend of CEM I with GGBS were:

| | |
|-----------------------|------|
| 7 Day strength (Mpa) | 26.9 |
| 28 Day Strength (MPa) | 57.3 |

Based on equivalent results obtained for the last 1 month, the permitted proportions of combinations conforming to the requirements of Annex A of BS 8500-2 are:

| Strength Class of Combination | GGBS Content (%) | |
|-------------------------------|------------------|-----|
| | Min | Max |
| 32,5L | 76 | 80 |
| 42,5L | 39 | 80 |
| 52,5L | 6 | 49 |

| BS 8500-2 Combination Designation | GGBS Content (%) | |
|-----------------------------------|------------------|-----|
| | Min | Max |
| CIIS | 6 | 35 |
| CIIIA | 36 | 65 |
| CIIB | 66 | 80 |

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Conformity of Ground Granulated Blast Furnace Slag to BS 8500-2: Annex A

**Tudela EN 15167-1 GGBS
 (0099/CPR/B34/0001)**

Based on the **May 2020** monthly composite samples of:

| Constituent | Source |
|-----------------|------------------|
| EN 15167-1 GGBS | Tudela |
| EN 197-1 CEM I | Hope CEM I 52,5N |

The results of compressive strength testing (in accordance with BS EN 196-1) on a 50:50 blend of CEM I with GGBS were:

| | |
|-----------------------|------|
| 7 Day Strength (Mpa) | 33.3 |
| 28 Day Strength (Mpa) | 54.6 |

Based on equivalent results obtained for the last 1 month, the permitted proportions of combinations conforming to the requirements of Annex A of BS 8500-2 are:

| Strength Class of Combination | GGBS Content (%) | |
|-------------------------------|------------------|-----|
| | Min | Max |
| 32,5L | 60 | 80 |
| 42,5L | 6 | 71 |
| 52,5L | 6 | 39 |

| BS 8500-2 Combination Designation | GGBS Content (%) | |
|-----------------------------------|------------------|-----|
| | Min | Max |
| CIIS | 6 | 35 |
| CIIIA | 36 | 65 |
| CIIB | 66 | 80 |

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Conformity of Ground Granulated Blast Furnace Slag to BS 8500-2: Annex A

**Tudela EN 15167-1 GGBS
 (0099/CPR/B34/0001)**

Based on the **May 2020** monthly composite samples of:

| Constituent | Source |
|-----------------|----------------------|
| EN 15167-1 GGBS | Tudela |
| EN 197-1 CEM I | Limerick CEM I 52,5N |

The results of compressive strength testing (in accordance with BS EN 196-1) on a 50:50 blend of CEM I with GGBS were:

| | |
|-----------------------|------|
| 7 Day Strength (Mpa) | 29.8 |
| 28 Day Strength (Mpa) | 53.0 |

Based on equivalent results obtained for the last 1 month, the permitted proportions of combinations conforming to the requirements of Annex A of BS 8500-2 are:

| Strength Class of Combination | GGBS Content (%) | |
|-------------------------------|------------------|-----|
| | Min | Max |
| 32,5L | 52 | 80 |
| 42,5L | 17 | 71 |
| 52,5L | 6 | 40 |

| BS 8500-2 Combination Designation | GGBS Content (%) | |
|-----------------------------------|------------------|-----|
| | Min | Max |
| CIIS | 6 | 35 |
| CIIIA | 36 | 65 |
| CIIB | 66 | 80 |

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**Tudela EN 15167-1 GGBS
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Based on the **May 2020** monthly composite samples of:

| Constituent | Source |
|-----------------|--------------------|
| EN 15167-1 GGBS | Tudela |
| EN 197-1 CEM I | Platin CEM I 52,5N |

The results of compressive strength testing (in accordance with BS EN 196-1) on a 50:50 blend of CEM I with GGBS were:

| | |
|-----------------------|------|
| 7 Day Strength (Mpa) | 33.1 |
| 28 Day Strength (MPa) | 55.1 |

Based on equivalent results obtained for the last 1 month, the permitted proportions of combinations conforming to the requirements of Annex A of BS 8500-2 are:

| Strength Class of Combination | GGBS Content (%) | |
|-------------------------------|------------------|-----|
| | Min | Max |
| 32,5L | 64 | 80 |
| 42,5L | 6 | 73 |
| 52,5L | 6 | 42 |

| BS 8500-2 Combination Designation | GGBS Content (%) | |
|-----------------------------------|------------------|-----|
| | Min | Max |
| CIIS | 6 | 35 |
| CIIIA | 36 | 65 |
| CIIB | 66 | 80 |

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**Tudela EN 15167-1 GGBS
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Based on the **May 2020** monthly composite samples of:

| Constituent | Source |
|-----------------|-------------------|
| EN 15167-1 GGBS | Tudela |
| EN 197-1 CEM I | Quinn CEM I 52,5N |

The results of compressive strength testing (in accordance with BS EN 196-1) on a 50:50 blend of CEM I with GGBS were:

| | |
|-----------------------|------|
| 7 Day Strength (Mpa) | 36.9 |
| 28 Day Strength (MPa) | 58.5 |

Based on equivalent results obtained for the last 1 month, the permitted proportions of combinations conforming to the requirements of Annex A of BS 8500-2 are:

| Strength Class of Combination | GGBS Content (%) | |
|-------------------------------|------------------|-----|
| | Min | Max |
| 32,5L | 73 | 80 |
| 42,5L | 6 | 79 |
| 52,5L | 6 | 63 |

| BS 8500-2 Combination Designation | GGBS Content (%) | |
|-----------------------------------|------------------|-----|
| | Min | Max |
| CIIS | 6 | 35 |
| CIIIA | 36 | 65 |
| CIIB | 66 | 80 |

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Based on the **May 2020** monthly composite samples of:

| Constituent | Source |
|-----------------|----------------------|
| EN 15167-1 GGBS | Tudela |
| EN 197-1 CEM I | Tunstead CEM I 52,5N |

The results of compressive strength testing (in accordance with BS EN 196-1) on a 50:50 blend of CEM I with GGBS were:

| | |
|-----------------------|------|
| 7 Day Strength (MPa) | 33.3 |
| 28 Day Strength (Mpa) | 59.3 |

Based on equivalent results obtained for the last 1 month, the permitted proportions of combinations conforming to the requirements of Annex A of BS 8500-2 are:

| Strength Class of Combination | GGBS Content (%) | |
|-------------------------------|------------------|-----|
| | Min | Max |
| 32,5L | 69 | 80 |
| 42,5L | 38 | 76 |
| 52,5L | 6 | 56 |

| BS 8500-2 Combination Designation | GGBS Content (%) | |
|-----------------------------------|------------------|-----|
| | Min | Max |
| CIIS | 6 | 35 |
| CIIIA | 36 | 65 |
| CIIB | 66 | 80 |

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