

Tarmac Cement National Laboratory  
 Yelsway Lane  
 Waterhouses  
 Staffordshire  
 ST10 3AZ

29/03/2019

**Composition of Ground Granulated Blastfurnace Slag**

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

Based on the **January 2019** monthly composite sample:

| Property   | Value | BS EN 15167-1 Limit |
|--|-------|---------------------|
| Magnesia (% MgO)                                       | 7.49  | Max 18%             |
| Sulfate (% SO <sub>3</sub> )                           | 0.21  | Max 2.5%            |
| Sulfide (% S <sup>2-</sup> )                           | 0.84  | Max 2.0%            |
| Chloride (% Cl) %                                      | 0.018 | Max 0.10%           |
| Alkalis (% Na <sub>2</sub> O eq)                       | 0.64  | -                   |
| Alumina (% Al <sub>2</sub> O <sub>3</sub> )            | 11.40 | Max 14%*            |
| Fineness (m <sup>2</sup> /kg)                          | 463   | -                   |
| Declared Mean Alkali Content (% Na <sub>2</sub> O) eq) | 0.70  | -                   |

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

For and on behalf of Tarmac Cement:

*W.F. Price*

**Dr Bill Price**

**National Commercial Technical Manager  
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**TARMAC.COM**

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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 **January 2019** 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)  | 36.0 |
| 28 Day Strength (MPa) | 58.5 |

Based on equivalent results obtained for the last **12** months, 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                         | 65               | 80  |
| 42,5L                         | 16               | 73  |
| 52,5L                         | 6                | 45  |

| 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 **January 2019** 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)  | 29.7 |
| 28 Day Strength (MPa) | 58.3 |

Based on equivalent results obtained for the last **12** months, 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                         | 62               | 80  |
| 42,5L                         | 6                | 71  |
| 52,5L                         | --               | --  |

| 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 **January 2019** 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)  | 25.6 |
| 28 Day Strength (MPa) | 59.0 |

Based on equivalent results obtained for the last **12** months, 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                         | 62               | 80  |
| 42,5L                         | 6                | 72  |
| 52,5L                         | 6                | 44  |

| 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  
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Based on the **January 2019** 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)  | 33.5 |
| 28 Day Strength (MPa) | 58.0 |

Based on equivalent results obtained for the last **12** months, 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               | 79  |
| 42,5L                         | 6                | 67  |
| 52,5L                         | 6                | 38  |

| 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 **January 2019** monthly composite samples of:

| Constituent     | Source             |
|-----------------|--------------------|
| EN 15167-1 GGBS | Tudela             |
| EN 197-1 CEM I  | Lemona CEM I 52,5R |

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)  | 32.6 |
| 28 Day Strength (MPa) | 57.1 |

Based on equivalent results obtained for the last **12** months, 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                         | 61               | 80  |
| 42,5L                         | 13               | 72  |
| 52,5L                         | 6                | 33  |

| 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 **January 2019** 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)  | 32.5 |
| 28 Day Strength (MPa) | 56.8 |

Based on equivalent results obtained for the last **12** months, 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                         | 55               | 80  |
| 42,5L                         | 6                | 68  |
| 52,5L                         | 6                | 30  |

| 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 Blastfurnace Slag to BS 8500-2: Annex A**

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

Based on the **January 2019** 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)  | 32.9 |
| 28 Day Strength (MPa) | 54.6 |

Based on equivalent results obtained for the last **12** months, 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                         | 63               | 80  |
| 42,5L                         | 6                | 72  |
| 52,5L                         | --               | --  |

| 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 **January 2019** 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)  | 36.1 |
| 28 Day Strength (MPa) | 58.2 |

Based on equivalent results obtained for the last **12** months, 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                         | 32               | 73  |
| 52,5L                         | 6                | 47  |

| 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 **January 2019** 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)  | 32.1 |
| 28 Day Strength (MPa) | 59.0 |

Based on equivalent results obtained for the last **12** months, 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                         | 58               | 78  |
| 42,5L                         | 6                | 66  |
| 52,5L                         | 6                | 45  |

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

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