

## Brick Technical Bulletin - Concrete Engineering Quality Bricks

BTB 11

### INTRODUCTION

Concrete Engineering Quality Bricks (EQs) produced by Marshalls satisfy the majority of criteria in terms of technical performance, but more importantly they are produced at a number of strategically placed factories across the country and are generally available on an ex stock basis. They were introduced over 30 years ago following the result of an extensive independent research and development programme and have been widely used in all forms of civil and general construction since then.

Produced in a solid form, a format in which the clay brick manufacturers may have limited volumes, the Marshalls EQ brick offers a cost competitive solution for ground works and utility constructions.

### HISTORY

The EQ brick was developed originally by Marshalls in the mid 1980s and its concept was adopted nationally by other concrete brick producers who existed at that time. The background was that there was a shortage of Clay Class Bs and a suitable alternative was required.

The original Standards for concrete bricks of BS 6073 and prior to that BS 1180, included a category for the production of 'Special Purpose' bricks which had a minimum cement content of 350kg/m<sup>3</sup> but with no recommendation as to where they could be used.

Research by Marshalls showed that although there were significant examples of other precast concrete units being used in underground and aggressive locations. eg. concrete pipes, rings, precast concrete manholes etc., there were no examples of performance of concrete bricks in these locations. A typical concrete brick in those days tended to be limited to a strength of 20N/mm<sup>2</sup> which restricted its use to above and below dpc.

The Building Research Establishment had carried out work in 1970 with concrete buried in sulphate bearing soils and had concluded that the criteria for suitability under these conditions was a low absorption, sulphate resistant unit. BRE Digest 250, which was really concerned with in-situ concrete, did allow precast units as long as they were made with some forms of sulphate resisting cement for up to Class 3 sulphate levels.

Marshalls then embarked on a programme of testing which resulted in the production of a brick with a minimum cement content of 350kg/m<sup>3</sup> and made from a cement mixture of either sulphate resisting cement (SRPC) or Ordinary Portland Cement and cement replacements such as Ground Granulated Blast Furnace Slag (GGBS) or Pulverised Fuel Ash (PFA). These blends gave the same degree of sulphate resistance as bricks made with SRPC.

To carry out a performance comparison of concrete and clay Class B bricks Marshalls commissioned the Laing Design and Development Centre to institute a six month programme. The test involved the construction of three walls of a simulated blocked manhole using three different types of concrete bricks (limestone, basalt, and limestone aggregates at 40, 40, and 20 N/mm<sup>2</sup> respectively). The fourth was built using a Clay Class B brick. The chamber was filled with a simulated acidic effluent, the pH of which was maintained throughout the six month experiment. Laing's subsequent report gave conclusions as follows:

*'The evidence produced shows that any of the three types of concrete brick is suitable for manhole construction, but if there is a preference it is for the 40N/mm<sup>2</sup> limestone one.'*

*'All three types performed extremely well and only lost fractions of a millimetre at their exposed surfaces in an acid effluent for 6 months and only then from the three month interval.'*

*'Under practical conditions of use, a lifetime of many decades can be predicted for any of the bricks provided good workmanship is followed and the conditions of exposure lie within the ranges tabulated.'*

Following these test results Marshalls applied for an Agrément Certificate which was granted in 1986. This Agrément Certificate has not been replaced as the collated data from it formed part of the updated concrete masonry Standard BS 6073 and subsequently BS 771-3.

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### TYPICAL APPLICATIONS

Marshalls Engineering Quality bricks are particularly suitable above and below ground level where aggressive conditions occur and/ or where natural sulphate levels up to and including Class 3 are present. They are especially suitable in chimney stacks, manholes, drainage inspection chambers, retaining walls, copings and caps and other constructions subject to aggressive conditions.

### APPROVALS

Engineering Quality bricks are approved under the following Standard and by the following authorities:

1. EQ bricks comply with BS EN 771-3: 2011
2. Bricks produced to the EQ specification comply with Table 12 'Durability of Masonry in Finished Construction' BS 5628-3: 2005 and in the subsequent Standard PD 6697: 2010.
3. Freeze-thaw tests carried out the BRE in Scotland concluded that EQ bricks could be classed as frost resistant and equivalent to the old Category 'F' for clay bricks. They have minimal soluble salts.
4. As EQ bricks comply with BS EN 771-3 and BS 5628, and in addition are suitable for use up to and including Class 3 sulphate levels, the bricks are approved by the National House Building Council.
5. BS 8301: 1985: Clause 5.73 (now replaced by BS EN 752) states that a 40N/mm<sup>2</sup> concrete brick with a minimum cement of 350kg/m<sup>3</sup> should be used in foul situations. Consequently this Standard is referred to under the Building Regulations.
6. EQ bricks can be used for inspection chambers, manholes and catch pits which are to be adopted by a Local Authority. In particular they are approved in:
  - WAA 'Civil Engineering Specification for the Water Industry'
  - Water Services Association's Guide 'Sewers for Adoption'
  - Highways Agency 'Specification for Highway Works'.

### PERFORMANCE

Under BS 5628: Part 3: 2005 and PD 6697, the required strength requirement for use in foul situations requires the strength of concrete bricks to be 48N/mm<sup>2</sup>. Marshalls EQs are produced to a compressive strength of 50N/mm<sup>2</sup>. In addition they are produced using a cement mix which is suitable up to Class 3 sulphate conditions.

**Note:** It should be noted that the requirement for a Clay Class B brick in the same location is now 75N/mm<sup>2</sup>. THIS IS PURELY BECAUSE THE TEST METHOD FOR PREPARING AND TESTING THE COMPRESSIVE STRENGTH OF CLAY BRICKS HAS CHANGED.

### APPEARANCE

Marshalls EQs are produced in a fully solid format and are a dark red colour. The colour is primarily due to cosmetic perceptions of what an Engineering Brick looks like. Marshalls EQs are not classed as facing bricks, although in certain locations their appearance may be aesthetically acceptable.

Marshalls EQs are a solid brick, produced to extremely tight tolerances with a smooth, reddish colour appearance.

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### BRICK COMPARISON

#### Concrete EQs compared to Clay Class Bs

Clay Engineering bricks are categorised into two types: Class 'A' with a compressive strength of 125N/mm<sup>2</sup> and Class 'B' with a compressive strength of 75N/mm<sup>2</sup>. Following on from the introduction of the new Standard for clay bricks, BS 771-1, the strength categories of these bricks were increased purely due to a change in the preparations of the sample prior to compressive testing. THE BASIC COMPOSITION OF THE BRICKS HAS NOT CHANGED.

The use of Clay Class B and Concrete EQs is covered in both BS 5628: Part 3 and PD 6697.

The requirement for long term durability should not be confused with the different compressive strengths exhibited by different materials. Only a few specialised structural situations require bricks with strengths in excess of 35N/mm<sup>2</sup>. In the majority of situations, where durability is the prime requirement, Concrete EQs perform in the same way as Clay Class B bricks.

### LIMITATIONS OF USE

EQs should not be used in excessively strong acid environments. However, it should be noted that in these particular locations, if built with any brick, then the mortar joints may be subject to attack and consideration should be given to using an alternative form of construction.

They are also not suitable for use as dpcs.

### ADVANTAGES OF CONCRETE EQS

EQs are produced in solid form with no frogs, perforations or voids, which is the preferred option for a number of Local Authorities and Agencies.

Concrete hardens with age. A brick which is 50 N/mm<sup>2</sup> strength at its early stage will keep increasing in strength and resistance to moisture.

Marshalls EQ's are a custom made unit manufactured on a Regional basis with competitive prices, consistent availability and realistic delivery periods.

### SUMMARY

The development of the Concrete EQ, which has been in existence now for over 30 years, has led to its increased use as a cost effective, readily available masonry unit. Produced on a regional basis throughout the UK it is generally available from stock and can be delivered either direct to site or via the extensive network of Builders Merchants supplied by Marshalls.