



**TRANSPORT SCOTLAND (Agency of the Scottish Executive)
TRUNK ROAD NETWORK MANAGEMENT (Bridges)**

**TS INTERIM AMENDMENT No 22 – IMPLEMENTATION OF NEW
REINFORCEMENT STANDARDS (BS 4449:2005, BS 4482:2005, BS 4483: 2005 and BS
8666:2005)**

1. Introduction

This Interim Amendment should be read by all those involved in highway works contracts and should be freely disseminated throughout the supply chain. This Interim Amendment shall be implemented for all scheme designs commencing on or after 1 January 2006. It also applies to ongoing scheme designs from 1 January 2006 provided that, in the opinion of the Overseeing Organisation, this would not result in significant additional cost or delay. Note: Further advice on implementation with respect to ongoing schemes is given in Section 3.

As a direct result of UK Membership of the European Union, the UK is required, amongst other obligations, to implement the requirements of the Construction Products Directive (CPD), and Public Procurement Directive (PPD), which includes requirements to implement European Standards as these become available.

BSI published BS EN 10080:2005 'Steel for the reinforcement of concrete – Weldable reinforcing steel – General' in December 2005 and new versions of the following related British Standards, for use in conjunction with BS EN 10080, have also been published:

- BS 4449 'Steel for the reinforcement of concrete - Weldable reinforcing steel - Bar, coil and decoiled product - Specification.'
- BS 4482 'Steel wire for the reinforcement of concrete products - Specification.'
- BS 4483 'Steel fabric for the reinforcement of concrete - Specification.'
- BS 8666 'Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete - Specification.'

The British Standards listed above come into effect on 1 January 2006.

It should be noted that BS EN 10080:2005 does not define steel grades. Therefore, use of BS EN 10080 in isolation would require the designer to specify properties such as yield strength, tensile strength, elongation at maximum force, fatigue strength, weldability, bond strength etc.

BS 4449:2005 and BS 4482:2005 simplify the process for designers by specifying the required properties for standardised grades. BS 4449:2005 specifies three standard grades (B500A, B500B and B500C). These standard grades are, with some exceptions (See Section 2), suitable for use in designs to Eurocode 2 Part 1-1 and Part 2. Note: Standardised grades of reinforcement for use in steel fabric are not defined in BS 4483:2005. Reinforcement used in the production of steel fabric reinforcement is specified to BS 4449:2005.

2. Principal Implications

The revised reinforcement standards introduce significant changes in comparison with existing standards, including the following:

- Reinforcement with a characteristic yield strength of 250MPa has been deleted from BS 4449.

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(BS 4449:2005, BS 4482:2005, BS 4483:2005 & BS 8666:2005)

- Reinforcement with a characteristic yield strength of 460MPa has been replaced in BS 4449, BS 4482 and BS 4483 by reinforcement with a characteristic yield strength of 500MPa.
- A third ductility class (Ductility Class C) has been added to BS 4449.
- Plain round bar is no longer covered in BS 4449 or BS 4483.

These changes to the reinforcement standards necessitate essential changes to BS 5400 Part 4. Changes to BS 5400 Part 4 required for the implementation of the revised reinforcement standards are detailed in this Interim Amendment. It should be noted that the opportunity has been taken to implement additional changes in order to align reinforcement requirements to Eurocode 2 Part 1-1 'Design of concrete structures - General rules and rules for buildings' and Eurocode 2 Part 2 'Design of concrete structures - Concrete bridges. Design and detailing rules'.

The three grades included in BS 4449:2005 conform to the requirements of Eurocode 2 Part 1-1, with the exception of Grade B500A bars for nominal sizes below 8mm. In addition, two of the three grades (B500B and B500C) conform to the recommendations of Eurocode 2 Part 2. Note: Eurocode 2 Part 2 does not recommend the use of ductility Class A reinforcement in highway structures. However, it is expected that the UK National Annex to Eurocode 2 Part 2 will permit the use of ductility Class A for fabric (mesh) reinforcement only. In essence, this means that:

- Grade B500A reinforcing bars to BS 4449:2005, with a nominal diameter less than 8mm, are not compatible with the requirements of Eurocode 2 Part 1-1 or Part 2.
- With the exception of fabric reinforcement, Grade B500A reinforcing bars of any size will not be permitted in designs to Eurocode 2 Part 2 in the UK.

These requirements have been written into the changes to the SHW, NGSHW and BS 5400 Part 4 detailed in this Interim Amendment.

The opportunity has also been taken to include stainless steel reinforcement in the changes to BS 5400 Part 4.

Note: As the use of grade 250 reinforcement is no longer covered, the provisions of Clause 1713 of the Specification for Highway Works relating to the re-bending of grade 250 bars not exceeding 12mm has been deleted in the May 06 amendment. Where there is a requirement to re-bend reinforcement, a specification departure shall be submitted for consideration.

Note: There are references to 'Type 1 deformed' and 'Type 2 deformed' reinforcement in current DMRB standards (e.g. BD 28). It should be noted that these terms are not used in the revised reinforcement standards. However, the bond characteristics of 'ribbed' reinforcement to BS 4449:2005 and BS 4482:2005 may be taken as being equivalent to the bond characteristics of Type 2 deformed reinforcement.

3. Implementation of New Reinforcement Standards

The new reinforcement standards (BS 4449:2005, BS 4482:2005, BS 4483:2005 and BS 8666:2005) shall be implemented for all scheme designs commencing on or after 1 January 2006.

Where design has commenced on a scheme before 1 January 2006 and continues beyond that date, it is acceptable to continue using the existing reinforcement standards beyond 1 January 2006 in order to avoid changing standards in the course of the design. It is understood that reinforcement conforming to BS 4449:1997, BS 4482:1985 and BS 4483:1998 will be available for some time after 1 January 2006. CARES have advised that many reinforcement suppliers are adopting 'dual certification' arrangements for their products. For example, a particular product may be certified to BS 4449:1997 and BS 4449:2005. The product can therefore be used in the construction irrespective of whether BS 4449:1997 or BS 4449:2005 has been specified by the

designer. Similarly, it is understood that fabricators will be able to supply reinforcement scheduled to BS 8666:2000 for some time beyond 1 January 2006. However, it is recommended that designers verify the position with proposed suppliers.

For schemes where design is likely to continue for an extended period beyond 1 January 2006, consideration shall be given to switching to the new standards in order to realise the potential efficiency savings associated with the use of 500MPa reinforcement. In addition, there could be difficulties sourcing material to superseded standards in the longer term. It should be noted that 'dual certification' arrangements are expected to remain in place for approximately 12 months from 1 January 2006. Note: Where a change in reinforcement standards is effected in the course of a scheme design, it is important that technical approval documentation accurately reflects the standards used for individual structures.

In the longer term, there may be circumstances in which a design has been prepared using reinforcement with a characteristic yield strength of 460MPa and it then becomes apparent that reinforcement certified to the relevant standard (including 'dual certified' reinforcement) is not available at normal commercial rates. In these circumstances, reinforcement certified to the revised standards and of the same nominal diameter, with a characteristic yield strength of 500MPa may be substituted in the construction, provided that the designer and checker are content that the use of the higher strength reinforcement does not adversely effect the design. It should be noted that a change in reinforcement during construction should be recorded in relevant technical approval documentation (e.g. an addendum to the Approval in Principle). For the avoidance of doubt:

- Where grade 460A reinforcement is specified, B500A, B500B or B500C reinforcement may be used.
- Where grade 460B reinforcement is specified, B500B or B500C reinforcement may be used.

4. Changes to BS 5400 Part 4.

Clause/Table	Change	Comments
Clause 4.7	In the last paragraph, delete '460' and replace with '500'. Also in the last paragraph, delete 'and to 265 N/mm ² for grade 250 bars'	
Clause 5.2.2(a)	Delete the following expression: $\frac{0.6\phi}{d - d_c}$ and replace with the following: $\frac{0.6\phi}{d - d_c}$ for ductility class A reinforcement $\frac{0.7\phi}{d - d_c}$ for ductility classes B and C and stainless steel reinforcement.	

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(BS 4449:2005, BS 4482:2005, BS 4483:2005 & BS 8666:2005)

Changes to BS 5400 Part 4, continued:

Clause/Table	Change	Comments																								
Table 6	<p>Delete Table 6 and replace with the following:</p> <table border="1"> <thead> <tr> <th>Designation</th> <th>Nominal sizes</th> <th>Characteristic strength, f_y</th> </tr> </thead> <tbody> <tr> <td></td> <td>mm</td> <td>N/mm²</td> </tr> <tr> <td>Steel bars Grade B500B or Grade B500C to BS 4449</td> <td>All sizes</td> <td>500</td> </tr> <tr> <td>Wire Grade 500 to BS 4482 (See Note 1)</td> <td>8 to 12</td> <td>500</td> </tr> <tr> <td>Fabric Grade B500A to BS 4483</td> <td>8 to 12</td> <td>500</td> </tr> <tr> <td>Fabric Grade B500B or Grade B500C to BS 4483</td> <td>6 to 12</td> <td>500</td> </tr> <tr> <td>Stainless steel bars Grade 500 to BS 6744</td> <td>All sizes</td> <td>500</td> </tr> </tbody> </table> <p>Note 1: Wire Grade 500 to BS 4482 shall only be used in precast concrete products.</p>	Designation	Nominal sizes	Characteristic strength, f_y		mm	N/mm ²	Steel bars Grade B500B or Grade B500C to BS 4449	All sizes	500	Wire Grade 500 to BS 4482 (See Note 1)	8 to 12	500	Fabric Grade B500A to BS 4483	8 to 12	500	Fabric Grade B500B or Grade B500C to BS 4483	6 to 12	500	Stainless steel bars Grade 500 to BS 6744	All sizes	500				
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Clause 5.8.3.2	Delete existing text and replace with: '5.8.3.2 <i>Bar schedule dimensions</i> . Reinforcement schedules should be in accordance with BS 8666.'																									
Clause 5.8.4.1	Delete '460' and replace with '500'. Also, delete 'or 0.25 % of b_d when grade 250 reinforcement is used.'																									
Clause 5.8.4.2	Delete '460' (in both places where this occurs) and replace with '500'. Delete ', or 0.15 % of b_d when grade 250 reinforcement is used' Delete 'and 0.15 % of b_d in the case of grade 250 reinforcement'																									
Clause 5.8.6.1	Delete existing text and replace with: '5.8.6.1 <i>Geometrical classification of deformed bars</i> . For the purposes of this code, deformed bars are ribbed in accordance with BS 4449 or, in the case of stainless steel, BS 6744'																									
Table 14	<p>Delete Table 14 and replace with the following:</p> <table border="1"> <thead> <tr> <th rowspan="2">Bar type</th> <th colspan="4">Concrete grade</th> </tr> <tr> <th>20</th> <th>25</th> <th>30</th> <th>40 or more</th> </tr> </thead> <tbody> <tr> <td></td> <td>N/mm²</td> <td>N/mm²</td> <td>N/mm²</td> <td>N/mm²</td> </tr> <tr> <td>Ribbed bars</td> <td>2.6</td> <td>2.9</td> <td>3.3</td> <td>4.0</td> </tr> </tbody> </table>	Bar type	Concrete grade				20	25	30	40 or more		N/mm ²	N/mm ²	N/mm ²	N/mm ²	Ribbed bars	2.6	2.9	3.3	4.0						
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Clause 5.8.6.8	Delete 'BS 4466' and replace with 'BS 8666'.																									
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Changes to BS 5400 Part 4, continued:

Clause/Table	Change	Comments
Clause 5.8.9	Delete '460' and replace with '500'. Also, delete 'and 0.006 for grade 250 reinforcement'	
Clause 6.3.5.2	Delete '460' and replace with '500'.	
Clause 6.8.6	Delete ', preferably of grade 250 steel'	
Clause 7.5.9	Delete '460' and replace with '500'. Also, delete 'and 0.006 for grade 250 reinforcement'	

5. Further Information

If you have any questions regarding this document, please contact:

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If you have any queries about individual schemes, please contact the relevant Transport Scotland Unit Bridge Manager.