An overview of the specifying and detailing of masonry construction

June 2019
An Overview of the Specifying and Detailing of Masonry Construction

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Constitution of the Working Group

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Foreword

This report is part of the Institution of Structural Engineers response to the formal enquiry into the issues raised by the defective construction of schools in Edinburgh. It highlights the need for effective communication between those parties responsible for design of a project and those charged with the execution of the works. Whilst it is the case that, depending upon the contractual situation, the role of the Structural Engineer will vary there is an overriding requirement to do everything possible to ensure that the design intentions are met during the construction process.

In this report the key aspects of masonry construction have been presented and the main responsibilities highlighted. The importance of ensuring that the type and location of ties is clearly identified on the documentation provided to site is emphasized. Where bed joint reinforcement is required to control movement or enhance lateral load resistance attention is drawn to the need to clearly specify the lap lengths required for the specified product. On occasions where design is carried out by a supplier, for example for shelf angles, it is important that the execution requirements are properly integrated with rest of the construction documentation used on site.

Masonry construction has been successfully used for thousands of years but modern economic masonry construction does require careful attention to detailing and the correct installation of ancillary components. It is not sufficient to leave execution to the bricklayer without clear guidance as to the designer’s intentions. To further assist the Structural Engineer in the correct use of masonry the Institution has recently published an updated version of the manual for the design of plain masonry in building structures to Eurocode 6 (BS EN 1996). In addition to the Eurocode itself, BSI publishes very useful NCCI in the form of PD 6697 which gives recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2. An updated version of this Published Document is under development as of the release of this guide.
1 Introduction and Scope

This document has been prepared as part of the response of the Institution of Structural Engineers to the Report of the Independent Inquiry into the Construction of Edinburgh Schools – February 2017.

The Masonry Working Group of the Institution was formed in 2017 to respond formally to the inquiry and to provide guidance to practicing Structural Engineers specifying masonry on construction projects.

This document is intended to provide guidance on the implementation of relevant recommendations from the enquiry and contains the following information:

- A guide to resources and sources of information;
- A designers’ checklist for specifiers of materials and construction methods on projects in which masonry is being used (incorporating; masonry units, common pitfalls and a rudimentary responsibility matrix).
- A guide to clear communication of design intent and the use of drawings and specifications issued to site operatives.
- Typical details and resources where such details can be found.

The nature of construction work is highly variable, and this document is not intended as a substitute for good engineering judgement. Rather, this guide to specification and detailing is intended to aid the structural engineer in ensuring the communication of their design intent is clear, and that their responsibilities are fully understood and defined when offering design services.

This document will also serve to highlight any particular services, responsibilities or expertise that may be lacking in a client’s design brief – allowing the structural engineer to provide guidance to their client in understanding the requirements when undertaking masonry construction.

The main points from the enquiry related to an effective communication of essential design information in an accessible form to tradesmen working on site. In particular, all relevant structural information, details and specifications impacting on the structural integrity of the building should be included on the structural engineers’ drawings. Furthermore, structural engineers should describe in their documentation and drawings the approach adopted in terms of reliance on the inclusion of bed joint reinforcement, wall head and lateral restraints, and wind posts. Information on the construction of external cavity walls should be provided by the structural engineering consultants. (Particularly when they are non-loadbearing.)

This document should help establish the minimum standards required in the production of construction information relating to both loadbearing and non-loadbearing masonry walls. The construction information should be comprehensive, yet concise and should be provided ideally in a single document or set of documents produced by the structural engineer.

Structural engineers should describe in their documentation and drawings the approach adopted in their designs in terms of the importance and reliance on the inclusion of bed joint reinforcement, wall head and lateral restraints or wind posts in the required locations and the inter-dependence of these various components. The proper installation of wall accessories and secondary steelwork should be adequately conveyed in the design documentation such that it is fully understood by those actually building the walls.
2 Sources of Information

There are many sources of information with regards to the design and specification of masonry, mortar, accessories and workmanship. Similarly, good detailing of masonry must be collated from a multitude of documents.

This is a hindrance to comprehensive and detailed design and specification. In light of this, the following table details a summary of valuable resources in the specification and detailing of masonry construction. Where Eurocodes are referenced, it is strongly suggested that the appropriate National Annex be referred to. Note that the following table does not include a comprehensive guide to all literature on masonry construction.

Table 2.1

<table>
<thead>
<tr>
<th>Document</th>
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Table 2.1 Cont.

<table>
<thead>
<tr>
<th>Document</th>
<th>Includes</th>
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</table>
| **BS EN 1996-2:2006**  
(Incorporating corrigendum September 2009)  
UK National Annex to Eurocode 6 – Design of Masonry Structures  
Part 2: Design considerations, selection of materials and execution of masonry | • Material selection, detailing requirements and particulars of the execution of masonry structures  
• Durability requirements  
• Movement in masonry incl. joints, DPCs  
• Deviations, tolerances and mortar / material quality and workmanship |
| **PD 6697:2010**  
Recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2 | • Supporting information for designers of masonry |
| **BS EN 771**  
Part 1 Specification for masonry units. Clay masonry units  
Part 2 Specification for masonry units. Calcium silicate masonry units  
Part 3 Specification for masonry units. Aggregate concrete masonry units (dense and light-weight aggregates)  
Part 4 Specification for masonry units. Autoclaved aerated concrete masonry units  
Part 5 Specification for masonry units. Manufactured stone masonry units  
Part 6 Specification for masonry units. Natural stone masonry units | • Specification of performance for masonry units (incl. compressive stresses)  
(Note: that this document only relates to the use of parts 1 to 4 of BS EN 771 – Solid stone (manufactured or natural) masonry covered in BS EN771 parts 5 and 6 is not addressed in this document.) |
| **BS 8000-0:2014**  
Workmanship on construction sites. Introduction and general principles | • General principles regarding tolerance, accuracy preparation of construction materials etc. |
| **BS EN 998**  
Part 2: Masonry mortar | • Specification of mortars for masonry construction (incl. strengths, mixes etc.) |
| **BS 8000-3:2001**  
Workmanship on building sites. Code of practice for masonry | • Recommendations for site operatives  
• Guidance for ‘good practice’ on site.  
• Guidance on the specification of design requirements for required workmanship |
| **The Building Regulations 2010**  
Approved Document A | • Provides minimum wall thicknesses for low rise construction (2C5)  
• Minimum requirements for wall ties, incl. spacing, provision for joints, openings and return walls(2C8)  
• Minimum requirements for workmanship (2C19) and manufacture/strength of masonry units (2C20)  
• Guidance on restraint of walls (2C25, 2C26, 2C27)  
• Guidance on chases and recesses (2C28, 2C29, 2C30, 2C31) |
<table>
<thead>
<tr>
<th>Document</th>
<th>Includes</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS 8103-2</td>
<td>• The use of masonry in low rise buildings</td>
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<tr>
<td>Structural Design of Low-Rise Buildings Code of practice for masonry walls for housing</td>
<td></td>
</tr>
<tr>
<td>Small Buildings Structural Guidance for the Building regulations (Scotland)</td>
<td>• The use of masonry in small buildings</td>
</tr>
<tr>
<td></td>
<td>• Updates following significant changes to the Eurocode in 2012 not reflected in the previous edition.</td>
</tr>
<tr>
<td>How to design masonry structures to Eurocode 6 MPA The Concrete Centre</td>
<td>Part 1 – Introduction</td>
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<td></td>
<td>Part 2 – Vertical Resistance</td>
</tr>
<tr>
<td></td>
<td>Part 3 – Lateral Resistance</td>
</tr>
<tr>
<td>Failures in masonry construction (CROSS Reports)</td>
<td>The following CROSS reports were some of those considered in the preparation of this document:</td>
</tr>
<tr>
<td></td>
<td>• No.56 Effective lengths of load-bearing walls</td>
</tr>
<tr>
<td></td>
<td>• No.82 Wind on internal masonry walls during construction</td>
</tr>
<tr>
<td></td>
<td>• No.84 Collapse of brickwork cladding</td>
</tr>
<tr>
<td></td>
<td>• No.92 Collapse of a gable wall</td>
</tr>
<tr>
<td></td>
<td>• No.99 Collapse of a wall during construction</td>
</tr>
<tr>
<td></td>
<td>• No.135 Critical wall failure</td>
</tr>
<tr>
<td></td>
<td>• No.144 A failure survey of free standing walls</td>
</tr>
<tr>
<td></td>
<td>• No.164 Tying walls to floors in domestic properties</td>
</tr>
<tr>
<td></td>
<td>• No.177 Gain in strength of mortar slower than concrete</td>
</tr>
<tr>
<td></td>
<td>• No.242 Stability compromised in school roof</td>
</tr>
<tr>
<td></td>
<td>• No.295 Masonry fall due to high wind</td>
</tr>
<tr>
<td></td>
<td>• No.306 Wall collapse from building in city centre - who is responsible?</td>
</tr>
<tr>
<td></td>
<td>• No.414 Blockwork lateral restraint</td>
</tr>
<tr>
<td></td>
<td>• No.511 Collapse of infill wall panel</td>
</tr>
<tr>
<td></td>
<td>• No.602 Padstones out of position leads to collapse</td>
</tr>
</tbody>
</table>

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Table 2.1 Cont.
3 Designers’ Checklist

The following checklist has been prepared to aid the designer and specifier in addressing the particulars of masonry construction. References are provided for appropriate standards and regulations, and a basic responsibility breakdown is provided. An indication of appropriate design documentation provided to the contractor is given.

Using this Table

For the appropriate stage in the delivery of a structure (documentation or execution), the designer can consult the table for relevant guidance in the specification of an element of masonry design and use the information contained therein to clearly communicate the information required to ensure structural adequacy.

Element – Denotes the element or aspect of masonry construction considered

Activity Required – Processes (e.g. specification, checking procedures and/or quality assurance requirements) associated with the element

Responsibility – Which party is traditionally involved in undertaking the required activity for a given element.

Design Documentation – Activity undertaken at Design / Documentation Stage

Execution / Construction – Activity undertaken at Construction Stage

Comments – remarks related to the element, associated activities and responsibilities in the context of design and construction. These relate almost entirely to structural implications of design choices and reference appropriate codes / guidance.
### Table 3.1

<table>
<thead>
<tr>
<th>Element</th>
<th>Activity Required</th>
<th>Responsibility</th>
<th>Design Documentation</th>
<th>Execution / Construction</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Masonry Units</td>
<td>• Specification</td>
<td>A / SE</td>
<td></td>
<td></td>
<td>• Specification to BS EN 771. Clear instruction on the acceptability of alternates (e.g. solid vs. hollow block) Note that Group II masonry units will contain &gt; 25% voids.</td>
</tr>
<tr>
<td></td>
<td>• Delivery Checks</td>
<td>C / M / A / SE</td>
<td></td>
<td></td>
<td>• Where masonry units (typically facing masonry) is specified by the architect, it is essential that the Structural Engineer review and ensure chosen units meet the minimum engineering requirements, rejecting any specification that does not comply.</td>
</tr>
<tr>
<td></td>
<td>• Manufacturer’s Declaration</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factory Produced Mortar</td>
<td>• Specification</td>
<td>A / SE</td>
<td></td>
<td></td>
<td>• Prescribed or designed mortar to be specified. Note that BS EN 9982 does not cover Site-mixed Mortars.</td>
</tr>
<tr>
<td></td>
<td>• Third Party Visual Check on production</td>
<td>M</td>
<td></td>
<td></td>
<td>• Where masonry mortar is specified based on aesthetic / architectural qualities, the Structural Engineer must ensure it complies with the minimum engineering and durability requirements, rejecting any specification / mortars that do not comply.</td>
</tr>
<tr>
<td></td>
<td>• Manufacturer’s test certificates</td>
<td>M / C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Element</td>
<td>Activity Required</td>
<td>Responsibility</td>
<td>Design Documentation</td>
<td>Execution / Construction</td>
<td>Comments</td>
</tr>
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<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Site Mixed Mortar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Not to be used for Execution Class 1 (EXC1) Structures</td>
</tr>
<tr>
<td>Bed Joint Reinforcement</td>
<td>• Specification</td>
<td>SE</td>
<td></td>
<td></td>
<td>• Check galvanised steel reinforcement is permitted for use in external / internal leaf by the manufacturer. Specify required lap length for reinforcement</td>
</tr>
<tr>
<td></td>
<td>• Delivery Checks</td>
<td>C / M / SE</td>
<td></td>
<td></td>
<td>• Compliance with manufacturer’s requirements (particularly lapping of reinforcement, placement within mortar) Check that galvanised reinforcement is not cut on site without treating ends with suitable protection.</td>
</tr>
<tr>
<td></td>
<td>• Manufacturer’s Declaration</td>
<td>M / C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Inspection</td>
<td>C / SE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filling of Mortar Joints</td>
<td>• Testing / spot checks</td>
<td>C / SE</td>
<td></td>
<td></td>
<td>• Inspection conducted at rate dependent upon size of scheme. Particular attention should be paid to ensure perp-ends (cross joints) are fully filled. – This is particularly important for blockwork.</td>
</tr>
<tr>
<td>Location of wall ties</td>
<td>• Specification</td>
<td>SE</td>
<td></td>
<td></td>
<td>• Type 1/2/3 or 4 in accordance with PD6697. Appropriate spacing of ties with particular attention paid to movement joints, openings and corner returns. (min. 2.5 ties/m², min. 50mm embedment) If hollow concrete masonry is being used, the designer should specify the location of wall ties in relation to cross-web within the block. (Refer to Appendix A for details) Where cavity widths are large, wall ties should be ‘designed’ for lower compressive strength than ordinarily rated. (See Table 12 PD6697) Inspections of wall tie placement, locations and embedment proportional to the size of the proposed scheme.</td>
</tr>
<tr>
<td></td>
<td>• Spot Checks</td>
<td>C / SE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Element</td>
<td>Activity Required</td>
<td>Responsibility</td>
<td>Design Documentation</td>
<td>Execution / Construction</td>
<td>Comments</td>
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<tr>
<td>Windposts</td>
<td>• Specification</td>
<td>SE</td>
<td>•</td>
<td></td>
<td>• The designer should specify appropriate wind posts and suitable fixings to the primary structural members / framing.</td>
</tr>
<tr>
<td></td>
<td>• Installation</td>
<td>C / SE</td>
<td>•</td>
<td></td>
<td>• Structural engineer will need to check that the windposts are in accordance with the design and setting out.</td>
</tr>
<tr>
<td>Corbels &amp; Overhangs</td>
<td>• Specification</td>
<td>SE</td>
<td>•</td>
<td></td>
<td>• These are now covered in PD 6697. Designer to specify these in accordance with this.</td>
</tr>
<tr>
<td></td>
<td>• Installation</td>
<td>SE / C</td>
<td>•</td>
<td></td>
<td>• The designer will need to provide the limiting values for overlapping of the masonry units to ensure that the masonry remains in compression.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Structural engineer will need to check that the corbels and overhangs are within the tolerances required and are in compliance with specified dimensions.</td>
</tr>
<tr>
<td>Fixing details to</td>
<td>• Specification</td>
<td>SE</td>
<td>•</td>
<td></td>
<td>• Adequate detailing and specification of tying to main structural frame, around movement joints, openings and at corner returns.</td>
</tr>
<tr>
<td>Structural Frame</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Explicit instruction that wall ties are not to be omitted if obstructed by other structural members, but instead reported to the structural engineer if significant, otherwise; ties to be placed at next available space.</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td>• Adequate specification of structural thermal breaks with clear understanding of compression, creep, movement characteristics of both frame and break plates. (e.g. compressibility of polymer thermal breaks, shrinkage of concrete frame, expansion of brickwork.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>• Allowances to be made for tolerances on the main structure. E.g. NSCS indicates that the accuracy of a concrete frame may be +/- 50mm. – Similar allowances will need to be made for the majority of structural systems.</td>
</tr>
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</table>
### Table 3.1 (Cont.)

<table>
<thead>
<tr>
<th>Element</th>
<th>Activity Required</th>
<th>Responsibility</th>
<th>Design Documentation</th>
<th>Execution / Construction</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>Fixing details to Structural Frame</td>
<td>• Delivery Checks</td>
<td>C</td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td></td>
<td>• Manufacturer’s Declaration</td>
<td>M</td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td></td>
<td>• Inspection</td>
<td>C / SE</td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Formation of Movement Joints</td>
<td>• Specification</td>
<td>SE / A</td>
<td></td>
<td></td>
<td>• Typical details &amp; specification of suitable gap filling compounds etc.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>• Locations to be coordinated with other disciplines. Careful attention paid to the different movement characteristics of clay and concrete masonry units.</td>
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<td>• General guidance indicates 6-7m spacing for concrete masonry units, 9-12m for clay masonry units.</td>
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<td></td>
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<td></td>
<td>• Width of joint to be approximately 1-1.5mm per metre of masonry.</td>
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<td>• Consider debonded ties across the movement joint which permit shrinkage and thermal movement in the length of the wall whilst resisting wind load etc. orthogonal to the wall</td>
</tr>
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<td>• Sleeved ties should be used, and the engineer is to ensure movement is in the direction of the tie</td>
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<td></td>
<td>• Ensure that Movement joints are properly executed, clear and uninterrupted</td>
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<td></td>
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<td></td>
<td>• Ensure movement joints are not inhibited by fixing back to structural frames either side of the joint.</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>• Check that movement is not inhibited by fixings, frame or hard material bridging across the joint</td>
</tr>
<tr>
<td></td>
<td>• Installation</td>
<td>C / SE</td>
<td></td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Element</td>
<td>Activity Required</td>
<td>Specification</td>
<td>Design Documentation</td>
<td>Execution / Construction</td>
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<tr>
<td>Intersecting walls</td>
<td></td>
<td>Specification</td>
<td>SE</td>
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<td>Specification</td>
<td>SE</td>
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<td></td>
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<td>Installation</td>
<td>C / SE</td>
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<tr>
<td>Head restraints</td>
<td></td>
<td>Specification</td>
<td>SE</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>Installation</td>
<td>C / SE</td>
<td></td>
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<tr>
<td>Frame ties</td>
<td></td>
<td>Installation</td>
<td>C / SE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cavity wall ties</td>
<td></td>
<td>Specification</td>
<td>SE</td>
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<td></td>
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<tr>
<td>Allowances for creep, deflection and sagging/hogging behaviour of the surrounding structure</td>
<td></td>
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<tr>
<td>Suitable restraint of non-load-bearing walls.</td>
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<td>Checks proportional to the size of the scheme.</td>
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<td>Overall dimensional compliance</td>
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<td>Placement of insulation</td>
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<td>Specification</td>
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<td></td>
<td></td>
<td>Installation</td>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall dimensional compliance</td>
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<tr>
<td>Installation of fire stops</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Placement of insulation</td>
<td></td>
<td>Specification</td>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Installation</td>
<td>C</td>
<td></td>
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<tr>
<td>Overall dimensional compliance</td>
<td></td>
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</tr>
<tr>
<td>Installation of fire stops</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Table 3.1 (Cont.)

**Intersecting walls**
- Specification of adequate tying and appropriate details in proportion to size of the scheme.
- The designer should consider the implications of inadequate tying of cross walls. Stressing the importance of these to the contractor and allowing for suitable inspection if deemed necessary.

**Head restraints**
- The lack of properly detailed and constructed head restraint will very significantly reduce the capacity of masonry panels.
- Proprietary head restraints are available for horizontal beams but for inclined members, a bespoke solution may need to be specified.

**Lintels**
- Lintels should be specified by the designer with appropriate minimum bearing into new masonry (min. 100mm).
- Lintels should bear onto whole masonry units (as opposed to cut, or half bricks).
- Pistol bricks and weep holes to be specified as required.
- Checks proportional to the size of the scheme.
- Packing around lintel and mortar joints to be fully filled.
- Checks proportional to the size of the scheme.
- Compliance to be in accordance with BS EN 1996-2 (Table 3.1).

**Placement of insulation**
- Wall ties should be appropriately specified to ensure compatibility with insulation proposed by others. Note that in many cases, insulation will obscure the wall ties from inspection post installation.
- Generally specified by the Architect.
<table>
<thead>
<tr>
<th>Element</th>
<th>Activity Required</th>
<th>Responsibility</th>
<th>Design Documentation</th>
<th>Execution / Construction</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Finishing of Mortar Joints     | • Specification   | SE / A         | •                    |                          | • Joints to be specified. Design calculations to reflect proposed finishing of joints.  
• Refer to Figure 3.1 of *Manual for the design of plain masonry in building structures to Eurocode 6 (1st Ed.)*  
• Note that not all joints are suitable for all types of masonry unit.  
• Recessed joints are to be avoided due to the resulting decrease in frost resistance.  
• Ideally specify flushed joints or lightly tooled joints.  
• Joints are as specified in the design, and in accordance with design calculations. |
|                               | • Visual Inspection| SE / A         |                      |                          |                                                                                                                                          |
| Cleaning of facing work        | • Visual Inspection| A              |                      |                          | • Inspection conducted at rate depended upon size of scheme.                                                                                   |
| Aesthetics of completed masonry| • Specification   | A              | •                    |                          | • Specification of appropriate benchmarks and agreement with contractor, architect etc. at early stage.  
• Additional advice on this can be found in PD 6697  
• The Architect may specify that test-panels are to be fabricated to establish a suitable aesthetic benchmark. |
| Cavity Width                   | • Specification   | SE / A         | •                    |                          | • Specification of cavity width coordinated with other consultants, suitable specification of wall ties appropriate for cavity width and specification in accordance with design calculations.  
• Checks made at rate proportional to the size of the scheme. |
<table>
<thead>
<tr>
<th>Element</th>
<th>Activity Required</th>
<th>Responsibility</th>
<th>Design Documentation</th>
<th>Execution / Construction</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Padstones</td>
<td>• Specification</td>
<td>SE</td>
<td></td>
<td></td>
<td>• Size, position and typical details for requirements of bearing new steel onto padstones. Emphasis on tolerances from centre of padstone for new steel based on design calculations / analysis.</td>
</tr>
<tr>
<td></td>
<td>• Visual inspection</td>
<td>C / SE</td>
<td></td>
<td></td>
<td>• The designer should allow for construction loads on adjacent elements.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• The designer should allow for loads and moments due to reasonable tolerance and specify the tolerance to which the contractor should work.</td>
</tr>
<tr>
<td>Chases</td>
<td>• Specification / coordination</td>
<td>SE / ME</td>
<td></td>
<td></td>
<td>• Full coordination of services to ensure no impairment of the structural performance of the element.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Refer to UK National Annex of BS EN 1996-1-1 for help in specifying.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Design assumptions and intent should be present in the Operation &amp; Maintenance (O&amp;M) Manual to facilitate future refurbishment and modification of services.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Specification of the largest acceptable chases and/or general rules for chasing out during future refurbishment in order to facilitate new plant etc.</td>
</tr>
<tr>
<td>Cavity trays</td>
<td>• Specification</td>
<td>A</td>
<td></td>
<td></td>
<td>• Coordination with other design disciplines.</td>
</tr>
<tr>
<td></td>
<td>• Specification</td>
<td>SE</td>
<td></td>
<td></td>
<td>• Weepholes to be specified to prevent moisture buildup.</td>
</tr>
<tr>
<td>Damp Proof Course (DPC)</td>
<td>• Specification</td>
<td>A</td>
<td></td>
<td></td>
<td>• The structural engineer must take into account the impact of the DPC on structural assumptions and restraint conditions for masonry walls. This can be particularly onerous for parapets.</td>
</tr>
</tbody>
</table>
Table 3.1 (Cont.)

<table>
<thead>
<tr>
<th>Element</th>
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<th>Responsibility</th>
<th>Design Documentation</th>
<th>Execution / Construction</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequencing</td>
<td>• Specification</td>
<td>SE</td>
<td>•</td>
<td></td>
<td>• The Designer should specify the assumed sequence of construction to the contractor as this may influence programme.</td>
</tr>
<tr>
<td></td>
<td>• Construction</td>
<td>SE / C</td>
<td></td>
<td></td>
<td>• Details of the contractor's method statement should be provided to the designer to ensure compliance, with any changes highlighted.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Consider the desire for weather-tightness and the possibility of internal leaves being constructed prior to external leaves (i.e. out of sequence) and the implications this may have on installing masonry, mortar, shrinkage, and wall ties / ancillary elements.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Consider the intermediate stability of single leaf prior to construction of outer leaf.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Contractor's proposed method to be compared with design and detailing assumptions.</td>
</tr>
<tr>
<td>Protection of masonry and curing</td>
<td>• Proposal / Method statement</td>
<td>C</td>
<td></td>
<td></td>
<td>• The structural engineer should specify that protection and workmanship generally is to BS 8000-0:2014 and BS 8000-1:2001.</td>
</tr>
<tr>
<td>Temperature &amp; ambient conditions</td>
<td>• Specification</td>
<td>SE</td>
<td>•</td>
<td></td>
<td>• Suitable limits on temperatures / conditions under which masonry is laid. Construction of masonry should be stopped when the ambient temperature falls below 5°C unless special provisions have been put in place.</td>
</tr>
<tr>
<td></td>
<td>• Reporting</td>
<td>C</td>
<td></td>
<td></td>
<td>• Monitoring and recording of temperatures during installation and subsequent curing of mortar.</td>
</tr>
<tr>
<td>Rate of construction</td>
<td>• Specification</td>
<td>SE</td>
<td>•</td>
<td></td>
<td>• Specification on limits on masonry lifts per day.</td>
</tr>
<tr>
<td></td>
<td>• Reporting</td>
<td>C</td>
<td></td>
<td></td>
<td>• Recording of height of masonry built in one day.</td>
</tr>
</tbody>
</table>
4 Additional guidance

Aircrete Products Association Ltd. – www.aircrete.co.uk
Brick Development Association Ltd. www.brick.org.uk
International Masonry Society - www.masonry.org.uk
Concrete Block Association - www.cba-blocks.org.uk
Modern Masonry Alliance - www.modernmasonry.co.uk
Mortar Industry Association - www.mortar.org.uk
The Concrete Centre - www.concretecentre.com
An overview of the specifying and detailing of masonry construction

June 2019

Appendix A - Indicative Details
5 Appendix A – Indicative Details

The following details have been prepared to illustrate detailing requirements for masonry, particularly cavity wall construction.

These details are intended only to provide the designer with easily understood diagrams and should not be used as-is for the purposes of construction documentation.

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<tr>
<td>• CONTRACTION JOINT – TYING (PLAN DETAIL)</td>
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<td>• THE COORDINATION OF BRICK COURSES FOR CAVITY WALL TIES (SECTION DETAILS)</td>
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<table>
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<td>• PROVISIONS FOR ACCOMMODATING MOVEMENT OF SHORT RETURNS (PLAN DIAGRAM)</td>
<td>36</td>
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<tr>
<td>• JOINT IN MASONRY (ELEVATION)</td>
<td>37</td>
</tr>
<tr>
<td>• THE CONSTRUCTION OF JOINTS (SECTION DETAILS)</td>
<td>37</td>
</tr>
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<td>• SLIP PLANES IN FRAMED CONSTRUCTION (ELEVATION)</td>
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The Institution of Structural Engineers and the members who served on the Masonry Working Group that produced these typical details have endeavoured to ensure the accuracy of its contents. However, the guidance and recommendations given should always be reviewed by those using the report in the light of the facts of their particular case and any specialist advice.

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Any person using this document should pay particular attention to the provisions of this condition.
### Example Drawing Revision Table

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<td>AS CLOUDED</td>
<td>AB</td>
<td>CD</td>
<td>08/02/2019</td>
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</table>

**Revision No.**  
**Descriptive Notes**  
On changes - these should be clouded on the drawings as appropriate.

**Drawing Author**  
**Drawing Reviewer**  
**Date of Issue**

---

### Example Title Block

**Title Block** must contain all relevant details to ensure contractor and site operatives have relevant, up-to-date information.

- Title Block must contain all relevant details to ensure contractor and site operatives have relevant, up-to-date information.
- A method of identifying if a drawing has been printed in colour may be prudent to include.
- This can also serve to confirm that there are no areas on the drawing that use colour.
- Here, a colour bar has been added in a consistent location across all drawings.

---

**Scale: 1:100 @ A1**

**Min. 100mm**

**Drawing Notes:**

**Consultant Details**

**Project Title**

**Project Address**

**Drawing Title**

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</tbody>
</table>
SITE PLAN 1:200 (SOMETIMES 1:500)
GENERAL ARRANGEMENT 1:100 1:50
COMMON DETAILS 1:50 1:20
UNIQUE / SPECIAL DETAILS 1:20 1:10
ELEVATIONS 1:100 1:50
SECTIONS 1:100 1:50

TYPICAL SCALES

LOCATION PLAN (IF APPROPRIATE) SHOULD BE VISIBLE WHEN DRAWING IS FOLDED

DRAWING

DRAWING NOTES, KEY TO SYMBOLS ETC.

REVISION TABLE

TITLE BLOCK PLACED IN BOTTOM RIGHT HAND CORNER AND FULLY VISIBLE WHEN DRAWING FOLDED

TYPICAL DRAWING LAYOUT

The Institution of Structural Engineers Specifying and Detailing Masonry Construction 20
THE FOLLOWING LINES, HATCHES AND SYMBOLS ARE PROVIDED AS EXAMPLES AS TO HOW ELEMENTS MAY BE PRESENTED. FOR FULL SPECIFICATIONS FOR DRAFTING AND CAD STANDARDS, USERS OF THIS MANUAL SHOULD REFER TO BS ISO 128-23:1999

EXAMPLE HATCHES
COMMON 2D HATCH TYPES ARE DETAILED IN BS8541-2:2011 (IN ALL CASES, HATCHES AND COLOURS ARE TO BE DEFINED CLEARLY IN THE DRAWING NOTES)

PRIMARY STRUCTURAL ELEMENTS (LOAD-BEARING ELEMENTS, SLABS, COLUMNS ETC.)
SECONDARY ELEMENTS (COMPONENTS, REFERENCE FEATURES, ARCHITECTURAL CONTEXT, ELEMENTS IN ELEVATION ETC.)
REFERENCE LINES, CENTRELINES & GRIDS
HIDDEN ELEMENTS
SECTIONS THROUGH ELEMENTS
EDGES OF SLAB / BUILDING OUTLINES

DENOTING LEVELS
EXAMPLE LINEWEIGHTS / TYPES
GENERALLY IN ACCORDANCE WITH BS ISO 128

COMMON SYMBOLS
COMMON ERRORS IN Annotation AND DIMENSION NOTATION

LEADER 1
LEADER 2
LEADER 3

AVOID CROSSING LEADER LINES AND MAINTAIN CLEAR SEPARATION OF ANNOTATIONS

ENSURE CLARITY OF LEADER LINES AND ANNOTATIONS WHEN CROSSING HATCHED AREAS

LEADERS, DIMENSIONS AND ANNOTATIVE TEXT SHOULD BE PLACED OUTSIDE OF ELEMENTS

COMMON ERRORS IN Annotation AND DIMENSION NOTATION

COMMON ABBREVIATIONS
(Where used, they should be defined on the drawing)

The Institution of Structural Engineers Specifying and Detailing Masonry Construction 22
DETAILS RELATING TO DIMENSIONS, TOLERANCES AND SETTING OUT

"THE ANATOMY OF A FROGGED BRICK"

The Institution of Structural Engineers and the members who served on the Masonry Working Group that produced these typical details have endeavoured to ensure the accuracy of its contents. However, the guidance and recommendations given should always be reviewed by those using the report in the light of the facts of their particular case and any specialist advice. No liability for negligence or otherwise in relation to these drawings and its contents in accepted by the Institution, the members of the Masonry Working Group its servants or agents. Any person using this document should pay particular attention to the provisions of this condition.
COMMON MASONRY UNIT TYPES
STANDARD AND SELECTED 'SPECIALS'

SOLID MASONRY UNITS
(MAY OR MAY NOT HAVE A 'FROG' - A DEPRESSION IN THE BRICK TO REDUCE WEIGHT OF UNIT.)

NOTE: IF FROG IS PRESENT, UNIT TO BE PLACED FROG-UP TO ENSURE IT IS FILLED WITH MORTAR. FROG ORIENTATION MAY IMPACT WALL STRENGTH

HOLLOW / CELLULAR UNIT

PERFORATED UNIT

ANGLE / DOG-LEG UNIT

BULL-NOSE / COPING UNITS

SHELF ANGLE 'PISTOL' BRICK

RADIAL / TAPERED UNITS
"TYPICAL UK CLAY BRICK DIMENSIONS"

- FLUSH / BAG-RUBBED JOINT
- CURVED RECESSED / BUCKET HANDLE
- STRUCK / WEATHERED
- OVERHUNG STRUCK
- SQUARE RECESSED

"TYPICAL UK CONCRETE BLOCK DIMENSIONS"

- MAXIMUM CORBEL $T_1 / 3$
- WALL THICKNESS $T_1$

"DIMENSIONING OF CORBELS"

"JOINT FINISHING"
SELECTED COMMON UK MASONRY WALL BOND PATTERNS (ELEVATIONS)

- **TRADITIONAL ENGLISH BOND**
  - Alternating header stretcher courses

- **HEADER BOND**
  - All headers
  - (Sometimes used to form curved walls)

- **FLEMISH BOND**
  - Must use full width headers and not 'snapped' headers

- **STRETCHER BOND**
  - Most cavity wall construction will use this pattern for at least one leaf

- **STACK BOND**
  - (Not generally recommended for structural walls and not covered by BS EN 1996-1-1)
DESIGNERS AND SPECIFIERS SHOULD HAVE AN APPRECIATION OF THE APPROPRIATE TOLERANCES FOR STRUCTURAL MASONRY. DIMENSIONAL TOLERANCES CAN IMPACT SPECIFICATION, FINISHED LOOK AND LONGEVITY OF WALLS.

MASONRY PLACED TO PROVIDE EXTERNAL 'FAIR' FACE AND TOLERANCE IS ACCOMMODATED ENTIRELY ON ONE SIDE OF THE WALL.

THE THICKNESS OF SINGLE LEAF WALLS WILL BE GOVERNED BY THE DIMENSIONAL TOLERANCE OF MASONRY UNITS.

RULES FOR MASONRY WALLS MADE OF MORE THAN A SINGLE LEAF

THICKNESS

- ALLOWABLE DEVIATION PER STOREY OF MASONRY (UP TO 2 STOREYS)
- MAXIMUM ALLOWABLE DEVIATION FOR BUILDINGS THREE STOREYS OR GREATER

VERTICALITY

TOLERANCES ON STRUCTURAL MASONRY (REFER TO BS EN 1996-2 & PD 6697) (SECTION DIAGRAMS)
DETAILS RELATING TO CAVITY WALL CONSTRUCTION

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SELECTED TYPES OF CAVITY WALL TIES

END OF TIE DRILLED AND FIXED INTO INNER LEAF AND / OR OTHER SUPPORTING STRUCTURAL ELEMENT

IN SOME CASES, IT MAY BE REQUIRED TO DRILL AND FIX TO THE INTERNAL MASONRY LEAF OR SUPPORTING STRUCTURE

INSULATION KEPT IN PLACE BY PLASTIC RETAINER

HELICAL TIE GENERALLY USED AS A REMEDIAL OR POST-FIXED TIE

DOUBLE SIDED SLIDE-ON TIE (USUALLY USED WITH PROPRIETARY SYSTEM / ANCILLARY COMPONENTS)

V-PROFILE INCORPORATED IN SOME FLAT TIES TO MITIGATE MOISTURE INFILTRATION IN MASONRY

LACK OF WALL TIES DO NOT ALLOW COMPOSITE ACTION OF BOTH LEAVES

LACK OF WALL TIES FORCE INDIVIDUAL LEAVES TO ACT INDEPENDENTLY UNDER LATERAL LOAD

BEHAVIOUR OF CAVITY WALLS WITHOUT TIES

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TIES IMMEDIATELY EACH SIDE OF JOINT

TIE DEBONDED / SLEEVED ON ONE SIDE OF JOINT (ALLOWS MOVEMENT PARALLEL TO PLANE OF WALL)

"CONTRACTION JOINT - TYING AT CORNER RETURNS" (PLAN DETAIL)

TIES IMMEDIATELY EACH SIDE OF JOINT

TIE DEBONDED / SLEEVED ON ONE SIDE OF JOINT (ALLOWS MOVEMENT PARALLEL TO PLANE OF WALL)

"CONTRACTION JOINT - TYING" (PLAN DETAIL)

PROVIDE TIE ACROSS JOINT

FLEXIBLE JOINT FILLER - FINISHES MUST ACCOMMODATE MOVEMENT
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LINTEL ABOVE OPENING AS REQUIRED

ADDITIONAL TIES EITHER SIDE OF OPENING. VERTICAL SPACING TO SUIT INNER LEAF MASONRY

EXAMPLE CAVITY WALL TIE SPACING (ELEVATION)

TO SUIT 2.5 TIES PER SQUARE METRE
MINIMUM SPACING SHOULD BE
CHECKED ACCORDING TO BS EN 1996-1
Effort should be made to minimise any bending of ties. Where it is necessary for ties to be inclined, they are to slope down towards the outer leaf to facilitate the management of water/moisture. Longer ties may need to be used, and stainless steel ties will have the advantage of maintaining their durability over galvanised ties, the coating of which may be damaged during bending.

As ties are bent, there is significant risk of 'lifting' at the joint - this is particularly the case when ties are stiff.

Cut blocks to inner leaf can also be used to ensure good head restraint.

Cut blocks, brick slips or similar to inner leaf used to coordinate coursing of inner and outer leaves.

RC slab upstand to coordinate coursing.

PCC lintel or in-situ reinforced concrete to ensure good head restraint.

"The coordination of brick courses for cavity wall ties" (section details)
DETAILS RELATING TO MOVEMENT IN MASONRY

"ANATOMY OF A MOVEMENT JOINT" (ISOMETRIC)

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SECTION OF WALL EXPANDS DUE TO ENVIRONMENTAL CONDITIONS AND / OR MATERIAL BEHAVIOR E.G. TEMPERATURE INCREASE, MORTAR VOLUME CHANGE

CRACKING / FAILURE OF RESTRAINT AT OR ADJACENT TO CORNERS WILL OCCUR AS WALL 'BUCKLES' DUE TO IN-PLANE COMRESSIVE FORCE

"BEHAVIOUR OF CORNER RETURNS WITHOUT MOVEMENT JOINTS" (PLAN DIAGRAM)

AS EXPANSION CAUSES LEAF TO 'BOW', WALL TIES PULL AWAY, IMPAIRING THE COMPOSITE ACTION OF THE CAVITY WALL

"OVER-RESTRAINED MASONRY REDUCES LONG-TERM RESTRAINT OF LEAF" (PLAN DIAGRAM - ALSO APPLIES IN SECTION)
"PROVISIONS FOR ACCOMODATING MOVEMENT OF SHORT RETURNS"

(PLAN DIAGRAM)
MORTAR 'BRIDGES' BETWEEN EACH SIDE OF MOVEMENT JOINT ARE TO BE AVOIDED

"THE CONSTRUCTION OF JOINTS"
(SECTION DETAILS)

"JOINT IN MASONRY"
(ELEVATION)

VERTICAL MOVEMENT JOINT

COMPRESSIBLE JOINT FILLER
(VOIDS ARE NOT GENERALLY RECOMMENDED)

SIMILAR DETAILS CAN BE USED FOR CONTRACTION JOINTS IN E.G. CONCRETE MASONRY

COMPRESSIBLE BACKER ROD

INTERNAL SEALANT

"THE CONSTRUCTION OF JOINTS"
(SECTION DETAILS)
CLAY BRICKWORK EXPANDS

CONCRETE FRAME SHRINKS

SLIP PLANE MUST BE PROVIDED WHERE MATERIAL COMPATIBILITY PRESENTS THE POSSIBILITY OF DIFFERENTIAL MOVEMENT

A SEALED, SOFT HEAD JOINT OR MEMBRANE DETAIL COULD BE USED TO ALLOW FOR THIS MOVEMENT

DETAILING OF FIRE-STOPS ETC. MUST BE ACCOUNTED FOR DURING SPECIFICATION OF JOINTS

"SLIP PLANES IN FRAMED CONSTRUCTION" (ELEVATION)
DETAILS RELATING TO THE REINFORCEMENT OF MASONRY

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REINFORCEMENT PLACED ON MASONRY LEAF CENTRELINE WITH MORTAR ALL AROUND

15MM COVER IN STANDARD BED JOINT GALVANISED AND MILD STEEL REINFORCEMENT IS NOT RECOMMENDED. STAINLESS STEEL IS PREFERRED FOR LONGER DESIGN LIFE

RULES FOR LAP LENGTHS MUST BE OBSERVED. LENGTH TO SUIT CONCRETE DETAILING GUIDANCE FOR REINFORCEMENT

"LAPPING OF REINFORCEMENT"
(PLAN DIAGRAM)
TIE DEBONDED / SLEEVED ON EACH SIDE OF JOINT (ALLOWS MOVEMENT PARALLEL TO PLANE OF WALL)

PROVIDE TIE FASTENED TO STEEL COLUMN FOR OUTER LEAF

ANGLE TYPE WINDPOST AFFIXED TO INTERNAL BLOCKWORK LEAF TO FACILITATE HIGHER LATERAL BENDING CAPACITY

"WINDPOSTS IN MASONRY" ANGLE SECTION
(PLAN DETAIL)

"WINDPOSTS IN MASONRY" CHANNEL SECTION
(PLAN DETAIL)

NOTE: WINDPOSTS MUST BE FIXED TOP AND BOTTOM TO A STRUCTURAL MEMBER
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WHERE VERTICAL SPAN OF WALL IS 'BROKEN' BY INTERMEDIATE SUPPORTING ELEMENTS, CONTRACTION / EXPANSION TO BE ALLOWED FOR WITH COMPRESSIBLE JOINT

CAVITY WALL TIES SPACED AROUND INTERFACE WITH FLOOR AS USUAL

COORDINATION OF COURSING ESSENTIAL TO ENSURE WALL TIES ARE NOT EXCESSIVELY SKEWED IN PLAN OR SECTION (COURSES OF INNER AND OUTER LEAF SHOULD ALIGN AT TIE LOCATIONS)

BENDING TIES CAN CAUSE 'LIFTING' OF THE LEAF, CAUSE FLAKING OF THE TIE'S PROTECTIVE COATING. TIES SHOULD SLOPE (IF AT ALL) TO THE OUTER LEAF FAILURE TO DO SO CAN LEAD TO INTERNAL MOISTURE INGRESS

PROVIDE HEAD RESTRAINT TO MASONRY INNER LEAF IN THE FORM OF DEBONDED TIES

THERE ARE PROPRIETARY SYSTEMS AVAILABLE FOR THE FIXING OF SHELF ANGLES TO A VARIETY OF STRUCTURAL ELEMENTS. MANUFACTURERS' GUIDANCE SHOULD BE CONSULTED AND APPROPRIATE ACCESSORIES / ANCILLARY COMPONENTS SPECIFIED AS APPROPRIATE

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CAVITY WALL TIES SPACED AROUND INTERFACE WITH FLOOR AS USUAL

"FRAMED CONSTRUCTION WITH SHELF ANGLE / INTERRUPTED EXTERNAL LEAF" (SECTION DETAIL)

DETAILING OF COURSING ESSENTIAL TO ENSURE WALL TIES ARE NOT EXCESSIVELY SKEWED IN PLAN OR SECTION (COURSES OF INNER AND OUTER LEAF SHOULD ALIGN AT TIE LOCATIONS)

"SHELF' ANGLE TO SUPPORT MASONRY (FIXING TO SLAB TO BE DESIGNED - CAST-IN SYSTEM, POST FIXED OR OTHER)

WHERE VERTICAL SPAN OF WALL IS 'BROKEN' BY INTERMEDIATE SUPPORTING ELEMENTS, CONTRACTION / EXPANSION TO BE ALLOWED FOR WITH COMpressible JOINT

"FRAMED CONSTRUCTION WITH CONTINUOUS EXTERNAL LEAF" (SECTION DETAIL)

PROVIDE HEAD RESTRAINT TO MASONRY INNER LEAF IN THE FORM OF DEBONDED TIES AT REGULAR INTERVALS IN PERPENDS

"FRAMED CONSTRUCTION WITH SHELF ANGLE / INTERRUPTED EXTERNAL LEAF" (SECTION DETAIL)
HEAD RESTRAINT EMBEDDED IN PERPEND OF MASONRY. FIXED TO CONCRETE CAST-IN CHANNEL OR POST-FIXED TO SOFFIT OF BEAM / SLAB
DEBONDED TIE ALLOWS FOR DIFFERENTIAL MOVEMENT IN VERTICAL DIRECTION (THERMAL, DEFLECTION ETC.)

"HEAD RESTRAINT TO MASONRY WALLS TO PRIMARY STRUCTURAL FRAMES"
(SECTION DETAIL)

HEAD RESTRAINT EMBEDDED IN PERPEND OF MASONRY. FIXED TO STEEL USING PROPRIETARY SYSTEM OR FIXED / SHOT-FIRED INTO BOTTOM FLANGE OF BEAM. DEBONDED TO ALLOW FOR VERTICAL MOVEMENT
LATERAL LOADING TO BE CONSIDERED FOR THE SPECIFICATION OF HEAD RESTRAINT. CONSIDER FIXITY OF DESIGN SUPPORTS.

"HEAD RESTRAINT TO MASONRY WALLS TO COMPOSITE DECKING"
(SECTION DETAIL)
RESIN / CHEMICAL OR EXPANDING ANCHORS MAY BE REQUIRED FOR FIXING TO CONCRETE ENGINEER TO CONSULT MANUFACTURERS' LITERATURE FOR SPECIFICATION (CONSIDERING CRACKED / UNCRACKED CONDITIONS AND LONGEVITY REQUIREMENTS)

BOLTS OR SET SCREWS TO MANUFACTURER'S RECOMMENDATIONS

BEAM AT HEAD OF WALL

TIES ARE USUALLY BESPOKE, MANUFACTURED ACCORDING TO REQUIREMENTS / ENGINEER'S SPECIFICATION

VERTICAL LEG OF HEAD RESTRAINT TIE

SINGLE SIDED TIE

DOUBLE SIDED SLIDE-ON TIE

TIES SLIDE ONTO VERTICAL LEG

"THE USE OF BESPOKE CAVITY HEAD RESTRAINTS"
(ISOMETRIC)

SLOPE OF BEAM

SKewed TIE

SLOPED AND CRANKED BEAMS WILL REQUIRE BESPOKE SPECIFICATION OF TIES TO ENSURE VERTICAL LEG IS PLUMB AND TIES ARE NOT SKewed IN RELATION TO MASONRY JOINTS. HERE, A BRACKET HAS BEEN DETAILED TO MATCH THE INCLINE OF THE BEAM

"THE USE OF BESPOKE CAVITY HEAD RESTRAINTS WITH INCLINED BEAMS"
(ELEVATION)
TIES TO FLANGES OF STEEL COLUMN
(PLAN DETAIL)

TIES CAN ALSO BE FORMED OF 'HAMMERED ON' CLIPS

TIE SECURED TO STEELWORK

DEBONDED TIES TO ALLOW FOR MOVEMENT BETWEEN MASONRY AND COLUMN

"TIES TO CONCRETE COLUMN"
(PLAN DETAIL)

TIES SLOTTED INTO CAST-IN CHANNEL/WALL-STARTER SYSTEM OR POST-FIXED TO CONCRETE COLUMN

DEBONDED TIES TO ALLOW FOR MOVEMENT BETWEEN MASONRY AND COLUMN
TIE DEBONDED / SLEEVED ON EACH SIDE OF JOINT (ALLOWS MOVEMENT PARALLEL TO PLANE OF WALL)

BLOCKWORK BUILT TIGHT INTO WEB

"CAVITY WALL CONSTRUCTION - RESTRAINT TO PRIMARY STRUCTURAL ELEMENTS" - CORNER (PLAN DETAIL)
Where possible, walls are to be fully bonded/toothed into one another.

Where walls are not toothed in, suitable restraint ("wall starter systems") should be provided if compatible with the design intent. (i.e. restraint and end conditions) refer to manufacturer’s literature for options.

Ties extend into leaf, tying in shear, but allowing in-plane movement (expansion or contraction) of the crosswall.

"Restraint of Crosswalls" (isometric)
"LINTELS IN NEW MASONRY" (SECTION DETAIL)

PIER ONTO WHICH LINTELS BEAR TO BE IN ACCORDANCE WITH BS 5977-1:1981 STABILITY CHECKS SHOULD BE UNDERTAKEN WHERE PIER MAY BE SLENDER, OR RESTRAINT IS NOT PROVIDED FULL HEIGHT AND ACTS AS A MASONRY 'COLUMN'

CUT HEADER TO ENSURE PROPER COURSING OF MASONRY

PRECAST CONCRETE LINTEL OVER OPENING IN MASONRY WALL

LINTELS TO LAND ON WHOLE UNIT. AVOID SPANNING THE END OF A LINTEL OVER A JOINT

"PRESS STEEL CAVITY WALL LINTELS" (SECTION DETAIL)

CAVITY TRAYS, DPC, INSULATION AND OTHER ACCESSORIES SPECIFIED BY ARCHITECT ARE OMITTED HERE - THESE DETAILS ARE GENERALLY BY OTHERS

NOTE: SOME MOISTURE RELATED ACCESSORIES MAY REQUIRE OPEN PERPENDS TO FACING BRICKWORK

CAVITY TRAYS, DPC, INSULATION AND OTHER ACCESSORIES SPECIFIED BY ARCHITECT ARE OMITTED HERE - THESE DETAILS ARE GENERALLY BY OTHERS

NOTE: SOME MOISTURE RELATED ACCESSORIES MAY REQUIRE OPEN PERPENDS TO FACING BRICKWORK

"LINTELS IN NEW MASONRY" (ELEVATION)

CAVITY TRAYS, INSULATION, DPC AND OTHER ACCESSORIES SPECIFIED BY ARCHITECT ARE OMITTED HERE - THESE DETAILS ARE GENERALLY BY OTHERS

NOTE: SOME MOISTURE RELATED ACCESSORIES MAY REQUIRE OPEN PERPENDS TO FACING BRICKWORK
WHERE JOIST SPAN PARALLEL TO WALL PROVIDE HARDWOOD FOLDING WEDGES TO FILL ANY GAP THAT EXISTS TIGHT AGAINST MASONRY AND SLANT NAIL INTO POSITION.

CAST SHORT LEG OF THE STRAP INTO AN IN-SITU CONCRETE PADSTONE, MINIMUM GRADE C35/10
NOTE: TRADITIONAL PADSTONE SPECIFICATION USES 'C35/10' TO INDICATE COMPRESSIVE STRENGTH (35MPa) AND AGGREGATE SIZE (10MM)

REBATE TOPS OF FLOOR OR ROOF JOISTS TO RECESS STRAP AND FIXINGS, PROVIDE 30MM WIDE x 5MM THICK x 1200MM LONG GALVANISED STEEL STRAPS SCREWED TO MIN. 3NO. JOISTS WITH A MINIMUM OF 2NO. 50MM LONG NO.12 WOOD SCREWS EACH.

PROVIDE FULL DEPTH TIMBER NOGGINS BETWEEN JOISTS AT LINE OF STRAP

WHERE JOIST SPAN PARALLEL TO WALL PROVIDE HARDWOOD FOLDING WEDGES TO FILL ANY GAP THAT EXISTS TIGHT AGAINST MASONRY AND SLANT NAIL INTO POSITION.

"RESTRAINT STRAPPING FOR NEW FLOORS IN EXISTING TRADITIONAL MASONRY CONSTRUCTION" (TO COMPLY WITH APPROVED DOCUMENT A OF THE BUILDING REGULATIONS) (SECTION DETAIL)
WHERE TOP FLANGE OF BEAM IS NOT WIDE ENOUGH TO ACCOMMODATE FULL WIDTH OF CAVITY WALL, PLATE MAY BE WELDED TO TOP OF BEAM

DEFLECTION LIMITS ON STEEL BEAMS TO BE APPROPRIATE FOR THE SUPPORTED WALL CONSTRUCTION. PRE-DEFLECTION OF BEAM MAY BE REQUIRED

"SUPPORT OF EXISTING MASONRY CAVITY WALLS ON STEEL BEAM" (SECTION DETAIL)

25MM NON-SHRINK DRY-PACK (WELL RAMMED)

DEFLECTION LIMITS ON STEEL BEAMS TO BE APPROPRIATE FOR THE SUPPORTED WALL CONSTRUCTION. PRE-DEFLECTION OF BEAM MAY BE REQUIRED

"SUPPORT OF EXISTING SOLID MASONRY WALLS ON STEEL BEAM" (SECTION DETAIL)

"PROVISION OF RESTRAINT WITH BEAMS SPANNING PARALLEL TO MASONRY WALL" (SECTION DETAILS)
WHERE TOP FLANGE OF BEAM IS NOT WIDE ENOUGH TO ACCOMMODATE FULL WIDTH OF CAVITY WALL, PLATE MAY BE WELDED TO TOP OF BEAM.

DEFLECTION LIMITS ON STEEL BEAMS TO BE APPROPRIATE FOR THE SUPPORTED WALL CONSTRUCTION.

“When Supporting Cavity Wall Eccentrically on Steelwork” (SECTION DETAIL)

SHELF ANGLE OR OVERSIZED PLATE TO SUPPORT EXTERNAL LEAF OF CAVITY WALL

“When Support of New Masonry Cavity Walls on Steel Beam” (SECTION DETAIL)

WHEN SUPPORTING CAVITY WALL ON A BEAM, TORSION MOMENT CAPACITY SHOULD BE CONSIDERED AND ROTATIONAL DEFLECTION WITH CONSIDERATION OF RESULTING HORIZONTAL DEFLECTION AT THE TOP OF THE WALL.
EXISTING MASONRY WALL

20mm DRYPACK

NEW OR RESUPPORTED STEELWORK

IN THIN WALLS, CARE MUST BE TAKEN TO AVOID SPLITTING AT LOCATION OF WIDE PADSTONES

CARE TO BE TAKEN DURING INSTALLATION TO AVOID 'PUNCHING' THROUGH WALL

BEAMS MUST BE FABRICATED TO SIT ON ENTIRE WIDTH OF PADSTONE. ECCENTRICITY WILL CAUSE STRESS CONCENTRATIONS UNDER THE PADSTONE

EXISTING MASONRY WALL

AVOID PLACING BEAMS ECCENTRIC TO PADSTONE CENTROID. ANY STRESS CONCENTRATIONS RESULTING FROM SUCH ECCENTRICITIES SHOULD BE CHECKED

ANY ECCENTRICITY SHOULD NOT PRODUCE TENSION WITHIN THE SUPPORTING MASONRY

"SUPPORT OF BEAMS SPANNING ONTO TO MASONRY WALL" (SECTION DETAIL)
OPENINGS, SERVICE
PENETRATIONS AND CHASES

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TAKE CARE WITH SPLITTING WHEN CUTTING CHASES IN MASONRY WALLS

"CHASES ADJACENT TO OPENINGS"
(ELEVATION)

CHASES CLOSE TO OPENINGS MUST BE CAREFULLY CONSIDERED TO AVOID FAILURE DUE TO STRESS CONCENTRATIONS (PADSTONES, LINTEL BEARING ETC.)

COURSES ABOVE OPENINGS TO INCLUDE REINFORCEMENT OR LINTEL

SERVICE PENETRATIONS THROUGH WALLS CAN BE SLEEVED DURING CONSTRUCTION

"CHASES IN SOLID MASONRY"
(SECTION DETAIL)

IN-DEPTH DETAILING RECOMMENDATIONS CAN BE FOUND IN BS EN 1996 AND THE ACCOMPANYING NATIONAL ANNEX

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