

## ***Waterproofing detail at base of brick veneer wall.***

### **1 BACKGROUND**

- 1.1 The matter before the Authority is the adequacy of a waterproofing detail (“the detail”) constructed at the base of a brick veneer wall. The territorial authority concerned is withholding the code compliance certificate as it believes the detail to be inadequate.
- 1.2 The applicant is the building owner acting through a firm of consultants and the other party is the territorial authority.
- 1.3 The Authority takes the view that it is being asked in effect to determine whether the detail complies with clause E2 “External moisture” (and consequentially clause B2 “Durability”) of the New Zealand building code (the First Schedule to the Building Regulations 1992) (“the building code”).
- 1.4 The Authority engaged the services of an independent expert (“the expert”) to give advice as to whether the detail would comply with the relevant requirements of the building code.
- 1.5 In making its determination, the Authority has not considered any other aspects of the building code.

### **2 THE BUILDING WORK**

- 2.1 The building is built on a sloping site and comprises a main residence built entirely on one level and a habitable unit built underneath at one end. The building has concrete masonry foundation walls with timber framing over faced with a brick veneer.
- 2.2 This Determination refers to the detail at the base of the external brick a veneer wall that has already been constructed. A drawing of the detail was provided with the applicant’s submission and is appended to this Determination as Appendix A. As shown, the detail consists of brick veneer cavity construction sitting on a concrete masonry header block, which also supports the timber framed floor. There is no nib on top of the masonry foundation wall, meaning that the underside of the bolted H3 treated plate supporting the floor joists is at the same level as the bedding course of the brick veneer.

- 2.3 The detail provides for ‘waterproofing’ via a proprietary damp proof layer (“the DPC”) that runs “down [the] boundary joist and lap[s] under [the] first course of bricks” finishing approximately 30 mm back from the outside face of the wall. The building paper over the timber framed wall is shown as lapping over the DPC. Additionally, but only over those sections of the wall which abut the habitable unit, a bitumen emulsion coating has been applied “to [the] top of the header block and up [the face of the H3 treated] plate”. The brick veneer is shown as having weepholes in its bottom course and the H3 treated plate sits on a bituminous type damp-proof course.
- 2.4 The territorial authority had previously issued a building consent for the building based on drawings that included the detail.

### 3 THE LEGISLATION

The relevant provisions of the building code include:

#### **Clause E2 External moisture**

**E2.3.2** Roofs and exterior walls shall prevent the penetration of water that could cause undue dampness, or damage to building elements.

**E2.3.5** Concealed spaces and cavities in buildings shall be constructed in a way which prevents external moisture being transferred and causing condensation and the degradation of building elements.

#### **Clause B2 Durability**

**B2.3.1** Building elements must, with only normal maintenance, continue to satisfy the performance requirements of this code for the lesser of the specified intended life of the building, if stated, or:

- (a) The life of the building, being not less than 50 years, if:
- (i) Those building elements (including floors, walls, and fixings) provide structural stability to the building, or
  - (ii) Those building elements are difficult to access or replace, or
  - (iii) Failure of those building elements to comply with the building code would go undetected during both normal use and maintenance of the building.

### 4 THE SUBMISSIONS FROM THE PARTIES AND THE EXPERT’S REPORT

#### 4.1 General

- 4.1.1 The Authority received written submissions from the applicant, including a letter from the technical manager of a brick manufacturer and a written submission in the form of a letter from the territorial authority. The expert also furnished a report giving his opinion as to the adequacy of the detail.

## 4.2 The Applicant

### 4.2.1 The applicant advised:

The [territorial authority] have stated they will not certify [the detail] – approx 25 m in dispute.

The area directly above the habitable [unit] has had [a bitumen emulsion coating] applied to the top of the header block and up the side of the bottom plate. The other area in dispute has not had the [bitumen emulsion coating] applied to it.

The detail in dispute has been constructed by the building contractor as per the designs that were supplied by the owner. The owner obtained a building permit (sic) for [the detail] from the [territorial authority].

I have been advised that this identical method of construction has been certified in the past by both the [territorial authority] and independent Building Certifiers, so therefore believe that the solution is an acceptable alternative to the solutions detailed in NZS 3604.

### 4.2.2 In a later submission the applicant forwarded written advice from the technical manager of a brick manufacturer who had studied the detail and visited the site. The technical manager commented:

NZS3604 calls for a waterproof membrane in this location, because builders could not be relied upon to smooth plaster and [apply the bitumen emulsion coating to] the up stand at the base of the brick veneer cavity, and moisture on occasions, enviably (*sic*) tracked inside. The concern was not primarily where an earth sub-floor is involved, as is 80% of the case in question, but where a 'habitable' space existed on the ground floor. (Fig.11.3(D) NZS3604). Simple observation with an earth sub-floor, reveals the moisture under the dwelling on a sloping clay base is hundred's of times greater than any moisture that is ever likely to come through a failed flashing in this area. In the unlikely event that this happens, ventilation and drainage is provided to accommodate the moisture.

The Standard calls for a waterproof membrane. [The DPC] is a waterproof membrane. It is a purpose designed damp-proof-course for exactly this situation. It has a thickness of 0.5mm or twice the thickness required under concrete slabs as per code.

The detail used on this home is as per [a particular detail published in the brick manufacturer's trade literature] and complies with the NZ Standard. It should be noted that [another detail published in the brick manufacturer's trade literature] calls for a rubber membrane or similar flashing where a ground floor/basement area exists. However, I stress that this is only a recommendation we would like to see in 'habitable' type areas, the [DPC] used complies and there should be no reason not to issue a Code Compliance Certificate on this home in this regard. Further, this detail has been used successfully throughout New Zealand since late 1998 without any issues at all and does not warrant the cost and delays of a 'Determination' as requested by council.

### 4.2.3 In its final submission the applicant confirmed the details of the bitumen emulsion coating and the DPC, noting that the former was only applied to those areas adjacent to the habitable unit. The applicant also advised:

The [bitumen emulsion coating] has been applied directly to the timber and extends up the bottom plate by a 100mm minimum.

The [DPC] used is ... specifically designed for the type of application that it has been used in. The fact that the [DPC] has been lapped up the face of the bottom plate and extended down to the front of the bricks results in a natural fall being achieved which acts to divert water from the brick cavity to the exterior of the building via the weep holes in the bricks.

Where joins were required in the [DPC], the lapping detail consisted of a minimum of 150 mm overlap at all points, thus ensuring no water is able to penetrate the [DPC].

- 4.2.4 The applicant also attached a copy of a letter from a staff member of the Authority to the territorial authority. This letter was in response to an initial query by the applicant's architect as to whether the detail would qualify as an alternative solution to the equivalent detailing in NZS 3604. The enquiry and its subsequent response were dated prior to the application for a Determination. The staff member was of the opinion that the detail was "an acceptable detail as an alternative solution". The opinion was based on the information provided and was set out under a disclaimer, which included the statement that "[a] different decision might be reached if the matter was referred to the Authority for a formal determination".

### **4.3 The Territorial Authority**

- 4.3.1 The territorial authority confirmed the installation of the [proprietary DPC] noting:

The [DPC] has been lapped under the building wrap and fixed to the boundary joist, and folded out over the top of the [header] beam, finishing approximately 30-40 mm from the outer edge of the [header] beam.

- 4.3.2 Although the territorial authority did not observe the application of the bitumen emulsion coating it noted its understanding that it had been applied as described above but only over the area adjacent to the habitable unit.

- 4.3.3 The territorial authority raised questions as to whether the detail:

...[incorporating the bitumen emulsion coating] is ... an acceptable waterproof system above a habitable space that complies with New Zealand Building Code? Does it replace the requirement to have a concrete nib on masonry foundation walls [as required by NZS 3604: 1999 Clause 11.7.3.2]? and

... provide[s] adequate protection from dampness, to the wall plate, opposite the subfloor area, considering that water from the cavity could track across top of concrete [header] beam, underneath the [proprietary DPC] and perhaps through any laps in the [proprietary DPC].

### **4.4 The Expert's Report**

- 4.4.1 The expert noted that:

The traditional approach to this detail has involved a rebate being formed in the top of a foundation wall or in the edge of a concrete floor and allows the base of the brick veneer cladding to rest in the rebate at least 50mm below any adjacent timber plates or framing. The purpose of the rebate is to facilitate drainage of moisture that enters the cavity behind the bricks and to avoid water damage to adjacent timber framing.

- 4.4.2 The expert initially reviewed the relevant standards and the acceptable solution regarding the detail. These being respectively, NZS 3604:1990 “Light timber frame buildings”, NZS 3604: 1999 “Timber framed buildings” and Acceptable Solution E2/AS1. The expert concluded:

Out of all of the details provided there is no exception to the 50mm step between the bottom of the brick veneer and the timber framing. Figure 11.3D [of NZS 3604: 1999] introduced the need for a waterproofing membrane at the bottom of the cavity however this detail specifically refers to there being a habitable space on the inside. The purpose of the waterproofing membrane would be to prevent excessive absorption of water into the top course of blocks that may transfer to lining materials on the inside.

- 4.4.3 The expert also referred to the technical literature from the manufacturer of the DPC and to an independent appraisal of it, neither of which made reference to the use of the DPC without a rebate.
- 4.4.4 The expert collected a sample of the DPC from the building site. In his opinion, the product “is typical of many damp proof course membranes in that it is not suited to being glued either to itself or to other surfaces and applying jointing tape would not provide a waterproof seal”.
- 4.4.5 The expert was not able to access the habitable unit but did inspect the subfloor space. The plate had a moisture content in the vicinity of 21% and there was moisture staining on the inside of the blockwork header following rain. The expert considered the fact that header was wetter on the inside than the lower part of the wall could be an indication of failure of the detail, however, he considered it could take many years for the consequences of failure to become apparent and be detected and would be very difficult to rectify.

#### *Above Habitable Space*

- 4.4.6 Consideration of the proposed detail where used over a habitable room, led the expert to consider that in this situation it did not satisfy the functional and performance requirements of the building code. He advised:

There is no proposal to adhere the [DPC] to the top of the filled concrete blocks. Without a continuous waterproof connection between the underside of the [DPC] and the concrete blocks, water is able to flow under the [DPC] across the top of the blocks and into the interior. This water may be either from within the veneer cavity or even external water from house washing or rain that causes wetting to the lower portion of the bricks. Water will be drawn through this area by capillary action and this may either cause dampness to the adjacent bottom plate or to wall framing and lining materials of the lower habitable room.

There will also be an opportunity for water to travel between joints in the [DPC] because it will not be possible to provide a seal at the laps of the [DPC]. While the [DPC] may be provided in long runs it is inevitable that joints will occur and these will be vulnerable to water entry.

The [bitumen emulsion coating] on top of the header block does nothing to mitigate the above two problems. Applying [the bitumen emulsion coating] up the face of the timber plate is also not helpful ...[as it].. is not suited to spanning across a joint between concrete and timber.

The detail ... indicates that the bottom plate is to be treated to H3 level whereas the joists attached to that plate are only to be treated to H1 level. I see no benefit in having the plate treated to H3. If that plate becomes excessively wet, water will transfer into the adjacent joists. If that plate becomes wet for long periods it will still decay even though H3 treated. For the detail to be effective it must be robust enough to prevent the bottom plate becoming wet, in which case an H1 plate would be adequate.

#### *Above Undeveloped Sub-floor*

4.4.7 In respect of the detail over the sub-floor areas the expert advised the following issues as still being relevant:

The causes of water entry will be capillary attraction under the [DPC] and water flowing through the unsealed joints in the [DPC]

Even if the inside plate is H3 treated it is important that it does not stay wet for long periods because:

- a) Even H3 timber will decay if it is wet enough for long enough; and
- b) There is potential for moisture transfer from the plate to the adjacent timber.

Placing the plate on a single layer of [damp-proof course] is not enough protection to ensure that it will not get wet from water drawn into the vicinity.

4.4.8 Further the expert noted that:

Sub floor ventilation should not be regarded as a means of drying out timber that has become wet due to leaking from above. The purpose of sub floor ventilation is to remove ground moisture from the sub floor space to prevent humidity levels from rising to unacceptable levels. Sub floor ventilation may also be helpful to remove construction moisture but should not be relied upon to dry wet timber on an ongoing basis. Timber that has become wet from a failure of this detail could easily exceed 40% mc and this cannot be expected to dry successfully in a sub floor environment.

The bottom plate should have a 50 year durability to comply with B2.1.3a (sic) and such durability is not a certainty when the plate has the potential to become occasionally wet and potentially wet for long periods.

4.4.9 The expert concluded that the detail above the habitable unit should not be regarded as an alternative solution and considered that they were major issues to be addressed even when used adjacent to the sub-floor space.

4.4.10 With respect to the applicant's claims that the detail has been widely used, the expert noted:

... that does not provide evidence that the detail should now be formally adopted as the minimum industry standard. It would take many years (possibly 20 years or more) for the failures flowing from this detail to become apparent. Where certainty of 50 year durability is needed I can see no justification for departing from the details in NZS 3604 and the current acceptable solution because it is not difficult to intuitively see that the existing acceptable details offer greater certainty of performance, less opportunity for contractor error and a safety margin to protect the consumer from building failure.

4.4.11 The expert's report was forwarded to the parties, and there was no response from them as regards the report.

## **5 THE AUTHORITY'S VIEW**

- 5.1 The Authority notes that Figure 3 in Acceptable Solution E2/AS1 shows a rebate and for the particular case where the detail is used next to a habitable space Figure 11.3(D) of NZS 3604:1999 has a 50 mm set down plus a “waterproof membrane”. The Authority considers there is no demonstrable conservatism in these details and that any proposal that eliminates the set down, needs to incorporate other compensating factors if it is to meet the requirements of the building code. To enable comparison with the detail Figure 11.3(D) of NZS 3604 is appended to this Determination as Appendix B.
- 5.2 The Authority considers that water will get into the veneer cavity for a variety of reasons. This observation is not based merely on the evidence of water staining found by the expert (see paragraph 4.4.5), as this probably relates to an isolated failure, but on the general nature of brick veneer construction. That water must be directed away from the interior of the building or from building elements so that undue dampness inside the building, or damage to building elements, does not result.
- 5.3 The Authority considers that if the detail is to be accepted to achieve an equivalent performance, it is essential that the DPC is securely fixed to any substrate, and that the laps and angles formed in it are fully sealed and watertight. The Authority accepts the contentions of the expert that neither of these criteria has been met in this case.
- 5.4 The Authority is also of the opinion that the bituminous emulsion coating applied over the areas adjacent to the habitable unit does not compensate for the perceived failings of the DPC. There are major concerns regarding the junction between the blockwork and the timber framing.
- 5.5 The Authority agrees with the opinion of the expert that additional drying factors in a sub floor area as compared with a habitable space, if any, are not sufficient to overcome the deficiencies of the detail.
- 5.6 The Authority also considered the opinion that the Authority's staff member gave regarding the detail prior to the application for this Determination. Since the date of that response, the Authority has received further information pertaining to the detail, which was not made available to the staff member concerned. This additional information has led to the Authority reaching the opinion in this Determination that differs from that originally proffered by the staff member.

## **6 THE AUTHORITY'S DECISION**

- 6.1 In accordance with section 20 of the Building Act:
- (a) The Authority hereby determines that the detail without the provision for an upstand or nib does not comply with the relevant requirements of clauses E2 and B2 of the building code, whether installed over the habitable unit or over the sub floor areas.

- (b) It is not for the Authority to decide how defects of the detail are to be rectified or to determine the extent of the work that should be rectified. These matters are for the owner to propose and for the territorial authority concerned to approve. Similarly, it is not for the Authority to direct the territorial authority as to what will amount to reasonable grounds on which it may be satisfied as to compliance with the building code.

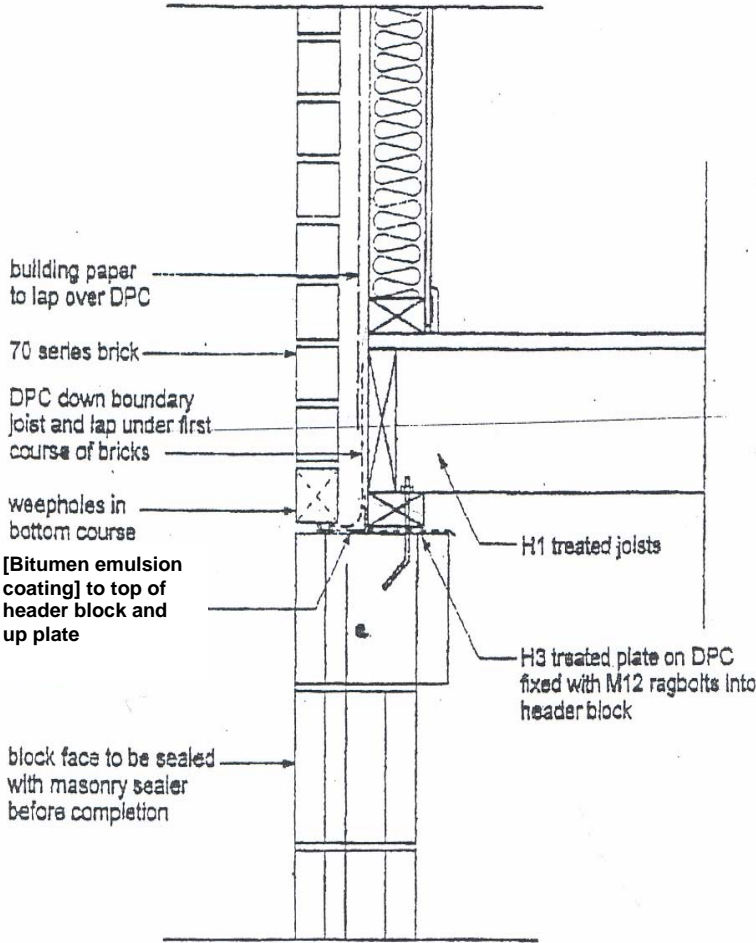
Signed for and on behalf of the Building Industry Authority on this                      day of  
2004

J Ryan  
Chief Executive



# Appendix A

## Waterproofing detail at base of brick veneer wall (“the detail”)



AS-BUILT FOUNDATION WALL DETAIL - SCALE 1:10

# Appendix B

Figure 11.3(D) of NZS 3604:1999

