HARLEY
HADDOW

124-125 Princes St
Edinburgh
EH2 4AD

T +44(0)131 226 3331
E edin@harleyhaddow.com

HARLEYHADDOW.COM

Our Ref: 303253/[redacted]/NR

4 September 2018

Scottish Borders Council
Building Standards
Newton Street Boswells
Melrose
TD6 0SA

For the Attention of Mr James Whiteford

Dear Sir

Structural commentary regarding the use of M2.5 mortar and incorporating inspections at [redacted] and 16 Kittlegairy Crescent and [redacted] Kittlegairy [redacted] Peebles

1.0 Introduction and Description of Brief

Harley Haddow were appointed by Scottish Borders Council to provide a degree of impartiality in the assessment offered by David R Murray Consulting Engineers, acting as Consulting Civil and Structural Engineers for the estate developer Taylor Wimpey, as regards specifically mortar strength (and information supporting) together with matters regarding how this mortar is performing in-situ in terms of durability at the relatively modern Kittlegairy estate, Peebles.

Based on building surveys previously undertaken separately by Taylor Wimpey and where mortar defects had been identified in areas zoned for M2.5 mortar use, they in turn offered a list to Scottish Borders Council of a number of properties for inspection. These properties were subsequently lettered and 3 no. properties, selected by Scottish Borders Council at random, were brought forward to Harley Haddow for a visual assessment. The inspection of mortar durability or 'friability' was thereby limited to these properties only. No specific opening ups were undertaken or cavity wall block inner leafs reviewed at these properties to support our opinion going forward, nor were any assessment of matters regarding damp considered.

Whilst a limited comment is made as regards structural calculations and certification, the emphasis of this commentary is on the condition of the mortar to the facing brickwork.

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The estate lies on the eastern boundary of Peebles, off the B7062 and bounded on its eastern and southern elevation by open farmland, the western boundary by a slightly more mature estate and its north by the aforementioned road. Completion certificates as supplied by Scottish Borders Council show that dwellings were offered up between 2008 and 2015 with the years 2010, 2011 and 2015 (for the southern boundary of the site) supporting in excess of 30 completions per annum for an estate of over 200 dwellings, these mostly low rise detached and semi-detached two storey dwellings though with some terrace units also noted along the western boundary.

Structurally the dwellings consist of a traditional cavity wall to form the perimeter (lightweight blockwork inner and facing brick outer), with internal partitions of both blockwork and timber partitions; timber only to upper floors. Ground floors are of concrete slab construction with upper floors in timber with roofs also formed using proprietary timber trusses. Locally, steelwork would also be provided to accommodate, say, elevation step backs above garages or at bay windows.

We have been provided, via David R Murray Consulting Civil and Structural Engineers and SER Certifiers for the development, Taylor Wimpey standard house type details for the estate together with an interpretive site investigation and foundation zoning plan. This plan shows traditional, singly reinforced concrete strip footings to natural ground (sands and sands / gravels) at shallow depths or mass concrete trench fill to deeper bearing strata, a strategy wholly appropriate for the load applied by low rise domestic properties.

Harley Haddow attended site on 17 May 2018 to review selected properties (as noted above). Access was gained to the full external perimeter to [redacted] and 16 Kittlegairy Crescent with only the front and rear elevations of [redacted] Kittlegairy [redacted] a mid-terrace two storey dwelling reviewed.

Both [redacted] 16 Kittlegairy Crescent are detached two storey dwellings, with No. 16 having a detached garage and [redacted] having this garage integral with the dwelling. We understand that No. 16 corresponds to a 'Rosewood' standard Taylor Wimpey house type, with [redacted] being a 'Sherwood.'

The following is based on our visual assessment only and with reference to the following information supplied to Harley Haddow by David R Murray Associates.

- Blyth and Blyth Report EC21515 June 2017 entitled, 'Review of Past Work and Summary Report on Defective Mortar to External Leafs.'
- Layout plan showing M2.5 / M4 mortar in dwellings.

Furthermore the following information was presented for review by Mr and Mrs. P Hall, owner of No. 16 Kittlegairy Crescent, this issued to Harley Haddow during our site visit and for full visibility is as outlined below:

- David Narro Associates, 17.09.18, Nov 2017, '16 Kittlegairy Crescent, Peebles – Structural Survey Report.'
- Robertson Eadie Consulting Engineers, January 2018, 16 Kittlegairy Crescent, Peebles – 'Calculations to consider structural adequacy of dwelling.'
- Supporting information relating to mortar tests at 16 Kittlegairy Crescent.

2.0 Mortar Specification and Use Within the Estate

In summary we understand that the mortar mix specified within the originally submitted and certified warrant drawings was a class (iii) mortar mix to BS5628. However, for dwellings constructed pre 2012 then an M2.5 mix was used, with dwellings constructed thereafter using an M4 mix.

For simplicity and for clarity for those of a non-technical background, an M4 mix has a higher compressive strength capacity than that of M2.5, this generally by a proportionally greater by volume amount of cement in comparison to sand within the base mix, though other factors can influence.

3.0 Commentary on Structural Design

With specific regards to the assessment of the dwellings and their structural adequacy we would note, based on the information that we have been supplied with, that there has been no less than four Edinburgh based Consulting Structural Engineers appointed either by the developer or by individual homeowners to review the dwellings' condition or check their structural adequacy by calculation.

These consultants appear satisfied that in broad terms that the dwellings are found satisfactory by calculation and by inspection. Our review would similarly suggest in principal that the dwellings are structurally adequate with a M2.5 mortar. Furthermore assessing by calculation against localised factors such as funneling between adjacent houses or garage gables, this set against the requirements BS8103, also suggests that these wall panels are, overall, also satisfactory.

The above notwithstanding robust masonry design with appropriate load factors together with no evidence of on-site structural distress to the properties inspected should give confidence as regards the overall design performance and stability.

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We would further note specifically the detached garage to No 16 Kittlegairy Crescent and would confirm, set within the terms of relevant British Standards, that this is adequate as regards its structural design capacity and is not in immediate danger of collapse. That notwithstanding there were clearly, we feel, matters pertaining to appropriate tying either for roof trusses and wall piers amongst others, and would suggest that these are actioned as soon as possible – a situation we understand, at the time of writing, that Taylor Wimpey are progressing separately.

4.0 Commentary on Inspection

Numbers [redacted] 16 Kittlegairy Crescent lie on the eastern boundary of the development, with No. 16 being particularly exposed; its rear elevation facing to open farmland. [redacted] lies diagonally south of No. 16, with [redacted] Kittlegairy [redacted] situated along the western boundary, and somewhat sheltered within the main body of the estate.

Scottish Border Council records indicate completion certificates show handovers for No. 16 in February 2011, [redacted] in October 2011 and for the terrace block that forms [redacted] Kittlegairy [redacted] between July 2011 and March 2012. All dwellings were constructed within the area zoned under M2.5 mortar.

Our site observations at both properties on Kittlegairy Crescent particularly No. 16 raised concerns as regards the mortar condition and its durability or friability. Here our findings are in agreement with the aforementioned David Narro Associates Report of November 2017, section 4.0 (as commissioned by the homeowner) where we would note and concur:

- Noticeable variation or banding in mortar colour to the perimeter facing brick elevations. This could be through variation in mortar mix, laying condition, weathering or temporary protection (perhaps even such mundane elements such as scaffolding toe boards that could locally offer protection) or prevailing wind direction etc.;

- When the mortar bed was tested with a metal point the beds could be easily scraped back. Our own experience noted that in perpends, metal point ends in localized locations could be 'pushed through' to the cavity. Good, well cured mortar beds should show a strike or score mark rather than being scraped away. This emphasizes the highly friable nature of the mortar.

- The surface of the mortar beds appears more weathered and granular than would normally be expected given its relatively young age. Rather than a smooth 'bucket handle' type finish or similar as would be anticipated, it appears granular and rough finished, more a sandpaper surface. We would also note that to the garage at No. 16, a wall tie end was exposed, this protruding through the weathered mortar bed.

Harley Haddow cannot comment on matters regarding inside the loft where described by David Narro Associates.

Our assessment of [redacted] exhibited similar concerns as regards mortar finish and friability generally. [redacted] Kittlegairy [redacted] however appeared to have similarly friable beds, though to be fair not to the same extent as that exhibited on Kittlegairy Crescent.

Though only 3 properties were inspected by Harley Haddow, the matters arising from these inspections suggest that there is a significant issue as regards medium to long term durability of the M2.5 mortar mix as used on site. In brief we would consider that the mortar is friable and liable to deterioration and wear, this likely at an increasing rate without repair. Whilst in the short term, say over the next 12 – 18 months, substantial manifestation of 'defects' (such as water penetration) is unlikely, in the medium term (up to 5 years) and the longer term (beyond 10 years) the mortar will weather, will subsequently weaken and will undoubtedly result in failure. It would be prudent to arrest this deterioration to the appropriate dwellings now.

5.0 Commentary on Wall Ties

During preliminary discussions with Scottish Borders Council regarding the mortar's friability Harley Haddow raised concern as regards the tensile capacity of cavity wall ties (these Vista VE4 wall ties). To this end, and for completeness Taylor Wimpey agreed to undertake wall tie pull-out tests, this undertaken at 5 discrete locations at [redacted] Kittlegairy [redacted] Peebles on 16 August 2018 and witnessed by Harley Haddow.

These tests, conducted within an upstairs bedroom and ground floor garage, required the internal block wall to be removed, the exposed wall tie clamped and thereafter 'pulled' to failure. These tests found a pull out value circa 1kN or more, greater than anticipated tension loads applied to walls of circa 0.65kN (refer RJ Fixings report of 16 August 2018, Ref No. DRM 02)

Given the above and based on these tests we are satisfied that the tensile capacity has not been demonstrably compromised by the bedding mortar's friability.

6.0 Conclusions and Recommendations for Future Work

Low cement rich mortar mixes such as that of M2.5 can be unforgiving. It needs careful batching coupled with clear and appropriate site protection measures, particularly against weathering, using experienced tradesmen. On and off site quality control when using such mixes is simply fundamental.

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Whilst we have not been commissioned to comment fully on workmanship within the estate overall our limited assessment of the properties as noted found examples of what we would consider poor overall site quality control over and above that of the mortar. This varied from poor restraint strapping details and pier construction / tying (this evidenced in the garage to [redacted] Kittlegairy[redacted] through to setting out of the conservatory outer leaf at [redacted] sitting off, by some 20mm, from its supporting outerbuild. Whilst we accept that this is only to two properties, and therefore cannot be truly considered as representative of the site as a whole, we understand that a number of properties have had 'workmanship' issues over and above that concerning friable mortar.

The above notwithstanding and with specific reference to the friable mortar, if left without repair and as noted, then the mortar beds would continue to deteriorate and likely at an increasing rate, leading perhaps to water ingress, damp and eventual structural distress.

Given the above we would recommend the following:

- A property by property 'scrape and view' of the in-situ mortar characteristics of each M2.5 dwelling. (This has perhaps already been done (or is on-going) and some attempt has been made by Taylor Wimpey to identify the extent of 'friability.' We would consider that the issue is estate wide where M2.5 mortar is used and also not limited to somewhat unique matters such as the location of each dwelling or its completion date, say during the particularly harsh winters of 2010 and 2011).

The remediation strategy as suggested by Taylor Wimpey to dwellings with identified friable mortar is to rake out and repoint. This is a relatively common repair methodology and coupled with the comfort given by the pull out tests (admittedly limited to only one property) Harley Haddow are satisfied that this is adequate.

Given the above and in summary we would therefore confirm, offering our independent view to Scottish Borders Council as Consulting Structural Engineers, that the dwellings are satisfactory in terms of structural design and load capacity using M2.5 mortar. However where this mortar is exhibited to the outer leaf and found friable, without repair, this will undoubtedly lead to defects being manifested.

We trust that we have satisfied your requirements of Harley Haddow as regards this matter however if you would like to discuss the above please do not hesitate to contact the undersigned direct.

Yours faithfully
For HARLEY HADDOW

[redacted]

Director