RICHARD GOWAN CONSULTING
structural engineering

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BY EMAIL

Our Ref: 20-149-XX-LR01

26 November 2020

Ms Clare Lenehan
Maintenance Surveyor
Building and Estate Department
Devon and Cornwall Police

Dear Ms Lenehan

ST MARY'S POLICE STATION, ISLES OF SCILLY
STRUCTURAL ENGINEERING NOTES

Further to my recent visit to the above property to look at the reported cracking in the detached garage building and first floor bridge structure, I write to confirm my observations and thoughts on the building structure.

I visited the site on Thursday 19th November 2020, the weather was fine and dry during my visit.

GARAGE BUILDING

The garage building consists of three garage units that are all largely open plan internally; two of the units are the same depth (on plan), and the third extends out deeper towards both the front and rear, with the rear of this end unit divided off into a separate area with a separating blockwork wall.

The garages are built out of concrete blockwork laid as a single thickness wall with double block thickness piers at varying positions around the wall perimeter. The floor throughout the garages is a concrete slab and the flat roof is timber joisted, supported over the garage off timber beams.

The garages are built onto what would have been a sloping site. The concrete driveway to the front slopes down from the road, at the sides of the garage the ground continues to slope down, leaving the rear ground level approximately 800mm down from the internal slab level. It is believed the rear wall of the garage below slab level is retaining made up ground below the garage floor slab. Beyond the rear of the garage the ground carries on sloping down before a random coursed stone retaining wall reduces the level down by a further 1700mm to 2400mm in height, along the length of the garage.

Various trial pits were dug around the garage to reveal the foundations, which vary considerably around the building. To the front the building appeared to be founded fairly shallow at 600mm below ground level, the foundation here is only around 100mm thick and appeared quite weak in make up as simply sand with a small amount of cement. A similar foundation depth and thickness was observed at the rear of the deeper garage, however a more 'concrete like' consistency was exposed here in the foundation. Lastly the trial pit at the rear of the shallower depth garages was much deeper at around 1000mm below ground level, here the foundation was an 850mm deep shuttered trench fill concrete strip. This last foundation was revealed to have some irregularities in it, possibly from failure of any formwork/shuttering when the wet concrete was poured. My site sketches of the trial pits are enclosed for reference.

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Various cracks were observed around the walls of the garage and across the surface of the concrete floor slab. The majority of the cracking observed is across the rear of the garages and ranged from 0.5mm across, through 2-6mm across, and in the worst instance up to 30mm across (this last crack has been filled with cement in the past but has re-opened to 2mm across). In addition to the cracking the rear wall of the garage is rotating outwards by 0.5° to 1.5°; the greatest outwards rotation was observed in the section of wall below floor slab level, which it is believed is retaining, noticeably the slab is protruding now around 3mm out beyond the wall above slab level.

Not directly linked to the garages, the stone retaining walls behind the garage are distorted with visible cracking and an outwards rotation of around 3-5° (averaged across the uneven wall surface).

The observations made suggest that there is a wider scale movement of this area of the hillside; the stone retaining walls rotating causing the ground behind to move and sink, the garage wall rotating outwards most likely aggravated by the lower section of garage wall appearing to retain ground below the garage floor slab; all of this resulting in distortion and cracking of the relatively weak single skin block construction garage above.

To secure the garage and significantly reduce the risk of future movement and cracking occurring in the garage, works would be required to enhance the foundations by underpinning the footings down to firm subsoil and importantly also strengthening or possibly rebuilding the stone retaining wall below the property as a properly engineered structure with blockwork reinforced with a concrete core and a new reinforced concrete foundation.

All of this work will be quite complex, not least complicated by the garages remaining in situ above. A simpler approach would be to take down the garages to make construction of proper foundations much easier. These foundations could be detailed to avoid a need to improve the stone retaining wall below, rendering that area of retained ground simply a raised flower bed and not an important piece of land required to hold up a block of garages. Of course, if the garages are not required then a replacement parking area could be detailed, perhaps kept closer to the roadside away from the retained section of ground as an even simpler solution!

If you would like any engineering details and specifications on any improvements to the existing garages or replacement structures please do let me know.

FIRST FLOOR BRIDGE

A shuttered reinforced concrete pedestrian bridge gives private access from the road level across into the first-floor apartment over the police station. The bridge spans around 3700mm and is a little over 1700mm wide. The bridge deck spans side to side between a 200mm deep downstand beam running along each side of the bridge.

Spalling of the concrete has locally occurred under the bridge deck exposing the reinforcing bars. This spalling must have occurred some time ago as the reinforcement is very significantly corroded with little of the original cross section remaining. It is worth noting that the concrete cover over the reinforcement is very minimal at less than 10mm whereas I would expect much more like 35 to 40mm of concrete protecting the steel. There appears to have been a history of problems with this bridge seen by various patch repairs to the concrete soffit of the slab suggesting other areas of corroded reinforcement have been revealed in the past. I also observed crack lines along the underside of the side beams, a symptom of corrosion of embedded steel work within the beam that could be impacting on the strength of the beam.

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Looking for the source of this problem I suspect it is a result of a combination of things including poor detailing of the bridge (or poor following of details by the Contractor) with the reinforcement close to the surface and so very vulnerable; no drip detail on the side of the concrete beam to throw run off water away from the concrete, and lastly a poor coping detail over the top of the masonry walls over the bridge beams with simply painted plywood used to prevent water penetrating into the fabric of the bridge.

On review, I am concerned about the condition of embedded reinforcement within the beams to the bridge and would suggest that some localised breaking out of the concrete is carried out to expose the reinforcement to allow its condition to be assessed. If the reinforcement is sound then we can detail a repair process for the concrete to reinstate integrity of the beam structure, this would then allow us to introduce new support beams under the bridge deck to give support to the deck that has been lost by corrosion of the embedded steel reinforcement. I can detail the investigations I would require to be able to assess the bridge if you like me to, and we can find a general labourer on the island who can break out locally the concrete for us, and I can review photographs of the investigations to allow a plan of repairs to be made.

I trust my notes above are all clear and helpful, do ask if you have any queries.

Yours sincerely

[redacted]

Richard Gowan
for Richard Gowan Consulting Limited

The Institution of StructuralEngineers
Chartered Member