

The Structural Strengthening of a Masonry Heritage Shop House using Glass Fibre Based Materials

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1 Introduction

A masonry shop house in Malaysia was badly affected by construction being undertaken at an adjacent lot. The building was in a serious state of disrepair and on the verge of collapse at the time of the investigation and temporary propping and a stoppage of adjacent works had to be imposed. The uneven loads due to differential settlement on the masonry columns had caused the characteristic structural cracking of the Arches, where cracks of up to 50 mm in width were noted. The structural cracking extended to the party wall along Gridline A2- A5 where cracks of up to 30 mm were noted. The wall away from the new development was structurally intact. The cracking on the walls and the Corridor Arch were clearly to do with settlement and vibration loads associated with the adjacent construction, rendering the building unsafe. Compensation Grouting was undertaken for all footings at the common Boundary between the Shop House 150 and 152 from Gridline A/1 to 7 to guard against future movement and settlement.

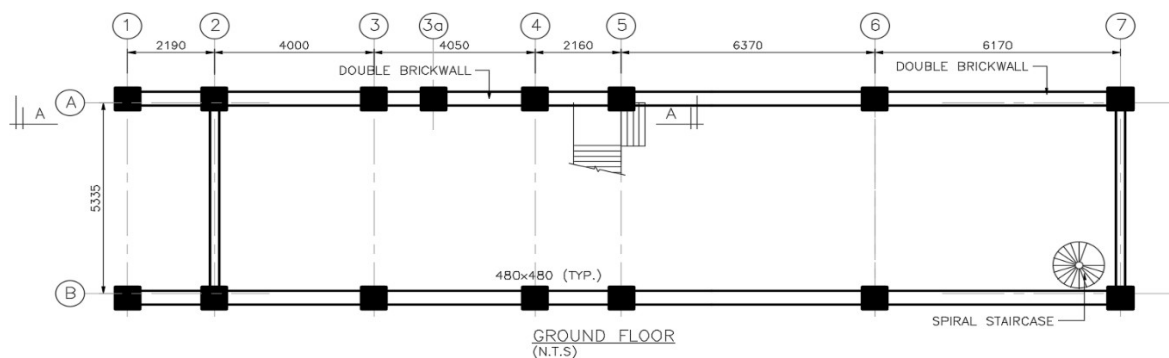


Figure 1. Plan View of Shop House.

2 Options for Structural Reinstatement

Several innovative techniques for intervention of the masonry building was considered and the use of the glass fibre based Maperod G and Mapewrap Foccio was adopted. The masonry wall cracks were repaired by a stitching method, using Maperod G a glass fiber rod. This was used due to the compatibility of modulus of elasticity (40,800N/mm²) to the lime mortar and good tensile strength of 760 N/mm² to help bridge the cracks in case of further movement. As glass fiber is also corrosion resistant it will be protected in future even though it is embedded in the highly porous masonry substrate. The materials used were easily transportable, flexible *i.e.* could be

prepared to requirements on site, and the supplier had the infrastructure to deliver the materials to site quickly despite this being imported. As the stitching could only be performed at one-side Mapewrap G Fiocco was used. This consists of an L-shaped anchor using epoxy impregnator Mapewrap 31SP and is bonded at both ends of the Maperod G, having been planted deep into the masonry wall to a depth of ~140mm to provide full anchorage. Structural bonding was achieved by using epoxy adhesive Adesilex PG2 TG and all contact surfaces of the masonry were primed with Mapewrap primer 1 SP to consolidate the porous surface and eliminate dust. The crack lines were reinforced at every 4-5 brick intervals and inserted into the pointing layer for a minimal impact on the existing masonry wall. The full extent of the repairs is illustrated in Figure 2.

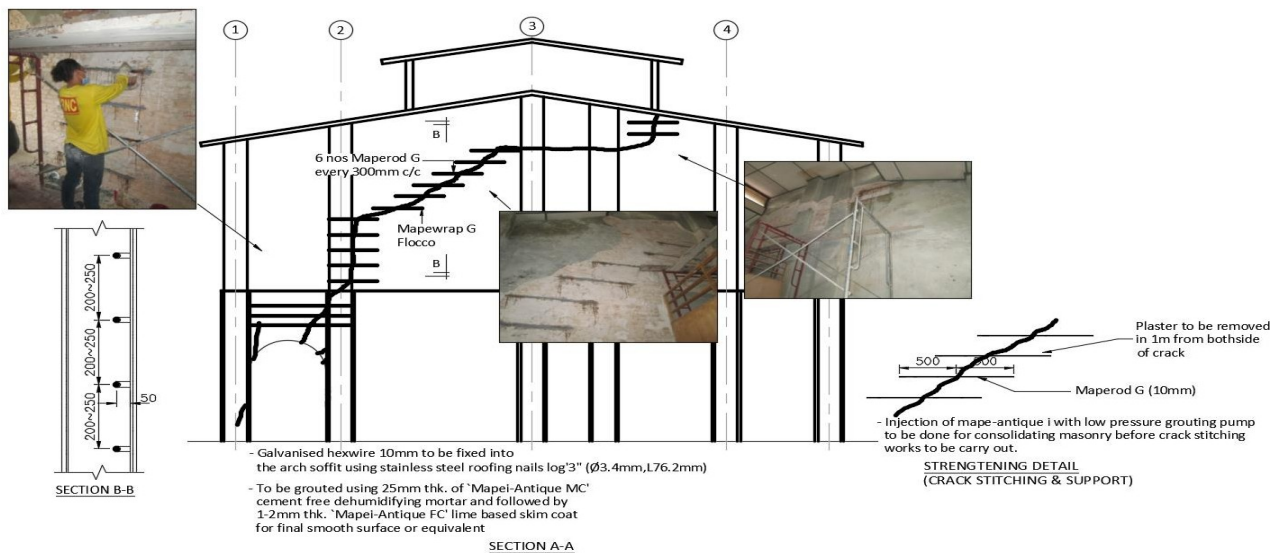


Figure 2. Significant Cracking of the Arch and Party Wall and the proposed approach to crack repair.

3 Project Accomplishment

The remedial works were undertaken rapidly and reduced the impact of the loss of access to the facility. The engineering solution entailed using modern materials developed specifically for heritage upgrading and was done with little impact on the overall heritage value of the building.

The works were successfully undertaken at approximately a quarter of the cost and 1/3 of time compared to rebuilding of the structure which was the only other option. This work demonstrated the validity of the use of modern materials for a non-invasive low maintenance reinstatement of a heritage building badly affected by settlement and structural movement with little impact on its heritage value.

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References

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