附件 A

與保護歷史建築物有關的發展項目／個案
(截至二零二二年十一月十五日的進展)

港島

	發展項目／個案	受影響的建築文物	最新進展
1.	中區警署建築群活化計劃	● 中區警署建築群(即中區警署、中央裁判司署和域多利監獄)是香港境內維多利亞式和愛德華式殖民地風格建築物的典範，於一九九五年列為法定古蹟。	● 中區警署建築群活化後定名為「大館—古蹟及藝術館」，二零一八年五月二十九日開始營運。 ● 至於在二零一六年五月二十九日部分倒塌的已婚督察宿舍(第四座)，香港賽馬會(馬會)已於二零一九年十二月十二日向古物諮詢委員會(古諮會)講解最新的修復計劃。 ● 馬會於二零二一年七月九日宣布，重新評估的結果顯示，第四座現時狀況較二零一九年預期的更為惡劣。基於公眾安全理由，馬會決定終止最新的修復計劃，並重新考慮於二零一六年向古諮會提交的八個初步修復方案。 ● 馬會正研究第四座不同保育安排和計劃的可能性，以保障公眾安全為首要考慮因素。馬會在最新發布的技術資訊中指出，第四座有欠安全的部分將會被移除，而修復計劃則會在移除工程進行期間再行探討和制訂。詳情請參閱夾附的馬會最新技術資訊(只備英文版)。

附件 A

	發展項目／個案	受影響的建築文物	最新進展
2.	市區重建局(市建局)卑利街／嘉咸街發展計劃(H18)	● 威靈頓街 118 及 120 號的騎樓式唐樓分別為三級和一級歷史建築。 ● 嘉咸街 26A 至 C 號是一列三幢戰前樓宇，獲評為三級歷史建築。 ● 閣麟街磚石構件不獲古諮會評級。	● 市建局計劃保留威靈頓街 118 號由書法家蘇世傑所題的兩幅水磨石招牌，日後於原址興建的公眾休憩用地展示。 ● 市建局會原址保留威靈頓街 120 號的騎樓式唐樓及嘉咸街 26A 至 C 號唐樓的正面外牆。
3.	前中區政府合署西座(合署西座)翻新工程	● 前中區政府合署(包括當中的三座建築物)獲古諮會評為一級歷史建築。西座於一九五九年落成，二零一一年前一直用作政府辦公室，歷時逾 50 年。	● 前合署西座翻新工程的文物影響評估報告於二零一五年三月四日獲古諮會通過後，前合署西座會改建成為律政司和法律相關組織的辦公室。保育工程已於二零一六年十月展開，並已大致完成，而文物詮釋工程的目標完工日期為二零二三至二四年。

附件 A

九龍

	發展項目／個案	受影響的建築文物	最新進展
4.	鑽石山綜合發展區發展項目及沙田至中環線鑽石山列車停泊路軌的建造工程	● 機槍堡及前皇家空軍飛機庫分別為二級和三級歷史建築。	● 按照已獲通過的環境影響評估報告，前皇家空軍飛機庫部分構件須分拆存放，日後連同飛機庫模型展出，機槍堡則須整個移走存放，作日後復建之用。香港鐵路有限公司已分別在二零一八年七月及八月把飛機庫及機槍堡移往工地。 ● 房屋署(房署)獲委託負責活水公園的規劃工作。房署建議把飛機庫及機槍堡重置於鑽石山綜合發展區西面的活水公園內(而非原來的位置)。房署建議在公園竣工後，把飛機庫及機槍堡活化再利用，在公園內展示，並附有詮釋資料。 ● 古蹟辦繼續按照已獲通過的環境影響評估所載規定，從文物保育角度提供技術意見。 ● 房署已於二零二二年五月十六日就機槍堡提交修復方案。古蹟辦於二零二二年七月二十二日回覆房署並提供意見。房署遂於二零二二年十月二十八日再次就機槍堡提交修復方案。

附件 A

	發展項目／個案	受影響的建築文物	最新進展
5.	重建廣華醫院並增設中醫大樓	● 原先的醫院，連現時用作東華三院文物館的大堂，始建於一九一一年，後於一九二三年擴建，一九五八年全面重建為廣華醫院，大堂得以保存。 ● 大堂於二零一零年列為法定古蹟，現為東華三院文物館。	● 動工前已按照二零一五年六月四日古諮會通過的文物影響評估報告所載規定，妥善保護大堂。 ● 第一期的重建工程於二零一六年六月展開。二零一八年十一月二十六日發現東華三院文物館出現沉降，故醫院管理局暫停地盤工程。經進行補救工程後，沉降情況已見穩定。工程遂於二零一九年二月恢復進行。 ● 目標是在二零二五年年底前完成整個重建項目(第一、二期工程)。

Annex

LATEST TECHNICAL APPRAISAL FOR BLOCK 4 THE CENTRAL POLICE STATION COMPOUND

ABSTRACT

1. This Paper relates to the Married Inspectors' Quarters ("Block 4") located at the Former Central Police Station Compound ("CPS Compound"). The context for the preparation of the Paper is that safety concerns emerged during the preparatory work for the 2019 Updated Recovery Plan[1] ("Updated Recovery Plan") for Block 4, which triggered a re-appraisal of the building's condition. The re-appraisal was conducted by a series of reviews carried out by an expert team including Purcell, Arup and PAYE[2] ("expert team"). The team advised that Block 4 cannot be revitalised according to the Updated Recovery Plan in a safe manner within acceptable levels of risk, and there would be an undue risk of sudden collapse during the recovery work, which would place an unacceptable level of danger on the operatives undertaking the works and on the public, both within the site and immediately outside it. As the condition of Block 4 has continued to deteriorate, despite careful protection, the expert team advised that the parts of the extant building fabric that cannot be retained safely must be removed as soon as practicable. This paper explains the findings of the re-appraisal and inform the Antiquities Advisory Board ("AAB"/"Board") on the proposed schedule of removing the unsafe building fabric of Block 4.

PURPOSE OF PAPER

2. This Paper explains the latest development of the Updated Recovery Plan for Block 4, which suffered a partial collapse (Figure 1) on 29 May 2016. Specifically, AAB members are invited to note the following, which is explained later in detail.

- It was revealed during the preparatory work[3] (see Figure 1 for location) for the Updated Recovery Plan that the building was in worse condition than was previously known (see paragraphs 8 to 11).
- Safety concerns emerged during the preparatory work, which triggered a re-appraisal of the building's condition in 2020–21 by the expert team. It revealed that previous assumptions about the inherent strength characteristics of the masonry (which were already low) were too optimistic (see paragraphs 12 and 13).
- The strength of the masonry is derived from two factors: the quality of materials and the quality of workmanship used to construct the building. Both have been found to be poor. In this case, another important factor is the uncertain load paths down through the building, as more temporary propping has been installed to counter

[1] Details of the Updated Recovery Plan can be found in the board paper (ref. AAB/11/2019-20) for the AAB meeting on 12 December 2019. This proposal comprised retention of the external envelope of the building and some rearrangement of the interiors to meet statutory and operational demands, including changes to the façade design of the rebuilt part at the west end.

[2] The expert team comprises:
- Purcell Asia Pacific Limited, Architects and Heritage Consultants ("Purcell")
- Ove Arup & Partners Hong Kong Limited, Structural Engineers ("Arup"); also the project Registered Structural Engineer ("RSE")
- PAYE Stonework and Restoration Limited, Masonry Contractors ("PAYE"), United Kingdom

[3] The preparatory work refers to the removal in 2020 of the extant portion adjacent to the collapsed part, referred to as the "West Room".

building movements. Considering the inherent weakness in the structure and uncertain load paths, it was concluded that robust methods of undertaking the recovery work cannot be developed with sufficient confidence in the safety of the operations necessary to carry them out (see paragraphs 14 to 20). Taking account of the expert team's advice and, being mindful that safety must be the top priority, The Hong Kong Jockey Club (the "Club") concluded in July 2021 that it had to terminate the implementation of the Updated Recovery Plan (see paragraphs 21 and 22).

- Given the grave circumstances of the situation, the Club and its consultants revisited the original eight recovery options[4] (Figure 2) with a view to identifying whether any alternative approaches could be applied to mitigate risk to within acceptable limits. However, exhaustive reviews have confirmed that there would be an undue risk of sudden collapse during the recovery work.

- As a result, the Club and its consultants are now in the process of pursuing an optimal solution that reconciles the retention of heritage value with the over-riding need to achieve an assured level of safety. It is therefore essential to arrive at the optimal solution by a process that is based in fact – a process that is particularly challenging when there are many unknowns regarding inherent weaknesses of the building. The aim is to identify and adopt a recovery scheme once the range of unknowns is within reasonable limits. To do this, it is first necessary to remove the historic fabric sufficiently to make the building safe and to retain what remains as a relic (see paragraphs 23 to 25). Detailed design work on the recovery schemes can then proceed, which will be shared with the Board as soon as sufficient information is available.

- As the condition of Block 4 has continued to deteriorate despite careful protection, the expert team advised that the parts of the extant building fabric that are unsafe to retain must be removed as soon as practicable before ongoing dilapidation further weakens the building fabric, which would make it more hazardous to handle. A plan for removal of unsafe fabric is proposed, and the rationale is explained (see paragraphs 26 and 27).

BACKGROUND

3. The CPS Revitalisation Project is a large-scale heritage conservation scheme aimed at conserving one of Hong Kong's most distinguished heritage assets for adaptive reuse. The Club has been leading the Project since 2008. Its objective was, and remains, to conserve safely as many heritage features as possible while sensitively adding compatible new elements to revitalise the site to create a heritage and arts centre for public enjoyment. This approach has earned the accolade of the UNESCO Asia Pacific Award of Excellence[5].

4. Of the sixteen historical buildings that were retained, fifteen have been meticulously conserved. The policy framework that has guided the Project is set out in the

[4] Original eight recovery options presented in the board paper (ref. AAB/33/2015-16) for the AAB meeting on 8 September 2016: (A) Restoration, (B) Reconstruction, (C) Adaptation, (D) Preservation, (E) Façade Retention, (F) Façade and Interior Retention, (G) Total Reconstruction and (H) Demolition

[5] UNESCO Award of Excellence October 2019. The citation reads: "The technical quality of the restoration work is standard-setting on an international level, ensuring the authenticity and integrity of the historic fabric. Innovative architectural and engineering solutions are underpinned by meticulous investigation and rigorous conservation principles."

Conservation Management Plan ("CMP") and the project vision statement. The revitalised CPS Compound operates as Tai Kwun – Centre for Heritage and Arts ("Tai Kwun"), which commenced operations on 29 May 2018. Block 4 has remained out of use owing to the partial collapse in May 2016 whilst much effort has been spent planning for its recovery.

5. Block 4 was constructed in 1862–64. Its construction form followed that of traditional British architectural styles but was modified to suit Hong Kong's sub-tropical climate. On the north and east façades (Figure 3), there are large arched openings between brick piers, and high ceilings, all intended to aid ventilation in the hot and humid weather. The building is roofed in Chinese clay tiles that are heavier than British tiles or slates.

6. As a result of the construction form of tall and slender piers, using low-strength materials and poor workmanship, the brick piers are more highly loaded yet weaker than those in British buildings of a similar date. Hence, Block 4 has inherent structural weaknesses and a lower safety factor than other buildings in the CPS Compound. Whilst other buildings were safely restored for adaptive reuse and have remained stable, Block 4 suffered a partial collapse during construction works whilst undergoing similar works.

7. The partial collapse and the further surveys and data gathering that have occurred since 2016 have presented a considerable challenge: on the one hand, Block 4 was, and remains, a key building on the site, in both the context of the former Central Police Station and now as Tai Kwun. Its close proximity to the primary entrance to the site and to the Parade Ground, its spatial relationship with the former Central Magistracy and being among the first substantial group of buildings built in the 1860s, all combine to place this building among the surviving principal group of buildings on the site. On the other hand, its building form, the materials used (Figure 4; Paragraph 11) and the poor workmanship (Figure 5) have rendered the building very fragile, and therefore vulnerable to local failure or even progressive collapse.

PREPARATORY WORK / BUILDING MOVEMENTS

8. Preparatory work necessary to enable the Updated Recovery Plan to proceed was carried out in 2020. It comprised the removal of roof tiles, roof timber trusses, brick walls and timber floors (Figure 6). It was carried out by a Registered General Building Contractor ("RGBC"), with qualified workers using hand tools in accordance with the industry best practice and work processes approved by government authorities.

9. During the removal of the West Room, four movement incidents were detected during daily inspections (Table 1). These building movements included enlargement of existing cracks in both vertical and horizontal directions (Figure 7), tilting, and settlement. Whilst small movements are not uncommon during construction works, in view of the 2016 partial collapse, these movements caused considerable alarm because they also included slight but unexpected movements of the east façade facing Arbuthnot Road, some twenty metres away from the West Room where the removal work was being carried out.

10. Another movement incident was detected more recently, on 3 November 2022, after typhoon 'Nalgae' (Table 1). Since there was no construction work going on at Block 4 at that time, the movement detected would likely have been caused by the environmental effects of wind and rain induced by typhoon Nalgae, and despite the extensive

temporary propping that was, and remains, in place. This is a clear sign of the building's fragility.

11. For each of the movement incidents, the RGBC prepared an incident report. Arup, the project RSE, then prepared and submitted the respective investigation reports to the Buildings Department, detailing the investigation and conclusion. Possible causes for each movement incident were identified but the root cause(s) could not be confirmed.

RE-APPRAISAL OF BUILDING CONDITION

12. The safety concerns that emerged during removal of the West Room triggered a re-appraisal in 2020–21 of the building's condition and design parameters. Its findings revealed that the building was in worse condition than was previously known. The basis for the change of view about the robustness of Block 4 lies in the widespread and very poor quality of materials discovered during the removal of the West Room where the expert team was provided with the opportunity to inspect a very large sample of the existing brickwork (approximately 57,000 bricks). The inspections revealed the weakness of many of the bricks exposed as explained below:

- *Visual Inspection* – The mortar in the West Room construction would have been prepared locally. Inspections revealed that large areas of the mortar have a powdery composition, with very little cohesion. It is so weak that it is possible to separate the bricks by hand easily (Figure 8). Thus the brick walls should be described as a loose assembly of low-strength bricks in a matrix of weakly-bound sand (Figure 9) rather than a cohesive structural unit.
- *In-Situ Assessment of Brick Hardness* – Inspections of various brick layers, assisted by the use of hand-tools, in the walls of the West Room (Figure 10) revealed that approximately 75% of the bricks are very soft (Figure 11). The distribution of these bricks is random.
- *Brick Compression Tests* – Compression tests on 40 brick samples were conducted (Figure 12). The test results show that the characteristic strength of the bricks is 4.32 N/mm^2, some 28 – 44% lower than the results of the previous comparable tests carried out in 2009 and 2016 (Table 2).

13. The above results were unexpected and not in line with the strength characteristics that had been established when the Updated Recovery Plan was prepared[6]. In summary, the new findings showed that the brickwork superstructure is more variable in strength and therefore has less predictable performance characteristics. Whilst the most recent tests apply to the bricks from the West Room only, it is reasonable to expect that the bricks

[6] It should be noted that the scale of the inspection conducted during the removal of the West Room was unique, and such an opportunity was not possible before because most of the brickwork was concealed under plaster or render of heritage value, and the previous investigations were limited to small, discrete areas.

extracted from the West Room walls are representative of the materials in the remainder of the building[7,8].

STRUCTURAL ENGINEERING RISKS

14. Most of the construction operations necessary to complete the Updated Recovery Plan are now considered to be unduly hazardous and are not capable of being mitigated. This stems from the use of relatively weak materials, generally not well built, in a multi-storey building with unduly large openings and tall, slender piers. The outcome of these factors is that the brickwork is excessively stressed but more significant is the fact that the areas of particular weakness cannot be identified with certainty. This makes the structural performance unfeasible to predict with sufficient certainty to mitigate risk to within acceptable limits.

15. *Hazards owing to Low Vertical Strength of Existing Brickwork under Gravity Loads*. The recent testing shows that some of the brickwork is very weak. Back-calculations suggest that the ground floor piers could be close to failure due to the self-weight of the brickwork alone. This would explain the compression failure cracks found in some of the piers (Figures 13, 14 and 15). As the ground floor piers could be close to failure due to the self-weight of the brickwork, even a very small change, for example owing to construction variations, could result in a collapse.

16. *Highest Hazard Operations*. The Updated Recovery Plan requires many operations, some of which are hazardous and invasive structural interventions. The highest hazard operations are considered to be:

- Removing the internal walls and floors, because these tie together the outer walls that were to be retained;
- Underpinning the existing walls (if required owing to excessive settlement on sheet pile installation), because this relies on the existing walls being able to temporarily arch between the pins which are constructed in a hit and miss pattern;
- Excavating for the new foundations because this is likely to result in some settlement of the foundations of the existing walls, even though they have been underpinned;
- Replacing the temporary props supporting the projecting bay on the north façade with permanent support (Figure 16);
- Replacing the temporary timber frames in each opening with new permanent steel brackets. (Figure 17);

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[7] *Brick Sampling*. The removal of the West Room walls provided an opportunity to extract a large number of grey brick samples, which would otherwise have been impossible to extract in significant numbers from within the existing walls. These samples provided a larger quantum of bricks available for testing than would ordinarily have been possible. The brick samples for compression tests were selected randomly from the bricks removed from the West Room walls in all three storeys, and grouped in two broad types: (i) 20 nos. whole bricks (10 nos. 'soft' whole bricks; 10 nos. 'not soft' whole bricks) and (ii) 20 nos. broken bricks (10 nos. 'soft' broken bricks; 10 nos. 'not soft' broken bricks).

[8] *Brick Sample Representativeness*. Whilst the most recent tests apply to the bricks from the West Room only, it should be noted that it was not constructed in isolation. Rather, it was built at the same time as the remainder of the building with the brickwork progressing vertically upward, course by course, as in a typical masonry construction method. It is therefore reasonable to expect that the bricks extracted from the West Room walls are representative of the materials in the remainder of the building.

- Repairing and, if necessary, rebuilding the slender piers (Figure 18). Given the poor condition of the brickwork, there is no certainty that a viable temporary works scheme can be developed for this operation;
- Temporary removal of the roof timber trusses, which are acting as ties between the outer walls, to facilitate the construction works owing to restricted site work area.

CONSTRUCTION HAZARDS

17. To retain the masonry fabric safely, the building first needs to be stabilised. To do this, four phases of work are required as outlined below. However, there is an underlying risk attached to this task because the masonry walls have limited structural integrity, which prevents educated judgements to be made in advance of and during the works.

    - Provide temporary vertical support to the structural arches and floors;
    - Restrain the external fabric (entailing invasive structural interventions which are themselves hazardous, Figure 19);
    - Remove the existing floors; and
    - Infill masonry voids by grouting and making good arches, etc, progressively with the removal work.

    These tasks rely upon the ability of the existing structure to bear short-term additional loads. A problem therefore arises when the structure is barely able to support its own weight, and the material strength is very weak, as in this case, which inhibits the ability to install temporary support safely.

18. The success of grouting of voids in masonry walls is based upon the three main factors below.

    - Extent of voids and ability to accommodate a flowable grout;
    - Grout injection pressure; and
    - Integrity of the wall to be grouted.

    The extent of voids and limited bonding arrangement / integrity within the walls of Block 4 is a concern when applying a pressurised grout[9]. Such increase in internal pressure could cause bulging of the weak masonry walls (Figure 20). When the weaknesses are random in location and widespread, it is not feasible to confirm the long-term integrity of the wall because of the inability to guarantee the extent of grouting or bonded masonry undertaken.

19. PAYE has assessed the risks associated with the building operations required to restore the building, which shows that:

    - Of the twelve operations evaluated (Figure 21), all are considered High Risk in the initial risk rating;
    - After introducing mitigation measures, the risk level of three items can be reduced to Medium Risk; and

[9] For example, the preferred grout is St Pauls Lime Grout which requires an increased grouting pressure to penetrate masonry voids

- The remaining nine items remain at High Risk.

20. The risk assessment raises major concerns about the health and safety risks of the Updated Recovery Plan, to the extent that there is undue risk of sudden collapse during the recovery work. PAYE's conclusion is that it is unfeasible to deliver the Updated Recovery Plan safely given the scale of invasive structural interventions required in light of the poor building condition and construction hazards identified (Figure 22).

TERMINATION OF UPDATED RECOVERY PLAN

21. Given the new findings and the construction hazards identified, the expert team believes that the recovery structural interventions will be far more hazardous than was initially anticipated. The low strength brickwork might not survive the structural interventions required. Local failure or partial collapse, similar to the partial collapse in 2016, may occur suddenly without warning, posing severe concern for the safety of workers, staff and visitors in the CPS Compound, as well as road users on Arbuthnot Road. The expert team therefore strongly advised against proceeding with the Updated Recovery Plan.

22. The control of risks to the health and safety of construction workers and the public, not least the adjacent public highway, Arbuthnot Road, is the highest priority of the Club. Ordinarily, such risks are manageable but in this case the expert team concluded, regrettably, that this was not practicable. Looking ahead with public safety as the principal consideration, the Club accepted the findings and advice of the expert team, and concluded in July 2021 that it had to terminate the implementation of the Updated Recovery Plan[10] and to seek an alternative recovery option.

DEVELOPMENT OF RECOVERY SCHEME

23. Since Block 4 has experienced a partial collapse, the recovery work must therefore be based on an approach that has sufficient certainty in construction safety to ensure building operatives, and ultimately members of the public, future users of the building facilities, visitors to Tai Kwun, and staff, tenants and programme partners who work there, will have full confidence in its safety. The Club and its consultants revisited the original recovery options in order to see whether any alternative approaches could be applied to mitigate risk to within acceptable limits, but arrived at the conclusion that, regrettably, there is no feasible method of undertaking the works that would provide sufficient confidence of avoiding a serious incident, such as further collapse and/or serious injury to operatives.

24. Given the outcomes of the re-appraisal and Block 4's status as a Declared Monument, the optimal recovery scheme is likely to be one that retains heritage fabric where it is feasible to do so whilst ensuring safety and sustainability[11]. In broad terms, the Club and its consultants are exploring two recovery options, i.e. (i) conserve-as-found[12] and

[10] "Update on the Married Inspectors' Quarters (Block 4) of the Central Police Station Compound", 9 July 2021, https://www.taikwun.hk/en/taikwun/press/press_release/update-on-the-married-inspectors-quarters-block-4-of-the-central-police-station-compound/117

[11] "Sustainability" here means that the recovery scheme should facilitate a new use that is sustainable in the long term.

[12] Conserve-as-Found option – This option seeks to remove the historical fabric that is strictly necessary to make Block 4 safe and to retain what remains as a relic. The aim would be to convey some tangible sense of the building after removal of the unsafe building fabric.

(ii) new building[13], which are basically derived from the original eight recovery options (see Footnote 4). Working out what this means in detail is ongoing. As soon as sufficient details are available, the recovery schemes will be shared with the Board.

25. In the meantime the Club seeks to remove only the historical fabric that is strictly necessary to make the building safe and to retain what remains as a relic. The precise extent of retained fabric will be subject to the structural expert's advice and permitted limits under the Building Regulations. What can be said at this stage is that the granite retaining walls facing Arbuthnot Road and the Sergeant's Yard (Figure 23) would be capable of retention. As to the superstructure and masonry wall foundations, it is envisaged that a series of defined stages of removal works will be completed, followed by inspections and testing to confirm the extent of historic fabric that could be safely retained. With public safety being the most important principle, the long-term safety performance of the masonry structure must be the primary criterion to determine the extent of building fabric that can be kept.

PROPOSED SCHEDULING OF BLOCK 4'S REMOVAL WORKS

26. As the condition of Block 4 has continued to deteriorate despite careful protection, the expert team advised that the parts of the extant building fabric that are unsafe to retain must be removed as soon as practicable before ongoing dilapidation further weakens the building fabric, making it more hazardous to handle. The Club therefore proposes to submit an application for a permit under section 6 of the Antiquities and Monuments Ordinance ("Section 6 permit") to the Antiquities Authority (i.e. Secretary for Development) to enable commencement of Block 4's preparation for the removal works (i.e. site hoardings, catch fans, working platforms, etc) to start in June 2023, with physical removal works starting in November 2023.

27. Scheduling the physical removal works to start in November 2023 is to ensure that all risky removal works at height (e.g. removing roof clay tiles and timber roof trusses, taking down fragile masonry arches and piers, particularly those facing Arbuthnot Road and the Sergeant's Yard) can be completed before the next typhoon season in May 2024. Failing to commence in June 2023 would mean deferring the removal works for another year and prolonging the deterioration of Block 4 in what is a live, publicly-accessible site.

CONCLUDING REMARKS

28. Block 4's partial collapse was a most unfortunate incident that has damaged the heritage value of the building and the site. Six years on, the detailed studies and lengthy deliberations on Block 4 demonstrate the Club's commitment to facing substantial technical, practical and engineering challenges necessary to recover the building for adaptive reuse. Despite the unfortunate situation concerning Block 4, the Club remains committed to achieving an optimal solution that reconciles the need to retain heritage value whilst achieving a sustainable long-term future and to do so safely.

[13] New Building option – This option is a wholly new building that would replace the extant building in a form similar to the present building and thus reinstate the spatial relationship between the extant Block 4 and its neighbours, including the Parade Ground.

29. The findings of the re-appraisal in 2020–21 have clearly shown that the weaknesses of the building are random in location and widespread, which means they cannot be pinpointed and the likelihood of failure quantified. Test results obtained from the re-appraisal show that the estimate of the brickwork compressive strength is some 28 – 44% lower than the previous comparable tests carried out in 2009 and 2016, which reduces the strength to a level below the acceptable limit stipulated by the current masonry code of practice. Given these new findings and the construction hazards identified, the expert team believes that the structural interventions necessary to carry out the recovery operations will be far more hazardous than was initially anticipated. As there is an undue risk of sudden collapse during the recovery work that cannot be mitigated, the expert team strongly advised against proceeding with the Updated Recovery Plan.

30. In the short term, Block 4 has been kept in a stable condition by extensive temporary support (Figure 24; Table 3). The building condition is also monitored daily by detection devices and by the inspection of a care and maintenance contractor. It is however necessary to acknowledge that, according to the expert team, the condition of Block 4 has continued to deteriorate despite careful protection. Hence, the parts of the extant building fabric that are unsafe to retain must be removed as soon as practicable before the ongoing dilapidation further weakens the building fabric, making it more hazardous to handle. A removal work schedule is thus proposed in that the preparation for the removal works will start in June 2023, with physical removal works starting in the non-typhoon season in November 2023. **To enable this, a Section 6 permit application will be made in early 2023 for approval**.

31. The Club and its consultants are now pursuing a solution as a result of the above outcomes. At present, the recovery schemes are in the early development stage, which are expected to be shared with the Board as soon as sufficient details are available.

32. Members of the AAB are invited to note the latest development on the recovery of Block 4 and to offer views on the content of this Paper.

The Hong Kong Jockey Club
December 2022

Tables and Figures

Table 1 – Summary of four movement incidents during preparatory work of Block 4

Date	Number of Monitoring Devices Detecting Movements	Location(s) of Building Movements
22 Jun 2020	13	Ground floor west corbel and brick pier on east façade; Second floor arch portal
29 Sep 2020	1	Ground floor west corbel
29 Oct 2020	2	Second floor arch portal
2 Dec 2020	1	Second floor arch portal
3 Nov 2022	1	Ground floor west corbel

Table 2 – Summary of brick compression test results

Brick Compression Tests	2009	2016	2021
No of bricks tested	5	10	40
Mean compressive strength	11.42 MPa	13.54 MPa	8.35 MPa
5% Characteristic strength	5.97 MPa	7.72 MPa	4.32 MPa

Coupled with the weak and powdery mortar, the low brick compressive strength means the brickwork (i.e. the combined strength of bricks and mortar) would likely be weaker than the lowest characteristic value of 2.2 N/mm^2 (▭) as recommended in Table 2 of BS 5628 – *Code of practice for use of masonry* (see extract below).

Table 2 — Characteristic compressive strength of masonry, f_k, in N/mm^2

a) — Constructed with standard format bricks of clay and calcium silicate having no more than 25% of formed voids, or 20% frogs											
Mortar strength Class/Designation	Compressive strength of unit (N/mm^2)[a]										
	5	10	15	20	30	40	50	75	100	125	150
M12 / (i)	2.5	4.0	5.3	6.4	8.3	10.0	11.6	15.2	18.3	21.2	23.9
M6 / (ii)	2.5	3.8	4.8	5.6	7.1	8.4	9.5	12.0	14.2	16.1	17.9
M4 / (iii)	2.5	3.4	4.3	5.0	6.3	7.4	8.4	10.5	12.3	14.0	15.4
M2 / (iv)	2.2	2.8	3.6	4.1	5.1	6.1	7.1	9.0	10.5	11.6	12.7

Notes to Table 2, BS 5628:

- As shown in the second column of the table above, the lowest compressive strength of bricks allowed by the code is 5 N/mm^2 (▭). The Block 4's brick compressive strength of 4.32 N/mm^2 is even lower than the lowest required by the code.

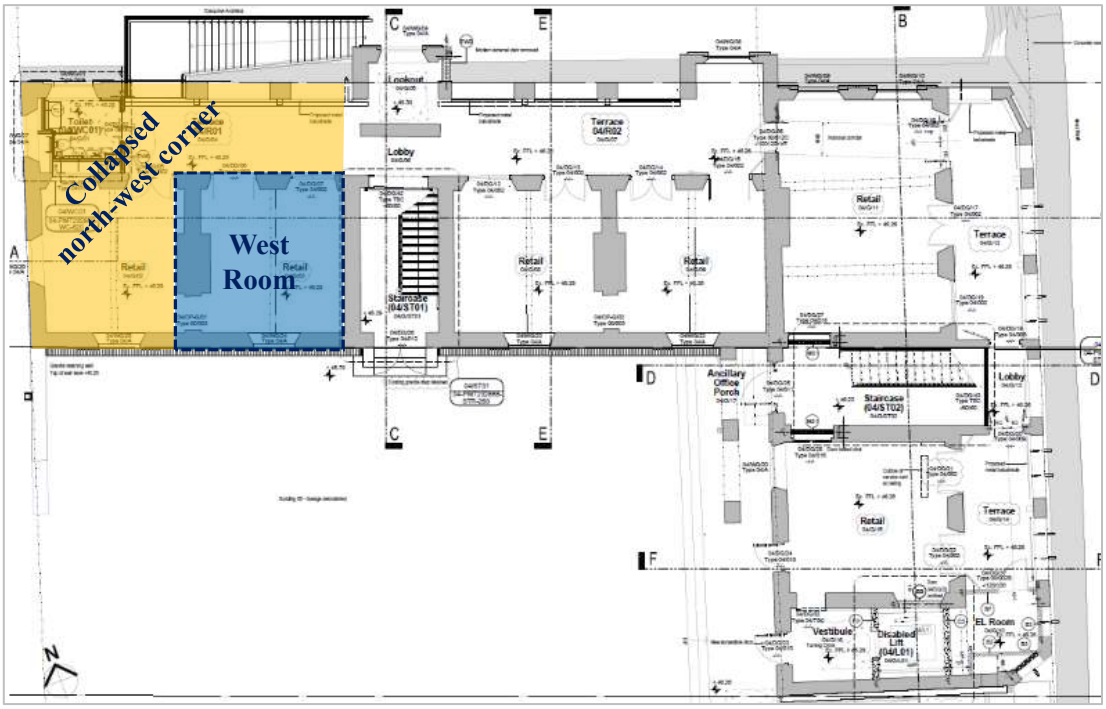
- Block 4's mortar strength is considered worse than Class M2 / (iv) ( ) because of its low 'cementitious material'-to-sand ratio. Therefore, the characteristic strength of masonry (bricks + mortar) would be lower than 2.2 N/mm^2.
- The code requires the above value to be further divided by a material factor of 3.5 to obtain a design strength (i.e. 2.2÷3.5), meaning that the design strength of the masonry will be less than 0.63 N/mm^2. In practice, the actual strength will be even lower owing to the voids and poor bonding observed and also to the slenderness of the piers.

Table 3 – Summary of temporary support to Block 4

Date	Locations / Nos of Props		Remarks
	Floors	Internal & External Arched Openings	
May 2016	**336**	–	Immediately after the partial collapse
April 2019	–	**272**	Upon recommendation by the UK experts
May 2020	+ 60 = **396**	–	Before the preparatory work (i.e. West Room removal)
Aug 2020	+ 406 = **802**	–	After detection of building movements during the West Room removal

Note – For a total floor area of approximately 790 square metres, there are some 802 props for the floors and 272 props for both internal and external arches

(a)



(b)

Figure 1 – (a) Aerial views of partially collapsed Block 4 (North Wing) with extent of West Room indicated diagrammatically in broken lines;
(b) Ground floor plan indicating location of partially collapsed portion and West Room

(A) Restoration

(B) Reconstruction

(C) Adaptation

(D) Preservation

(E) Facade Retention

(F) Facade and Interior Retention

(G) Total Reconstruction

(H) Demolition

Figure 2 – Original eight recovery options presented in the AAB meeting on in September 2016

Figure 3 – Block 4 before partial collapse. The design provides relatively tall ceiling heights and large window openings to aid ventilation in the hot and humid climate of Hong Kong, resulting in large arched openings with brick piers in between on the north and east façades

(a)   (b)

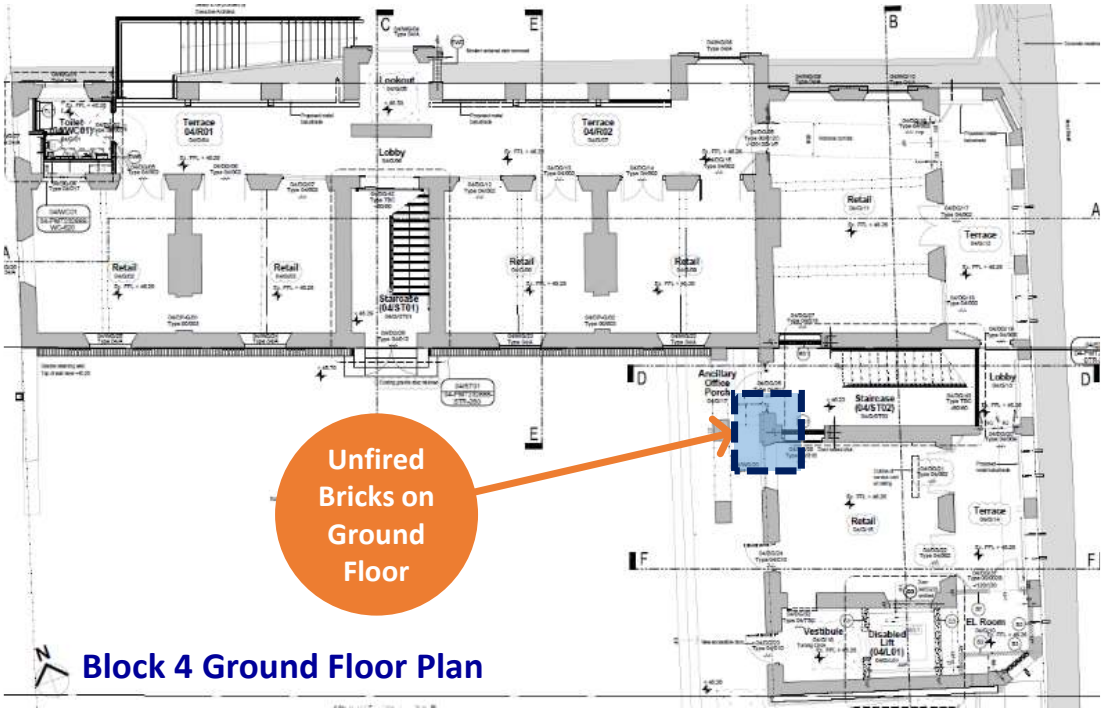


Figure 4 – (a) & (b) Views of brickwork after removal of plaster. Some bricks appeared to be unfired and could be rubbed away by hand;
Ground floor plan indicating location of unfired bricks (one of many locations)

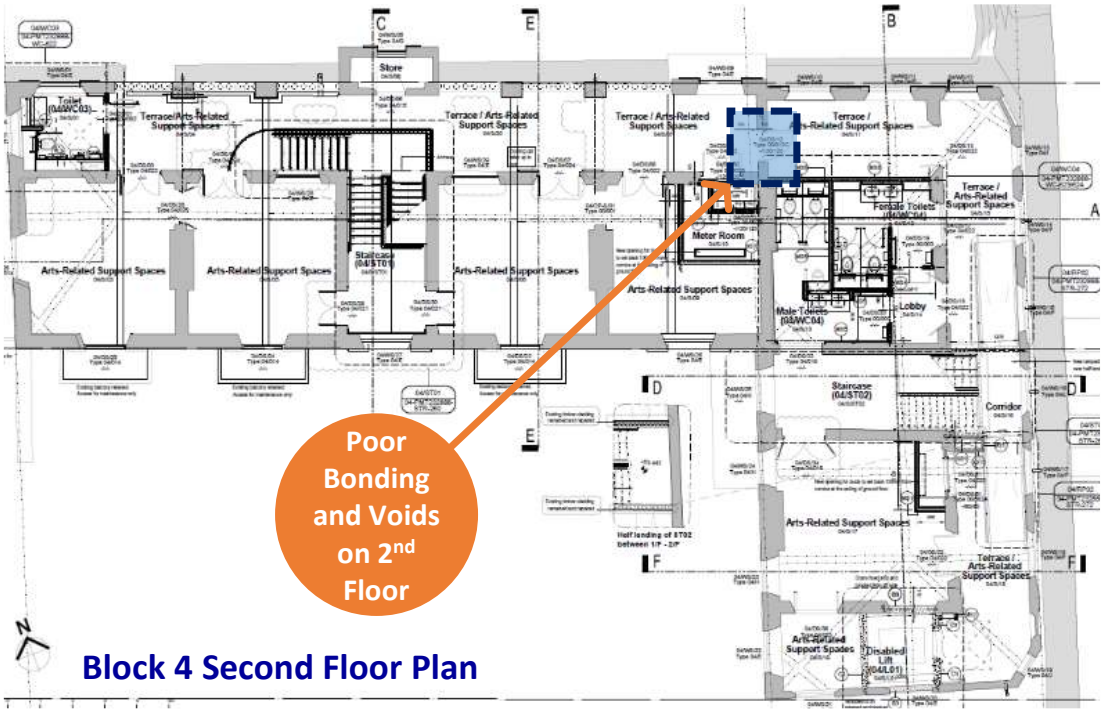
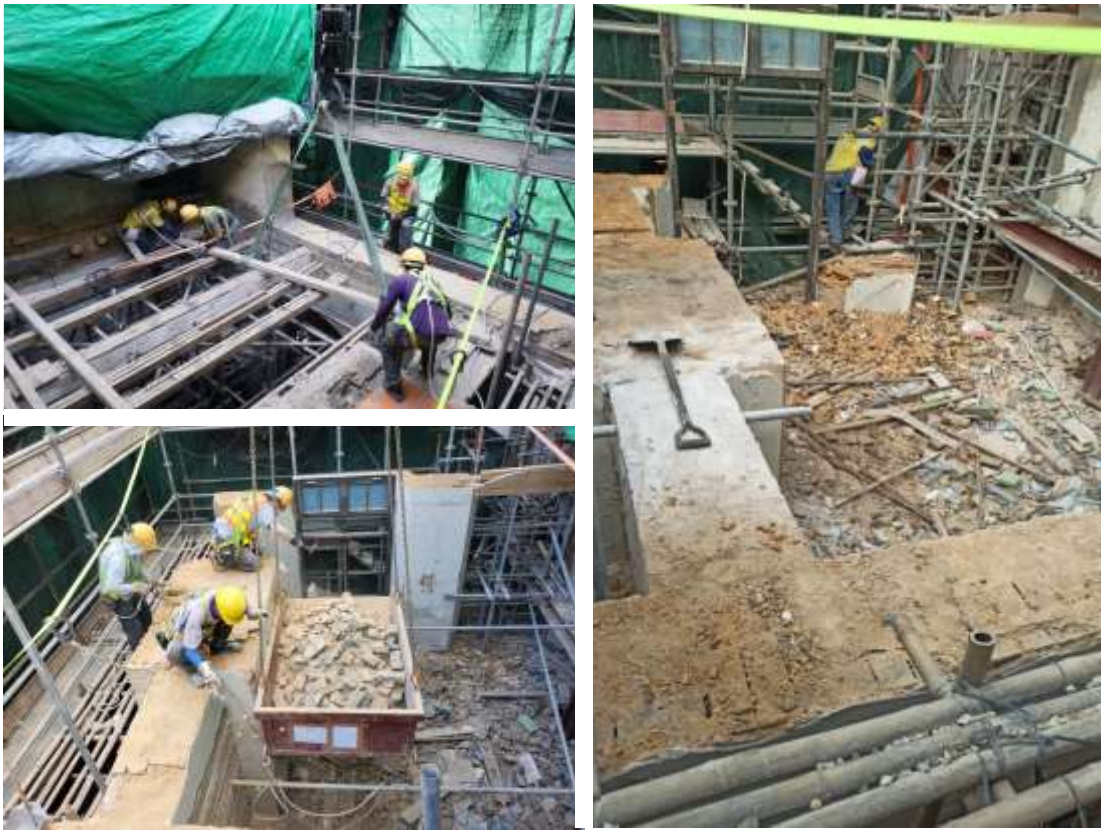


Figure 5 – Views of brickwork showing poor bonding and voids in the centre of the walls whilst cutting new door openings;
Second floor plan indicating location of walls with poor bonding and voids



(a)

(b)

Figure 6 – (a) Work-in-progress views of preparatory work (West Room removal)
(b) Completed preparatory work (West Room removal) in December 2020

(a)   (b)

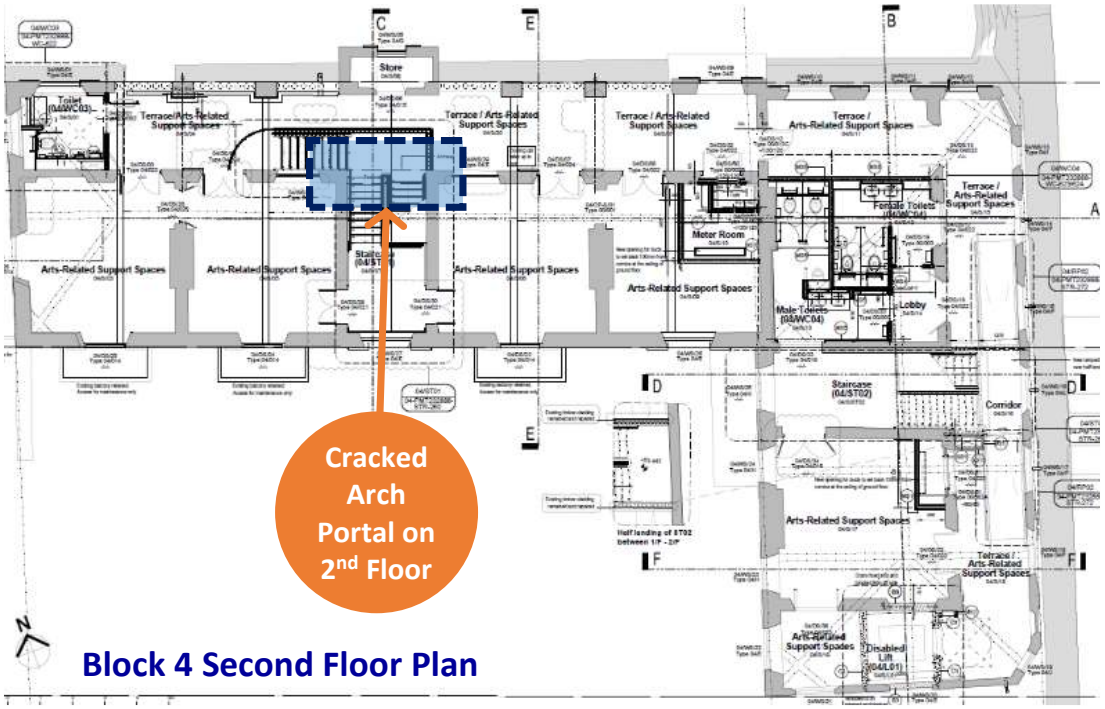


Figure 7 – (a) Overview of second floor arch portal;
(b) Close-up view of second floor arch portal showing enlargement of exiting crack;
Second floor plan indicating location of arch portal

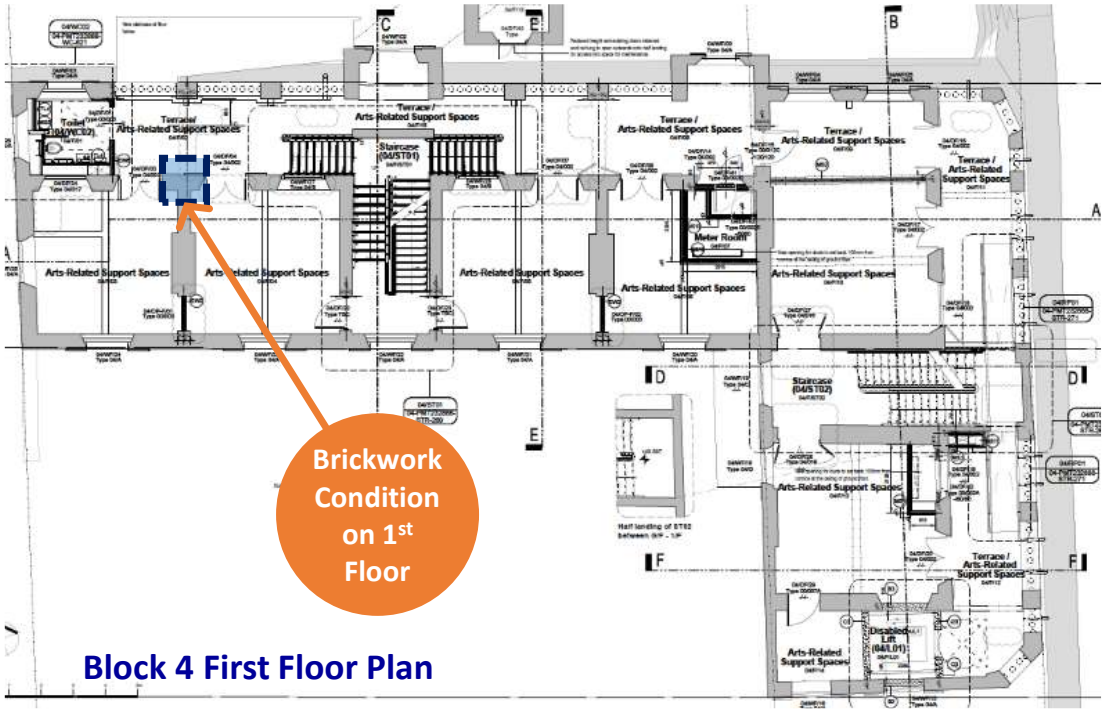


Figure 8 – Mortar is weak and powdery with little cohesion, and it is possible to separate bricks by hand easily
First floor plan indicating location of poor brick condition

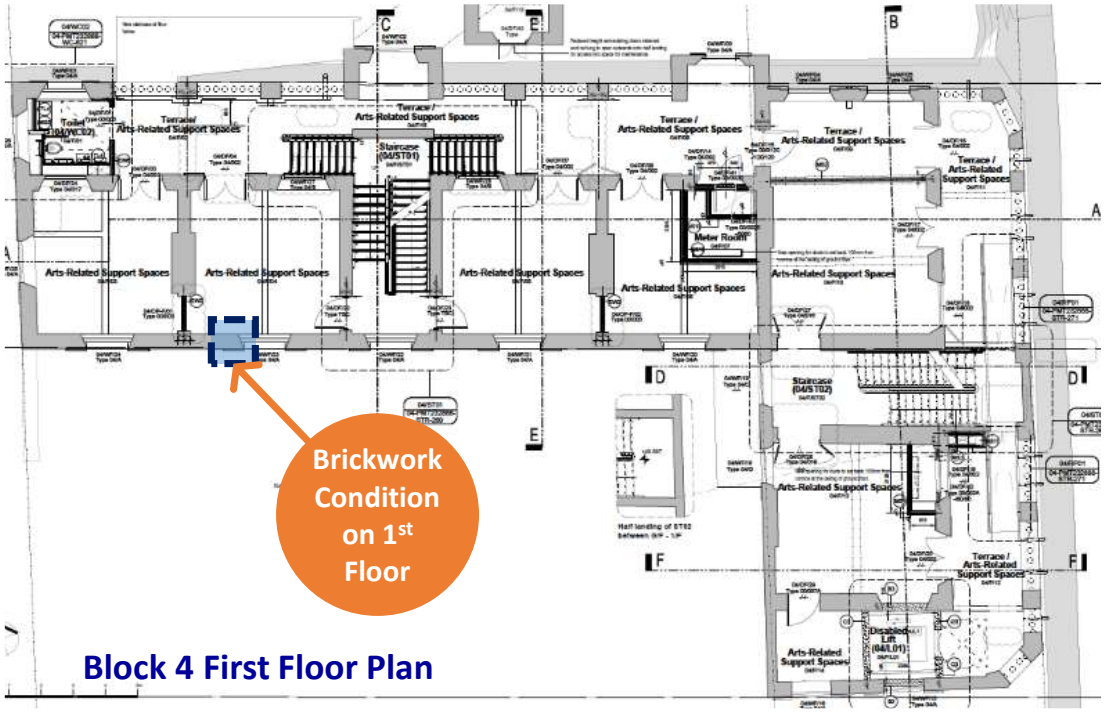
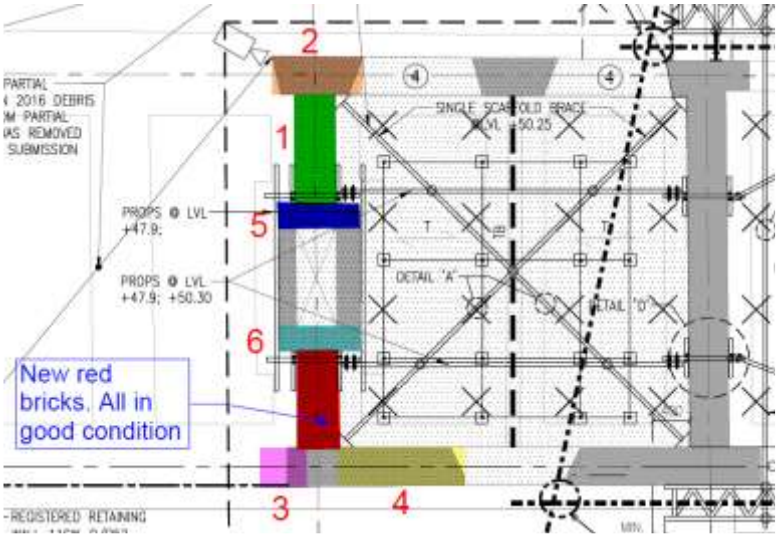


Figure 9 – View of brickwork during removal of the West Room, showing powdery mortar with very little cohesion. Brick walls are more an assembly of weak bricks in a matrix of sand than a cohesive structural units
First floor plan indicating location of poor brick condition

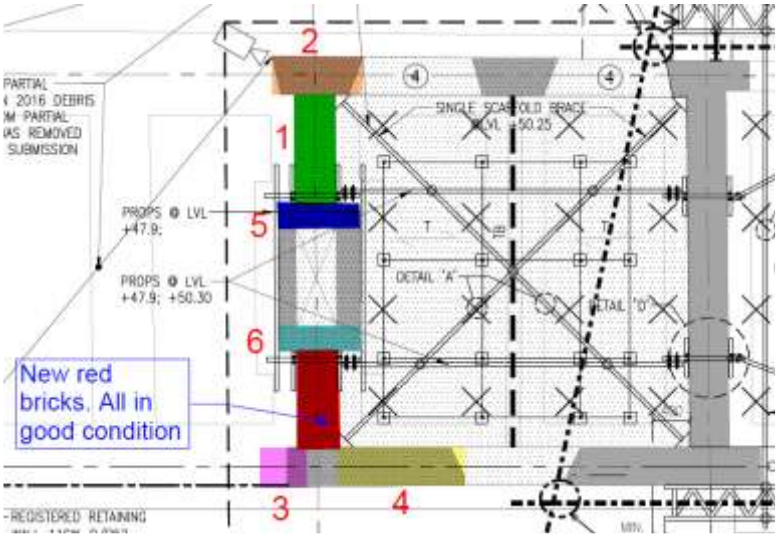
Figure 10 – Layer-by-layer inspection of brickwork during removal of the West Room by Purcell and Arup



Wall layout plan of West Room.

The two images below show brick inspection findings (soft and non-soft bricks) at wall locations **[1]** and **[6]**

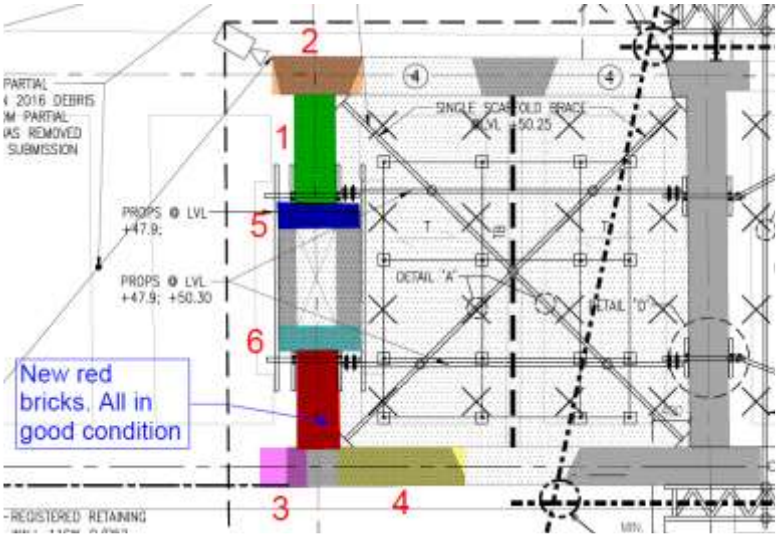
Figure 11 – (a) Approximately 75% of the bricks in random locations were considered soft ("X" Soft brick; "O" Not soft brick)



Wall layout plan of West Room.

The two images below show brick inspection findings (soft and non-soft bricks) at wall locations **[2]** and **[3]**

Figure 11 – (b) Approximately 75% of the bricks in random locations were considered soft ("X" Soft brick; "O" Not soft brick)



Wall layout plan of West Room.

The two images below show brick inspection findings (soft and non-soft bricks) at wall locations **[4]** and **[5]**

Figure 11 – (c) Approximately 75% of the bricks in random locations were considered soft ("X" Soft brick; "O" Not soft brick)

Figure 12 – Forty brick samples were collected for compression tests with results showing that the characteristic compressive strength of the bricks was only 4.32 N/mm^2

Defect No **DB-19**, Photo Ref. **P4163120**

Defect No **DB-20**, Photo Ref. **P4163123**

Extract from Appendix C4 of Structural Condition Survey – Volume 3, Final Report 2009 – Defect Photographic Record for Dormitory A and B

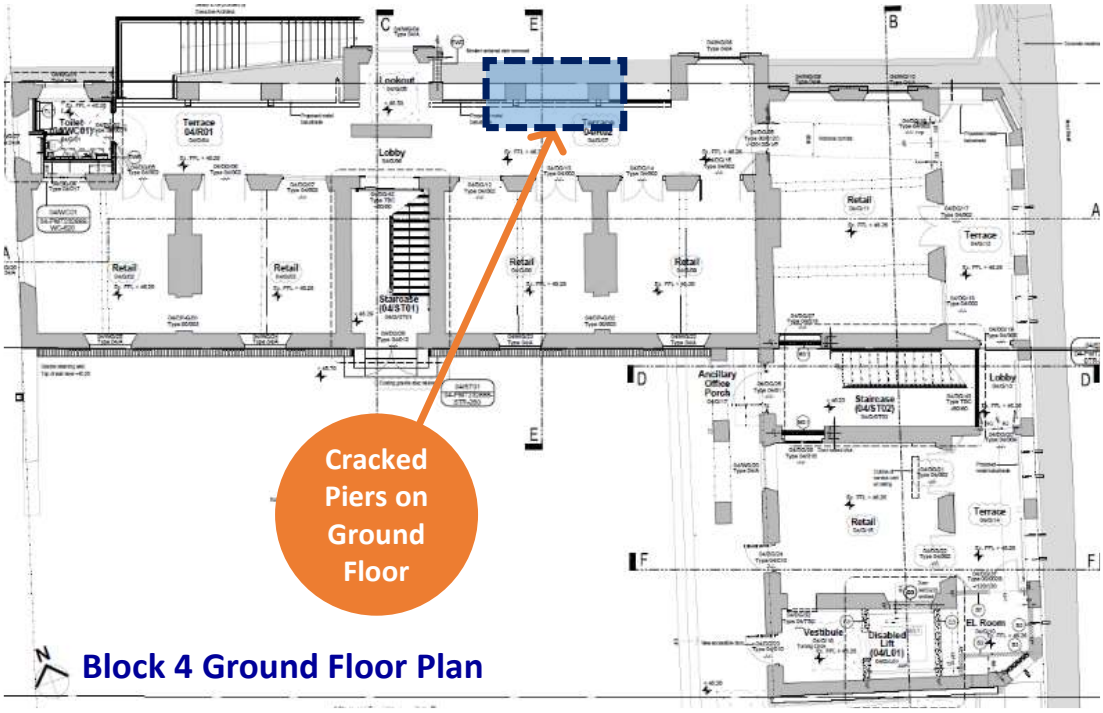


Figure 13 – 2009 structural survey identified cracked piers in the north façade which would require further investigation and structural repair;
Ground floor plan indicating location of cracked piers

Before rebuilding (discovered on 27 September 2014)
Extract from Appendix D2, 214A Repair Survey Report Revised, Building 04 – Married Inspectors, North Elevation, Central Police Station Hong Kong, Stonewest (HK)

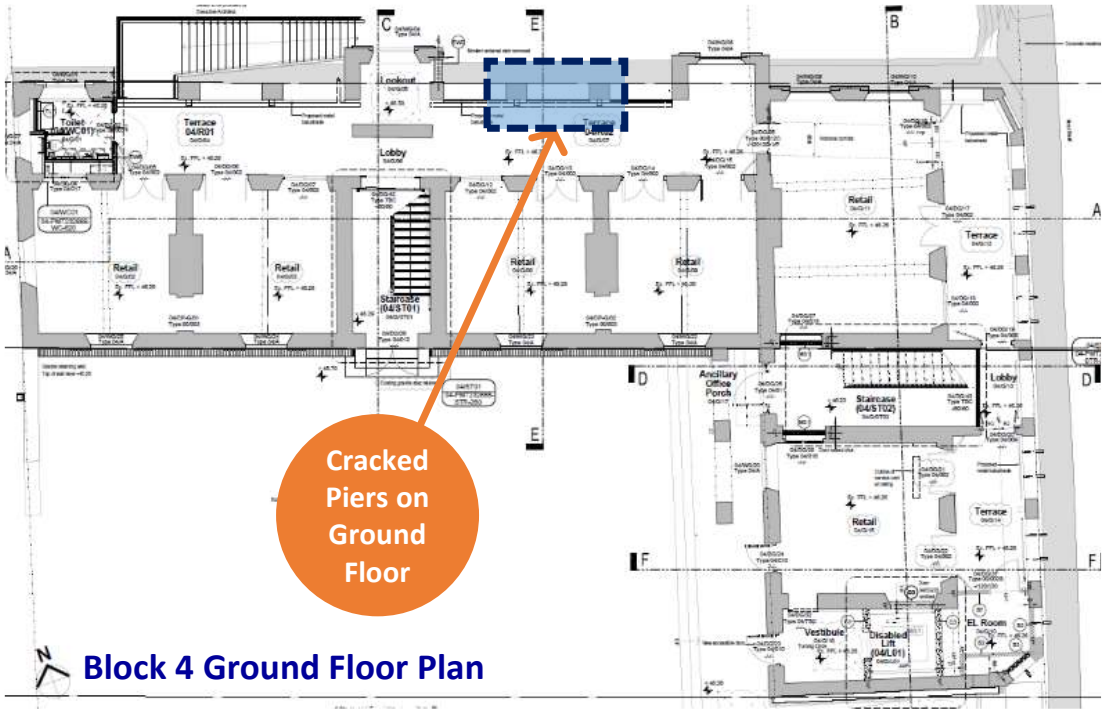


Figure 14 – 2014 repair works, major cracks in two brick piers on north facade discovered (Note – These two brick piers were repaired);
Ground floor plan indicating location of cracked piers

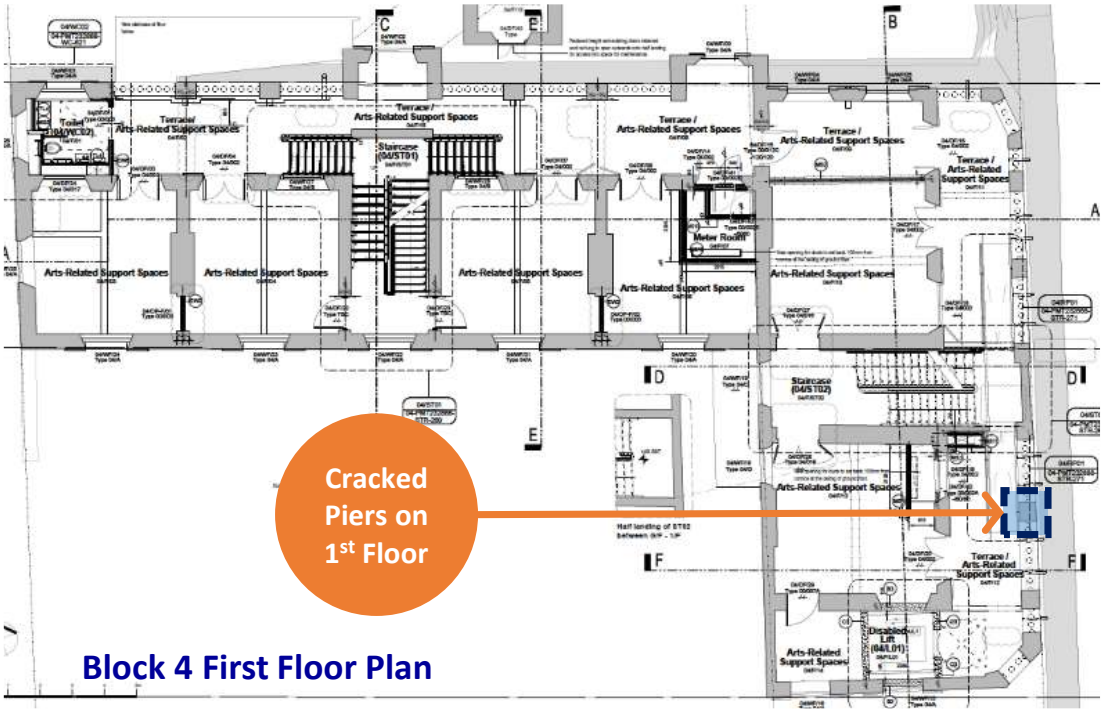


Figure 15 – Hidden cracks in brick piers which were revealed after removal of window frames on ground floor and first floor;
First floor plan indicating location of cracked piers

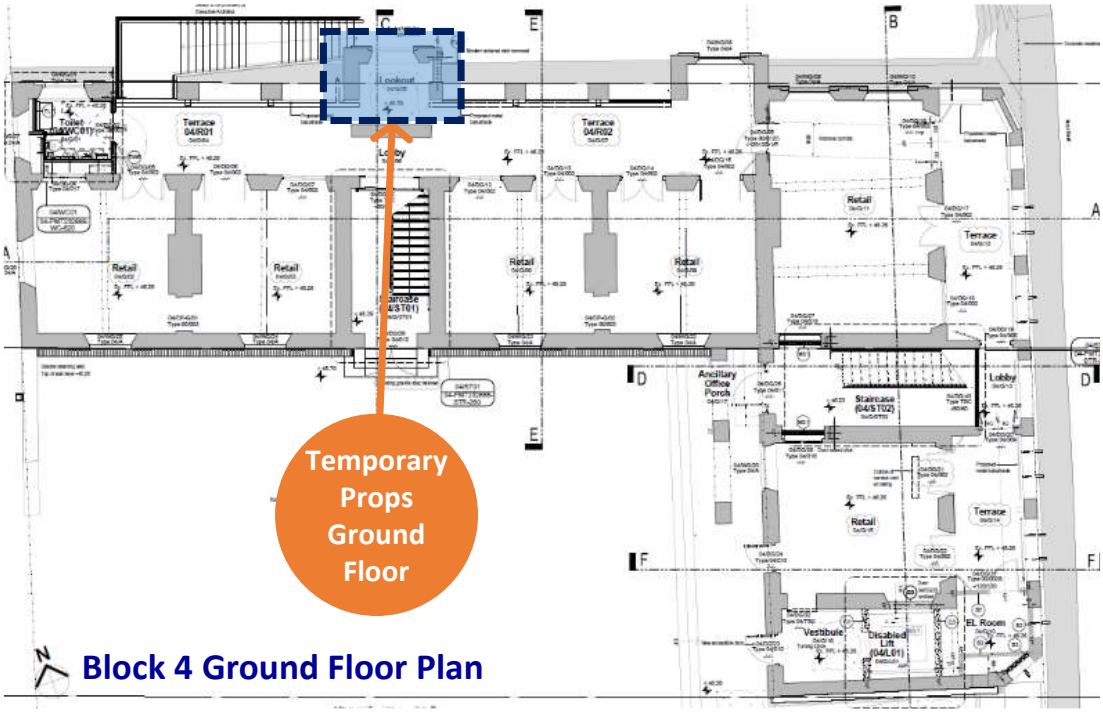
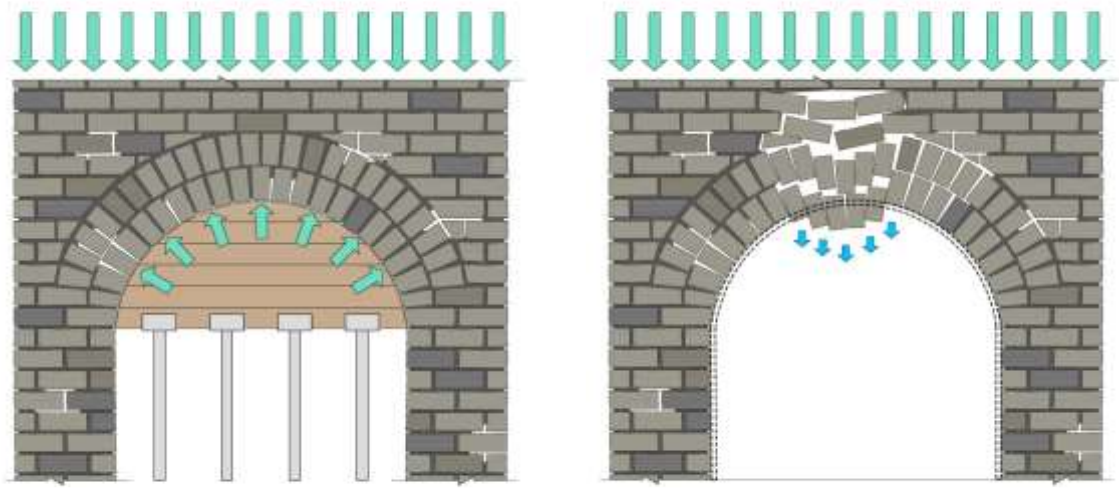


Figure 16 – Temporary props to projecting bay on north facade (needs to be replaced by permanent supports which is a high hazard operation)
Ground floor plan indicating location of temporary props to projecting bay

(a)



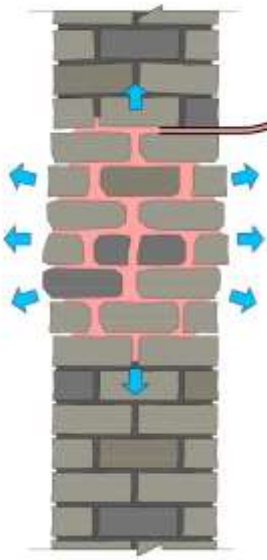
(b)

Figure 17 – Replacing temporary timber pack (supported by steel props) by permanent steel brackets, inducing hazards as it is difficult to envisage a sequence where brick arches are not left unsupported

Figure 18 – Slender and cracked brick piers in poor condition remain standing (supported by temporary works), and substantial repairs will be required in recovery work

Given the hidden weaknesses within the masonry, the technically feasible design / interventions are now considered particularly ambitious. As recent testing in 2020–21 has reduced confidence in the masonry, the construction will be more hazardous than was the case when the **Updated Recovery Plan** was developed.

Figure 19 – Hole-drilling through masonry facade, several hundred in quantity, is required to restrain the facade to a shoring system; this type of structural interventions are now considered ambitious as recent testing had reduced confidence in the masonry



Voids Grouting – Pressure grouting to penetrate masonry

Given the hidden weaknesses within the masonry, the technically feasible design / interventions are now considered particularly ambitious. As recent testing in 2020–21 has reduced confidence in the masonry, the construction will be more hazardous than was the case when the **Updated Recovery Plan** was developed.

Figure 20 – Grouting of voids in masonry walls is required to restore integrity. However, the increase in grout pressure could cause sudden bulging of weak brick walls; this type of structural interventions are now considered ambitious as recent testing had reduced confidence in the masonry

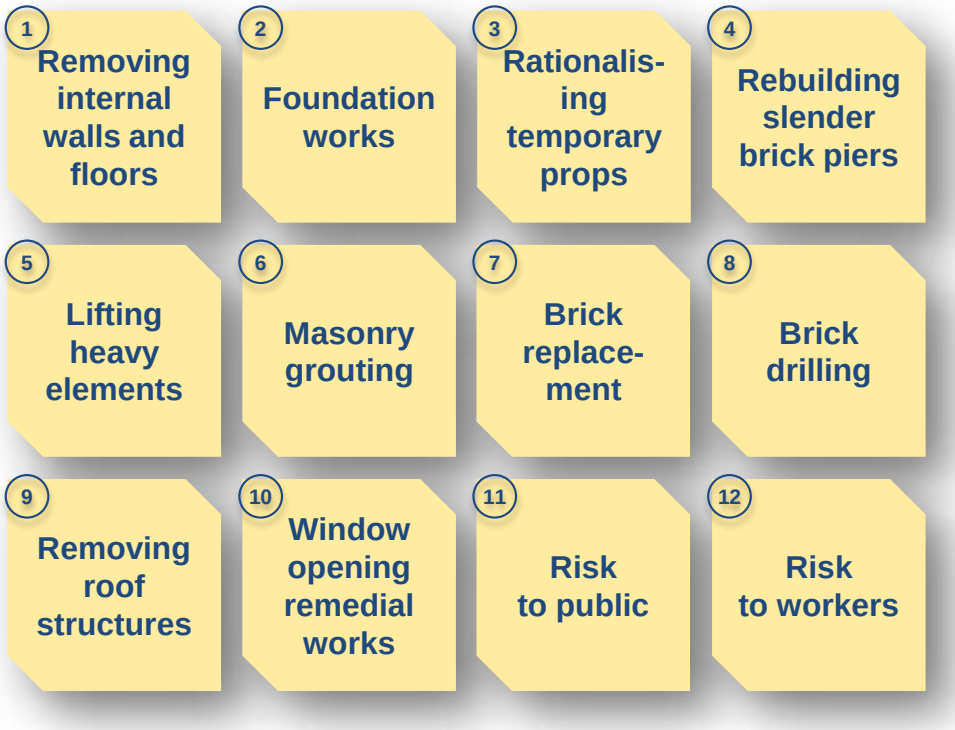


Figure 21 – Twelves operations considered in PAYE's standardised risk assessment

	Heritage Risk	Risk Rating (Pre-Controls)			Assessed risks and concerns	Residual Risk Rating		
		S	L	R		S	L	R
1	Removing internal walls and floors	5	5	25	Walls are providing stiffness and restraint of the facades through creating the thrust block to flat arches. Window propping removal will be protracted.	5	3	15
2	Foundation works	5	5	25	Confined working space. Risk that any vibratory works will dislodge the fragile masonry components.	5	4	20
3	Rationalising temporary props	5	5	25	Unable to determine which of the props within the 3 phases of installation are providing the primary support. Unable to determine the loadpath vertically and laterally.	5	5	25
4	Rebuilding slender piers	5	4	20	Difficulty in achieving temporary support. Mortar specification and setting times will prolong the process. Masonry panel above is fragile and the risk of collapse remains a constant concern.	5	4	20
5	Lifting heavy elements	5	3	15	Strict lifting plan in place. Design to reduce number of lifts required. Protect lifting areas with scaffold as a buffer zone. Lift away from fragile masonry	5	3	15
6	Masonry grouting	3	5	15	Weakness of masonry to resist hydrostatic pressure. Clamp façade but masonry bond remains questionable.	3	3	9
7	Brick replacement	5	4	20	Fragility of masonry and loss of mortar bond is a constant problem. Sudden collapse will undertaking the works is a constant concern.			
8	Brick drilling	5	5	25	Weakness of masonry and risk of bursting through compounded by limitations in bracing/clamping façade because of existing temporary props. Diamond drill.	5	3	15
9	Removing roof structure	5	3	15	Roof is providing some strength to the building and temporary restraint will be required.	3	3	9
10	Window opening remedial works	5	3	15	The requirement to transfer support safely from temporary frame to permanent condition needs to be developed.	4	3	12
11	Risk to public	5	4	20	Risk to public from sudden collapse remains a constant concern even with FRS in place.	5	3	15
12	Risk to workers	5	5	25	Risk to workers from sudden collapse.	5	4	20

KEY	PARTY (P)	SEVERITY (S)	LIKELIHOOD (L)	RISK (R) = (S) x (L)
	M = Management S = Supervisor O = Operative T = Third Party C = Client	1 = Trivial damage to historic fabric 2 = Minor damage to historic fabric 3 = Major damage to historic fabric 4 = Major damage / injury 5 = Collapse / risk to life	1 = Improbable occurrence 2 = Remote occurrence 3 = Possible occurrence 4 = Probable occurrence 5 = Likely occurrence	13–25 = HIGH RISK 6 –12 = MEDIUM RISK 1 – 5 = LOW RISK

The high scores within the risk assessment and predominantly red colour coding raises some major concerns regarding the health and safety risks associated with the 2019 Updated Recovery Plan and constant risk of sudden collapse during the works

Figure 22 – PAYE's standardised risk assessment of twelves items of the Updated Recovery Plan. Results show that the remaining nine items are High Risk still, including risk to public and workers

(a) Granite retaining wall on Arbuthnot Road

(b) Granite retaining wall facing Blocks 6 and 7; granite retaining wall on Pottinger Ramp

Figure 23 – Granite retaining walls being retained in both recovery options in "Ruins Approach"

Figure 24 – Presence of densely installed propping (making it harder to undertake follow-on works safely)