



Practice Guidebook for Adaptive Re-use of and Alteration and Addition Works to Heritage Buildings 2012

(2017 Edition)

**Practice Guidebook
on
Compliance with
Building Safety and Health Requirements
under the Buildings Ordinance for
Adaptive Re-use of and Alteration
and Addition Works to Heritage
Buildings**

**Buildings Department
Hong Kong**

(2017 Edition)

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Preamble

Conservation of heritage buildings not just underpins the sustainability of the built environment, but also adds variety to the architecture contributing to the character of a city.

Adaptive re-use of heritage buildings may economically save their historic and aesthetic values usually involving alterations and additions (A&A) works to comply with the contemporary building safety and health standards under the Buildings Ordinance (BO).

Heritage buildings are mostly age-old. Their structural adequacy for adaptive re-use should be comprehensively assessed. A holistic structural strengthening proposal, covering sequence of works, safety precautionary measures and qualified site supervision for the adaptive re-use is indispensable.

To facilitate heritage conservation, the Buildings Department (BD) prepared this Practice Guidebook in consultation with the Antiquities and Monuments Office (AMO) of Leisure and Cultural Services Department, the Fire Services Department (FSD) and the Architectural Services Department (ArchSD) to provide pragmatic design alternatives and approaches as well as site safety supervision guidelines for meeting the current requirements under the BO. In addition, BD has also set up dedicated Heritage Units (HU) to process submissions involving heritage buildings.

After its first issue in June 2009, the Practice Guidebook was revised in May 2012 and July 2016. In the current edition, the case references in Appendix I have been enriched with more successful heritage conservation projects. Relevant parts on the precautionary measures, sequence of works, qualified site supervision and monitoring of the effects of the construction works have also been reinforced for assuring safety.

To keep the Practice Guidebook under regularly review and update, the BD has set up a technical committee consisting of representatives from the relevant government departments, building industry and academia. The BD welcomes suggestions for improving the Practice Guidebook.

Buildings Department
Dec 2017

1. INTRODUCTION

- 1.1 This Practice Guidebook provides design guidelines in terms of straight-forward practical solutions and alternative approach that may be adopted for compliance with building safety and health requirements under the BO so as to facilitate the planning and design of adaptive re-use of and A&A works to heritage buildings, including construction safety.
- 1.2 This Practice Guidebook serves as a reference not only for persons or organisations intending to propose adaptive re-use of or A&A works to a heritage building but also for architects, engineers, surveyors, heritage conservationists and designers who are engaged for this type of projects.
- 1.3 The main focus of this Practice Guidebook is on the building safety and health requirements under the BO and its allied regulations for the adaptive re-use of and A&A works to heritage buildings. The principles of heritage conservation are under the jurisdiction of the AMO. When the Building Authority (BA) makes a decision on a submission involving a heritage building, comments made by the AMO will be duly considered. The designer should carefully consider requirements set out in the Conservation Guidelines agreed by the AMO on a project basis.
- 1.4 Under section 4 of the BO, an authorized person (AP) shall be appointed as the coordinator of the building works to be carried out and a registered structural engineer (RSE) shall be appointed for the structural elements of such building works. To facilitate the design process, the AP and the RSE concerned with the planning and design of projects involving adaptive re-use of or A&A works to a heritage building are encouraged to approach the relevant government departments including the AMO, the BD and the FSD, with adequate information, to identify critical requirements at an early stage. Such early contact may help to identify key design, site constraints and potential problems before the detailed design stage. The contact points of these departments are provided at the end of this Practice Guidebook. AP and RSE are also encouraged to refer their enquiries to the HU for advice through the pre-submission enquiry service as provided for in the Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers (PNAP) ADM-19.

- 1.5 This Practice Guidebook contains case references in Appendix I, lists of contemporary design standards in Appendix II, a sample Management Plan in Appendix III and useful information for reference in Appendix IV.

2. TERMINOLOGY

Heritage building

- 2.1 For the purpose of this Practice Guidebook, a heritage building is taken as either a *declared monument* or a *proposed monument* defined under the Antiquities and Monuments Ordinance, Cap. 53 (A&MO), a *graded historic building* accorded by the Antiquities Advisory Board (AAB), a proposed graded historic building identified by the AMO¹. Where a building has not been declared under the A&MO nor graded by the AAB and yet possesses a cultural significance² in terms of aesthetic, historic, scientific, social or spiritual value, etc, the project designer should consult the AMO on whether or not the building is a heritage building.

Monument

- 2.2 Under section 3 of the A&MO, a monument means a place, building, site or structure declared to be a monument, historic building or archaeological or paleontological site or structure. Declaration of a proposed monument or a monument under section 2A or 3 of the A&MO shall be made by the Authority³, by notice in the Gazette. Once a building has been declared as a monument or a proposed monument, the building is legally protected and no person shall undertake building or other works on it without a permit granted by the Authority under section 6 of the A&MO. For the list of declared monuments and their respective location plans and monument boundaries, please visit the Heritage Discovery Centre Reference Library or the AMO's website <http://www.amo.gov.hk/en/monuments.php>. For the exact boundary of the declared monuments, please consult the AMO.

Graded historic building

- 2.3 Other than the formal declaration of monument, the AMO has adopted a three-tier grading system which is an administrative arrangement, to provide an objective basis for determining the heritage values and the conservation needs of the historic buildings. They are:

¹ The information and updated lists of declared / proposed monuments and graded / proposed graded buildings can be obtained from the website of AMO at <http://www.amo.gov.hk>

² According to the Burra Charter, cultural significance means aesthetic, historic, scientific, social or spiritual value for the past, present or future generations.

³ Under the A&MO, the Authority means the Secretary for Development.

- Grade 1: Buildings of outstanding merit, which every effort should be made to preserve if possible.
- Grade 2: Buildings of special merit, efforts should be made to selectively preserve.
- Grade 3: Buildings of some merit, preservation in some form would be desirable and alternative means could be considered if preservation is not practicable.

Grade 1 buildings will be accepted as providing a pool of highly valuable historic buildings for consideration by the AAB under the A&MO as to whether some of these may have reached the high threshold of monuments to be put under statutory protection. As such, unlike the declared monuments, a graded building does not enjoy the protection under the A&MO. The list of graded historic buildings and proposed graded historic buildings is available at the AMO's website: <http://www.amo.gov.hk>. The owner and/or his agent is advised to check the status of the building before any works are carried out.

Adaptive re-use

- 2.4 For the purpose of this Practice Guidebook, adaptive re-use of a heritage building may be defined as modifying a building for use other than its original use, such as from a residential home to an exhibition hall or a tea house for public access⁴. In other words, adaptive re-use will involve a material change in use. Through adaptive re-use, a heritage building may be rejuvenated in terms of both physical and economic values. Some local remarkable examples include the Western Market and the Kom Tong Hall, both declared monuments.

⁴ It differs slightly from Burra Charter's definition of 'Adaptation' which includes 'modifying a place to suit the existing use or a proposed use'.



Photo 1 Western Market, traditional trades, arts and crafts centre converted from a market building



Photo 2 Kom Tong Hall, once the residence of Mr. Ho Kom-tong, a wealthy Hong Kong merchant in the early 20th century, has been adapted into the Dr Sun Yat-sen Museum

3. LEGISLATION ON BUILDING CONTROL

Background

- 3.1 The BO and its allied regulations together with other related enactments, constitute the legal framework of the building control system for all private buildings and building works in Hong Kong. All buildings in Hong Kong are subject to the control under the BO unless exempted under section 41(1) thereof. For example, government buildings or public housing under the control and management of the Housing Authority are exempted from the provisions of the BO.
- 3.2 The objective of the BO is to provide for the planning, design and construction of buildings and associated building works to ensure public safety and health in buildings by setting therein the minimum safety and health standards.
- 3.3 Apart from the BO, the following legislations also contain fire safety requirements concerning the building fabric and the fire service installations that may be applicable to certain existing buildings :
 - (a) Fire Services Ordinance, Cap 95 and its subsidiary regulations;
 - (b) Fire Safety (Commercial Premises) Ordinance, Cap 502; and
 - (c) Fire Safety (Buildings) Ordinance, Cap 572.
- 3.4 The two Ordinances mentioned in Section 3.3 (b) and (c) above may require the upgrading of fire safety measures in certain existing commercial, domestic and composite buildings to the current standards as specified in the two Ordinances. For information on the types of buildings that are affected and the fire safety measures required to be upgraded under the said Ordinances, reference may be made to the guides jointly issued by the BD and the FSD⁵. When only part of the said buildings undergoes A&A works or involves change in use, the AP of the project is strongly advised to take the opportunity to upgrade the fire safety measures of the whole building to comply with the

⁵ An Introduction to the Fire Safety (Commercial Premises) Ordinance Cap.502 and An introduction to the Fire Safety (Buildings) Ordinance Cap. 572 jointly issued by the BD and FSD.

requirements of both the BO and the said two Ordinances at the same time.

Submission of proposals to the Buildings Department

- 3.5 As provided for in sections 14(1) and 41(1) of the BO, except for buildings belonging to the government, buildings upon any land vested in the Housing Authority or over which the Housing Authority has control and management or buildings upon any unleased government land, proposals for A&A works with or without a material change in use of a heritage building are normally required to be submitted to the BD for obtaining approval and consent prior to commencement of the works. An AP shall be engaged to prepare the necessary submissions. An RSE should normally be required in view of the need to conduct structural appraisal and structural integrity assessment of the heritage building, taking into consideration the age of the building.

Compliance with the requirements of the Buildings Ordinance

- 3.6 In principle, buildings constructed before any new standards come into force are not required to be upgraded to the new standards (except for certain commercial, domestic or composite buildings to which the two Ordinances mentioned in Section 3.3(b) and (c) above apply) which only come into force after the buildings are constructed. However, when such buildings undergo change in use or A&A works, those parts of the buildings so affected will normally be required to be upgraded to comply with the current standards.
- 3.7 From the perspective of heritage conservation, the major building safety and health requirements which may affect the design and construction of buildings for the adaptive re-use or A&A works may be categorised as follows:

(a) Structural Considerations

Structural Design for Alteration and Addition Works

- (i) The adaptive re-use of or A&A works to a heritage building may involve the design of new structural works and/or the checking of structural adequacy and structural strengthening of an existing building. All new structural elements in the A&A works should be designed in accordance with the current building

regulations and relevant codes of practice. In principle, the building regulations and codes of practice prevailing at the time of construction of the building may be used for checking the structural adequacy of the existing portion of the building affected by the proposed A&A works, provided that the design assumptions on which the building was originally based still apply. A list of contemporary design standards in Hong Kong is given in Appendix II.

Structural Appraisal

- (ii) As heritage buildings are often constructed long time ago, it is necessary to appraise their current conditions and identify the extent of defects, deterioration and any damage. The RSE should re-assess the validity of the design parameters. When structural documentation record is not available, site measurement, non-destructive investigation and, where appropriate, destructive tests such as taking material samples from existing structure for strength tests, and opening up for structural investigation are effective methods for assessing the design parameters. As to the locations of any destructive tests and opening up, prior approval from the AMO should be obtained for proposals involving declared monuments, whereas advice from the AMO should also be sought for proposals involving heritage buildings other than declared monuments.
- (iii) Although current design codes of practice containing advanced limit state design methods are usually more comprehensive and contain more accurate findings and well-proven concepts for structural design, specific partial material factors are incorporated which may not be applicable to heritage buildings. In conducting a structural appraisal to substantiate the stability of heritage buildings during the course and upon completion of the proposed A&A works, the RSE may use either the method in the then prevailing codes of practice to which the buildings were designed or advanced limit state design methods in the current codes of practice if the partial material factors could be substantiated, and they should not overlook alternative load paths or over-simplify the structural model. It is an essential step to understand how the structure stands and its load paths before

embarking on any A&A works. Particular attention should be paid to the sequence of the proposed A&A works and the possible effects on the load paths of the structure.

- (iv) Structural appraisal for heritage buildings should be carried out in a scientific and rational way, taking into consideration the deterioration in material properties over time and the validity of design parameters. Hence, all structural appraisals should start with a desktop study on the history of the building, since part or the entire floor of the building could have been re-built. Appendix IV contains some useful information about structural appraisal.

Design Imposed Loads

- (v) Many heritage buildings were constructed with timber floors resting on masonry or brick walls. These constructions were often based on traditional practice, craftsmanship and relevant prescriptive requirements that were prevalent at the time of construction. A complete set of approved plans and structural calculations for this type of construction in many heritage buildings may not be available. When carrying out A&A works, taking into account the possible material deterioration of these buildings, it would be prudent to carry out a structural assessment with site measurements of dimensions and tests for the material properties of structural elements respectively, to substantiate the structural capacity of these elements for adaptive re-use.
- (vi) Buildings constructed in different periods, even if they are of the same use, may have been designed with different design imposed floor loads as the relevant statutory requirements have changed over time. For instance, the minimum design imposed load for buildings of domestic use was changed from an equivalent load of 3.35 kPa in the 1915 version of the London County Council By-laws (LCC 1915) to 2.35 kPa in the LCC 1938, 1.90 kPa in the LCC 1952, 2.50 kPa in the Building (Construction) Regulations (B(C)R) 1976 and to 2.0 kPa in the Building (Construction) (Amendment) Regulation 2011.

- (vii) In essence, the structural appraisals should be very cautious when comparing directly the design imposed load of the proposed adaptive re-use with that of the existing use for heritage building, as the existing use may not tally with the original design imposed load. Further verification on the structural capacity of existing floor like back calculations or loading tests should be provided.

(b) Fire safety provisions

- (i) Building (Planning) Regulations (B(P)R) 41, 41A, 41B, 41C and 41D and B(C)R 90 stipulate the statutory requirements pertaining to fire safety of buildings. The Code of Practice for Fire Safety in Buildings issued by the BD⁶ (FS Code) provides guidance on compliance with such requirements. The FS Code provides technical standards for the passive fire protection measures including the provision of means of escape, means of access for fire fighting and rescue and fire resisting construction in a building. For A&A works without involving change in use, only the areas affected by the proposed A&A works (e.g. shared exits) will need to comply with the current standards prescribed in the FS Code.
- (ii) Technical standards for the active fire protection measures such as the fire alarm, detection and suppression systems are provided for in the Code of Practice for Minimum Fire Service Installations and Equipment (FSI Code) issued by the FSD.
- (iii) The primary objectives of the fire safety standards prescribed are to ensure that occupants are able to escape from the building safely, fire fighters can enter the building safely to fight the fire and for rescue, and to prevent the spread of fire within the building and to adjacent properties. Protection of the properties themselves against damage by fire is not the primary concern. As such, owners and designers may wish to enhance the fire safety provisions in their heritage buildings to protect such properties of high heritage

⁶ The new Code of Practice for Fire Safety in Buildings 2011 comes into operation in April 2012. This Code replaces the 'Code of Practice for the Provision of Means of Escape in Case of Fire 1996', the 'Code of Practice for Fire Resisting Construction 1996' and the 'Code of Practice for the Provision of Means of Access for Firefighting and Rescue 2004'. Reference should be made to PNAP APP-153 on the application of the new Code.

value against damage by fire.

(c) Protective Barriers

The requirement for the provision of protective barriers between adjoining floor space at different levels was first introduced in 1956 when the B(P)R and B(C)R were first enacted. These early requirements were subsequently found to be inadequate. Incidents of people or objects falling over or through gaps in the barriers causing injury and litigation against the building owners have led to tighter controls on the design of the barriers. Current statutory requirements on the design and construction of protective barriers are set out in B(P)R 3A and B(C)Rs 8 and 17(3).

(d) Barrier Free Access

The Disability Discrimination Ordinance (DDO), Cap 487⁷, has made it unlawful to discriminate against a person on the basis of a disability. The requirements for the provision of barrier free access for persons with a disability are prescribed in section 84 of the DDO. B(P)R 72 and the Design Manual : Barrier Free Access 2008 (DMBFA) issued by the BD specify the design requirements and standard for such barrier free access.

- 3.8 Apart from the building safety and health requirements identified in Section 3.7 above, there are also building requirements of a planning nature such as site coverage, plot ratio, lighting and ventilation, etc. Application for exemption from or modification of such requirements will be considered on individual merits of each case.
- 3.9 The adaptive re-use of and A&A works to heritage buildings could have safety implications on geotechnical features associated with the buildings, e.g. slopes and earth retaining structures adjoining or adjacent to the buildings, basement or screen walls, foundations, etc. Since the adaptive re-use of and A&A works to heritage buildings are subject to the control under the BO, Registered Geotechnical Engineer (RGE) should be engaged where appropriate for geotechnical tasks in accordance with PNAP APP-141.

⁷ Section 84(1) of the DDO stipulates that any new building or alterations or additions to an existing building must be provided with such access as is reasonable in the circumstances to the building or premises for persons with a disability.

- 3.10 During the construction stage, the AP/RSE/RGE shall provide qualified site supervision under the BO to ensure that the works are carried out in accordance with the approved plans and in such a manner so as not to render inadequate the margin of safety of, impair the stability of or cause danger to any building, structure, land, street or services. To this end, systematic monitoring of the effects of the works should be carried out on site with adjustments or rectification measures taken when necessary. Depending on the scale and complexity of the works involved, the AP/RSE/RGE should determine the supervision requirements including the frequency levels of inspections.

4. APPROACHES IN DEALING WITH ADAPTIVE RE-USE OF HERITAGE BUILDINGS

Balanced Approach

- 4.1 The successful conservation of heritage buildings requires an optimal balance between the degree of conservation⁸ and the type of adaptive re-use and/or the extent of A&A works proposed. Not all heritage buildings can be adapted into any other uses and the selection of an appropriate use is most crucial to minimize the possible conflict between preserving the heritage value and upgrading the building to current standards to make it suitable for the new use⁹.
- 4.2 Every heritage building has its unique historical and cultural significance. Its character-defining elements that account for its heritage values may vary from case to case. In order to identify the character-defining elements and to comply with the building safety, health as well as conservation requirements, the AP/RSE responsible for the project are advised to conduct a comprehensive appraisal of the building and to consult a heritage conservationist at an early stage to prepare a conservation study or a set of conservation guidelines for the heritage building to address the scope of proposed works, the assessment of impact on heritage and the corresponding mitigation measures. Such study/ guidelines should be agreed by the AMO prior to the commencement of the proposed works. Seeking comments from or agreement by the AMO on the requirements of heritage conservation at an early stage is also advisable. Building owners and future operators, if already identified, also play a pivotal role in the design process. They should understand the limitations of the existing building and their responsibility in proper management and maintenance of the building. An understanding of what should be retained, and what can be altered as how the building will be used and managed in the future will significantly help the AP/RSE in coming up with a holistic plan before embarking on the adaptive re-use project.
- 4.3 In this connection, the AP/RSE are advised to make reference to some international principles in conservation, including the Venice Charter (by ICOMOS), the Burra Charter (by ICOMOS Australia) and the Principles for the Conservation of Heritage

⁸ According to Burra Charter, conservation means all the processes of looking after a place so as to retain its cultural significance.

⁹ The Burra Charter points out that 'compatible use means a use which respects the cultural significance of a place. Such a use involves no, or minimal, impact on cultural significance'.

Sites in China (by China ICOMOS) in dealing with an adaptive re-use project. In general, reusing the heritage buildings with compatible use, introducing minimal intervention to the character-defining elements, carrying out A&A works in a reversible manner, upholding both integrity and authenticity when carrying out A&A works to the heritage buildings and not attempting to falsify history (i.e., the new should be distinguishable from but also compatible with the old, and the new should not be made to look like the old) will be the key principles for the AMO to assess the suitability of the adaptive re-use/ A&A proposals. Since every building has its unique cultural significance and its character-defining elements that account for its heritage values vary case by case, timely engagement of a conservation expert may be necessary.

- 4.4 In certain heritage buildings, incorporation of facilities that are necessary to fulfill modern needs may have adverse effects on their architectural value. Careful treatment and sensible design in preserving the heritage value of the building may reconcile the two distinctive needs. To name but a few, an access ramp for persons with a disability has been added inside the Forbidden City in Beijing to take care of the needs of these persons. It may not be possible to summarise what ought and what ought not to be done.



Photo 3 An access ramp for persons with a disability in the Forbidden City, Beijing.



Photo 4 A circular access ramp to a church in Cambridge, UK

- 4.5 Owing to the age of heritage buildings, the intended change in the use of such building will invariably create difficulties for the AP/RSE to tackle, which in turn would make compliance with the statutory building safety and health requirements a challenge. Another balance to be considered by the AP/RSE is the need for preservation of character-defining elements of the heritage buildings and the need to comply with the minimum building safety and health standards stipulated under the BO and other relevant legislations. In many cases, the AP/RSE has to consider what requirements can be met by the prescribed methods and what requirements need to be met by alternative methods to achieve the equivalent safety standards in performance or function. For instance, the design of protective barriers may vary to suit the heritage conservation needs in each individual case. Some successful examples of these are provided in Appendix I. AP/RSE may consider merits of each of these examples when devising their solutions.



Photo 5 A protective barrier on the parapet wall of a building at the Tombs of the Thirteen Ming Emperors



Photo 6 A glazed panel added behind the existing balustrade to meet the current safety requirement in Oxford Castle, UK

Alternative Approach

- 4.6 As stated in Section 3.2 above, the objective of the BO is to ensure public safety and health by setting the minimum safety and health standards in the design and construction of private buildings. It should be noted that the BA is not empowered to grant modifications prejudicing the standard of structural stability and public health established from time to time by regulations by virtue of section 42(4) of the BO.
- 4.7 In recognition of the needs for preservation of the whole or part of a heritage building, the BD takes a pragmatic and flexible stance to consider the proposals for adaptive re-use of or A&A works to heritage buildings. An alternative design, though deviating from

the prescriptive requirements, will be favourably considered if equivalent level of safety and health standards of its performance or function can be explicitly demonstrated to be achieved on a case-by-case basis.

Principles of accepting alternative design

- 4.8 In vetting an alternative design that meets equivalent level of standards of the relevant prescriptive building safety and health requirements, the BD will consider if such design can achieve an equivalent performance to ensure the safety of the users and occupants of a heritage building. When determining the merits of each design option, the views of the AMO towards the preservation of specific character-defining elements are important, which in many cases would dictate how specific features or areas in the heritage building could be used, upgraded or strengthened. Hence, the AP/RSE should liaise with the BD and the AMO to arrive at an alternative design that can satisfy both needs. From conservation point of view, the AMO may consider the compatibility of the proposed use, the reversibility of the proposed A&A works, the safeguard of authenticity and the degree of disturbance.
- 4.9 Very often, to achieve fire safety in a heritage building, a fire engineering approach may be adopted to work out an alternative design which may achieve equivalent performance as laid down in the fire safety codes. In general, a variety of compensatory measures may be taken to achieve fire safety in a building. These measures may include, but not limited to, early warning by automatic fire detection systems, facilities for control of smoke, automatic fire suppression systems such as sprinkler systems, and a capacity for fire containment through compartmentation, etc. A guideline on adoption of this approach for the fire safety design of new buildings or A&A works in existing buildings is provided in Part F and Part G of the FS Code.
- 4.10 In the event that no other alternative design of equivalent standards is found to be feasible and practicable, building safety and health achieved by adopting a management approach will be critically considered. The acceptance of this alternative is based on the merits of each individual case. In this connection, it is imperative that the AP should formulate a feasible and enforceable management plan in collaboration with the building owner and future operator, if already identified. Application adopting this approach should be accompanied with suitable

justifications and undertaking to demonstrate that there is a reliable and effective management system during the life of the building and that a monitoring system could be effectively and reasonably implemented to avoid abuse. If the proposal adopting a management approach is considered acceptable, the BA may impose conditions requiring compliance with the management plan upon granting modification of or exemption from the relevant regulations, under section 42 of the BO. In all cases, the responsibility for the provision, management and maintenance of the alternative measures will rest with the owners. An undertaking letter from the owner is required to be provided in the management plan. A management plan is outlined in Appendix III for reference. The management approach would be subject to the approval of the BA and should therefore be considered as a last resort.

4.11 To assist the AMO in formulating their views on the proposed alternative design, the AP/RSE, when applying for a modification of and/or exemption from the prescriptive requirements of the building regulations, should also provide the following information :

- (a) Statement to describe the heritage values of the subject building element(s) proposed for modification;
- (b) Threats to the heritage values if modification is not granted, with substantiation by an appraisal of design options;
- (c) Recommendations on the design options;
- (d) Mitigation measures for minimising the adverse impact on the heritage values if modification is not granted; and
- (e) Proper photographic records and plans of the subject building element(s).

The AMO will consider the case by assessing the impacts caused by each design option and whether such impacts have been minimised as far as possible.

5 PRACTICAL ADVICE

- 5.1 Practical advice given in this section aims to provide guidance to resolve some common problems that may be encountered in complying with the current building safety and health requirements while taking due care of the objectives of heritage conservation. As every case has to be considered on its own merits and the heritage value of a building feature varies from case to case, the examples of the alternative design described in this section are by no means suitable for universal application. The AP/RSE are advised to fully understand the conservation requirements as agreed with the AMO before adopting any one of these examples.

Structural Safety

- 5.2 Structural works involving in any change in use and structural strengthening in buildings should proceed in accordance with the requirements stipulated in PNAP APP-117.

There are innovative methods and techniques for structural investigation and structural strengthening that can be devised to minimise the impact on the aesthetic and heritage values of a particular project.

In certain circumstances where it is impracticable to carry out structural strengthening works, alternative approach as specified in Section 5.8 may be adopted.

Some practical solutions for strengthening and alternative designs are further elaborated below.

- 5.3 The lack of approved plans and structural records

One of the common problems for heritage buildings is the lack of approved plans and structural records. The uncertainty in the load carrying capacity of the existing buildings makes it difficult to assess accurately the extent of structural strengthening required. For buildings without approved plans and structural records, a detailed structural appraisal should be adopted. The following measures are practical solutions to some typical structural issues:

- (a) The use of archaic records

The BD maintains an archive of approved plans and structural records including calculations and material test reports of private buildings whilst the ArchSD may have

archaic records of some government-owned buildings. However, the records for pre-war (i.e. pre-1946) buildings were lost in the Second World War. The AP/RSE should first check for A&A records after 1946 in the BD archive. Then, attempt should be made to trace the archaic records of the building from other sources such as the current and previous owners or tenants, or other Government departments. Old photographs may reveal valuable information on the probable period when the building was built, an annex was added or a roof was replaced, etc. Other useful sources of reference include the Public Records Office, university libraries, the ArchSD, the AMO, the Lands Department, the Hong Kong Museum of History, etc.

(b) Full survey and structural appraisal

When the design information of an existing building is not available, the structural system of the building may be ascertained by conducting full survey and structural appraisal of the existing building in order to re-establish the structural framing information, the load path, the construction details of the structural elements, the robustness of the structure, the material strengths and the current condition of the existing structures including the foundations. Coring and opening-up or other destructive tests may be employed to obtain the construction details and material strengths. For heritage buildings, however, the AP/RSE should adopt the use of non-destructive tests as far as practicable. Opening-up and destructive tests should be kept to a reasonable minimum. The AP/RSE should note that destructive tests or full scale load test carried out on the existing structure may constitute building works requiring prior approval and consent from the BA. Significant breaking up of structure can cause danger and persons instructing or carrying out such building works without prior approval and consent from the BA may be liable to prosecution under the BO. Moreover, as destructive tests or load test may incur irreversible damage to the specific feature of a heritage building, the AMO should be consulted for agreement in advance. Information should include the sampling/ test locations, reinstatement proposals after the sampling/ opening up works and photographic record before and after the carrying out of the sampling/ test. With respect to the information required for structural appraisal and safety issues, the AP/RSE should liaise with the BD to arrive at a reasonable number of destructive tests and an appropriate structural investigation plan.

5.4 Addition of new structural elements

The addition of new structural elements such as lateral ties, shear walls, braced frames or concrete lining to the existing building is often found necessary to improve structural performance. The addition of these new structural elements should be identified at an early stage of the design and their design should be agreed with the AMO. Elements for strengthening such as tie rods to the gable walls and masonry arches may either be concealed in the roof, in the floor screed or under the floor. In some cases, these elements can be exposed as these provisions were often found in old timber structures. The AMO should be consulted to obtain the desired architectural and heritage treatment of them.

5.5 Re-distribution of design loads

The re-distribution of design loads that may act on the existing building may be considered to reduce the extent of the required strengthening works and hence minimising the impact to the heritage value of the heritage building. For example, the lateral stiffness of an old building may be significantly improved by adding shear walls inside concealed rooms instead of strengthening every structural frame in the building. To consider the redistribution of loads, the RSE must have a thorough understanding of the load paths of the structure. This relies on the full survey and structural appraisal. The cracks identified in the full survey may reveal how the loads have been redistributed within the structure in the past history of the building.

5.6 Additional supports to reduce the span

The deficiency of the load carrying capacity of floors or beams may be resolved by putting in additional supports in specified locations. Often, large rooms need to be sub-divided through re-planning by constructing new partitions. These partition walls can be designed as structural supports to reduce the floor span. It is also possible to put in additional columns and beams constructed of material that are distinguishable from the existing structure to reduce the stresses in the existing structures.

5.7 Insertions to strengthen timber elements

To increase the flexural strength of timber beams or joists against bending moment, it is possible to insert a steel plate at the bottom or the centre of the timber beam/ joist to form a composite section with the timber or constructing a new steel beam underneath the existing timber beam/ joist to increase its carrying capacity (as in Figure 1). The steel plate, which may form a composite section with the timber, must be fixed to the timber section with connectors at suitable spacing capable of transmitting the horizontal shear forces. The steel plate should be adequately protected to achieve the required fire resistance rating (FRR).

It is also possible to add timber joists or steel plates bolted alongside the joists. Where the inserted steel plate is used (as in Figure 2), the plate and associated connections should be protected with timber plugs against fire in accordance with BS5268 Part 4.1.

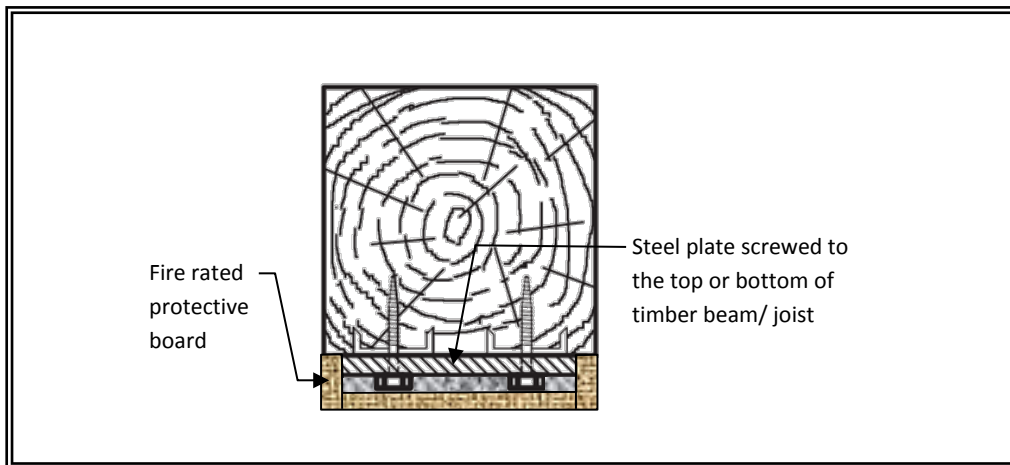


Figure 1 Steel plate for strengthening a timber beam/ joist (with composite action)

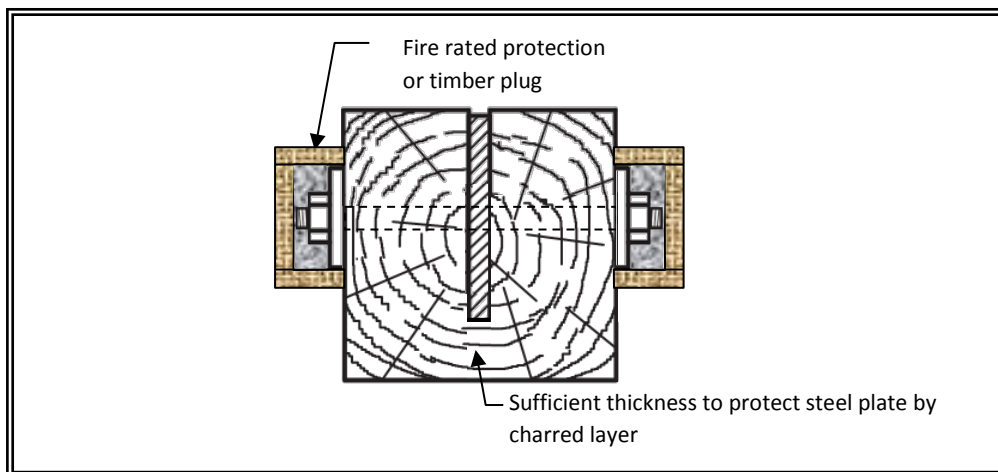


Figure 2 Steel strengthening plate in vertical sawn slot



Photo 7 New beams and columns underneath the timber Joists



Photos 8 and 9 Three timber joists bolted together

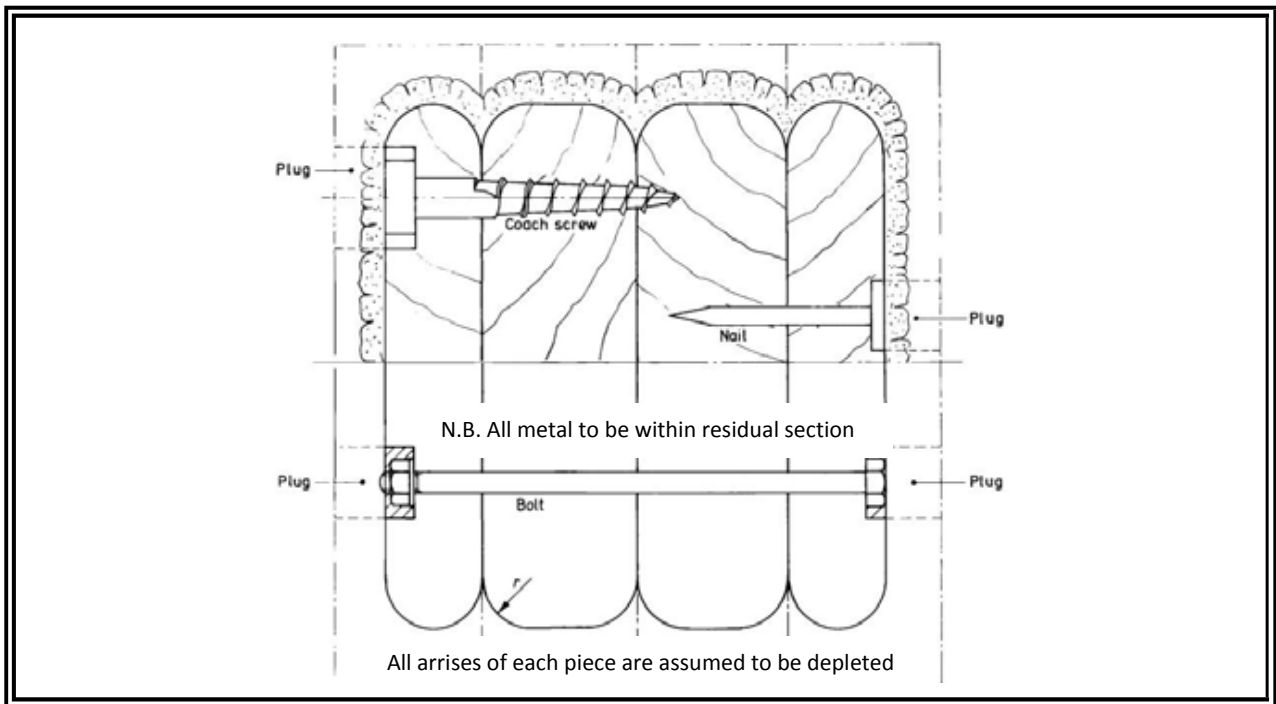


Figure 3 Charred timber section with steel connections to BS 5268 Part 4.1

5.8 Minimum imposed loads for floor

B(C)R 17 specifies the requirements of minimum imposed loads for various uses as set out in Table 1 thereof.

However, the adaptive re-use of a heritage building raises the concern that the existing structure may not be capable of supporting the minimum imposed load for the adaptive re-use as stipulated in the current regulations. Whilst strengthening of the existing structure may be feasible, significant A&A works may affect the heritage fabric. To avoid such damaging intervention, it may be reasonable to determine a minimum imposed load based on the nature or specific function of the adaptive re-use. The Code of Practice for Dead and Imposed Loads 2011 provides guidelines on determining the magnitude of imposed loads for specific use not prescribed in the B(C)R17. If the concerned floors, including the roofs, do not involve any change in use or A&A works, following the principle mentioned in Section 3.6 above, their structural capacities are not required to be upgraded to comply with the current requirements of minimum imposed loads.

Full justification should be provided on the methodology, source of reliable data and calculations in determining the magnitude of the imposed load taking into consideration the actual floor area, influence area of the occupants' lumped mass, configuration and framing of the structural elements, load transfer path and effects of concentrated load, etc. The reliability of the above design parameters should also be justified. Reference should be made to Section 4.2 of the Code of Practice for Dead and Imposed Loads 2011.

The BA will consider this approach on a case-by-case basis together with the following information :

- (a) Assembly of people. For example, floor layout indicating the location of fixed setting, such as partitions, furniture, railing, equipment and plant, etc, that controls the movement of occupants and hence the imposed load intensity;
- (b) Accumulation of equipment, display items and furnishing;
- (c) Storage of materials; and.
- (d) Undertaking and management plan with details of effective management measures to limit the occupant capacity.

5.9 Wind load on roof

The restoration works of a roof structure not involving the total removal or change in any of the following aspects: geometry,

material and load paths will be considered as repair works¹⁰ in nature. In this respect, the repair works of the roof structure would not be required to be designed to meet the current Code of Practice on Wind Effects in Hong Kong (Wind Code).

If the condition of the existing roof has dilapidated to a state beyond repair, the demolition and re-construction of the roof structure is regarded as A&A works.

If the roof is such dilapidated that it may have already been replaced with other construction materials, the restoration of the roof structure to its original form is also regarded as A&A works.

When A&A works are involved in roof conservation works, the AP/RSE can refer to the structural requirements for design of new structural elements and checking of structural adequacy of existing elements set out in PNAP APP-117. As stipulated in PNAP APP-117, all new structural elements should be designed in accordance with the current building regulations and relevant codes of practice. However, the structural adequacy of an existing building or part thereof can be checked according to the then prevailing building regulations and codes of practice to which they were designed. In the case of A&A works involving:

- (a) partial or total removal of existing major wind resisting walls or frames, which would result in a reduction in their stiffness by 5% or more, or
- (b) the extension of building dimensions which would result in an increase of 10% or more of the wind exposure areas of a building,

the structural adequacy of the building due to wind should be checked based on the current Wind Code.

¹⁰ Strengthening/replacement of individual timber purlins and rafters of a timber roof structure that does not involve any change in geometry, material and load paths, such strengthening/replacement will be considered as repair works. In case of an existing timber roof that had not collapsed, dismantling the whole roof for strengthening or replacement of defective members and re-assembling according to the original design will also be considered as repair works. The repair works may be carried out under minor work items 1.17 in accordance with the original design. Prescribed building professionals are required to carefully consider both the design and construction of the repair works. For design, due considerations should be given to the transient conditions and temporary supports, compatibility of new and existing structures, overall structural integrity etc. For construction, proper temporary support is required.

When new structural elements are designed to comply with the current Wind Code, wind tunnel test may be conducted to determine the wind loads for design of the roof structures instead of adopting the design wind loads prescribed in the Wind Code.

- 5.10 Since heritage buildings were built a long time ago, some of the building fabrics are likely to have suffered deterioration to various degrees. Selection of appropriate repair methods for these building fabrics without damaging the heritage value of a building is of great importance. Recommendations in this Practice Guidebook may also be applied to the repair and strengthening of these heritage buildings.
- 5.11 If the proposed A&A works involve temporary removal or alteration of existing structural elements or unconventional construction methods, the AP/RSE should indicate clearly the method statements, sequence of construction works and provisions for temporary works, monitoring, precautionary and protective measures on the structural plans submitted to BD for approval.

Fire Safety

- 5.12 When a heritage building undergoes adaptive re-use, improvement to the fire safety provisions is necessary to cater for the possible increase in occupancy load and fire risk in association with the new use. As such, the existing fire safety provisions, both active and passive, may need to be upgraded to provide the adequate means of escape, means of access for fire fighting and rescue, fire resisting construction, and fire service installations and equipment.
- 5.13 The solutions to address the inadequacy of the fire safety measures cannot be considered in isolation, as a solution for one particular situation may not be valid for another. It is imperative that a comprehensive fire safety package is developed for the building which takes into consideration the level of risk, the overall fire safety strategy and the specific building conservation needs. The compensatory measures provided in this section aims to provide guidance to the AP in compliance with the building safety and health requirements under the BO. The AP shall consider carefully whether such compensatory measures are adequate to ensure the safety of the occupiers or a fire engineering study shall be carried out to achieve a holistic design to resolve the various fire safety issues in one go. Where structural matters are involved, an RSE should be appointed to provide structural advice. The BA will consider acceptance of such compensatory measures on a case basis having considered the characteristics of the building, its

proposed use and the associated risk.

Means of Escape

5.14 Inadequate width and number of exit routes

In cases where additional means of escape in terms of the number and the width of exit routes, staircases and doors are required, the following practical measures will be favourably considered:

- (a) Installation of new exit doors and exit staircases at inconspicuous location

Where the existing width of a staircase or the number of staircases available is not adequate, new staircases may be erected in areas of less heritage value, e.g. areas which are not identified as character-defining elements and where there is minimal visual impact to the building, or a room inside the building where the room carries less heritage value than the exterior of the building. However, since each heritage building has its unique character-defining elements, the acceptable location of new staircases from conservation point of view varies from case to case. As the location of new staircases may affect the fundamental planning of the building layouts, early consultation with the AMO is highly recommended.

In view of the adverse impact on the existing structures by adding new exits and staircases, existing exits and staircases should be re-used as far as possible from conservation point of view. As such, the possibility of reusing, modifying and adopting (with management approach if considered appropriate) the existing exits and staircases should be explored before new exits and staircases are introduced.

- (b) Compensatory measures for a narrow staircase

An existing staircase of width not less than 860mm will be accepted for the purpose of means of escape and/or means of access if:

- (i) the building is provided with the following fire service installations:
 - (1) automatic sprinkler system with fast response type sprinkler heads; and

- (2) fire detection system to alert the occupiers the outbreak of fire and to notify the FSD within the shortest time;
 - (ii) either the access to such staircase is via a protected lobby or the staircase is naturally ventilated with sufficient openings to the external air in accordance with the FS Code;
 - (iii) for the purpose of demonstrating compliance with the FS Code, the discharge value (DV) of the narrow staircase shall be computed with a reduction in its capacity as follows:

$$\text{DV of staircase} = 56 + 17 (n-1),$$
 where n is the no. of storey above ground level of building
 - (iv) handrails are provided on each side of the staircase in accordance with the FS Code;
 - (v) the staircase is free from any combustible materials and unprotected services other than emergency services in accordance with the FS Code;
 - (vi) clear signs with an illustrated diagram showing the single-row users design are posted at the entrance to the staircase and along the stair;
 - (vii) where the heritage building is of such use or of such design and capacity that requires more than one exit staircase, at least one of these staircases is code compliant; and
 - (viii) a management plan is provided in accordance with Appendix III.
- (c) Management approach

Management approach may be adopted to limit the number of occupants in licensed premises¹¹ subject to justifications such as furniture and seating layouts and the number of occupants controlled by effective management measures undertaken and detailed in a management plan. Reference should be made to Section 4.10 above.

¹¹ The BA recognises actual counting as a reliable way to establish the occupant capacity of a building in accordance with Note 3 of Table B1 of the FS Code.

5.15 Non-compliant risers and treads of staircase and staircase with winder

If a staircase is with winder and its risers and treads deviate from the requirements in the FS Code and such staircase has to be preserved for conservation needs, the following options will be favourably considered :

(a) Addition of a new staircase

A new staircase may be added at suitable locations for the purpose of means of escape and/or means of access, and the existing substandard staircase may be retained for circulation purpose.

(b) Compensatory measures for non-compliant staircase

In case it is impractical to provide a new staircase, depending on the number of people using such non-compliant staircase, the occupiers' level of familiarity with the building and the number of storey the staircase serves, an existing non-compliant staircase can be accepted as a means of escape and/or means of access if :

- (i) handrails of height not less than 850mm and not more than 960mm are provided on each side of the staircase;
- (ii) tread surface is firm and slip-resistant;
- (iii) adequate warning signs are posted at the entrance to the staircase to alert occupants the geometry of the staircase;
- (iv) the tread is not less than 220mm wide along a straight flight; and
- (v) a management plan is provided in accordance with Appendix III.

For the avoidance of doubt, a non-compliant staircase that serves primarily children, elderly and persons with low mobility, such as in a kindergarten, nursery, learning centre, child care centre, elderly care centre, etc will not be accepted as a means of escape and/or means of access.

5.16 Excessive number of risers in a flight of staircase

An existing staircase having not more than 18 risers will be favourably considered as a means of escape and/ or means of access if the following compensatory measures are provided:

- (a) handrails of height not less than 850mm and not more than 960mm are provided on each side of the staircase;
- (b) adequate warning signs are posted at entrance to the staircase to warn the users of a long stair flight; and
- (c) a management plan is provided in accordance with Appendix III.

For the avoidance of doubt, a non-compliant staircase that serves primarily children, elderly and persons with low mobility, such as in a kindergarten, nursery, learning centre, child care centre, elderly care centre, etc will not be accepted as a means of escape and/or means of access.

5.17 Exit door not opening in the direction of exit

According to the current FS Code, every exit door from a room or a storey shall open in the direction of exit where the capacity of the room exceeds 30 persons. If it is impractical to have an existing inward opening door altered to swing in the direction of exit, then the following options will be favourably considered:

- (a) Door kept open

If the door is not required to perform a fire or smoke separation function, such door may be kept fully opened permanently using a door holder, to remove the impediment to egress.

- (b) Subdivision of room

A room may be subdivided into smaller compartments so as to accommodate not more than 30 people in each subdivided room.

- (c) Addition of new door

New doors that open in the direction of exit may be added at suitable locations of the room for exit.

- (d) Compensatory measures

If there are operational needs to have the door kept normally closed, a non-compliant door will be favourably considered for the purpose of exit if :

- (i) the door is fitted with a device that will open the door automatically upon activation of the fire alarm. Such device is required to be included in the Schedule of Building Materials and Products under PNAP APP-13 when applying for occupation permit or certifying the completion of the respective A&A works; and
 - (ii) a management plan is provided in accordance with Appendix III.
- (e) Management approach

Management approach can be adopted to limit the number of occupants in licensed premises. Reference should be made to Section 4.10 above.

5.18 Basement connected with upper floors by a common staircase

The FS Code stipulates that an escape staircase serving the floors above ground should not be continued directly to the basement. If it is impractical to erect a new staircase to serve the basement, the following options will be favourably considered:

(a) Provision of dividing wall

If the landing of the staircase at the ground level of exit is wide enough, a wall having the same FRR required under the FS Code as the staircase may be erected to separate the staircase serving the floors above ground from the staircase serving the basement.

(b) Compensatory measures

If it is not feasible to construct a dividing wall as described in item (a) above, a staircase that serves both storeys above and below ground can be accepted for the purpose of means of escape and/or means of access if:

- (i) the building is provided with the following fire service installations:
 - (1) automatic sprinkler system with fast response type sprinkler heads; and

- (2) fire detection system to alert the occupiers the outbreak of fire and to notify the FSD within the shortest time;
- (ii) the staircase is provided with protected lobby at each floor to inhibit the spread of smoke and heat into the staircase;
- (iii) adequate directional and exit signs are provided within the staircase;
- (iv) the exit door leading to a street or an open area at ground level/ ultimate place of safety as described in the FS Code is fitted with a device that will open the door automatically upon activation of the fire alarm. Such device is required to be included in the Schedule of Building Materials and Products under PNAP APP-13 when applying for occupation permit or certifying the completion of the respective A&A works;
- (v) an audio and visual advisory system is provided inside the staircase at the level of exit to show the direction of safe egress; and
- (vi) a management plan is provided in accordance with Appendix III.

For the avoidance of doubt, a non-compliant staircase that serves primarily children, elderly, persons with low mobility or a large crowd who may be unfamiliar with the building, such as in a kindergarten, nursery, learning centre, child care centre, elderly care centre, places of public entertainment, etc will not be accepted as a means of escape and/or means of access.

Fire Resisting Construction

5.19 Timber construction

Timber is a combustible material but charred timber is also a good insulator. In the event of fire, the charred layer protects the inner part of the timber section from being consumed by the fire while the strength properties of the uncharred timber are virtually unaffected. The charring rate of timber in mm/min is predictable for various timber species and is well documented by many international timber design codes of practice such as BS5268 to calculate the strength of the residual section in the event of fire.

Guidelines on fire resisting construction for individual timber elements are provided in the following Sections.

5.20 Timber floor

A floor is an element of construction and in some circumstances may also be required to act as a compartment floor as stipulated in the FS Code. In heritage buildings, the timber joists are typically 8" deep by 4" wide (i.e. 203mm deep x 101mm wide) spaced at 1'6" (450 mm) centre to centre. When fully exposed to fire, they are unable to provide the required FRR in terms of stability for 1 hour. Furthermore, the FS Code prohibits the use of combustible material. Hence, some form of modification or A&A works on a floor constructed of timber may be inevitable. However, methods (e.g. by fire engineering approach) of full retention of a timber floor as element of construction and to expose both sides of the floor should be sought as far as possible when the floor is identified as an element of high heritage value. In other situations, the following options will be favourably considered to suit specific needs:

- (a) Installation of fire rated floor board underneath the existing timber floor board

When the existing timber floor board is required to achieve certain FRR under the FS Code, additional fire rated floor board can be installed beneath the existing timber floor planking (Fig. 4 refers). If the top surface of the existing timber floor board is exposed to fire, the additional fire rated floor board installed underneath can still provide structural support to the imposed floor loads. Details of the upgraded timber floor should also be included in the Schedule of Building Materials and Products under PNAP APP-13 when applying for occupation permit or certifying completion of the respective A&A works.

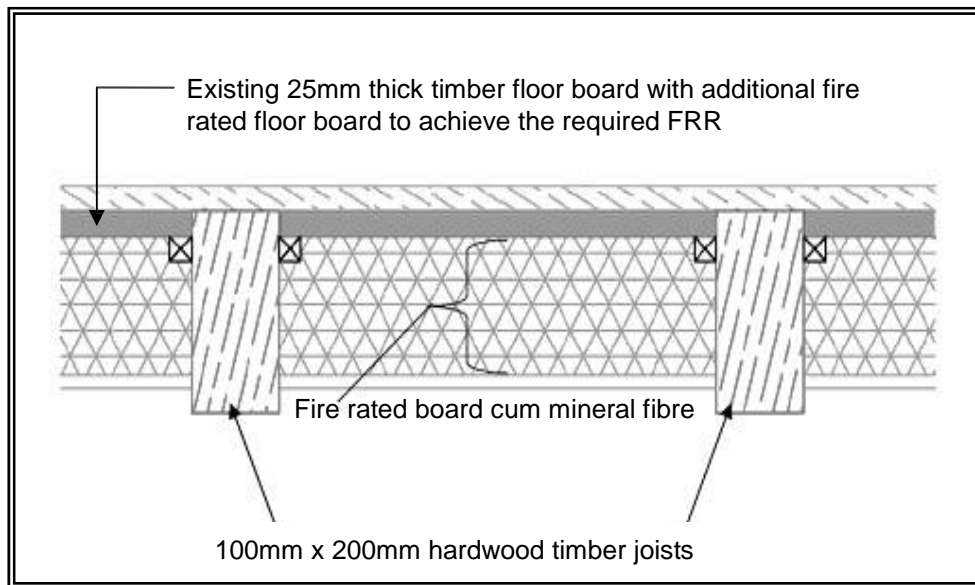


Figure 4 Additional fire rated protective board fixed at underside of floor board with additional fire rated board installed underneath the top timber planking

(b) Installation of structural deck with adequate fire resistance

If it is required to expose one side of a timber floor, an additional structural steel deck with adequate fire resistance can be erected on the other side of the floor. The timber floor is then preserved in-situ. Stability of the timber floor in case of fire should be considered and justified.

(c) Sandwich approach

In cases where it is decided to retain a timber floor, it may be upgraded to achieve the requisite fire resistance rating by using a “sandwich approach”. Fire-resisting materials could be installed on the top and soffit of the floor to achieve the required fire protection. However, the heritage value of the floor would be grossly affected by adopting this approach. It should be noted that the actual improvement in fire resistance performance depends on the details of the construction and condition of the existing floor. A technical assessment should be conducted to ensure that appropriate decisions and choices could be made to suit the specific situation. Details of the upgraded timber floor should also be included in the Schedule of Building Materials and Products under PNAP APP-13 when applying for occupation permit or certifying completion of the respective A&A works.

(d) Erection of new reinforced concrete floor slab

A new reinforced concrete floor slab may be constructed to replace the existing timber floor not meeting the FRR requirements. This approach is subject to the agreement with the AMO and should be considered as a last resort.

5.21 Timber staircase

A required staircase including the landings and supports thereto being an element of construction is required to be fire rated, unless it is enclosed within walls having the required FRR, and should be constructed of non-combustible materials.

- (a) In order to fulfill this safety requirement, a new staircase may be added so that an existing timber staircase, being one having significant heritage values, may be maintained to serve as a circulation staircase or left intact. In this case, Section 5.13(a) above should be noted while considering the choice of location to erect a new staircase. The condition of the existing timber staircase should also be assessed and upgraded where necessary to ensure structural safety if it is to serve as a circulation staircase.
- (b) An existing timber staircase can be accepted as a means of escape and/or means of access if:
 - (i) the staircase is separated from the rest of the building by fire resisting walls as required under the FS Code;
 - (ii) all timber elements are protected with fire retardant treatment¹² applicable to foot traffic to achieve a Class 1 surface spread of flame when tested in accordance with BS476 Pt. 7 or other equivalent standard in accordance with the manufacturer's recommendations, and such fire retardant treatment is to be included in the Schedule of Building Materials and Products under PNAP APP-13 when applying for occupation permit or certifying completion of the respective A&A works;
 - (iii) if the staircase is the main staircase of the building with frequent foot traffic, a single layer of 13mm thick gypsum board or equivalent proprietary fire protective lining is

¹² The main function of fire retardant treatment is to reduce the heat supplied to the substrate of timber for sustaining flaming in timber. Such treatment includes impregnation treatment or application of fire retardant paint to the timber elements.

required to be fixed to the underside of the stair flight and landing. Details of the upgraded timber floor should also be included in the Schedule of Building Materials and Products under PNAP APP-13 when applying for occupation permit or certifying completion of the respective A&A works;

- (iv) the staircase is provided with automatic sprinkler system with fast response type sprinkler heads and fire detection system; and
- (v) a management plan is provided in accordance with Appendix III.

5.22 Timber column

Timber columns should be covered by proprietary fire protective lining system to achieve the required FRR. Subject to the satisfactory demonstration of the overall stability performance of the building based on the residual strength and stiffness of the columns in case of fire, existing timber columns can be accepted with or without additional fire resisting protection. Details of the upgraded timber floor should also be included in the Schedule of Building Materials and Products under PNAP APP-13 when applying for occupation permit or certifying completion of the respective A&A works.

5.23 Timber roof

According to the FS Code, if a roof does not form part of an exit route or perform the function of a floor and is not within 1.8m and 0.9m from the adjoining building and common boundary respectively, all roofs, together with the members forming the roof structure, are not required to have FRR, but shall be constructed of non-combustible materials. A timber roof may be retained to meet conservation needs if :

- (a) the rafters and battens supporting the roof have been proven to be structurally safe;
- (b) all timber elements are protected with fire retardant treatment to achieve a Class 1 surface spread of flame when tested in accordance with BS 476 Pt. 7 or other equivalent standards in accordance with the manufacturer's recommendations, and such fire retardant treatment is to be included in the Schedule of Building Materials and Products under PNAP APP-13 when applying for occupation permit or

certifying completion of the respective A&A works;

- (c) the roof is covered by non-combustible roof covering including roof tiles such as natural slates, clay tiles, concrete tiles, etc; and
- (d) a management plan is provided in accordance with Appendix III.

5.24 Timber door

When a heritage building undergoes adaptive re-use, some of the existing doors may need to be upgraded to provide the required FRR. If it is necessary to retain the original door fabric, the following options will be favourably considered :

- (a) Installation of new fire rated door

An additional fire rated door may be provided in the vicinity to take up the role of fire protection, leaving the existing door intact as a decorative feature. The appearance of the additional door shall be compatible with but distinguishable from the existing building fabric from conservation point of view.

- (b) Upgrading of existing door

There are available techniques to upgrade the fire resistance rating of a timber panelled door without altering the external appearance (at the front) of the door. The AP is strongly advised to check and submit test evidence for the proposed upgrading methods with the submission of building plans to BD. Implementation of the upgrading should be carried out by experienced personnel of the trade in accordance with the manufacturer's recommendations. Such upgraded fire door is required to be included in the Schedule of Building Materials and Products under PNAP APP-13 when applying for occupation permit or certifying completion of the respective A&A works. Depending on the type of upgrading methods, some may cause irreversible changes to the components of a door to be preserved. Thus, this approach would be subject to the agreement with the AMO and should be considered as a last resort.

(c) Assessment of existing door

If an existing door to be preserved is of solid construction, of adequate thickness and with a suitable rebate provided by the door frame, an assessment may be carried out by a HOKLAS accredited laboratory or equivalent to determine whether the door and its associated door frame could meet the requisite fire resistance rating. Fire test on a door of similar construction may need to be carried out to provide further evidence on the fire resistance property of the existing door.

5.25 Reinforced concrete structure of inadequate fire resistance

Where the existing concrete cover to reinforcement in the reinforced concrete structure is found inadequate for the required FRP, a new layer of gypsum plaster on metal lathing or proprietary fire protective lining can be applied to the face of the reinforced concrete element to enhance its fire resistance.

5.26 Inadequate protection to adjoining building

Existing openings in the external walls of a heritage building that are within 900 mm of an adjoining building can be protected by fire resisting glass panels, having the same FRR required under the FS Code as the element of construction of the building, installed at the inner side of the openings.

Emergency Vehicular Access and Access for Fire Fighting and Rescue

5.27 Emergency vehicular access

An emergency vehicular access (EVA) is required for new buildings. The AP can make reference to the FS Code on the typical enhanced fire safety measures to compensate for the non-provision or deficiency of EVA. Besides, reference can also be made to PNAP APP-136 on the guidelines on the exemption/modification in special circumstances. An application for exemption from the Building (Planning) Regulation 41D(1) or (2) supported with a fire safety assessment report in accordance with the FS Code should be submitted for consideration by the BA. Early consultation with FSD on the upgrading works and compensatory measures required is recommended.

5.28 Structural and spatial constraints for the provision of major fire service installations or means of access for fire fighting and rescue

(a) Fireman's lift and fire-fighting and rescue stairway

Subject to full justifications on the hardship encountered, e.g. due to site constraint, a smaller lift to serve as a fireman's lift and relaxation on the provision of firefighting and rescue stairway will be favourably considered by the BA and the Director of Fire Services on a case by case basis.

Street Fire Hydrant and Fire Service Installations and Equipment (FSI)

5.29 The provision of street fire hydrant(s) may be required with due consideration of water supplies at the vicinity by the FSD.

5.30 In case of technical constraints, the following alternative measures in the provision of FSI will be favourably considered on a case by case basis. Advice from the FSD shall be sought at an early stage.

(a) Emergency generator

Electricity supply to fire service installations and fireman's lift may be met by secondary power supply before the incoming main switch from the electricity company.

(b) Water tank for automatic sprinkler system

- (i) Reduced capacity sprinkler tanks are accepted in accordance with FSD Circular Letter No. 3/2006.
- (ii) A new sprinkler tank may be constructed outside a heritage building or built on top of a new lift or within a floor with new supporting beams.
- (iii) A fire service tank of the building's fire hydrant/hose reel system may be augmented to supply the improvised sprinkler system.
- (iv) Subject to water pressure available, improvised sprinkler system may be fed directly from the town main. Specification for improvised sprinkler system is stipulated in FSD Circular Letter No. 4/96.

Protective Barrier

5.31 Many existing protective barriers in the form of parapet walls or balustrades to stair-wells, balconies or verandahs are of insufficient height or have excessive gaps to prevent falling of persons or objects, or have not been designed to prevent persons from climbing over the barrier. To improve safety, the following options will be favourably considered:

(a) Secondary protective barrier

To preserve the existing barrier, a secondary protective barrier, such as a glass panel or steel balustrade that complies with the current safety requirement, may be installed behind the existing one. Care should be taken to minimise intervention to the floor of heritage value.

(b) Adding height to existing protective barrier

To achieve the required height, a glass panel or additional railings which are compatible with the existing may be added on top of the existing barrier. The existing barrier, the fixing and the structural strength of the additional members together with their effects at the support should meet the current structural requirements. In this case, the fixing details should be agreed with the AMO for compatibility with and preservation of the existing heritage elements.

(c) Adding mesh or grille to reduce the opening dimensions

Wires, wire mesh or metal grille may be added behind the existing protective barrier to reduce the size of its openings. These additions should be securely fixed to the existing barrier or adjacent structures to meet the current structural requirements. In this case, the fixing details should be agreed with the AMO for compatibility with and preservation of the existing heritage elements.

(d) Compensatory measures for protective barrier with wider gaps and/or with lower solid curb

Depending on the use of the premises, the location and function of the protective barrier and the difference in adjacent levels, an existing protective barrier with gap marginally wider than 100mm and/or with solid curb less than 150mm will be favourably considered if:

- (i) access to the passage or area under the protective barrier is restricted;
- (ii) adequate warning signs are posted at conspicuous locations close to the protective barrier to alert occupiers of the non-compliance;
- (iii) an effective management control system is in place with measures¹³ that will prohibit children's access to such protective barriers; and
- (iv) a management plan is provided in accordance with Appendix III.

For the avoidance of doubt, the above compensatory measures will not be acceptable if the premises are used primarily by children, such as a kindergarten, nursery, learning centre, child care centre, primary school, etc.

- (e) Compensatory measures for protective barrier of height less than 1100mm but not less than 900mm at balconies and verandahs

An existing protective barrier of height less than 1100mm will be favourably considered if:

- (i) the height of the protective barrier is not less than 900mm;
- (ii) the sum of the width of the top surface measured from centreline of the barrier being not less than 300mm and the height of protective barrier being not less than 900mm, is not less than 1220mm. Figure 5 refers;
- (iii) such top surface is so constructed to prevent persons sitting or placing articles which are liable to fall to any area below;
- (iv) the fixing and structural strength of the top surface meets the requirements on the minimum horizontal imposed load;
- (v) adequate warning signs are posted at conspicuous location to alert occupiers of the lower parapet height and not to sit on the parapet;
- (vi) floor surface in front of the protective barrier is non-slip;
- (vii) an effective management control system is in place with measures¹³ that will prohibit children's access to such protective barriers; and

¹³ Barrier such as fixed cabinets or fixed planters of suitable dimensions, for preventing users from exposure to the danger of falling over the protective barrier, will be favourably considered.

- (viii) a management plan is provided in accordance with Appendix III.

For the avoidance of doubt, the above compensatory measures will not be acceptable if the premises are used primarily by children, such as a kindergarten, nursery, learning centre, child care centre, primary school, etc.

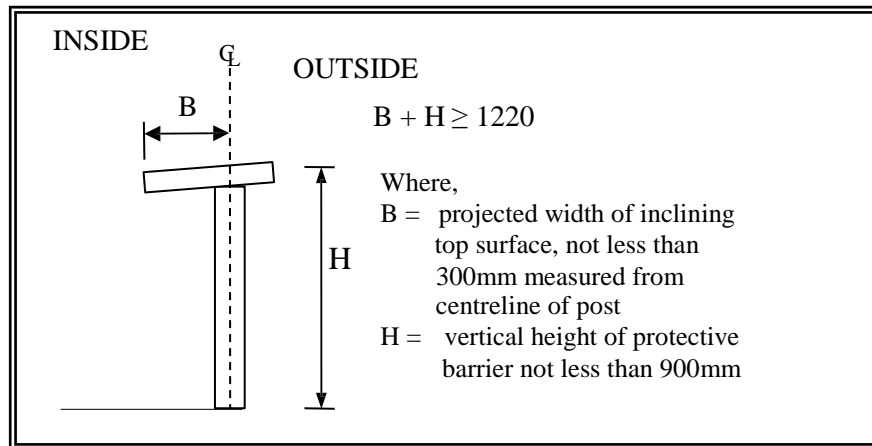


Figure 5 Relationship between the height of protective barrier (H) and minimum width of top surface (B)

- (f) Compensatory measures for protective barrier of lesser height and/or with wider gaps, along flight of staircase

Depending on the use of the premises, the location and function of the staircase and the difference in adjacent levels, existing protective barriers of height not less than 900mm and/or with gaps marginally wider than 100mm along the flight of a staircase will be favourably considered if :

- (i) the staircase is not of open well design;
- (ii) adequate warning signs are posted at conspicuous location close to the barrier to alert occupiers of the non-compliance;
- (iii) an effective management control system is in place with measures¹³ that will prohibit children's access to such protective barriers; and
- (iv) a management plan is provided in accordance with Appendix III.

For the avoidance of doubt, the above compensatory measures will not be acceptable if the premises are used primarily by children, such as a kindergarten, nursery, learning centre, child care centre, primary school, etc.

- (g) Minimum horizontal imposed load for protective barrier

The horizontal imposed loads on any protective barrier is stipulated in Table 3 of the B(C)R17(3). To demonstrate the structural adequacy of an existing protective barrier in a heritage building, the project RSE may discuss and agree with the BA the appropriate level at which the minimum horizontal imposed loads apply.

Barrier Free Access

5.32 Most heritage buildings are not designed to cater for access for persons with a disability. Improving access to these buildings may benefit many people, not only to persons with a disability, but also the elderly and families with children. It is therefore essential that all reasonable steps should be taken to ensure proper access to heritage buildings. In order to minimise any adverse effect on character-defining elements that give heritage values to the building, the following options will be favourably considered:

- (a) New ramp, lifting platform and lift at areas of less heritage value

An accessible lift or lifting platform should be conveniently located. It should also be placed at a location which is not identified as a character-defining element. If placed externally, it should impose minimal visual impact to the building. Alternatively, it may be placed inside the building, within a space that carries less heritage value than the exterior of the building. Where a ramp is required for entry into the building, elegant solutions that compliment the architecture of the building may be explored. Where there is an unjustifiable hardship to provide a fixed ramp, a removable ramp will be favourably considered based on case merits.

Since each heritage building has its unique character-defining elements, the acceptable location of a new lift, lifting platform or ramp from conservation point of view varies from case to case. As the location of the new lift, lifting platform or ramp may affect the fundamental planning of the building layouts, early consultation with the AMO is highly recommended.

(b) New entrance at lower level

To overcome the initial flight of entry steps which have been identified as a character-defining element of a heritage building, an alternative access via a lower ground floor that matches with the external floor level may be explored. Appropriate and sensible solutions such as incorporating a new lower ground floor and subtly modifying the external floor level at the entrance may also be considered. This alternative main entrance should be prominently located and designed to be commonly used by the public.

(c) New entrance via an alternative access route

It may be possible to change the way in which a building is managed by opening up an alternative main entrance that is accessible to all. Altering an existing window to form a doorway for creating a side entrance may be possible subject to the AMO's agreement. While the original main entrance with its entry steps is retained, the alternative main entrance should be prominently located and designed to be commonly used by the public.

5.33 Minor alteration for adequate manoeuvring space inside a lobby in a corridor

It may be possible to either change the direction of door swing or to replace the door hinges by those allowing double action such that the full length of the lobby being not less than 1200mm can be allowed for manoeuvring wheelchairs (Figure 6 refers). If the latter one is to be adopted, a check mechanism shall be provided to prevent the door swinging beyond the closed position and a transparent vision-panel with a bottom edge not more than 1000mm and the top edge not less than 1500mm above the finished floor level shall be provided.

Alternatively, where there is enough space, it may also be possible to extend the walls of the lobby to achieve the minimum length requirement subject to the AMO's agreement. Figure 7 refers.

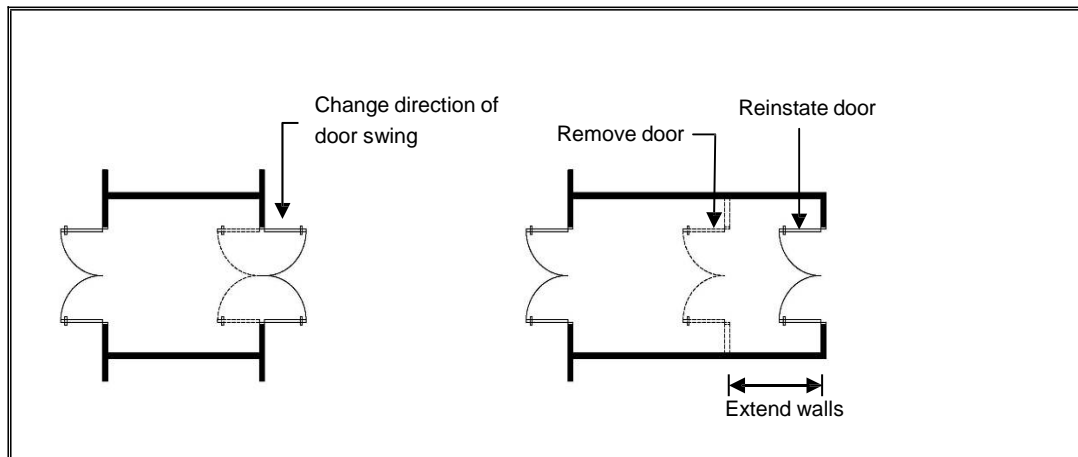


Figure 6 Change door swing direction

Figure 7 Lobby extension

5.34 Leveling the minor level difference along a path

It may be possible to fasten a wedge-shaped solid piece having gradient of not less than 1:8 or 1:10 to bridge a level difference of not more than 75mm or 150mm respectively if its maximum length is not more than 600mm and 1500mm respectively. Figure 8 refers.

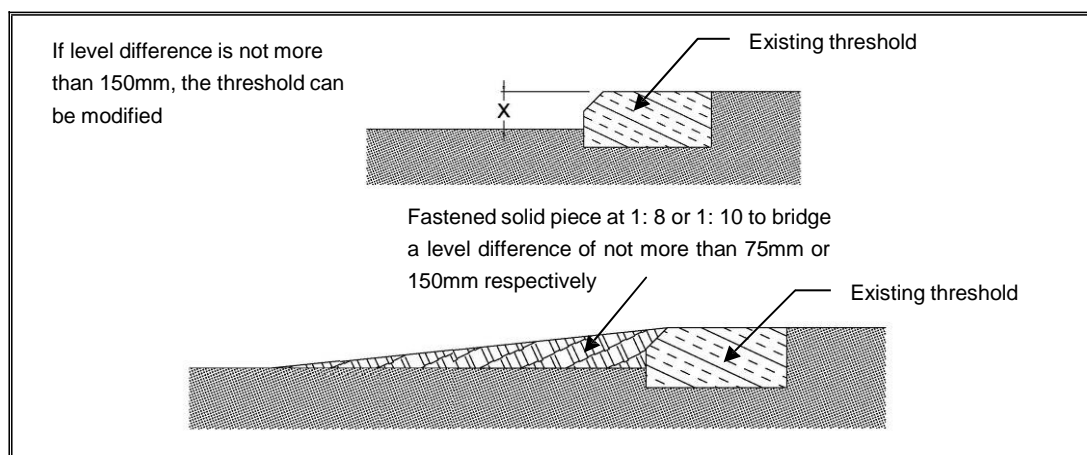


Figure 8 Installation of solid piece

5.35 Adding width to existing doorway

If the width between an open door and the opposite jamb or the other leaf is marginally less than the requirement, it may be possible to replace the hinges of the existing door by the 'swing-away' or 'offset' type such that the door will be open out of the door opening and this in turn increases such width by about 50mm depending on the performance of such hinge. Such hinge forming the doorset is required to be included in the Schedule of Building Materials and Products under PNAP APP-13 when applying for occupation permit or certifying the completion of the

respective A&A works.

Unjustifiable hardship

- 5.36 It is normally possible to plan adequate access and facilities for persons with a disability without compromising the significance of a heritage building. Where it is impracticable to provide reasonable access within the building, bearing in mind the physical location and immediate environs of the building, and where providing such access would impose unjustifiable hardship on the person seeking approval in relation to plans submitted for A&A works or change in use of an existing building, applications to vary the provisions required under B(P)R 72 and the DMBFA will be favourably considered.
- 5.37 In considering such applications to vary the required provisions, the BA will consider the special circumstances of the case and may seek advice from the Advisory Committee on Barrier Free Access (ACBFA). The terms of reference and membership of ACBFA are set out in PNAP APP-41. In this respect, the applicants should demonstrate the nature of the “unjustifiable hardship” and any practicable alternatives for consideration of the BA.
- 5.38 For A&A works to existing buildings where initial access for persons with a disability is not provided, applications will be favourably considered if the BA is satisfied with the design of the building in respect of the non-provision of facilities for persons with locomotory disabilities in cases where the provision of a ramp access would involve alteration works to the common parts of a building and where the applicant can demonstrate that:
- (a) the applicant has no control over the area;
 - (b) consent from co-owners or owners' corporation to permit the carrying out of the A&A works to the common parts of the building is declined or cannot be obtained; and
 - (c) where ground beam is involved, there is spatial or structural constraint.

- 5.39 Also, if there are insurmountable site constraints making it impractical to provide a passenger lift or ramp, a self-operated vertical lifting platform complying with Chapter 5.5 of the DMBFA as an alternative means for vertical transportation for wheelchair users will be favourably considered.

Provision of Sanitary Fitment

- 5.40 It is common that more sanitary fitments are required to be provided to cater for the new use of a heritage building. In order to minimize any adverse effect on the character-defining elements that give heritage value to the building, the following options will be favourably considered:

- (a) Alteration of existing rooms for new toilets

Existing rooms may be altered for accommodating new toilets to meet the current sanitary fitments standard. In this case, the proposal shall be agreed with the AMO for compatibility with the existing policy to preserve the character-defining elements as far as possible.

- (b) New toilets in another building at the same site

For a heritage site comprising a group of buildings which are under the same ownership and management, new toilets required for one building may be provided in another building within the same site if:

- (i) the buildings are in close proximity with each other;
- (ii) the total number of sanitary fitments provided is not less than the sum required for the buildings to be served;
- (iii) unrestricted access to such toilets is maintained during the operation of the buildings;
- (iv) adequate directional signs showing the location of such toilets are posted at conspicuous part of the buildings concerned; and
- (v) a management plan is provided in accordance with Appendix III.



Appendices

Appendix I: Case References

Appendix II: List of Contemporary Design Standards
in Hong Kong

Appendix III: Sample Management Plan

Appendix IV: Reference

Appendix I

Case References

This Appendix gives an account of some actual cases to demonstrate how the approaches mentioned in Section 4 and advice in Section 5 and the PNAP APP-69 could be adopted to meet the needs for preservation of historic buildings without compromising the safety and health standards. These actual cases are selected projects completed since 2012.

The accepted solutions to issues encountered as illustrated are case specific and for reference only.

Summary of Issues Encountered and Resolved

Issues		Cases						
		1. Lui Seng Chun	2. Old Tai O Police Station	3. Fong Yuen Study Hall	4. Green House Cluster (Mallory Street)	5. Old Tai Po Police Station	6. Former Lai Chi Kok Hospital	7. Stone Houses
A. Projections over Street								
A1	Preservation of existing balconies/verandahs over streets ^a	○			○			
Structural Safety								
B1	Repair of timber roofs (under Minor Works Control System) ^c					○		○
B2	Strengthening or reconstruction of timber roofs ^c			○	○	○	○	
B3	Strengthening or reconstruction of floors/staircases ^c	○		○	○		○	○
B. Fire Safety								
Means of Escape								
C1	Use of existing non-compliant staircases with compensatory measures ^b	○		○				
C2	Provision of new staircases ^c	○	○	○	○		○	○
C3	Adoption of fire safety assessment/management approach with compensatory measures ^b	○	○	○		○		
Fire Resisting Construction								
C4	Provision of fire retardant on timber roofs ^b			○	○	○	○	○
C5	Adoption of fire safety assessment/management approach	○	○	○				
Means of Access								
C6	Non-provision of or inadequacy in emergency vehicular access ^a		○	○		○		
C7	Provision of new fireman's lifts				○			

Summary of Issues Encountered and Resolved

Issues		Cases						
		1. Lui Seng Chun	2. Old Tai O Police Station	3. Fong Yuen Study Hall	4. Green House Cluster (Mallory Street)	5. Old Tai Po Police Station	6. Former Lai Chi Kok Hospital	7. Stone Houses
Fire Service Installations								
C8	Improvised Sprinkler System – Connection from FH/HR System ^c	○	○		○	○	○	
C9	Improvised Sprinkler System – Direct Town's Main Connection ^c			○				
C. Danger of Falling								
D1	Mitigation of level difference	○	○		○	○		
D2	Provision of secondary protective barriers to existing balustrades/railings ^c	○	○		○			○
D3	Addition of height to existing balustrade/railing ^c		○				○	○
D4	Use of existing protective barrier with lesser height/wider gaps/lower solid curb with compensatory measures and management plan ^a	○			○	○		
E. Barrier Free Access								
E1	Erection of new vertical lifting platforms/ accessible lifts ^c	○	○	○	○		○	○
E2	Provision of new entrance ^c	○			○			
E3	Adoption of management approach ^c		○	○				
F. Provision of Sanitary Fitment and Drainage System								
F1	Provision of toilets in another building ^c			○				○
F2	Non-provision of gutters and rainwater down pipes to existing roofs ^a				○		○	○

Footnote:

^a Table A of Appendix A to PNAP APP-69 refers.

^b Table B of Appendix A to PNAP APP-69 refers.

^c Section 5 of this Practice Guidebook refers.

CASE 1

LUI SENG CHUN, 119 LAI CHI KOK ROAD, MONG KOK

The Project

Lui Seng Chun (LSC) was one of Hong Kong's distinctive shophouses constructed in around 1931 for selling Chinese medicine on the ground floor and private residence on the upper floors. In 2003, the owner of LSC donated the building to the Government. It was included in the Batch I Projects of the Revitalising Historic Buildings through Partnership Scheme and was accorded as a Grade 1 Historic Building in 2009.

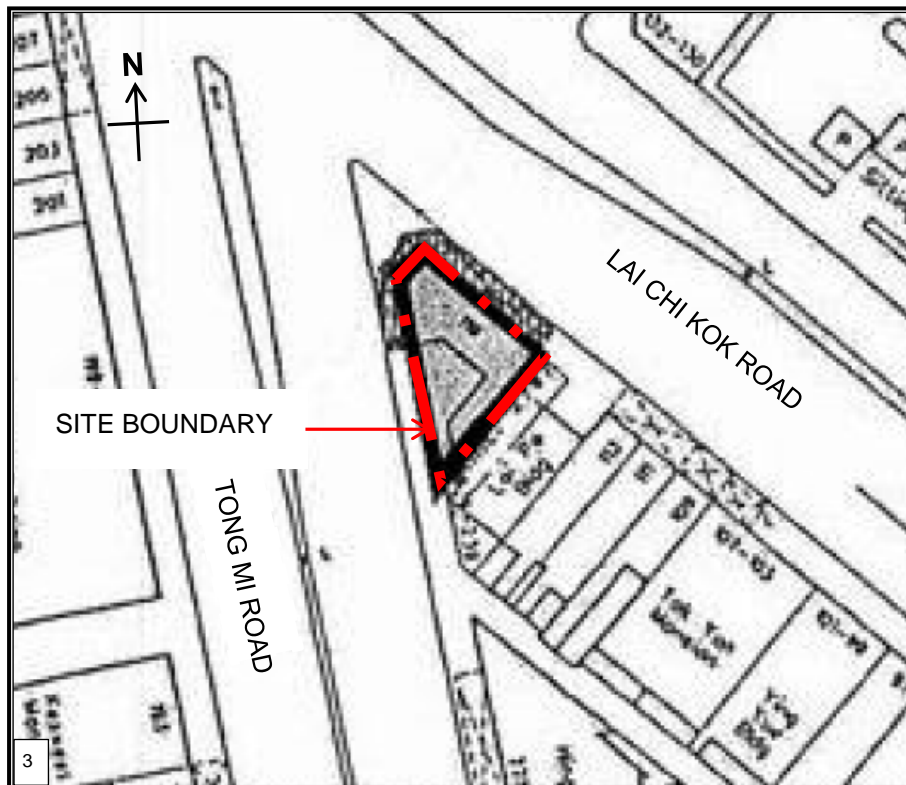
The building has been revitalised as a modern medical and health centre since 2012 with the original floor plates, structure, façade and verandah retained.



Before revitalisation



After revitalisation



Site Plan

Major Issues Encountered

Projection over Streets

(a) Verandahs Projecting over Streets

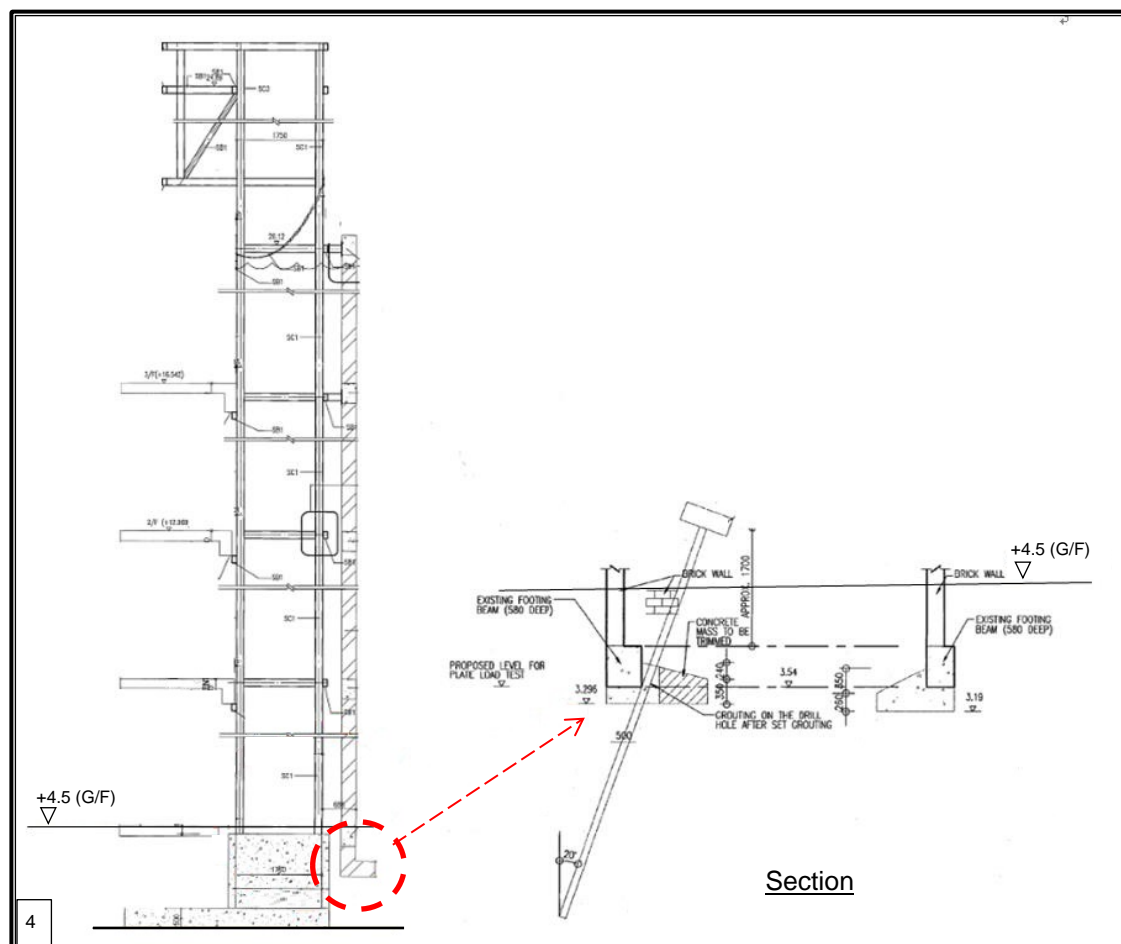
The existing verandahs which are key character-defining elements (CDE) are projecting outside site boundaries and over streets. Despite the exemption permit granted under the Buildings Ordinance to project over the adjoining streets, still they are accountable for the calculation of the gross floor areas under the Building (Planning) Regulations¹.

¹ The area contained within external walls and verandahs of subject building shall be included in gross floor area calculation in accordance with Building (Planning) Regulation (B(P)R) 23(3)(a)).

Structure

(b) Installation of New Accessible Lift

To accommodate a new accessible lift, a structurally independent new steel frame has been constructed on a new spread footing within the existing building. To allow space for the new footing, a portion of the existing footing has been trimmed and modified. Ground improvement underneath the affected footing has also been carried out locally to enhance the bearing capacity.



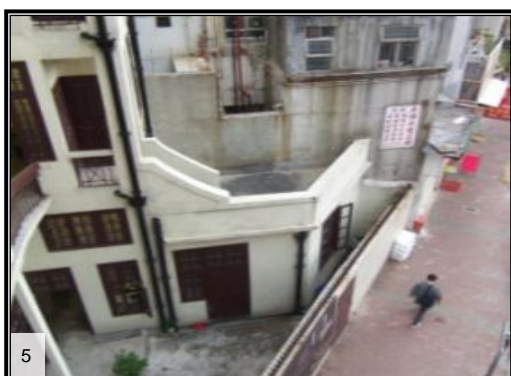
New steel structure, footing for accessible lift and ground improvement works by injecting cement grout into ground soil underneath existing footing

Fire Safety

(c) Means of Escape (MOE) and Fire Resisting Construction (FRC)

Challenges

LSC has the following constraints in meeting the current fire safety requirements: (i) there is only one staircase of about 900mm wide with winders and one exit door of 710mm wide², (ii) the vertical spandrel between 1/F and 2/F is 600mm³.



Servants Annex demolished for new external staircase



The new external staircase

Solutions

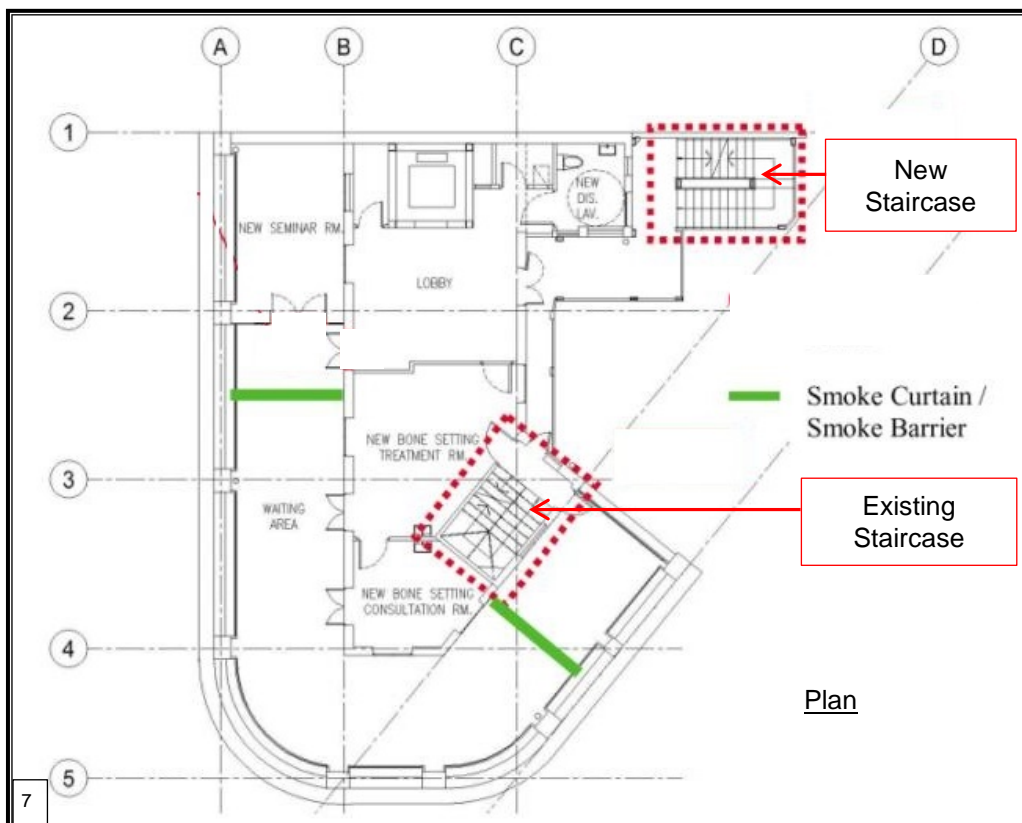
To supplement the existing concrete internal staircase for MOE, a new external metal staircase of 1050mm wide has been added at the rear courtyard without affecting the prominent façade. A fire engineering assessment to demonstrate that an equivalent fire safety standard could be met by enhancement measures including :

- (i) Fast response type sprinklers and smoke detection system
- (ii) Automatic smoke curtains at strategic locations
- (iii) Portable fire extinguishers
- (iv) Upgrading of existing staircase doors to the required fire resisting rating

² For the subject building, the minimum number of escape staircases shall be 2 and each escape staircase shall be of a minimum width of 1050mm and without winders. Each exit door shall be minimum 850mm wide in accordance with B(P)R 41 and Code of Practice for Fire Safety in Buildings 2011 (FS Code).

³ A vertical spandrel of 900mm with adequate FRR shall be installed in accordance with Building (Construction) Regulation (B(C)R) 90 and FS Code.

- (v) Locating treatment rooms with higher occupant capacity and patients of lower mobility at lower floors
- (vi) The occupant capacity on 1/F to 3/F is limited by management undertaking
- (vii) Using electricity only in herbs brewing room
- (viii) Regular training of staff for assuring orderly and effective evacuation



Locations of required staircases and smoke curtains for 1/F – 3/F

(Source: AGC Design Limited)

(d) Fire Service Installations and Equipment (FSI)

Fire hydrant/hose reel system, fire detection system and sprinkler system are provided. However, due to site constraints, (i) the improvised sprinkler system is connected from the fire hydrant/hose reel system, and (ii) secondary power supply of Fire Service Installations is fed from electricity supply before main switch.

Danger of Falling

(e) Preserving Existing Verandahs over Streets

Challenges

The original bottle type balustrades at the verandahs on 1/F to 3/F were approx. 945mm high and with gaps of about 150mm wide, not meeting the current requirements⁴.

Solutions

Considering the need to convert the verandahs into consultation rooms, patient waiting areas and pharmacy, the verandahs are enclosed with full height tempered glass walls. Apart from preventing the danger of falling to meet the statutory requirements, the tempered glass panels provide weather protection, traffic noise barrier and air quality control serving the functional needs of the new rooms.



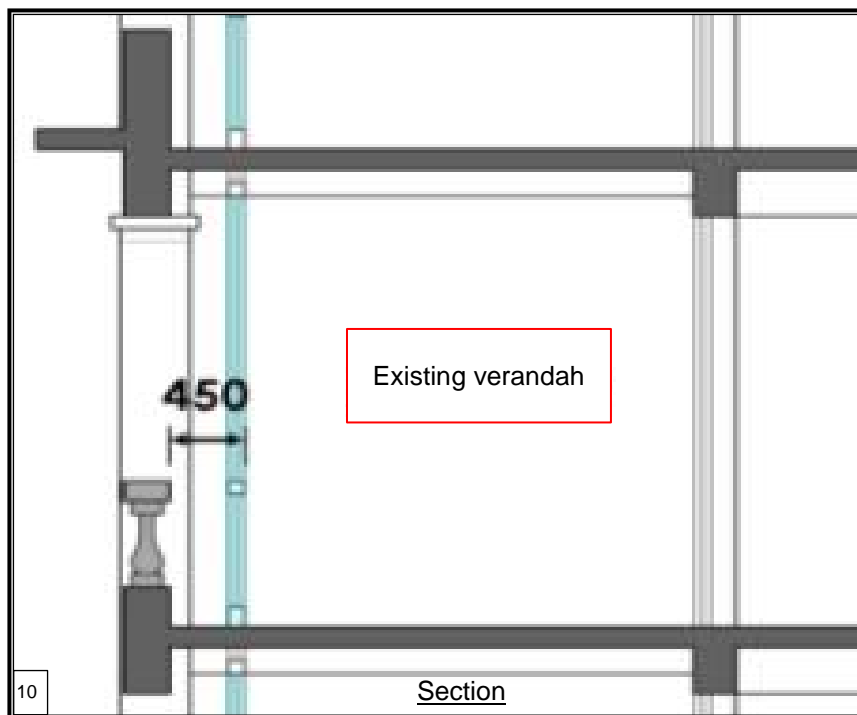
Open verandah with existing bottle balustrades lower than 1100mm



Enclosed verandah with new glass walls

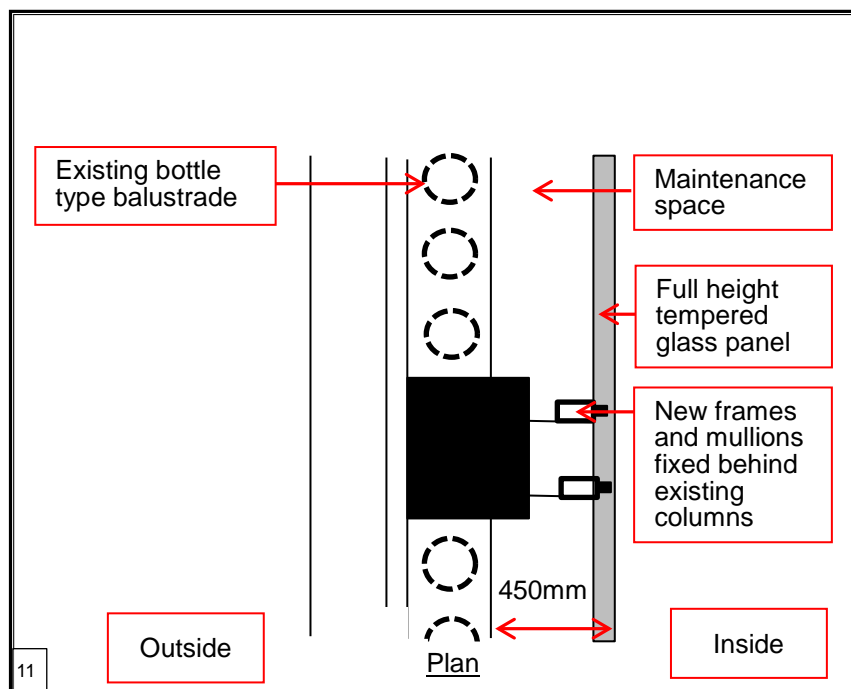
The new glass walls have been set back from the balustrade to avoid intruding the preserved facade. The new structural frames and mullions of the glass walls are positioned behind the existing columns to minimise visual impact on the elevations. The existing configuration and features of the verandahs are thus retained with minimal intervention.

⁴ Protective barriers shall be at a height above the higher of the adjacent levels of not less than 1100 mm; and constructed as to prohibit the passage of articles more than 100mm in their smallest dimension in accordance with B(C)R 8.



Setting out of tempered glass wall and existing balustrade

(Source: AGC Design Limited)



Typical layout of new glass walls and existing balustrade

(Source: AGC Design Limited)

(f) Preserving Existing Parapet Walls on Roof

Challenge

The existing parapet walls on roof are CDE and should be retained. The parapets are only 900mm high and cannot meet the current requirements⁴.

Solution

Part of the canton tile deck with insulation layer of about 200mm high adjoining the parapet walls on roof are removed to lower the adjoining floor level. Potted plants are placed along the parapet walls as a management measure to prevent the users from getting close to the parapet walls.



Canton tiles with insulation layer removed along the parapet walls



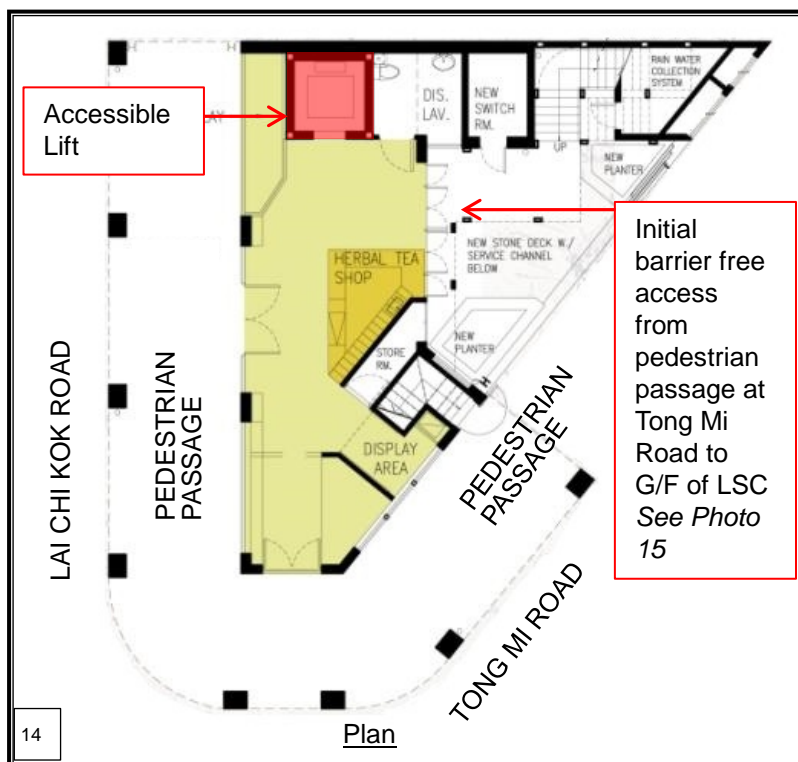
Potted plants to prevent users from getting close to low parapet walls

(Source: AGC Design Limited)

Provision of Barrier Free Facilities

(g) Barrier Free Access

The courtyard facing Tong Mi Road has been leveled up and finished with stone deck to eliminate the level differences between the internal area of LSC and the pavement of Tong Mi Road for providing initial access to the building and the accessible lift near by. Drainage slots are provided at the stone deck to drain off outdoor surface water.



Barrier Free Access arrangement on G/F

(Source: AGC Design Limited)



Initial Barrier Free Access

CASE 2

OLD TAI O POLICE STATION, SHEK TSAI PO STREET, TAI O

The Project



Before revitalisation

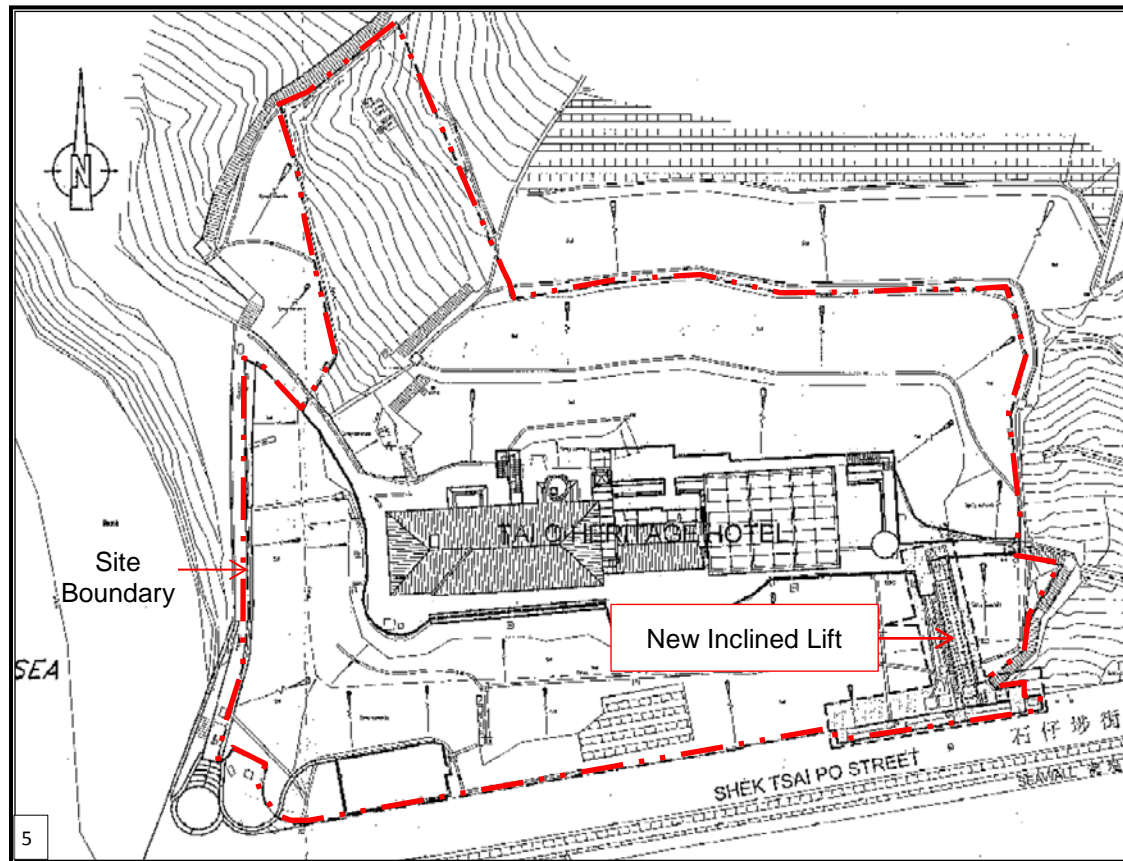


After revitalisation

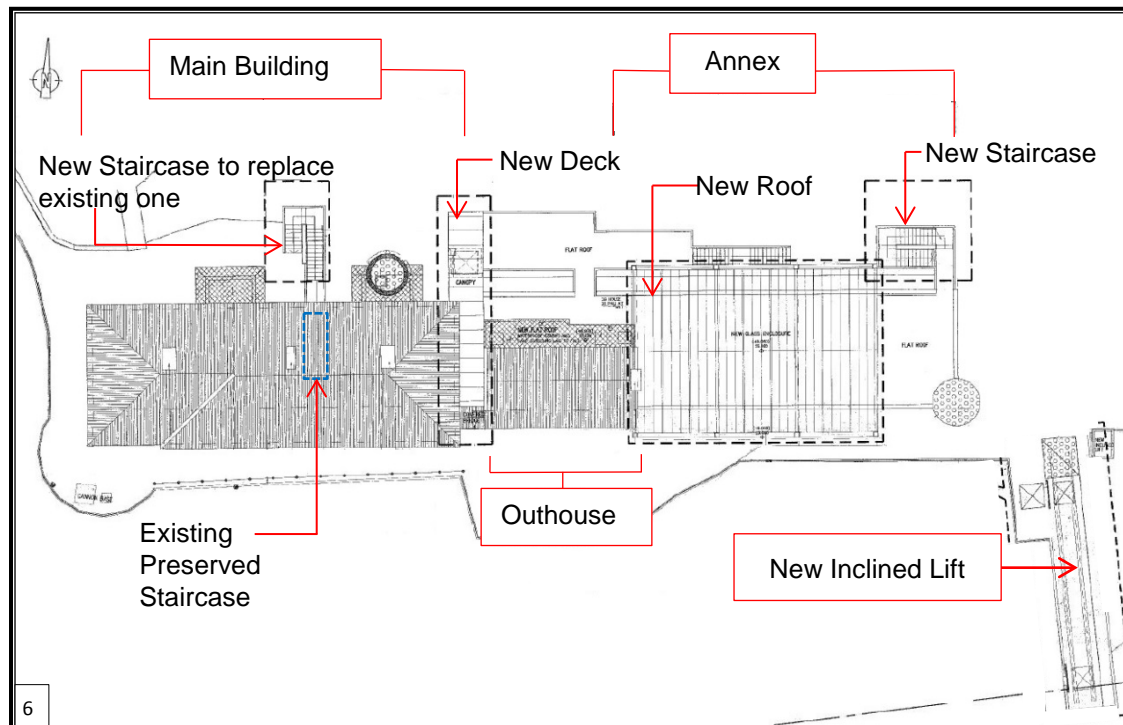


The Old Tai O Police Station comprising the two-storey Main Building and Outhouse was built in 1902 for serving the marine police. A one-storey Annex was added in 1961-1962.

In 2009, Grade 2 Historic Building was accorded to the compound. It is in the Batch I Projects of the Revitalising Historic Buildings through the Partnership Scheme and has been revitalised as a boutique hotel since 2012.



Site Plan



Layout Plan

Major Issues Encountered

Structure

(a) Structural Alteration and Addition Works for New Restaurant on Roof

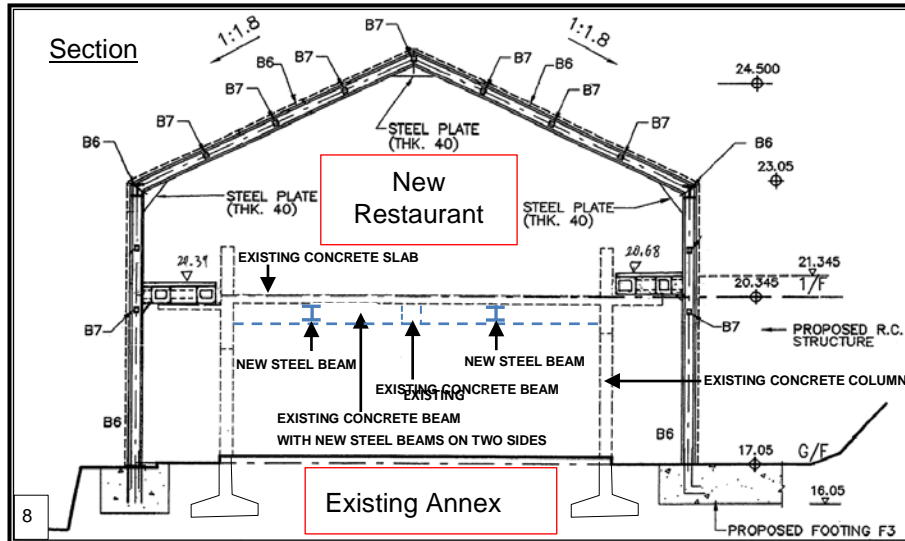
The new restaurant use on the existing roof of the Annex was made possible by reinforcing the concrete roof slab with new steel beams supported by the existing concrete columns resting on the existing pad footings without further strengthening works.

To provide a new roof for the restaurant but without inducing further additional loads on the existing structure, a structurally independent metal pitched roof and new pad footings were constructed.



Independent structure of the new roof for the restaurant

New roof of the restaurant of the Annex



Roof detail

Fire Safety

(b) Means of Escape (MOE) and Fire Resisting Construction (FRC)

Challenges

The internal timber staircase in the Main Building is 975mm wide with sub-standard balustrades and inadequate fire resisting rating (FRR)¹.

Some of the existing exit routes in the Main Building were of 767 to 850mm wide or with localised low headroom².

To have the least impact to the historic building, the proposed new metal staircases have to be located more than 48m apart³.

¹ For the subject building, each escape staircase shall be of a minimum width of 1050mm and constructed of non-combustible materials with adequate FRR in accordance with Building (Planning) Regulation (B(P)R) 41, Building (Construction) Regulation (B(C)R) 90 and Code of Practice for Fire Safety in Buildings 2011 (FS Code).

² An exit route shall be of a minimum width of 1050mm and have a clear headroom of not less than 2000mm in accordance with B(P)R 41 and FS Code.

³ The exit route between a required staircase and another required staircase shall not exceed 48m in accordance with B(P)R 41 and FS Code.

Solutions

The existing staircase is retained but not serving as a MOE. Two new code-compliant metal staircases are added at the rear of the Main Building and the Annex Block as MOE.

A fire safety assessment demonstrates that the safety standards of the building would not be compromised and occupants could safely evacuate from the buildings by adopting the following enhancements and compensatory measures:

- (i) Closely spaced sprinklers on both sides of the existing timber doors to Suite 7 and 8 on 1/F for cooling purpose and surface protection
- (ii) Sprinkler protection for the external verandah which could limit the fire and smoke spread
- (iii) Smoke detection system to the restaurant
- (iv) Management Plan and well-trained staff to control maximum occupant capacity of the building
- (v) Non-combustible false ceiling at indoor areas
- (vi) Existing timber roofs and timber doors treated with fire retardant finish to limit combustibility and fire spread



New staircase to the Main Building



New staircase to the Annex

(c) Provision of Emergency Vehicular Access (EVA)

Challenge

The compound sits on a platform which is approximately 13m above and 20m away from the Shek Tsai Po Street. Hence, EVA cannot be provided to the site⁴.

Solution

With the provision of fast response type sprinkler heads to cover the entire building as enhanced fire safety measure, an exemption has been granted to permit the non-provision of EVA.

(d) Fire Service Installations and Equipment (FSI)

Fire hydrant / hose reel system, fire detection system, emergency generator and sprinkler system are provided. However, due to site constraints, the improvised sprinkler system is connected from the fire hydrant / hose reel system.

Danger of Falling

(e) Adding Height to Existing Parapet Walls

Challenges

The existing parapet walls along the verandahs on 1/F of the Main Building and the roof of the Annex are about 950mm and 850 mm high respectively⁵.

Solutions

Glazing panels are added on top of the existing parapet walls for minimum intervention.

⁴ Abutting EVA shall be provided for the building in accordance with B(P)R 41D and FS Code.

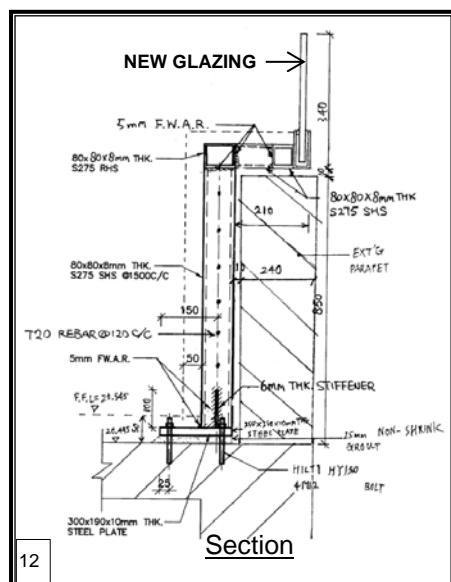
⁵ Protective barriers shall be at a height above the higher of the adjacent levels of not less than 1100mm; and constructed as to prohibit the passage of articles more than 100mm in their smallest dimensions in accordance with B(C)R 8.

For the parapet walls on 1/F of the Main Building, a small gap is reserved between the new glazing panels and the existing parapet walls so that the panels can be removed without damaging the existing parapet walls in future. The glazing panels are supported by the nearby columns.



Additional glazing panels to add height to the existing parapet walls in the Main Building

Similarly for the parapet walls at the Annex, the new glazing panels are fixed by independent steel frame mounted on the structural floor.



Fixing detail of steel frame for additional glazing panel at Annex



Additional glazing panel at Annex

(f) Mitigating Level Difference

The existing parapet walls on G/F of the Main Building are also of insufficient height for serving as protective barriers⁵. The ground level of the adjoining open garden is raised so that protective barriers are not required at the verandahs.



Before levelling



After levelling

Provision of Barrier Free Facilities

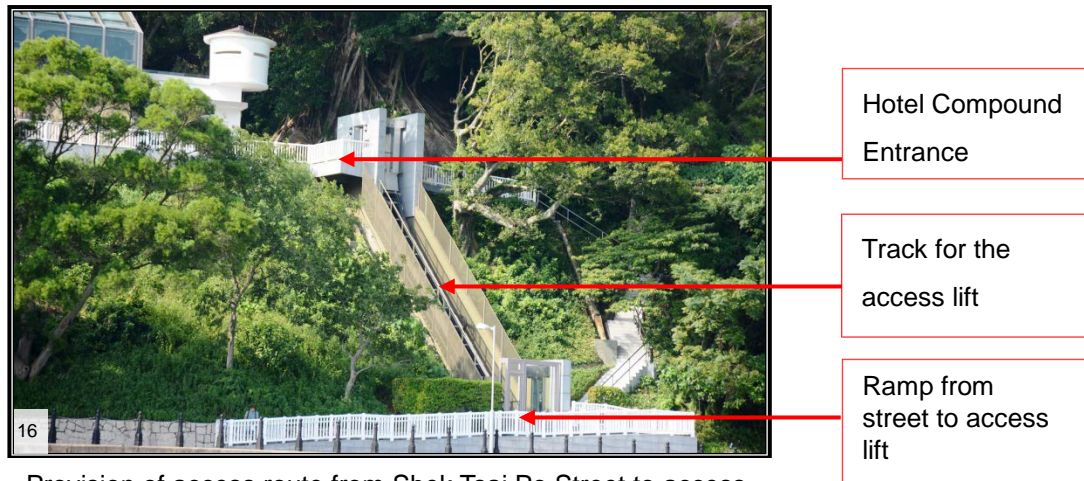
(g) Initial access

Challenge

The level difference from Shek Tsai Po Street and the main building is more than 13m.

Solution

An inclined lift respecting the existing slope profile is added to provide access for persons with a disability (PwD) from Shek Tsai Po Street to the entrance level of the compound.



Provision of access route from Shek Tsai Po Street to access lift and onward to the entrance level

(h) Access within compound

Challenges

There were level differences between G/F of the Main Building and the entrance to the Hotel Compound. Width of the corridor giving access to the Reception and Interpretation centre in the Main Building was also insufficient⁶.

Solution

To overcome the level differences, two vertical lifting platforms are added. One is at the rear of the Main Building to provide access to the Reception and Interpretation centre (Photo 17). Another one is installed on G/F of the Main Building to provide access to 1/F (Photo 18).

⁶ Passageway shall be of a minimum width of 1050mm in accordance with Design Manual: Barrier Free Access 2008.



Vertical lifting platform to the Main Building



Vertical lifting platform to 1/F

To facilitate PwD moving around the narrow corridor, standard small-size wheelchairs are provided for use by occupants and visitors.

(i) Other Barrier Free Facilities

Other facilities such as accessible toilets, braille and tactile floor map, etc. are provided for PwD. Two out of nine nos. of guest rooms in the hotel are designed as accessible guest rooms in accordance with Design Manual: Barrier Free Access 2008. In addition, the hotel has adopted a management plan which the staff is 24-hours on duty and designated trained staff is available to provide attendance for any guests and users.



Accessible toilet



Braille and tactile floor map

Provision of Natural Lighting and Ventilation

(i) Lighting and Ventilation for Guestrooms

Some of the the existing historic windows are not large enough to meet the statutory requirements⁷ on natural lighting and ventilation for use as guestrooms. The deficiency are in the range of 0.3% to 18%.

With the provision of mechanical ventilation and artificial lighting as compensatory measures, the sizes of existing windows are accepted and thus preserved.

⁷ Window area of guestroom shall not be less than 1/10 of the guestroom floor area in accordance with B(P)R 30(2)(a)(i).

CASE 3

FONG YUEN STUDY HALL, MA WAN

The Project



Before revitalisation

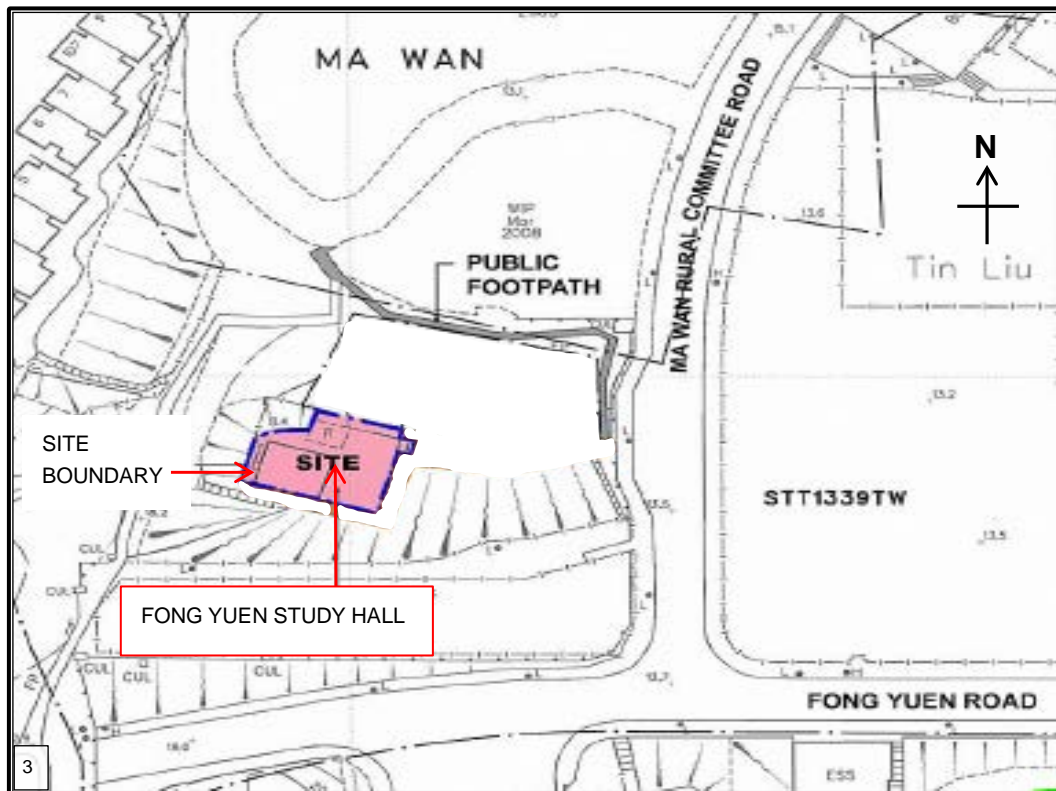


After revitalisation

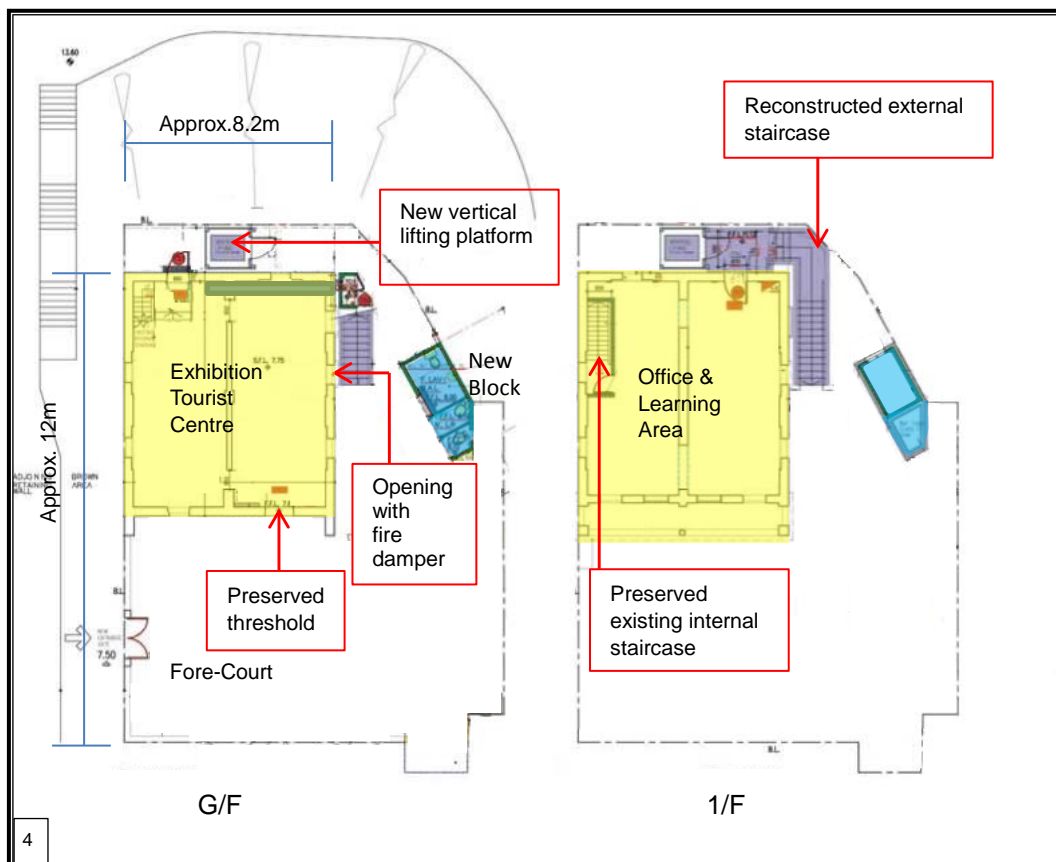
(Source: The Yuen Yuen Institute)

Fong Yuen Study Hall (FYSH) built in the 1920s – 1930s had been a small rural private school in the Ma Wan Island until closed in 2003. It was accorded as a Grade 3 Historic Building in 2010 and in the Batch I Projects of the Revitalising Historic Buildings through the Partnership Scheme.

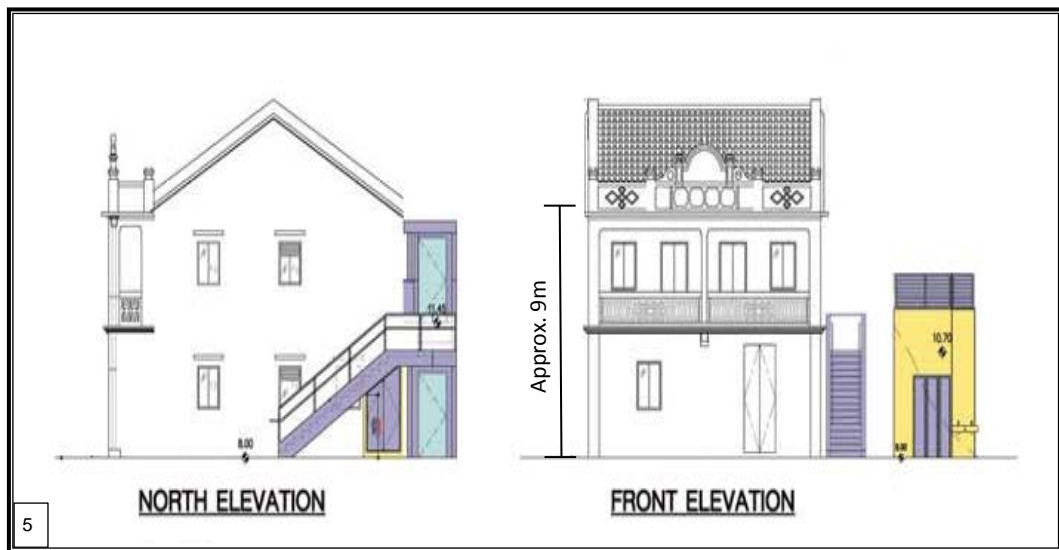
The concrete and brick structure has been transformed into the Ma Wan Residents Museum cum Tourism and Chinese Cultural Centre since 2013. An exhibition room and tourist centre are provided on G/F while 1/F is used as the administration office and learning area.



Site Plan



Layout Plan



Elevations (new structures shown in colour)

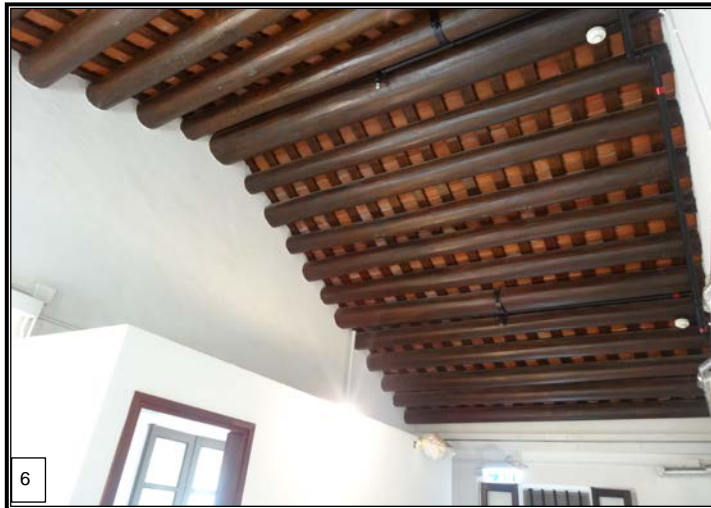
Major Issues Encountered

Structure

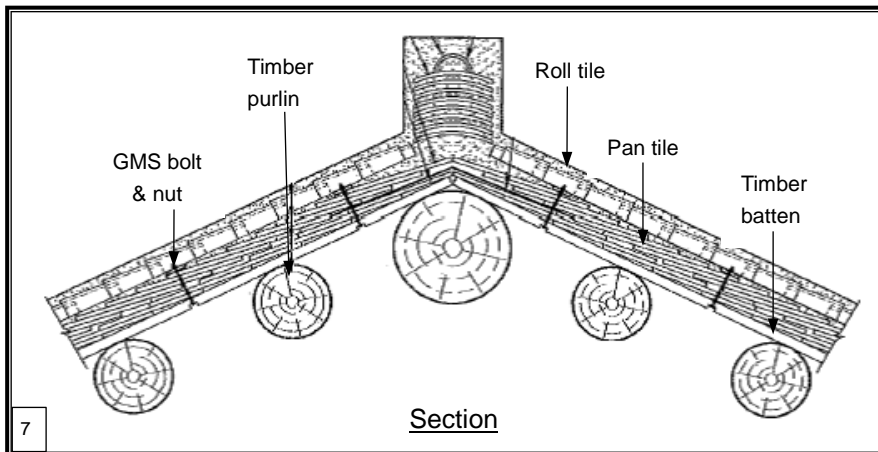
(a) Reconstruction of Timber Pitched Roof

The original timber pitched roof was replaced by metal roof supported by metal truss around 1998. A new pitched roof has been reconstructed with timber purlins and battens as well as clay pan-&-roll roof tiles to restore the original design. Concealed bolts have been used to secure the roof tiles to meet the current requirements¹.

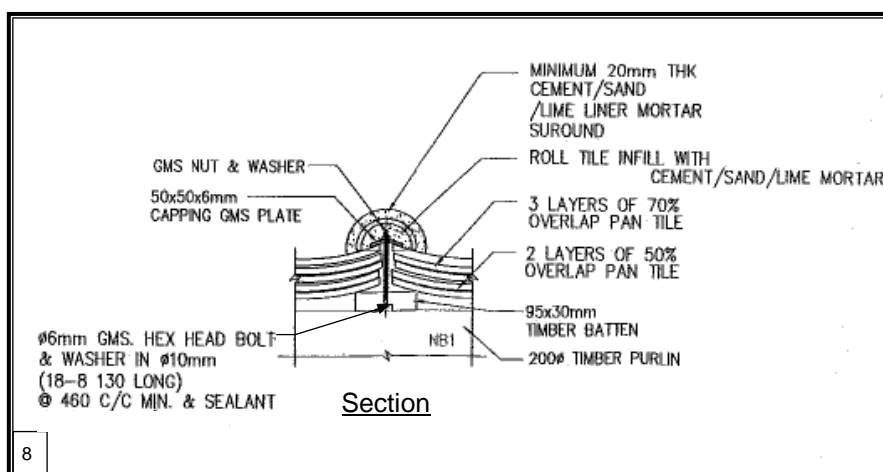
¹ Wind loadings are assessed in accordance with Code of Practice on Wind Effects in Hong Kong 2004.



Reconstructed timber roof



Detail of new timber roof



Fixing details of tiles

Fire Safety

(b) Means of Escape (MOE) & Fire Resisting Construction (FRC)

Challenges

- (i) The existing internal concrete staircase of FYSH is 750mm wide, with 15 risers each of 190mm high and treads of 200mm deep as well as not enclosed with FRC. The existing external concrete staircase is 900mm wide, with 15 risers each of 213mm high and treads of 215mm deep².
- (ii) A granite threshold of 150mm high is located across the main entrance on G/F. The threshold is a key Character-Defining Element (CDE) but causing obstruction to the MOE on G/F.
- (iii) The G/F and 1/F are without fire separation in between³.
- (iv) There is no access road to serve as thoroughfare and emergency vehicular access (EVA) for the Place of Public Entertainment (PPE) on G/F⁴.
- (v) The new external open metal staircase is within 6m from the site boundary and not enclosed by FRC⁵.

² For the subject building, each escape staircase shall be of a minimum width of 1050mm, riser of not more than 175mm high, treads of minimum 225mm deep in accordance with Building (Planning) Regulation (B(P)R) 41 and Code of Practice for Fire Safety in Buildings 2011 (FS Code).

³ The office use on 1/F and PPE use on G/F shall be separated by fire barriers with adequate fire resisting rating (FRR) in accordance with Building (Construction) Regulation (B(C)R) 90 and FS Code.

⁴ For use as PPE, the site shall abut upon and have frontages to 2 or more thoroughfares in accordance with B(P)R 41 and FS Code .

⁵ The external wall of a required staircase and associated wall openings within 6m of a common boundary with an adjoining site shall have adequate FRR in accordance with B(C)R 90 and FS Code.

Solutions

In view of the challenges above, a fire safety assessment demonstrates that the current safety standards of the building would not be compromised by adopting the following compensatory measures:

- (i) The existing internal concrete staircase is enclosed with FRC to separate the G/F and 1/F. Edge tiles are provided to increase the depth of the treads and emergency lightings are provided to the staircase
- (ii) The existing external concrete staircase is replaced by a new metal staircase of 1200mm wide
- (iii) The existing openings of the building within 6m of the new open staircase are protected by new fire-rated door or dampers with adequate FRR
- (iv) 1/F would be restricted mainly to staff who should be familiar with the MOE arrangement
- (v) Smoke detectors with direct link to the Fire Services Communication Centre are provided to cover the whole building
- (vi) The entire building is provided with fast response type improvised sprinkler system
- (vii) Audio advisory system is installed to guide the evacuation of the occupants
- (viii) Breathing masks are available to the occupants on 1/F
- (ix) Fire warden is assigned and trained for fire fighting and crowd control
- (x) Fire drill is conducted on a half yearly basis
- (xi) A comprehensive fire safety management plan including the control of the number of occupants on G/F and 1/F



A new external metal staircase added
at the side and rear elevations

(c) Fire Service Installations and Equipment (FSI)

Modified hose reel system with a 2m³ water tank, fire detection system and sprinkler system are provided. However, due to site constraints, (i) the improvised sprinkler system is connected directly from the town's main, and (ii) secondary power supply of Fire Service Installations is fed from electricity supply before main switch.

(d) Timber Roof

Challenge

The newly reconstructed timber pitched roof cannot meet the current requirements on fire safety⁶.

Solution

Purlins and battens of the reconstructed roof are protected with fire retardant paint to achieve the Class 1 surface spread of flame tested in accordance with the requirements of BS 476 Part 7, and covered with non-combustible clay tiles.

(e) Provision of Emergency Vehicular Access (EVA)

Challenge

The site can only be accessed via a footpath of approximate 1.2m wide to an unnamed public road of approximate 6m wide which finally linked to Ma Wan Rural Committee Road. An EVA cannot be provided to the site⁷.

Solution

With the provision of fast response type sprinkler heads to cover the entire building and direct link to the Fire Services Communication Centre of the Fire Services Department, an exemption has been granted to permit the non-provision of EVA.

⁶ All roofs, together with the members forming the roof structure shall be constructed of non-combustible materials in accordance with B(C)R 90 and FS Code.

⁷ Abutting EVA shall be provided for the building in accordance with B(P)R 41D and FS Code.

Provision of Barrier Free Facilities

(f) Preservation of Granite Threshold across Exit Route

Similar to most Chinese eclectric buildings, there is a granite threshold of 150mm high at the G/F main entrance. The threshold is a CDE but also causing obstruction to the barrier free access⁸.

Apart from providing tactile warning strips near the threshold, a barrier free access management plan has been adopted to enhance the barrier free access including the operation of a standby movable ramp and provision of trained staff during operation hours of FYSH to assist persons with a disability to enter or leave the building.



Tactile warning strips and movable ramp at G/F entrance

⁸ Access for persons with a disability shall be provided to at least one entrance which is commonly used by public in accordance with Design Manual: Barrier Free Access 2008 (DMBFA)

(g) Accessible Toilet

FYSH has very restricted space, provision of new accessible toilets within the building⁹ is not feasible. An accessible toilet and other ancillary building services is provided in a new block adjacent to FYSH.



Provision of accessible toilet

⁹ All parts of non-domestic building shall be provided with at least one accessible toilet on a floor or in part of floor designed for access by persons with disability in accordance with DMBFA.

CASE 4

GREEN HOUSE CLUSTER, 7 MALLORY STREET, WANCHAI

The Project



Elevation facing Mallory Street



Views from open space

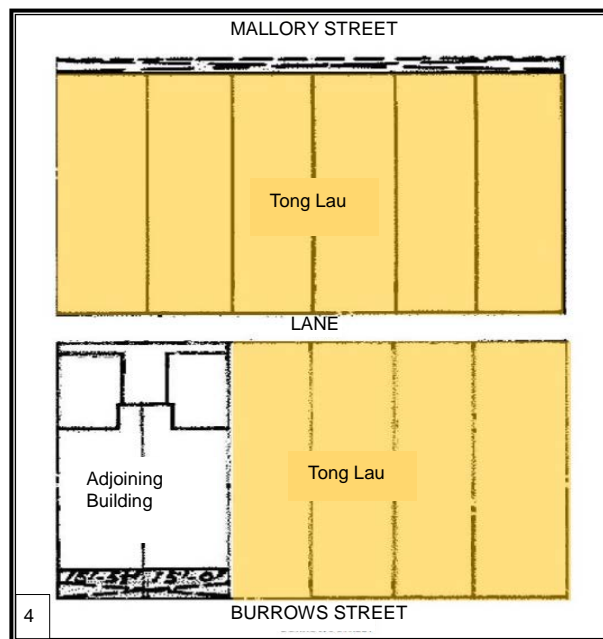
The Green House Cluster¹ comprising 10 tenement houses (i.e. the “shophouses” or “tong laus”) was built in 1920s. The Cluster was accorded as a Grade 2 Historic Building in 2009 and has been transformed into a centre for comics and animation for cultural and creative industry use since 2013.

The Cluster was partly demolished and a new Annex Block was erected at the back of the Mallory Street block, integrating the 10 “tong laus” into one building for retail, restaurant and office use. The building façade and the cantilevered balconies along Mallory Street and Burrows Street

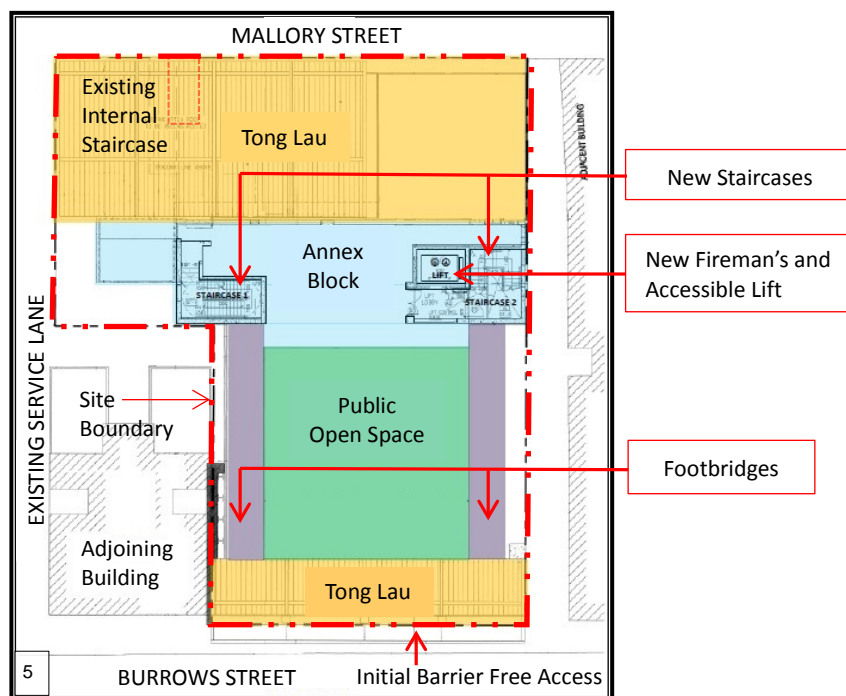
¹ The Green House Cluster comprises 6 no. of tong laus at Mallory Street and 4 no. of tong laus at Burrows Street.

have been retained characterizing the local streetscape. The balconies are rare examples of the cantilevered type construction.

While the Character-Defining Elements (CDE) showcasing the synergy of Chinese and Western architecture are retained, 300m² public open space from the 780m² site has been harvested as breathing space in a congested streetscape.



Original Site Layout



Site Plan

Major Issues Encountered

Projection over Streets

(a) Balconies Projecting over Streets

The existing cantilevered balconies project over the two streets. Due to their unsatisfactory structural conditions, the balconies had to be reconstructed replicating the original profile. They are permitted to project over the adjoining streets through exemptions under the Buildings Ordinance but are accountable for gross floor area calculation under the Building (Planning) Regulations².



Reconstructed balconies facing Burrows Street and Mallory Street

Structure

(b) New Lateral Supports for Stabilising Old Facade

The existing façade of the 4 “tong laus” along Burrows Street including the cantilevered balconies are retained while the remaining portion of this block is demolished for an open space. This innovative design is made possible by constructing a two-storey high steel trusses at 3/F as extensions from the new Annex Block at the back of the Mallory Street “tong laus”, lending tie and lateral support to this façade.

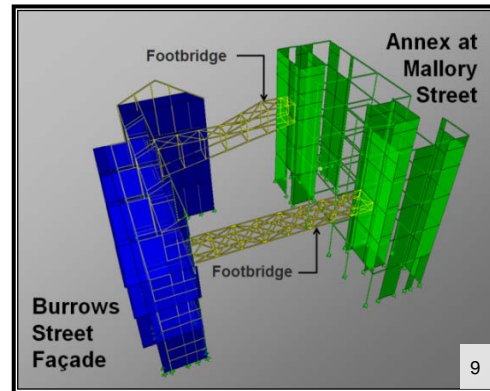
² The area contained within external wall and balconies of subject building shall be included in gross floor area calculation in accordance with the Building (Planning) Regulation 23(3)(a).

These two trusses also serve as connecting footbridges offering vistas to the public open space in the central court.



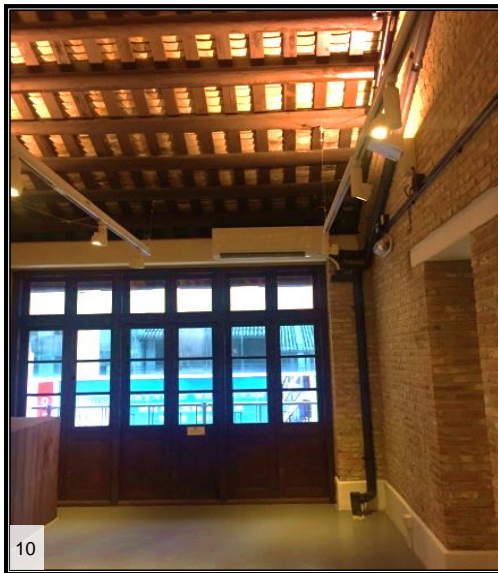
Aerial photo showing the trusses connecting the New Annex and the existing facade

(Source: C M Wong & Associates Ltd)



Three-dimensional structural model showing arrangement of the structural system

(c) Retaining the Timber Pitched Roof



The Chinese-style tiled and timber roof

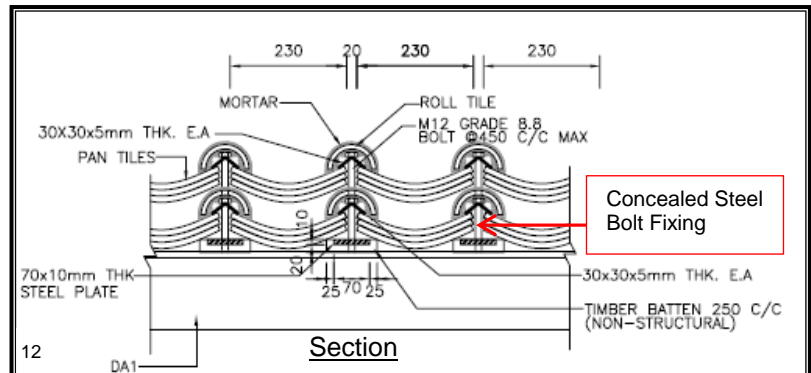
New steel members have been integrated with the restored timber purlins and heatproof materials; and new steel fixings were embedded in traditional Chinese double-layer pan-and-roll tiling construction to meet the current requirements on structural safety³. The original distinctive outlook of the timber pitched roof which is one of the CDE can therefore be retained.

³ Wind loadings are assessed in accordance with Code of Practice on Wind Effects in Hong Kong 2004.



11 New steel members embedded in timber purlin

(Source: C M Wong & Associates Ltd)



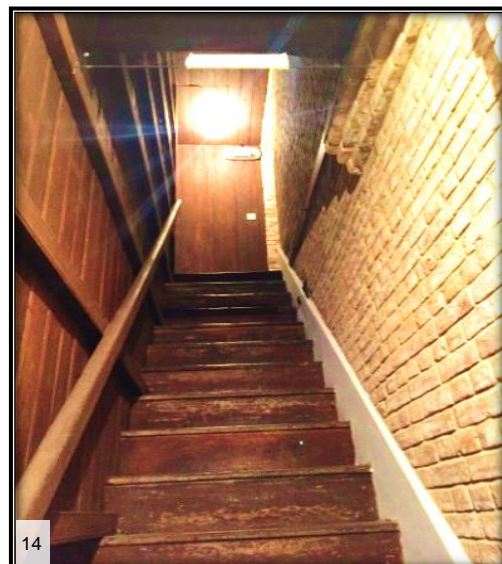
12 Fixing details of double-layer pan-and-roll tiles

(d) Retaining Timber Staircase and Timber Slab

New steel structures have been erected to stabilise the staircase structure which have been covered by the original timber planks and components of the staircase. Similarly, new structural decks have been installed above the preserved structural frame of the timber floor and the original timber planking was re-installed above the new steel frame. In the process of preservation, current standards on structural safety⁴ have not been compromised.



13 Before revitalisation

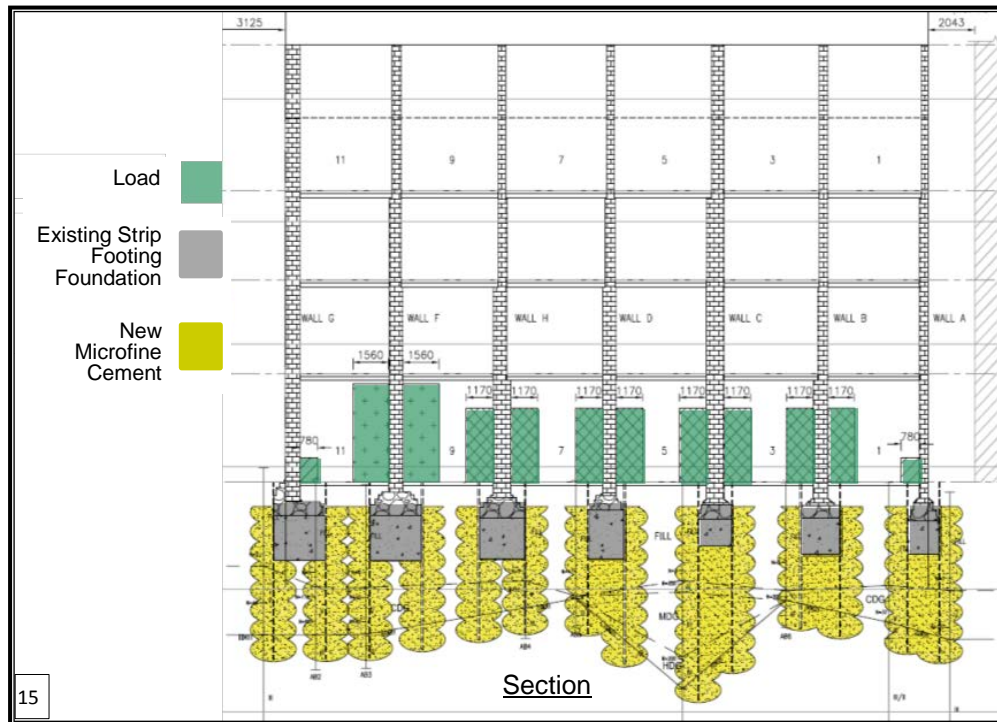


14 After revitalisation

⁴ The minimum imposed floor load of the building shall be in accordance with the Building (Construction) Regulation (B(C)R) 17.

(e) Ground Improvement

To cater for the additional imposed loads due to the changes in use from residential to commercial or exhibition, microfine cement (particle size $<20\mu\text{m}$) has been injected by pressure into the soil underneath the existing footings for strengthening to increase the load bearing capacity.



Strengthening of foundation by pressure grouting

(Source: C M Wong & Associates Ltd)

Fire Safety

(f) Means of Escape



The new additional staircase

Challenge

The widths of the existing staircases (ranging from 750mm to about 900mm) cannot meet the current requirements⁵.

Solution

Two new compliant staircases have been constructed in the new Annex Block serving the cluster now designed as one building. One of the existing staircases has been retained for visual appreciation of the original design and for internal circulation.

(g) Fire Resisting Construction

Challenge

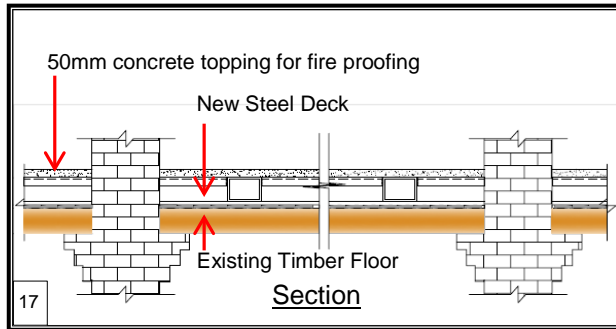
The timber construction of the existing floor cannot meet the current requirements⁶.

Solution

New structural decks have been installed above the preserved structural frame of the timber floor, to provide adequate fire resisting rating to the floor while the timber floor pattern can be appreciated underneath.

⁵ For the subject building, a required escape staircase shall be of a minimum width of 1050mm in accordance with Building (Planning) Regulation (B(P)R) 41 and Code of Practice for Fire Safety in Buildings 2011 (FS Code).

⁶ Floors and escape staircases shall be constructed of non-combustible materials with adequate fire resistance rating in accordance with B(C)R 90 and the FS Code.



Typical floor system

(Source: C M Wong & Associates Ltd)

(h) Means of Access

A fireman's lift has been added at the new Annex Block to meet the current safety standards as well as to enhance the vertical mobility of Persons with a Disability (PwD) and servicing.



The new Annex Block

(i) Fire Service Installations and Equipment (FSI)

New fire hydrant / hose reel system, fire detection system and improvised sprinkler system (with water supply from fire service tank) are provided.

Danger of Falling

(j) Retaining Original Railings

Challenge

The original iron railings at the balconies are 900mm high and with gaps ranging from 124mm to 200mm, not meeting the current requirements⁷.

Solution

Considering the iron railings are the key CDE of the front façade facing streets, new railings replicating to their original appearance are installed.



Existing railings are inaccessible and retained for visual enjoyment

For the accessible balconies, secondary barriers made of clear tempered glass panels of 1100mm are installed behind the railings for meeting statutory requirements⁷. Original state of the railings in other balconies has been retained for visual enjoyment only from a distance, to prevent the risk of falling.

⁷ Protective barriers shall be at a height above the higher of the adjacent levels of not less than 1100mm; and constructed as to prohibit the passage of articles more than 100mm in their smallest dimension in accordance with B(C)R 8.



New glass balustrade added behind the existing railing at accessible balconies

Provision of Barrier Free Facilities

(k) Barrier Free Access

Barrier free access including an accessible lift is provided in the new Annex Block connecting to the “tong laus” on each floor.



The initial access on G/F facing Burrows Street without level difference



Preserved prestigious doorways

Existing brick arched doorways 800mm - 825mm wide are inadequate to serve as passageway required under DMBFA for PwD⁸. Alternative access routes are provided in less conspicuous locations so that prestigious doorways in prominent locations can be preserved.

Preserving the Original Balcony Design

- (I) No Level Difference between Interior and Exterior from Adjoining Flat Roof



The historical terraces facing Burrows Street

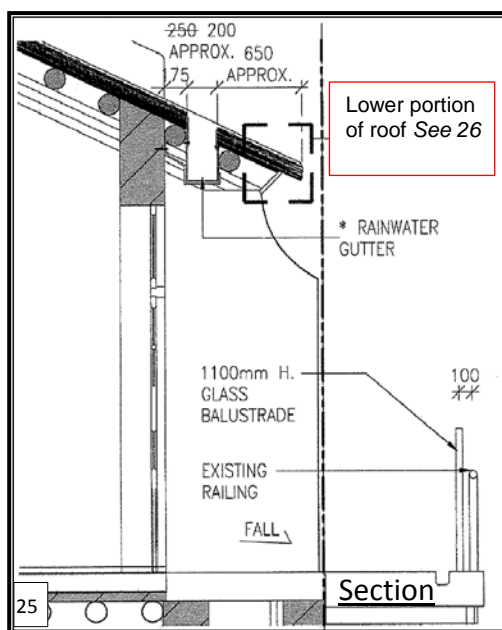


⁸ Passageway shall have a clear width of not less than 1050mm in accordance with the Design Manual: Barrier Free Access 2008 (DMBFA).

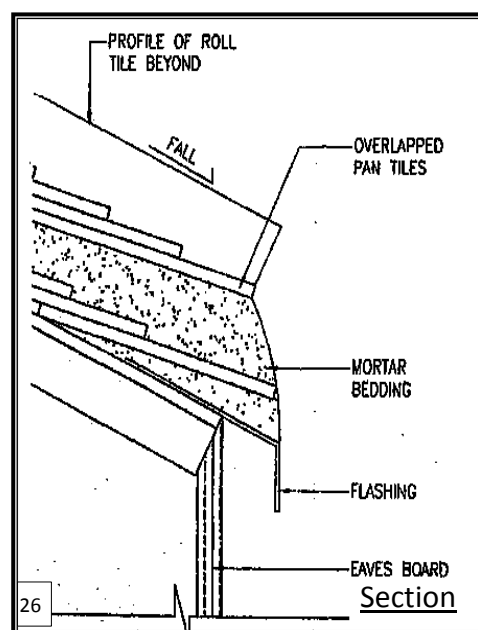
Without providing the statutorily required 150mm level difference between the interior and the exterior for preventing the ingress of surface water into the interior⁹, a new surface water channel has been constructed near the outer edge of the balcony as a compensatory measure for preserving the original French design of the door openings.

(m) New Rain Water Gutter for Pitched Roof

As the conventional method of installing gutter along the eaves to meet current requirement¹⁰ would impair the traditional appearance of the Chinese-style pitched roof, gutters have been installed at a 650mm setback. Exemption from relevant statutory requirements has been granted permitting rain on lower portion to discharge directly to the floor of the balcony and then to the surface water channels.



The glass balustrade and rain water gutter



The eave facing Burrows Street

⁹ In accordance with B(C)R 49, a flat roof adjoining any building shall be at a level of not less than 150 mm below any adjoining usable floor space.

¹⁰ Gutters and rainwater downpipes shall be provided to existing roof in accordance with Building (Standards of Sanitary Fitments, Plumbing, Drainage Works and Latrines) Regulation 39.

CASE 5

OLD TAI PO POLICE STATION, TAI PO

The Project

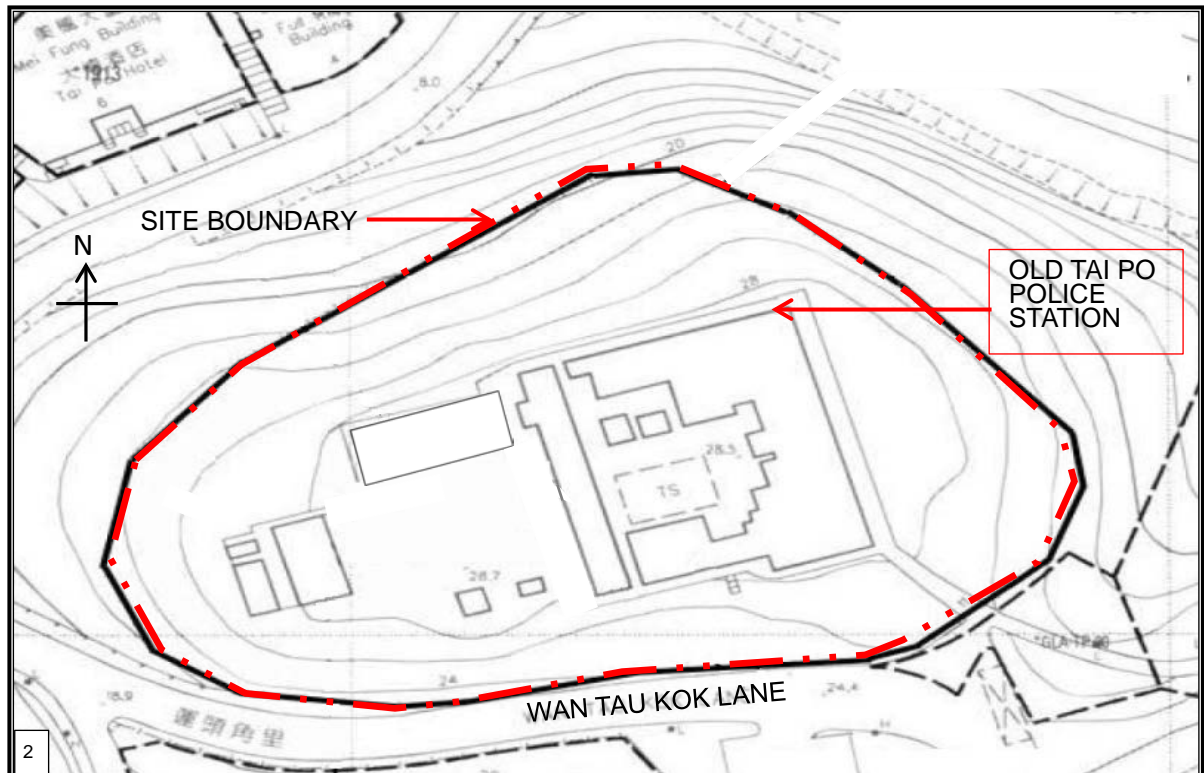


The Main Building after revitalisation

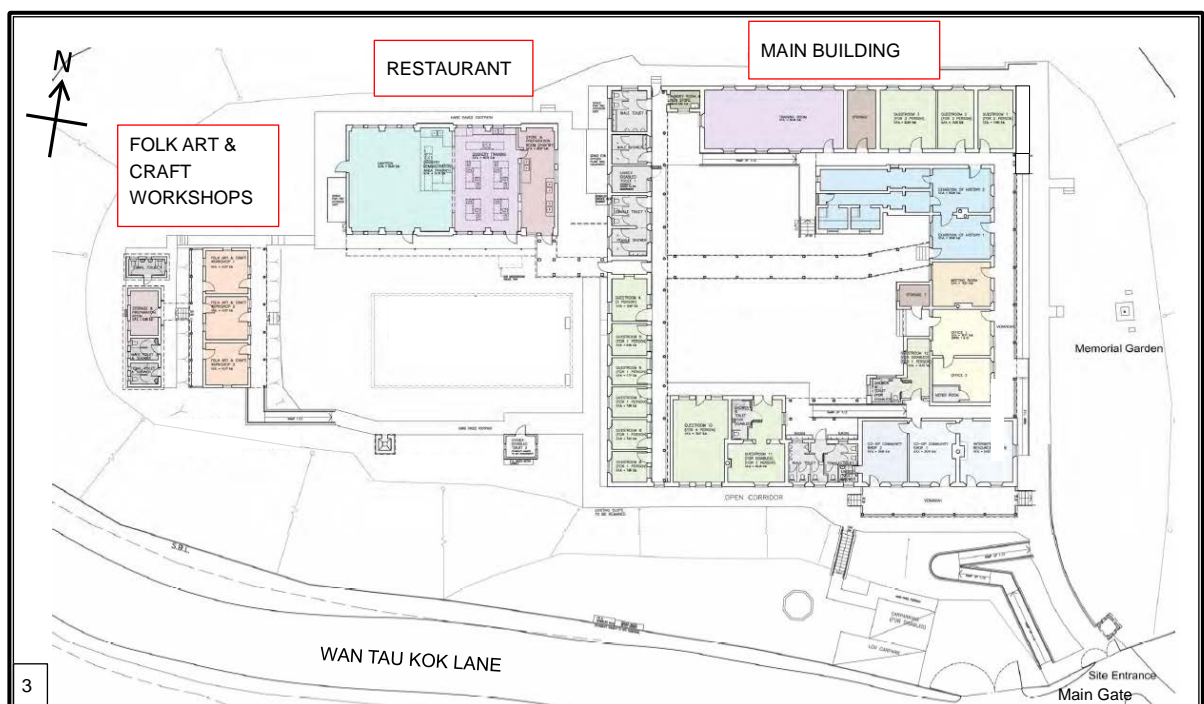
The Old Tai Po Police Station, located at the top of Tai Po Wan Tau Tong Hill, was built in 1899 shortly after the British leased the New Territories. It was the first police station and police headquarters in the New Territories. After World War II, it had been used by the Police as offices until 1987.

The compound comprising three single-storey buildings, namely the Main Building, Ancillary Staff Quarters Block and Canteen Block was accorded as a Grade 1 Historic Building in 2009. It is in the Batch II Projects of the Revitalising Historic Buildings through Partnership Scheme and has been transformed since 2015 into a "Green Hub for Sustainable Living" to demonstrate how people can live sustainably with nature.

The original staff quarters are now used as guestrooms, the staff canteen as restaurant and the back of house as workshops. Suitable uses adapting to the existing structures have been designated minimizing disturbance to the original character of the compound and modification of the existing fabric.



Site Plan



Layout Plan

(Source: Kadoorie Farm and Botanic Garden)

Photos after Revitalisation



Restaurant



Guesthouse



Multi-function room



Interpretation room

Major Issues Encountered

Structure

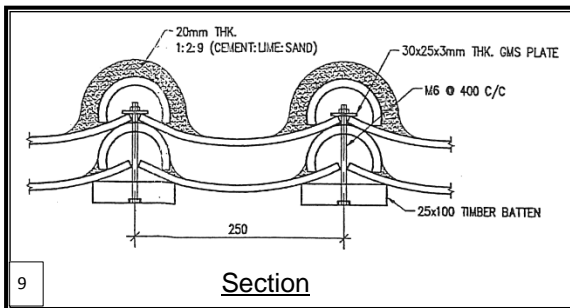
(a) Preserving the Timber Pitched Roof

In the Main Building, the original timber pitched roofs are partially replaced by steel purlins and battens. After obtaining approval and consent under the Buildings Ordinance (BO), the relevant portions are reconstructed with timber purlins, timber battens and double-layer clay pan-&-roll roof tiles to restore the original design. To meet current requirements on structural safety¹, concealed metal bolts are introduced to fix the roof tiles in positions against wind uplifting.

¹ Wind loadings are assessed in accordance with Code of Practice on Wind Effects in Hong Kong 2004.



New timber roof for the multi-function room in the Main Building



Fixing details of roof tile

The existing timber roofs of the Ancillary Staff Quarters Block and the steel roof of the Canteen Block are repaired following the simplified requirements under the Minor Works Control System (MWCS).



The existing timber roof repaired under MWCS

The re-constructed timber roof approved under the BO

The timber roofs

Fire Safety

(b) Means of Escape (MOE)

Challenge

The existing corridor adjacent to the 3 guestrooms in the Main Building, being a required exit route, is only 1m wide and cannot meet the current requirements².



Existing corridor adjacent to the guestrooms

Solution

Noting that the total occupant capacity of the guestrooms is only 6 persons, a secondary escape route for the guestrooms is available, the subject building is only 1 storey high, the importance to keep the original design and that the corridor is one of the Character-Defining Elements (CDE), the slight deficiency in the width of this corridor is accepted as not compromising fire safety standards.

(c) Timber Roofs

Challenge

The existing timber roofs of the compound being one of the CDE cannot meet the current requirements³.

² For the subject building, each exit route shall be of a minimum width of 1050mm in accordance with Building (Planning) Regulation (B(P)R) 41 and Code of Practice for Fire Safety in Buildings 2011 (FS Code).

³ All roofs, together with the members forming the roof structure, shall be constructed of non-combustible materials in accordance with Building (Construction) Regulation (B(C)R) 90 and FS Code.

Solution

The purlins and battens of the reconstructed timber roof are protected with fire retardant paint to achieve the required Class 1 surface spread of flame tested in accordance with the requirements of BS 476 Part 7, and covered with non-combustible clay tiles.



Existing timber purlins and battens are protected with fire retardant paint



Reconstructed timber purlins and battens are protected with fire retardant paint

(d) Deficiency of Emergency Vehicular Access (EVA)

The site is abutting Wan Tau Kok Lane at least 11m away from the nearest façade of the Main Building. Since less than 25% of major façade of the existing buildings can be served by the EVA⁴, the following enhanced fire safety measures are adopted :

⁴ Abutting EVA shall serve at least one major façade having not less than one-fourth of the total length of all the perimeter walls of building in accordance with B(P)R 41D and FS Code.

- (i) Fast response type sprinkler system and fire detection system covering the entire building
- (ii) Size of water tank for sprinkler system enhanced

(e) Fire Service Installations and Equipment (FSI)

Due to the site constraint and conservation reasons, combined water tank for fire hydrant/hose reel system and sprinkler system and exemption of sprinkler for certain verandahs are accepted with the following additional provisions, management measures and justified by a fire engineering assessment:

- (i) Additional fire extinguishers
- (ii) Additional alarm bells
- (iii) No cooking activities (except canteen)
- (iv) No smoking
- (v) Provide fire safety briefing to all visitors
- (vi) Implement fire safety management
- (vii) Proper fire safety training to staff
- (viii) Limitation on visitor population
- (ix) Monitoring the corridor by staff including using CCTV
- (x) No storage and handling of goods at the verandahs

Danger of Falling

(f) Preserving Existing Railings

Challenge

A level difference of over 600mm is found between the verandahs of the Main Building and the adjoining passageway. However, the design of the original balustrade cannot meet the current requirements for protection against falling⁵.

Solution

An intermediate platform is added to mitigate the level drop at the same time offering outdoor bench seating.



Intermediate platform added to mitigate level difference

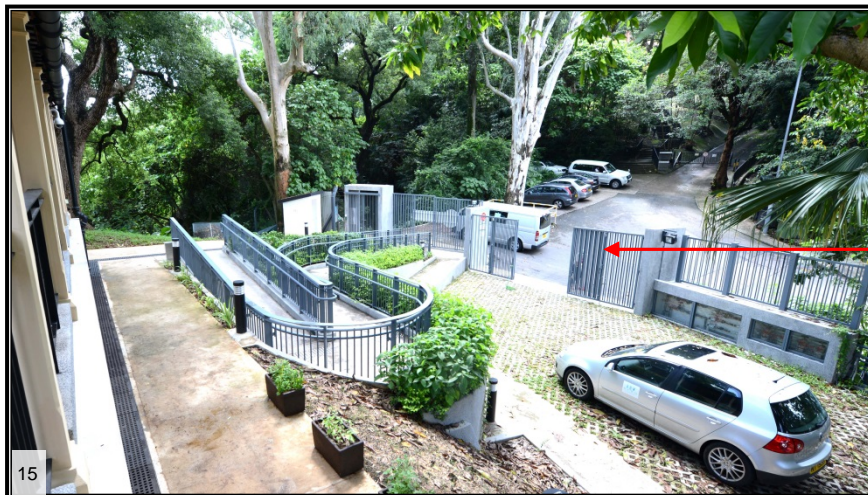
Verandah of the Main Building and the adjoining intermediate platform

⁵ Protective barriers shall be at a height above the higher of the adjacent levels of not less than 1100mm; and constructed as to prohibit the passage of articles more than 100mm in their smallest dimension in accordance with B(C)R 8.

Provision of Barrier Free Facilities

(g) Barrier Free Access

The compound is on elevated platforms about 2m higher than the adjoining street. In order to provide barrier free access, new ramps are added for connecting different platforms.

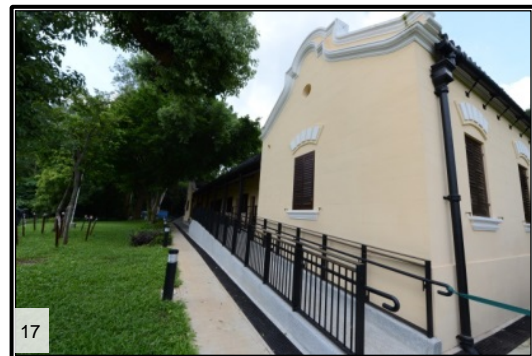


The Main Gate

Barrier free access from the main gate



Initial access ramp to the compound



Ramp to the Main Building



Ramp connecting the Main Building and courtyard



Ramp connecting the Main Building and guestrooms

(h) Accessible Toilets

An existing store is converted into an accessible toilet.



New accessible toilet

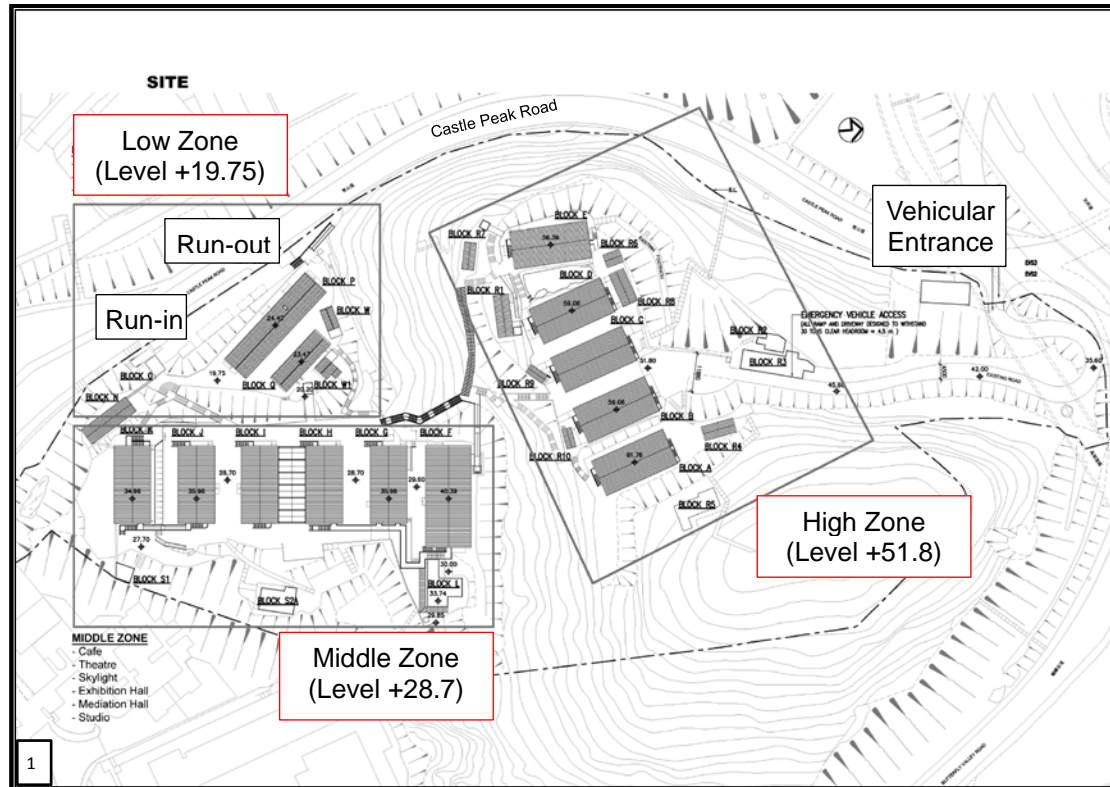


Interior

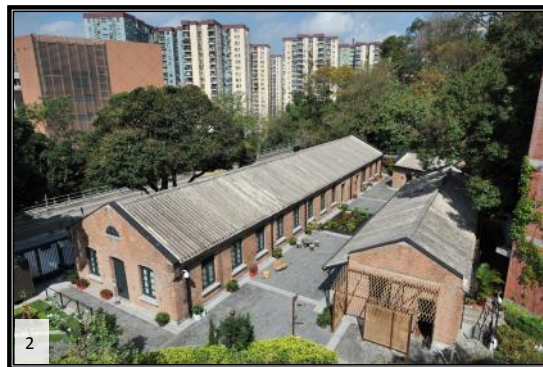
CASE 6

Former LAI CHI KOK HOSPITAL

The Project



Site Plan (Source: P&T Architects and Engineers Ltd.)



Low Zone



Middle Zone

(Source: P&T Architects and Engineers Ltd.)

Former Lai Chi Kok Hospital (LCKH) is a Grade 3 Historic Building perching on the lush hillside of Castle Peak Road. It comprises 18 main blocks made of brick walls supporting pitched roof, most of which were built in the 1920s.

The former LCKH is one of the Batch I Projects of the Revitalising Historic Buildings through Partnership Scheme. Since 2012, the compound has been transformed into an academy for promoting Chinese culture namely the “Jao Tsung-I Academy 饒宗頤文化館”:

- | | | |
|-------------|---|--|
| Low Zone | - | Exhibition halls |
| Middle Zone | - | Multi-function rooms, cafeteria and administrative offices |
| High Zone | - | Hostel |

Major Issues Encountered

Structural Strengthening

Buildings were constructed mainly with brick walls and pitched roofs of timber or timber with steel trusses atop with roofing tiles. Suspended floors in 2-storey buildings were constructed of reinforced concrete slabs supported by timber joists and steel beams.

(a) Strengthening of Existing Buildings

Localised strengthening of the pitched roofs and 1/F floor slabs are carried out to enhance the stability and structural performance of the existing structures as shown in Table 1.

Location	Pitched Roofs		1/F Floor slabs	
	Original	Additional	Original	Additional
Low Zone (1-storey)	Timber trusses and purlins	Repair and Enhancement Works Localised strengthening by adding steel beams and plates to existing timber structural members	N/A	N/A
Middle Zone (2-storey)	Timber / steel truss and purlins	Repair and Enhancement Works Adding horizontal steel bracings to existing trusses	Reinforced concrete slabs	A&A Works Existing deteriorated timber joists are replaced by new steel beams
High Zone (2-storey)	Steel trusses and purlins	A&A Works Existing steel roof sheets and purlins are replaced by new steel corrugated sheets and steel purlins	Reinforced concrete slabs	Repair and Enhancement Works Adding steel beams to existing floor slabs

Table 1 – Strengthening to Pitched Roof and Floor Slab

(Remark: The different requirements for roof/ floor repair works and roof/ floor A&A works are given in Sections 5.8 and 5.9 of this Practice Guidebook.)

"Sandwich" strengthening by through bolts

New steel beam

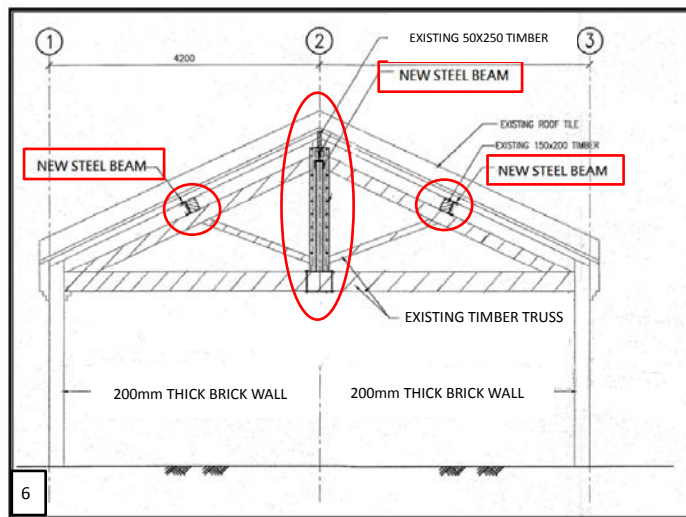
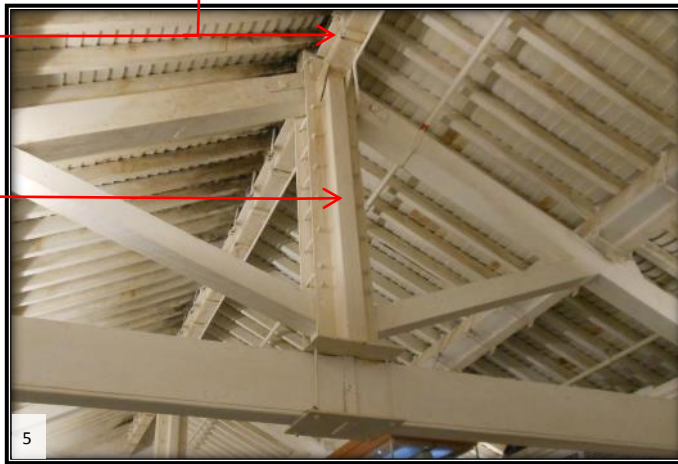
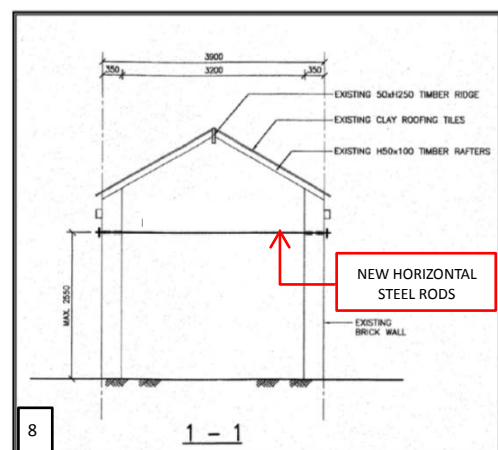
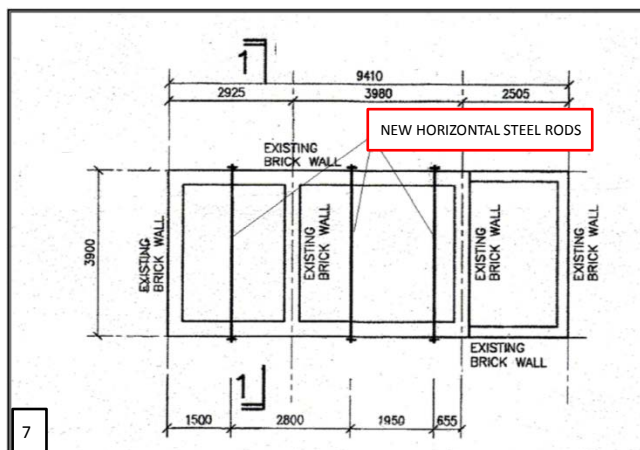
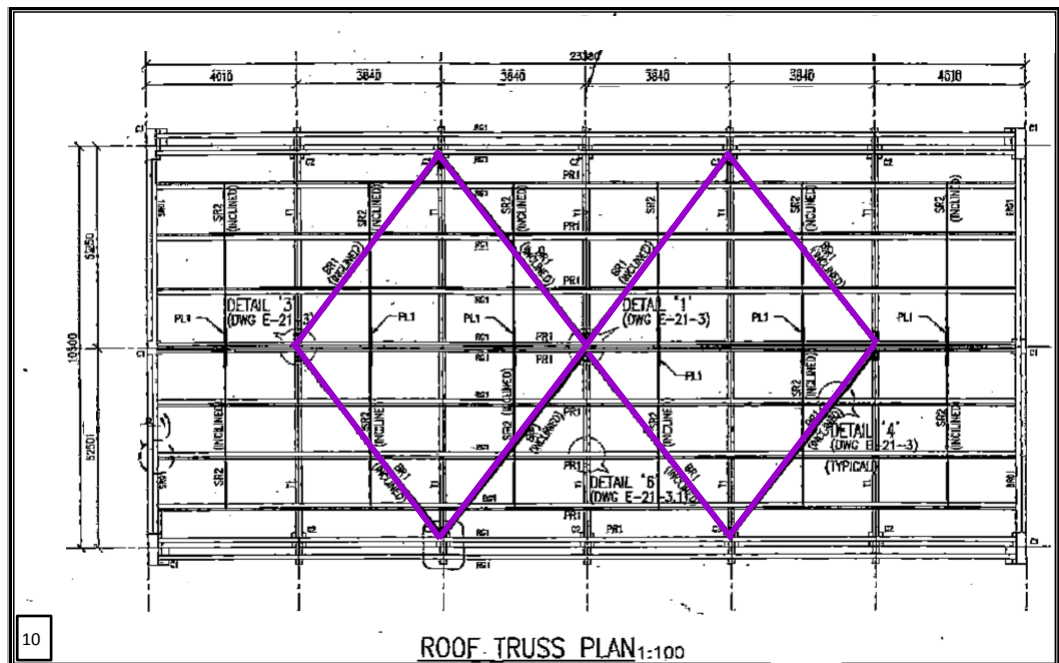


Photo and section showing strengthening to the structural elements and connection joints of roofs of buildings in the Low Zone (Source: P&T Architects and Engineers Ltd.)



Plan and section showing strengthening works by horizontal steel rods in buildings at the Low Zone

Additional
steel bracing



— Diagrammatic indication of additional steel bracings

Additional steel bracings for roofs of existing buildings in the Middle Zone

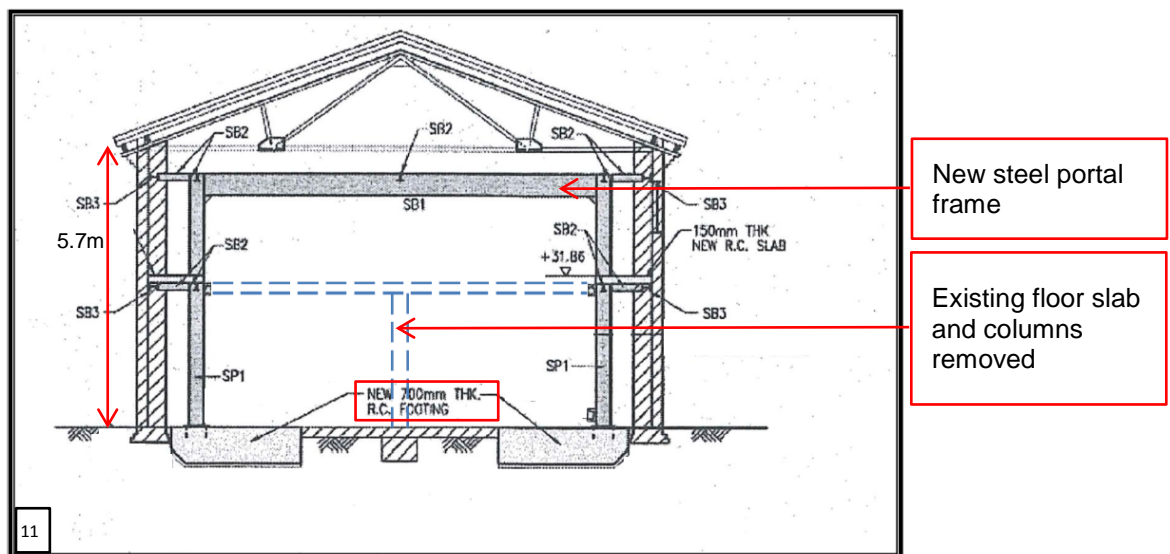
(b) Major Alteration and Addition Works for Adaptive Re-use

Challenge

Majority of the 2-storey buildings in the Middle Zone were converted into function rooms. The average clear headroom of the existing buildings, being around 2.7m, was inadequate for their intended purposes.

Solution

To strike a balance between maintaining architectural authenticity of the buildings and creating spacious environment for functional needs, headroom of one of the buildings in the Middle Zone is doubled by removing the first floor slab and the associated columns.



Section showing additional steel portal frame

As such alteration would reduce the lateral load resisting capacity of the building to a significant extent, new steel portal frames with new footings are erected to provide proper wind resisting system.



First floor slab removed to form a multi-function room with high headroom
(Source: P&T Architects and Engineers Ltd.)

Fire Safety

(c) Fire Resisting Construction

Challenge

The timber construction of the existing pitch roofs of the buildings in the Low and Middle Zones cannot meet the current requirements on fire safety¹.

Solution

Timber elements of the roofs are protected with fire retardant paint for achieving Class 1 standard tested in accordance with BS 476 Part 7 on surface spread of flame.

¹ All roofs, together with the members forming the roof structure shall be constructed of non-combustible materials in accordance with Building (Construction) Regulation 90 and Code of Practice for Fire Safety in Buildings 2011.



Timber element
protected with
fire retardant
paint

Timber pitched roof protected with fire retardant paint



Timber pitched roof covered with non-combustible clay tiles

(d) Fire Service Installations and Equipment (FSI)

The FSI provisions are based on risk assessment and considerations of the constraints encountered in conservation. Two fire hydrant/ hose reel systems and two improvised sprinkler systems are provided for the development. The existing 27m³ fire service water tank is retained and a new 36m³ tank is added to supply the fire hydrant and hose reel systems for the High and Low/Middle Zones respectively, which are interconnected and augmented to supply the improvised sprinkler systems. A fire detection system is provided for areas not protected by automatic sprinkler systems and a smoke detection system is provided for all hostel rooms.

Danger of Falling

(e) Adding Protective Barriers to Window

Challenges

The height of existing window openings on 1/F of the buildings in the Middle and High Zones are only 700mm above the floor level not meeting the current requirements².

Solution

Fixed glazing panels are added to serve the function of protective barriers.



Provision of Barrier Free Facilities

(f) Initial Access and Access within Compound

The Low and High Zones are provided with independent vehicular access from Castle Peak Road.

² Every opening placed on an external wall above the ground floor of building shall be protected by a barriers at a height of not less than 1100mm and lowermost 150mm of barrier built solid in accordance with Building (Planning) Regulation 3A.

Challenges

The level difference from the Low to Middle and from the Middle to High Zones is about 9m and 23m respectively. The Middle Zone is accessible from the Low Zone by accessible ramps, a lift and a link bridge, but there is no barrier free access provided between the High Zone to the other Zones.



Photos taken before revitalization

(Left) The Low and Middle Zones are linked by flight of steps

(Middle and Right) The Middle and High Zones are linked by flight of steps and covered footpaths

Solution

The site has a difficult terrain, in particular the Middle and High Zones are connected by a steep and winding footpath and steps. It is therefore impractical to have a common entrance linking up all the three Zones. In the circumstances, each of the Low and High Zone is provided with an entrance at the lot boundary accessible to persons with physical limitations. Shuttling between the two zones by vehicles is acceptable.

The connection between the Low and Middle Zones is enhanced by a new accessible route comprising lifts and link bridges. New lifts, lifting platforms and ramps are also added in various locations over the vast compound to enhance accessibility.

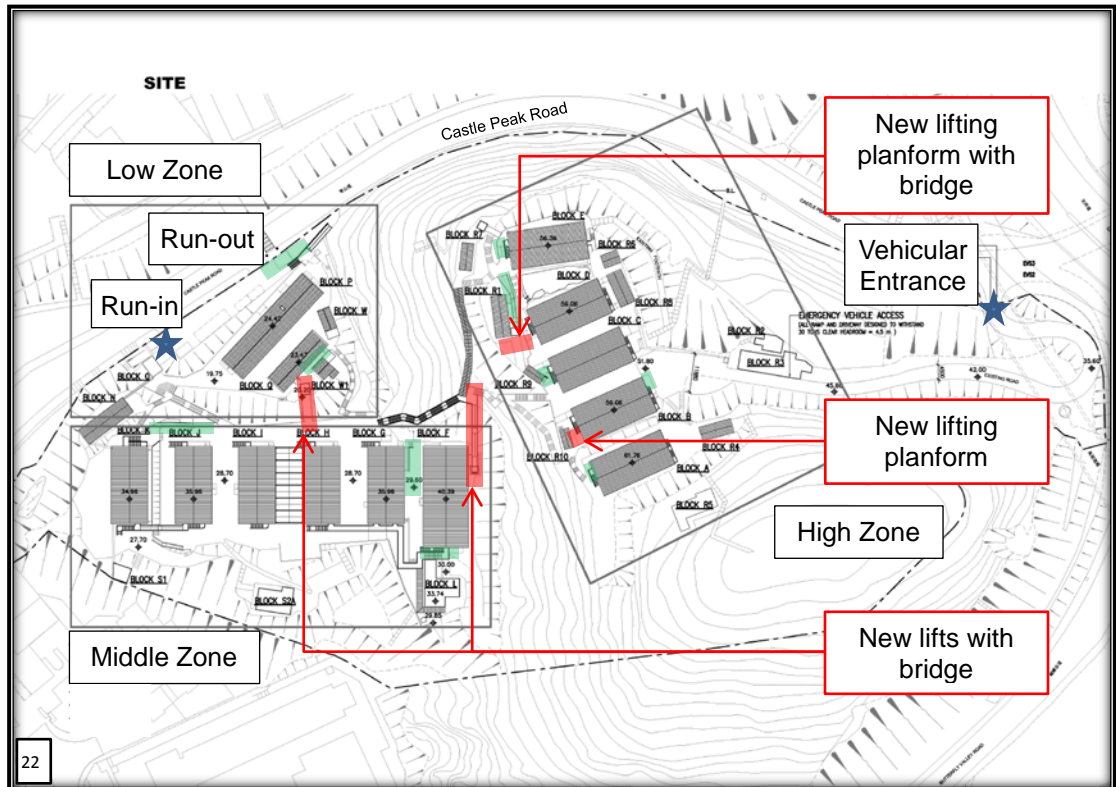


New Accessible ramps at the entrance and other locations within the site



New accessible lift and link bridge connecting the Low and Middle Zones

(Source: P&T Architects and Engineers Ltd.)

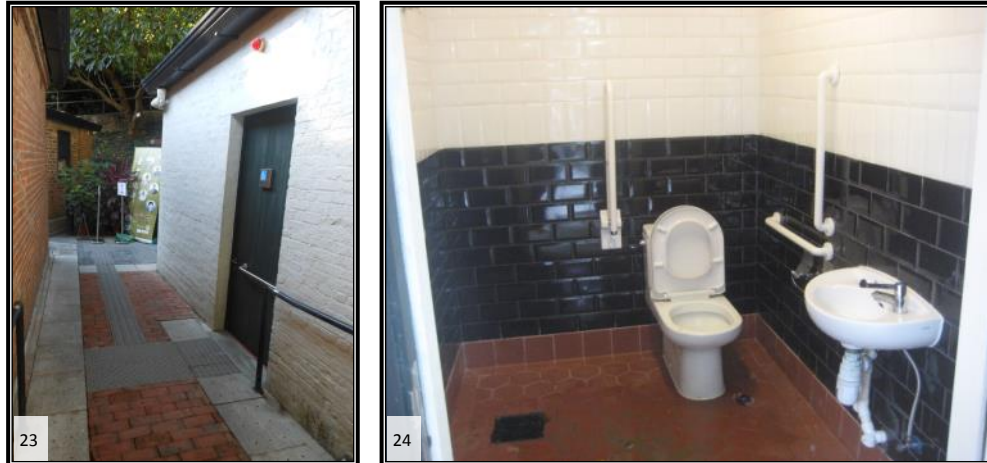


Site plan showing entrances (blue star), new ramps (green), new lifting platforms/lift towers and bridges (red)

(Source: P&T Architects and Engineers Ltd.)

(g) Other Barrier Free Facilities

Accessible toilets, tactile guide paths, tactile warning strips, etc are provided. At least two out of the eighty-nine nos. of hostel rooms are designed as accessible rooms.



Other barrier free facilities, such as tactile guide path and accessible toilet

(h) No Level Difference between the Interior and Exterior

Level difference between the external and the internal areas of exhibition halls, multi-function rooms and cafeteria are eliminated. New surface water channels are provided at the courtyards to prevent influx of surface water to the buildings.



New surface water channels added at the courtyard

CASE 7

STONE HOUSES, JUNCTION ROAD, KOWLOON CITY

The Project

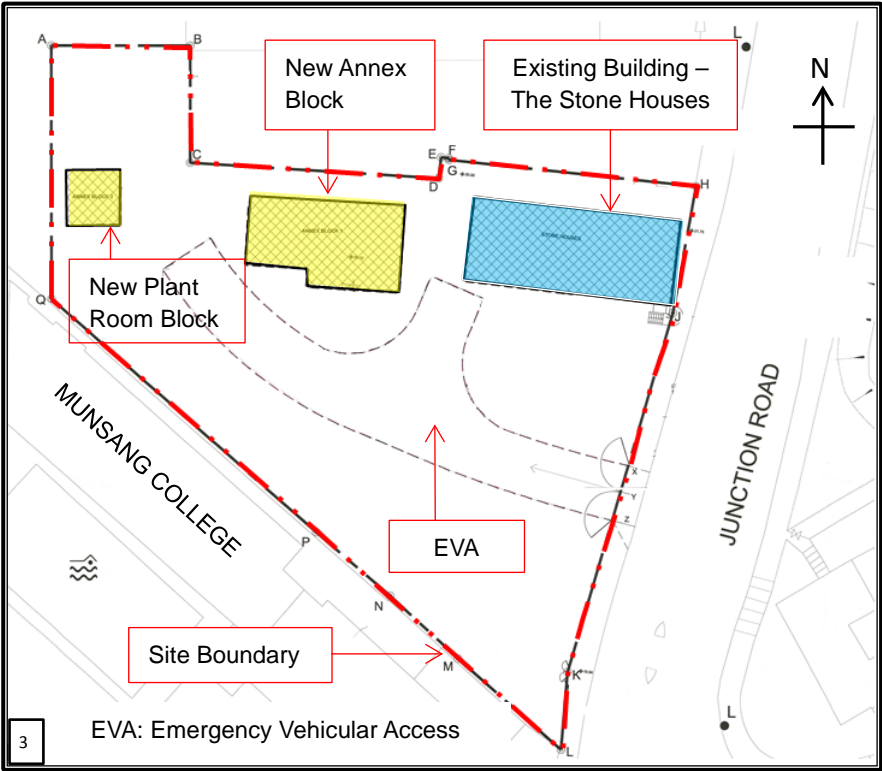


Stone Houses after revitalisation

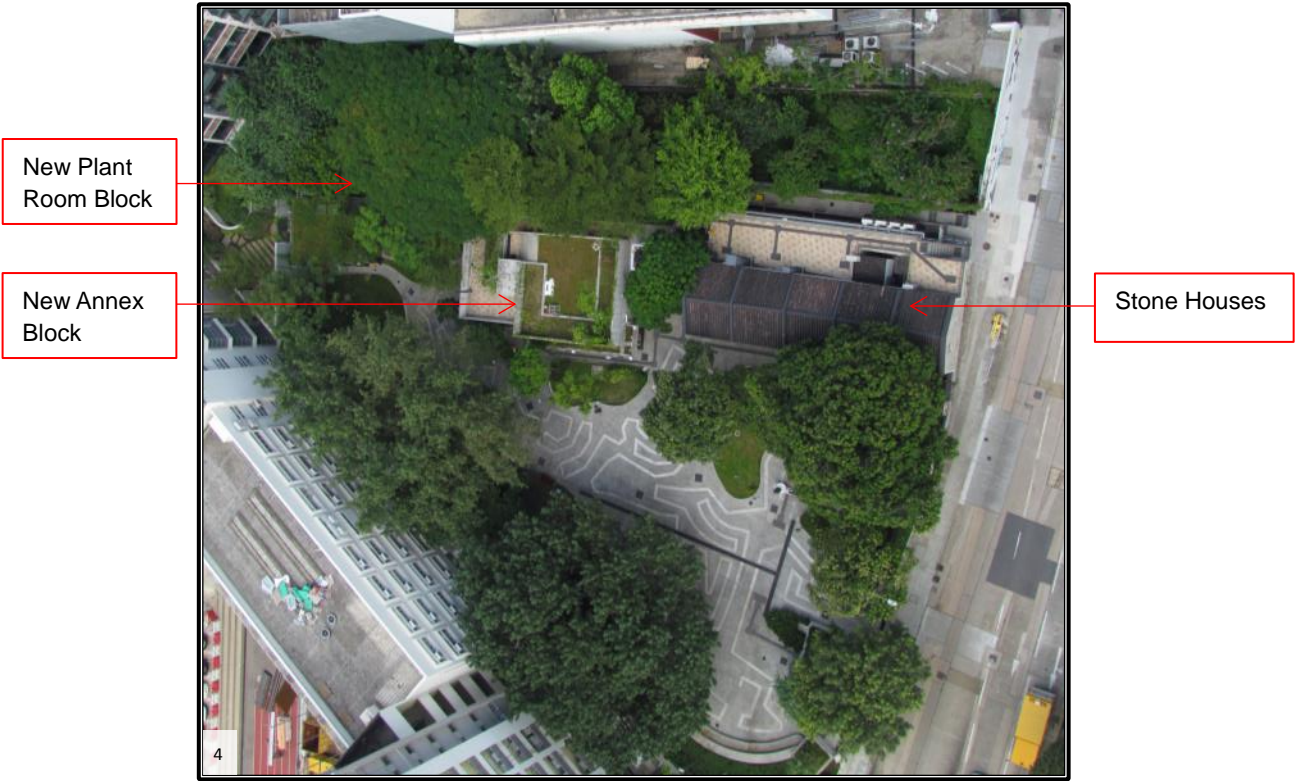
Stone Houses (SH) in Kowloon City is a row of five Chinese style two-storey tenement buildings constructed of granite blocks walls supporting pitched roof of timber rafters, purlins and clay tiles. It was built in the 1940s and is a Grade 3 Historic Building.

The SH are one of the Batch II Projects of the Revitalising Historic Buildings through Partnership Scheme. Since 2015, it has been transformed into an education and activity centre namely the "Stone Houses Family Garden" comprising a themed cafeteria, a tourist centre and an interpretation centre.

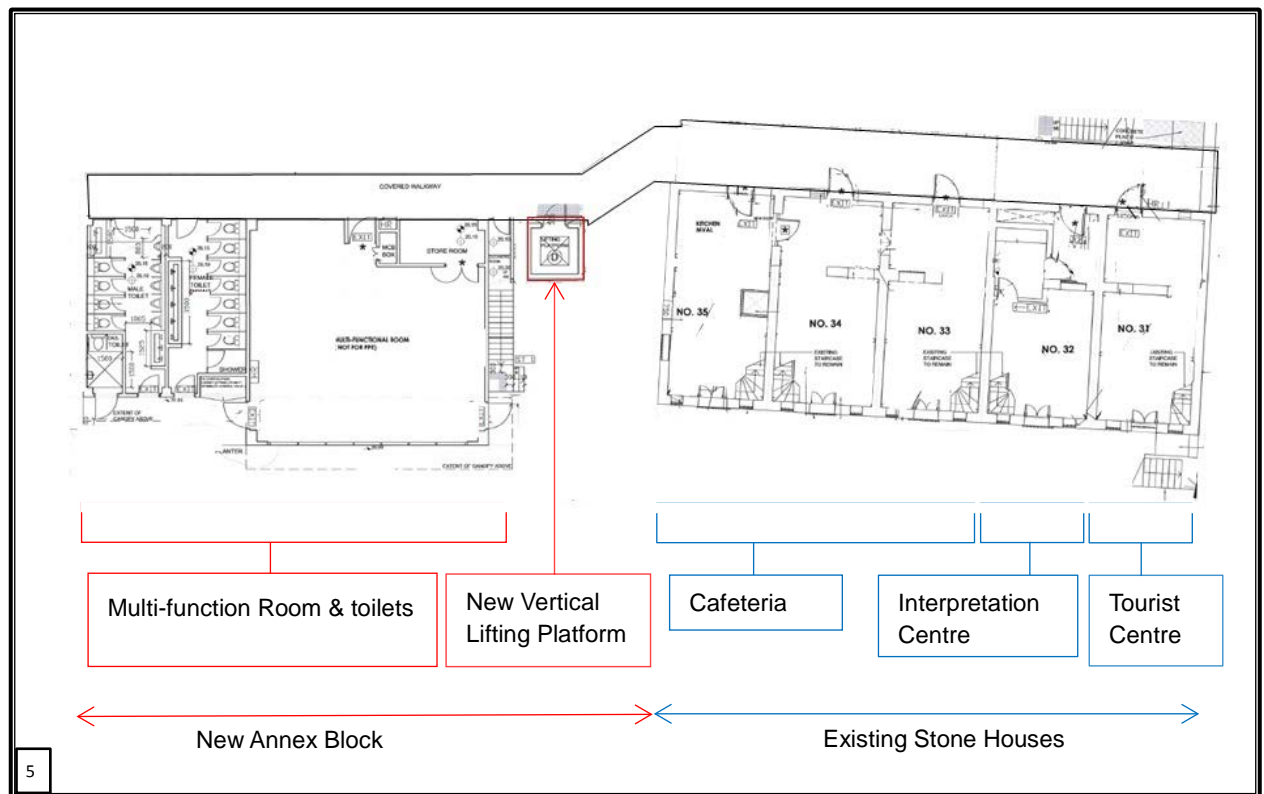
Two new single-storey blocks for use as a multi-function room and plant rooms were built to share the extensive area of the courtyard with the existing buildings.



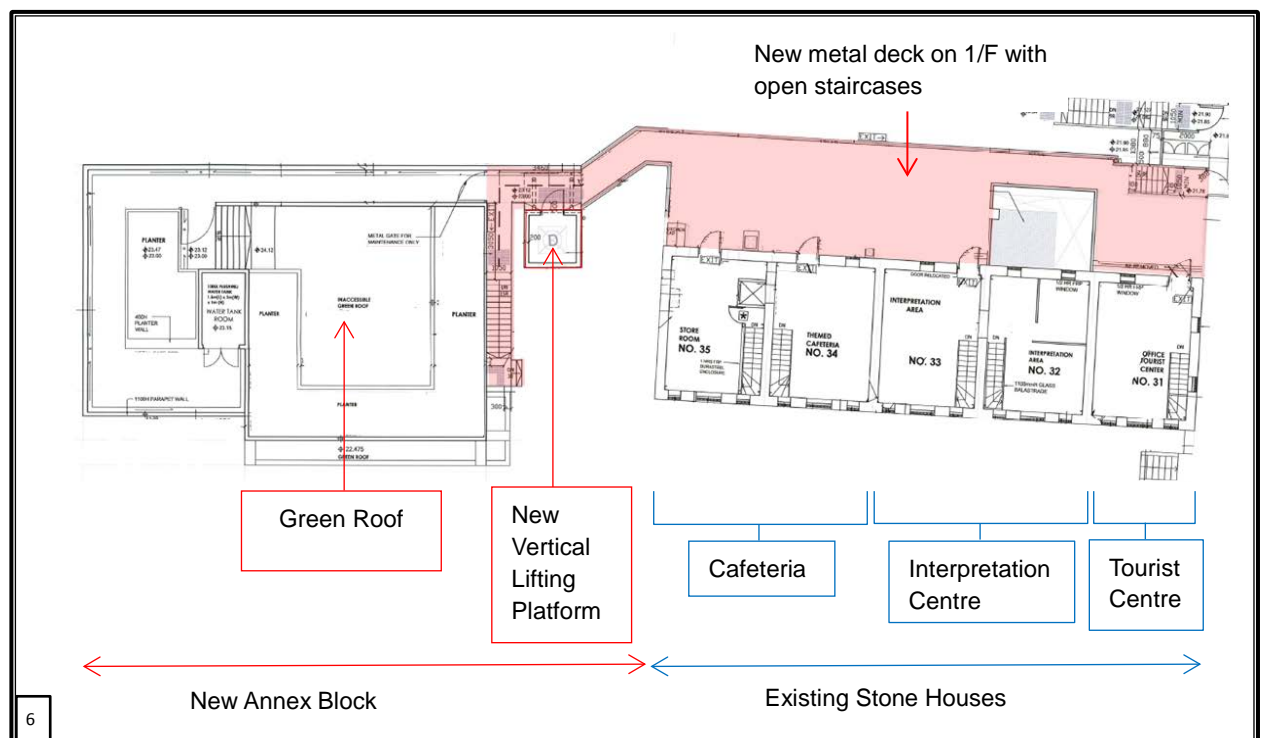
Site Plan (Approximate Scale 1:800)



Stone Houses, New Annex Block and Plant Room



Ground Floor Layout Plan after revitalisation (Approximate Scale 1:300)



First Floor Layout Plan after revitalisation (Approximate Scale 1:300)



7

Interpretation Centre in Stone Houses



8

Themed Cafeteria in Stone Houses

Major Issues Encountered

Structure

(a) Retaining Timber Floor and Timber Staircase

Challenge

The existing timber floors and timber staircases in the SH are amongst the character-defining elements (CDE) but their previous conditions and structural strength are inadequate to meet the current design standards on imposed loads¹ for the adaptive re-use.

Solution

The 1/F timber floor (including joists and planks) and the timber staircase (including stringer beams, treads and risers) in the Interpretation Centre are preserved. In order to meet the current design standards, strengthening of the 1/F floor and staircase is required by means of additional steel beams and stringers.

The timber floors and staircases of the remaining four units are replaced with new steel decks, beams, frames and columns supported by new reinforced concrete raft footings. Some original timber planks and floor tiles are salvaged and relayed on the new structures as floor finishes.

¹ Code of Practice for Dead and Imposed Loads 2011



Existing RC beams supporting timber floor & staircase

New steel beams at the sides of existing timber joist

New steel stair stringers

Timber staircase and timber floor of Interpretation Centre strengthened with steel beams and stringers

Fire Safety

(b) Means of Escape (MOE)

Challenge

The existing timber stairs connecting G/F and 1/F are 725mm wide, with risers 200mm high, treads 200mm deep and solid winders at the bottom and no enclosure walls. Their construction and fire resistance rating (FRR) are inadequate in meeting the current fire safety requirements².



Existing timber staircase with solid winders at the bottom before revitalisation

² For the subject building, the minimum number of escape staircases shall be 2 and each escape staircase shall be of a minimum width of 1050mm, riser of not more than 175mm high, treads of minimum 225mm deep and without winders; and constructed of non-combustible materials with adequate FRR in accordance with Building (Planning) Regulation (B(P)R) 41, Building (Construction) Regulation (B(C)R) 90 and Code of Practice for Fire Safety in Buildings 2011 (FS Code).

Solution

Two new code-compliant open staircases connecting the 1/F of the 5 houses via a structurally independent deck are constructed at the back to serve as the MOE, without intervening the main facade which carries higher heritage value. The new metal deck with new footings is structurally separated from the existing masonry structures. No additional loading from the new metal deck is transferred to the existing masonry walls. The original internal timber staircases are repaired and retained for circulation only.



New metal deck

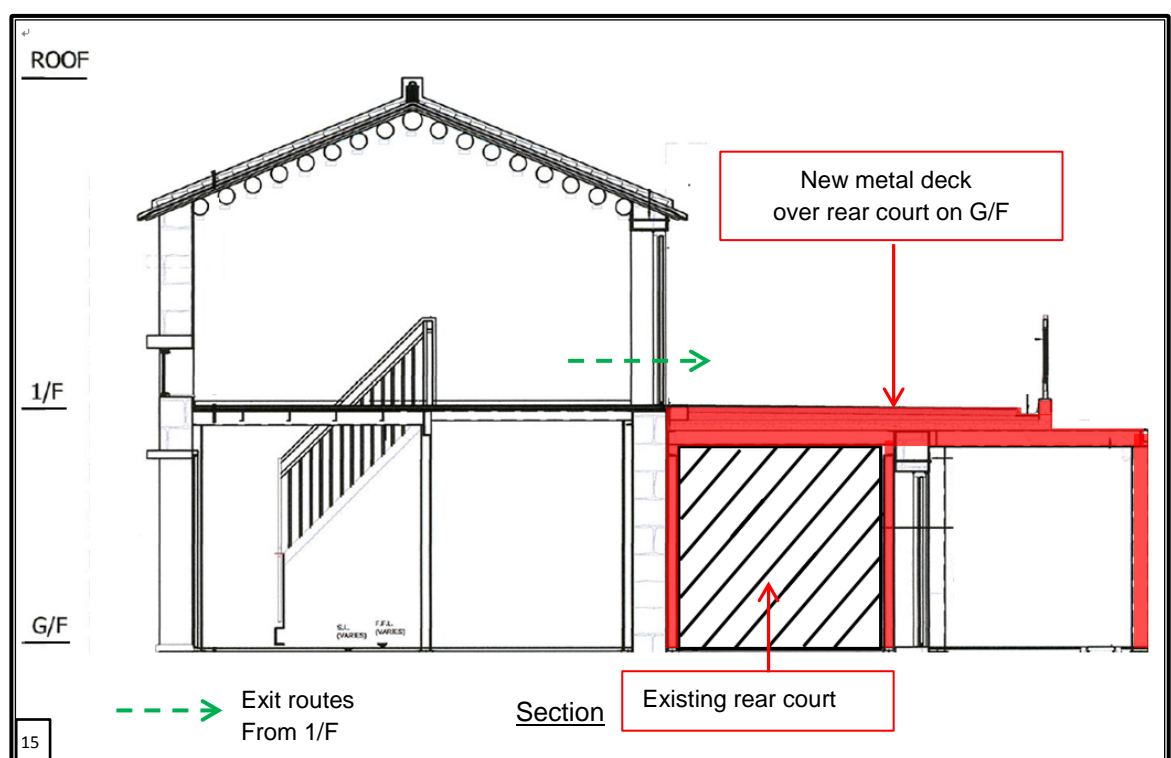
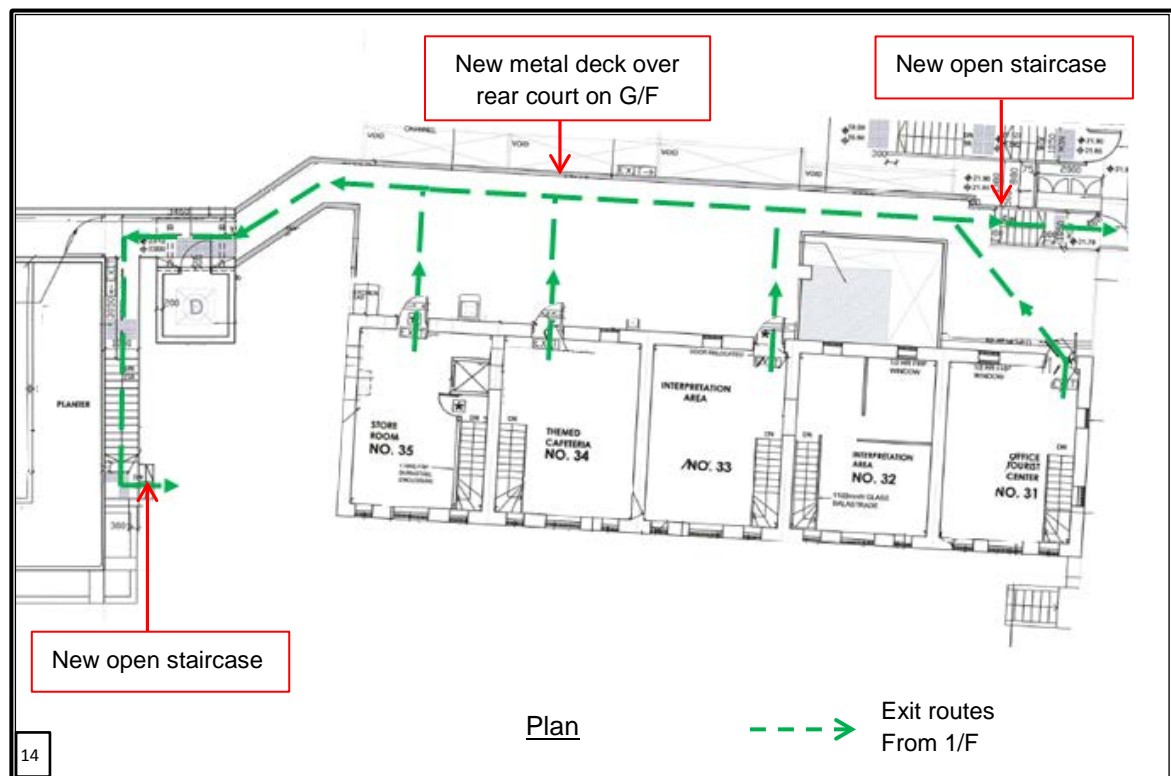
New metal deck at the rear



New metal deck

One of the new open staircases serving 1/F of Stone Houses

New metal deck connecting to open staircases



(c) Timber Pitched Roof

Challenge

The existing timber pitched roof with tiles being one of the CDE cannot meet the current requirements on fire safety³.

Solution

All timber elements of the roof are repaired and protected with fire retardant paint to meet the Class 1 standard on surface spread of flame tested in accordance with the requirements of BS 476 Part 7, and then covered with the original non-combustible clay tiles.



Existing timber pitch roof are retained for appreciation but timber elements are painted with fire retardant paint

³ All roofs, together with the members forming the roof structure, shall be constructed of non-combustible materials in accordance with B(C)R 90 and FS Code.

(d) Fire Service Installations and Equipment (FSI)

The FSI provisions are based on risk assessment and considerations of the constraints encountered in conservation. A modified hose reel system with a 4 m³ water tank instead of a fire hydrant/hose reel system and a sprinkler system with a 25 m³ water tank are provided to serve the entire development. A secondary power supply to FSI is fed from the electricity supply before the main switch and a fire detection system is provided for areas not protected by sprinklers.

Danger of Falling

(e) Preserving Existing Railings of the Timber Staircases

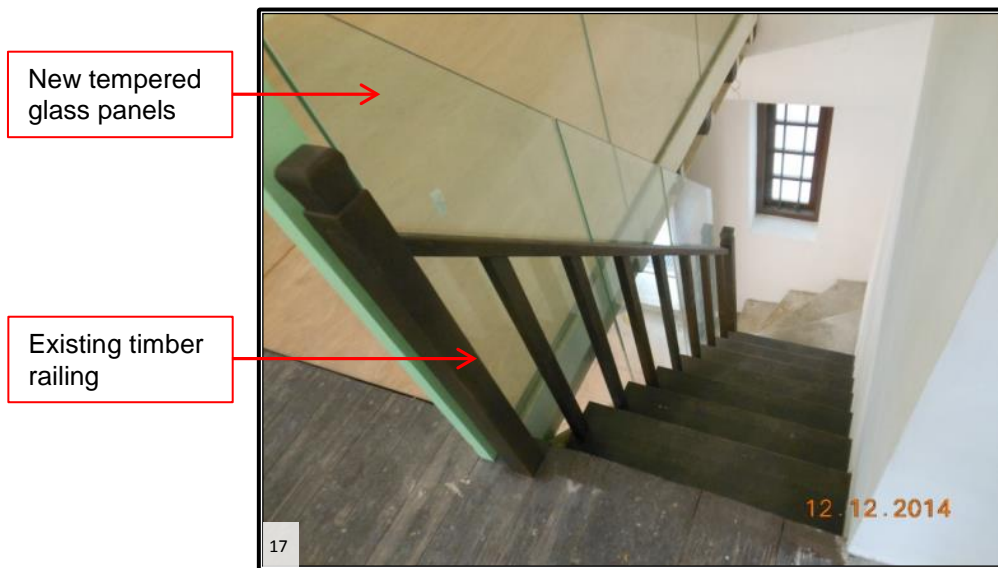
Challenge

The original timber railings for staircases are approximately 800mm high which cannot meet the current requirements for protection against falling⁴.

Solution

Secondary protective barriers made of tempered glass panels or steel not less than 1100mm high are installed behind the existing timber railings for meeting the current statutory requirements.

⁴ Protective barriers shall be at a height above the higher of the adjacent levels of not less than 1100mm; and constructed as to prohibit the passage of articles more than 100mm in their smallest dimension in accordance with B(C)R 8.



New protective barrier behind the existing sub-standard railing

(f) Preserving Existing Window

Challenge

The height of some existing window openings is only 530mm above the floor level of 1/F and cannot meet the current requirements⁵.

Solution

To avoid making irreversible changes to the components of the original timber framed windows which are CDE, the protection against the danger of falling is achieved by adding new metal grilles on the walls behind the windows.



New metal grilles added at the existing window openings

⁵ Every opening placed on an external wall above the ground floor of building shall be protected by a barriers at a height of not less than 1100mm and lowermost 150mm of barrier built solid in accordance with B(P)R 3A.

Provision of Barrier Free Facilities

Relevant provisions are outside the SH to avoid intervention.

(g) Barrier Free Access

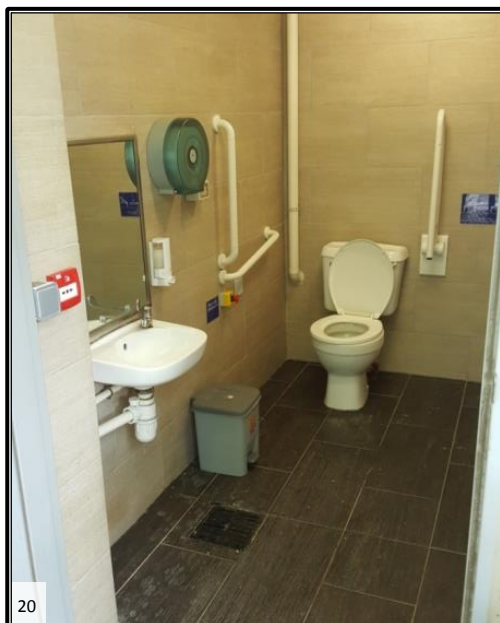
A new vertical lifting platform is installed between SH and the New Annex Block to provide access to 1/F of SH through the new metal deck at the back.



New lifting platform, 1/F

(h) Accessible Toilet

An accessible toilet and other ancillary facilities are provided in the New Annex Block next to SH.



New accessible toilet, New Annex Block

Appendix II

List of Contemporary Design Standards in Hong Kong

Design Standards for the Structural Use of Reinforced Concrete

Period	Design Standards
1903~1934	Public Health and Buildings Ordinance 1903 (R.C. building belonging to Exceptional Building which is subject to approval of Building Authority)
1935~1955	Buildings Ordinance 1935 London County Council By-laws 1915
1956~1968	Buildings Ordinance 1955; B(C)R 1956 London County Council By-laws 1938 or London County Council By-laws 1952 and subsequent amendments (for structural design prepared and signed by a person qualified as an engineer)
1969~1974	London County Council By-laws 1952 and subsequent amendments (for structural design prepared and signed by a person qualified as an engineer)
1975~1986	B(C)R 1975 (imperial version) and B(C)R 1976 (metric version)
1987~1989	Code of Practice for the Structural Use of Concrete 1987
1990~2003	B(C)R 1990; Code of Practice for the Structural Use of Concrete 1987 and BS 8110
2004~2008	B(C)R 1990 and Code of Practice for the Structural Use of Concrete 2004
2009~2013	B(C)R 1990 and Code of Practice for the Structural Use of Concrete 2004 (2 nd edition)
2013~now	B(C)R 1990 and Code of Practice for the Structural Use of Concrete 2013

Design Standards for the Structural Use of Steel

Period	Design Standards
1903~1934	Public Health and Buildings Ordinance 1903 (Steel framed building belonging to Exceptional Building which is subject to approval of Building Authority)
1935~1955	Buildings Ordinance 1935 London County Council By-laws 1915
1956~1968	Buildings Ordinance 1955; B(C)R 1956 London County Council By-laws 1938 or London County Council By-laws 1952 and subsequent amendments (for structural design prepared and signed by a person qualified as engineer); and BS 449
1969~1974	London County Council By-laws 1952 and subsequent amendments (for structural design prepared and signed by a person qualified as engineer); and BS 449
1975~1986	B(C)R 1975 (imperial version); B(C)R 1976 (metric version) and BS 449

Period	Design Standards
1987~1989	Code of Practice for the Structural Use of Steel 1987 and BS 449
1990~2004	B(C)R 1990, Code of Practice for the Structural Use of Steel 1987 and BS 5950
2005~2011	B(C)R 1990 and Code of Practice for the Structural Use of Steel 2005
2012~now	B(C)R 1990 and Code of Practice for the Structural Use of Steel 2011

Design Standards for the Structural Use of Timber

Period	Design Standards
1903~1934	Public Health and Buildings Ordinance 1903 – some prescriptive requirements on timber floors
1935~1955	Buildings Ordinance 1935 – some prescriptive requirements on timber floors
1956~1968	Buildings Ordinance 1955 – B(C)R 1956 London County Council By-laws 1938 or London County Council By-laws 1952 and subsequent amendments
1969~1974	London County Council By-laws 1952 and subsequent amendments
1975~1989	B(C)R 1975 (imperial version)
1990~now	B(C)R 1990; BS 5268 and Code of Practice on Fire Resisting Construction 1996. Reference can be made to B(C)R 1976.

Design Standards for the Structural Use of Masonry

Period	Design Standards
1903~1934	Public Health and Buildings Ordinance 1903
1935~1955	Buildings Ordinance 1935
1956~1974	Buildings Ordinance 1955 – B(C)R 1956
1975~1989	B(C)R 1975 (imperial version)
1990~now	B(C)R 1990 and BS 5628. Reference can also be made to B(C)R 1976.

Design Standards on Wind Effects in Hong Kong

Period	Design Standards
1956~1958	B(C)R 1956
1959~1967	Code of Practice (Wind Effects) 1959
1968~1975	Code of Practice on Wind Effects 1968
1976~1982	Code of Practice on Wind Effects 1976
1983~2003	Code of Practice on Wind Effects, Hong Kong 1983
2004~now	Code of Practice on Wind Effects in Hong Kong 2004

Design Standards for Foundations

Period	Design Standards
1903~1934	Public Health and Buildings Ordinance 1903
1935~1955	Buildings Ordinance 1935
1956~1974	Buildings Ordinance 1955 – B(C)R 1956
1975~1989	B(C)R 1975 (imperial version)
1990~2003	B(C)R 1990
2004~now	B(C)R 1990 and Code of Practice for Foundations

Design Standards for the Minimum Design Imposed Loads

Period	Design Standards
1915~1955	London County Council By-laws 1915
1956~1968	Buildings Ordinance 1955; B(C)R 1956 London County Council By-laws 1938 or London County Council By-laws 1952 and subsequent amendments (for structural design prepared and signed by a person qualified as an engineer)
1969~1974	London County Council By-laws 1952 and subsequent amendments (for structural design prepared and signed by a person qualified as an engineer)
1975~1989	B(C)R 1975 (imperial version)
1990~7/2011	B(C)R 1990
8/2011~now	Building (Construction) Amendment Regulation 2011 Code of Practice for Dead and Imposed Loads 2011

Appendix III

Project Name – Management plan to enhance safety/ health standard for compliance with the Buildings Ordinance and its allied regulations

The following information shall be included in the management plan :

A. Project description

- project title,
- site address,
- details of the owner,
- existing use,
- proposed use and capacity,
- operation details of the premises,
- relevant approved building, drainage and structural plans and documents

B. Exemption(s) / modification(s) sought under the Buildings Ordinance and allied Regulations with justifications

- the relevant section of the Buildings Ordinance and the allied regulations that modification/exemption is sought
- description of the modification/ exemption sought
- special circumstances
- justification, proposed remedies and supporting documents including the information provided to AMO described in Section 4.11.

C. Details of the management measures

- List of compensatory measures
- Enforceable management strategy
- **Management plan**, e.g. monitoring mechanism with traceable records of evidence that can be retrieved; survey data of population, CCTV tape recordings, etc. as a proof of compliance with approval conditions/justifications
- **Maintenance plan** on testing and maintenance procedures and schedule of the long term implementation of the compensatory measures
- **Training plan** for key personnel who implement the compensatory measures
- **Other action plans** which may include contingency plan in the event that the compensatory measures become ineffective due to normal maintenance or any unforeseen events, etc or evacuation plan where appropriate

D. Owner's undertaking

BD file ref: _____ Date: _____
To the Building Authority

*I/We (name in full) _____ (Chinese) _____ of
(Address) _____ telephone no. _____, fax no. _____ holder of
*HKID No./Business Registration Certificate No. _____, being the
owner(s) / tenant(s) of (address of site, "the premises") _____ at (lot no.)
_____, undertake to observe the following :

2. I/We fully understand that the approval of the general building plans under BD ref : _____ for the proposed change in use of and/or alteration and addition works to the above premises is subject to the conditions that all compensatory measures as stated in Part C of this Management Plan are complied with. I/We will comply with, and cause those employed to manage the premises to comply with, all compensatory measures as stated in the Management Plan.

3. The Management Plan will be incorporated into the conditions of sales in every assignment or as part of the tenancy agreement of the premises, if any. I/We will require subsequent owner / tenant to endorse a similar undertaking for incorporation into this Management Plan.

4. The Management Plan will be kept at both the management office and other areas easily accessible to occupants / visitors, e.g. the reception counter, for reference by both the occupants and visitors of the premises at all reasonable times.

5. I understand that contravention of any condition of a permit granted by the Building Authority under section 42 of the Buildings Ordinance is an offence under section 40(2)(b) thereof.

(Signature)

(Name and Capacity)

*Delete whichever is inapplicable

Reference

Legislations

1. Antiquities and Monuments Ordinance, Cap 53
2. Buildings Ordinance, Cap 123
3. Building (Construction) Regulations, Cap 123, Sub Leg B
4. Building (Planning) Regulations, Cap 123, Sub Leg F
5. Disability Discrimination Ordinance, Cap 487
6. Fire Services Ordinance, Cap 95
7. Fire Safety (Buildings) Ordinance, Cap 572
8. Fire Safety (Commercial Premises) Ordinance, Cap 502
9. Fire Service (Installations and Equipment) Regulations, Cap 95 Sub Leg B

Codes of Practice and Design Manual

10. Design Manual : Barrier Free Access 2008, Buildings Department
11. Code of Practice for Dead and Imposed Loads 2011, Buildings Department
12. Code of Practice for Foundations, Buildings Department
13. Code of Practice for Minimum Fire Service Installations and Equipment 2012, Fire Services Department
14. Code of Practice for Structural Use of Concrete 2013, Buildings Department
15. Code of Practice for the Structural Use of Steel 2011, Buildings Department
16. Code of Practice on Wind Effects in Hong Kong 2004, Buildings Department
17. Code of Practice for Fire Safety in Buildings 2011, Buildings Department¹⁴
18. Technical Guidelines on Minor Works Control System

Practice Notes

19. PNAP ADM-19, Re-engineering the Building Approval Process
20. PNAP APP-69, Conservation of Historic Buildings
21. PNAP APP-117, Structural Requirements for Alteration and Addition Works in Existing Buildings
22. PNAP APP-153, Code of Practice for Fire Safety in Buildings 2011

¹⁴ This Code replaces the 'Code of Practice for the Provision of Means of Escape in Case of Fire 1996', the 'Code of Practice for Fire Resisting Construction 1996' and the 'Code of Practice for the Provision of Means of Access for Firefighting and Rescue 2004'

Relevant Design Standards

23. BS 7913: 1998, The Principles of the Conservation of Historic Buildings, British Standards Institute

Relevant Guidelines and Publications

24. An Introduction to the Fire Safety (Commercial Premises) Ordinance Cap. 502, jointly issued by the Buildings Department and Fire Services Department.
25. An introduction to the Fire Safety (Buildings) Ordinance Cap. 572, jointly issued by the Buildings Department and Fire Services Department.
26. FSD Circular Letter No. 3/2006 Specification for Automatic Sprinkler Installations by Fire Services Department.
27. FSD Circular Letter No. 4/96 FSD Circular Letters by Fire Services Department.
28. Review of Built Heritage Conservation Policy 2.2004, Home Affairs Bureau
29. Appraisal of Existing Structures, The Institution of Structural Engineers, October 2010
30. Increasing the Fire Resistance of Existing Timber Floor, Building Research Establishment, BRE Digest 208
31. Timber Panelled Doors and Fire, Guidance Note, 1997, English Heritage
32. The Use of Intumescent Products in Historic Buildings, Guidance Note, 1997, English Heritage
33. Upgrading the Fire Resistance of Timber Panelled Doors, Technical Information Sheet 3, 1980, The Heritage Council of New South Wales

International Principles in Conservation

34. The Venice Charter (by ICOMOS)
35. The Burra Charter (by ICOMOS Australia)
36. The Principles for the Conservation of Heritage Sites in China (by China ICOMOS)

Enquiries

Practice Guidebook

Heritage Unit, Buildings Department:

Telephone : 2626 1354 / 2626 1576

Fax: 3157 1412

Email: enquiries@bd.gov.hk

Fire Services Installations

New Projects Division, Fire Services Department

Telephone : 2733 1568

Fax : 2722 6234

Email : fschq@hkfsd.gov.hk

Guidelines on Conservation

Antiquities and Monuments Office

Telephone : 2208 4400

Fax: 2721 6216

Email: amo@lcsd.gov.hk

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