GUIDANCE

Securing parapets and facades on unreinforced masonry buildings

Advice for building owners, councils and engineers

NZ BUILDING ACT

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HIKINA WHAKATUTUKI

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Ministry of Business, Innovation and Employment (MBIE)

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MBIE develops and delivers policy, services, advice and regulation to support economic growth and the prosperity and wellbeing of New Zealanders.

MBIE combines the former Ministries of Economic Development, Science and Innovation, and the Departments of Labour and Building and Housing.

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Introduction

Objective of the guidance

There is an increased risk of further earthquakes from Amberley in the South Island, to Lower Hutt in the North Island over the next 12 months, following the Hurunui/Kaikōura earthquake on 14 November 2016. The Government has made an Order in Council, amending the Building Act, to address the increased risk to public safety from unreinforced masonry (URM) buildings and contribute to overall public confidence in the performance of these buildings in Wellington City, Hutt City, Marlborough District and Hurunui District Council areas.

Owners of URM buildings who are notified by their council are required to secure the street-facing parapets and facades on their buildings within 12 months of the date of the notice. The parapets and facades must be secured within this time frame to reduce the risk of falling masonry.

The Government and affected councils have set up a fund to support building owners who are subject to this requirement. It will fund a contribution of approximately half of the design and construction work associated with securing parapets and/or facades, up to a maximum contribution of $10,000 for a URM parapet and $15,000 for a URM facade.

This guidance document is published by the Chief Executive of the Ministry of Business, Innovation and Employment (MBIE) under section 175 of the Building Act 2004 (the Building Act). It provides support to building owners, engineers, and councils to assist them with complying with their obligations under the Order in Council and the Building Act. It is a guide only and, if used, does not relieve any person of the obligation to consider any matter to which that information relates according to the circumstances of the particular case.

While this guidance is set out by section for building owners, councils and engineers respectively, if you are affected by the requirement under the Order in Council, each section in this document will provide useful information.

Background

URM buildings perform poorly in earthquakes. In an earthquake, parts of masonry can break away from a URM building and entire parapets or parts of the facade can collapse onto the ground.

Experience from Christchurch and overseas has shown that URM building failures can endanger lives. Thirty-nine people lost their lives when URM buildings failed during the Christchurch earthquake on 22 February 2011. These included building occupants, pedestrians and passengers on a passing bus.

The Canterbury Earthquakes Royal Commission of Inquiry was established to examine building issues in Christchurch following the 2011 earthquake. It found a need to secure or remove hazardous elements of URM buildings in the interests of public safety.

The current increased risk of further earthquakes in Wellington, Lower Hutt, Marlborough and Hurunui also increases the risk that vulnerable elements of URM buildings, such as parapets and facades, could fall and threaten people's safety in these areas. The risk increases significantly in locations that have high concentrations of street-facing URM buildings and high levels of pedestrian and vehicular traffic.

Securing parapets and facades of URM buildings is a cost-effective way to reduce the risk to people in future earthquakes.

Audience

The audience for this guidance includes:

- engineers
- building owners
- territorial authorities in areas with a heightened risk of earthquakes
- architects, designers and other building professionals
- Property Council New Zealand
- technical and professional societies such as the Institution of Professional Engineers New Zealand (IPENZ), the New Zealand Society for Earthquake Engineering Inc (NZSEE), Structural Engineering Society New Zealand Inc (SESOC) and the New Zealand Institute of Architects (NZIA)
- Earthquake Commission (EQC) and insurers in areas with a heightened risk of earthquakes
- heritage bodies, and business and resident associations in areas with a heightened risk of earthquakes.

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Section 1: Regulatory context

1.1 Hurunui/Kaikōura Earthquakes Recovery (Unreinforced Masonry Buildings) Order 2017

The Hurunui/Kaikōura Earthquakes Recovery (Unreinforced Masonry Buildings) Order 2017 (the Order in Council) was made under the Hurunui/Kaikōura Earthquakes Recovery Act 2016. It came into force on 28 February 2017 and will be revoked on 31 March 2018.

1.1.1 Modifications to the Building Act

The Order in Council makes the following modifications to the Building Act:

- Sections 121, 122 and 133AB: to create a new class of dangerous building – street-facing URM buildings
- Section 124: to enable territorial authorities to issue notices to owners requiring them to do work to secure the parapets and facades of their dangerous street-facing URM buildings within one year of the date of the section 124 notice
- Section 125: to outline the requirements for notices issued in respect of dangerous street-facing URM buildings, including the requirement to notify Heritage New Zealand Pouhere Taonga if the building is a heritage building
- Section 128A: to clarify that the existing penalties apply to owners who fail to comply with a notice relating to a street-facing URM building. Owners can be fined up to $200,000 for this offence
- Section 129: to clarify that a territorial authority may take further action if a street-facing URM building also poses an immediate danger
- Sections 131 to 132A: to confirm that territorial authorities are not required to review or amend their dangerous buildings policies in respect of street-facing URM buildings
- Part 3 of Schedule 1: to exempt building work needed to secure the parapets or facades from the requirement to obtain a building consent, as long as:
  - the design is carried out or reviewed by a chartered professional engineer
  - the design has regard to any applicable heritage values of the building or area in which the building is located to the extent that is reasonably practicable in the circumstances
  - the work is carried out in accordance with that design
  - the relevant territorial authority is advised of the intention to carry out any building work not less than three working days before any building work is carried out.

The modifications enable Wellington City, Hutt City, Marlborough District and Hurunui District Councils to issue notices under section 124 of the Building Act for URM buildings that have street-facing parapets or facades that have not been secured or strengthened to an acceptable standard and that may fall from the building onto any part of a listed street in an earthquake. The notices must be issued no later than 29 March 2017. The affected streets are set out in the Order in Council and the criteria used to select these streets are provided for information in section 1.1.3 below.

Building owners issued with a notice must secure the building and keep it secure so as to reduce or remove the danger posed by the URM parapets or facades that, in an earthquake, may fall from the building onto any part of a listed street. The work to secure the parapets and facades must be completed within 12 months of the date of the notice.

1.1.2 Modifications to the Resource Management Act (RMA)

The Order in Council also modifies the RMA so that resource consent is not required for work to secure the URM parapets and facades of street-facing URM buildings, as long as:

- the building owner has received a section 124 notice from Wellington City, Hutt City, Hurunui District or Marlborough District Councils and is required to secure the parapets and/or facades of the building within 12 months
- the work does not involve demolition (whether partial or full) of the building (including the parapet and/or facade).

1.1.3 Rationale for the streets included in the Order in Council

The specific streets/routes to which the requirement of the Order in Council applies are set out in the Order in Council itself. This determines where a building must be located in order for a council to issue a notice under section 124 requiring the street-facing parapet and/or facade to be secured. The listed streets will have some or all of the following characteristics:

- areas where people are concentrated (outdoor cafes, restaurants, bars, theatres, malls)
- public transport hubs or stops, or where people congregate for public transport
- in central business areas or areas of high economic or social activity
- arterial routes, state highways or key local routes
- areas of high foot traffic – for example walking routes to and from central or local public transport centres (eg railway station and car parking buildings)
- routes likely to be used by emergency services, either in an emergency or because they are the only route to central services such as hospitals.

1.2 Other relevant policies and legislation

The URM securing requirement, under the Order in Council, addresses a known risk in designated streets in a short time frame.

It will not replace the existing provisions for managing earthquake-prone buildings under individual council policies and the Building Act, or the future regime implemented by the Building (Earthquake-prone Buildings) Amendment Act 2016 (the Amendment Act), which was passed in May 2016 and is likely to come into force in July 2017.

Building owners who receive a notice from their council under section 124 of the Building Act with respect to 'street-facing URM buildings' may have also received a notice under section 124 for an 'earthquake-prone building'.

The earthquake-prone buildings provisions (current and future) address overall building performance in earthquakes longer term. Information on existing provisions can be found at www.building.govt.nz/managing-buildings/earthquake-prone-buildings-policy-framework/ and information on the treatment of priority buildings under the Amendment Act is provided in section 1.2.1 of this document.

1.2.1. Priority buildings under the Amendment Act

Under the Amendment Act, certain types of earthquake-prone buildings in high and medium seismic risk areas that are considered to present a greater risk, whether because of their construction type, or use or location, are treated differently. These are called priority buildings and will need to be identified and remediated in shorter time frames. There are two key categories of priority buildings:

- those prescribed in the Amendment Act, which include certain hospital, emergency and education buildings
- those determined by territorial authorities with community input, which include parts of URM buildings that could fall in an earthquake onto certain roads or thoroughfares, and buildings that could impede strategic routes if they were to collapse in an earthquake. For these types of priority buildings, councils will need to undertake a public consultation process to decide with their communities which roads and routes this prioritisation should apply to.

Buildings that are required to have secured parapets and/or facades under the regulatory modification in the Order in Council will most likely also fall under the priority buildings provisions of the Amendment Act. This is due to the fact that they have a part of a URM building that could fall in an earthquake onto certain roads or thoroughfares that have sufficient vehicular or pedestrian traffic to warrant prioritisation.

If the parapet and/or facade is permanently secured, to a level that makes that part of the building no longer earthquake prone, that is likely to also address the factor that makes it a priority building (the falling hazard). The building will still be required to be strengthened if it is found to be earthquake prone under the Amendment Act, however the time frame for remediation will be longer if it is not a priority building.

Temporary solutions may not be sufficient to move the building outside the priority building regime. The building would likely still be subject to reduced priority building time frames for strengthening the building as a whole.

Section 2: Advice for building owners

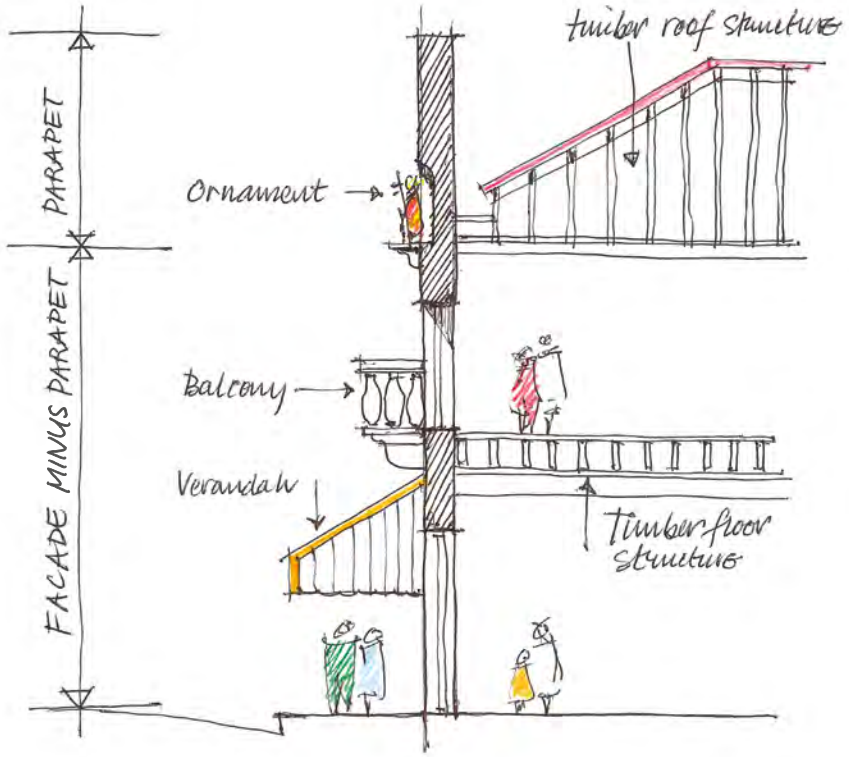
This advice is for building owners who receive a notice from their council under section 124 of the Building Act, as modified by the Order in Council, requiring them to secure the parapet and/or facade on their street-facing unreinforced masonry (URM) building.

This section guides building owners through the process to follow when they get a notice. It also gives advice on applying for funding support.

2.1 Why parapets and facades of URM buildings are considered high risk

A URM building has masonry walls that do not contain steel, timber or fibre reinforcement. URM buildings are older buildings that often have parapets, as well as verandahs, balconies, decorative ornaments, chimneys, and signs attached to their facades (front walls that face onto a street or open space).

Figure 1: *A typical example of the parapet and facade of a small URM building is illustrated below. A parapet is the section of front wall that is elevated above the roof eaves line.*

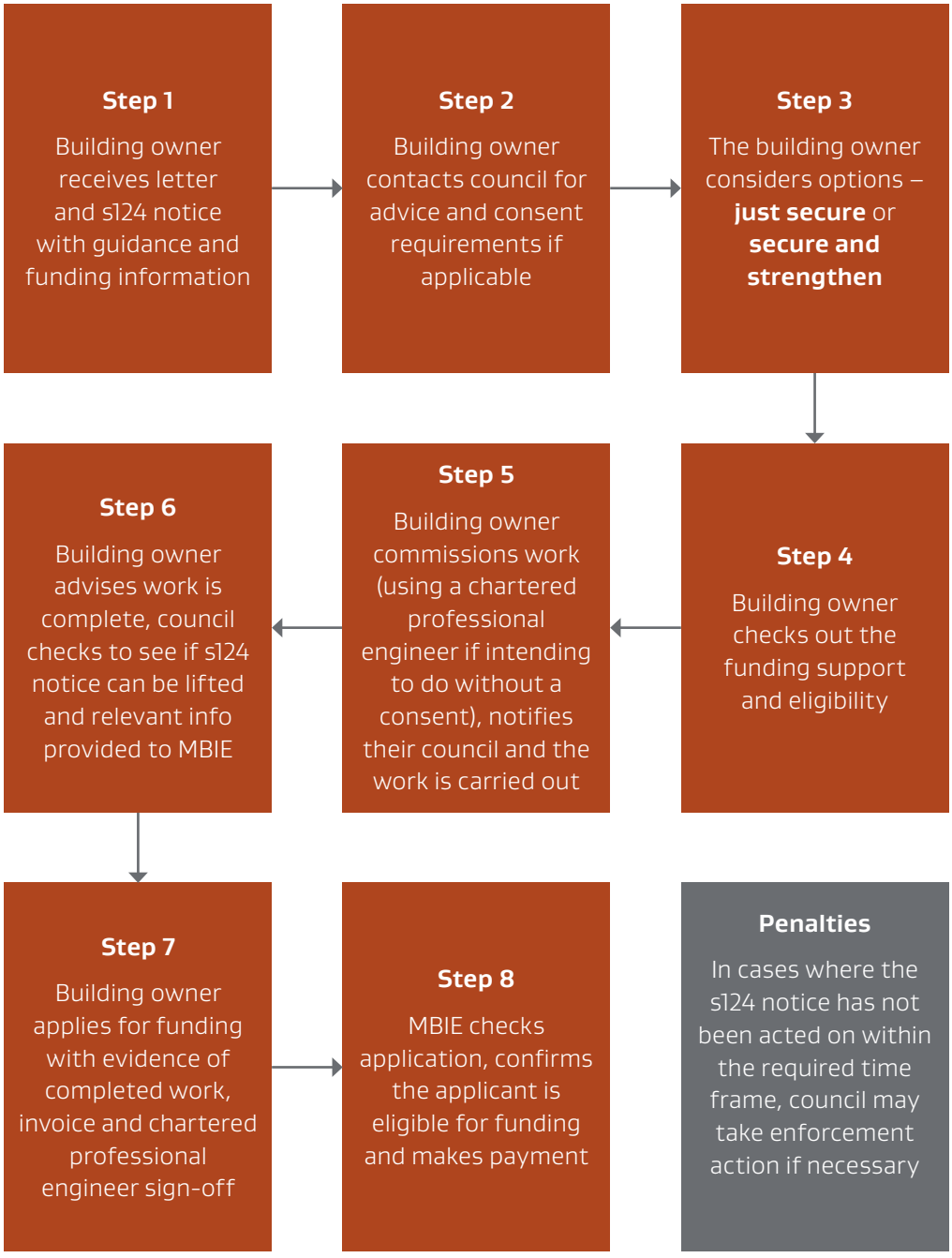


Experience from Christchurch and overseas shows that unsecured URM parapets and facades on URM buildings perform poorly in earthquakes. Figure 2 shows a facade that collapsed in the 2011 Christchurch earthquake and the debris that fell into the surrounding public spaces.

Figure 2: *Christchurch, February 2011.*

The front facade to the left has collapsed and there is partial collapse to the right-hand side. (Photo: Win Clark)

2.2 The process to follow when you receive a notice to secure the parapet and/or facade of a URM building



Step 1: receiving a notice

You are likely to receive a notice from your council under section 124 of the Building Act if you are the owner of a URM building:

- that is located on a street specified in the Order in Council
- that has a parapet and/or facade that has not been strengthened or secured to an acceptable standard, to prevent it falling in an earthquake.

The notice will instruct you to secure the parapet and/or facade within 12 months of the date the notice was issued, so that the risk of it falling is reduced or removed.

The following steps set out how a building owner might ensure the securing work meets the requirements of the notice.

Note: If you are issued with a notice to secure the URM parapet and/or facade under section 124 of the Building Act (as modified by the Order in Council) and believe that these building components are already secure, you should provide evidence to the council as soon as possible after you receive the notice. Evidence may include:

- copies of permits/consents and compliance documentation for securing or strengthening work
- engineering reports (reports completed earlier may need updating to reflect current seismic loading requirements)
- relevant site reports and/or producer statements
- photographs of any work done to confirm work has been completed.

Step 2: talk to your local council

It is a good idea to contact the council and ask for their advice. They will help you to consider your options.

Council staff can give you advice on:

- where and how you apply for funding support
- ways to respect heritage values – if you have a heritage building it is recommended that you talk to your council heritage advisor and Heritage New Zealand Pouhere Taonga
- the actions, permits and costs required if the securing work involves fencing off part of the street or pavement, eg an encroachment licence, notice of road closure, traffic management plan, parking fees and permits
- the building and/or resource consents required for any additional building or strengthening work you may decide to do.

Step 3: consider your options

Securing the parapets and facades of URM buildings is a measure to reduce the risk to public safety quickly. If it is structurally possible, you can consider strengthening the whole building and use the funding support for parapets and facades to cover that part of the overall cost. A chartered professional engineer can give you advice on what is structurally possible and suggest a design solution for your building. For assistance to find an engineer check the following web page: www.ipenz.nz/home/footer-pages/for-the-public/help-with-engineers-or-engineering/how-to-find-an-engineer

You need to think about:

- the resources you can commit to the project in the next 12 months
- the potential impact on tenants in the building and any notice you need to give them – structural work may affect the tenants' ability to run a business, make certain areas of the building inaccessible or difficult to use, or interfere with the 'quiet enjoyment' of the building.

Below are several scenarios that may help if you:

- have already received a section 124 notice because your building is deemed to be earthquake prone
- have a heritage building
- are planning to strengthen your building but may not have the funds within 12 months.

It's a good idea to discuss your options with a chartered professional engineer.

Scenario 1

You already have a section 124 notice (in relation to an earthquake-prone building) requiring the building to be strengthened within a certain time frame, and you receive a further section 124 notice because your building is a street-facing URM building.

- You have to strengthen the building as a whole within a (longer) specified time frame, as well as secure the parapet and/or facade within 12 months.
- You could decide to do all of the required work in the next 12 months: secure the parapet and facade; and strengthen the building. You would need to contact your council to make sure you obtain the necessary consents.
- Alternatively, you could treat the work to secure the parapet and/or facade as the first stage of strengthening, which may not require building or resource consent. You will still have to fully strengthen the building within the time specified on the earthquake-prone building notice.
- Strengthening the whole building will cost more and take longer than securing the parapet and facade. Get an engineering assessment to scope the work.

Scenario 2

You own a heritage building.

- The council will send a copy of the section 124 notice to Heritage New Zealand Pouhere Taonga.
- The design for the securing work should have regard to the heritage values of the building as much as is reasonably practicable in the circumstances. Contact your council heritage advisor or Heritage New Zealand Pouhere Taonga for assistance.
- If you intend to demolish or partially demolish the parapet and/or facade, then standard consenting requirements will apply, and you will not be eligible for funding support.
- It is worth considering strengthening the building as well as securing the parapet and/or facade. There are funds to support strengthening of heritage buildings. See Step 4 in section 2.2 for details on these funds. You could:
  - get support from the Unreinforced Masonry Buildings Securing Fund to do the work on the parapet and/or facade
  - apply to other funds for support to strengthen the rest of the building.

Scenario 3

You plan to strengthen the whole building but need time to obtain the funds.

- You still need to secure the parapet and facade within 12 months. You could use a temporary solution as a holding option until you can strengthen the whole building.
- Temporary solutions are quick to put in place and less expensive, however they have a short life and require regular maintenance and testing.
- Consider the visual effect on the building. Talk to your engineer, council and Heritage New Zealand Pouhere Taonga for advice.
- If your building is earthquake prone you will still have to strengthen it within the required time frames. You could treat the work to secure the parapet and/or facade as the first stage of strengthening.

Both temporary and permanent solutions can be satisfactory options for securing URM parapets and facades to reduce the risk of the parapet and/or facade from falling in an earthquake.

Temporary solutions	Permanent solutions
Quick to put in place	Require more consideration (ie careful design) and work can take longer
The initial costs can be cheaper than most permanent solutions, but not as durable	Likely to cost more in the short term but will last longer and are likely to be a better solution in the long term
Enable you to improve public safety and protect heritage features until you can strengthen the building	Enable you to improve public safety and protect heritage features in the long term
Can be visually intrusive	Good practice permanent solutions are not visually intrusive
Can limit use of spaces in buildings, ie where temporary tie rods or straps pass through habitable rooms, often on top floors	Good practice permanent solutions can be designed to limit effects on habitable rooms
Not a substitute for overall strengthening – in most cases permanent strengthening work will still be required in the future	Can be the first stage of overall strengthening work

Other considerations

- You don't need a **building consent** to secure the parapet and/or facade within 12 months **as long as**:
  - the building work is designed or reviewed by a chartered professional engineer
  - the work done follows the engineer's design
  - the work respects the heritage values of the building and area as far as is reasonably practicable in the circumstances (see Appendix A for advice)
  - the council is notified at least three days before any work begins (see section 1.1.1 for full details).
- Where the above conditions are not met, or if you choose to do more advanced strengthening work, building work that is not the work required in the notice, or demolition, the exemption from obtaining building consent for the securing work will not apply.

- You should obtain advice from your council on whether a building consent is required for the work you are intending to undertake or whether it falls within the exemption in the Order in Council or within any of the other existing exemptions in Schedule 1 of the Building Act.
- Any new building work must comply with the Building Code, whether a building consent is required or not.
- You don't need a **resource consent** to secure the parapet and/or facade within 12 months **as long as** the work:
  - is the work that is required to be done under a notice issued by the relevant council under the Order in Council
  - does not involve demolition (whether partial or full) of the building (including the parapet and/or facade).
- You will need to keep records of the works undertaken. More information is in Steps 6 and 7 below.

Step 4: check out the funding support

Unreinforced Masonry Buildings Securing Fund

In recognition of the public and private benefits from securing URM parapets and facades on URM buildings, the Government and affected councils have established a $4.5 million fund to support building owners in areas where there is a heightened risk of earthquakes.

The fund will contribute approximately half of the costs of the actual work involved in securing the parapet and/or facade, up to a maximum of $10,000 for a parapet and $15,000 for a facade. The fund is only available for building work to satisfy the requirement to secure URM parapets and facades where a building owner has been issued with a notice under section 124 of the Building Act (as modified by the Order in Council) for 'street-facing URM buildings'.

The scope of securing work eligible for funding support includes the cost (exclusive of GST) of:

- designing and specifying the strengthening solution, including consideration of heritage values
- monitoring, to ensure the strengthening solution is constructed correctly
- tendering and any additional contract supervision
- physical work, including:
  - labour and materials
  - accessing the parapets and facades (such as scaffolding, craneage)
  - essential safety measures to protect workers, occupants and the public from hazards arising from falling from height, falling building materials and equipment, and obstacles in pathways
  - rubbish removal and site clean-up
  - minor cosmetic 'making good' work.

There will be additional costs that are not covered by the support fund. The following costs not directly associated with the securing work are excluded from funding eligibility:

- demolition
- business interruption costs
- costs associated with incidental identification and removal of asbestos or other hazardous substances
- labour or services provided by the owner or a direct relative of the owner, unless that person is suitably qualified (eg chartered professional engineer, licensed building practitioner, member of a trade association in a trade or profession applicable to the securing work)
- incidental improvements
- legal costs
- permits and fees charged by the council for vehicle parking, easements etc
- costs associated with work prior to the 2016 Hurunui/Kaikōura earthquake.

The fund is administered by the Ministry of Business, Innovation and Employment (MBIE). Building owners apply for support when the work has been done, and information on this is set out in Step 7 below.

Support for heritage buildings

If you own a heritage building, see Appendix A for information on respecting heritage values and examples of good practice, and contact your council heritage advisors for advice.

If you plan to strengthen the building as well as secure the parapet and/or facade, there are other funds that support this work. It is not possible to get support from two funds for the same work, eg to get support from two funds to secure the parapet and/or facade of a building. However, owners of a heritage building could apply to the Unreinforced Masonry Buildings Securing Fund to secure the parapet and facade and apply to the Heritage EQUIP fund, for example, for support to strengthen the building excluding the parapet and facade.

Heritage EQUIP Fund

The Heritage EQUIP fund, administered by the Ministry for Culture and Heritage, provides support to strengthen earthquake-prone heritage buildings. There is further information on the Heritage EQUIP fund at www.heritageequip.govt.nz

Built Heritage Incentive Fund (BHIF)

This fund helps owners preserve, restore and protect the heritage values of their buildings. Wellington and Hutt City Councils operate BHIFs. There is further information at:

- wellington.govt.nz/services/community-and-culture/funding/council-funds/built-heritage-incentive-fund
- www.huttcity.govt.nz/heritage-fund

Wellington City Council offers rates remission, consent fee rebates and free first resource consent pre-application meetings for strengthening projects that require a resource consent. Hutt City Council offers free advice to building owners and a range of development remissions for specific work in the city. Hurunui District Council has a small heritage grant fund.

Step 5: commission the work

- Engage a chartered professional engineer[1] to design and review the work. The following website has information on engaging a chartered professional engineer: www.ipenz.nz/home/footer-pages/for-the-public/help-with-engineers-or-engineering/how-to-find-an-engineer
- If you have a heritage building it is advisable to engage a chartered professional engineer who is experienced in work on heritage buildings. The Heritage EQUIP website www.heritageequip.govt.nz has information on how to engage professionals when dealing with a heritage building.
- Ensure your chartered professional engineer is familiar with the securing requirement in the Order in Council, and the performance guidelines set out in section 4 of this document.
- There may be pressure on engineering and building resources. Consider working with other building owners and jointly engaging an engineer and building contractor, and ask your council if they can help a group of owners jointly commission an engineer or contractor.
- Be sure to work with your neighbours to agree an approach to such features as shared facades or verandahs, if they are in scope of the securing requirement, as set out in sections 3.5.1 and 4.2.1.
- Talk to your chartered professional engineer about the pros and cons of temporary and permanent securing work.
- Ensure you agree a design that is suitable for your building and your budget, and takes into account heritage concerns, as far as is practicable in the circumstances.
- Once the chartered professional engineer has drawn up the design, be sure to inform your council of the intention to carry out the building work at least three days before the work begins.
- You may also need to engage a weathertight specialist (a licensed building practitioner) to review the securing design.
- If your work involves fencing off part of a pavement or street, ensure you have taken the necessary steps and have the right permits.
- Ensure your building contractor has a health and safety plan and follows that plan.
- Keep all the relevant documentation, including invoices and the engineer's site notes and sign-off.

1 A chartered professional engineer is required for building owners who wish to take advantage of the exemption from consenting requirements. Building owners may opt to engage another design professional, such as a licensed building practitioner, instead of a chartered professional engineer. If you do this, you will require a building consent for the work.

Step 6: notify the council when the work is complete

When the work is complete, and has been reviewed and signed-off by the chartered professional engineer, notify your local council.

Supply all relevant design and completion documentation to the council. This is evidence that the parapet and/or facade has been secured appropriately.

Suitable evidence of the design work undertaken includes:

- a statement of competency from the chartered professional engineer doing the design work. This should include the registration number as well as a brief summary of the engineer's experience in designing seismic remediation solutions
- a design summary of the securing work, which should include:
  - a description of the items that were identified as being unsecured
  - the design philosophy used for the solutions, including whether any solutions contained in this document were used
  - the plans and specifications for the securing work confirming that the connections satisfy the securing requirements in the Order in Council.

Suitable evidence for the construction work undertaken includes:

- a statement from the chartered professional engineer who did the design work that it has been completed in accordance with his or her design, with details of any changes to the design needed during construction. This might be supported, if necessary, by site notes, a PS1 and a PS4 signed by the chartered professional engineer
- photographs that show the completed work
- a statement from the builder that the work has been completed in accordance with the plans and specifications of the design and that identifies any construction changes agreed with, and approved by, the chartered professional engineer.

The council will check this documentation to be satisfied that the parapet and/or facade has been secured so that it meets the requirement of the Order in Council, to reduce the risk of falling in an earthquake. If it is satisfactory, they will lift the section 124 notice and notify MBIE.

Note that other section 124 notices will not be affected. For example, if the building is subject to another notice requiring the building to be strengthened because it is earthquake prone, that notice will remain in force.

Step 7: apply to the Unreinforced Masonry Buildings Securing Fund

Apply to MBIE for support from the Unreinforced Masonry Buildings Securing Fund. You can find information at www.building.govt.nz/urm. You will need to provide evidence to support your claim, including:

- a written copy of advice from the council to show that the building is now secure and the section 124 notice has been complied with

- itemised invoices that:
  - relate to the recoverable costs, eg explicit stating of 'costs associated with protecting those doing securing remediation'
  - state both labour hourly rate and hours claimed, supported with contractual documents. If fixed costs, evidence that costs were agreed in advance and any agreed escalation payments will be required
  - clearly separate qualifying work and non-qualifying work where building work is done for work outside of the section 124 obligations
- a declaration from the owner that claims are true and correct.

The application form sets out the required format for information to support your claim.

Step 8: MBIE decision

- MBIE will receive your application, and check that all the information required has been provided and that you are eligible for funding.
- All claims meeting the administrative criteria (ie all evidence is provided) will be approved unless:
  - there are clear discrepancies between normal and claimed expenditure (eg an engineer's charge-out rate is significantly outside guidelines)
  - companies providing services which are invoiced cannot be located on the Companies Office Register or other sources of verification of existence.
- Where there are discrepancies, owners will be required to justify or explain, or be given the opportunity to withdraw their claim.
- Once eligibility is confirmed, MBIE will make payment directly to your nominated bank account.

2.3 Penalties

If the territorial authority considers, on reasonable grounds, that the building remains a danger as a result of the parapet and/or facade not being secured within the 12-month period, it can take enforcement action against you. That could include applying to the District Court for an order allowing them to carry out the work, at your cost, or taking other enforcement action against you which could include fines of up to $200,000.

Section 3: Advice for affected councils

Territorial authorities are responsible for overseeing the requirement to secure unreinforced masonry (URM) parapets and facades under the Order in Council.

This section sets out the key functions and roles of territorial authorities resulting from the modifications in the Order in Council.

3.1 Identifying buildings subject to the Order in Council securing requirement

The requirement in the Order in Council will capture URM buildings, which are located on one of the streets listed in the Order in Council, and that have a parapet and/or facade that has not been strengthened or secured to an acceptable standard so as to reduce or remove the danger of those parts falling from the building onto any part of a listed street.

It is the responsibility of the affected territorial authorities to identify the specific buildings subject to the requirement in their area.

When considering whether parapets and/or facades have been strengthened or secured to an acceptable standard, territorial authorities will need to consider any evidence of securing or strengthening provided by building owners as well as information contained on the council's property file. It is anticipated that, where a building's parapets and facades have not been secured or strengthened by way of a connection to the primary structure that is at least 34% of the New Building Standard, they are unlikely to have been secured or strengthened to an acceptable standard. The connection from the parapet and/or facade to the primary structure must reduce or remove the danger of the parapet and/or facade falling.

A number of buildings with parapets and/or facades that have not been secured or strengthened to an acceptable level and are therefore subject to requirements in the Order in Council will be in different existing regulatory situations, such as:

- buildings already identified by the relevant territorial authority as earthquake prone (whether issued with a notice under section 124 of the Building Act or not)
- buildings that have undergone prior earthquake strengthening
- buildings not yet identified as earthquake prone or potentially earthquake prone.

3.2 Issuing notices under section 124 for 'street-facing URM buildings'

Once a territorial authority has identified the buildings in their area subject to the securing requirement in the Order in Council, they can issue a notice under section 124 of the Building Act. These notices must be issued no later than 29 March 2017 and need to:

- be in writing
- be given in the form of a copy to the owner and occupiers of the building, and to Heritage New Zealand Pouhere Taonga if the building is a heritage building
- state the time within which the building work must be carried out, which must be 12 months from the date of the notice
- state whether the building owner is required to obtain a building consent to carry out the work required by the notice.

The notices do not need to be displayed on the building.

When issuing the notices, territorial authorities should assist owners by providing a printed copy of this guidance document and information on the application process for funding support.

Territorial authorities should provide MBIE with relevant information about the notices issued to owners to assist with MBIE's monitoring and evaluation role.

Note: A building owner who is issued with a notice to secure the URM parapet and/or facade under section 124 of the Building Act (as modified by the Order in Council), and who believes that these are already secure, should provide evidence to the territorial authority as soon as possible. Evidence may include:

- copies of permits/consents and compliance documentation for securing or strengthening work
- engineering reports (reports completed earlier may need updating to reflect current seismic loading requirements)
- relevant site reports or producer statements
- photographs of any work done to confirm work completed.

3.3 Liaising with building owners

Many building owners issued with a notice under section 124 as modified by the Order in Council may require assistance to understand their obligations. Affected owners are encouraged in section 2 of this guidance to contact their local councils for further information and assistance.

Queries are likely to relate to the following processes:

Building consent

The Order in Council creates an exemption from the requirement of the Building Act to obtain a building consent. This exemption is only for the building work required by the Order in Council to secure the parapets and/or facades so as to reduce or remove the danger that they pose. It does not cover other building work.

The exemption from obtaining a building consent for securing work only applies if:

- the design is carried out or reviewed by a chartered professional engineer
- the design has regard to any applicable heritage values of the building or area in which the building is located to the extent that is reasonably practicable in the circumstances
- the work is carried out in accordance with that design
- the relevant territorial authority is advised of the intention to carry out any building work not less than three working days before any building work is carried out.

Where the above conditions are not met, or if a building owner opts to do more advanced strengthening work, building work beyond the requirement of the Order in Council, or demolition, the exemption from obtaining building consent for the securing work will not apply.

Building owners should obtain advice from their council on whether a building consent is required for the work that they are intending to undertake, or whether it falls within the exemption in the Order in Council or within any of the other existing exemptions in Schedule 1 of the Building Act.

Resource consent

The Order in Council modifies the Resource Management Act so that the work required to be done under a section 124 notice, issued under the Order in Council, is a permitted activity. This means owners carrying out the required work will not need to obtain a resource consent for that work. This is only applicable if the securing work:

- is the work required by the section 124 notice for 'street-facing URM buildings', and
- does not involve any demolition (partial or full) of the building (including the parapet and/or facade).

Where the above conditions are not met, or a building owner opts to do more advanced strengthening work, building work not required by the Order in Council, or demolition, they may need to obtain a resource consent, depending on the building work proposed.

Territorial authorities should obtain more information about the proposed building work, where necessary, to be able to accurately advise owners on their consenting requirements.

Heritage considerations

Advice for owners and engineers on how to respect heritage values while undertaking securing work is provided in Appendix A of this document. There are also a number of design considerations set out in section 4 to assist engineers in designing appropriate securing solutions for heritage buildings.

Owners of heritage buildings may have additional questions or concerns. Council heritage advisors are encouraged to assist these owners where possible.

Additional permits or consents

Although many affected building owners undertaking securing work will be exempt from obtaining building or resource consents, they may need to obtain additional permits or consents, such as encroachment licences or road closure permits, to carry out the work.

Building owners are encouraged to approach their councils for advice on additional permits or consents that may be required to carry out the securing work. Councils are encouraged to assist building owners promptly, to ensure they can obtain these without delay.

Providing advice for commissioning contractors to do the work

Affected building owners will need to engage a chartered professional engineer in the design phase of the securing work if they wish to do the work without obtaining a building consent. They will also need to engage additional construction professionals to undertake the work itself.

There is expected to be significant pressure on available resources to undertake the amount of securing work required within the specified time frame.

Building owners are encouraged to work with neighbouring affected building owners to share resources.

Councils may wish to set up a network of engineers and contractors available to undertake this work in their areas to support building owners to access appropriate resources to meet their obligations.

3.4 Record notification of the intention to undertake securing work

If owners are intending to do the securing work without obtaining a building consent, the Order in Council requires them to notify their territorial authority of the intention to carry out any building work not less than three working days before any building work is carried out.

While this is one of the conditions required for the work to be exempt from the requirement to obtain a building consent, it is also an important mechanism for monitoring the securing work underway. It will assist with monitoring how the risk posed by falling URM parapets and facades is being managed progressively over the 12-month period.

Territorial authorities are encouraged to pass this information on to the Ministry of Business, Innovation and Employment (MBIE), to assist with MBIE's monitoring and evaluation role.

3.5 Process to lift a section 124 notice for 'street-facing URM buildings'

It is the responsibility of the territorial authority to both issue a notice under section 124 of the Building Act for 'street-facing URM buildings', and to lift the notice once the requirements of the notice have been satisfied.

This section provides indicators to assist territorial authorities to decide whether the securing work has been done adequately.

3.5.1 Scope of attachments to parapets and facades required to be secured

Any attachments in scope should be adequately secured as part of the securing work for the parapet and/or facade to meet the requirements of the section 124 notice.

Attachments, such as balconies and verandahs, are commonly affected in earthquakes due to the impact of something from above, ie a falling parapet. Attachments to parapets, such as ornaments, therefore need to be secured to meet the requirement of the Order in Council.

The performance guidelines set out in section 4.2.2 of this document indicate the floor levels of the building at which the parapet or facade should be connected to the primary structure to adequately secure these elements. These guidelines recommend that for two-storey buildings, the facade is connected to the primary structure at the roof level. For buildings greater than two storeys, it is recommended that the facade is connected to the primary structure at the top floor and roof levels.

If an attachment, such as a balcony, is positioned on the facade at the same floor level as the recommended connection from the facade to the primary structure (see Figure 4), this attachment will also need to be secured to meet the requirement of the Order in Council.

This means that, in most cases, attachments positioned below the top storey of the building, such as verandahs, will not be in scope of the securing requirement. However it is recommended that the engineer considers the structural condition of these attachments and advises building owners where there may be an issue.

3.5.2 Securing URM parapets and facades to satisfy the securing requirement

Securing work must satisfy the requirement under the Order in Council to reduce or remove the danger of the parapet and/or facade falling in an earthquake onto a listed street.

In this context, connections from the parapet and/or the facade to the primary structure of the building that are less than 34% of the New Building Standard are unlikely to satisfy the requirements. A connection that is less than 34% of the New Building Standard is unlikely to reduce or remove the risk of the parapet or facade falling.

It is recommended that for two-storey buildings, the facade is connected to the primary structure at the roof level. For buildings greater than two storeys, it is recommended that the facade is connected to the primary structure at the top floor and roof levels. The examples of temporary and permanent securing concepts in Appendix B illustrate this.

To make sure that the parapet and/or facade is sufficiently secured from the risk of falling in an earthquake, the securing work should:

- use securing concepts in this guidance document, or an alternative engineered design supervised by a chartered professional engineer
- be adapted for the building undergoing the securing work by a chartered professional engineer in the design phase of work
- be constructed/undertaken in accordance with the design, and monitored by a chartered professional engineer to Construction Monitoring Level CM3
- comply with the Building Code.

Appropriate evidence to check securing work undertaken

Territorial authorities will need to check any documentation supplied by building owners, including design and completion documentation, so they can assess whether the work required by the section 124 notice has been done.

Suitable evidence of the design work undertaken could include:

- a statement of competency from the chartered professional engineer doing the design work. This should include the registration number as well as a brief summary of the engineer's experience in designing seismic remediation solutions

- a design summary of the securing work, which should include:
  - a description of the items that were identified as being unsecured
  - the design philosophy used for the solutions, including whether any solutions contained in this document were used
  - the plans and specifications for the securing work confirming that the connections satisfy the securing requirements in the Order in Council.

Suitable evidence for the construction work undertaken includes:

- a statement from the chartered professional engineer who did the design work that it has been completed in accordance with his or her design, with details of any changes to the design needed during construction. This might be supported, if necessary, by site notes, a PS1 and a PS4 signed by the chartered professional engineer
- photographs that show the completed work
- a statement from the builder that the work has been completed in accordance with the plans and specifications of the design and identifies any construction changes agreed with, and approved by, the chartered professional engineer.

Once the territorial authority has checked this documentation, if they are satisfied on reasonable grounds that the parapet and/or facade has been secured, so that the danger of those parts falling in an earthquake is reduced or removed, they can confirm to the owner that the section 124 notice has been complied with.

Note that other section 124 notices will not be affected. For example, if the building is subject to another notice requiring the building to be strengthened because it is earthquake prone, that notice will remain in force.

Notify MBIE that the work required by the section 124 notice has been completed

Once a territorial authority has confirmed that the work required by a section 124 notice for 'street-facing URM buildings' has been completed, the territorial authority should also provide the relevant information to MBIE.

This is important to enable MBIE to administer funding support when an application is received from a building owner.

3.6 Enforcement

If the territorial authority considers on reasonable grounds that the building remains a danger as a result of the parapet or facade not being secured within the 12-month period, it can take enforcement action against the owner. That could include applying to the District Court for an order allowing the territorial authority to carry out the work at the building owner's cost, or taking other enforcement action, which could include fines of up to $200,000 for the building owner.

Section 4: Advice for engineers

Unreinforced masonry (URM) parapets and facades generally fail in moderate to major earthquakes because the masonry (particularly the mortar) is brittle or weak, or the connection back into the body of the building is weak. The 2011 Christchurch earthquake demonstrated the impact of an earthquake on URM parapets and facades and the potential risk to the public.

Figure 3: *Christchurch, February 2011. Brick masonry parapet and facade have collapsed onto the pavement. Note only minor fixing between front facade brickwork and brick partitions at right angles. There is no fixing of facade brickwork back into roof framing that could provide support from the body of the building. The extension of the partition wall above the roofline has collapsed onto the adjacent roofing. Other areas of failure associated with facades are the brick piers between window and door openings, and brick masonry return walls adjacent to front facades. (Photo: Win Clark)*

The Government initiative requiring URM parapets and facades to be secured and kept secure relies on suitable engineering input.

For building owners to be exempt from consenting requirements for the securing work, the work must be designed and reviewed by a chartered professional engineer.

Each building will have its own characteristics and the chartered professional engineer will need to develop an appropriate design. This section aims to support the design of securing solutions that are efficient and ensure parapets and/or facades are adequately secured. It is supported by the securing concepts set out in Appendix B.

It includes:

- performance guidelines for securing work in this context
- design considerations for securing solutions
- an introduction to the permanent and temporary securing concepts for parapets and/or facades set out in Appendix B.

4.1 Objective of the securing concepts

Securing parapets and facades to the main building fabric will significantly improve the seismic performance of these features, but is not a substitute for strengthening of the overall structure of a URM building.

The objective of the solutions recommended in this guidance is to secure parapets and walls (facades) against out-of-plane failure (collapse) by tying them back to the main body of the building.

Construction options include adding structural connections to secure the masonry back to the roof, floor and structural walls of the building, and temporary solutions such as clamping, strapping and through-bolting.

The concepts outlined in Appendix B will need to be adapted, depending on the configuration of the building and its existing structural elements. The engineer will need to look at the existing structural elements to which the parapet and/or facade is being connected and make a judgment, based on experience, as to whether these structural elements are capable of providing reasonable restraint for the likely out-of-plane seismic loads imposed by the parapet and/or facade. This does not mean a detailed assessment of the structure with fully calculated capacities. Refer to Figure 4 and Note 1 to Figures 12-22 in Appendix B for the addition of sub diaphragms.

All of the construction options illustrated in this guidance are eligible for funding from the Unreinforced Masonry Buildings Securing Fund. There are a range of other protection measures that can be taken, such as pedestrian protection canopies, however this document focuses on securing concepts.

The Ministry of Business, Innovation and Employment (MBIE) may provide additional securing concepts for engineers in the near future, if required, to assist with securing the parapets and/or facades of URM buildings.

For further information on the seismic assessment of URM buildings, see www.eq-assess.org.nz/

4.2 Performance guidelines for securing work

Performance guidelines help ensure that securing work required by the Order in Council effectively reduces the risk of URM parapets and facades from falling during the period of heightened earthquake risk.

Performance guidelines can also help to:

- reduce demands on engineering resource capacity in the design stage
- support territorial authorities with implementation of the requirement
- enable a clear mechanism by which an owner can demonstrate compliance with the section 124 notice issued for 'street-facing URM buildings'.

4.2.1 Scope of attachments to parapets and facades required to be secured

Any attachments in scope should be adequately secured as part of the securing work for the parapet and/or facade to meet the requirements of the section 124 notice.

Attachments, such as balconies and verandahs, are commonly affected in earthquakes due to the impact of something from above, ie a falling parapet. Attachments to parapets, such as ornaments, therefore need to be secured to meet the requirement of the Order in Council.

The performance guidelines set out in section 4.2.2 below indicate the floor levels of the building at which the parapet or facade should be connected to the primary structure to adequately secure these elements.

If an attachment, such as a balcony, is positioned on the facade at the same floor level as the recommended connection from the facade to the primary structure (see Figure 4), this attachment will also need to be secured to meet the requirement of the Order in Council.

This means that, in most cases, attachments positioned below the top storey of the building, such as verandahs, will not be in scope of the securing requirement. However it is recommended that the engineer considers the structural condition of these attachments and advises building owners where there may be an issue.

4.2.2 Securing URM parapets and facades to satisfy the securing requirement

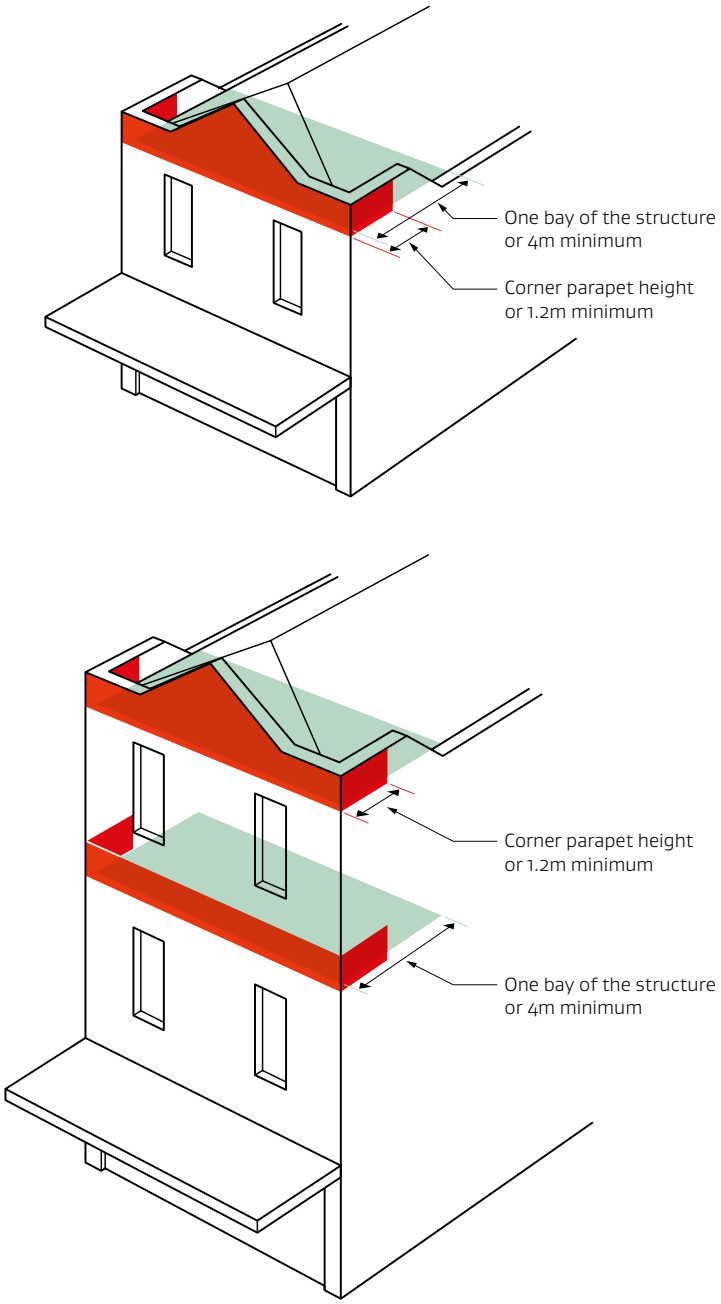
Securing work must satisfy the requirement under the Order in Council to reduce or remove the danger of the parapet and/or facade falling in an earthquake.

In this context, connections from the parapet and/or the facade to the primary structure of the building that are less than 34% of the New Building Standard are unlikely to satisfy the requirements. A connection that is less than 34% of the New Building Standard is unlikely to reduce or remove the risk of the parapet or facade falling.

Since owners must complete the securing work within 12 months, it is recommended that for two-storey buildings, the facade is connected to the primary structure at the roof level. For buildings greater than two storeys, it is recommended that the facade is connected to the primary structure at the top floor and roof levels. This concept is detailed in Figure 4 on page 31, and temporary and permanent securing concepts in Appendix B assist engineers to develop designs that support this recommendation. For a definition of primary structure see Appendix C: Glossary of engineering terms.

This will significantly reduce the risk of the parapet or facade falling in an earthquake, but the overall building may still be earthquake prone and considered a priority building when the Building (Earthquake-prone Buildings) Amendment Act comes into force.

Figure 4: *Scope diagrams showing one and two-storey buildings. Areas shown in red must be secured back to areas shown in green to make sure that the parapet and facade are secure from falling. It is recommended that, where practicable, the green areas are more robustly secured to the main body of the building.*



To make sure that the parapet and/or facade is sufficiently secured from the risk of falling in an earthquake, the securing work should:

- use securing concepts in this guidance document, or an alternative engineered design supervised by a chartered professional engineer
- be adapted for the building undergoing the securing work by a chartered professional engineer in the design phase of work
- be constructed/undertaken in accordance with the design, and monitored by a chartered professional engineer to Construction Monitoring Level CM3
- comply with the Building Code.

Building owners should supply all relevant design and completion documentation to their council as evidence that the work to secure the parapet and/or facade meets the requirements of the Order in Council. Engineers will need to ensure this work is well documented.

Suitable evidence of the design work undertaken could include:

- a statement of competency from the chartered professional engineer doing the design work. This should include the registration number as well as a brief summary of the engineer's experience in designing seismic remediation solutions
- a design summary of the securing work, which should include:
  - a description of the items that were identified as being unsecured
  - the design philosophy used for the solutions, including whether any solutions contained in this document were used
  - the plans and specifications for the securing work confirming that the connections satisfy the securing requirements in the Order in Council.

Suitable evidence for the construction work undertaken includes:

- a statement from the chartered professional engineer who did the design work that it has been completed in accordance with his or her design, with details of any changes to the design needed during construction. This might be supported, if necessary, by site notes, a PS1 and a PS4 signed by the chartered professional engineer
- photographs that show the completed work
- a statement from the builder that the work has been completed in accordance with the plans and specifications of the design and identifies any construction changes agreed with, and approved by, the chartered professional engineer.

Engineers are encouraged to be specific about what the design intends to achieve, ie secure not strengthen, unless the owner has opted to undertake strengthening within the 12-month time frame.

This will help councils to consider whether the securing work sufficiently reduces or removes the risk of the parapet and/or facade from falling from the building, and lift the section 124 notice. The building owner will then be able to apply for government funding support.

4.3 Understanding consent requirements

Under the Order in Council, securing work does not require building and resource consents as long as it meets certain conditions. These are detailed in sections 1.1.1 and 1.1.2 of this document.

It is important that the engineer understands these conditions and is able to advise the building owner.

4.4 Respecting heritage values in engineering design

Engineers are required to have regard to the heritage values of the building and area as much as is reasonably practicable in the circumstances. Further information and examples of good practice can be found in Appendix A.

4.5 Design considerations for securing concepts

Practical ways to design a securing solution with minimal visual impact include:

Concealed fixings

Concealed fixings can help protect the exterior cladding from water ingress and simplify long-term maintenance.

- Consider the use of concealed threaded rods, URM stainless steel self-tapping screws, and proprietary concealed stainless steel products rather than fixings that will be visible on the exterior of the building.

Visible fixings

New bolted connections and pattress plates can look cluttered and obtrusive, and can also raise issues with water-proofing. If exterior fixings are required on the masonry facade, consideration of the following points is recommended:

- keep any existing/original pattress plates and consider using similar or traditional style plates
- consider using as few plates/bolted connections as possible to achieve the required structural outcome
- consider how new penetrations through exterior cladding will be sealed and made watertight (see note on water ingress on page 34)
- try to create a regular pattern and alignment with the new bolted connections:
  - consider using circular washers as these are easier to align than square washers
  - consider the colour of the new connections. Traditional plates on plain brickwork are generally painted black. Modern bolted connections and washers on rendered or painted surfaces can be painted to match

- the quality of workmanship is important to ensure good structural and aesthetic outcomes. Wherever possible the contractor should set out the plates so that they are square and level, in a straight line and distributed at equal centres. If square washers are required for structural reasons then they should be rotated so they line up neatly.

Parapets

Parapets, copings, gutters and roofs play a critical role in waterproofing many nineteenth and early twentieth century buildings, therefore consideration of the following points is recommended:

- try to conceal parapet fixings, walers and bracing behind the line of the parapet
- try to avoid any works to existing gutters
- steel clamps and tie rods that penetrate through window heads and copings can be visually obtrusive, and lead to problems with waterproofing. Consider how new penetrations through the cladding will be sealed and made watertight. Seek advice from a weathertightness expert (a licensed building practitioner) who specialises in URM buildings when necessary.

Interiors

When planning works that will affect the interior spaces of a building, keep in mind that, to keep using buildings, spaces must be able to be tenanted. The work must not compromise fire protection features. Care should also be taken to avoid damage to interior heritage features such as cornices, architraves, skirtings and panelling as these can be costly to repair.

General comments

- Water ingress can cause considerable damage to any building. Refer to MBIE's Acceptable Solution E2/AS1 for assistance. When necessary, seek advice from a weathertightness expert (a licensed building practitioner) who specialises in URM buildings, particularly to design, supervise and install any work that alters a building's weathertightness.
- Keep good records and documentation of the work. Hand a copy of the documentation to the building owner at the end of the works for incorporation into their maintenance manual or conservation plan.
- Repair damaged traditional materials with like-for-like traditional materials.
- Inform building owners of any requirements for long-term maintenance.

Case study

Figure 5: *A strengthened heritage building, 280 Cuba Street, Wellington. (Photo: Wellington City Council, 2014)*

The work to strengthen the parapet of the small URM building in Figure 5 has had a mixed effect on its heritage aspects.

The pattress plates are relatively small and discreet and the use of circular washers gives a reasonably neat appearance to the work, but there are some problems with the installation. The plates do not appear to be aligned horizontally and are spaced unevenly.

This photo was taken during construction and shows steel fixings for threaded tie rods. These rods will be trimmed once the works are completed. The problem with this detail is that the work is visually obtrusive and could lead to problems with water ingress at the window heads and coping. A better solution could be to use the smallest possible plates and to repair the rendered coating using expanded stainless steel mesh.

4.6 Permanent securing concepts for parapets and facades

The permanent concepts outlined in Appendix B of this guidance are most commonly applicable to buildings that are either part of a 'row', or where there is no adjacent restraint (ie a building at the end of a row, a freestanding building, or corner buildings with a low building adjacent).

The diagrams in Appendix B indicate the scope of works intended to reduce or remove the danger of URM parapets or facades falling in an earthquake. In all cases the work is intended to stabilise the parapet by ensuring this, and the top-most level of the facade, is tied back into the roof.

For buildings over two storeys the facade is also secured to the uppermost floor level.

Given the wide range of floor and roof forms in URM buildings, the level of securing may vary from building to building. The design needs to ensure that, as far as is practicable, the connections for the parapet and/or facade are located in areas secured back to the body of the building.

Concept details include these as the 'sub diaphragm' elements.

4.7 Temporary securing concepts for parapets and facades

Temporary solutions to secure parapets and facades can be a useful option for building owners. They are often used as an immediate response to secure a URM building that has been damaged by an earthquake or as a holding option until further strengthening can be undertaken. This approach can reduce the risk to public safety in the aftermath of an earthquake, and in the period when there is an increased risk of aftershocks. It can also give building owners time to plan and obtain funding for permanent strengthening works.

4.7.1 Securing systems

Temporary securing systems restrain the masonry back into the body of the building and use existing elements of the structure to resist horizontal loading. It is important to inspect and carry out a qualitative assessment of the structure before installing a temporary solution to reach a view on the following:

- whether the existing elements of the structure are able to pick up the horizontal seismic loading from the restrained masonry
- whether the existing elements have sufficient capacity to restrain the parapet and/or facade against failure[2].

Some temporary securing concepts for securing the parapets and facades of URM buildings are detailed in Appendix B.

2 Refer to paragraph four in section 4.1.

4.7.2 Temporary securing: general options

The temporary securing concepts set out in Appendix B outline some common forms of temporary securing, such as tying parapets and facades back into the building to inhibit these masonry elements collapsing into a public area. Other forms of securing are possible where they meet the particular requirements for securing and are appropriate for the building.

These solutions will require careful consideration from a structural capacity and aesthetics points of view and engagement with the owner.

4.8 Complex URM buildings

Complex URM buildings fall into two categories.

4.8.1 Buildings that have previously been strengthened

In the case of the older retrofits, the strengthening work concentrated on risk reduction for occupants within the buildings. It is important to ensure that the parapets and facades are adequately tied back, and that this work augments what has been done previously.

Attaching the facade to the structure that is already there will generally produce a less disruptive and costly intervention, will acknowledge the work carried out in the past, and should result in better building performance than a standard solution would for the same building.

Connecting the facade to the previous strengthening will however take more structural engineering design effort, both to ensure the previous strengthening is understood from the existing documentation, and to ensure the solution is appropriate to the structure.

4.8.2 Complex buildings over two storeys high

Complex buildings over two storeys high will require considerable effort to understand the building's response to earthquakes and to decide and design an appropriate solution. This will require further engineering input, particularly where there is additional complexity due to previous strengthening.

For these buildings, the parapets and facades will need to be tied further back into the building to be adequately secured. The design solution will vary between buildings.

4.9 Other considerations

4.9.1 Other issues when undertaking securing work

Securing work may uncover associated issues that need to be dealt with at the same time, or to make the securing work possible. These will be dependent on the building itself, however could include:

- asbestos investigation and removal
- addressing weathertight issues, such as flashings
- obtaining encroachment licences
- road closures and parking costs
- trenching or other earthworks, which may require an archaeological authority from Heritage New Zealand Pouhere Taonga.

Building owners will need to work with their engineers and councils to determine necessary permits and consents, further investigation or associated building work required to be able to undertake and complete the necessary securing work. They will also need to work with their neighbours to agree an approach to such features as shared facades or verandahs. Only securing work required by the Order in Council is exempt from the requirement to obtain a building consent.

APPENDICES

Appendix A: Respecting heritage values

Heritage is a matter of national importance under the RMA. Building owners and engineers are required to have regard to heritage values as much as is reasonably practicable in the circumstances when securing parapets and facades of URM buildings under the Order in Council.

New Zealand has a unique historical and cultural heritage and our heritage places are central to our national identity and well-being. Overseas experience has shown that historic buildings and the values they hold can act as a focus for the regeneration of urban environments, creating areas where people enjoy working, living and visiting. Historic buildings create opportunities to develop and add character to an area and provide tangible benefits for local economies and communities. Retaining and developing the distinctive historic character of urban centres is key to this.

It is very likely that some buildings required to secure the URM parapets and facades under the Order in Council will have heritage status.

A3.1 Identifying heritage values

Buildings can have heritage value for a variety of reasons. These include:

- historic values that arise from an association with an important person or event
- architectural and aesthetic values that relate to the appearance of a building and its contribution to a townscape or group of buildings
- scientific, archaeological, technological and educational values that contribute to our understanding of past human activity
- social values that consider whether places are held in high public esteem, or have symbolic, commemorative, traditional, spiritual or other cultural value to the community that has used or continues to use them. It includes places that are the focus of community, regional and national identity, and which contribute to sense of place and continuity.

Evaluation of heritage values allows for the assessment of cultural heritage significance. This asks whether an item:

- is rare, unique, influential or outstanding
- is a good representative example of the class it represents
- retains significant fabric from the time of its construction or from later periods when important additions or modifications were carried out
- is important at a local, regional, national or international level.

Heritage New Zealand Pouhere Taonga is the leading national historic heritage agency. Heritage New Zealand Pouhere Taonga maintains the New Zealand Heritage List / Rārangi Kōrero of significant heritage places and areas. You can contact Heritage New Zealand Pouhere Taonga to see if a building is entered on the New Zealand Heritage List, or the local authority to see if the building has been scheduled in the District Plan. Heritage New Zealand Pouhere Taonga specialists can advise owners and local authorities on the heritage values of buildings, heritage significance, and ways to minimise the effects of strengthening work on these values.

Assessments for places listed by Heritage New Zealand Pouhere Taonga as a Category 1 or 2 Historic Place or as part of a Historic Area are available from www.heritage.org.nz/the-list. You can also seek advice from suitably qualified heritage professionals.

A3.2 General principles

Works to heritage buildings in New Zealand are guided by the ICOMOS New Zealand Charter, available from the ICOMOS New Zealand website www.icomos.org.nz In general terms, conservation securing or strengthening should:

- be based on an understanding of the heritage values of a place
- be planned in advance
- involve the least possible damage, including loss of fabric and loss of heritage values
- involve the least possible degree of intervention
- be substantially reversible if a temporary securing solution is adopted
- be documented and recorded.

Some practical ways for building owners to achieve these goals are to:

- ask your council heritage advisor and Heritage New Zealand Pouhere Taonga for copies of heritage reports for your building
- consider the heritage values of the building and area as far as is practicable in the circumstances – it is a good idea to prepare a Heritage Impact Assessment (HIA)
- engage a chartered professional engineer and contractor, and weathertightness expert (licensed building practitioner) if required, who have experience working with heritage buildings
- talk to the heritage advisor at your local council or Alison Dangerfield, Heritage Advisor (Architecture), Central Regional Office, Heritage New Zealand, Wellington (Email: HAarchitectCR@heritage.org.nz).

A3.3 Examples of good practice

Figure 6: *The Thistle Hall on Cuba Street (below) is a good example of work to secure parapets and facades, although the works were part of a much larger project to strengthen the building.*

Figure 7: *The north elevation to Karo Drive (above) shows the original pattress plates, as well as new and existing steel channels that are just visible below first floor level, at first floor ceiling level and at parapet level. These have been painted to match the render and have been designed to complement the original string course and pilasters. The parapets have been secured with a steel frame, and the roof and ceiling structure substantially reinforced. (Photos: Wellington City Council, 2014)*

Figure 8: *The Karori Cemetery Chapel was strengthened in 2016 in a sensitive scheme that preserves both the original use and structure of this old building. This photograph shows the gable end secured with new traditional pattress plates. Although the pattress plates are the only visible strengthening works, there are concealed tie rods that pass through the roof space and tie the front and rear gable ends together. The pattress plates have been selected to complement the style of the chapel, and have been located discreetly in the shadows by the eaves. Additional tie rods have been concealed at rafter level. (Photo: Wellington City Council – Neil Price, 2016)*

Figure 9: *Bats Theatre at 1 Kent Terrace, Wellington (left) was strengthened in 2012 with new internal reinforced concrete columns and shear walls. There are new internal columns at the front elevation that continue from ground to roof level and support the parapet and facade. These have been designed so that they do not alter the street facade of the building.*

The structural strengthening and refurbishment have conserved the heritage values of the building. They have also ensured that the building remains in use as a venue for theatre and the performing arts. (Photo: Wellington City Council, 2014)

Figure 10: *Works to strengthen the former Cadbury's Building at 60 Ghuznee Street, Wellington (left) are due to start in 2017. These will include strengthening the street facade with internal reinforced concrete columns and steel cross bracing, and the installation of concealed stainless steel fixings to the decorative columns at ground and third floor. The parapet will be restrained by a steel frame that will be fixed back to the existing steel and concrete structure.*

The strengthening works respect the street-facing facade of this distinctive Edwardian warehouse. The structural engineer has taken care to avoid any alterations that would change the appearance of the building's exterior. The strengthening works will ensure that the building can continue to serve a useful purpose in the long term.

(Photo: Wellington City Council, 2014)

Figure 11: *The former Public Trust at 131 – 135 Lambton Quay, Wellington (left) is an early example of a steel framed building clad in brick and stone. It was strengthened in 2016 with internal reinforced concrete shear walls and the existing brick and stonework cladding was pinned back to the new and existing structure. The building was subject to careful repair by a traditional stonemason, and the mix of traditional and modern techniques is key to the success of this sensitive conservation project.*

The Public Trust is an example of Edwardian Baroque architecture designed by Government Architect, John Campbell. It has national significance as the head office for the Public Trust and for the quality of its design. The strengthening works respect the heritage values of the building by minimising any changes to the building's exterior and to its internal spaces.

(Photo: Wellington City Council, 2015)

Appendix B: Securing concepts

Each URM building has its own characteristics. Because of the differences between URM buildings, engineers will have to consider innovative solutions. Engineers will also need to be conscious both of the time constraint and the building owner's possible financial constraints within the next 12 months.

MBIE may provide additional securing concepts for engineers in the near future if required, to assist them to secure the parapets and/or facades of URM buildings.

B1 Permanent Solutions

These solutions:

- have a longer life than temporary solutions
- are less intrusive but cost more
- can significantly increase the resilience of parapets and facades of URM buildings
- if well designed, will have less impact on heritage values
- can be the first stage of structural strengthening.

The concept drawings in this section will assist engineers to design securing solutions suited to each building. The concepts will have to be adapted to suit the building's specific needs.

The concept drawings are in line with best practice development to support the Building (Earthquake-prone Buildings) Amendment Act. They show examples of possible solutions for row and corner or freestanding buildings. Where the side elements of the building pose a threat to the front or nominated street, the details are continued around the corner. This is to provide the protection to the front or nominated street only.

B1.1 Parapet bracing for solid and cavity masonry – tying the parapet into the roof structure

The schematic diagrams on pages 49–58 show the essential elements required for securing the parapet to the roof structure. This type of securing applies for a hipped roof and the side walls of a gable structure. There can be other elements that make up the roof framing and trusses of a URM building. The diagrams give an indication of what is appropriate. The securing details for each building will require specific assessment and design.

When securing the parapet to the roof structure, it is essential to take into consideration weathertight issues and flashings. Refer to MBIE's Acceptable Solution E2/AS1 for assistance. When necessary, seek advice from a weathertightness expert (a licensed building practitioner) who specialises in URM buildings, particularly to design, supervise and install any work that alters a building's weathertightness.

When using adhesive anchors, rather than through-plate anchors, it is essential that there is strict quality control of installation. Poorly installed adhesive anchors may fail prematurely.

The table below lists the securing options for parapets.

Figure	Securing option
12	Securing the parapet to the roof trusses of a hipped roof, where the trusses are at right angles to the facade – solid masonry solution
13	Securing the parapet to the roof trusses of a hipped roof where the trusses run parallel to the facade.
14	Securing for cavity masonry where the framing is parallel to the facade.
15	Vertically strengthening lower parapets and tying them into the roof, non-cavity masonry.
16	Vertically strengthening lower parapets and tying them into the roof, cavity masonry.
17	Securing the upper wall to the roof, non-cavity masonry.
18	Securing the upper wall to the roof, cavity masonry.
19, 20	Securing a gable roof – solid masonry and cavity masonry
21	Parapet securing for a gable building.
22	Parapet securing for a hip building.

Maximum Unbraced Parapet Heights

Maximum unbraced heights for parapets with and without veneers are detailed in Tables 1 and 2 below. Use these tables in conjunction with the schematic diagrams. Unbraced parapets with heights that exceed the maximum permitted shall be strengthened.

Table 1: *Maximum unbraced parapet heights for 34% NBS, no veneer*

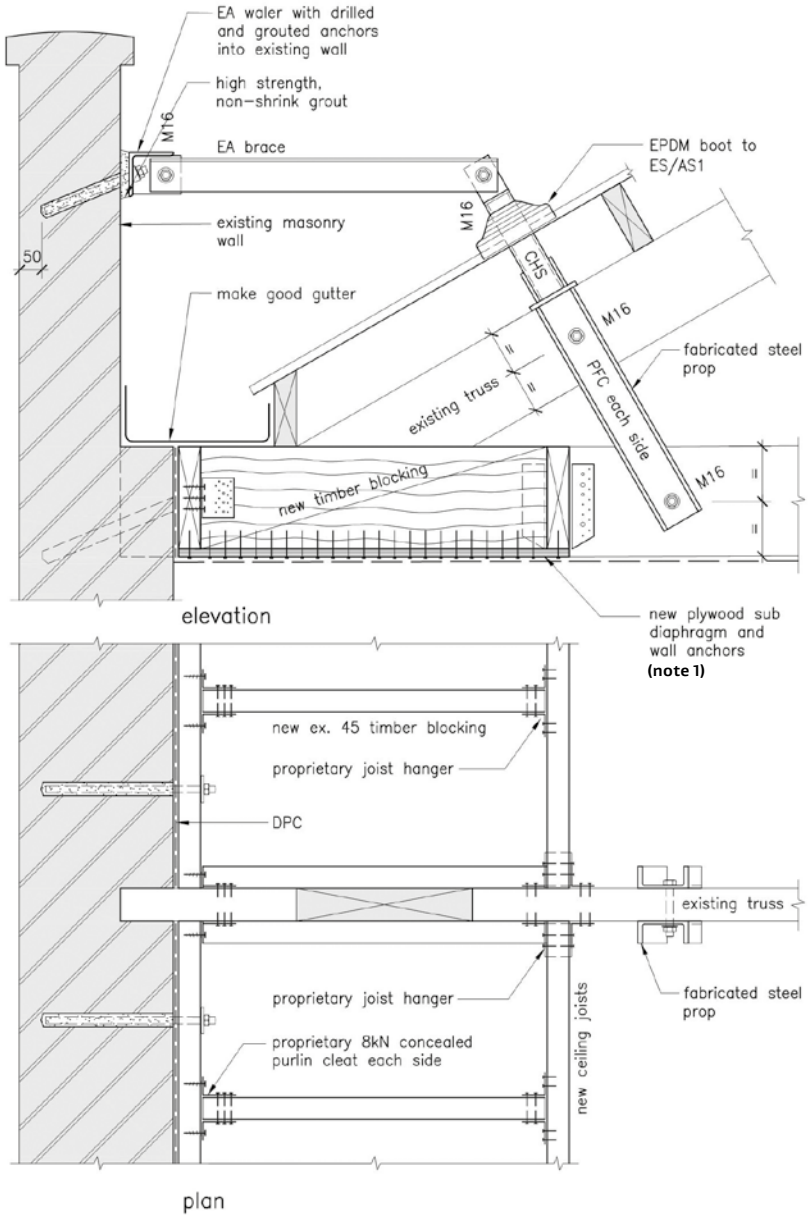
Number of storeys	Parapet thickness (m)	Maximum unbraced parapet height (m)
One	0.110	0.50
	0.230	0.80
	0.350	1.20
Two	0.110	0.40
	0.230	0.70
	0.350	0.90

Table 2: *Maximum unbraced parapet heights for 34% NBS, 110 mm thick veneer*

Number of storeys	Parapet thickness (m)	Maximum unbraced parapet height (m)
One	0.110	0.50
	0.230	0.70
	0.350	1.00
Two	0.110	0.40
	0.230	0.60
	0.350	0.80

Securing the parapet to the roof trusses of a hipped roof, where the trusses are at right angles to the facade – solid masonry solution

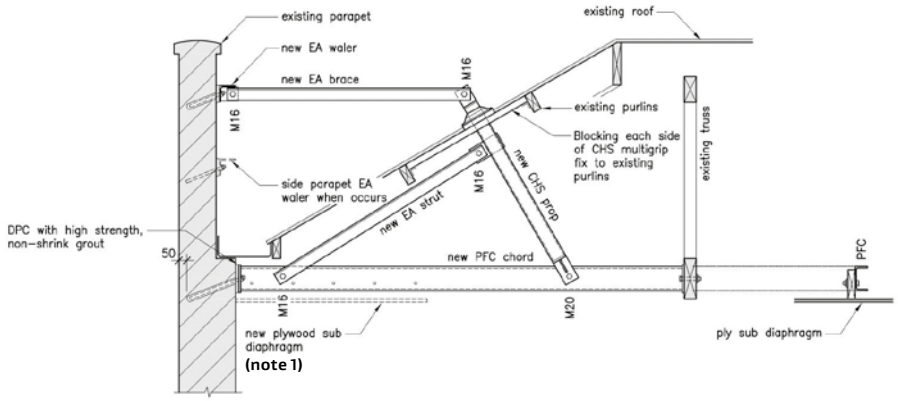
Figure 12



Note 1: Plywood sub diaphragm as needed to secure the masonry into the body of the building. Refer to green area of Figure 4. This sub diaphragm could be typically 600mm wide but will vary depending on the demand from the facade and layout of the roof framing.

Securing the parapet to the roof trusses of a hipped roof where the trusses run parallel to the facade

Figure 13

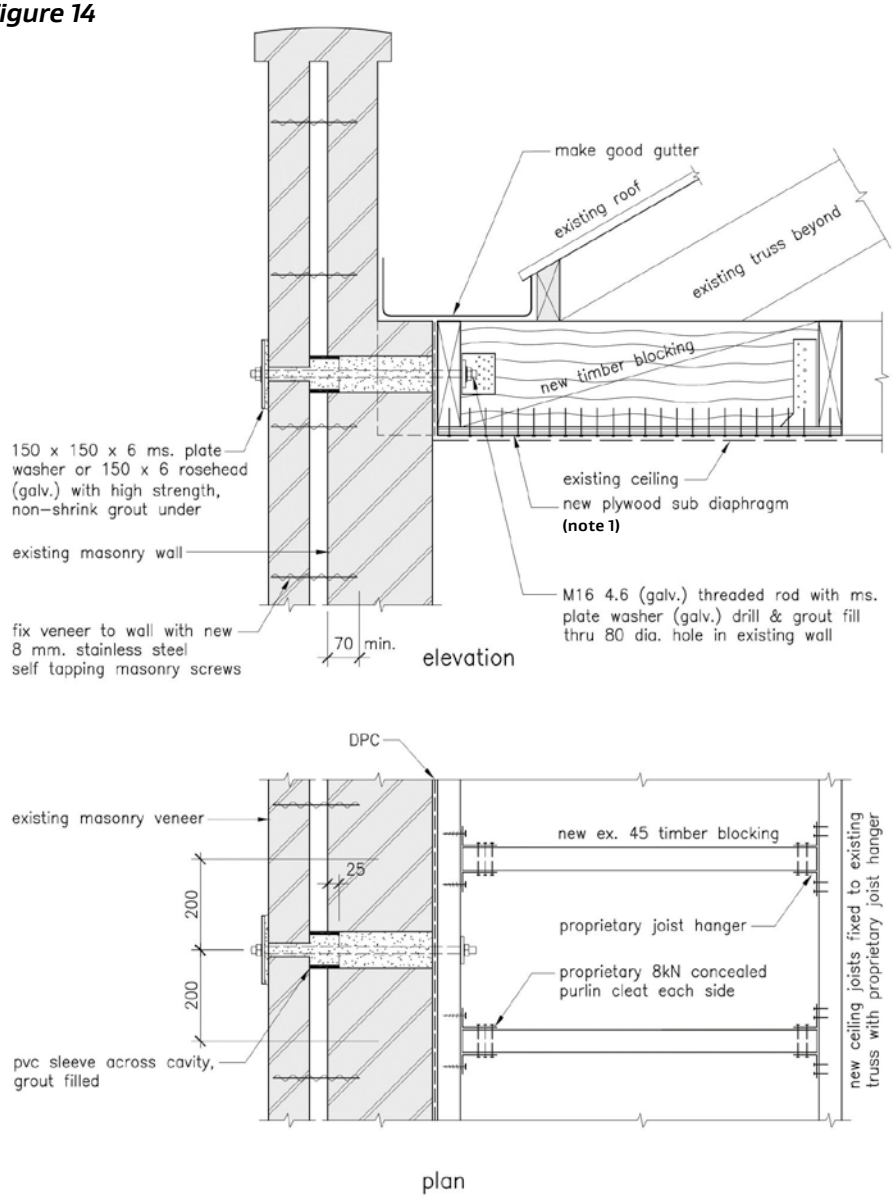


Note 1: Plywood sub diaphragm as needed to secure the masonry into the body of the building. Refer to green area of Figure 4. This sub diaphragm could be typically 600mm wide but will vary depending on the demand from the facade and layout of the roof framing.

If the trusses run parallel to the facade, intermediate subframes need to be formed to achieve the same securing as in Figure 12.

Securing for cavity masonry where the framing is parallel to the facade

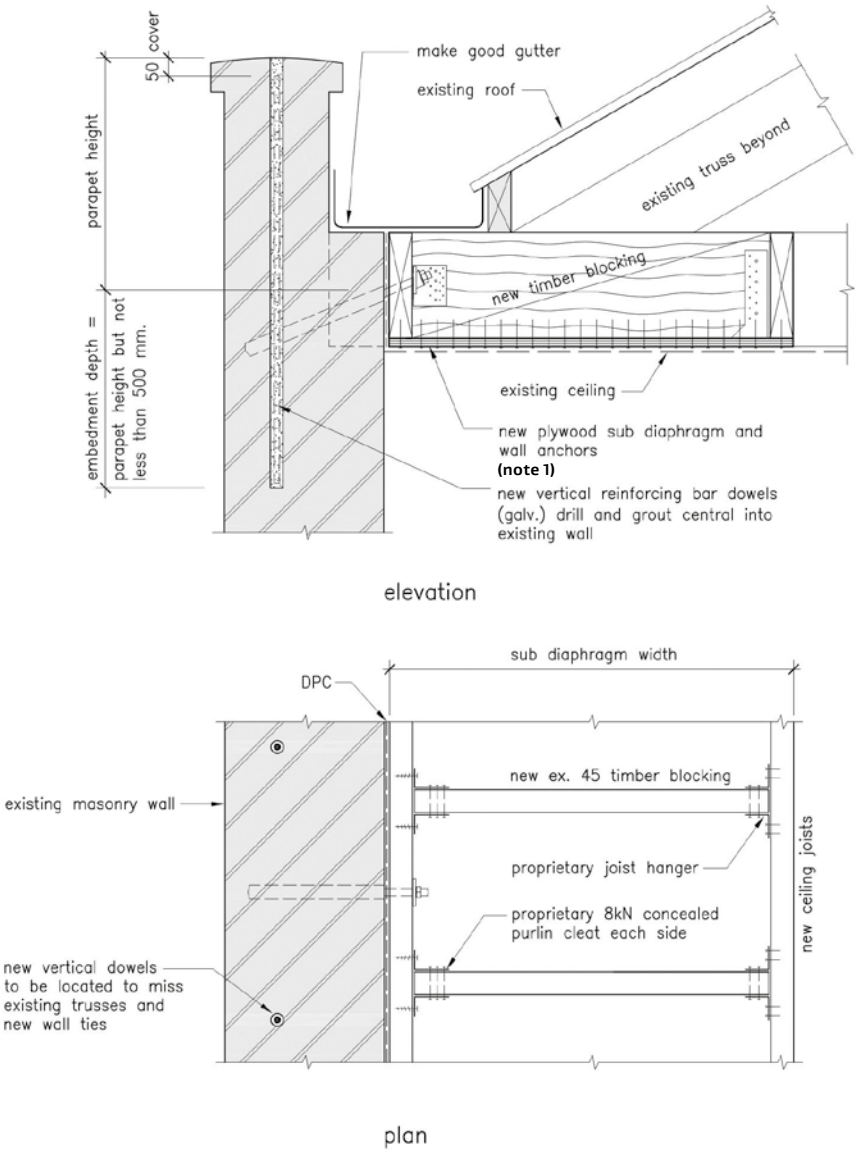
Figure 14



Note 1: Plywood sub diaphragm as needed to secure the masonry into the body of the building. Refer to green area of Figure 4. This sub diaphragm could be typically 600mm wide but will vary depending on the demand from the facade and layout of the roof framing.

Vertically strengthening lower parapets and tying them into the roof, non-cavity masonry

Figure 15

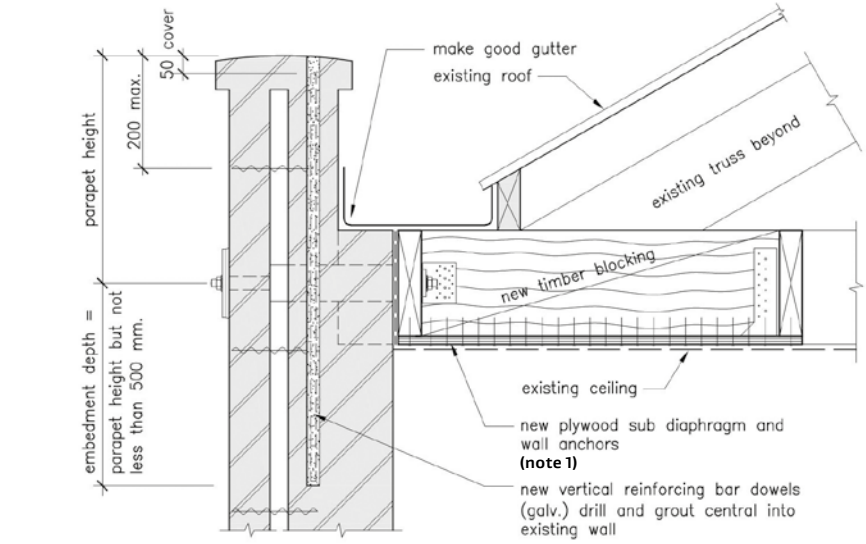


Note 1: Plywood sub diaphragm as needed to secure the masonry into the body of the building. Refer to green area of Figure 4. This sub diaphragm could be typically 600mm wide but will vary depending on the demand from the facade and layout of the roof framing.

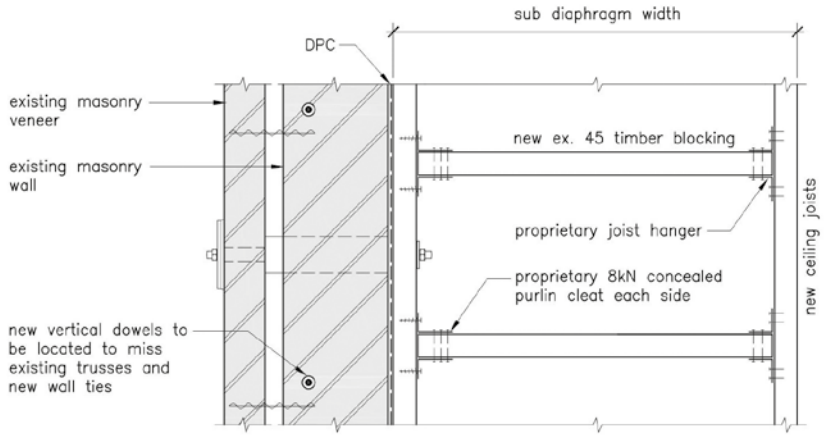
Vertically strengthening lower parapets and tying them into the roof, cavity masonry

The roof element is at right angles to the parapet.

Figure 16



elevation



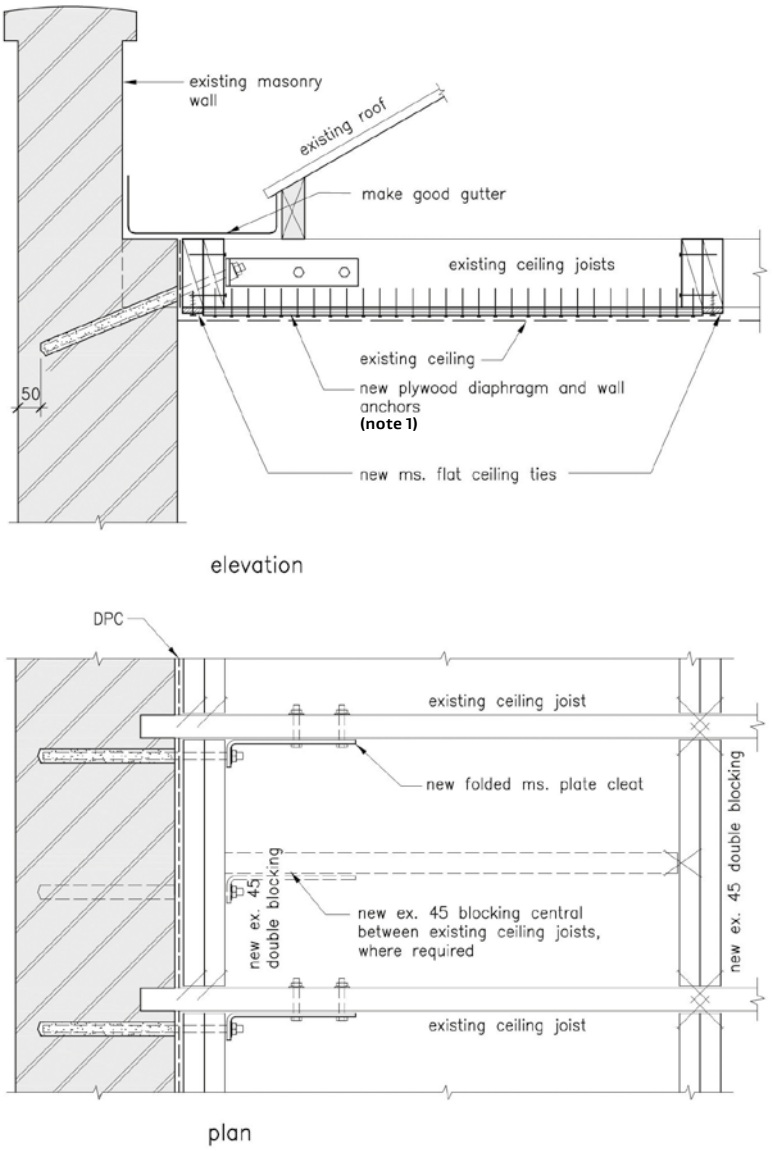
plan

Note 1: Plywood sub diaphragm as needed to secure the masonry into the body of the building. Refer to green area of Figure 4. This sub diaphragm could be typically 600mm wide but will vary depending on the demand from the facade and layout of the roof framing.

Securing the upper wall to the roof, non-cavity masonry

This option is only appropriate where parapets are sufficiently low.

Figure 17



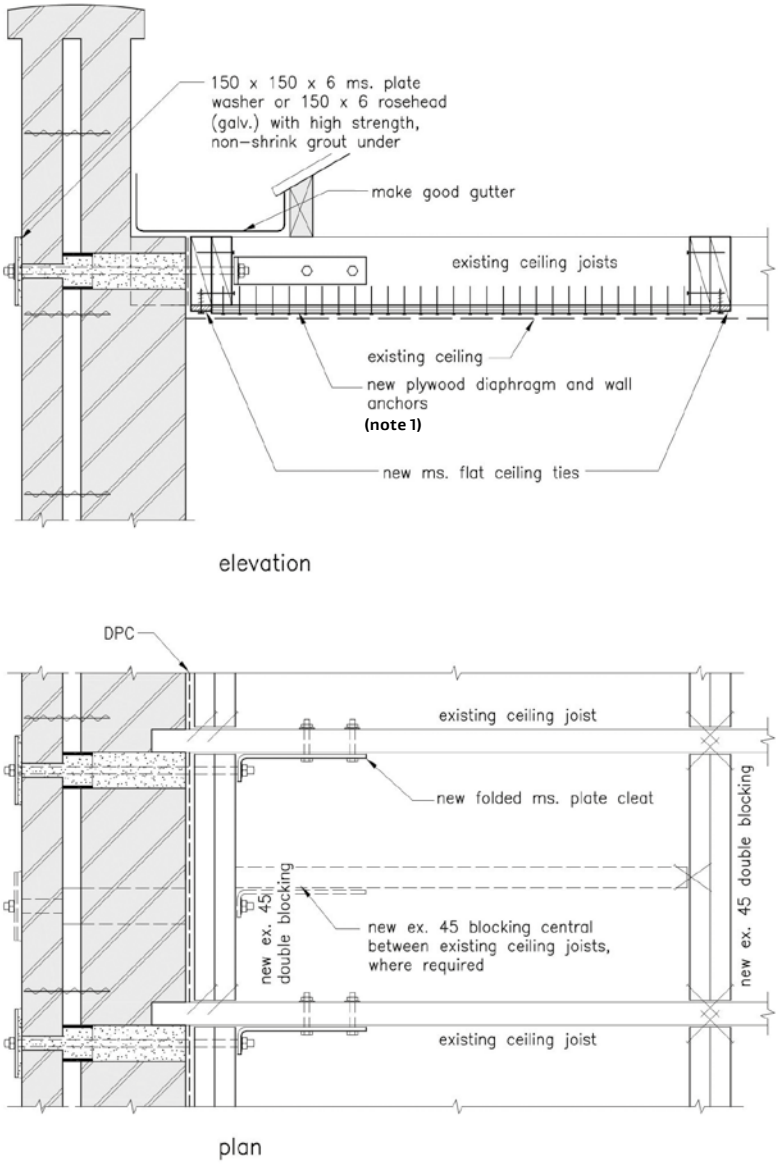
Note 1: Plywood sub diaphragm as needed to secure the masonry into the body of the building. Refer to green area of Figure 4. This sub diaphragm could be typically 600mm wide but will vary depending on the demand from the facade and layout of the roof framing.

Securing the upper wall to the roof, cavity masonry

This option is only appropriate where parapets are sufficiently low.

The roof framing is parallel to the parapet.

Figure 18

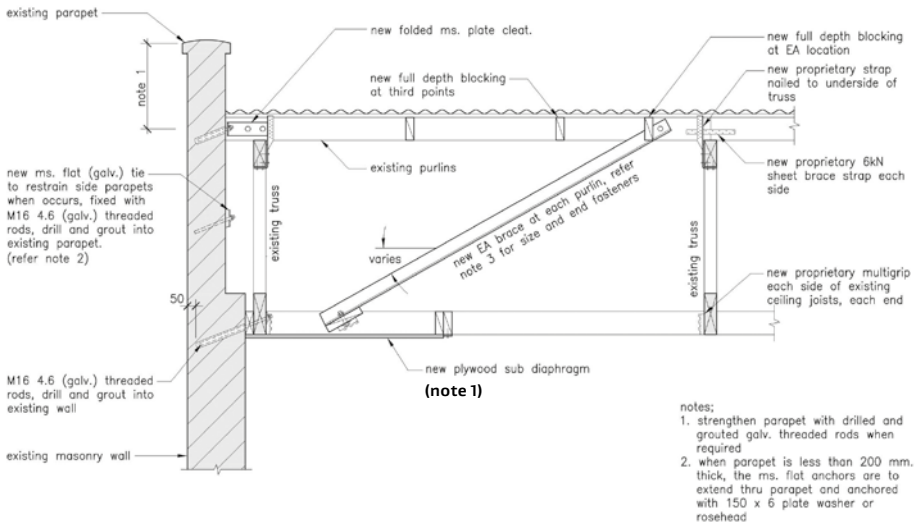


Note 1: Plywood sub diaphragm as needed to secure the masonry into the body of the building. Refer to green area of Figure 4. This sub diaphragm could be typically 600mm wide but will vary depending on the demand from the facade and layout of the roof framing.

Securing a gable roof

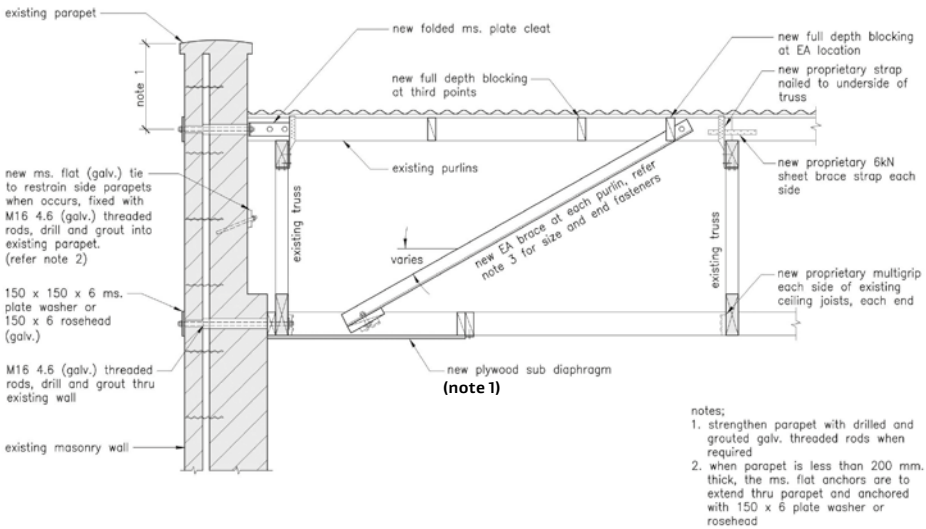
The following diagrams give a general indication of securing for a gable roof (it slopes up the inside of the parapet). It is more practical to secure this from the inside back to the roof trusses. This is shown for solid and cavity masonry.

Figure 19: Solid masonry



Note 1: Plywood sub diaphragm as needed to secure the masonry into the body of the building. Refer to green area of Figure 4. This sub diaphragm could be typically 600mm wide but will vary depending on the demand from the facade and layout of the roof framing.

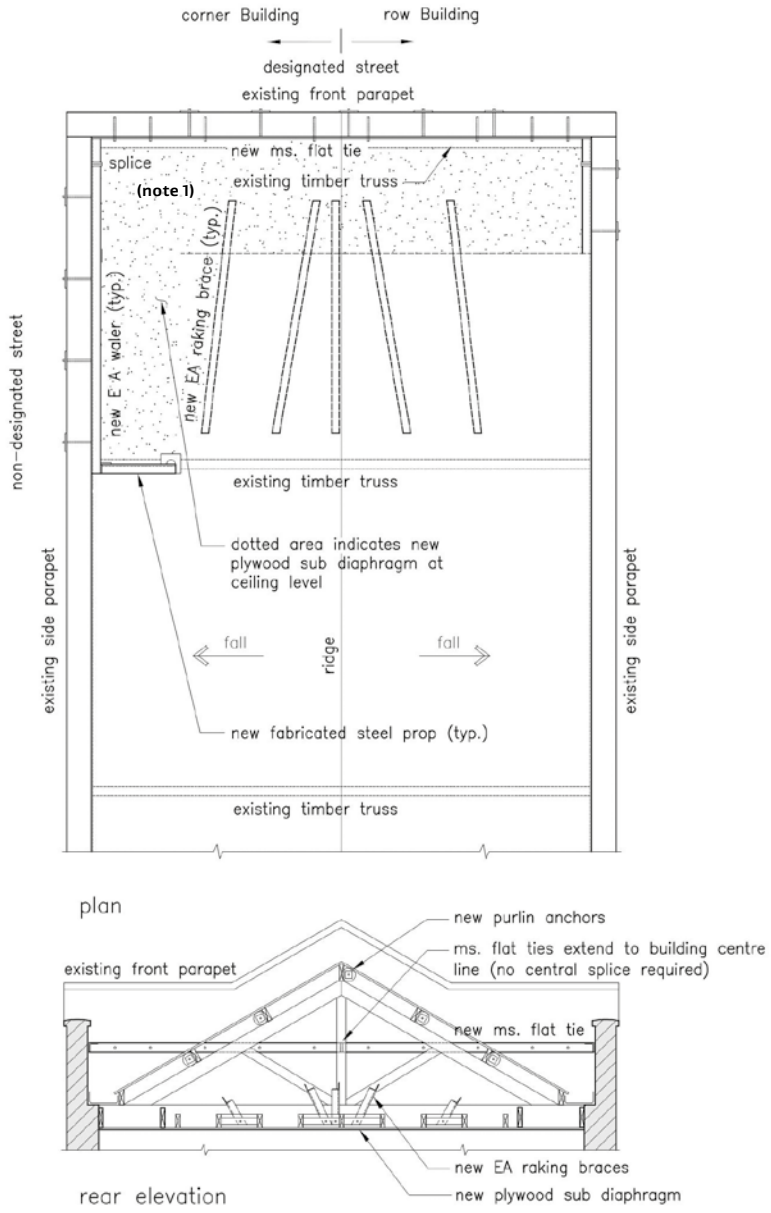
Figure 20: Cavity masonry



Note 1: Plywood sub diaphragm as needed to secure the masonry into the body of the building. Refer to green area of Figure 4. This sub diaphragm could be typically 600mm wide but will vary depending on the demand from the facade and layout of the roof framing.

Parapet securing for a gable building – summarised in the figure below

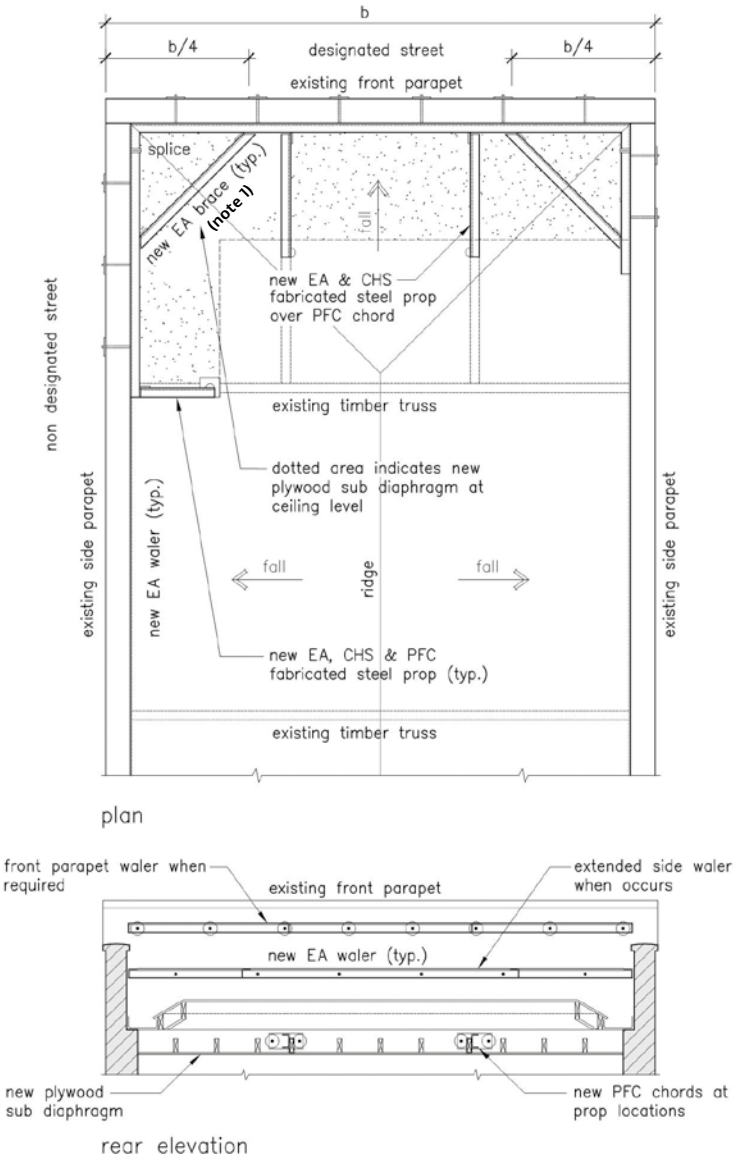
Figure 21



Note 1: Plywood sub diaphragm as needed to secure the masonry into the body of the building. Refer to green area of Figure 4. This sub diaphragm could be typically 600mm wide but will vary depending on the demand from the facade and layout of the roof framing.

Parapet securing for a hip building – summarised in the figure below

Figure 22



Note 1: Plywood sub diaphragm as needed to secure the masonry into the body of the building. Refer to green area of Figure 4. This sub diaphragm could be typically 600mm wide but will vary depending on the demand from the facade and layout of the roof framing.

B1.2 Tying the facade to the floor

The schematic diagrams on pages 60-63 show the essential elements required for tying the facade to the floor.

If the wall is unable to span vertically, mullion elements will need to be added that can be tied to the new roof strengthening and the floor below.

If the building is greater than two storeys, the facade then needs to be tied to the uppermost floor. Again, these are concepts, which engineers will have to adapt depending on the configuration of the building.

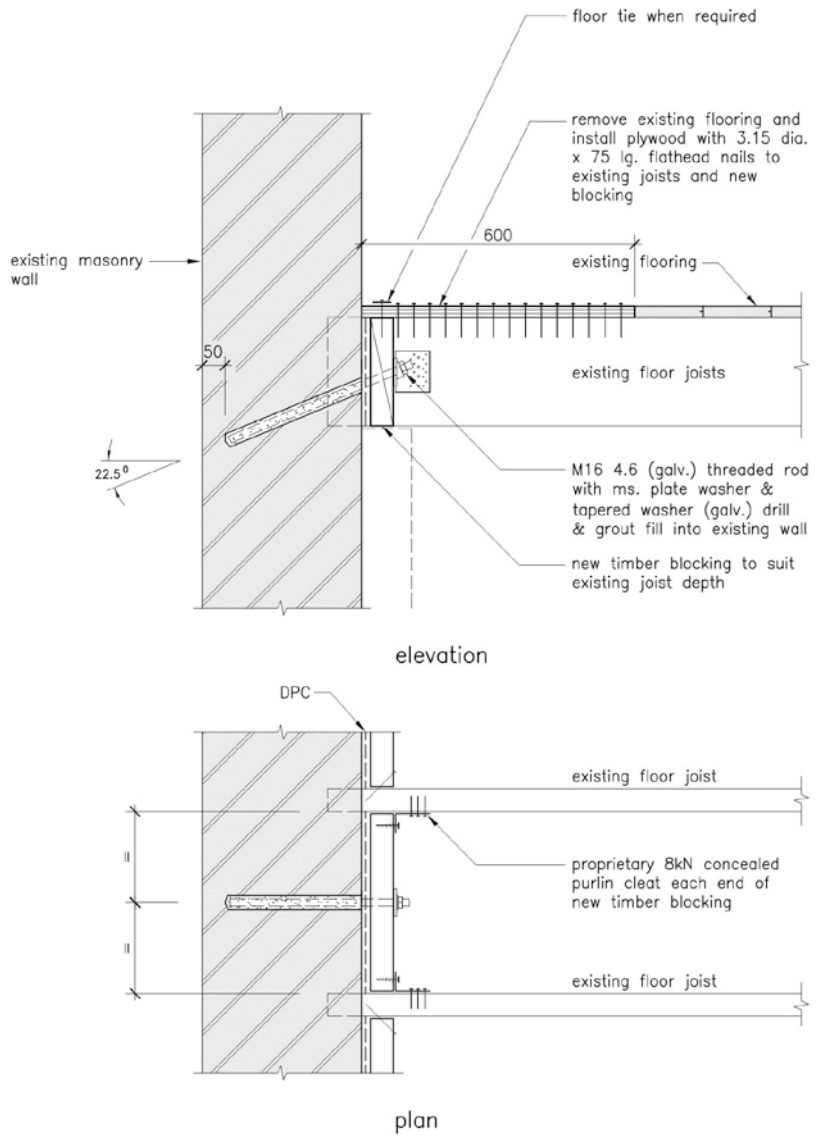
When using adhesive anchors, rather than through-plate anchors, it is essential that there is strict quality control of the installation. Poorly installed adhesive anchors may fail prematurely.

The table below lists options for tying the facade to the floor.

Figure	Securing option
23	Tying the facade to the (uppermost) floor, solid masonry.
24	Tying the facade to the (uppermost) floor, cavity masonry.
25	Tying the facade to the (uppermost) floor, when the floor spans parallel to the facade, solid masonry.
26	Tying the facade to the uppermost floor, when the floor spans parallel to the facade, cavity masonry.

Tying the facade to the (uppermost) floor, solid masonry

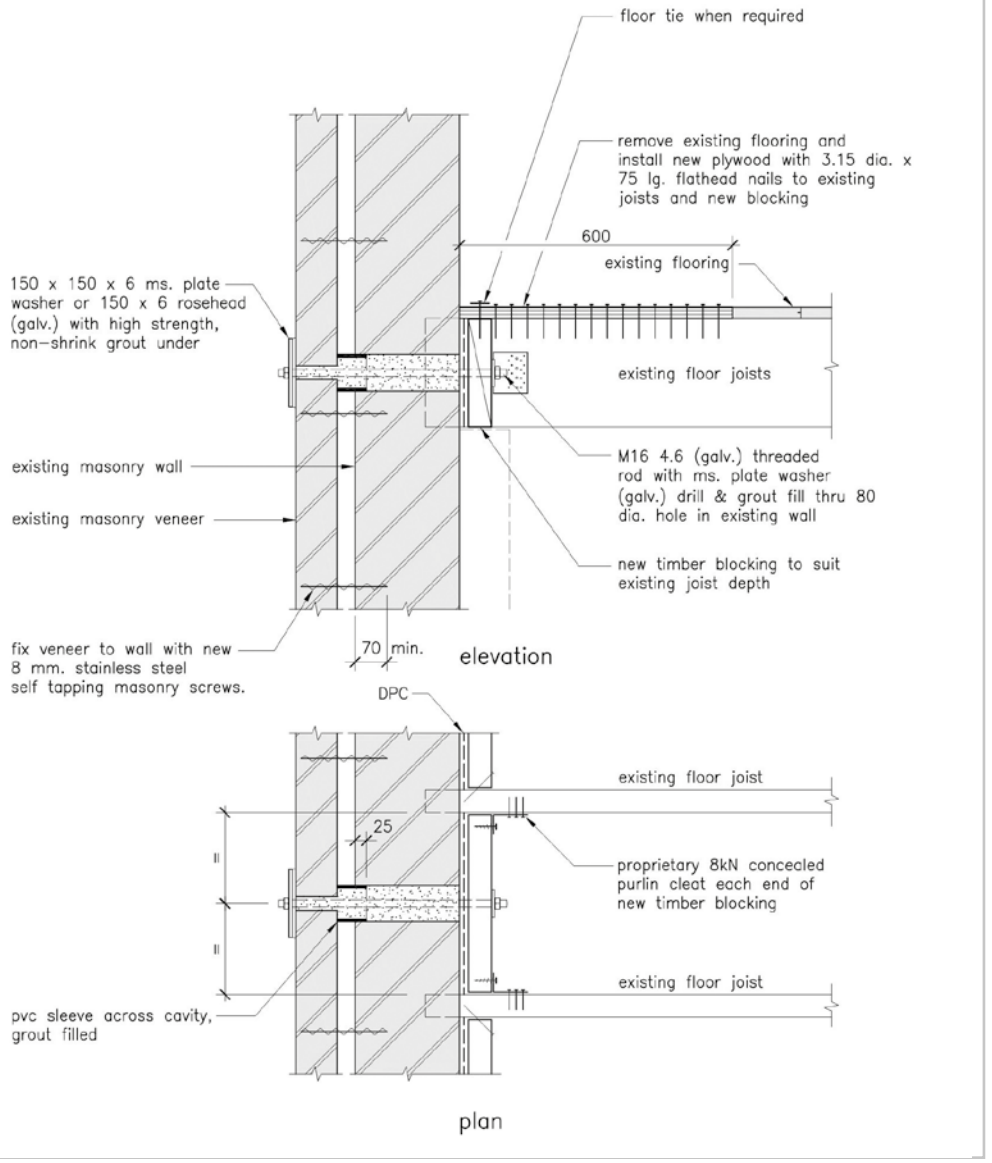
Figure 23



Tying the facade to the (uppermost) floor, cavity masonry

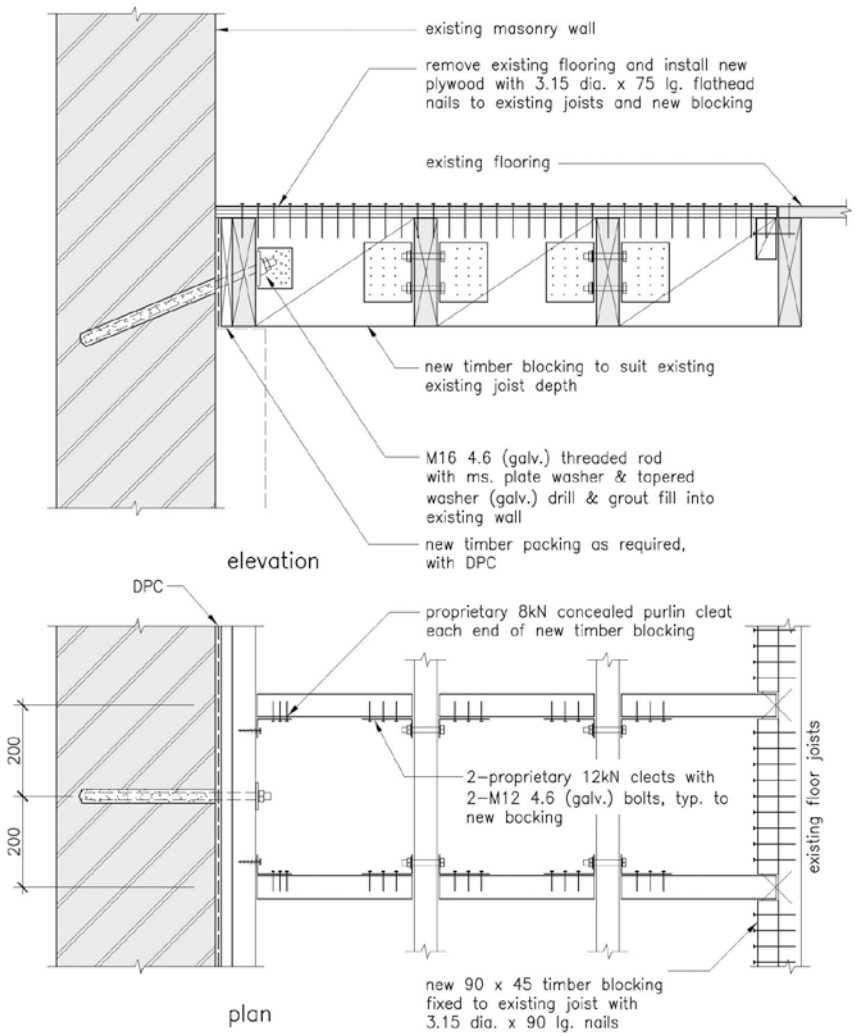
The joists are at right angles to the facade

Figure 24



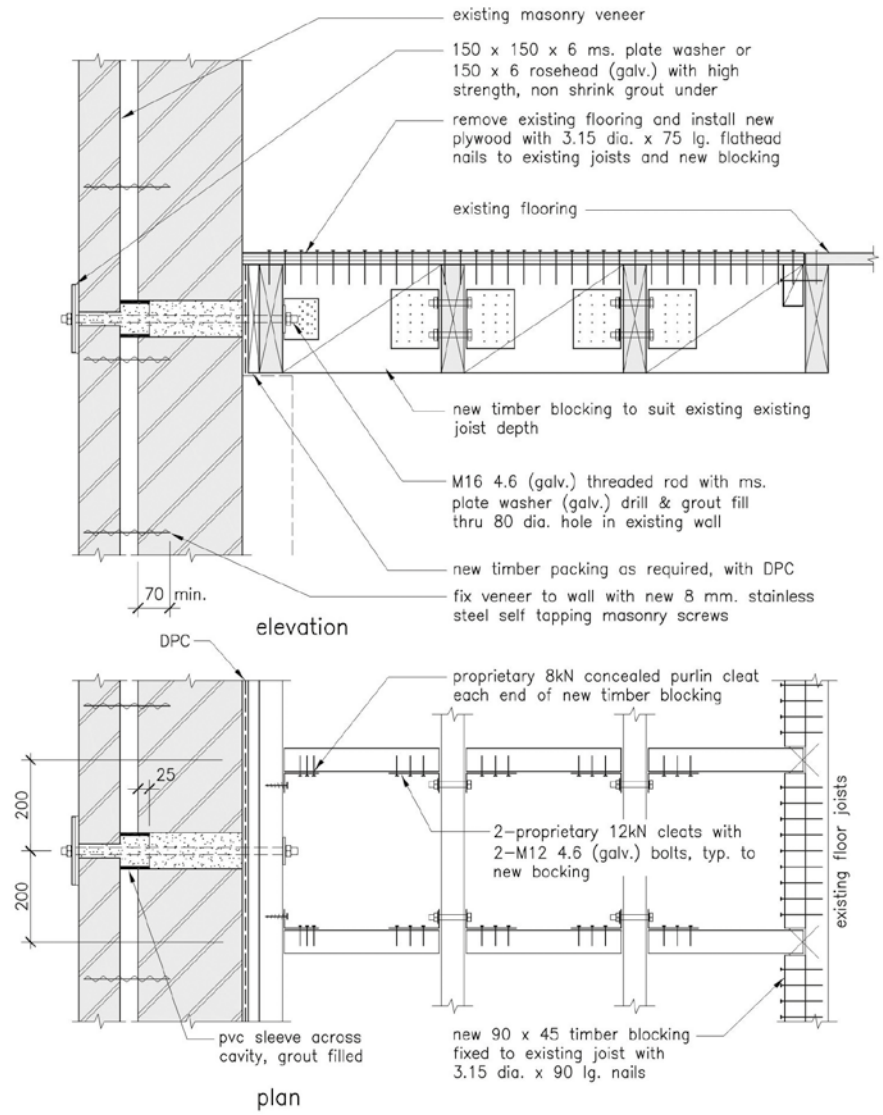
Tying the facade to the (uppermost) floor, when the floor spans parallel to the facade, solid masonry

Figure 25



Tying the facade to the (uppermost) floor, when the floor spans parallel to the facade, cavity masonry

Figure 26



B1.3 Securing a facade with a stair or void

If the building has a stair or void on the facade being secured, or within 4m of this back into the building, a beam will need to be fitted along the internal face of the walls secured to it as illustrated below for solid masonry and cavity masonry, and tied back into the floor at its ends.

FIgure 27: Solid masonry

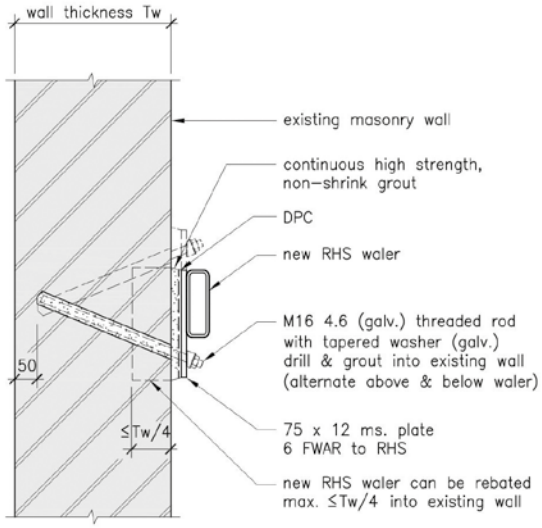
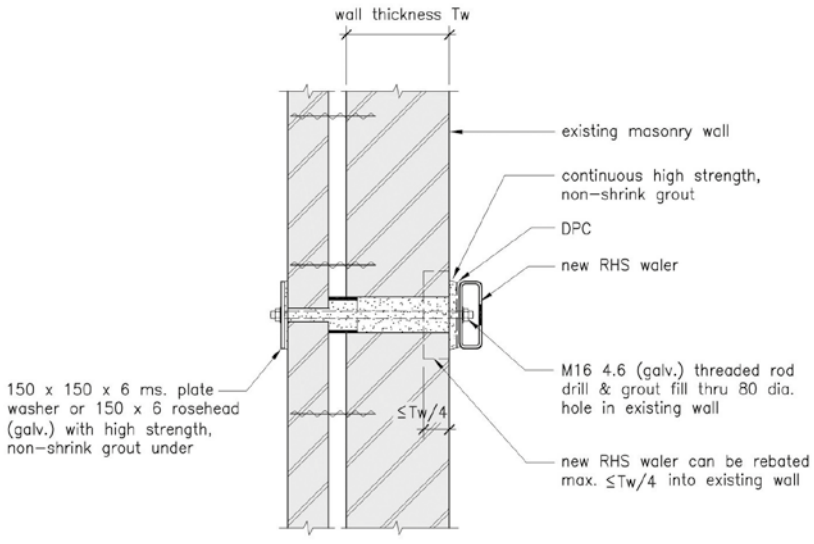


Figure 28: Cavity masonry



B2 Temporary Solutions

These are short-term solutions that:

- need to be constructed of durable material
- require maintenance and testing regimes. An inspection every three years is recommended to ensure that any deterioration is within acceptable limits, and to see if any remedial work is required
- include securing elements such as strapping, wire ropes, through-bolts.

The temporary solution concepts detailed in this section are as follows:

Page	Temporary Solution
65	Tie the front facade through the building to the back wall – Option A
67	Tie the front facade through the building to the back wall – Option B
70	Tie exterior corner masonry
72	Tie the parapet back onto the roof framing

B2.1 Option A: Tie the front facade through the building to the back wall

The objective is to clamp the masonry front facade and back wall onto the timber frame floor and roof diaphragms within the body of the building, and to reduce the potential for the facade to bend due to seismic inertia loading. The ties are formed from wire cable or fabric straps that pass through the building to clamp external horizontal walers to the exterior parallel faces of the building. The diaphragms within the building will transfer the horizontal loading to the walls running at right angles to the walls that are clamped. This type of securing is illustrated in Figure 29.

a) Inspect building structure to determine:
   - geometry of brickwork and building structure
   - engineering characteristics of facade brickwork and its mass.

b) Determine location and spacing of horizontal ties.

   One, or a combination of three, locations are generally considered sufficient, depending on the capacity of the brick masonry to span vertically. These locations are:
   - just above suspended floor level for buildings of two or more storeys
   - mid-height of inter-floor (or to eaves) spacing
   - just below ceiling height at about eaves level.

c) Determine the form and structural capacity of the waler elements.

They can be proprietary sawn timber double-beams, or hot-rolled steel sections or cold-formed steel sections, such as web-to-web double channels. The size of the waling elements shall be determined by structural analysis from the:

- load to be restrained
- vertical spacing of the walings
- horizontal spacing of the ties
- section capacity of the waling elements.

d) Where required to bring the existing building elements up to capacity, provide and fix additional timber framing and blocking, metal cleats and bracing.

e) At the height of the proposed ties, fit and fix walings to the outer faces of the front facade and back wall. The walings run across the full width of the facade and wall, and are packed back with timber to the face of the brickwork where the masonry face has a sculptured profile.

f) For the mid-height waling, the horizontal ties can pass through the window openings, if available.

g) At all other tie locations, drill a neat hole through the masonry wall to allow the tie to pass from the waling to the interior of the building:

- where the tie is just above floor level, make the hole flush with the floor surface
- where the tie is a mid-height, endeavour to keep the hole at 1.8m or greater above floor level
- where the tie is just below ceiling level, keep the distance between the tie and the ceiling framing to a minimum.

h) Determine the form and capacity of the horizontal ties. The ties can be made up from a combination of:

- steel wire rope with a fibre core (wire rope grips to be properly fitted to form eye-loop at each end)
- rolled thread steel rod
- turnbuckle
- heavy-duty polyester webbing ratchet straps.

i) At each tie position, a galvanised steel anchor plate is fitted to the exterior face of the front and back waling, with the central hole lined up with the gap between the waling pieces and the hole in the masonry wall.

j) Fit a threaded rod of the required size through the anchor plate, between the waling pieces and through the hole in the masonry wall. A nut and lock nut are fitted to the outer end of the threaded rod.

k) At the inner end of the threaded rod, just on the inside of the wall surface, fit an eye-nut.

l) Fit a turnbuckle to the eye-nut at the front facade.

m) Between the corresponding turnbuckle at the front facade and at the eye-nut at the back wall, run the wire rope with an eye-loop at each end so that a shackle connection can be made. As required to pass the wire rope, form a neat hole in any partition walls so that the wire is in a straight line between opposite walings. For ties at floor level, webbing straps can be used that fit under the floor covering.

n) When all the ties are in place, progressively tighten the turnbuckles to clamp the front facade and back wall together, onto the floor and ceiling diaphragms. Do not over-tighten, particularly the mid-height ties.

o) Seal all penetrations through the perimeter walls to exclude weather effects.

Figure 29: *Christchurch 2012.*
(Photo: Dunning Thornton/Heartwood Community)

B2.1 Option B: Tie the front facade through the building to the back wall

If a highly profiled wall of two or more storeys, which may include a parapet, needs to be temporarily secured to prevent it collapsing into the street, it may be more appropriate to clamp the wall back onto the building structure using an exterior grillage of steel walers (horizontal members) and soldiers (vertical members). This type of securing is illustrated in Figure 30.

a) Inspect building structure to determine the:

- geometry of brickwork and building structure
- engineering characteristics of facade brickwork and its mass.

b) Determine location and spacing of horizontal ties for each floor of masonry.

One, or a combination of three, locations are generally considered sufficient, depending on the capacity of the brick masonry to span vertically and the capacity of the soldiers. These locations are:

- just above suspended floor level for two or more storey buildings
- mid-height of inter-floor (or to eaves) spacing
- just below ceiling height at about eaves level.

c) Determine the form and structural capacity of the waler and soldier elements. They can be proprietary hot-rolled steel sections or cold-formed steel sections, such as web-to-web double channels. The size of the waling or soldier elements shall be determined by structural analysis from the:

- load to be restrained
- horizontal spacing of the soldiers
- vertical spacing of the walings
- horizontal spacing of the ties
- section capacity of the waling and soldier elements.

d) Where required to bring the existing building elements up to capacity, provide and fix additional timber framing and blocking, metal cleats and bracing.

e) To capture the profile of the wall exterior surface, fit the soldiers in a vertical plane, and pack back to the surface of the masonry to be retained. This could include extending the soldiers up to restrain the parapet.

f) At the height of the proposed ties, fit and fix double waling to bear on the outer face of the soldiers at the front facade and parallel back wall. The waling runs across the full width of the facade and wall.

g) For the mid-height waling, the horizontal ties can pass through the window openings, if available.

h) At all other tie locations, drill a neat hole through the masonry wall to allow the tie to pass from the waling to the interior of the building:

- where the tie is just above floor level, make the hole flush with the floor surface
- where the tie is a mid-height, endeavour to keep the hole at 1.8m or greater above floor level
- where the tie is just below ceiling level, keep the distance between the tie and the ceiling framing to a minimum.

i) Determine the form and capacity of the horizontal ties. The ties can be made up from a combination of:

- steel wire rope with a fibre core (wire rope grips to be properly fitted to form eye-loop at each end)
- rolled thread steel rod
- turnbuckle
- heavy-duty polyester webbing ratchet straps.

j) At each tie position, a galvanised steel anchor plate is fitted to the exterior face of the front and back waling, with the central hole lined up with the gap between the waling pieces and the hole in the masonry wall.

k) Fit a threaded rod of the required size through the anchor plate, between the waling pieces and through the hole in the masonry wall. A nut and lock nut are fitted to the outer end of the threaded rod.

l) At the inner end of the threaded rod, just on the inside of the wall surface, fit an eye-nut.

m) Fit a turnbuckle to the eye-nut at the front facade.

n) Between the corresponding turnbuckle at the front facade and at the eye-nut at the back wall, run the wire rope with an eye-loop at each end so that a shackle connection can be made. As required to pass the wire rope, form a neat hole in any partition walls so that the wire is in a straight line between opposite walings. For ties at floor level, webbing straps can be used that fit under the floor covering.

o) When all the ties are in place, progressively tighten the turnbuckles to clamp the front facade and back wall together, onto the floor and ceiling diaphragms. Do not over-tighten, particularly the mid-height ties.

p) Seal all penetrations through the perimeter walls to exclude weather effects.

Figure 30: *L'Aquila, Italy October 2011. Cold-formed steel channel waling and soldiers with threaded rod transverse ties. Note: this type of temporary work can encroach onto footpaths and road corridors, which can be an issue if there is limited space. (Photo: Win Clark)*

B2.2 Tie exterior corner masonry

The objective of this option is to clamp the brick masonry around the exterior corners of the building back into the body of the building. The roof and floor diaphragm of the building will transfer the horizontal loading to the walls running parallel to the direction of loading. Ideally, access to four sides of the building is available. If access is only available to the two adjacent faces of the building, with the corner between, then penetrations through the perimeter walls are required approximately 1.5 times the building height back from the corner, in each direction. The horizontal temporary ties pass around the exterior of the corner masonry walls, through the penetrations in each adjacent wall, then connect within the building on a diagonal line between the two penetrations; thus forming in plan a triangular tie to hold the corner masonry back into the building.

This type of securing is illustrated in Figures 31 and 32.

a) Inspect building structure to determine:
   - geometry of brickwork and building structure
   - engineering characteristics of masonry walls and their mass
   - capacity of roof and floor diaphragms.

b) Determine location and spacing of horizontal ties to restrain the masonry corners of the building, using wire rope or heavy-duty polyester webbing ratchet straps. Use proprietary items with certified load capacity.

c) Where required to bring the existing building elements up to capacity, provide and fix additional timber framing and blocking, metal cleats and bracing.

d) At the outer corners of the building fit timber boards or cold-formed steel angles (rounded outer corner) to protect the brickwork and webbing and distribute the clamping load back into the wall in each direction from the corner. If required, cleats can be fitted to the timber or steel angle protection to hold the webbing straps at the required height.

e) Where the webbing straps are required to pass into the building, identify an appropriate window or door opening, or cut a neat hole in the brick masonry.

f) Provide packing protection for the webbing straps where they pass around into these openings.

g) Fit the webbing straps around the building at the required height(s) and apply an initial tension in each strap.

h) Provide, fit and fix packing between the webbing strap and decorative elements of the building facade that causes a slight deviation in the straight line of the webbing strap.

i) Where restraint is required to inhibit outward distortion of the masonry wall, additional timber soldiers can be fitted between the wall and webbing strap so the strap is deviated from a straight line. This will induce an inward force on to the face of the wall when the webbing straps are finally tightened.

j) When all the straps are in place, progressively tighten the ratchets to clamp the perimeter corners of the building together, onto the floor and ceiling diaphragms. Do not over-tighten beyond the design tension required to inhibit wall failure in a moderate earthquake.

k) Seal all penetrations through the perimeter walls to exclude weather effects.

Figure 31: *The layout of straps for temporary securing for the corner of a URM building*

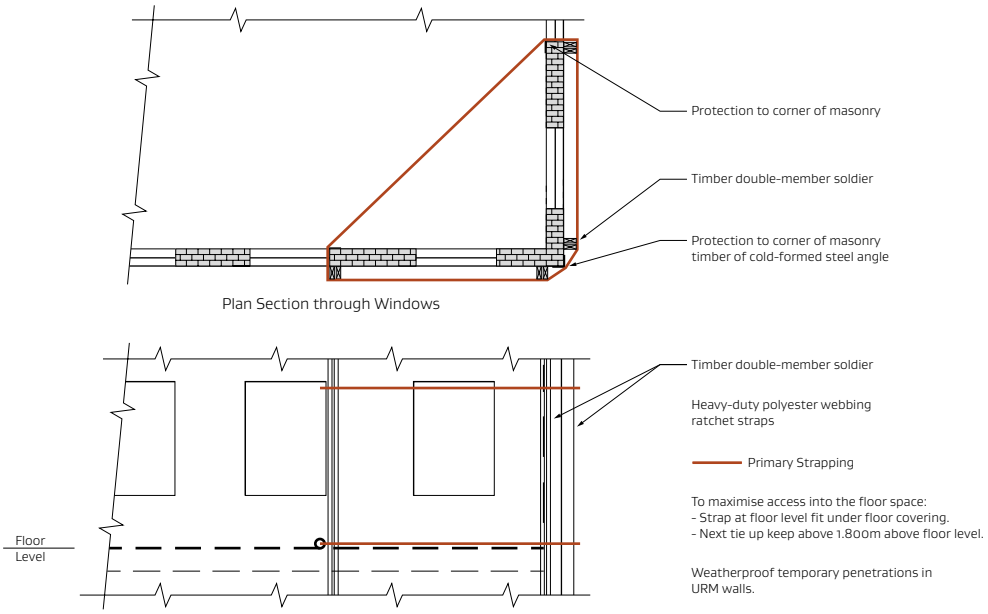


Figure 32: *L'Aquila, Italy October 2011. Heavy-duty polyester webbing ratchet straps fitted around the building perimeter. Note steel angle plate to protect the straps, and distribute the clamping load into the corner masonry. (Photo: Win Clark)*

B2.3 Tie the parapet back onto the roof framing

This option clamps the brick masonry parapet back onto the timber roof framing. It is a suitable option when the parapet is the vulnerable element of the facade, the roof framing has sufficient capacity to restrain the parapet from falling outwards, but the existing connection between roof framing and parapet needs strengthening. The tiebacks are formed from webbing straps that pass through the upper section of window openings just below the parapet, over the top of the parapet and roof, and back inside the building to the front facade. The diaphragms or strutting within the building will transfer the horizontal loading to the walls running at right angles to the walls that are clamped. Figures 33 and 34 show this option.

a) Inspect building structure to determine:

- geometry of parapet brickwork and building structure, including available window openings
- engineering characteristics of masonry parapet and its mass
- capacity of roof and floor diaphragms.

b) Where the ridge runs parallel to the parapet to be restrained, the tieback may be taken down the back of the ridge board, as it is supported by the rafters. The ridge flashing can be lifted to allow the tieback to be fitted, as well as any additional framing required to resist the restrain load.

c) Determine location and spacing of tiebacks to restrain the masonry parapet, using wire rope or heavy-duty polyester webbing ratchet straps. These are proprietary items with certified load capacity.

d) Where required to bring the existing building elements up to capacity, provide and fix additional timber framing and blocking, metal cleats and bracing.

e) Over the top of the parapet and at the window openings, fit timber boards or cold-formed steel angles (rounded outer corner) to protect the webbing and distribute the clamping load back onto the parapet.

f) Where the webbing straps are required to pass into the building, identify an appropriate window or door opening, or cut a neat hole in the brick masonry.

g) Provide packing protection for the webbing straps where they pass around into these openings.

h) Fit the webbing straps through the windows and over the parapet to form a closed loop, and apply an initial tension in each strap.

i) Provide, fit and fix packing between the webbing strap and decorative elements of the building parapet that causes a slight deviation in the straight line of the webbing strap.

j) When all the straps are in place, progressively tighten the rachets to clamp the parapet onto the roof framing and ceiling diaphragms. Do not over-tighten beyond the design tension required to inhibit the parapet failure in a moderate earthquake.

k) Seal all penetrations through the perimeter walls to exclude weather effects.

Figure 33: *Temporary securing of the parapet into the timber frame roof structure, where roof trusses are parallel to the parapet*

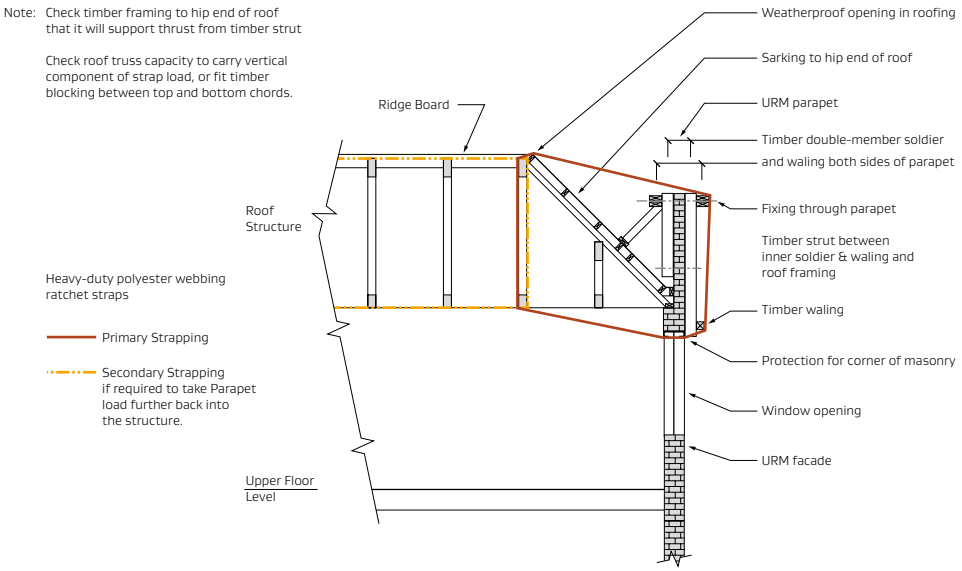
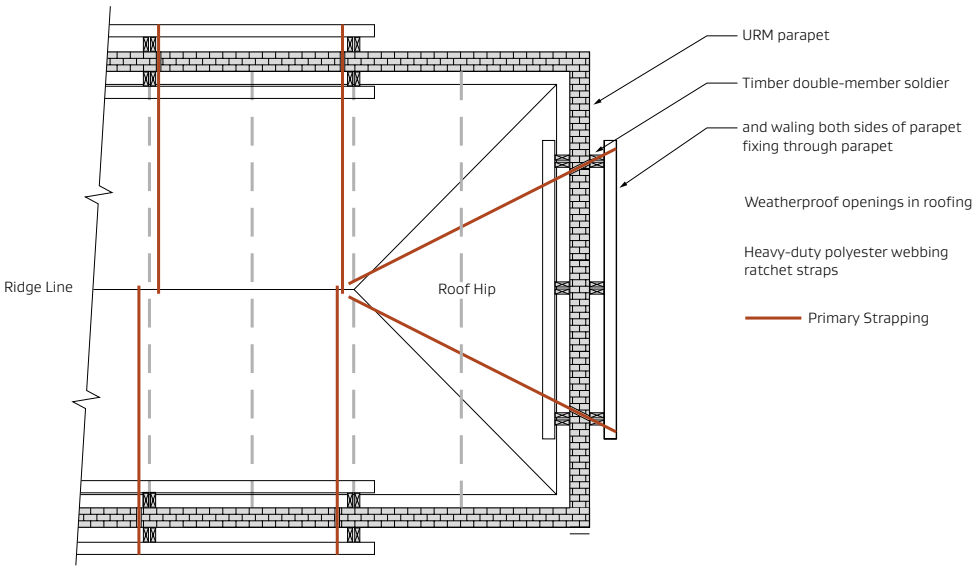


Figure 34: A plan view of the roof and the layout of straps to secure a parapet to a timber frame roof structure



Appendix C: Glossary of engineering terms

Blocking	Short pieces of timber fitted and fixed between main timber members such as floor joists.
CHS	Circular hollow section (structural steel tube).
Cleats	A 'cleat' fixes two timber members together. A 12kN cleat has a characteristic load capacity of 12kN.
EA	An 'Equal Angle brace'. The EA brace is formed by rolling a steel 'L' shaped member with legs of equal length. The section of 'L' shaped steel is then fabricated into a brace member.
EPDM boot	Proprietary flexible rubber boot to fit around member that penetrates roofing to provide a weather seal.
FWAR	Fillet weld all around. This is where two steel members are connected by welding, and the weld is in a complete loop such as a RHS to a plate fitted to a face of the RHS.
Joist hanger	Fixing of a timber floor joist to a supporting beam with a 'U' shaped metal plate, nailed or screwed to the timber members.
Ms flat tie	A hot rolled 'mild-steel' strip that has a rectangular cross section.
M16	Size of bolt in metric. M16 refers to a 16mm diameter bolt.
PFC	Parallel flanged channel
Primary structure	In the context of securing a URM building the primary structure can be considered to be either a floor or roof diaphragm, or a lateral load resisting element which is perpendicular to the parapet or facade which is to be secured. The connection to the primary structure shall be sufficient to ensure the tributary seismic loads associated with the item to be secured are transferred to the main body of the primary structure.

Proprietary multigrip	A proprietary triangular shaped galvanised steel plate used to connect adjacent sections of timber together with nail fixing.
Ratchet straps	A proprietary fabric strap that incorporates a ratchet mechanism for applying tension to the strap.
RHS	Rolled hollow section
Rosehead	A cast steel or galvanised fabricated plate fixed to the exterior face of a masonry building to provide anchorage for an anchor bar that passes through the masonry wall to tie the wall back into the main structure within the building. Circular plates are called pattress plates.
Sheet brace strap	A cold-formed galvanised steel strip that is nail fixed to timber members to provide a tension brace. For example, with a timber framed wall, the strap is fixed to the face of the studs on the diagonal to form a brace to carry in-plane horizontal load from top plate to bottom plate of the wall. A 6kN strap has a characteristic tension load capacity of 6kN.
Soldier	A vertical member fixed to a wall to provide transverse (to wall) load support for the wall.
Sub diaphragm/diaphragm	A horizontal structure (such as a floor with boards or plywood flooring) that transfers horizontal load from face-loaded walls to the supporting wall that is parallel to the direction of loading.
Turnbuckle	A fitting that consists of a yoke with a threaded section at each end. A threaded hook-bolt is screwed in at each end of the yoke. A wire tie can be fitted to the hook-bolt which is tensioned by turning the yoke, bringing the two hook-bolts closer together.
Waler/waling	A horizontal member fixed to a wall to provide transverse (to wall) load support for the wall.

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