UFB DESIGN GUIDE

Best practice guide for installing ultra-fast broadband into heritage buildings

Version 1 October 2014

Chorus

New Zealand Heritage Properties Ltd

Investing In Our Heritage

Authors

UFB Design Guide: Best practice guide for installing ultra-fast broadband into heritage buildings was written by New Zealand Heritage Properties.

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Disclaimer

Statements and recommendations included in this guide represent best practice for mitigating the effects of a necessary infrastructure install. New Zealand Heritage Properties Ltd takes no responsibility for any inappropriate actions, negligence, damage or loss as a result of the installing services to heritage buildings, or the actions presented in this guide.

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Introduction

Accessibility, whether it is physical or digital, aims to enhance the user experience. In terms of buildings, accessibility allows users to stay connected to the space, and digital access connects those users to the wider world. With the technology of connection expanding rapidly, it is vital that buildings and spaces adapt to changing technologies, keeping them flexible, tenanted, and ultimately viable. This is particularly pertinent when it comes to New Zealand's extant heritage buildings. It is vital that they stay connected, remain accessible, relevant, and reused. Service elements in a building typically last 15 to 30 years (Moss, 2001). Therefore, most heritage buildings will require service upgrades multiple times during their lifetime. The provisioning of fibre-optic cables for ultrafast broadband Internet, digital television and voice-over-internet-protocol (VOIP) services represents the latest advancement in technology and the next stage in heritage building service upgrade.

The ultra-fast broadband (UFB) upgrade will provide homes and businesses with greater and faster access to the internet and will ensure New Zealand continues to make efficiency gains and stays competitive in the global market place (Crown Fibre Holdings 2010). This document provides a "best practice" guide for designing install solutions into heritage buildings and character areas that will minimise the physical and visual impact of the UFB connections. It has been developed in consultation with Heritage New Zealand, select council heritage staff, heritage consultants, architects, and UFB install designers throughout the country.

The audience for these guides are those tasked with designing install solutions, those charged with physically installing fibre into heritage buildings, and city councils in which heritage buildings feature. The latter to ensure install is undertaken in a sensitive manner. It outlines seven implementation guides for minimising both physical and visual impacts while maintaining weathertightness.

Chorus and the UFB network

There are two parts to the nationwide UFB upgrade. First, the fibre infrastructure is built into the road, which connects towns and cities across the country, and second, customer provisioning, which connects individual customers to this network. The build must happen before provisioning, and customers are only connected once they order UFB. In customer provisioning, fibre runs from the street, across the property boundary, to an external termination point (ETP) on the building itself. This external point (approximately 200mm x 150mm in size) then has a corresponding internal point, which must be directly adjacent, albeit on the other side of the wall. The internal units must be at 300 mm above the floor level for ongoing access. In most cases, trunking or conduit is used to carry cable from the point of contact with the building, to the point where the ETP is located. These guidelines relate to the provisioning and the installation of UFB into heritage buildings and streetscapes, and combine the technical/physical requirements of the install with mitigation techniques for minimising impact to such structures.

Customer provisioning is deployed in one of two ways:

- Aerial – cable is deployed atop poles connecting with the building at height.
- Subsurface – in a subsurface deployment, cable is inserted below ground, with it rising above ground at the point of connection to a building only. An ETP can be installed internally or externally.

In each implementation, the install of UFB in heritage buildings will require an entry point, or a connection, into the premises. In many instances installation can utlise existing entry points:

- Existing ducts – existing opening into a building that already caters for the delivery of services.
- Replacing existing cables/infrastructure – In many cases, heritage buildings may contain obsolete or redundant services that can be removed without consequence to the building itself. These could include obsolete copper connections, early gas lines etc. In these cases, modern fibre cabling may be installed in their place with some improvements in visual impact.

Where existing entry points cannot be utilised, a new connection must be created. Depending upon the nature of the building, the connections can be located in such a way as to minimise the impact of the install.

- Entering below ground - hides cabling and infrastructure as it enters the property.
- Rear and side connections - connecting to the rear and side of buildings reduces the visual impact.
- Façade connection - where each of the options above cannot be satisfied, then it may be necessary to install UFB directly on to a building's principal elevation.

These connections can be separated into two types:

- Set back – A façade connection on a structure that is set back from the boundary. Typically those of a residential style (Res).
- On boundary – A façade connection on a structure that is located at the property boundary. Typically those of a commercial style (Com).

In each instance the option chosen has implications for the level of impact upon the heritage structure.





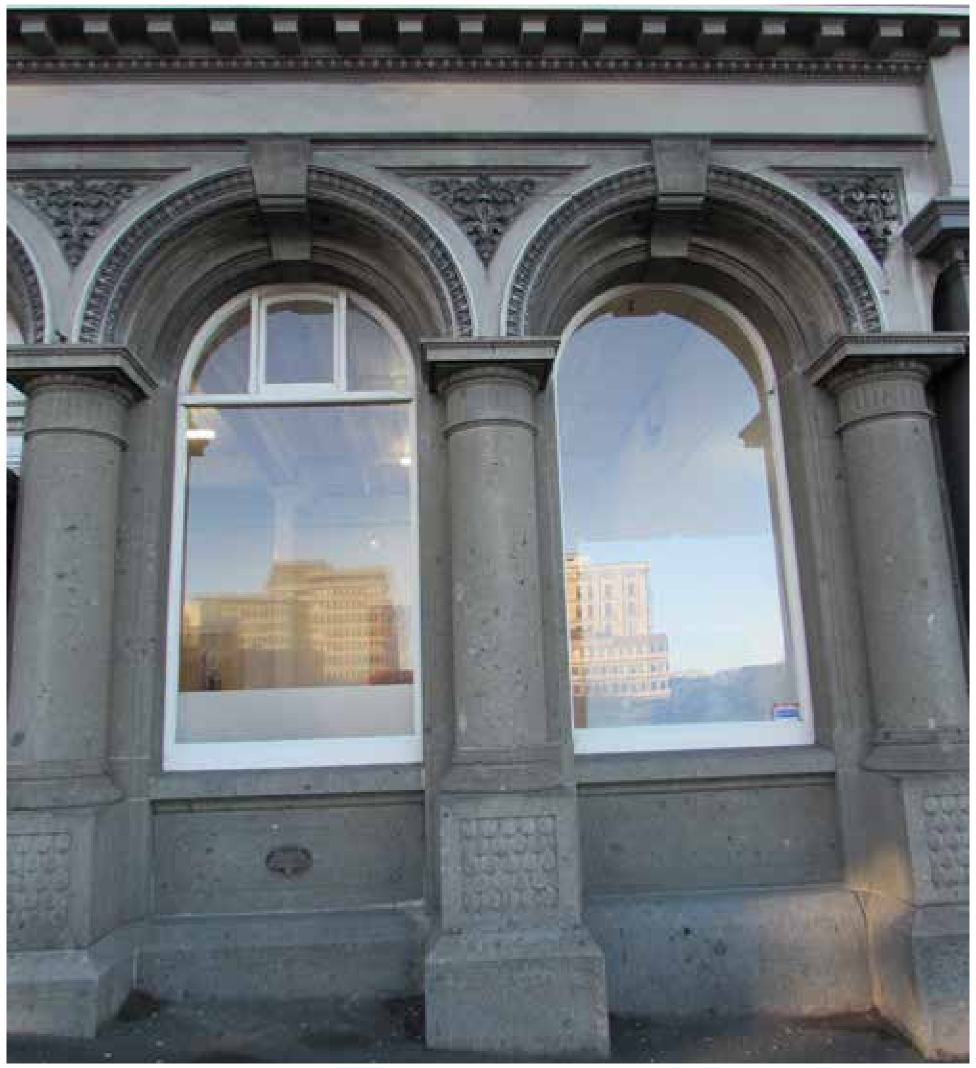
Top Left - Example of an ETP. *Top Centre* - Example of an aerial installation point (Chorus).
Top Right - Example of a subsurface installation (Chorus).
Bottom Left - Example of a residential style building set back from the boundary.
Bottom Right - Example of a commerical building on the property boundary.

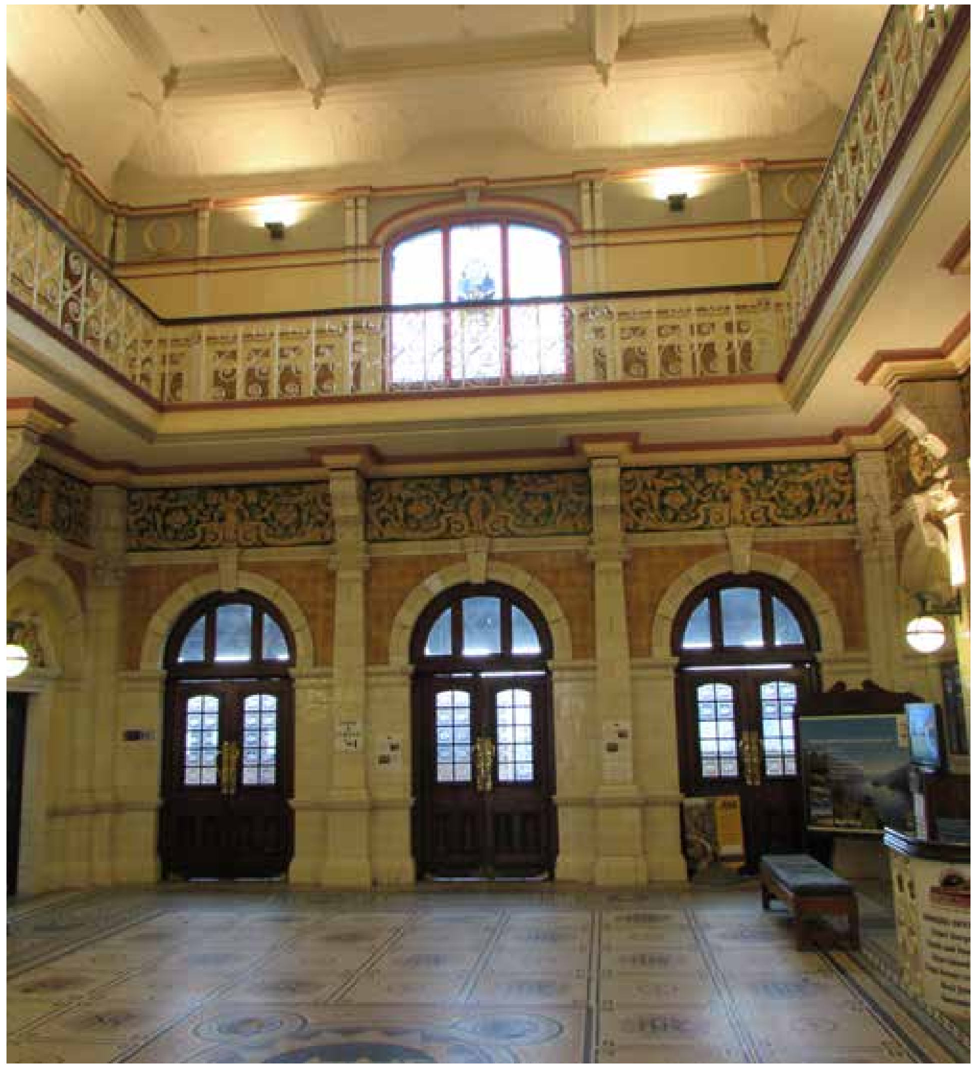
Purpose

The purpose of these national guidelines is identifying universally accepted design principles that assist Chorus and their UFB contractors to design appropriate install solutions for heritage structures, minimising the physical and visual impact of the UFB upgrade. They represent a process of best practice whereby standardised solutions are proposed, but where a suitable solution cannot be identified, provides a means for seeking further advice from key personnel. An example of an install checklist (Appendix A) has been developed to aid contractors to meet objectives, which will help meet best practice guidelines.

Objectives

The objectives of these guidelines are to ensure that minimal adverse effects occur to a heritage structure as a consequence of the UFB upgrade. The key requirements are to Maintain Weathertightness, Minimise Physical Impact and Reduce Visual Impact. These are not hierarchical considerations, they instead represent a process of consideration with regards to design.





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Maintain Weathertightness

Maintain weathertightness

The fate of a building exposed to the elements is one that will deteriorate quickly. Water egress over time will undermine the structure and cause irreversible damage, often resulting in the building's ultimate demolition. Therefore, consideration must be given to locating and installing services where their install will not create or contribute to the loss of weathertightness.

To ensure a structure remains protected from the elements consideration must be given to how and where conduit and ETP are placed.

How To Maintain Weathertightness:

- Conduit should be aligned vertically to prevent material and moisture build up. The orientation of conduit has the potential to affect long-term weathertightness. Horizontally aligned conduit has the potential to trap airbourne debris that will collect moisture, forcing it in to the structure. Such debris also allows for vegetation growth, with roots penetrating cladding materials, flaking them off and also forcing moisture inside.
- Where conduit is horizontal, it must be beneath an eave, ledge, cornice or stringcourse, thus protecting it and the building from weather and debris build up.
- Where required, locate cabling and conduit beneath the eaves of a property (mainly residential) rather than running along the surface of external walls, reducing risk of conduit capturing moisture and debris and also reducing the visual impact.
- While there are visual benefits to attaching conduit vertically against downpipes this practice must be avoided as it poses a risk to the long-term weathertightness should downpipes fail. If no other suitable options exist, conduit may be installed within the vertical cavity.
- Entry holes should be orientated upwards (exterior to interior) so that if seals were to fail and moisture were to form, it would drain out of the building.
- When installing duct or cables into buildings it is required to be sealed at both ends.

Triggers for further advice:

- In any situation where any of the above points cannot be complied with and/or
- In situations where MDU's require external conduit to deliver fibre to individual units and there are no eaves, ledges, stringcourse to protect conduit.
- Where the best solution to maintain weathertightness would create an undesirable visual appeal.

Who to contact

- Local Chorus install designer for a redesign (if possible)
- Chorus RMA Compliance team - RMACompliance@chorus.co.nz

Above Left - Poor example of conduit installation attached to downpipe.
Above Centre - Good example of conduit installation in vertical cavity but not attached to downpipe.
Above Right - Poor example of conduit installation with horizontal cable and significant visual impact.

Minimise Physical Impact

The most obvious or recognisable impact is the physical act of providing a new space/duct through the exterior cladding into the building interior. The other is the fixation of the ETP and delivery conduit to the exterior of the structure. Both of these activities have the potential to physically damage exterior cladding materials. The level of impact will depend largely upon the type of exterior cladding, as certain materials will handle perforation better than others.

Exterior:

- Minimise physical impact by utilising existing ducts and/or perforations.
- Where possible, UFB install should be capable of being easily reversible, meaning conduit, cable and ETP could be removed in future and not permanently fixed to both exterior and interior walls.
- Penetrations into buildings (especially commercial buildings) should be through doorframe (unless oranate or detailed) rather than stone, brick or timber if possible.
- Consideration should be given to the type of exterior cladding, identifying sensitive building materials prior to drilling (*e.g.* faience).
- Penetrations to building masonry should be through mortar joints and pointing rather than through the face of brick or stone to avoid damaging fabric.
- Use existing holes where possible to avoid damage by further perforation or attachment.
- Perforating holes into heritage buildings should be as small as possible.

Interior:

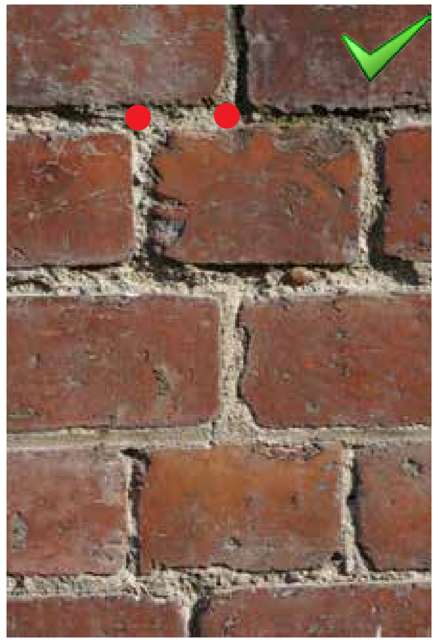
- Check the corresponding interior location for heritage features, care should be taken to avoid damage to skirting, architraves or ornate cornices, mouldings, faience, as well as heritage and significant floors, *e.g.* terrazzo, mosaic.
- Use existing penetrations where possible (*i.e.* If other services have already penetrated heritage interior).
- Consider existing service corridors, basements, fireplaces, and utility cupboards.
- Where possible, in areas of significant heritage interiors services should be installed using concealed methods.

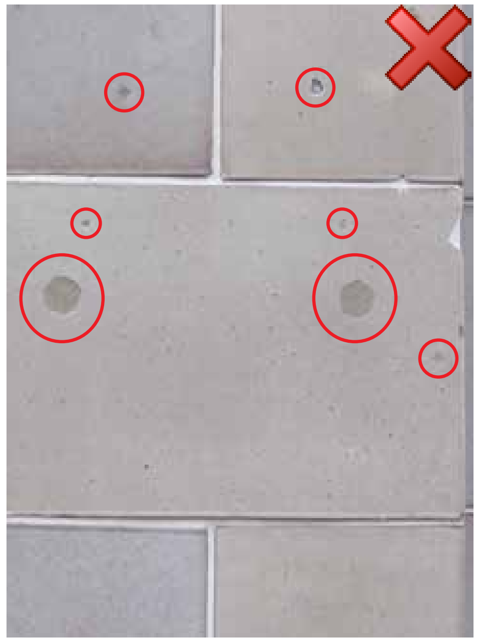
Exceptions and triggers

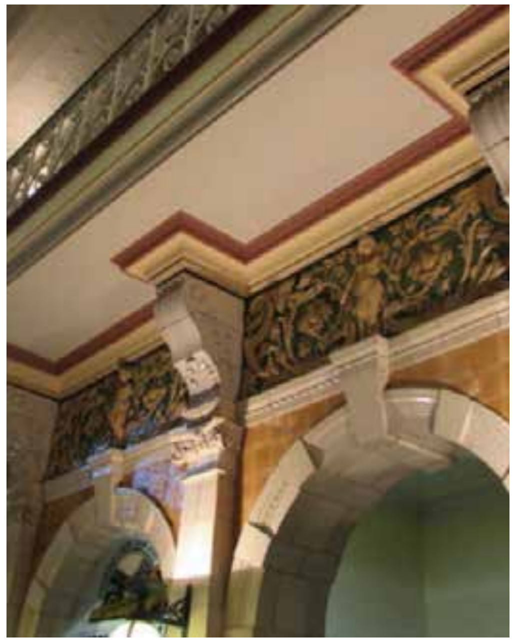
- Where the use of existing ducting or replacement of redundant services contributes to a negative physical or visual effect (*i.e.* if that duct is poorly positioned (see Reduce Visual Impact) or installation does not comply with weathertightness guidelines).
- Where install is likely to damage sensitive materials: sod, cob, faïence, stone tiles.
- Where exterior perforation will contribute to a cumulative effect.
- A significant heritage interior cannot be avoided including floors and/or ceilings.

Who to contact

- Local Chorus install designer for a redesign (if possible)
- Chorus RMA Compliance team - RMACompliance@chorus.co.nz







Above Left - Pentetrations to building masonry should be through mortar joints and pointing indicated by red dots.
Above Centre - Example of damage to faïence exterior caused by pentrations through face.
Above Right - Example of significant heritage interior with detailed faience finish.

Reduce Visual Impact

Appearance plays an important part in shaping our appreciation and understanding of the historic built environment. The aesthetic of an individual building contributes to the wider appreciation of a streetscape, thus the location of the ETP and conduit on an individual building will be paramount to reducing the visual impact of the upgrade.

Street views should be considered in the same vein (*i.e.* how will the UFB install impact upon the street itself). The visual absorbency of a street (ability for a street to absorb new materials) is dependent upon how similar the individual buildings in the street are. For example, an intact street of 19th century buildings will have a reduced ability to absorb new items, materials and services. These materials will dominate the view, drawing attention to them, and away from the building or streetscape itself. A differentiated streetscape of multiple building styles has a greater ability to absorb new material. Where a streetscape is largely intact, extra consideration should be given to the potential impact, and the appropriate location for new services.

In terms of where to locate the UFB infrastructure on individual buildings, it is a matter of how, and for how long, the public interact with the exterior of the building in their daily lives (*i.e.* how long is it in their view during their approach). The UFB install will have the greatest impact in the elevation that is in view for the greatest duration (the principal elevation(s)). Therefore, the simplest way to reduce visual impact is to locate the UFB infrastructure away from the principal elevation, in either the rear, or side of a building. However, other options can also be considered.

How to reduce visual impact

- Where possible, UFB should be installed utlising existing ducts or entry points. Further to the physical mitigation benefits, installation with existing services will remove the need for a new connection, reducing the visual impact by keeping services contained in one area. Existing ducts could be in a building's façade or the principal elevation.
- Replacing existing (obsolete) services – often a heritage building will have redundant services that can be replaced. However, consideration must be given to whether this install is contributing to a negative effect (*i.e.* existing location would not meet best practice).

Where to locate new connection

- **To side or rear of building** - identify the principal elevation, (typically this is the front) meaning the adjacent elevation is typically the side. The rear is the generally the elevation with least interaction. It is possible, especially in commercial settings, that a building might have two principal elevations. Where possible, infrastructure should be installed in either the rear or to the side of a building (elevations with reduced public interaction).
- **Enter building below ground** - in many situations, it will be possible to install fibre directly into the building below ground, making use of features like basements, pile foundations, grates *etc,* meaning the fibre cabling will be hidden from view.
- **New connection to building façade** – in many instances there will be only one elevation available for UFB install and this will be the building façade. This is more likely to occur in the CBD or in situations such as terrace housing. The greatest visual impact of the UFB upgrade will occur when services are required to be placed in this principal elevation. Therefore, extra consideration must be given to where, within this façade, services should be located in order to reduce the visual impact. A building's style will determine the level of visual absorbency it has (ability to hide the ETP and conduit). Buildings with higher visual absorbency will be those that have texture and features in high and low relief (see appendix C). Where the building is located on the section will also determine the level impact. Buildings will either be built:
    - Set back from boundary (typically residential styled buildings) or,
    - On the street boundary (typically commercial styled buildings)

In cases where services can only be installed on the façade, but the building is set back from the boundary, vegetation can help mitigate the visual impact. This is not the most desirable long-term solution, but can be useful if no other options are available. Similarly, being further back from the street boundary means the ETP and conduit will appear much smaller, and thus have a reduced impact on views when compared to a building on the street boundary. Whether a building is set back from the boundary or upon it (and in all options), the following guidelines apply:

- Where possible, install UFB at margins of façade - locating the conduit and ETP close to the margin of the façade will push them into the peripheral vision, meaning the duration in which people are visually exposed to the units are reduced.
- Where the façade of the building has texture, most likely in neo-classical inspired structures, villas and bungalows, reduce the visual impact by installing the conduit and ETP adjacent to a protruding feature (*e.g.* pilaster, column, bay window). Texture is created when a building has features that are formed between low and high relief. A building with a lot of texture will have a greater ability to hide the UFB materials in its façade (high visual absorbency). Identify a prominent stylistic feature (in high relief) and install UFB in the adjacent low relief.
- Align conduit to follow existing vertical cavities that do not pose a risk to maintaining weathertightness (*e.g.* attached to downpipes).
- In situations where there are no existing vertical features, conduit could also be hidden

Reduce Visual Impact

amongst areas of low relief.

- Conduit in particular should be installed in such a way that it does not cut across or extend from a location of low relief into an area of high or bas-relief. Or have curved or free-formed conduit on buildings with clean, straight lines in its construction.
- In situations where the exterior of the building is unpainted masonry/stone (and thus unlikely to be repainted by the owner) colour the conduit and ETP to match exterior. If a building exterior has previously been painted (and thus, is likely to require ongoing painting by owner) conduit and ETP can remain as installed.

Exceptions and Triggers

- The façade is completely bereft of texture, colour, vegetation, and conduit and ETP will itself create high relief; or
- In cases of MDU's where delivery to each unit can only be on the exterior of the structure.
- The conduit and ETP contrast with an unpainted masonry façade and they cannot be matched in colour.

Who to contact

- Local Chorus install designer for a redesign (if possible)
- Chorus RMA Compliance team - RMACompliance@chorus.co.nz

Top left and Top Right - Examples of poor service installation. Here conduit cuts across stylistic features. Or conduit in itself creates positive relief.
Below Left - Modernist church with minimal exterior decoration/ texture to hide UFB.
Below Right - Art Deco building largely benefit of texture.

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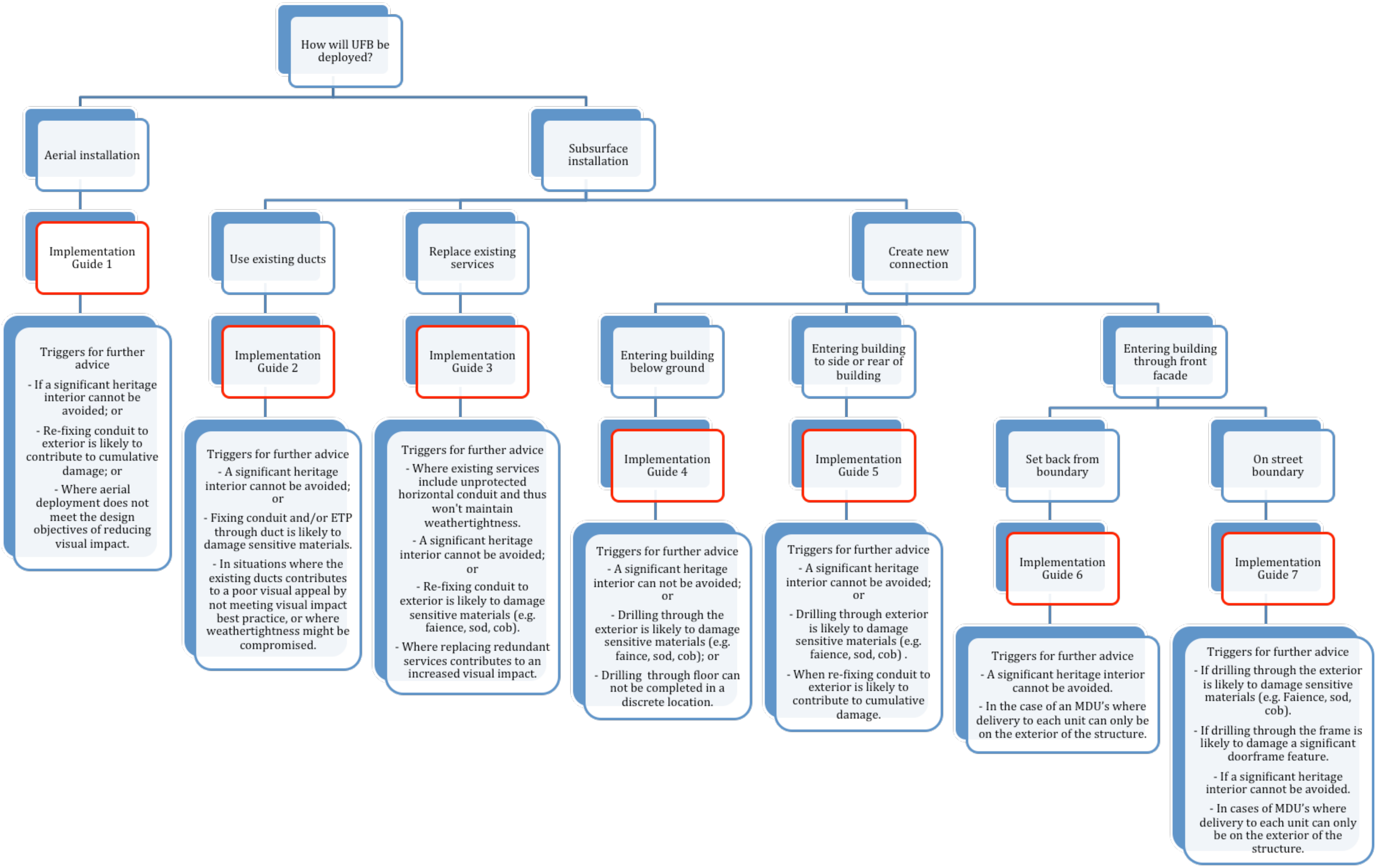
Chorus - Heritage Flow Chart

The heritage flow chart is a quick reference summation of the ways in which UFB will be deployed and installed, and then the options available to these installers. It allows installers to quickly identify the corresponding implementation guide for their chosen install method and location and the key trigger points for seeking further advice.



Implementation Guide 1

Aerial installation: Renall Street, Ponsonby Auckland

The delivery of UFB cabling to private residences or commercial buildings can be provisioned through existing aerial corridors. An aerial connection requires the fibre-optic cable to be delivered to the building alongside existing overhead cables (power, telephone), connecting with the structure at height.

Renall Street is a listed area with the Heritage New Zealand List (List No. 7010) that includes 21 historic buildings from the late 19th century. The street is narrow and its historic buildings represent a high-density middle to lower income Victorian Street.

Existing aerial cables connect to the houses – to either pediments or the space between the main hipped roof and the verandah roof. Due to existing lines, Chorus installation would be via aerial installation replacing the current lines or creating a hybrid line.

The install processes for these two examples are similar and the considerations are presented below:

Maintain Weathertightness

- Orientate conduit under eaves of building.

Minimise Physical impact

- Use existing line overhead cables for deployment.
- Ensure fixings are capable of being removed in future.
- Use smallest diameter drill bit as possible.

Reduce visual impact

- Align conduit to follow existing feature (*i.e.* hide conduit in roof line and beneath eave).
- Locate an area of low relief (install beneath eave, not on it).
- With the roof line able to hide the conduit, use conduit to direct cable to the margins of façade for ETP install.
- Avoid vertical conduits on the front facade, set back at least one metre.

Outcome

- Building remains watertight, physical impact is reduced and UFB infrastructure is mostly hidden from view and with the property set back from the boundary vegetation allows for further mitigation of visual impact.

Triggers for Further advice

- If a significant heritage interior cannot be avoided; or
- Re-fixing conduit to exterior is likely to contribute to cumulative damage; or
- Where aerial deployment does not meet the design objectives of reducing visual impact.

Who to contact

- Local Chorus representative.

Above - Bungalow located on Renall Street with current aerial installation. Red line indicates optimal path for installation (Google Street View 2014).
Below - Square Villas with red line showing optimal path for installation (Google Street View 2014).

Implementation Guide 2

Example 1. Modernist building with existing ducts

Modernist buildings offer fewer opportunities to disguise services in low relief or behind mouldings and ornamentation. However, due to their more recent construction (middle half of the 20th century), architects will have had to consider the provisioning of modern services like electricity and telephone during the design, meaning existing services are likely to have been more sympathetically integrated into the building design. As such, it is likely existing ducts will prove the most sympathetic install.

Maintain Weathertightness

- New UFB conduit and ETP will use existing service ducts designed for such purposes.

Minimise Physical impact

- Conduit and ETP should maintain the same orientation, location, and height, utilising the existing building perforation.

Reduce visual impact

- In this case, the building has been designed with services in mind and these existing ducts are designed to be used.
- Services can be set back from façade meaning they don't create areas of high relief.

Triggers for Further advice

- A significant heritage interior cannot be avoided; or
- Fixing conduit and/or ETP through duct is likely to damage sensitive materials.
- In situations where the existing ducts contributes to a poor visual appeal by not meeting visual impact best practice, or where weathertightness might be compromised.

Outcome

- Building remains watertight, there is no physical impact to the building itself and UFB infrastructure is mostly hidden from view by utilising spaces provided for services.

Who to contact

- Local Chorus representative.

Above - Modernist building with existing ducts.
Below Left - View of ducts along street front showing that they are set back from the façade.
Below Right- Close-up of ducts suitable for service installation.

Implementation Guide 2

Example 2. Dunedin Law Courts - Neo-classical building with improvised existing ducts

Built in times before the telephone and even electricity, Victorian buildings have been previously retrofitted to provide modern services. Often this includes improvised ducts. In the case of installing UFB into the Dunedin Law Courts, this improvised duct provides a good opportunity to keep services together, minimising both physical and visual impact.

Maintain Weathertightness

- New UFB conduit and ETP will use existing service ducts improvised for such purposes.

Minimise Physical impact

- Conduit and ETP should maintain the same orientation, location, and height, utilising the existing building perforation.

Reduce visual impact

- Keep services together reduces the potential visual impact. Thus, UFB install produces no greater impact than that which exists already.

Triggers for Further advice

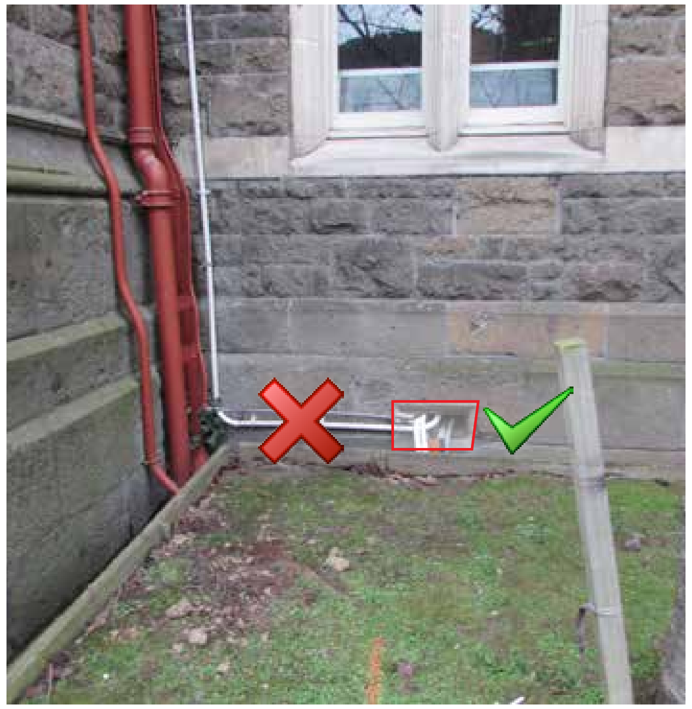
- A significant heritage interior cannot be avoided; or
- Re-fixing conduit to exterior is likely to damage sensitive materials (*e.g.* faience, sod, cob).
- In situations where the existing ducts contributes to a poor visual appeal by not meeting visual impact best practice, or where weathertightness might be compromised.

Outcome

- Building remains watertight, there is no physical impact associated with the UFB install and the visual impact of the infrastructure is restricted to a single area. Conduit and ETP will be largely hidden from view by utilising this improvised duct for services.

Who to contact

- Local Chorus representative.



Above - Neo-classical style building, Dunedin Law Courts.
Right - Example of improvised existing ducts being used for cabling of old services. This avoids the need for addtional service locations Note: horizontal conduit does not meet best practice.

Implementation Guide 3

Replace redundant services: Bond St, Dunedin.

This option relates to the penetration of the physical building fabric, not excavation for deployment, which is addressed separately. The replacement of existing infrastructure with new fibre-optic cables, conduit and ETP will have little to no impact upon heritage values beyond that which already exist.

The nature of physical, visual impact will be no worse than the status quo (subject to actions below) and it is likely that improvements will be realised.

Maintain Weathertightness

- New UFB conduit and ETP will replace existing services.
- Conduit installed vertically.

Minimise Physical impact

- New UFB conduit and ETP will replace existing services.
- Conduit and ETP should maintain the same orientation, location, and height, and utilise the existing building perforation.
- Refixing should be through existing holes thus reducing the cumulative effects of perforation.
- Alternatively, fixing should be through pointing rather than the face of the brick.

Reduce visual impact

- Replacing obsolete services provides visual improvements as the modern ETP are small and more compact.
- Further visual improvements could be realised by colouring conduit and ETP to match the wall.

Triggers for Further advice

- Where existing services include unprotected horizontal conduit and thus will not maintain weathertightness.
- A significant heritage interior cannot be avoided; or
- Re-fixing conduit to exterior is likely to damage sensitive materials (*e.g.* faience, sod, cob).
- Where replacing redundant services contributes to an increased visual impact (*i.e.* new services are larger and more prominent than existing ones).

Outcome

- Building remains watertight, there is no added physical impact and the visual impact is less than the impact displayed by the redundant infrastructure.

Who to contact

- Local Chorus representative.

Above - Suitable location for replacement of a redundant service.

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Implementation Guide 4

Installation entering building below ground: National Bank of New Zealand Building.

By connecting to a building below ground through a basement or underfloor the visual impact is greatly reduced leaving only the potential physical impact. In this case, there is less emphasis on identifying the location of install other than to connect below ground into a space that is hidden from view.

Maintain Weathertightness

- Conduit will be placed below ground.
- Perforation where required, must be orientated to allow moisture to flow away from building.
- Perforation must be well sealed.

Minimise Physical impact

- There will be limited need for fixing of conduit meaning the physical impact will be minimised.
- Where services will then be provisioned through floors, avoid sensitive flooring such as terrazzo, marble, mosaic, or parquet floors where possible.
- Avoid sensitive interiors.

Reduce visual impact

- By entering the building below ground through the basement, conduit and ETP will be largely out of view and thus not impact upon the visual appearance.

Triggers for Further advice

- A significant heritage interior and/or floor cannot be avoided; or
- Drilling through exterior (subsurface) is likely to damage sensitive materials (*e.g.* faience, sod, cob); or
- Drilling through floor cannot be completed in a discrete location.

Outcome

- Building is watertight, there is limited physical impact and UFB infrastructure is mostly hidden from view.

Who to contact

- Local Chorus representative.

Left - Location of basement grate for installation of services below ground
Bottom Left - Close-up of grate. Red line indicates optimal location for installation.
Bottom Right - Existing services are installed below ground, meaning they are hidden from view.

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Implementation Guide 5

Installation entering building to side or rear of building: Bracken Court Building

This connection requires a space adjacent to the principal elevation (most often the façade) of a building. In commercial buildings, this would be an alleyway, a driveway, or a void alongside of the structure. In residential buildings, this would be along its shortest plane or away from the prominent viewing plane.

As can be seen in this example, the Bracken Court building has been designed with a highly decorative neo-classical façade (the principal elevation) whereas the adjacent elevation is bereft of detail. This is because this elevation is not the main approach to the building, nor do the public interact with this plane as they swiftly pass by. For this reason, this side elevation is the most appropriate location for UFB install in this case.

Maintain Weathertightness

- Weathertightness is maintained by installing conduit vertically.

Minimise Physical impact

- Holes drilled into exterior fabric are as small as possible.
- Fixing conduit to building masonry should be through mortar joints and pointing rather than through the face of brick or stone to avoid damaging fabric.

Reduce visual impact

- Located to side of building.
- Conduit aligned to follow existing vertical feature.
- Hidden in area of low relief.

Triggers for Further advice

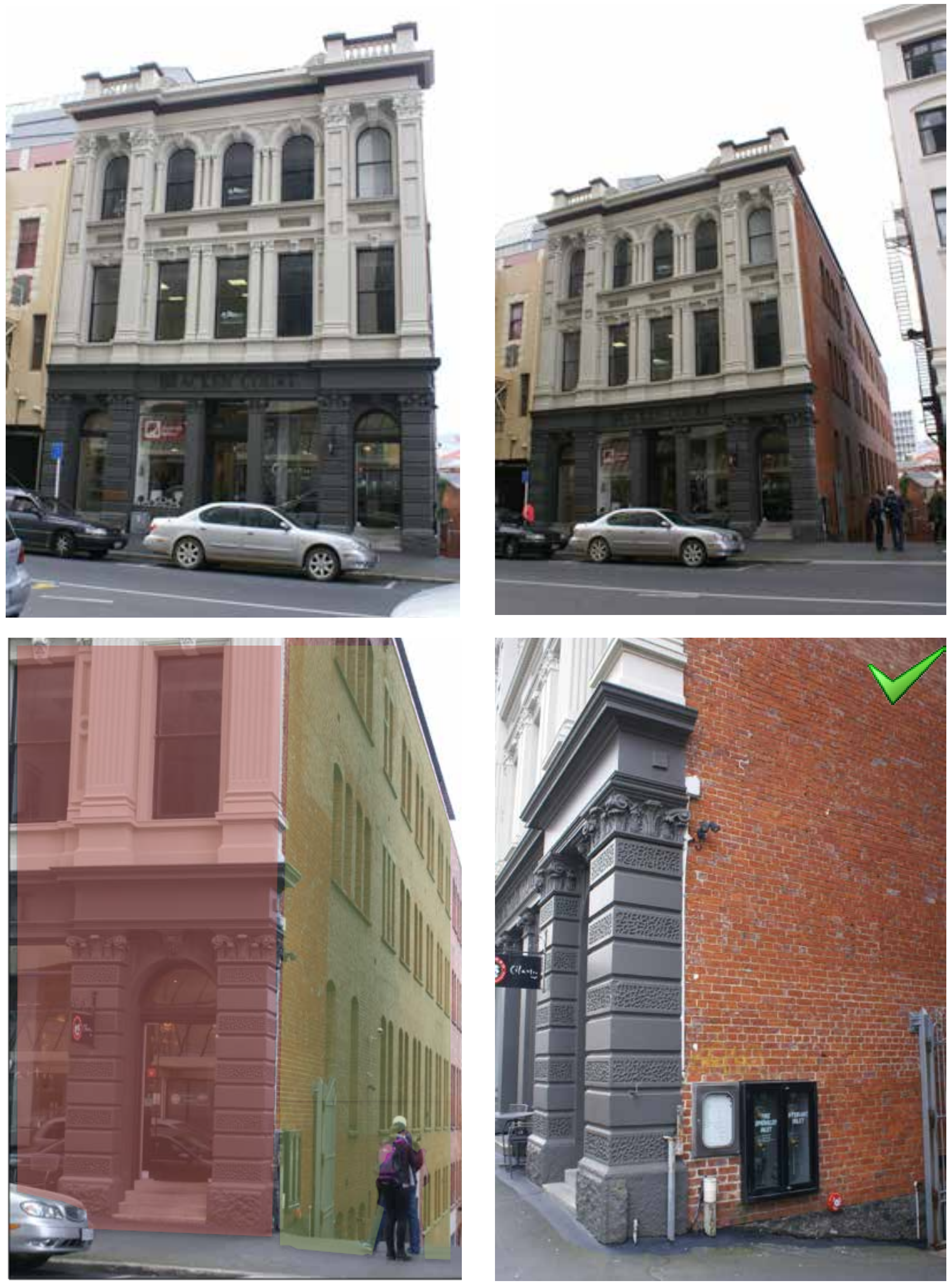
- A significant heritage interior cannot be avoided; or
- Drilling through exterior is likely to damage sensitive materials (*e.g.* faience, sod, cob).
- When re-fixing conduit to exterior is likely to contribute to cumulative damage.

Outcome

- Building remains weathertight and likely to well into the future. There is limited physical impact and UFB infrastructure is largely hidden from view while preserving the feature and character of the ornate façade.

Who to contact

- Local Chorus representative.



Top Left - Principal elevation of a commercial building.
Top Right - Principal and side elevation of a commerical building.
Bottom Left - Coloured planes showing best practice location of UFB install.
Bottom Right - Example of services installed on side of bulding.

Implementation Guide 6

Installation entering building through front façade, set back from boundary: Stuart Street Terrace Houses

The terrace houses are located along Stuart Street near the Octagon and main business district of Dunedin. The houses are on both the Dunedin District Plan Schedule of Heritage Buildings and on the Heritage New Zealand list (List no. 4709). They also form a significant heritage streetscape.

The UFB install option that has the greatest potential impact is that which requires a new connection and must be located on the building's façade. Installing UFB directly upon the front of a heritage building increases the risk of impacting upon visual and stylistic elements. There are few existing ducts into these properties and by their nature, terraced houses have no side alleyways, lanes, service areas. Therefore, the UFB install must be upon the most prominent façade.

For structures set back from the boundary, there are some further mitigation measures that are not available to those constructed at the boundary like vegetation and fences. With UFB cable installed to the boundary, deployment will be by subsurface means.

The install processes for these prominent and listed terraces are similar and the considerations are presented below.

Maintain Weathertightness

- Install vertical trunking to ETP.
- Avoid attaching to downpipes.

Minimise Physical impact

- Where possible, UFB install should be capable of being reversible if required, meaning conduit, cable and ETP could be removed in future.
- If the exterior cladding material is plaster over brick, it is not possible to drill through mortar joints. Therefore, holes should be as small as possible and drilled through plaster.
- Where exit fixing points exist, these should be utilised to minimise the cumulative effect.

Reduce visual impact

- The style of the structures are such that the features are set in high relief meaning they are made obvious and prominent. The best location for the install of ETP is therefore the low relief space between the bay window and the stylised pillaster, which also acts as a firewall between properties.
- This location is also at the margins of the principal elevation placing the UFB infrastructure into the peripherical vision. This means the chances that the ETP will be seen as people move past is much reduced.
- The exisitng fence lines and shrubbery also allow for discrete installation by drawing attention away from the low relief space between the bay and pillaster and thus the ETP.
- In this example, the install location is coloured white and thus white UFB conduit and ETP will be well hidden amongst the plinth foundation.

Triggers for Further advice

- A significant heritage interior cannot be avoided.
- In the case of an MDU's where delivery to each unit can only be on the exterior of the structure.

Outcome

- Building remains weathertight, physical impact is reduced and UFB infrastructure is mostly hidden from view by locating conduit and ETP in the area of low relief at margin of façade. With the property set back from the boundary the ornate fence and some vegetation allows for further mitigation of visual impact.

Who to contact:

- Local Chorus representative.

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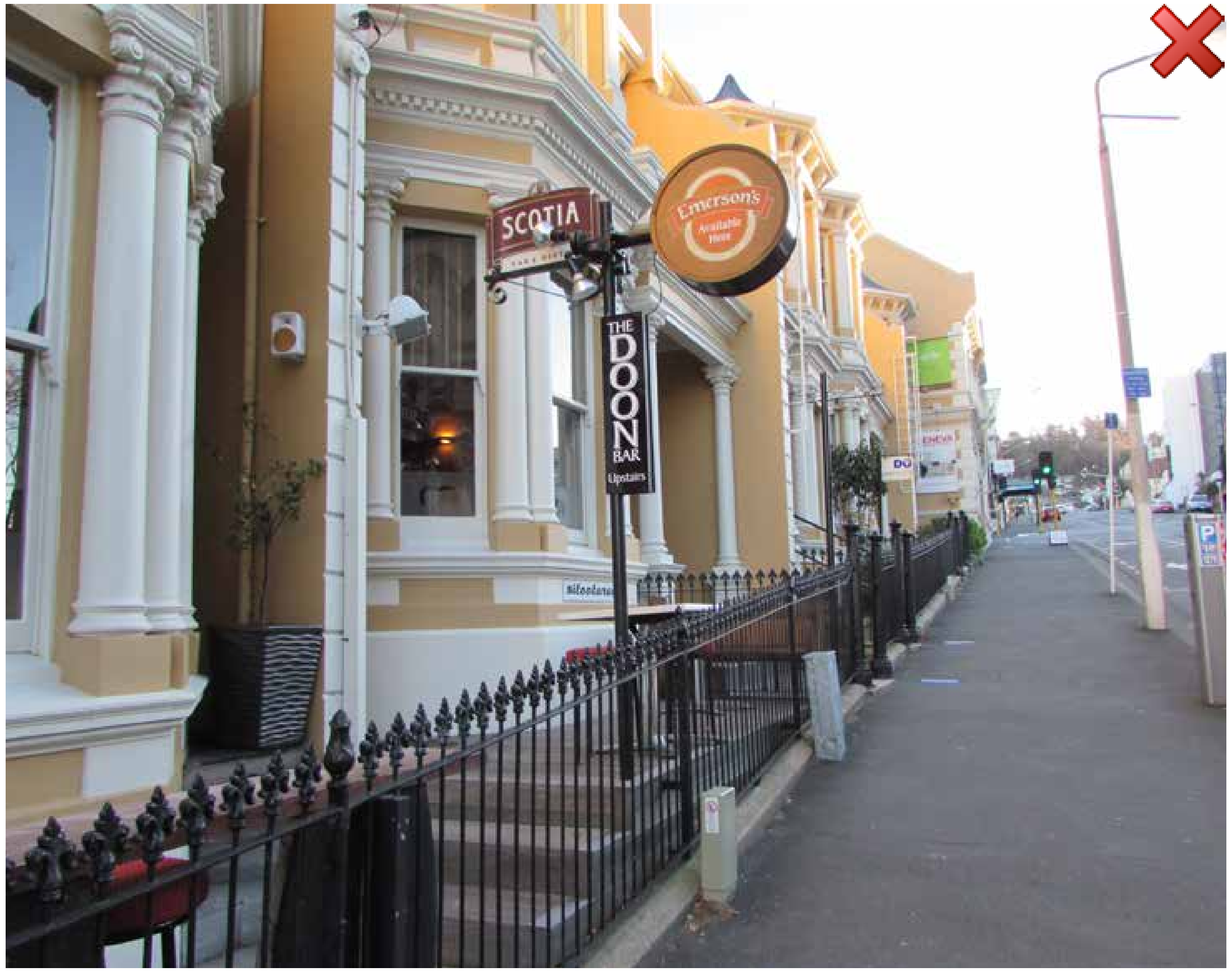
Further note:

- The terrace houses are schedulted on the Dunedin District Plan and on the Heritage New Zealand list (List No. 4709) as a significant streetscape. In cases like these, the location of UFB services along the footpath should also be considered. Installation in such sensitive areas should consider the visual absorbency of the street. In this case, the ability to hide modern services is reduced, meaning modern services attract undue attention, drawing the eye away from the structures.
- There are multiple examples of current service installations to the terrace buildings. These examples are not attached to the buildings but they demonstrate the impact that misplaced services can have on the aesthetic the streetscape.



Above - Terraced housing located on Stewart Street, Dunedin, with misplaced services along fence line.
Right- Red marker indicates optimal area for installation.

Implementation Guide 7

New connection to front façade, on street boundary: Dowling Street, Dunedin

New connection to building façade – on-street boundary: Dowling St (one principal elevation).

The UFB install option that has the greatest potential impact is that which requires a new connection, and must be located on the building's façade. Commercial properties tend to be built to the boundary, and therefore lack many of the options for obscuring UFB infrastructure as is available in properties set back from the boundary. Commercial buildings have few options other than the building's own features and texture in which to hide conduit and ETP.

This Dowling Street example has one principal elevation, is built to the boundary and has some stylistic features that give the building texture. There are two options available for locating the ETP and conduit. One is at the margin of the façade in the low relief between pilaster and adjacent building. The other is through the doorframe of the main entrance.

Option one. Installation at margin of façade.

Maintain Weathertightness

- Install vertical trunking to ETP.
- If installing to an upper floor, maintain a vertical orientation.

Minimise Physical impact

- Where possible, UFB install should be capable of being reversible, meaning conduit, cable and ETP could be removed in future.
- Penetrations to building masonry should be through mortar joints and pointing, rather than through the face of brick or stone to avoid damaging fabric.

Reduce visual impact

- Locate conduit and ETP at the margin of the façade.
- Install in an area of low relief at right of façade between high relief pilaster and adjacent building.
- Align conduit adjacent to the vertical feature (pilaster).
- Ensure the work does not alter, obscure or remove significant heritage fabric and fixtures.
- Colour conduit to match exterior materials.

Triggers for Further advice

- If drilling through the exterior is likely to damage sensitive materials (*e.g.* faience, sod, cob).
- If a significant heritage interior cannot be avoided.
- In cases of MDU's where delivery to each unit can only be on the exterior of the structure.

Above - Option One. Installation at margin of façade. Red line indicates optimal path for installation.

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Implementation Guide 7

Option two. Entering through doorframe

Maintain Weathertightness
- Install vertical conduit.
- Avoid horizontal conduit unless it can be protected within the building footprint.
- Ensure perforation into timber is well sealed.

Minimise Physical impact
- Where possible, UFB install should be capable of being reversible, meaning conduit, cable and ETP could be removed in future.
- Penetrations to the doorframe should be as small and as high as possible in the frame.

Reduce visual impact
- Locate conduit and ETP at the margin of the façade (in doorframe cavity).
- The cavity represents an area of low relief.
- Align conduit adjacent or attached to the vertical frame.
- Ensure the work does not alter, obscure or remove significant heritage fabric and fixtures.

Triggers for Further advice
- If drilling through the frame is likely to damage a significant doorframe feature.
- If a significant heritage interior cannot be avoided.

Outcome for option one and two
- The building remains weathertight, there is minimal physical impact to the buiding and its materials, and in each option, the public interaction with the area where UFB infrastructure are located is limited. Thefore, the visual impact of the UFB install will be well mitigated.

Who to contact:
- Local Chorus representative.

Above - Option Two. Entering through doorframe.
Right - Close-up of area. Red line indicates area and optimal path for installation.

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Appendix A

Chorus

Heritage Building Install Checklist

Date

City

Building Address

Circle

Type Res Com

Exterior Material	Deployment	Location	Connection	Entry type for new connections	Use only for façade install	
					Façade Location	Visual mitigation*
Brick						
Stone						
Plaster						
Weatherboard						
Concrete						
Roughcast						
Seek specialist advice before install into these materials						
Faince						
Sod						
Cob						

CODES

Deployment	A=Aerial	S=Subsurface			
Location	Fr=Front	Si=Side	Re=Rear		
Connection	E=Existing	R=Replacement	N=New		
Entry	N1=Entering below ground		N2=Rear and side connections		N3=Façade install
	F1=Façade install set back from boundary			F2=Façade install on boundary	
Visual mitigation	Ve=Vegetation	Lo=Low relief	PC=Painted conduit		*include all that apply

	Circle	
Will weathertightness be maintained?	Y	N
Have you considered minimising the physical impact?	Y	N
Does the UFB install avoid sensitive interiors?	Y	N

Name

Contractor

Company

Note:
Local contacts for further advice
Chorus

HNZ

For office use only

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Appendix B

Glossary

Residential Building

1. Bargeboard: A board that hides the end of a horizontal roof timber. It may be decorated.
2. Bay: An angular or curved projection of a house front filled by fenestration.
3. Bracket: A small supporting piece of stone, wood, metal or other material that projects from a wall.
4. Double-Hung Sash Window: Counter-balanced windows where each sash is balanced by a weight connected to it by a cord that runs over a pulley set in the window surround.
5. Fanlight: A window, often semicircular, over a door, in Georgian and Regency buildings, with radiating glazing bars suggesting a fan.
6. Fretwork: Decorative geometrical carving or metalwork, sometimes with holes.
7. Gable: A section of a building's outside wall that is shaped like a triangle and that is formed by two sections of the roof sloping down.
8. Gable roof: Pitched roof.
9. Verandah: A covered porch or balcony that extends along one or more walls of a building and is open on the outer side.

Commerical Building

1. Column: A structural architectural element that transfers load, which is typically round and with decorative capitals and bases. Types of classical columns include Doric, Ionic, and Corinthian columns. A is fluted, with no base and a capital with simple moulding and an abacus. An Ionic column is characterised by scroll shaped volutes on the column's capital, normally standing on a base which separates the shaft of the column from the stylobate or platform. Composite columns include a mixture of Ionic and Corinthian columns. A Corinthian column is fluted and has more ornate decoration of the capital.
2. Fluting: Shallow concave channels that run vertically down the shaft of a column or pilaster.
3. Corbel: A projecting block, usually of stone, supporting a beam or other horizontal member. A series, each one projecting beyond the one below, can be used in constructing a vault or arch.
4. Pediment: A low-pitched gable end of a building, usually above a portico. A distinctive feature of classical and classically inspired architecture, it is often decorated with a high-relief sculpture.
5. Pilaster: A rectangular column, especially one projecting from a wall.
6. Relief: The projection of forms from a flat surface, so that they are partly or wholly free of it.
7. Set Course: Decorative horizontal band on the exterior wall of a building. Such a band, either plain or molded, is usually formed of brick or stone.

Appendix B

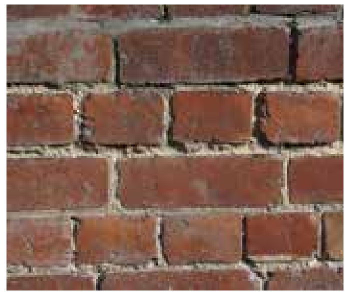
Materials

1. Sod
2. Cob
3. Schist
4. Brick
5. Plaster Render
6. Weatherboards
7. Roughcast
8. Concrete
9. Masonry (limestone, basalt, breccia, etc.)
10. Faïence: Tin-glazed earthenware or ceramic, often used for tiles for pavements and floors, interior and exterior wall cladding.
11. Marseilles Tiles: Tiles are derived from the Gilardoni tile, which was unique in that it was the first interlocking tile to be given a rib in the centre of the tile.
12. Terrazzo - Type of concrete containing high quality stones, which is ground and polished to produce high-gloss floors and benches.


1. Sod (Heritage New Zealand)


2. Cob (Te Ara)


3. Schist


4. Brick


5. Plaster Render


6. Weatherboards


7. Roughcast

8. Concrete


9. Basalt masonry


10. Faïence


11. Marseilles Tiles (Te Ara)


12. Terrazzo floor (Te Ara)

Appendix C

Materials and Regional Variation

Early material choices were dictated with what was readily available in the varying New Zealand regions: Auckland had a supply of Kauri, Otago had rimu, New Plymouth also had a good wood supply and sandstone, with Otago having abundant stone resources for building (Salmond 1986). Canterbury had little wood or stone resources but it did have, as did the rest of New Zealand, material for sod and cob houses, and raupo, toetoe or tussock for thatch roofs (Salmond 1986: 30).

Special Character Areas

Special character areas are generally determined by the presence of a consistent architectural style or structures of a particular period (*i.e.* pre-1900). They tend to form an intact historic streetscape such as in: Buckingham Street, Arrowtown, Harbour Street Oamaru, Renall Street, Ponsonby Auckland. These areas are largely the result of anomalies in urban development. These anomalies could relate to the regional variations noted above, or as a result of other economic, socio-political and/or environmental factors. Examples below.

- Economic - A slowdown in economic output or population growth meaning less demand for new buildings, keeping others intact.
- Socio-political - Development as a response to social initiatives– *e.g.* state housing
- Environmental - A catastrophic event that destroys a streetscape (fire, earthquake) meaning rebuild is reflective of contemporary fashion - *e.g.* the Napier earthquake and Art Deco inspired rebuild.

Reading a building

New Zealand architecture is an eclectic mix of influences and styles across residential, commercial, industrial and public buildings. Architectural styles, much like clothing are subject to changing fashions and advances in technology that allow architects and designers to conceptualise new physical forms and aesthetics. New technologies and external influences provide new ways of designing structures and creating useable space. The most important factor influencing design is a building's function. What it is to be used for? Warehouses are large open spaces for distributing product. Homes are for people and must function accordingly. Thus residential and commercial buildings require different design approaches, but both will be equally influenced by a range of factors including, but not limited to: a design movement, socio-political situations, environmental elements and of course, economic conditions. These elements flow through into the way in which the architect or designer envisages their work and meet the functional needs that then underpin the aesthetic. Identifying the architectural style of a building relies on being able to identify characteristic features within the building including exterior façade that reflect these influences and changes in technology. The aesthetic or character is often produced in the juxtaposition between high and low relief, between what the architect wants us to see and what they hide from view. Features they want us to see are made obvious, they are set forward or created in bas-relief, and as a consequence, give a building texture. In some architectural styles it is the overt lack of texture that is desired to produce clean, simple, modern forms. The key means of reducing the visual and stylistic impact of UFB install is to understand the architectural style and its ability to absorb new materials placed upon it. There is greater visual absorbency (ability to hide something) in a building with a lot of texture than in an art deco or modernist building with limited texture.

Above - Napier, an example of a Special Character Area