

NATSPEC for refurbishment, retrofitting and adaptive re-use

This TECHreport outlines how the NATSPEC specification system may be used for refurbishment, retrofit and adaptive re-use projects. Key upgrade options are summarised and refurbishment related items in NATSPEC worksections are highlighted.

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NATSPEC FOR REFURBISHMENT, RETROFITTING AND ADAPTIVE RE-USE

1 INTRODUCTION

1.1 NATSPEC and refurbishment

Specifications are essentially written descriptions of the required quality of the built product and its component products. In this respect, specifying a refurbishment or adaptive re-use project is no different from specifying a new build project. This TECHreport outlines how a NATSPEC based specification may be used for refurbishment and adaptive re-use projects by highlighting the appropriate worksections for various upgrade options.

1.2 Definitions

The terms refurbishment, retrofit, and adaptive re-use are related, yet each has a different focus.

- Refurbishment: *The remodelling, refashioning and general renovation of a building, site, product or infrastructure.*¹
- Retrofit: *The process of modifying a building's systems or structure after it is initially built and occupied.*²
- Adaptive re-use: *A process that changes a disused or ineffective item into a new item that may be used for a different purpose.*³

1.3 Reasons for building refurbishment

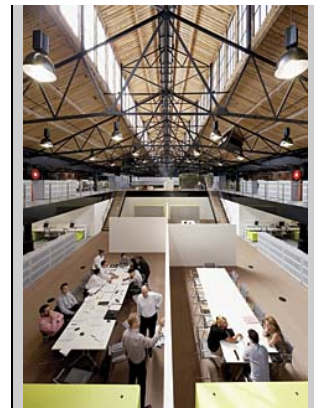
Refurbishment is usually undertaken to:

- Replace deteriorated finishes and building components.
- Reorganise spaces for new uses.
- Improve environmental quality.
- Achieve code compliance and improve safety.

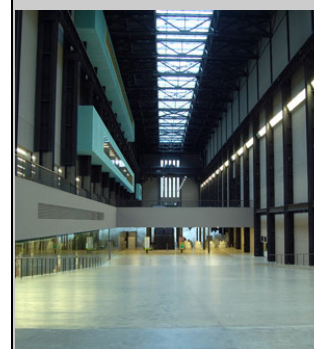
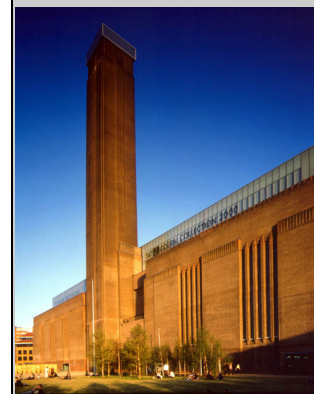
1.4 Levels of refurbishment

Refurbishment may be broadly grouped into three levels:

- Minor:
 - Building tune up and aesthetics.
 - Minor repairs to building services.
 - Non-tenancy upgrades in sanitary facilities and common areas.
- Major:
 - Central plant upgrade or replacement.
 - Tenancy upgrades including sanitary facilities and common areas.
 - Technology upgrades, such as lighting and air conditioning. May involve alterations to risers, walls and replacement of ceilings.
 - Facade upgrade.
 - Roof upgrade.
- Total:
 - Strip back to base building structure.
 - Removal of all building services.
 - Replacement of all building services with new technologies.⁴
 - Facade replacement.
 - Roof replacement.



Goods Shed North, Melbourne.
Elenberg Fraser, BVN 2009. Adaptive re-use of the heritage listed former 1890 railway goods building to offices with a 5 Star Green Star design rating.



Tate Modern, London
Herzog & de Meuron, 2000. Adaptive re-use of the 20th century Bankside Power Station to the Tate Modern art gallery.

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2 DESIGN ISSUES

Some of the main issues for refurbishment, retrofit or adaptive re-use projects include:

- **NCC compliance:**
Accessibility and fire safety system improvements to enhance building useability and safety.
- **Sustainability and ESD:**
Building systems and building fabric upgrades to create a more sustainable, energy efficient structure and improve a building’s energy efficiency rating.
- **Change of use:**
Retention and re-use of existing buildings to conserve their embodied energy, and reduce energy usage associated with demolition, waste disposal and new construction. Maintain heritage significance, where applicable, through reversible design insertions and sensitively designed new work.
- **Demolition:**
Removal of hazardous materials and protection of retained fabric. Address sustainability through material re-use and recycling.

3 KEY UPGRADE OPPORTUNITIES

3.1 Overview

Refurbishing provides an opportunity to improve a building’s environmental performance, increase occupant comfort and reduce running costs.

This TECHreport focuses on upgrade opportunities in the following areas:

- Demolition.
- Structure.
- Facade improvement.
- Accessibility.
- Mechanical services.
- On-site power generation.
- Water conservation.
- Fire safety.
- Lighting.

3.2 Demolition

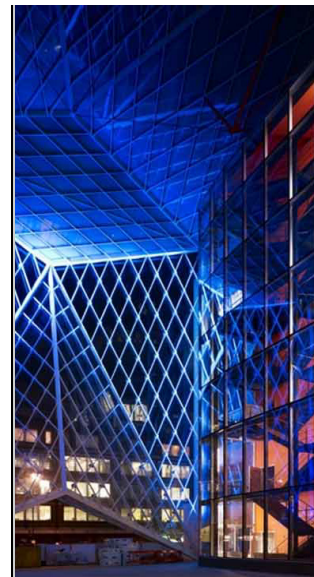
A key part of sustainable refurbishment is planning and undertaking demolition in a way that reduces waste and encourages material re-use and recycling. The **DEMOLISHED MATERIALS** and **DEMOLITION** clauses in *0201 Demolition* and *0202 Demolition (interior and alterations)* can be used to specify demolished materials to be diverted for re-use or recycling. Material re-use and recycling can also be specified in the **WASTE MANAGEMENT** clause of *0172 Environmental management*. Salvage for re-use is also covered in *0531 Suspended ceilings – combined*, which has options for scheduling demountability. The re-use of recovered hardware can be documented in the **SUBMISSIONS** clause in *0455 Door hardware*. The **PROTECTION** clauses in *0201 Demolition* and *0202 Demolition (interior and alterations)* can be used to specify weather and dust protection for existing plant, equipment and materials intended for re-use. Re-use of building service components is covered in the **DEMOLITION – BUILDING SERVICES** clause in *0201 Demolition*.

3.3 Structure

Base building structural modifications may be required for refurbishment and/or change of use projects to increase or reconfigure usable floor space, improve fire protection, strengthen the existing structure, or as a result of other modifications such as new stairs or lifts.

Strengthening may be required when the existing structure is no longer adequate due to change of use and new loading, or changes in design standards. Strengthening options include replacement framing, supplementary framing, or strengthening the existing framing.

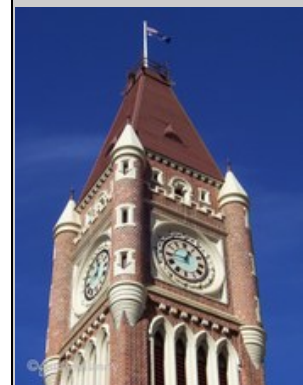
For residential buildings, retrofitting the structure to include new balconies is a popular way to add useable space. Atrium spaces may be cut through existing floors to improve daylight penetration and ventilation for deep floor plates.



55 Baker Street, London.

Make, 2008

Adaptive re-use of the 1950s office buildings, former headquarters of Marks & Spencer, into a mixed use office, retail, leisure and residential complex. BREEAM rating of ‘Excellent’.



Perth Town Hall

Cox Howlett + Bailey Woodland & Hocking Planning and Architecture, 2005

Staged refurbishment and restoration of heritage listed 1870s building, including services and access upgrade.

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Performance requirements may be specified in worksections such as *0310 Concrete – combined* or in the detailed concrete series *0311 Concrete formwork* to *0321 Precast concrete*. *0341 Structural steelwork* and *0381 Structural timber* may also be used to specify structural modifications, and changes to load bearing masonry can be specified in *0331 Brick and block construction*, *0334 Block construction* or *0335 Brick construction*.

3.4 Facade improvement

Facade upgrades can both improve a building’s environmental performance and assist to reposition the building in the marketplace. New facades will need to comply with BCA Section J Energy efficiency provisions, and existing building facades may need to be upgraded to comply if required by State or Territory legislation.

Strategies for improving the performance of an existing facade include the following:

- Applying solar control film.
- Resealing existing windows.
- Reglazing existing windows with high performance glass.

These options may be specified in *0461 Glazing*. Other strategies to reduce heat gain include:

- Providing automated internal blinds.
- Installing an additional panel of glazing to the internal face of the facade.
- Shading windows externally.

0574 Window coverings, *0461 Glazing*, *0432 Curtain walls* and *0457 External screens* have provisions for specifying the above options. Site reglazing for refurbishment works is covered in the **SITE REGLAZING** clause in *0462 Structural silicone glazing*. Improvements to the existing curtain wall such as resealing and improving spandrel panel insulation through to replacing the entire facade may be covered in *0432 Curtain walls*.

3.5 Accessibility

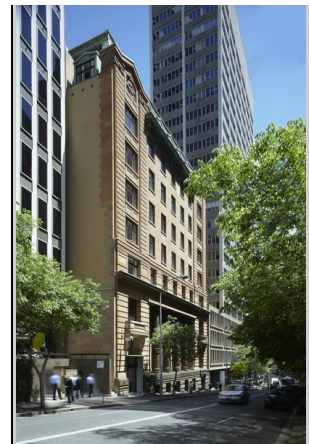
The Commonwealth’s *Disability (Access to Premises - Buildings) Standards* introduced in March 2010 and incorporated into the National Construction Code (NCC) in May 2011, resulted in changes to requirements for accessibility in and around buildings. The Premises Standards are triggered in the Building Code of Australia (BCA) for new Class 1b, 3, 5, 6, 7, 8, 9 and 10 buildings, or those undergoing refurbishment work that requires building approval. Class 2 buildings are excluded from this Standard except where accommodation for short-term rent is provided, although BCA Section D has further requirements for Class 2 buildings. Both new work and affected portions of the existing building need to comply to the Standard. Compliance issues include:

- Doorways:

Options include modifying existing doors such as changing door swings and replacing door hardware, widening existing doorways or installing alternative compliant doors to meet the access code requirements in AS 1428.1 and AS 1428.2. *0453 Doors and access panels* and *0455 Door hardware* may be used to specify performance requirements and schedule doors and hardware. Re-use of recovered hardware can be scheduled in *0201 Demolition* or *0202 Demolition (interior and alterations)* and the standard of refurbishment work to recovered hardware is covered in the **SUBMISSIONS** clause in *0455 Door hardware*.

- Sanitary facilities:

Accessible facilities, including ambulant and unisex accessible compartments, need to be provided for new work. Ambulant compartments may be provided by upgrading existing cubicles (provided they are adequately sized) with grab rails, appropriately positioned toilet paper dispensers, and correct height and type of toilet seats and backrests. *0802 Hydraulic design and install*, *0811 Sanitary fixtures* and *0812 Tapware* may be used to specify fixtures and fittings conforming to AS 1428.1 and AS 1428.2 for accessible sanitary facilities and showers. Grab rails, toilet backrests and shower seats may be covered in *0191 Sundry items*.



The Perpetual Building, Sydney. Jackson Teece Architects, 2010.

Refurbishment of heritage listed office building to create contemporary offices with a 6 Star Green Star Office Design rating.



Unilever House, London, Kohn Pedersen Fox, 2008

Extensive reconfiguration and refurbishment of the interior, and conservation and restoration to the façade of the Grade II listed 1930s office building. Additions include offices, conference area, exhibition space, restaurant, cafe and roof garden.

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- Stairs, ramps and walkways:

Stairs, ramps and walkways in the required path of travel may only need minor modifications if existing risers, goings, gradients and handrail provisions comply. Handrails to AS 1428.1 and AS 1428.2 may be specified in *0552 Metalwork – fabricated*. Luminance contrast for stair tread nosings and tactile ground surface indicators (TGSIs) to AS/NZS 1428.4.1 and AS 1428.2 may be specified in the pavements series *0272 Asphalt to 0279 Paving - on pedestals*, timber worksection *0383 Decking, sheet and panel flooring*, fixtures worksections including *0551 Joinery* and *0552 Metalwork - fabricated*, trowelled and sprayed coatings worksection *0613 Terrazzo in situ*, tiling worksections including *0631 Ceramic tiling, 0632 Stone and terrazzo tiling* and in the floor surfacing series *0651 Resilient finishes to 0657 Resin based seamless flooring*.

Stairlifts are an option for low rise buildings where there are no lifts and it is not practical to install ramps. Where there is sufficient space, a platform lift may be used to supplement stairs not more than 1 m high in an entrance and lobby. Reversible interventions such as threshold ramps and landings may be a practical solution for overcoming access issues in heritage buildings, where altering the existing built fabric is not permitted.⁵

- Lift and lift lobby refurbishment:

Existing lifts in the accessible path of travel may only require a minor refurbishment to comply if the internal dimensions meet NCC requirements. Upgrades may include providing handrails, and braille and tactile buttons to AS 1735.12 in both the lift car and at landings. Lifts serving more than 2 levels also require audible and visual information identifying stops and the position of the car.

- Floor finishes:

Firm, stable, slip-resistant flooring is required for an accessible path of travel. Existing uneven floors may need self-levelling, cementitious toppings applied to create a suitable substrate for new finishes. However, consideration should be given to the effect such changes in floor levels may have on stairs, where riser heights and floor gradients may be affected. Tactile ground surface indicators (TGSIs) to AS/NZS 1428.4.1 and AS 1428.2 are required.

Highly polished or glossy surfaces on an accessible path of travel may cause glare and become slip hazards and should be avoided. *0612 Cementitious toppings, 0613 Terrazzo in situ, 0631 Ceramic tiling, 0632 Stone and terrazzo tiling, 0651 Resilient finishes* and *0657 Resin based seamless flooring* have provisions for specifying the level of slip resistance required. Low pile carpets may be specified in *0652 Carpets*. Sustainable refurbishment options such as re-use of recovered carpet tiles can be scheduled in *0201 Demolition*. *0652 Carpets* covers re-usable carpet tile backing in the **CARPET TILES** clause.

0224 Stormwater – site may be used to specify grates and covers located on the path of travel to AS 1428.1 and AS 1428.2.

- Signage:

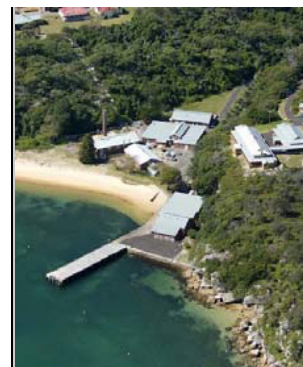
Areas that require braille and tactile signage include new accessible sanitary facilities, rooms with hearing augmentation systems, non-accessible pedestrian entrances and egress doors that require illuminated signs. *0581 Signage* may be used to specify signage to AS 1428.1 and AS 1428.2, and other statutory signage.

- Carparking:

Carparking may only need modifications to linemarking if existing building geometry allows for accessible carparking spaces in accordance with AS/NZS 2890.6. *0581 Signage* may be used to specify linemarking for accessible carparking facilities.

3.6 Mechanical services

A minor upgrade to the mechanical systems may include installing metering, recommissioning systems to operate at their maximum efficiency, and upgrading and tuning existing controls and the Building Management System (BMS) to ensure the system only functions when the spaces are occupied. *0773 Building management systems, 0791 Mechanical commissioning* and *0792 Mechanical maintenance*, may be adapted as required to suit an existing installation. Work on existing systems can be specified in *0701 Mechanical systems*.



Q Station, Manly
 Paul Davies Architects, Cate Young Design, 2010
 Conservation and adaptive reuse of the North Head Quarantine Station. Precinct includes a hotel, function rooms, restaurant, bar, visitor centre and museum.



Queensland Museum, South Brisbane
 Cox Rayner, 2012
 Upgrade of the 1980s building to improve the internal circulation, public facilities, lighting and staff areas. New café and new entry created off Grey Street.

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A major upgrade may include cleaning and rebalancing ductwork and pipe work systems, upgrading filters on air handling units (AHUs), and installing variable speed drives on fans and pumps to improve energy efficiency. Other options include replacing old and inefficient equipment, selecting more efficient pumps and fans or converting existing variable air volume (VAV) systems to low temperature VAV systems.⁶ *0714 Mechanical pumps* and *0731 Fans* may be used for specifying upgrades to these component

A total refurbishment is an opportunity to lower building energy consumption and improve indoor environment quality by replacing the existing air conditioning system with a new low energy system, such as a mixed mode system or chilled beams. Mixed mode VAV system air conditioning can be specified in *0701 Mechanical systems*, *0711 Chillers – combined*, *0714 Mechanical pumps* and *0724 Air handling plant – combined*. Mechanical subgroups *073 Air handling components* and *074 Ductwork and components*, particularly *0747 Variable air volume terminals*, will also be relevant. *0773 Building management systems* can be used to specify automated operation of windows and blinds for a mixed mode system.

3.7 On-site power generation

- Cogeneration and trigeneration:

These systems produce electricity and thermal energy from a single fuel source (commonly natural gas). *0931 Power generation – engine driven* may be used to specify either a cogeneration system, which supplies electricity and heat for space heating, hot water and steam,⁷ or a trigeneration system which goes a step further and provides cooling. Another option to consider, if available, is connection to a local trigeneration energy network.

- Solar power:

Renewable solar energy may supplement a portion of a building's electricity or hot water needs. *0802 Hydraulic design and install* can be used to specify solar hot water systems. *0933 Power generation – photovoltaic* may be used to document stand-alone or grid connected solar photovoltaic (PV) systems.

3.8 Water conservation

- Fixtures and equipment:

There is considerable potential for conserving water by specifying water efficient fixtures and equipment. *0811 Sanitary fixtures* may be used to schedule water efficient toilets and low water use/waterless urinals. Water efficient tapware and showerheads to AS/NZS 6400 can be scheduled in *0812 Tapware*. *0191 Sundry items* may be used to document selected equipment such as water efficient dishwashers and washing machines.

- Landscape irrigation:

Water consumption may be reduced for irrigation in refurbishment projects through using recycled water or installing low water using xeriscape gardens. *0825 Rainwater storage systems* has provisions for specifying rainwater tanks and ancillaries.

- Heat rejection water systems (cooling towers):

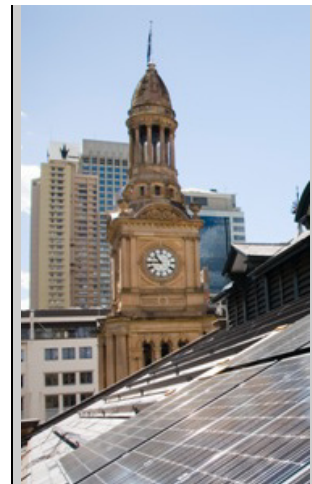
Water consumption may be decreased by specifying low water use cooling towers, reducing water use by increasing cycles of concentration and non-water consuming alternatives to cooling towers. *0713 Cooling towers* has provisions for specifying these water conserving options.

- Fire safety systems:

Thousands of litres of water a year may be wasted during fire protection system tests.⁸ *1033 Sprinklers* may be used to specify systems that recirculate water during the test or capture and re-use it on site. Water may also be conserved by improving fire sprinkler zoning to allow floor-by-floor testing.

- Water harvesting and re-use:

Where permitted by authorities, rainwater and greywater harvesting and re-use may significantly reduce potable water consumption. NATSPEC includes *0825 Rainwater storage systems* and *0826 Greywater systems* for specifying these systems.



Sydney Town Hall,
Tanner Architects, 2008
Staged refurbishment of heritage listed 1880s building including services upgrade.



The Hespeler Library,
Cambridge, Canada
Kongats Architects, 2006.
Preservation of the historic 1922 building and expansion of the library facilities through contemporary glass encasement.

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3.9 Fire safety

Upgrading fire safety systems to conform to current requirements may include installing, modifying or replacing emergency warning systems, smoke detection and control systems, and sprinklers.⁹ Other issues include providing passive fire protection to the existing structure, and fire stair remodelling and pressurisation.¹⁰

Electrical fire system upgrades or replacements can be specified in *1072 Fire detection and alarms*, and *1073 Emergency warning and intercommunication*. Hydraulic upgrades may be covered in *1031 Hydrants*, *1032 Hose reels* and *1033 Sprinklers*.

Upgrades to the existing structure to meet current regulations or due to change of use may be covered in *0346 Structural fire protection systems*. Individual worksections such as *0331 Brick and block construction* and *0321 Precast concrete* have provisions to specify fire rating requirements. Fire protection of service penetrations and control joints may be covered in *0182 Fire-stopping*. Other fire-stopping measures such as fire doors and smoke seals may be specified in *0453 Doors and access panels*.

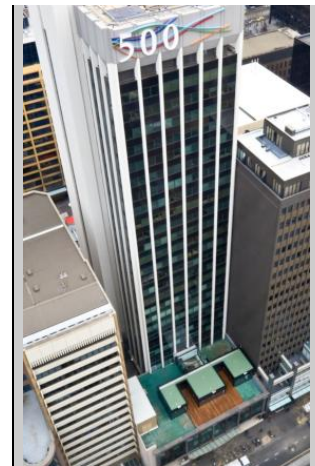
3.10 Lighting

Replacing outdated lighting may assist in reducing energy consumption, improving the indoor environment quality and reducing internal heat load. Options include installing energy efficient T5 fluorescent lamps and replacing incandescent lamps (including tungsten halogen and tungsten filament) with compact fluorescent or LEDs. Other options include providing automatic lighting controls, daylight sensors, motion detector sensors, and wiring of lighting to allow for separate switching of day-lit perimeter zones. Designing low level background illumination and supplementing with task lighting may also help reduce energy consumption. Upgrading external lighting may also help reduce light pollution through controlling light spill and upwards wasted light at night.

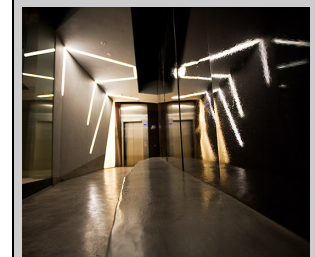
Provisions for specifying these upgrade options as well as refurbishment and re-use of existing luminaires can be scheduled in SELECTIONS in *0951 Lighting*.

4 USING NATSPEC

As a specification template, NATSPEC will not contain all the technical requirements for every project. Specifying refurbishment, retrofit and adaptive re-use projects is similar to a new build project - the specifier will need to select the appropriate NATSPEC worksections and edit the material to suit the project. Editing may include deletion of options, or samples and tests clauses when not required. It may also include revising the quality level, adding new material that is not covered by the NATSPEC templates and editing standard text where it conflicts with project requirements, drawings, and completed prompts, or with added new material. For a step-by-step procedure for producing a specification from the NATSPEC templates, refer to the NATSPEC paper *Specification Writing*.



500 Collins Street, Melbourne
 Peddle Thorp Architects.
 Staged refurbishment of a 1970s office building. 5 Star Green Star - Office Design v1 Certified Rating awarded in October 2006.



86-88 George Street, Sydney
 Terroir Architects 2007.
 Refurbishment of the heritage building's commercial office and retail spaces. State heritage listed building with a 5 star Green Star office design rating.

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REFERENCED STANDARDS

AS 1428	<i>Design for access and mobility</i>
AS 1428.1:2021	<i>General requirements for access – New building work</i>
AS 1428.2:1992	<i>Enhanced and additional requirements – Buildings and facilities</i>
AS/NZS 1428.4.1:2009	<i>Means to assist the orientation of people with vision impairment – Tactile ground surface indicators</i>
AS 1735	<i>Lifts, escalators and moving walks</i>
AS 1735.12:1999	<i>Facilities for persons with disabilities.</i>
AS 1735.12:2020	<i>Facilities for persons with disabilities (EN 81-70:2018, MOD)</i>
AS 2890	<i>Parking facilities</i>
AS/NZS 2890.6:2009	<i>Off-street parking for people with disabilities.</i>
AS 2890.6:2022	<i>Off-street parking for people with disabilities</i>
AS/NZS 6400:2016	<i>Water efficient products - Rating and labelling</i>

¹ Australian Government Department of Climate Change the Environment and Energy, 2007, *Energy Efficiency in government operations (EEGO) Fact Sheet 9 of 12.*
www.environment.gov.au/system/files/energy/files/buildingrefurbishmentfs.pdf

² 1200 buildings *What is a building retrofit ?* City of Melbourne.

³ Australian Government Department of Environment and Heritage, 2004, *Adaptive Re-use – Preserving our past, building our future.*
www.environment.gov.au/heritage/publications/adaptive-reuse

⁴ Robinson, J, 2010, *Refurbishment of Existing Buildings: Good for the Planet and the Bottom Line.*
<http://higherlogicdownload.s3.amazonaws.com>

⁵ Department of Environment, Land, Water and Planning, *Access for all to Heritage Places*, 2008, Victoria State Government.
https://www.heritage.vic.gov.au/__data/assets/word_doc/0022/505255/Disability-access-for-heritage-places.docx

⁵ Eric Martin and Associates Architects, *Access to Heritage Place Guidelines*, Vic, January 2018.
http://www.emaa.com.au/uploads/4/6/3/2/46326229/20180112_access_to_heritage_buildings_guidelines_vic.pdf

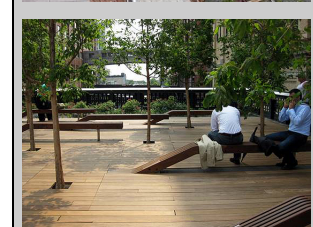
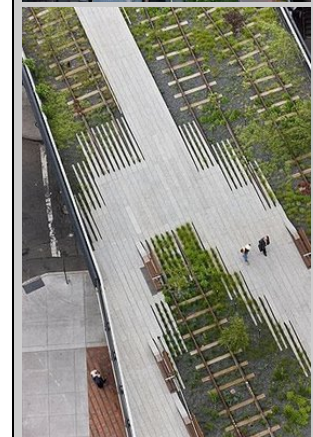
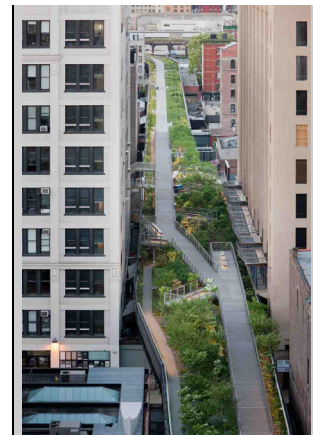
⁶ Robinson, J, 2010, *Refurbishment of Existing Buildings: Good for the Planet and the Bottom Line*, p14.

⁷ NSW Office of Environment and Heritage 2014, *Energy Saver Cogeneration feasibility guide*
<https://www.environment.nsw.gov.au/resources/business/140685-cogeneration-feasibility-guide.pdf>

⁸ Plumbing Industry Commission 2009, *Guide to Fire Sprinkler System Water Saving.*
<https://www.yumpu.com/en/document/read/31859079/fact-sheet-plumbing-industry-commission>

⁹ Adelaide City Council and Jones Lang LaSalle, 2007, *Building Refurbishment Guide.*
<https://silotips.com/download/building-refurbishment-guide>

¹⁰ OneSteel, 2000, *Fire engineering aids AMP's refurbishment.*
<https://www.libertygfg.com/media/54853/fire-engineering-aids-amps-refurbishment.pdf>



High Line, New York
 James Corner Field Operations, Diller Scofidio + Renfro, Piet Oudolf, 2009-2014.

Staged adaptive re-use of a disused 1930s elevated freight train line to a public park.

APPENDIX A: NATSPEC REFURBISHMENT WORKSECTIONS

01 GENERAL**013 Generic preliminaries**

0133 Preliminaries (Interior and alterations)

014 Contract preliminaries

0140 Preliminaries - ABIC 2018 C
 0141 Preliminaries - ABIC MW-2018
 0142 Preliminaries - ABIC SW-2018
 0143 Preliminaries - AS 2124
 0144 Preliminaries - AS 4000
 0145 Preliminaries - AS 4905
 0146 Preliminaries - AS 4902
 0149 Preliminaries - NCW4

017 General requirements

0171 General requirements
 0172 Environmental management

018 Common requirements

0181 Adhesives, sealants and fasteners
 0182 Fire-stopping
 0183 Metals and prefinishes
 0184 Termite management
 0185 Timber products, finishes and treatment

019 Sundry installations

0191 Sundry items
 0193 Building access safety systems

02 SITE, URBAN AND OPEN SPACES**020 Demolition**

0201 Demolition
 0202 Demolition (interior and alterations)

022 Preparation and groundwork

0221 Site preparation
 0222 Earthwork
 0223 Service trenching
 0224 Stormwater - site

024 Landscape structures

0241 Landscape - walling and edging
 0242 Landscape - fences and barriers
 0243 Landscape - water features

025 Landscape cultivation

0250 Landscape - combined
 0251 Landscape - soils
 0252 Landscape - natural grass surfaces

0253 Landscape - planting
 0254 Irrigation
 0255 Landscape - plant procurement
 0256 Landscape - establishment
 0259 Landscape - maintenance

026 Landscape finishes

0261 Landscape - furniture and fixtures
 0262 External sports and playground surfacing

027 Pavements

0271 Pavement base and subbase
 0272 Asphalt
 0273 Sprayed bituminous surfacing
 0274 Concrete pavement
 0275 Paving - mortar and adhesive bed
 0276 Paving - sand bed
 0277 Pavement ancillaries
 0278 Granular surfaces
 0279 Paving - on pedestals

03 STRUCTURE**030 Foundations**

0301 Piling

031 Concrete - In situ

0310 Concrete - combined
 0311 Concrete formwork
 0312 Concrete reinforcement
 0313 Concrete post-tensioned
 0314 Concrete in situ
 0315 Concrete finishes
 0318 Shotcrete

032 Concrete - Systems

0321 Precast concrete
 0322 Tilt-up concrete

033 Masonry

0331 Brick and block construction
 0332 Stone masonry
 0333 Stone repair
 0334 Block construction
 0335 Brick construction

034 Steel

0341 Structural steelwork
 0342 Light steel framing
 0343 Tensioned membrane structures
 0344 Steel - hot-dip galvanized coatings
 0345 Steel - protective paint coatings
 0346 Structural fire protection systems

036 Earth

0361 Monolithic stabilised rammed earth walls
 0362 Mud brick and pressed earth block walls
 0363 Straw bale walls

038 Timber

0381 Structural timber
 0382 Light timber framing
 0383 Decking, sheet and panel flooring
 0385 Cross-laminated timber (CLT)

04 ENCLOSURE**041 Tanking and damp-proofing**

0411 Waterproofing - external and tanking

042 Roofing

0421 Roofing - combined
 0423 Roofing - profiled sheet metal
 0424 Roofing - seamed sheet metal
 0425 Roofing - shingles and shakes
 0426 Roofing - slate
 0427 Roofing - tiles

0428 Roofing - insulated panel systems

0429 Roofing - glazed

043 Cladding

0431 Cladding - combined
 0432 Curtain walls
 0433 Stone cladding
 0434 Cladding - flat sheets and panels
 0435 Cladding - planks and weatherboards
 0436 Cladding - profiled and seamed sheet metal
 0437 Cladding - insulated panel systems

045 Doors and windows

0451 Windows and glazed doors
 0453 Doors and access panels
 0454 Overhead doors
 0455 Door hardware
 0456 Louvre windows
 0457 External screens

046 Glass

0461 Glazing
 0462 Structural silicone glazing
 0463 Glass blockwork
 0466 Structural glass assemblies
 0467 Glass components

047 Insulation

0471 Thermal insulation and pliable membranes
 0472 Acoustic insulation

05 INTERIOR**051 Linings**

0511 Lining

052 Partitions

0520 Partitions - combined
 0521 Partitions - demountable
 0522 Partitions - framed and lined
 0523 Partitions - brick and block
 0524 Partitions - glazed
 0525 Cubicle systems
 0526 Terrazzo precast
 0527 Room dividers

053 Ceilings

0531 Suspended ceilings - combined
 0532 Suspended ceilings - flush lined
 0533 Suspended ceilings - ceiling units

054 Access floors

0541 Access floors

055 Fixtures

0551 Joinery
 0552 Metalwork - fabricated

0553 Stainless steel benching

057 Furniture and furnishings

0571 Workstations
 0572 Miscellaneous furniture
 0573 Fire extinguishers and blankets
 0574 Window coverings
 0575 Tapestries

058 Signs and features

0581 Signage

APPENDIX A: NATSPEC REFURBISHMENT WORKSECTIONS

06 FINISH**061 Trowelled and sprayed coatings**

- 0611 Rendering and plastering
- 0612 Cementitious toppings
- 0613 Terrazzo in situ

062 Wet areas

- 0621 Waterproofing - wet areas

063 Tiling

- 0631 Ceramic tiling
- 0632 Stone and terrazzo tiling

064 Wall surfacing

- 0641 Applied wall finishes
- 0642 Wallcoverings

065 Floor surfacing

- 0651 Resilient finishes
- 0652 Carpets
- 0654 Multilayered board flooring
- 0655 Timber flooring
- 0656 Floor sanding and finishing
- 0657 Resin based seamless flooring

067 Painting

- 0671 Painting
- 0672 Textured and membrane coatings
- 0673 Powder coatings

07 MECHANICAL**070 Mechanical general**

- 0701 Mechanical systems
- 0702 Mechanical design and install

071 Water plant

- 0711 Chillers - combined
- 0712 Water heating boilers
- 0713 Cooling towers
- 0714 Mechanical pumps
- 0715 Mechanical services tanks, vessels and heat exchangers
- 0716 Chillers - centrifugal
- 0717 Chillers - water cooled screw
- 0718 Chillers - air cooled screw and scroll
- 0719 Chillers - absorption

072 Air plant

- 0721 Packaged air conditioning
- 0722 Room air conditioners
- 0723 Evaporative air coolers
- 0724 Air handling plant - combined
- 0725 Air handling plant - built up
- 0726 Air handling plant - minor
- 0727 Air handling plant - packaged

073 Air handling components

- 0731 Fans
- 0732 Air filters
- 0733 Air coils
- 0734 Humidifiers
- 0736 Space heating

074 Ductwork and components

- 0741 Ductwork
- 0744 Ductwork insulation
- 0745 Attenuators and acoustic louvres
- 0746 Air grilles
- 0747 Variable air volume terminals
- 0748 Chilled beams

075 Piping

- 0751 Mechanical piping
- 0752 Mechanical piping insulation
- 0753 Water treatment
- 0754 Liquid fuels
- 0755 Medical gas systems

076 Refrigeration

- 0761 Refrigeration

0762 Cool rooms**077 Control**

- 0771 Automatic controls
- 0772 Automatic controls - minor
- 0773 Building management systems

078 Mechanical electrical

- 0781 Mechanical electrical
- 0782 Mechanical electrical - minor
- 0784 Motors and starters

079 Mechanical commissioning and maintenance

- 0791 Mechanical commissioning
- 0792 Mechanical maintenance

08 HYDRAULIC**080 Hydraulic general**

- 0801 Hydraulic systems
- 0802 Hydraulic design and install

081 Hydraulic components

- 0811 Sanitary fixtures
- 0812 Tapware
- 0813 Water heaters
- 0814 Hydraulic pumps
- 0815 Drinking water dispensers
- 0816 Hydraulic services tanks

082 Hydraulic systems

- 0821 Stormwater - buildings
- 0822 Wastewater
- 0823 Cold and heated water

0824 Fuel gas

- 0825 Rainwater storage systems
- 0826 Greywater systems

088 Hydraulic electrical

- 0882 Hydraulic electrical - minor

089 Hydraulic commissioning and maintenance

- 0891 Hydraulic maintenance

09 ELECTRICAL**090 Electrical general**

- 0901 Electrical systems
- 0902 Electrical design and install

091 Electrical equipment

- 0911 Cable support and duct systems

092 Power systems

- 0921 Low voltage power systems
- 0925 Electric vehicle charging systems

093 Power supply equipment

- 0931 Power generation - engine driven
- 0933 Power generation - photovoltaic
- 0937 Uninterruptible power supply

094 Power distribution equipment

- 0941 Switchboards - proprietary
- 0942 Switchboards - custom-built
- 0943 Switchboard components
- 0947 Power factor correction

095 Lighting systems

- 0951 Lighting

096 Communication systems

- 0961 Information and communications technology (ICT) systems
- 0962 Television distribution systems
- 0963 Sound systems

097 Safety systems

- 0971 Emergency evacuation lighting

0979 Lightning protection**098 Security systems**

- 0981 Electronic security

099 Electrical commissioning and maintenance

- 0991 Electrical maintenance

10 FIRE**100 Fire general**

- 1001 Fire services systems
- 1002 Fire services design and install

101 Fire components

- 1014 Fire services pumps
- 1016 Fire services tanks

103 Wet fire suppression systems

- 1030 Combined wet fire suppression systems

1031 Hydrants**1032 Hose reels****1033 Sprinklers****104 Dry fire suppression systems**

- 1041 Gaseous fire suppression systems

105 Chemical fire suppression systems

- 1051 Liquid chemical fire suppression systems

107 Fire safety systems

- 1072 Fire detection and alarms
- 1073 Emergency warning and intercommunication

108 Fire electrical

- 1082 Fire services electrical - minor

109 Fire commissioning and maintenance

- 1091 Fire services maintenance

20 CONVEYING**201 Conveying equipment**

- 2011 Lifts design and install