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AUSTRALIAN BUILDING CODES BOARD

PROPOSAL FOR CHANGE TO THE NATIONAL CONSTRUCTION CODE 2019

COMMUNICATIONS ALLIANCE

AUGUST 2017

PROPOSAL FOR CHANGE

NATIONAL CONSTRUCTION CODE SERIES

SUBJECT	**Telecommunications pathways and spaces**
BCA Volume One:	**New Part F6 Telecommunications**
BCA Volume Two:	**New 3.8.3.4 and 3.8.3.5 Telecommunications pathways and spaces; Installation requirements**
Guide to Volume One:	**N/A**
PCA Volume Three:	**N/A**

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The Proposal

1. What is the proposal?

Introduction

Communication Alliance proposes the inclusion of new provisions in the National Construction Code (NCC) to specify pathways and spaces for telecommunications Carrier cabling and equipment in buildings.

The ABCB will be aware that Communications Alliance, with the assistance of the Department of Communications and the Arts, submitted a proposal for the NCC 2016 which took a broader approach and included, in addition to telecommunications Carrier requirements, the pathways and spaces for customer and related cabling within buildings, specifically on the customer side of the network boundary[1].

We see the proposed amendment to the NCC as a critical success factor for the efficiency and efficacy of the roll-out of the Australia's biggest infrastructure project – the National Broadband Network – both during the remainder of the current network build and into the future.

The amendment, in our view, has important implications for national economic competitiveness beyond the immediate cost/benefit estimations on which the ABCB normally relies in assessing the worthiness of proposed amendments.

The current proposal recognises the limitations of what is practically and economically possible for inclusion in the NCC. It addresses the primary shortcomings of the current environment, ensuring that buildings will be designed to provide the necessary infrastructure to allow adequate access, cabling pathways and spaces for equipment for telecommunications Carriers in bringing network cabling to the point where the customer connects.

It is estimated that the removal of the customer cabling aspects from the current submission results in a cost saving in the order of 50%, compared to the earlier proposal.

It is recognised that there are additional requirements to address other electrotechnology services within a building but that those are not the subject of this submission.

The approach

This proposal specifically addresses the following:

- telecommunications pathways and spaces for Class 1 buildings
- telecommunications pathways and spaces for Class 2, 3, 5, 6 or 9c buildings;
- requirements for sole occupancy unit developments with less than 60 units and for developments with 60 units and above;
- the telecommunications internal lead-in conduit;

[1] The telecommunications network boundary point is defined in the *Telecommunications Act 1997*.

- main equipment cupboard(s) and equipment room(s);
- vertical riser cupboards and shafts; and
- dedicated or shared pathways from the riser shaft to the tenancy/apartment

The proposed changes to Class 1 buildings reproduces the earlier work carried out by Communications Alliance for the ABCB consultation on the NCC 2016. The proposed changes have been reproduced in Attachment 2 with one change from the earlier submission, in referring to 'telecommunications networks' without the 'open' qualification.

For Classes 2, 3, 5, 6 and 9c, Communications Alliance has taken the opportunity to present the proposed inclusions for NCC 2019 by using the ABCB NCC 2016 public consultation draft as a base document. The proposed requirements in the draft NCC 2016 have been modified and updated to reflect the NCC 2019 proposal (see Attachment 1).

The approach differs from the NCC 2016 requirements in the following:

- Classes 2, 3 and 9c and Classes 5 and 6 have been combined into a single set of requirements as reflected in Table 1 in Attachment 1. This identifies the pathways and spaces required to satisfy the delivery of telecommunications to vertical Multi Dwelling Units (MDUs) of varying sizes and occupancy volumes.
- the equipment space requirements now focus on wall spacial areas rather than on floor area because all equipment installed in a development to meet the requirements for fibre-ready facilities is mounted to a wall, whilst maintaining the required workable and access space in front of the equipment. This space can be as simple as the vacant space directly in front of the equipment or the opening of a door(s) to access a communications cupboard or floor riser cupboard, allowing a technician to work unobstructed or in a confined space, as well as facilitating adequate pathway of egress for the technician in the event of an emergency or evacuation. This leads to a substantive reduction in space requirements as was proposed in the NCC 2016 submission.
- requirements for pathways from the floor communications cupboard or riser cupboard to apartments and or tenancies are now clearly reflected in Table 1, allowing for greater flexibility and a reduction in pathway requirements through the use of shared pathways. This provides the option for the installation of either:
    - a dedicated pathway from the floor communications cupboard or riser cupboard in the form of:
        - a P20 conduit;
        - a P50 truncation conduit that also supports an access panel where the apartments or tenancies P20 conduit meets the truncation conduit; or
        - a cable tray that supports an access panel where the apartments or tenancies P20 conduit meets the cable tray; or

    - a shared pathway in the form of a cable tray, allowing for a 100 mm wide reserved space along the length of the cable tray for the telecommunications cable. This also supports an access panel where the apartments or tenancies P20 conduit meets the cable tray.
- each apartment or tenancy on each level is serviced by an individual industry standard nominal rigid white telecommunications P20 conduit.

The requirements have been based on telecommunications access networks using Fibre-to-the-Premises (FTTP) technologies, for vertical high-rise buildings, addressing the greatest needs, but can equally be applied to all access networks including Hybrid Fibre-Coax (HFC) and those using copper or fibre lead-ins for DSL Access Modules (DSLAMs, micro DSLAMs). They can be adapted for horizontal MDUs, that is buildings covered by the NCC Volume One, including factories, campus, shopping centres and the like. The requirements have been designed to be telecommunications Carrier and technology independent.

The proposed changes will facilitate builders and developers when entering into agreements with telecommunication Carriers to customise specific installations for a particular Carriers' needs.

The requirements can cater for designs with mixed premises and tenancies.

The Current Problem

2. What problem is the proposal designed to solve?

Telecommunications has been an essential service for every Australian building - both domestic and commercial – for several decades. It is considered just as important as electricity, water and heating, ventilation and air conditioning (HVAC). Over the years, its services have migrated from basic telephony, to data, to notification of alarm and life-safety services, to internet and cloud access, and are now rapidly progressing to future 'smart' applications.

Unfortunately, the telecommunications industry has experienced challenges in delivering the cabling infrastructure that facilitates such telecommunications services, largely due to the construction industry's oversight of the need for pathways and spaces needed for the cabling reticulation. Such oversight has resulted in less-than-optimal provision of telecommunications cabling, manifested as unsightly surface mounted pathways, grossly more expensive cabling installation, reparation works to building, disruption to the building occupant, and/or limitation of services.

Such impediments could have been alleviated through the provision of adequate pathways and spaces for telecommunications cabling.

A lack of adequate telecommunications pathways and spaces also severely impedes a building's ability to utilise the wireless technologies that will make buildings 'smart' (i.e. via the Internet of Things). A wide range of 'smart' systems are already available to make buildings safer, more efficient, more secure, and to create a better work environment, with countless more systems in development. However, buildings that don't have adequate pathways for the cabling to reach antennas strategically distributed throughout the building will limit, or even prevent their deployment, resulting in a building's failure to provide the benefits of 'smart' technologies.

The application of the emerging *Internet of Things* (IoT) to make buildings 'smart' will also see a surge in cabling needing to be installed, often to a plethora of wireless devices throughout the building. Without adequate pathways and spaces, the building's ability to be 'smart' or 'IoT-ready' will be severely impeded, resulting in the 'smart' cost benefits being severely diminished, i.e. the anticipated gains in energy efficiencies, improved occupant safety and building amenity by being 'smart' may never be realised due to the prohibitively high cost to deploy them in the absence of adequate pathways and spaces.

3. What evidence exists to show there is a problem?

Inadequate pathways and spaces for telecommunications services often visibly manifest in unsightly surface-mounted conduits and ducts throughout premises, both inside and out. The problem is faced by both Carriers and premises cabling providers. The financial manifestation is higher costs to provide 'alternative' means to route cabling. It is common practice for cabling installers to increase their base installation rates in projects where there are no suitable pathways and spaces for them, because they themselves incur higher costs in materials, labour and disputes. These incremental costs are typically passed onto the building occupants.

It is informative to see that connecting an existing (brownfields) premises for FTTP costs $4405 in comparison to a new (Greenfields) site costing $2504[2]. This shows a 43% cost differential in retrofitting an existing premises compared to a new site.

According to the recent BICSI cabling survey (see Attachment 4 for details), the median cost increment is 20 to 29 percent. The data is derived from primary research conducted in April 2017, with respondents across the full spectrum of the industry – government and enterprise end-users, consulting engineers, installers and Carriers.

If adequate pathways and spaces were provided by the builder, telecommunications cabling installation costs would reduce accordingly, as the market is mature and very competitive.

[2] nbn Half Year Results 2017. Slide 14. http://www.nbnco.com.au/content/dam/nbnco2/documents/nbn-financial-results-HY2017-presentation.pdf

The Objective

4. How will the proposal solve the problem?

The objective of including requirements for telecommunications pathways and spaces in the NCC is essentially to allow for the deployment of new technologies in a cost-effective manner to make buildings safer, more habitable, more energy efficient and allow for the amenity of buildings to be maintained to acceptable standards during the life cycle of the building.

As discussed earlier, in today's connected environment, there is a growing dependence on ICT infrastructure to provide the interconnectivity for communications, building automation, environmental control, security, energy management, smart building services (metering etc.). The ability for a building to readily cater for telecommunications cabling is an essential component to ensure that tenants will not suffer from loss of amenity over time.

The benefit of having telecommunications pathways and spaces in the NCC will facilitate the engagement between builders/developers and telecommunications Carriers to develop solutions that are fit-for-purpose, meeting the needs of the building occupants,

As with electricity and plumbing, communications have become an essential component of a modern dwelling, underpinning the progress of services that are becoming available to a population that expects to enjoy the benefits that come with the advent of smart buildings and smart cities.

5. What alternatives to the proposal (regulatory and non-regulatory) have been considered and why are they not recommended?

From a commercial perspective, telecommunications has been an essential ingredient for more than half a century. Service delivery during these decades has been punctuated by many problems in delivering services to the public, often requiring the deployment of substandard and more costly options for the user.

This period without regulation of telecommunications pathways and spaces in buildings has often resulted in the telecommunications industry not being able to provide adequate access to their networks. The information from the nbn and BICSI provides some indication of the current situation.

This proposal is in response to the telecommunications industry's experience in providing telecommunications services. The situation becomes more critical as time goes on with the interconnectedness of an information society. More technology is being deployed in buildings, typically being driven by the building owners seeking improved amenities, safety and security for tenants, along with operational cost savings through sophisticated sensing and control using technology.

We note that the telecommunications industry has been proactive in its engagement with developers, property owners and councils. Where there is engagement among all parties at the right time in the development phase, positive outcomes have resulted. In Victoria for example, a developer cannot proceed with a development if they do not have an agreement with a telecommunications Carrier in place.

Wireless communications

Wireless communications is commonly, but mistakenly, seen as an alternative to telecommunications cabling, negating the need for cabling within buildings. The following endeavours to explain why, in fact, wireless technologies can increase the cabling requirements within buildings.

As the most commonly used wireless networks – 4G/5G and Wi-Fi – increase in speed and capacity, their RF coverage decreases, requiring more antennas be distributed throughout a building. Mobile coverage is expanding to meet increased data demands by reducing the size and increasing the number of mobile cells, installing antenna systems within buildings and other enclosed spaces and connecting to the main telecommunications network by cabling. Wi-Fi networks are increasing in speed and coverage by using more Wireless Access Points (WAPs) which are wired to the fixed broadband services in premises. In addition to achieving higher speeds, the signals that are being used between the mobile devices are limited to short distances and cannot effectively penetrate building materials such as gyprock, so WAPs need to be deployed in higher densities, therefore requiring more cabling to be installed within the building to connect them.

The Impacts

6. Who will be affected by the proposal?

There are many stakeholders that will benefit from the inclusion of requirements for telecommunications pathways and spaces in the NCC, e.g.:

- building owners will benefit, as the asset will be able to keep up with ongoing technological advancements facilitated by telecommunications infrastructure, as and when they are developed, without being impeded by inadequate pathways, or high capital costs to deploy the technologies. This covers access to very high-speed wireless services from Wi-Fi and cellular/mobile as it can be deployed into every location of a building.
- tenants/occupants will benefit through the ability to access the latest technologies for their business operations without needing to obtain permission from the building owner to have high impact work done. This supports the Federal Government's policy to support the ageing to stay at home[3].
- the telecommunications industry will benefit through more efficient deployment of the advanced technologies to service clients to businesses, and to occupants of all descriptions, within their homes.
- property developers will benefit through knowledge of what is required to provide access to telecommunications networks; with positive flow-on effects on building utility, aftermarket retrofitting and resale value.
- builders will benefit through the greater efficiency of building to a standard and avoiding ad hoc imposts and time delays.

7. In what way and to what extent will they be affected by the proposal?

There are many areas where various parties will be affected, both in economic and non-economic terms. The goal is to improve the present and future function of the buildings as new technologies can be deployed cost effectively, and to allow the amenity provided by the buildings to be in keeping with what is on offer in modern buildings. For example:

- economic impacts, both in costs (such as the initial design of the pathways and spaces) and in benefits, such as those arising from the timely connection of services, in particular for commercial activities.
- aesthetic impacts, including avoiding having cabling and conduit installed on exposed surfaces, both internally and externally, as a part of a retrofit.
- improved focus on compliance, including a positive influence in the use of compliant products and in discouraging the use of low-cost, non-compliant products. With greater certainty in the arrangements for the provisioning of telecommunications pathways and spaces,

[3] see Ageing and Aged Care Staying at home initiative (https://agedcare.health.gov.au/older-people-their-families-and-carers/staying-at-home

improved understandings between better-informed developers and telecommunications Carriers can lead to an improved level of amenities for the occupant.

- with an increase in the availability of services provided over telecommunications networks, increased savings can be realised through, for example. a reduction of electricity costs resulting from better access to services providing energy management.

Consultation

8. Who has been consulted and what are their views?

Communications Alliance has established a NCC Working Group to develop this proposal. The Working Group is made up of representatives from nbn, Telstra, Optus, Opticomm, the International Copper Association Australia (ICAA), Wood & Grieve Engineers (WGE), the Australian Digital Television Industry Association (ADTIA), VTI Services and the Building Industry Consulting Service International (BICSI).

As a part of the development, BICSI surveyed its members who include end Government and corporate end users, consulting engineers, integrators, installers and Carriers.

Attachment 1

Proposed changes to Volume One of the National Construction Code 2019

Communications Alliance proposes changes to the National Construction Code to incorporate requirements for telecommunications pathways and spaces.

To present these changes in this submission, the *NCC 2016 Draft for Public Comment*, which was released on 3 June 2015, has been used as a base document. All the pages that contained telecommunications-related changes in the NCC 2016 Draft were extracted and reproduced on the following pages.

For this submission, our proposed changes have been incorporated directly into the text in the red boxes, as relevant. (The red boxes were added to highlight all the telecommunications-related changes in the NCC 2016 Draft).

Attachment 2

Proposed changes to Volume Two of the National Construction Code 2019

Communications Alliance proposes changes to the National Construction Code to incorporate requirements for telecommunications pathways and spaces for Class 1 buildings.

These changes have been presented to the ABCB as a part of the NCC 2016 Draft for Public Comment, which was released on 3 June 2015.

All the pages that contained telecommunications-related changes in the NCC 2016 Draft were extracted and reproduced on the following pages.

Attachment 3

Evidence that there is a problem and analysis

In considering the DCWC Report[4], Communications Alliance has identified a number of assumptions that were made in the absence of data from the telecommunications industry, that should now be reconsidered. It is unfortunate that the assumptions made dramatically skewed the findings of the Report.

Market failure

It is the experience of our members that telecommunications Carriers encounter a range of scenarios where there are impediments in connecting a premises as a result of a lack of adequate telecommunication space. These impediments can range from having no provision for pathways or spaces to having substandard pathways such as insufficient or blocked conduiting. These add delay and costs to the works. It is typical that these costs are not itemised, recorded or published. They are often absorbed by the Carrier and ultimately borne by the users of the telecommunications services and through additional building costs.

The nominal figure of 1% selected by DCWC on which the analysis was based appears to bear little relationship to industry experience. In light of the feedback from industry, the BICSI Report and nbn data, the view of our members is that the incidence where there are delays, impediments or obstructions to connecting a premises is closer to 10%. We have elected to choose a figure of 6% as a conservative representative value in our analysis, aware that there are many variables which influence the ability to arrive at a precise figure. These include:

- different building classes involve different arrangements among parties, from individual owner-builders through to large property developers, reflecting a variety of commercial relationships, with varying levels of familiarisation and experience with regulations, auditing processes and financing.
- the obligations of the nbn as the Carrier of last resort who is required by law to provide service to any customer in a service area that requests it, in the absence of any other Carrier of wholesale services.

It should be stated that the financial impact of being without telecommunications services is typically reported in facilities once operational, but seldom reported prior to building occupancy. So empirical data on the latter has been difficult to obtain. That said, their monetised impacts would be very similar, so we believe the following statistics from operational commercial facilities to be representative of the financial impact of delayed communications services due to inadequate telecommunications spaces prior to occupancy, akin to an unplanned outage:

- US$926 per minute cost due to unplanned telecommunications outage in a small ICT network or data centre[5].

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[4] Donald Cant Watts Corks *Assessment Report on Cost Implications* 10 July 2015
[5] Ponemon Institute Cost of Data Center Outages Research Report January 2016

- US$8,851 per minute cost due to unplanned telecommunications outage in a large data centre[6]

Use of telecommunication services

It is our expectation that most buildings in Australia will be connected to telecommunicators networks for fixed phone lines, broadband data and IoT connectivity. In this light, the figure of 73% of occupants who demand fixed line services does not correlate well with the actual number of physical telecommunications connections to premises. The ACMA Communications Report[7] provides a better picture of phone line and internet usage.

Further to this, the Ponemon Institute[8] paints a future that will be far more dependent on data, emphasising the need for reliable access to telecommunications services now, stating: '*Cloud computing is in the midst of a…growth spurt today. Goldman Sachs projects a 30 percent CAGR between 2013 and 2018. The Internet of Things will likely drive the next wave of growth. Specifically, IDC predicts the global IoT market will grow to [US]$1.7 trillion in 2020 from $655.8 billion in 2014.*'

Scope of works

The Communications Alliance proposal for changes to the NCC 2016 reflected the current thinking at the time, to provide to the ABCB a 'best-practice' approach in the provisioning of communications services to buildings. This included provisioning adequate pathways and spaces into the future, catering for various types of services over the Carrier and customer cabling components of a network.

Not having the visibility of or being able to contribute to the methodology behind the analysis of the NCC 2016 proposal, we are now in better position to provide an optimised proposal that reflects the areas of greatest need and provides a viable approach to facilitate the connection of essential telecommunications services to the building occupants.

The DCWC analysis highlights the excess in the NCC 2016 proposed specifications for the building classes other than Class 1, particularly when the possible coexistence of other services and utilisation of building design was not taken into account as a part of the analysis. An iterative development between the telecommunications and building sectors would have, in our opinion, greatly improved the proposal, the analysis and ultimately led to a favourable outcome.

With the reduction of both the pathway requirements and the spaces requirement in this proposal when compared to the NCC 2016 proposal, and a more realistic market failure rate, the calculated *Cost of Specification* (and subsequent Net *Cost of Specification)* is substantially reduced. Our initial calculations indicate that the *Annual Impact* would be either neutral or provide a net benefit to all building classes.

As described elsewhere in the proposal, one of the fundamental changes to the proposal is in specifying reduced equipment space requirements in terms of wall spacial area, rather than floor area. This reflects the approach that is typically taken

[6] Ponemon Institute Cost of Data Center Outages Research Report January 2016
[7] Australian Communications and Media Authority Communications Report 2015-2016
[8] Ponemon Institute Cost of Data Center Outages Research Report January 2016

by Carriers today, compared with specifying dedicated floor and distributor space specifically for telecommunications purposes, as was apparently assumed in the DCWC analysis. Telecommunications equipment can be mounted in its own housing so a purpose-built floor distributor room is not required. Typically, such a housing will be located in the general equipment room where other utilities are also located. Utilising telecommunications cupboards in common spaces, including that associated with door access, and typically as used with other utilities, have allowed for a cost reduction in the order of 50%.

In reviewing the DCWC Report, some further observations can be made on the assumptions being made. As an example to consider, the Class 2 (3-story) building type details have been reproduced below.

As mentioned, the *Telecommunications Equipment Room* may not actually be present in all installations and may just be a cupboard or just a common area. Existing vertical risers be in place for other services such as power but can also be utilised for communications cabling. Often in practice, installed communications cabling is installed in common pathways or risers.

With regards to retrofitting, although space for a floor distributor may no longer be available, and hence no masonry and other fixtures costs, there would be costs associated with an installed cupboard etc.

Using the Class 2 (3-storey) example below, the *Telecommunications Equipment room* costing could reduce to around $2000 and the *Telecommunications spaces Floor Distributor* would be $0, effecting a 50% reduction in the cost.

Class 2 (3-storey) (54 apartments)	Current practice	2016 NCC proposal	Retrofitting
Entry point			
Trench	855 (30 m)	855 (30 m)	2,700 (45 m)
Conduits	750 (30 m)	750 (30 m)	1,350 (45 m)
Saw cutting existing concrete			2,250 (90 m)
Demolition of concrete			2,700 (45 m)
	1605	**1605**	**9000**
Telco equipment room (19 m²)			
Walls		5,319 (46 m)	7,978 (46 m)
Doors		1,850 (1)	2,300 (1)
Lighting		450 (1)	600 (1)
	nil	**7619**	**10,878**
Vertical Risers - existing Note 2			
Walls	5,434 (47 m²)	5,434 (47 m²)	5,434 (47 m²)
Doors	7,400 (4)	7,400 (4)	7,400 (4)
Sealing	1,600 (1)	1,600 (1)	1,600 (1)

	14,434	**14,434**	**14,434**
Telco spaces Floor Dist (9 m²)			
Walls		115.63 (98 m²)	
Doors		1,150.00 (3)	
Lighting		450.00 (3)	
		16,131	
Telco internal lead-in conduit			
Lead in conduits from riser to individual units termination point		14,025 (561 m)	16,830 (561 m)
Associated builders works allowance per floor			15,000 (3)
		14,025	**31,830**
Total net trade	**16,039**	**53,814**	**66,143**
+ preliminaries and margins	3362	11280	15292
Total	**19,401**	**65,094**	**81,435**

There also appears to be an anomaly when comparing with larger Class 2 apartment buildings. Retrofitting a 7-storey apartment building works out at $3057 and an 18-storey at $2981. It is industry experience that economies of scale lead to a reduction in cost per premises as the size of the building increases. Having said that, it would only take one problematic retrofit to skew the results as there are fewer larger apartment buildings.

Comparison of NCC 2016 and NCC 2019 proposals

An initial comparison of the NCC 2016 proposal to this proposal for offices (Class 5 buildings) using a 50% reduction in the Cost of Specification and a 6% Market Failure rate, produces a net benefit of $46 million.

These figures have been provided to demonstrate the impact of a reassessment of the assumptions and the new approach and the marked effect that it has on the outcome of the analysis. The figures have been developed as a guide and have not taken all the detailed calculations as executed in the DCWC Report.

It is useful to understand that with the evolution of technology with the provision of services over copper to services of optic fibre, the traditional space as required to house copper-based distributors (MDFs) are giving way to smaller fibre-based cabinets. The result is that the cost of specification in this proposal may be less that the 'traditional' Current Cost of Practice.

Class 5	2016 NCC proposal (best practice)	2019 NCC proposal (minimum spec)
Current practice cost	$132 K	$132 K
Cost of specification	$250 K	$125 K

Retrofitting	$325 K	$162 K
No. of new buildings per year	2600	2600
No of new buildings benefiting from proposal	26	156
Cost of current practice	$346 M	$346 M
Gross cost of specification	$658 M	$325 M
Net cost of specification	**$311 M**	**-$21 M**
Avoidance of retrofitting	$8 M	$25 M
Annual impact	**-$303 M**	**$46 M**

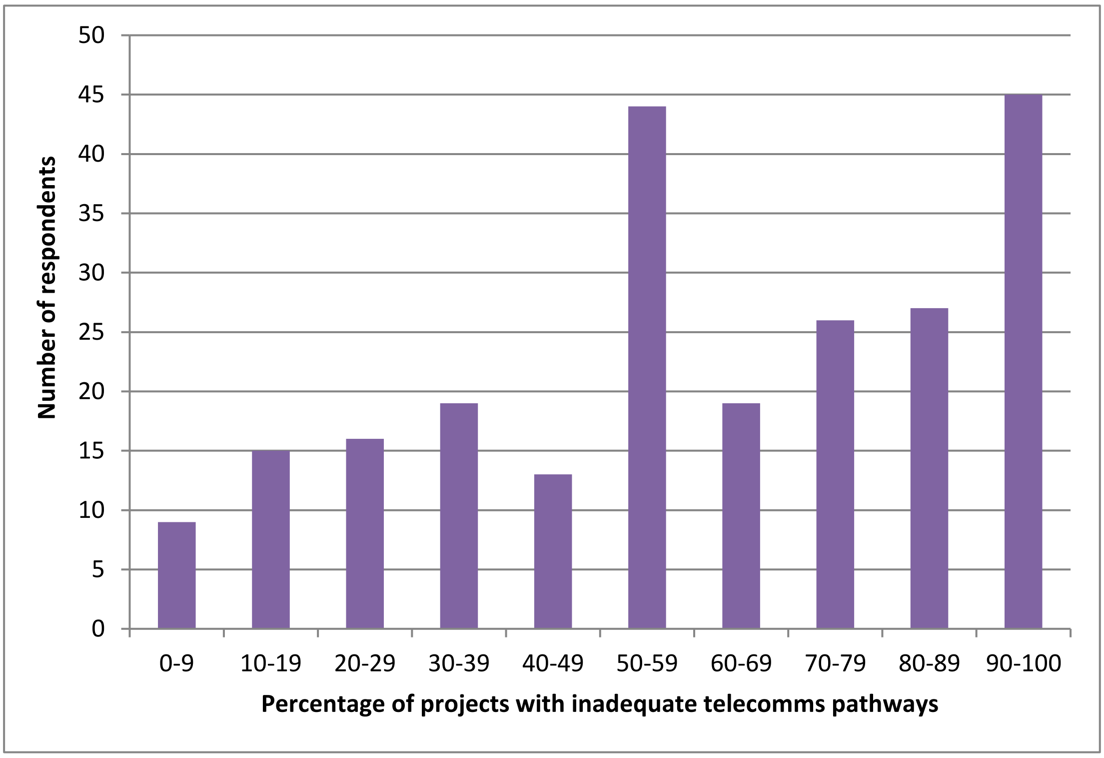
Attachment 4

Results from Telecommunications Pathways survey April 2017

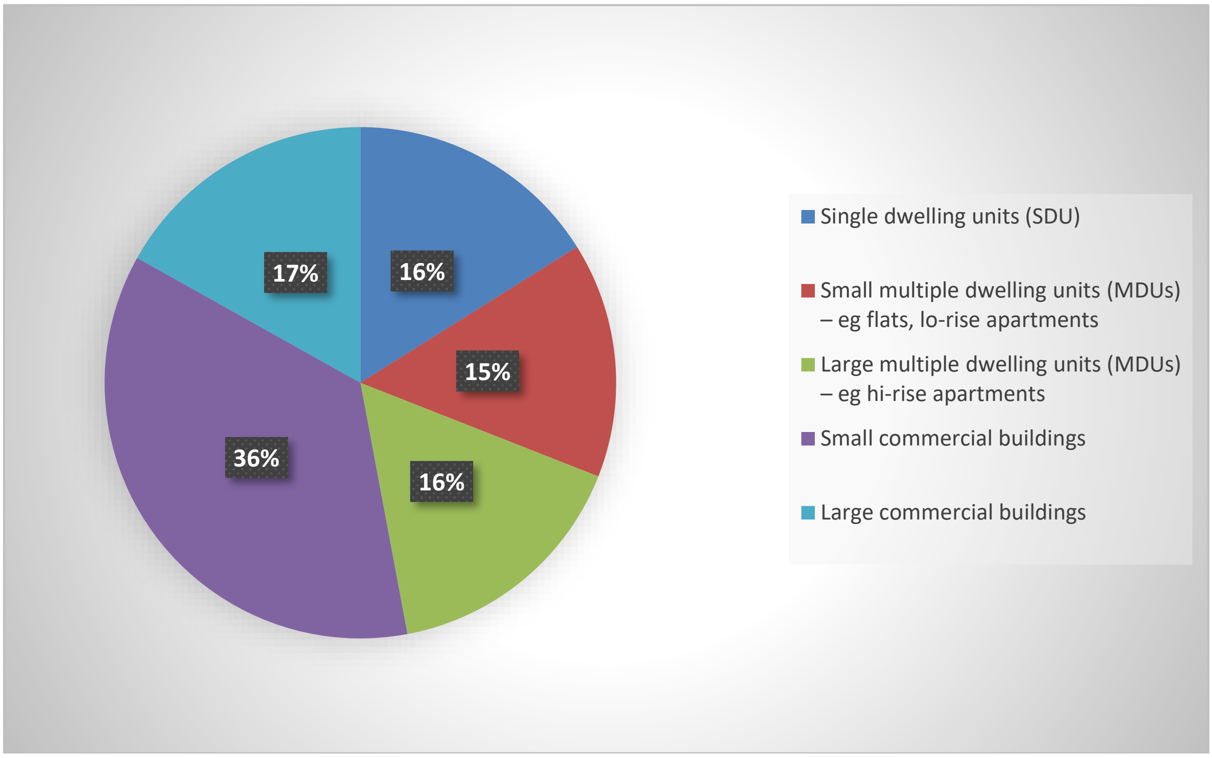
BICSI South Pacific, an Australian telecommunications industry association, surveyed its members in April 2017 on their experiences dealing with inadequate or no pathways to deliver telecommunications services into buildings.

Some 285 members responded to the eight-question survey, providing insight into how commonly inadequate pathways for telecommunications are being encountered, and the costly steps taken to overcome this inadequacy.

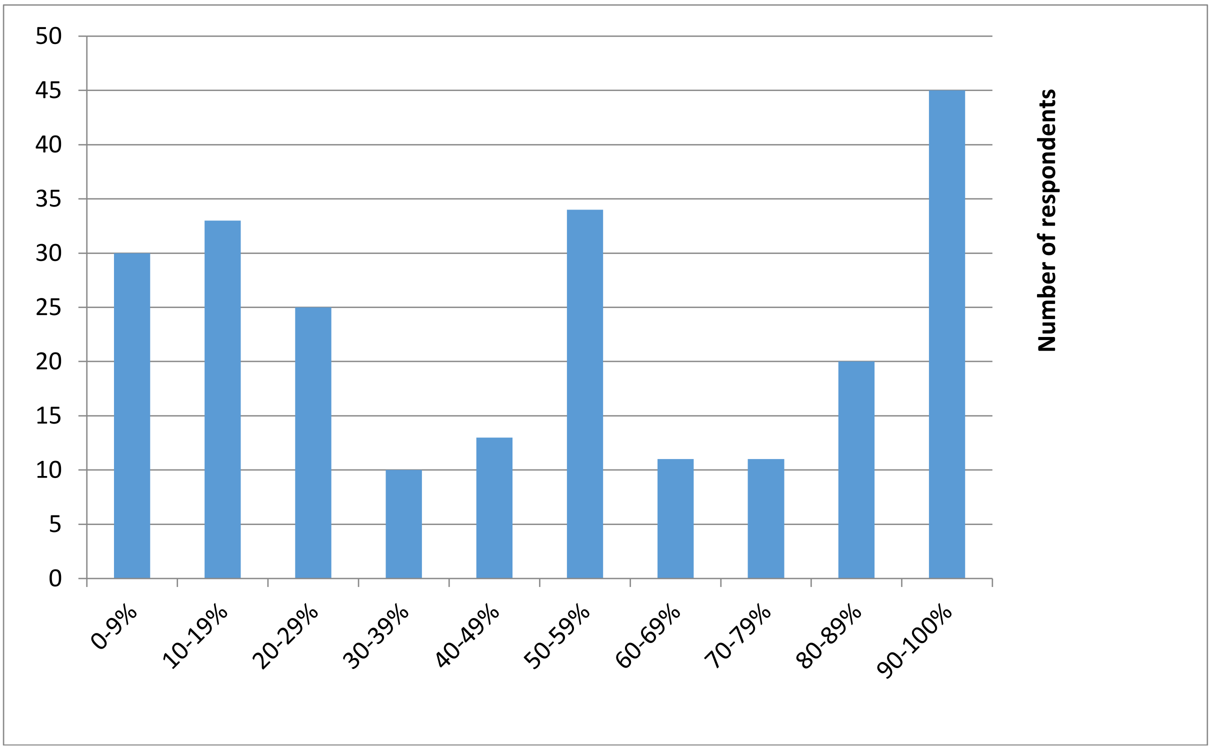
Q1. What percentage of your cabling projects each year have inadequate telecommunications pathways?



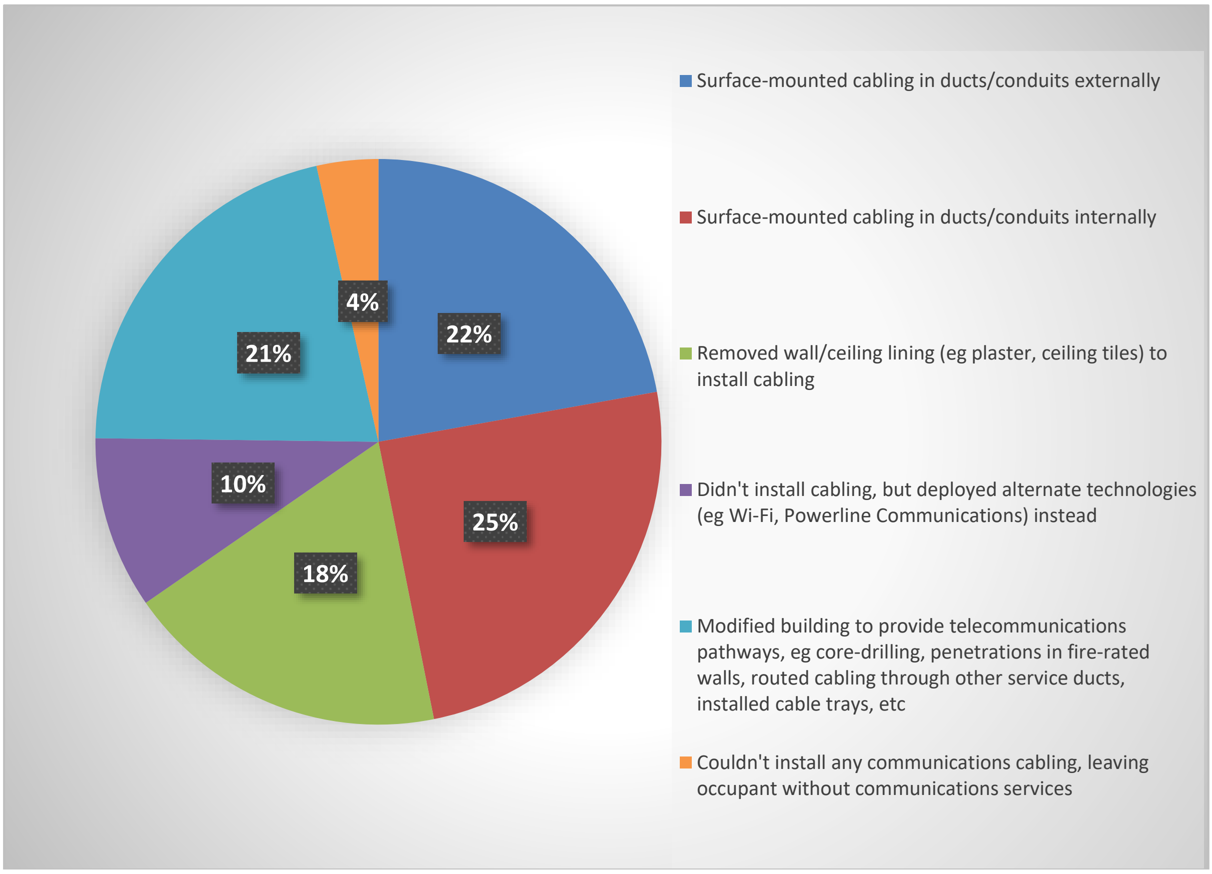
Q2. What type of building was the most common to have inadequate or no telecommunications pathways?



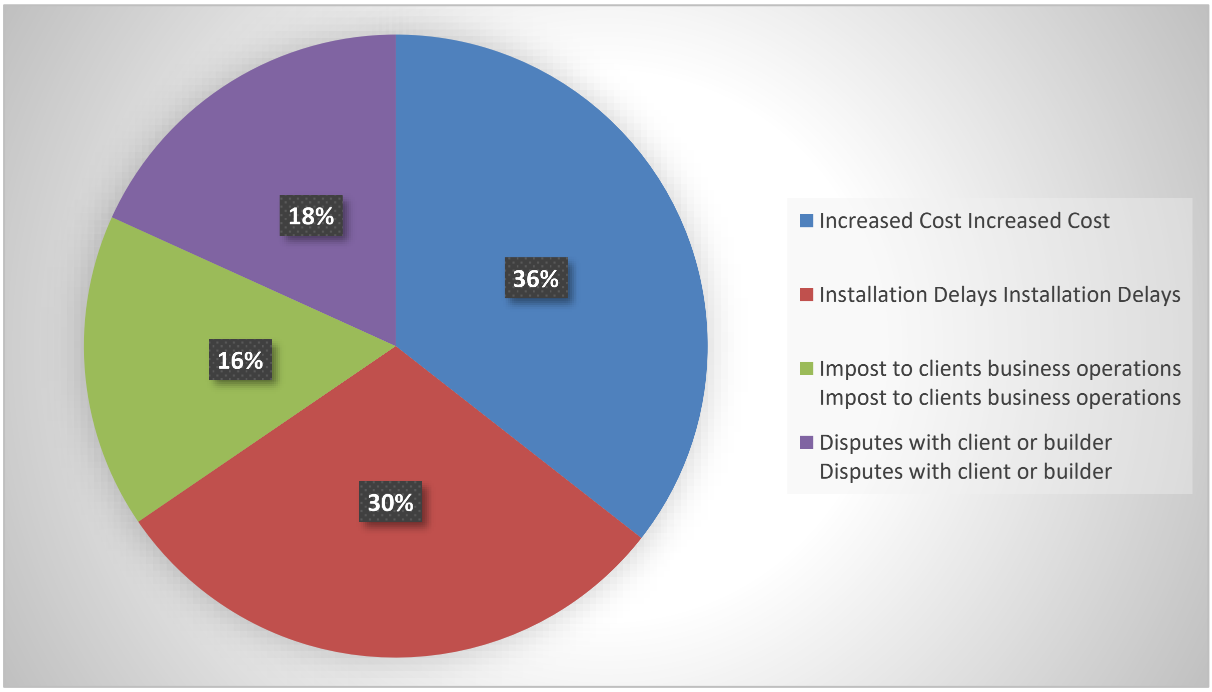
Q3. Of those projects, what percentage had no telecommunication pathways?



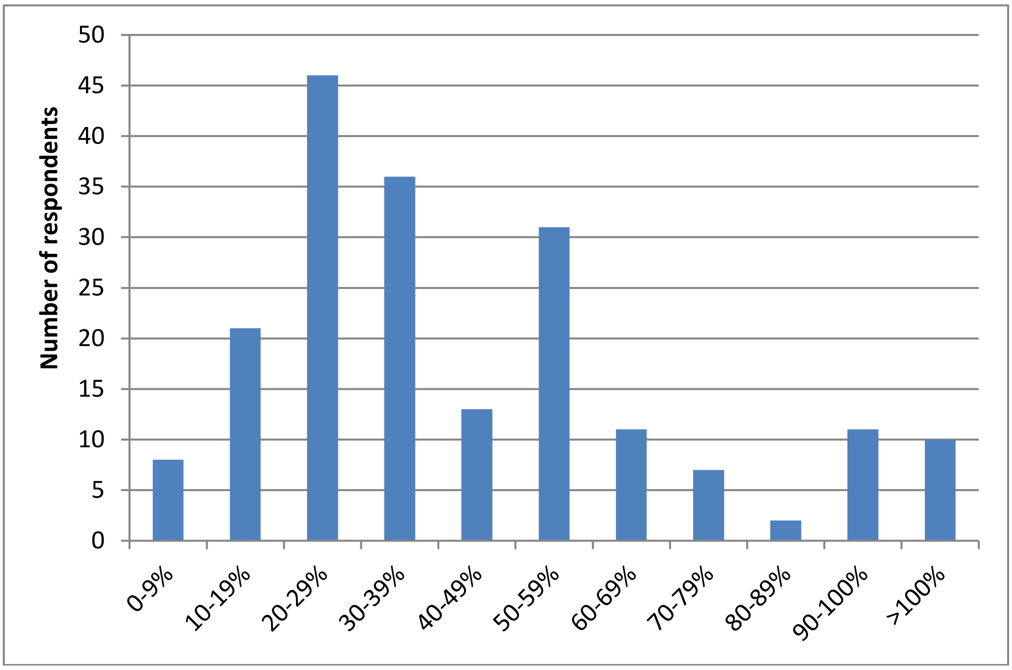
Q4. What steps were commonly taken to provide the cabling?



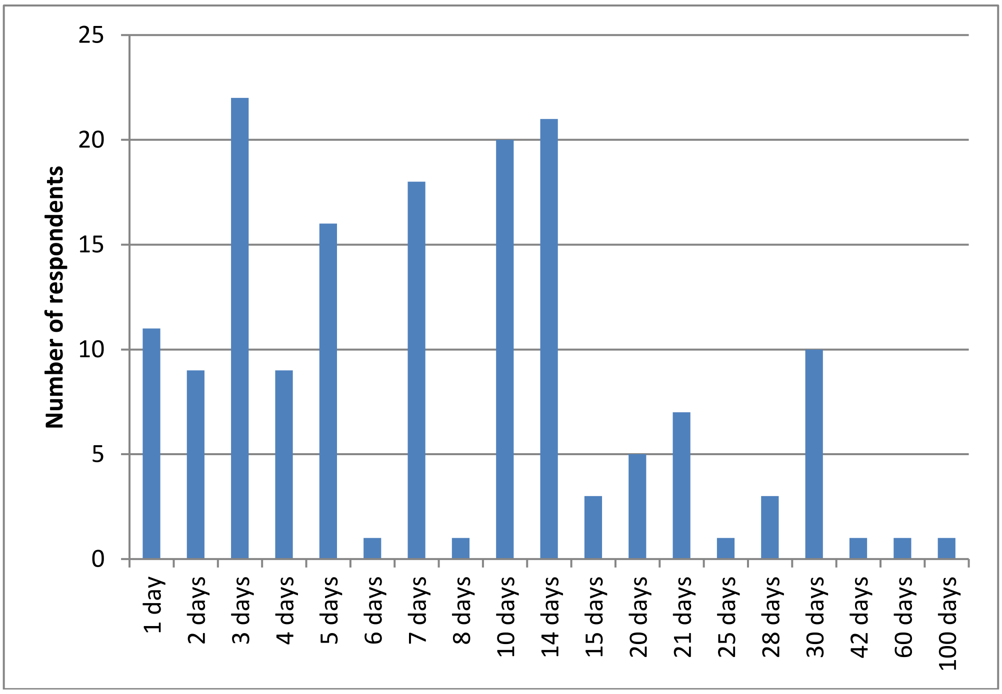
Q5. What were the most common financial consequences due to inadequate or no telecommunications pathways?



Q6. If increased cost, what were typical percentage cost increases?



Q7. If installation delays, what was the typical duration of the delays?



Q8. Has the inadequacy of the telecommunications pathways had a negative impact on the building?