Understanding the PCA's Performance Requirements: Developing an Alternative Solution under the Plumbing Code of Australia

A Case Study – Above-Ground (Elevated Pipework)

NB: This case study is based on the Australian Building Codes Board case study of the same name. This Case study has been specifically tailored to WA's plumbing regulations.

a) Introduction

It is essential that all plumbing practitioners have an understanding of the process involved in using a performance-based design under the Plumbing Code of Australia (PCA). By utilising a performance-based code, the PCA provides a strong degree of flexibility whilst ensuring acceptable plumbing and drainage solutions in this licensed area.

It is mandatory for all plumbing and drainage solutions to meet the *Performance Requirements* listed in the PCA. However, there is a dual approach to ensuring that *Performance Requirements* are met:

- *Deemed-to-Satisfy* – Where a plumbing or drainage solution follows a PCA referenced document, it is already '*deemed-to-satisfy*' the *Performance Requirements* in the PCA. That is, the proposed plumbing and drainage solution is accepted as complying with the PCA's *Performance Requirements*.
- *Alternative Solution* – There are often design situations which standards or other referenced documents may not have envisaged. Alternatively, a practitioner may see a new or innovative way of designing a plumbing or drainage solution that provides important benefits. If the practitioner wants to use an alternative approach, they have the opportunity to do so – on the understanding that their proposal must achieve the *Performance Requirements* of the PCA. This is referred to as the *'Alternative Solutions´* approach.

Most plumbing and drainage solutions are conducted under *Deemed-to-Satisfy provisions* (i.e. designed to a PCA referenced document). They are the safe solutions that have stood the test of time. However, that does not infer that a solution outside the *Deemed-to-Satisfy* provision will fail. Many practitioners will remember the 1990 edition of Australian Standard AS 3500 Part 2 limited the maximum length of an unvented branch drain to 8.5m to the weir of a fixture trap. In 1996 this measurement was amended and extended to 10m to the weir of the fixture trap. This was a direct outcome of testing that provided evidence supporting the extension without compromising the performance of the drain.

Another example that highlights the evolution of standards involves the overflow relief gully (ORG). Before AS 3500 Part 2 was published in 1990, the ORG height was 300mm below the lowest fixture to be drained and 150mm above the surrounding ground level. Today this measurement has been reduced to 150mm below the lowest fixture to be drained and 75mm above the surrounding ground surface.

In each of these cases, new approaches were trialled before they were applied. Eventually, this led to changes to traditional methods. This does not imply that the old standards were wrong; only that we now are more informed and have found alternative approaches through trials and testing. This

approach to plumbing will provide cost effective and innovative solutions providing savings to the community.

This is why the *Alternative Solution* approach is so important to an efficient and evolving industry. However, there are controls to ensure that *Alternative Solutions* comply with the *Performance Requirements* of the PCA. The PCA outlines this process under the *Alternative Solution* approach.

The purpose of this Case Study is to provide information on the process relating to the development of an *Alternative Solution* as a means of compliance with the *Performance Requirements* of the PCA. This process is explained by way of example.

b) The Project

A new hospital building is to be built in the confines of an existing hospital complex. The building is a 6 storey patient ward specialising in cancer research. The new building is located at the rear of the complex with limited space. The building is built on a sloping site that presents a number of building and planning restrictions; the site is small, compact and contains large rock formations.

A hydraulic consultant has been engaged to design the plumbing and drainage system for the new hospital building. The building brief requires an open plan design to provide for changing research requirements. Additionally, the drainage system is limited due to the encroachment of the rock formation impacting the layout of the sanitary facilities on each floor, making it difficult to apply traditional stack design.

Therefore, the drainage solution must contend with the site and height constraints, as well as the possibility of moving toilet and waste facilities in the future to accommodate an ever changing environment.

c) The challenge which led to an alternative approach

Traditional plumbing design in this case would limit the flexibility and number of sanitary facilities placing restrictions on the size and capacity of the ward. This is not the client's preference, so an *Alternative Solution* was sought.

Due to the site restrictions and service requirements, drainage principles (elevated pipework) seem to be the sensible and most effective approach. However, elevated pipework is restricted within the current referenced design standard, limiting the number of levels it can serve to four. The option to use above-ground (elevated) pipework is a feasible solution for the fifth and sixth floor. However, using a traditional DTS plumbing design may create a more costly solution, and restrict the ability to adapt the building to the future needs of the research program.

The licensed plumbing contractor and hydraulic consultant feel that they can design a drainage solution for this particular building based on elevated pipework for all six floors. They are well aware that this means they will be taking an *Alternative Solution* approach and will therefore have to use *Assessment Method(s)* to show compliance with the *Performance Requirements*.

Remember, just because a plumber or drainage solution goes outside a *Deemed-to-Satisfy* solution does not mean it will be a failed solution. It simply means that evidence is required showing that the alternative plumbing or drainage solution complies with the relevant *Performance Requirement(s)*.

d) Consultation with the Plumbers Licensing Board

It is not necessary for the licensing plumbing contractor who will be installing the alternative plumbing or drainage solution to consult with the Plumbers Licensing Board prior to lodging a '*Notice of Intention to Install an Alternative Solution*'. There may be some benefits in taking such a pro-active approach however. Plumbing inspectors from the Plumbers Licensing Board may be able to discuss some experiences from other similar projects and suggest any concerns they may have in regards to the assessment methods.

Please note that it is not the role of the Plumbers Licensing Board to 'approve' an alternative plumbing or drainage solution. However, if it is found that the plumbing work is not in accordance with the performance requirements of the PCA, a rectification notice may be issued to the licensed plumbing contractor responsible for the work.

Figure A (Building A)
Elevated pipework complying to AS/NZS 3500.2 (Deemed-to-Satisfy)

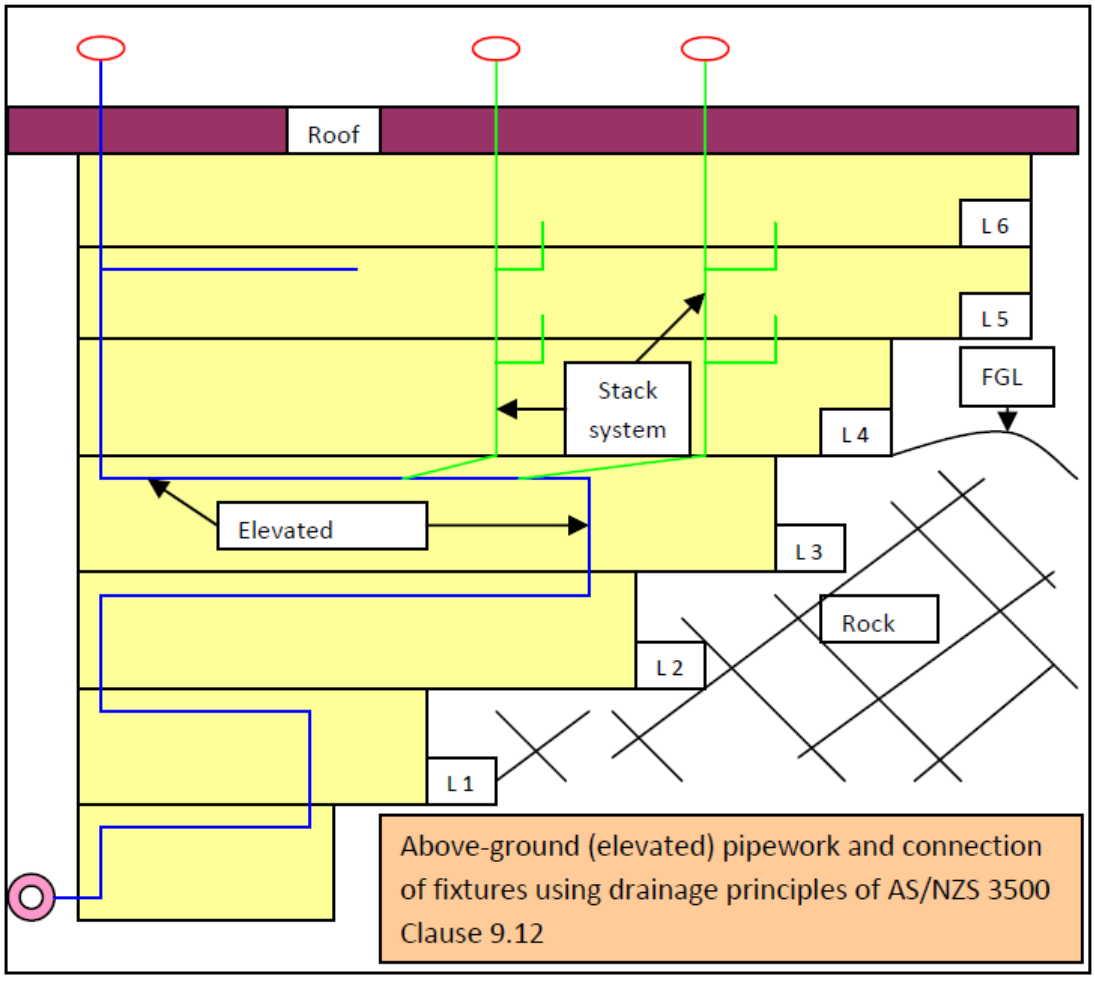
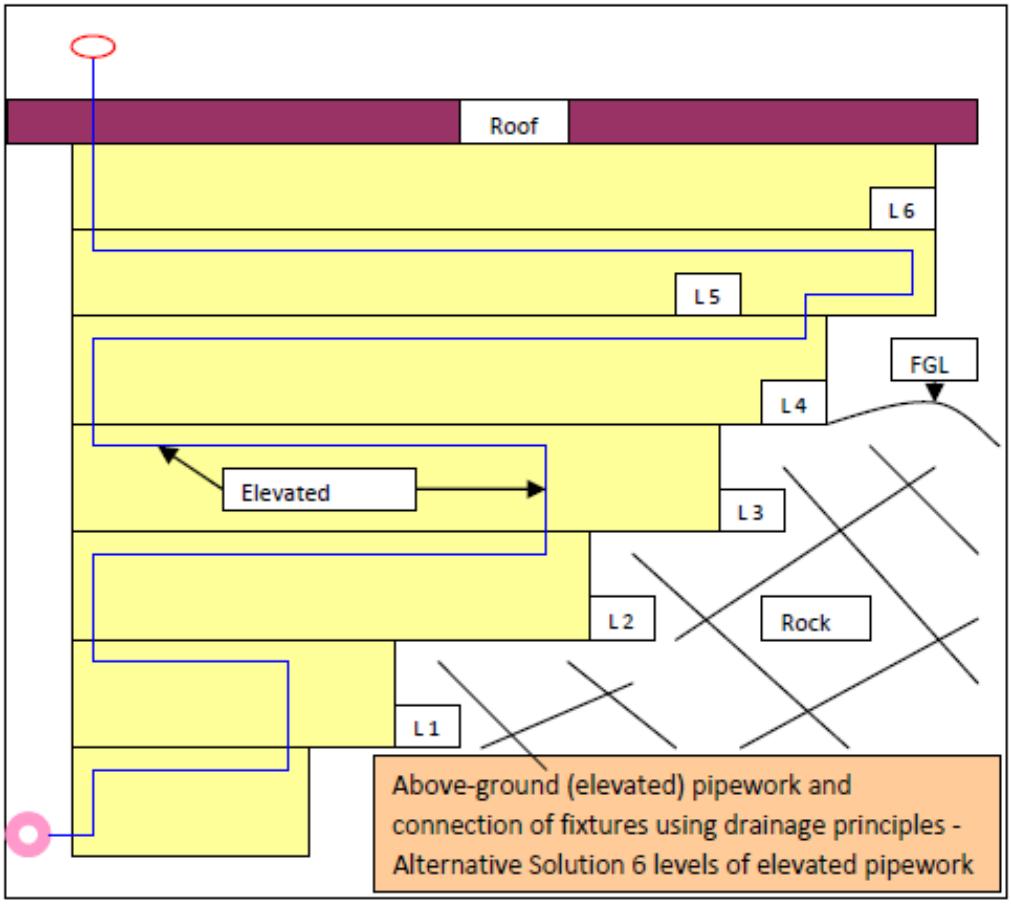


Figure B (Building B)

Elevated pipework Alternative Solution 6 Floors using 'elevated pipework'



Identification of relevant Performance Requirements

The designer suggests that *Performance Requirements* that apply to this *Alternative Solution* are *CP1.1 Sanitary plumbing systems* and *CP1.3 Materials and Products*. For CP1.1, the PCA offers an acceptable *Deemed-to-Satisfy* solution as being compliant with C1.2. C1.2 in this instance points us to the appropriate standard – AS/NZS 3500.2. Assessment of AS/NZS 3500.2 leads us to Clause 9.12: Installation of above-ground (elevated) pipework and connection of fixtures using drainage principles.

For CP1.3, the PCA steers us back to Part A2, where we discover that materials and products must be certified and authorised if listed in Table A2.1.

Clause 9.12 (excerpt from AS/NZS 3500 Part 2

9.12.1 General

Above-ground (elevated) pipework and associated fixture connections may be installed within buildings provided they are installed in accordance with the requirements of Clauses 9.12.2 to 9.12.4.

9.12.2 Maximum length and size

The maximum length and size of any unvented graded pipe, branch or fixture discharge pipe shall be in accordance with Clause 3.10 and Table 3.6.

9.12.3 Permitted installations

The requirements of this Section shall apply to the first four floor levels only above either the invert level of the connection point to the boundary trap riser or inspection shaft, and the uppermost floor only where connected into a discharge stack, are permitted to use drainage principles. Branches serving the floors below the uppermost floor shall comply with a nominated stack design in accordance with Clause 9.12.4(b).

9.12.4 Installation

Above-ground (elevated) pipework, materials, methods of support and fixing shall be in accordance with the relevant requirements of this Standard (see Figure 9.2) and the following:

a) No graded discharge pipe or branch, except a discharge stack, shall connect to any vertical section of pipework within the first four floor levels.
b) Any discharge stack system in excess of the maximum of four floor levels specified in Clause 9.12.3 shall be installed as a stack in accordance with the relevant requirements of Section 6, Section 7, Section 8 or Section 9, as applicable.
c) The loading in fixture units shall not exceed he maximum permitted as specified in Tables 3.1, 3.6 and 7.2, as applicable.
d) The connection of any discharge pipe or branch to the elevated pipework shall be in accordance with the relevant requirements of Clauses 6.6, 6.7, 7.6 and 8.9, and Section 9A.
e) The total length of an unvented branch pipe, including the length of the fixture discharge pipe that connects to the main section of graded elevated pipework, shall be in accordance with Clause 3.10.3.

The hydraulic consultant in this case intends for the sanitary plumbing work on the 5th floor of the building to be installed with elevated pipework, extending the accepted levels referred in Clause 9.12.3 of AS/NZS 3500.2 by one, noting that the upmost level is acceptable as elevated pipework. This is expected to reduce cost and provide a more flexible plumbing system accommodating the

hospitals request. The sanitary plumbing system will be consistent in design and present a more flexible approach for future extension work while providing a consistent maintenance arrangement.

e) Assessing compliance with the PCA

Because each *Alternative Solution* deals with a different and unique situation, the PCA provides a number of *Assessment Methods*. Which *Assessment Method* or combination of them used is up to the licensed plumbing contractor along with the hydraulic designer. It is important to note however that the licensed plumbing contractor is responsible for ensuring that the alternative plumbing or drainage solution is designed in accordance with the PCA (i.e. it is the licensed plumbing contractor who must be satisfied that the evidence is sufficient to show that the *Performance Requirements* will be met.

The PCA lists the following *Assessment Methods* that can be used to determine if a *Plumbing or Drainage Solution* complies with the *Performance Requirements*:

PCA Assessment Methods (Excerpt from PCA – see A0.9)

a) Evidence to support that the use of a material or product, the design or the form of construction meets a *Performance Requirement or a Deemed-to-Satisfy Provision* as described in A2.2.
b) *Verification Methods* such as –
    i. The *Verification Methods* in the PCA; or
    ii. Such other *Verification Methods* as the authority having jurisdiction accepts for determining compliance with the *Performance Requirements**.
c) Comparison with the *Deemed-to-Satisfy Provisions*.
d) *Expert Judgement.*

* NB: In WA, the authority with jurisdiction is the Plumbers Licensing Board. The Board does not approve alternative solutions and therefore does not limit the other *Verification Methods* you may choose to use. If the *Verification Method* is not suitable however, and a plumbing installation that does not meet the *Performance Requirements* of the PCA results a rectification notice may be issued.

f) Developing the *Alternative Solution*

In this case, we have a number of options. Looking at the *Assessment Methods* listed above, we could:

a) Provide **evidence** of calculations undertaken indicating that the discharge from the additional floor of elevated drainage did not affect the operation or function of the sanitary system.
b) Provide **expert judgement** discharge from the additional floor of elevated drainage did not affect the operation or function of the sanitary system.

In this case, the licensed plumbing contractor may satisfy themselves that the *Performance Requirements* of the PCA have been met through the provision of tests and calculations performed

as Part A2.2 Evidence of Suitability. However, the choice of evidence very much depends on the particular project.

PCA Evidence of Suitability (Excerpt from PCA – see A2.2)

Evidence to support that the use of a material or product, the design, form of construction or installation meets a *Performance Requirement or a Deemed-to-Satisfy Provision* may be in the form of one or a combination of the following:

a) A current *certification mark* issued in compliance with the requirements of **Part G** of the PCA.
b) A report issued by a *Recognised Expert* showing that the material, *product*, the design, construction and installation has been submitted to the tests listed in a report, and setting out the results of those tests and any other relevant information that demonstrates its suitability for use in the *plumbing or drainage* installation.
c) A certificate from a *professional engineer* or other appropriately qualified person which:
    i. certifies that a material, *product*, design, form of construction or installation complies with the requirements of the PCA; and
    ii. sets out the basis on which certification is given and the extent to which relevant *specifications*, rules, codes of practice or other publications have been relied upon.
d) Any other form of documentary evidence that describes the properties and performance of the material, form of construction or installation and adequately demonstrates its suitability for use in the *plumbing or drainage* installation.