CBD cable pits program

CitiPower RRP BUS 4.06

Revised proposal: 2021–2026

CitiPower

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1 Overview

We own and manage a large population of cable pits in the Melbourne central business district (CBD). Historically, we managed cable pit assets via a reactive approach, whereby remediation work was driven by the immediate need to access a pit to carry out planned works and other operational events.

We have since established a proactive cable pit refurbishment program to ensure the safety of our employees and the public, and maintain the reliability of supply in the CBD. The loss of strength in the supporting steel reinforcement within the concrete pit, due to corrosion, may result in the collapse of the pit roof or pit covers at the surface opening. The consequence of a roof or cover opening failure could be catastrophic. The focus of our program, therefore, has been the highest risk pits—namely, those in or adjacent to roadways and footpaths.

For our original proposal, our forecast was based on inspection data from 30 sites. We have now completed civil engineering inspections for 85 CBD cable pits. This has provided a much fuller dataset to assess the extent of the pit problems, their remediation costs and develop a more granular forecast method. These inspections have found that approximately 22 per cent of pits require immediate or prioritised work.

This business case addendum sets out our response to the AER's draft determination, and describes the further work we have undertaken since our original proposal. It should be read in conjunction with the following documents:

- our original proposal business case (CP BUS 4.06)
- our revised CBD pit forecast model (CP RRP MOD 4.05 - CBD cable pits - Dec2020 – Public).

Our revised forecast for CBD cable pit replacements is presented in table 1.1. This forecast reflects lower unit rates than our original proposal, but higher volumes.

Table 1.1 Capital expenditure forecasts: CBD refurbishment ($ million, 2019)

Expenditure	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Original proposal	2.7	2.7	2.7	2.7	2.7	13.5
Draft determination	0.6	0.6	0.6	0.6	0.6	2.9
Revised proposal	2.7	2.7	2.7	2.7	2.7	13.7

Source: CitiPower

2 Background

2.1 Our original proposal

The construction of our pit population varies from walls made of bricks and mortar in older examples, to modern pre-cast concrete. In today's environment, the design specifications that pits were initially built to are no longer sufficient—for example:

- in the 1950s, maximum design limits were generally based on a 15-tonne tractor
- between 1950 and 1976, the design standard was based on a 33 tonne semi-trailer
- between 1976 and 2000, designs were based on 44 tonne semi-trailer
- since 2000, designs were based on the SM1600 standard, which reflects a 160-tonne load.

Our original proposal explained that the deteriorating condition of our cable pit population includes weakening of the supporting steel structures, spalling of the reinforced concrete, and cracking in the bricks and mortar. The increased traffic density and larger size and mass of individual vehicles traversing our roadway pits is further increasing the risk associated with our ageing pit population.

In response to these risks, we partnered with Swinburne University of Technology (Swinburne) to pioneer a new approach to inspect and manage cable pits. Under the first stage of works, civil engineers from Swinburne developed a standardised methodology to assess pit conditions and their ability to meet dynamic loads. At the time of our original proposal, however, we had only limited information regarding the condition of the pits and the required remedial works (i.e. we had only undertaken around 30 pit inspections).

Despite the limited information available at the time of our original proposal, we demonstrated that the proposed program was strongly preferred to the alternative option of reverting to the previous reactive approach to CBD pit remediation. Our analysis included a risk monetisation assessment, which examined the benefit of avoiding a pit failure in relation to network performance, safety and financial impacts.

2.2 AER's draft determination

The draft determination did not accept our proposed capital expenditure for the CBD pit remediation program and instead allowed a substitute estimate of $2.9 million. The substitute estimate reflected our historical reactive approach to CBD pit refurbishments (even though the AER described this approach as 'not feasible').[1]

In making its draft determination, the AER commented that:[2]

- we did not consider a sufficient number of alternative options. The option analysis only compared the proposed proactive approach against the reactive approach
- our analysis did not include adequate testing of the chosen replacement volumes. The AER commented that the selected pit volume was based on an inspection defect rate, but this had reduced as the number of completed inspections increased
- we did not provide sufficient evidence that the estimated unit costs are representative of the requirements for all 45 pits. The AER also commented that the unit costs did not appear to take into account the efficiency gains from our transformation program

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1 AER, *Draft Decision, CitiPower Distribution determination 2021 to 2026, Attachment 5 Capital expenditure*, p. 44.

2 AER, *Draft Decision, CitiPower Distribution determination 2021 to 2026, Attachment 5 Capital expenditure*, p. 44.

- we only provided limited evidence of network reliability issues, safety incidents or near misses associated with pit failures.

The AER also commented that EMCa's review supported its conclusions, noting:

- the likelihood of consequence that a catastrophic failure will result in a loss of life (20 per cent) appears likely overstated, 'particularly when moderated for the time a person may be present at the time of the catastrophic failure and incur fatal injuries'[3]
- a pit failure due to dynamic loading from a vehicle would less likely result in a fatality given the protections in a vehicle, and therefore, EMCa concluded that the risks attributed to our cost benefit model should be amended.

[3] EMCa, *Review of aspects of CitiPower's regulatory proposal 2021–26*, September 2020, page 92.

3 Revised proposal

Our revised proposal is based on the improved information that is now available to support the expected volume and scope of CBD cable pit refurbishments over the 2021–2026 regulatory period, as reflected in our revised model.[4] We have now completed civil engineering inspections at 85 of our 484 CBD cable pits. These inspections revealed:

- eight of the inspected cable pits had major defects, typically being cracking and corrosion of the roof slabs and walls, requiring an immediate and full replacement of the defected assets
- 11 cable pits had medium rated defects that require immediate or prioritised steel reinforcement work
- 58 pits had minor defects that need to be fixed, but not prioritised
- only eight pits had no defects.

We have since refurbished four of these cable pits, and expect to have completed an additional nine by mid-2021.

The inspection data and completed pit refurbishments have provided more granular information regarding the cost and scope of our CBD pit refurbishment program. Compared to the information that we had available at the time of our original proposal, the additional inspection data has been used to develop a more detailed plan of the required works over the 2021–2026 regulatory period.

Importantly, our revised proposal reflects our current practice. That is, we will continue to proactively refurbish cable pits that require immediate or prioritised steel reinforcement work, and will manage minor defects on a reactive basis.

Our revised proposal is summarised in table 3.1, and is based on updated, granular information that differentiates between medium and major works (noting that both are regarded as higher risk).

Table 3.1 Revised proposal for CBD pits refurbishments: 2021–2026 ($ million, 2019)

CBD pits refurbishment	Volume	Average cost	Total cost
Higher risk - major works	25	0.27	6.6
Higher risk - medium works	35	0.20	7.1
Total	**60**	**0.23**	**13.7**

Source: CitiPower
Note: Total average cost represents a weighted average

[4] CP RRP MOD 4.05 - CBD cable pits - Dec2020 - Public.xlsx

3.1 Response to draft determination

Our revised forecast recognises the criticisms raised in the draft determination (which reflected more limited inspection information at the time of our original proposal). We respond to each of the issues raised in the draft determination below.

3.1.1 Consideration of alternative options

The draft determination stated we did not consider a sufficient number of alternative options. For example, as summarised in table 3.2, our original proposal reflected a single, uniform pit refurbishment rate (i.e. we assumed all pits that needed remediation required the same level and scope of works).

Table 3.2 Regulatory proposal for CBD pits refurbishments: 2021–2026 ($ million, 2019)

CBD pit refurbishment	Volume	Average cost	Total cost
Assumed 20 per cent defect rate	45	0.30	13.5

Source: CitiPower

We have now undertaken 85 pit inspections and obtained much better information regarding the condition of the pits and the required remediation works. These pit inspections have been conducted randomly (because we do not have good information on the current condition of pits, and hence cannot target those that might be higher risk) and therefore represent an unbiased sample of the condition of the total pit population.

Our updated inspection data differentiates between higher risk and lower risk CBD pits. Higher risk pits are those requiring major and medium level works associated with identified structural weaknesses in the pit roof slab and walls. Based on 85 pit inspections, the data shows that 22 per cent are classified as higher risk, with 9 per cent requiring major works and 13 per cent medium works.

The lower risk category, which relates to 68 per cent of the inspected pits, may also include deficiencies in the roof slab and walls (in addition to floor, footings and miscellaneous issues). However, these identified issues are regarded as lower risk as they do not compromise the structural integrity of the pit.

Options analysis

Consistent with the AER's feedback, we have now considered three alternatives with different volumes of work:

- option one - works program in line with the draft determination
- option two - remediate higher risk pits only
- option three - remediate higher and lower risk pits.

We have not considered the option of an accelerated CBD pit remediation program over five years (rather than the 10 years proposed). This is consistent with our actual program, which has been developed to:

- avoid major CBD disruptions
- enable the program to proceed on a 'no regrets' basis—in the unlikely event that our full inspection results in materially lower pit refurbishment requirements (than our current sample), this will translate to fewer works in future periods (rather than a reduction in our forecast volumes in the 2021–2026 regulatory period)

- balance risk with affordability and workload over the 2021–2026 regulatory period. This includes the use of temporary propping to reinforce high risk pits (13 have been installed to date).[5]

We have not sought to compare the risk reduction associated with each option, noting that as set out in section 3.1.5, there is a paucity of data in relation to pit failures and the potential consequences. In the absence of this information, we are necessarily (and prudently) acting on the available data.

Option one: works program in line with the draft determination

Based on the expenditure set out in the draft determination, and our revised unit cost of a cable pit refurbishment, option one would allow us to remediate 11 of the higher risk pits. This equates to just 18 per cent of pits that have been inspected and found to have major or medium defects that require immediate and prioritised remediation.

The residual exposure associated with this option, expressed in terms of the major and medium works that would not be completed during the 2021–2026 regulatory period, is shown in table 3.3. Although this represents the lowest cost option ($2.9 million over the 2021–2026 regulatory period), the residual exposure is not be consistent with our safety obligations, which are to minimise risk as far as reasonably practicable. It is also inconsistent with our current program of works, which is to address these higher risk sites (i.e. it would require a reversion to previous asset management practices no longer considered prudent).

Table 3.3 Option one: works program in line with the draft determination (pit refurbishment volumes)

CBD pits refurbishment	Revised proposal	Draft determination	Residual exposure
Higher risk - major works	25	11	14
Higher risk - medium works	35	-	35
Total	**60**	**11**	**49**

Source: CitiPower

Option two: remediate higher risk pits only

Table 3.4 shows the volume and cost breakdown of option two, which is the preferred option. Based on our inspection data, this option would include work at 60 pits during the 2021–2026 period. This option is consistent with our current practices.

[5] Temporary propping is not an alternative to remediation. After being propped, crews cannot access pits meaning works cannot be performed, temporary propping needs to be inspected every 3-6 months (depending on the pit's degradation) which requires road closures, and there are costs involved with inspecting and hiring props.

Table 3.4 Option two: remediate higher risk pits only ($ million, 2019)

CBD pits refurbishment	Volume	Average cost	Total cost
Higher risk - major works	25	0.27	6.6
Higher risk - medium works	35	0.20	7.1
Lower risk	-	0.03	-
Total	**60**	**0.23**	**13.7**

Source: CitiPower
Notes: Total average cost represents a weighted average

Option three: remediate higher and lower risk pits

As shown in table 3.5, option three includes the proactive remediation of both higher and lower risk pits. This represents the highest cost option.

Given the magnitude of the higher risk sites, we consider it prudent to focus on remediating these sites first.

Table 3.5 Option three: remediate higher and lower risk pits ($ million, 2019)

CBD pits refurbishment	Volume	Average cost	Total cost
Higher risk - major works	25	0.27	6.6
Higher risk - medium works	35	0.20	7.1
Lower risk	190	0.03	5.4
Total	**250**	**0.08**	**19.0**

Source: CitiPower
Note: Total average cost represents a weighted average

3.1.2 Testing of alternative volumes and inspection defect data

In addition to considering an insufficient number of alternative options, the AER raised further concerns regarding the veracity of the defect rate analysis used to inform our cable pit refurbishment volumes.

As explained in the previous section, we have now completed inspections at 85 CBD pits, which represents approximately 18 per cent of the CBD pit population that are either in or adjacent to roads. The data gathered from these inspections confirms the defect rate presented in our original proposal and provides more granular information in relation to the required works and the costs of remediation.

As already noted, in 2019, we partnered with Swinburne to pioneer a new approach to inspect and manage cable pits. Under the first stage of works, Swinburne developed a standardised methodology to assess pit conditions and their ability to meet dynamic loads. Under the second stage, Swinburne have undertaken further work to understand how pits perform under various conditions.

The Swinburne engineers have assessed the capacity of the roof slab and steel beams according to the Australian Standard for Bridge Design - Part 2: Design Loads AS5100.2 (2017). Their analysis indicates that if minor degradation is observed in the roof slab, the capacity can be considered as uncompromised and steps can be taken for remediation (e.g. lower cost interventions, including concrete repair and crack injection). If the pit

inspection identifies more significant issues in relation to the roof slab or cracking in the walls, then remedial work including replacement or strengthening of the pit roof is required.

The additional pit inspections now provide a more accurate assessment of the required works, focusing on high risk issues. We are acting now on this information, as it is not prudent to defer this work or to address issues on a reactive basis.

3.1.3 Estimated unit costs

The AER expressed concern our original proposal did not demonstrate that the unit costs are representative of the costs that will be incurred in the proposed program. In addition, the AER stated that the unit costs did not appear to take into account the efficiency gains from our transformation program.

We have now revised our unit costs based on the additional information available from our increased inspection volumes, and completed refurbishments. This information has enabled us to better understand the types of defects and the costs to remediate them. As a result, the unit rates in our revised proposal are lower than our original proposal.

The pit costs for completed major pit defect refurbishments is outlined in table 3.6. Our forecast costs have been informed by these costs (and are in line with the proposed costs), and a review of the inspection defect reports that have been completed.

Table 3.6 Cost of completed major defect pit refurbishments ($ million, 2019)

Pit number	Cost
Pit 135	0.34
Pit 224	0.23
Pit 684	0.20
Pit 009	0.21
Average	**0.24**

Source: CitiPower

The costings above represent our best estimates of undertaking the remedial works. As they represent recent projects, they reflect the impact of any historical efficiencies achieved.

With respect to the transformation program we completed in the 2016–2020 regulatory period, which was explicitly referred to in the draft determination, we note that as previously communicated to the AER our 'World Class' program did not materially change our approach to delivering major plant projects. Rather, the re-negotiation of contract arrangements was more focused on high-volume assets, and programs/works delivered by third parties. For example:

- the procurement of equipment for major projects, including civil works, have always been (and continues to be) sourced through open tenders in competitive markets
- efficiencies delivered through streamlining our internal procurement process are reflected in reduced overheads, so do not impact direct-cost forecasts.

3.1.4 Evidence of pit failures

The AER expressed concern that only limited evidence was provided in relation to the network reliability issues, safety incidents or near misses associated with pit failures.

We recognise that, fortunately, there is limited evidence of actual pit failures from which to derive the risk of a catastrophic event leading to death or serious injury. This does not imply, however, that risks are low or non-existent, or constant over time.

As a prudent network service provider, we want to ensure that we undertake timely remedial action so that the general public and our staff are not exposed to the risk of pit failure. Accordingly, we engaged Swinburne to assist us in assessing the risk and prioritising our work program so that risk is reduced to levels that are as low as reasonably practicable. If successful we expect the program to maintain historical safety performance in relation to CBD pits, with very limited or preferably no examples of 'near misses'.

3.1.5 Consequences of catastrophic failure

In our original proposal, our cable pit refurbishment program was supported by a risk monetisation assessment. In its report prepared for the AER, EMCa queried our modelling approach, arguing that:

- the likelihood of consequence (20 per cent) for a catastrophic failure will result in a loss of life appears likely overstated, 'particularly when moderated for the time a person may be present at the time of the catastrophic failure and incur fatal injuries'[6]
- a pit failure due to dynamic loading from a vehicle would less likely result in a fatality given the protections in a vehicle.

We acknowledge there is a paucity of data in relation to the pit failures and the possible consequences that would arise from a vehicle being involved in a pit collapse. In this regard, it is difficult to ascertain whether the consequence would result in loss of life in 20 per cent of cases, or some other lower (or higher) percentage, as proposed by EMCa.

Whilst EMCa may be correct that a vehicle could protect its occupants from the risk of death, this view is speculative. Equally, it might be reasonable to assume that the risk of fire or explosion (as there is a risk of gasses being trapped) is substantially increased if a vehicle (or multiple vehicles) is involved in a pit collapse, which would possibly expose multiple occupants of the vehicle and the general public to significant risk. We also note that if such an event occurred, it would likely lead to a public enquiry and an immediate decision to accelerate and expand the proposed refurbishment program, with consequential cost implications (i.e. it is likely that our refurbishment program would be completed in a significantly compressed timeframe).

As a prudent network service provider, our view is that it would not be appropriate to speculate regarding the potential for loss of life in the event of a CBD pit collapse, particularly in light of our inspection program that has demonstrated a real risk associated with the structural integrity of these pits. Instead, it is appropriate to take remedial action to address known defects that are classified as 'higher risk', having regard to the advice of engineering experts.

3.2 Revised proposal forecast

Consistent with the reasons provided in this addendum, the forecast for our CBD cable pit refurbishment program included in our revised proposal is set out in table 3.7.

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[6] EMCa, *Review of aspects of CitiPower's regulatory proposal 2021–26*, September 2020, page 92.

Table 3.7 Capital expenditure forecasts: CBD pit refurbishment ($ million, 2021)

Expenditure	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Revised Proposal	2.7	2.7	2.7	2.7	2.7	13.7

Source: CitiPower