Deloitte.

Registration of Building Engineers in Western Australia: Economic analysis

Department of Mines, Industry, Regulation and Safety

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Deloitte Access Economics

Contents

Glossary

Acronym	Full name
ABCB	Australian Building Codes Board
ABS	Australian Bureau of Statistics
BEA	Break-even analysis
CBA	Cost-benefit analysis
CPD	Continuing professional development
C-RIS	Consultation Regulatory Impact Statement
DMIRS	Department of Mines, Industry, Regulation and Safety
DRIS	Decision Regulatory Impact Statement
EA	Engineers Australia
IO	Industry organisation
NCC	National Construction Code
NER	National Engineering Register
PA	Professionals Australia
PI	Professional indemnity
RIA	Regulatory Impact Assessment
WA	Western Australia

1 Executive summary

1.1 Introduction

The Building and Energy Division within the Department of Mines, Industry, Regulation and Safety (DMIRS) has developed four recommendations to improve building compliance and public confidence in the WA building and construction industry with regard to engineering design and inputs. These included both regulatory and non-regulatory measures to govern WA's building engineers:

1. An occupational registration scheme for building engineers
2. A requirement for building surveyors to maintain adequate professional indemnity insurance
3. A Code of Conduct for registered engineers
4. A requirement for registered engineers to work within their area of competence.

In Western Australia, all proposals to enact new or amending legislation or regulations must be reviewed under the Regulatory Impact Assessment (RIA) process. The RIA process is designed to improve the quality of regulation by ensuring that relevant decision makers are fully informed when making decisions in respect of regulatory instruments. An element of the RIA process involves undertaking an economic analysis of the proposed regulatory change.

Chapter 2 provides further detail on the background and context of these proposed reforms.

1.2 Purpose of this study

DMIRS engaged Deloitte Access Economics to undertake an economic analysis of the proposed registration scheme for Building Engineers in Western Australia. As set out in this report, the objective of this analysis is to assess the potential economic and societal impacts of the proposed engineer registration scheme in Western Australia.

While a cost benefit analysis (CBA) represents best practice in evaluating the impact of a potential policy or investment proposal, other tools can be used to support decision-making where potential costs and benefits cannot be reliably quantified.

In this study, the benefits associated with the proposed registration scheme for Building Engineers in WA is difficult to quantify credibly due to a lack of empirical evidence. For this reason, a break-even analysis (BEA) is used in this study to assess the potential economic outcomes of the proposed reforms.

1.3 Break-even analysis

1.3.1 Approach

A BEA involves a detailed assessment and quantification of the costs (similar to the process undertaken in a cost-benefit analysis). The quantification of costs effectively sets the minimum level of benefits required for the policy to be cost-neutral to the economy, or 'break-even'. It is possible to then qualitatively assess whether the economic benefits associated with the reform are likely to meet this minimum based on available information and data.

Given that the cost of the proposed reforms is underpinned by the number of engineers in Western Australia who operate in the building and construction industry, accurately estimating this number of engineers forms an important part of this analysis. Up to date estimates of the number of workers within specific occupations, by industry and by location does not exist. To solve this data gap, Deloitte Access Economics' utilised its *Workforce and Occupational Estimation Tool* to estimate the number of engineers in WA that operate in the building and construction industry.

Further details on the methodology employed is provided in Chapters 3 and 4.

1.3.2 Costs estimated

Three sources of cost are considered in this study according to the proposed reforms. These costs are described in Chapter 5, along with the approach that has been applied to estimate value:

1. **COST 1: the initial accreditation costs** – the total cost to engineers to have their registration application assessed by industry organisations
2. **COST 2: the ongoing cost of meeting Continuing Professional Development (CPD) requirements** – the total ongoing cost for engineers to meet the CPD requirements set out by the proposed registration scheme
3. **COST 3: the initial and ongoing cost of registration to engineers** – the total administrative cost to DMIRS' Building and Energy Division of implementing and managing the registration scheme.

Given that costs in the BEA are measured incrementally between a base case (which assumes to be status quo) and a project case (which assumes the reforms are implemented), it is important to consider the quantum of engineers in the building sector who are already registered with a professional body or association, and therefore already incur many of the above costs associated with the proposed reforms. These estimates are provided in Chapter 4.1.4 and Chapter 4.2.

1.3.3 Outcomes

The proposed registration scheme is estimated to cost $13.6 million (present value terms) between 2023 and 2032. The results of this analysis are summarised in Table i.

Table i: Summary of break-even analysis outcomes (present value terms)

BREAK-EVEN ANALYSIS	Value ($, present value)
Initial accreditation cost	**$435,410**
Industry organisation accreditation	$435,410
Ongoing costs of meeting CPD requirements	**$8,220,391**
Assessment costs	$886,539
Cost of meeting CPD requirements	$7,333,852
Initial and ongoing cost of registration to engineers	**$4,928,298**
Licensing staff	$1,196,213
Compliance staff	$3,732,085
TOTAL INCREMENTAL COSTS	**$13,584,098**

Source: Deloitte Access Economics

Therefore, the benefits arising from the scheme need to equate to $13.6 million in present value terms over the assessment period for the scheme to be cost-neutral. To assess the likelihood of the benefits meeting this minimum amount, a range of data, case studies and qualitative benefits were considered.

The avoidance of rectification and remediation costs related to defects is a key reason for the implementation of the scheme. Rectification costs reduce builders' profit margins and are a major contributing factor to builder insolvencies. For example, the NSW Master Builder's Association estimates that the average size of remediation contingency may be around 5-10 per cent of project contract price.[1]

This would equate to approximately $313 million to $626 million of contingency costs being built into new WA residential property building projects alone, based on an annual average of the value of building approvals for the 10 years ended December 2019.[2] While not aiming to completely avoid this cost, the purpose of the proposed reforms are to improve the quality of building work in WA and subsequently reduce the size of these contingency costs built into new building projects.

Relative to the lower end of the spectrum of annual contingency costs budgeted for rectification - as estimated by the NSW Master Builder's Association (i.e. an annual average of $313 million in WA for the 10 years ended December 2019) - the annual average cost of the proposed registration scheme is just 0.7% per annum. This is based on the total undiscounted scheme cost of $21.3 million over the 10-year assessment period.

As a further comparison point, the $2.1m average annual cost (undiscounted) of the scheme over the 10-year assessment period adds around $93 per dwelling approved in WA over the year to December 2019. This is based on an annual average of 22,968 dwelling approvals granted in WA over the 10 years ended December 2019.[3]

Based on the assessment of the above, it appears likely that the benefits arising from the scheme will at least 'break-even' relative to the estimated monetised costs.

A range of sensitivity tests were performed to assess the relative impact of varying key assumptions on the results of the analysis. The results of the sensitivity analysis are outlined in Appendix A.

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[1] Based on consultation with builders; Master Builders Association of New South Wales, Response to the NSW Government's *Building Stronger Foundations* Discussion Paper, July 2019

[2] Based on ABS Catalogue 8731.0 Value of building Approved in Western Australia, Total value of building jobs for new residential buildings; The 10 period to December 2019 reflects an average period without COVID-19 and the associated policy measures that have impacted building activity.

[3] Based on ABS Catalogue 8731.0 Total Number of Dwelling Units Approved in Western Australia, private sector houses and total buildings across all sectors

2 Background

An occupational registration scheme for Building Engineers is being considered in Western Australia

2.1 Purpose of this study

The Department of Mines, Industry Regulation and Safety (DMIRS) engaged Deloitte Access Economics to undertake an economic analysis of a proposed registration scheme for Building Engineers in Western Australia. The objective of the analysis is to assess the potential economic and societal impacts of the proposed engineers' registration scheme in Western Australia.

In WA, all proposals to enact new or amending legislation or regulations must be reviewed under the Regulatory Impact Assessment (RIA) process. The RIA process is designed to improve the quality of regulation by ensuring that relevant decision makers are fully informed when making decisions in respect of regulatory instruments. An element of the RIA process involves undertaking an economic analysis of a proposed regulatory change, as set out in this report.

2.2 Background

In 2017, the Building Ministers' Forum (BMF) commissioned an assessment of the effectiveness of compliance and enforcement systems for the building and construction industry across Australia. The *Building Confidence Report*, released in 2018, found that there were multiple systemic deficiencies in Australia's building industry culture and governance arrangements. The report identified 24 recommendations for areas of reform to strengthen the effective implementation of the National Construction Code (NCC). These included reviewing the registration requirements for building practitioners, reviewing the powers of regulators, and considering strategies to proactively regulate building design and construction.[4]

This report catalysed an in-depth review of WA's legislative framework, including the *Building Act 2011* and its subsidiary regulations. The *Building Act 2011* provides a comprehensive system of building control and sets standards for buildings and demolition work in WA.

Engineers are central to the quality, efficiency and safety of the State's building sector. Engineers play an important role in applying scientific and quantitative principles to develop solutions to technical construction problems. Engineers are integral to ensuring that buildings meet the NCC, and in many cases, they may be the only qualified person to assess the compliance of the building elements they design. However, engineers are one of the few professions in Western Australia that remain unregulated.[5]

The registration of building practitioners is a regulatory mechanism for increasing public accountability by ensuring that only registered personnel can perform the work for which they hold registration.[6] It provides a framework whereby the work undertaken by registered individuals, and the standard of qualifications, experience and conduct that must be met, is clearly defined. It also provides a mechanism to manage those operating in the industry that do not meet the defined standards.

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[4] Peter Shergold and Bronwyn Weir, *Building confidence: improving the effectiveness of compliance and enforcement systems for the building and construction industry across Australia* (February 2018).
[5] Department of Mines, Industry Regulation and Safety, *Consultation Regulation Impact Statement – Registration of Building Engineers in WA* (July 2020).
[6] Peter Shergold and Bronwyn Weir, *Building confidence: improving the effectiveness of compliance and enforcement systems for the building and construction industry across Australia* (February 2018).

This is important as the standard of professionalism among engineers must be maintained at a safe level to ensure competent practice, ethical conduct, maximum economic benefit and most importantly, the safety of the Australian community.[7]

2.3 Proposed reforms

In July 2020, Building and Energy released the *Consultation Regulatory Impact Statement – Registration of building engineers in Western Australia* (C-RIS).[8] The C-RIS detailed three proposals to register and govern building engineers under the *Building Services (Registration) Regulations 2011* (BSR Regulations). These proposals were based on the first three recommendations of the *Building Confidence Report*. The C-RIS was open for public comment for five months through to 3 December 2020.

The consultation process resulted in four recommendations specific to engineers that aim to improve building compliance and public confidence in the WA building and construction industry (see below). These recommendations are detailed below and include both regulatory and non-regulatory measures to govern WA's building engineers. Executing these recommendations will partially fulfil the Government's commitment to implementing the recommendations of the *Building Confidence Report*.

These recommendations have received a high degree of industry support and are aligned with both the national registration framework developed by the Australian Building Codes Board (ABCB) and engineer registration schemes in other jurisdictions.[9]

2.3.1 Registration for building engineers

The first recommendation is for professional and technical building engineering designers who work on class 1 – 10 buildings (in accordance with the *National Construction Code,* under the *Building Services (Registration) Act 2011* WA) in the prescribed categories to be registered.

Practitioners will initially be registered across four prescribed categories including civil, structural, mechanical and fire engineering designers. The proposed recommendation will also introduce a three-tiered registration framework – professional engineers, technologists and associates. Engineers will need to meet certain requirements to retain registration.

2.3.2 Building surveyor professional indemnity insurance

The second recommendation is that both engineering and building surveyor contractors hold 'adequate' levels of professional indemnity (PI) insurance.

This reform avoids prescription of minimum levels of PI cover, as levels of 'adequate' coverage will depend on a number of commercial factors (e.g. the type, size and volume of projects contractors undertake). These factors can vary over time and need to be determined based on the nature of a contractor's services and related risks.

Additionally, under this recommendation, the PI insurance requirement for registered building surveyors will be amended to match that recommended for registered engineers.

Under the proposed approach, it will be the responsibility of applicants to demonstrate that their level of indemnity cover is adequate to manage the risk presented by the work they undertake. This recommendation is similar to the insurance requirement under NSW's *Design and Building Practitioners Act 2020* which requires that registered engineers must be "adequately insured".[10]

2.3.3 Code of conduct for registered engineers

The third recommendation is to introduce a Code of Conduct for registered engineering practitioners. A code of conduct for engineers sets out the minimum standard of professional

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[7] Professionals Australia, Engineers Australia and Institute of Public Works Engineering Australasia *Western Australian government brief*: a *model for registration of professional engineers in Western Australia* (2019) p.4
[8] Department of Mines, Industry Regulation and Safety, *Consultation Regulation Impact Statement – Registration of Building Engineers in WA* (2020).
[99] Department of Mines, Industry Regulation and Safety, *Consultation Regulation Impact Statement – Registration of Building Engineers in WA* (2020)
[10] *Design and Building Practitioners Act 2020* (NSW) s33(1)

conduct required to be met by registered engineers to enable execution of their roles with due integrity, care for the public, and competence.

The code of conduct is intended to be issued by the Building Commissioner, under section 96 of the *Building Services (Complaint Resolution and Administration) Act 2011* and will be modelled on Queensland's Code of Practice for Registered Professional Engineers.

2.3.4 Registered people to work within area of competence

The fourth recommendation is that all registered building service providers only act within their area of competence. This limits the possibility of a registered building service provider doing work outside their skill set.

Under the recommended WA scheme, a registered engineer can undertake professional engineering work of a type that may overlap with other engineering disciplines, recognising the fact that most categories for registration are very broad, empowering registered people to work on a variety of buildings. It is neither practicable nor desirable to require that every registered person be competent to work on every type and size of building. Therefore registered engineers must take responsibility for ensuring that they are competent to undertake the work they are contracted for.

3 Evaluation methodology

A break-even analysis is used in this study to assess the potential economic outcomes of the proposed reforms

3.1 Best practice – cost benefit analysis

A cost benefit analysis (CBA) represents best practice in evaluating the impact of a potential policy or investment proposal. The basis of a CBA is simple: for a given policy or investment, it compares the total estimated costs to the economy with the total estimated benefits. As such, a CBA determines whether the benefits outweigh the costs, and if so, to what extent. It is therefore an important tool to support government and commercial decisions.

The use of a CBA is an important tool for effective decision making in assessing regulatory proposals in particular. The rationale for using a CBA to support government decision-making is strong, given that public funds come at a significant cost to the economy (through taxes collected by local, state and Commonwealth governments).

While a CBA provides decision makers with a strong basis for comparing policy alternatives on the basis of quantifiable costs and benefits, there are some limitations associated with its use. A CBA methodology aims to quantify all potential costs and benefits, meaning that difficulties arise when such sums cannot be reliably quantified. This may be due to insufficient data or information, or because the transmission mechanisms are too nuanced to be appropriately encompassed by an economic appraisal.

In the absence of a cost benefit analysis, other supplementary tools can be used to support decision-making.

3.2 Break-even analysis

A break-even analysis (BEA) can be used in place of a CBA where the likely costs are quantifiable but limited data exists to reliably quantify benefits.

In this study, the benefits associated with the proposed registration scheme for building engineers in WA are difficult to quantify credibly due to a lack of empirical evidence. For example, quantifying the probability of building defects occurring based on past history and recorded costs of rectification is difficult due to the lack of available data. Even where data exists, it is not always straightforward to specifically attribute the emergence of a defect to the quality of engineering design and related inputs. In addition, limited data exists on the change in the occurrence of defects that could be achieved in the presence of a registration scheme for engineers specifically.

For these reasons, a BEA approach has been used in this study to assess the potential economic outcomes of the proposed reforms.

A BEA involves a detailed assessment and quantification of the costs (similar to the process undertaken in a cost-benefit analysis). The quantification of costs effectively sets the minimum level of benefits required for the policy to be cost-neutral to the economy, or 'break-even'. It is possible to then qualitatively assess whether the economic benefits associated with the reform are likely to meet this minimum amount based on available information and data.

3.2.1 The role of labour market modelling

The outcomes of this analysis are dependent on the ability to credibly estimate costs. Given that the cost of the proposed reforms are underpinned by the number of engineers in Western Australia who operate in the building and construction industry, accurately estimating this number of engineers forms an important part of this analysis.

Up to date estimates of the number of workers within specific occupations, by industry and by location does not exist. To solve this data gap, Deloitte Access Economics utilised its *Workforce and Occupational Estimation Tool* to estimate the number of engineers in Western Australia that operate in the building and construction industry. Further detail on the labour market modelling and approach is provided in Chapter 4.

3.3 Approach to the break-even analysis

3.3.1 Summary of approach

This BEA quantifies the incremental costs associated with the proposed registration scheme for Building Engineers in Western Australia. A qualitative assessment of whether the benefits are likely to offset the quantified costs is then undertaken.

Five key steps were taken to prepare the BEA:

1. Scenario definition
2. Assessment period definition
3. Cost specification and estimation
4. Discounted cash flow (DCF) modelling
5. Break-even analysis.

These steps are discussed in more detail below.

3.3.2 Scenario definition

3.3.2.1 Base case

Defining a counterfactual scenario, or base case, is a critical component of most economic analyses. The net costs of the investment are measured as an *incremental* change from the specified base case. This ensures that only the costs that can be reasonably attributed to the reform are included in the analysis.

For this study, a 'do nothing' base case is applied. This assumes a continuation of the current, or 'business as usual', state of operations. It implies a scenario in which the proposed reforms do not proceed (i.e. no mandatory registration of building engineers in Western Australia).

3.3.2.2 Project case

The project case is defined as a scenario in which the proposed reform of registering engineers in the building industry in WA proceeds as outlined in Section 2.3 of this report. The key assumptions that underpin the project case have been informed through consultation with DMIRS, and include:

- Scheme to commence on 1 January 2023
- Registration to take place over a two-stage implementation process:
    - In the first stage, registration will commence for structural and fire engineers, with a two-year transition period
    - The second stage will commence one year later for civil and mechanical engineers, with a two-year transition period.

Further assumptions that underpin the analysis are outlined in the relevant sections below.

3.3.3 Assessment period definition

For this analysis, the assessment period is defined as a period of 10 years, from 2023 to 2032. This period reflects the expected commencement date of the reforms from 1 January 2023, a 3-year transition period to register engineers (through to 31 December 2025), and 7 years of operation of the scheme.

The 10-year assessment period is consistent with the guidance published by the Department of Prime Minister and Cabinet, which suggests that a period of 10 years should be used for regulatory impact assessments for Commonwealth legislation in line with the *Legislative Instruments Act 2003*.[11]

3.3.4 Cost specification

The specification of costs in a BEA should take into account all the impacts of the reform that produce negative or undesirable effects. This includes costs to both individuals and groups within the community that are incurred as part of the implementation and operation of the proposed reforms. To be included in the BEA framework, the costs must be measurable; that is, it must be possible to attribute each reform with a meaningful measure of economic value.

For this study, three sources of costs have been identified as attributable to the proposed reforms, and measurable:

1. Initial accreditation costs
2. Ongoing cost of meeting continuing professional development (CPD) requirements
3. Initial and ongoing cost of occupational registration to engineers.

Chapter 5 provides a description of each of the costs, along with the key data inputs and assumptions that have been used to estimate their value.

3.3.5 Discounted cash flow modelling

In undertaking a BEA, the total estimated costs of the proposed reforms (i.e. the incremental change in costs between the base case and project case) are calculated in a discounted cash flow (DCF) framework to estimate the present value of future costs. The discounting of future costs to derive present value reflects the time value of money and uncertainty of future cash flows.

The costs are discounted in accordance with guidance published by Office of Best Practice Regulation (OBPR), which requires the calculation of present values at an annual real discount rate of 7 per cent.[12] The OBPR also recommends that present values are calculated at real discount rates of 3 per cent and 10 per cent as sensitivities. These discount rates have been tested as part of the sensitivity analysis (see Appendix A for further detail).

3.3.6 Break-even analysis

This step involves summarising the results of the analysis and assessing the outcomes of the cost analysis. This requires using judgement to determine whether the economic benefits associated with the reform are likely to 'break-even' with the costs. A range of case studies and other objective data is used to assess the likelihood of the benefits being achieved.

Policy makers are then able to assess whether the economic benefits associated with the reform are likely to exceed the quantified costs in present value terms and whether the proposed reforms will deliver net benefits to the WA community.

[11] Department of Prime Minister and Cabinet, User Guide to the Australian Government Guide to Regulatory Impact Analysis, March 2020
[12] Department of Prime Minister and Cabinet, Office of Best Practice Regulation, Cost-benefit analysis Guidance Note, March 2020, https://obpr.pmc.gov.au/sites/default/files/2021-09/cost-benefit-analysis.pdf

4 Estimating the size of the engineering workforce

Quantifying the number of building engineers in Western Australia is a critical component of the economic analysis.

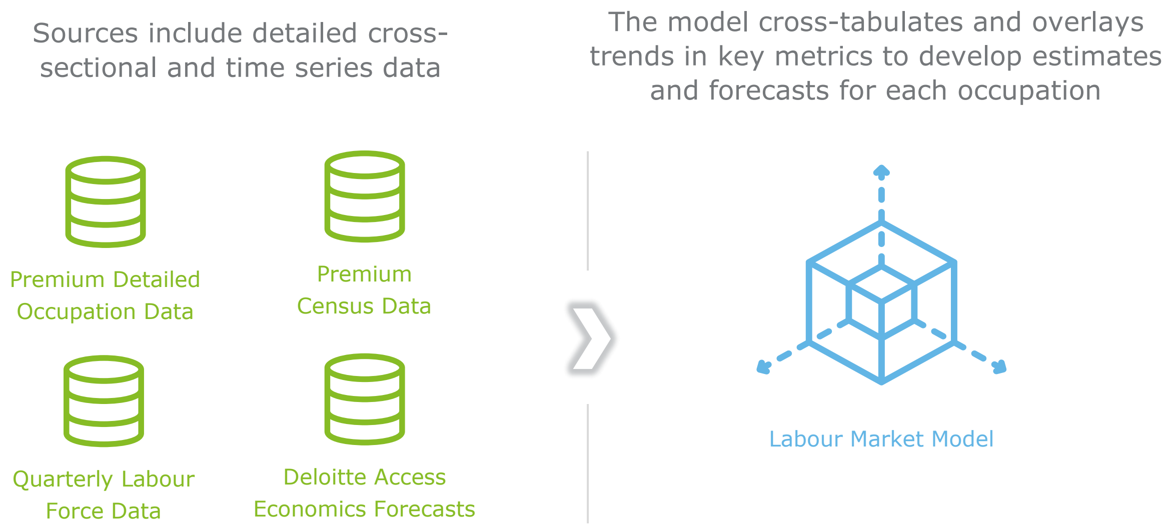
4.1 Workforce and occupational modelling

4.1.1 Approach

Deloitte Access Economics' Workforce and Occupational Estimation Tool calculates detailed current estimates of available labour pools, by detailed occupations, industry, set geographies (e.g. Western Australia, or SA3 and SA2-level areas) and other demographic data (e.g. age, gender and Indigenous status). For this study, the tool has been used to estimate the number of engineers currently in the WA workforce within the occupational and industry categories proposed for registration.

The Workforce and Occupational Estimation Tool was developed to overcome the lack of a detailed (i.e. at 6-digit ANZSCO occupational level), up-to-date labour market datasets. The tool models the magnitude and location of detailed occupations by integrating a variety of data sources and analytical techniques. An outline of the approach and the data sources utilised in the process is shown in Figure 4.1.

Figure 4.1: Overview of labour market modelling methodology



Source: Deloitte Access Economics

The estimates developed using the Workforce and Occupational Estimation Tool are a critical input to the BEA, given that it determines the number of engineers likely to need registration under the proposed reforms, and therefore the aggregate costs expected to be incurred. For the purposes of this study, the tool has been used to estimate the number of WA-based engineers in the building sector across specific occupations and industries which reflect the scope of the proposed reforms (i.e. 'in-scope' engineers and industries). The in-scope occupations and industries are outlined in Section 4.1.2 and Section 4.1.3.

4.1.2 Occupation matching

To develop the labour market modelling, engineering roles considered in-scope for the proposed reforms are matched to a corresponding *Australian and New Zealand Standard Classification of Occupations* (ANZSCO) role.[13]

The ANZSCO classification forms the basis of occupational disaggregation in ABS datasets (Census, Labour Force Quarterly etc.) and Deloitte Access Economics' Workforce and Occupational Estimation Tool. Within the classification system, the 6-digit level (ANZSCO6) is the most granular level of categorisation detail available. An overview of the in-scope engineering occupations and the respective ANZSCO6 occupation assumed for modelling purposes is outlined in Table 4.1.

Table 4.1: Engineers considered in-scope of the proposed reforms and corresponding ANZSCO6 match

In-scope engineer as per proposed reforms	ANZSCO6 name	ANZSCO6 code	ANZSCO6 description
Civil Engineering Practitioner	Civil Engineer	233211	Plans, designs, organises and oversees the construction and operation of dams, bridges, pipelines, gas and water supply schemes, sewerage systems, airports and other civil engineering projects. Registration or licensing may be required.
	Civil Engineering Technician	312212	Conducts tests of construction materials, prepares sketches and tabulations, and assists in estimating costs in support of Civil Engineering Professionals and Engineering Technologists. Registration or licensing may be required.
Mechanical Engineering Practitioner	Mechanical Engineer	233512	Plans, designs, organises and oversees the assembly, erection, operation and maintenance of mechanical and process plant and installations. Registration or licensing may be required.
	Mechanical Engineering Technician	312512	Conducts tests of mechanical systems, collects and analyses data, and assembles and installs mechanical assemblies in support of Mechanical Engineers and Engineering Technologists.
Structural Engineering Practitioner	Structural Engineer	233214	Analyses the statistical properties of all types of structures, tests the behaviour and durability of materials used in their construction, and designs and supervises the construction of all types of structures. Registration or licensing may be required.
Fire Engineering Practitioner	-	-	*No relevant ANZSCO6 occupation exists for Fire Engineering Designers, and hence these are estimated out of the labour market model*
Fire Systems Designer	-	-	*No relevant ANZSCO6 occupation exists for Fire Systems Designers, and hence these are estimated out of the labour market model*

Source: DMIRS, Deloitte Access Economics

[13] Australian Bureau of Statistics, *Australian and New Zealand Standard Classifications of Occupations* (2006).

As shown in Table 4.1, where available, both engineering and engineering technician ANZSCO6 occupations are matched to a respective in-scope engineering role (i.e. for civil and mechanical engineers). While there are no relevant ANZSCO occupations applicable to fire engineering designers or fire systems designers, it's likely that these occupations are included within underlying data sources as part of other occupations such as Civil Engineer. However, for completeness, estimates for these in-scope engineering roles are developed out of the labour market model based on consultation with DMIRS (see Section 4.1.4.1).

4.1.3 Industry matching

To ensure that estimates for the number of in-scope engineers are also measured within the appropriate in-scope industry, the modelling is filtered by an appropriate set of *Australian and New Zealand Standard Industrial Classification* (ANZSIC) industries.[14] Like the ANZSCO classification system, ANZSIC forms the basis of industrial disaggregation in ABS datasets.

To estimate the number of in-scope engineers specifically working in the building industry, the 'Building Construction' and 'Construction Services' industry classifications are used to develop the labour market modelling (refer Table 4.2). These form two of the three industries comprising the top-level 'Construction' industry within the ANZSIC. The third industry within Construction – 'Heavy and Civil Engineering Construction' – is out of scope for the proposed reforms.[15]

Table 4.2: Industries considered in-scope of the proposed reforms and corresponding ANZSIC2 match

In-scope industry as per proposed reforms	ANZSIC2 name	ANZSIC2 code	Sub-industries contained within
Building construction	Building Construction	30	• Residential Building Construction • Non-Residential Building Construction
	Construction Services	32	• Land Development and Site Preparation Services • Building Structure Services • Building Installation Services • Building Completion Services • Other Construction Services

Source: DMIRS, Deloitte Access Economics

4.1.4 Modelling estimates

4.1.4.1 Estimates of the current workforce

Table 4.3 shows the modelling outputs for estimates of in-scope engineers currently engaged in the WA workforce:

- working across all industries (Column B)
- working in the building industry only (Column C)
- compared to the 2016 Census estimate (Column A).
- The number of WA-based engineers across all industries currently registered with Engineers Australia and Professionals Australia (Column D).

[14] Australian Bureau of Statistics, *Australian and New Zealand Standard Industrial Classification* (2006).

[15] The ANZSIC2 code 69 ('Professional, scientific and technical services, except computer system design and related services') includes an ANZSIC4 level relating to 'Engineering Design and Engineering Consulting Services' (6923). This includes four industry sub-activities which could employ in-scope engineers working in the building industry, such as *'building consulting service'* and *'construction consulting service'*. However, as these relevant activities represent only four of 23 industry activities contained within this 4-digit industry, it is too broad to be included in the study and would risk overestimating the quantum of engineers in the building sector. Notwithstanding this, a sensitivity for a larger than anticipated number of in-scope engineers is outlined in Appendix A.

Table 4.3: Estimates of the number of in-scope engineers in the WA workforce

	2016 estimate	**Current estimate**	**Current estimate**	**Accredited members of professional bodies****	**Estimated Proportion accredited**
Data Source:	Census – All industries	Modelled - All industries	**Modelled - Building Industry Only**	All industries	**--**
	A	**B**	**C**	**D**	**D / B**
Civil Engineers*	2,863	4,597	**570**	848	18%
Mechanical Engineers*	2,903	4,640	**188**	547	12%
Structural Engineers	837	1,461	**78**	404	28%
Building Services Engineering	-	-	**-**	35	-
Fire Engineers	-	-	**30^**	10	-
In-scope total	**6,603**	**10,698**	**866**	**1,844**	**-**

Source: ABS Census, Deloitte Access Economics, C-RIS. *The number of Civil Engineers and Mechanical Engineers also includes Civil Engineering Technicians and Mechanical Engineering Technicians respectively; ^ While not included in the labour market modelling due a lack of an ANZSCO match, a conservative estimate is assumed. ** Engineers Australia and Professionals Australia

As shown in Column C of Table 4.3, it is estimated that approximately 866 in-scope engineers are employed in the WA building industry as at Q3 2021. This includes civil engineering technicians and mechanical engineering technicians - of which there are estimated to be 33. This compares to an estimated total of approximately 10,698 in-scope engineers across all WA industries, meaning the building sector employs only 8% of all in-scope engineers in WA. Major employing industries for engineers in WA include ‘Heavy and Civil Engineering’, ‘Mining’, ‘Professional, Scientific and Technical Services’, ‘Manufacturing’ and ’Public Administration and Safety’.

Column D of Table 4.3 shows that a total of 1,844 in-scope engineers are currently accredited *across all industries* by Engineers Australia (EA) and Professionals Australia (PA). Accreditation in this sense does not refer to membership, but rather engineers who are accredited by an industry association through the National Engineering Register (NER) or Chartered Institution of Building Services Engineers (CIBSE).

As noted above, there are no relevant ANZSCO occupations applicable to fire engineering designers or fire systems designers. Estimates for these in-scope engineering roles were developed out-of-model based on consultation with DMIRS. An estimate of 30 current Fire Engineers and Fire Systems Designers was assumed based on this consultation.

Based on the modelling, the estimated proportion of engineers accredited by an industry association across all industries (D / B) is estimated at approximately:

- 18% registration for Civil Engineers
- 12% registration for Mechanical Engineers
- 28% registration for Structural Engineers.

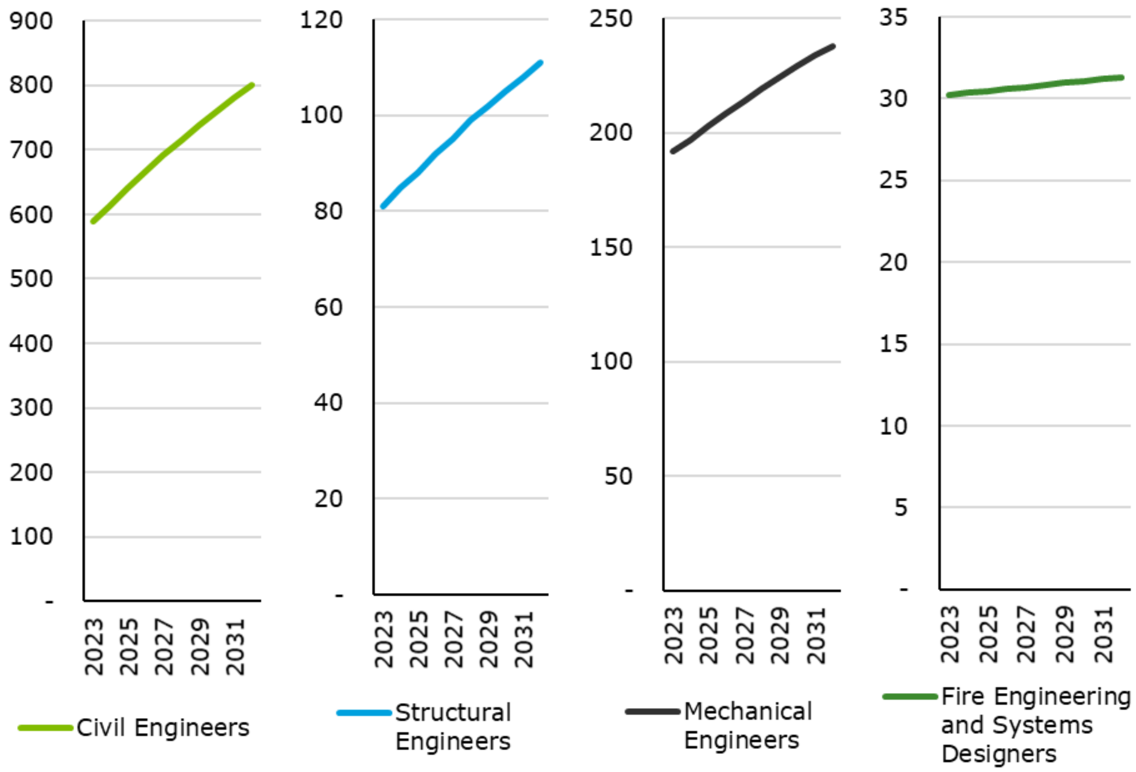
These proportions are important for the study as they form the assumptions used to estimate the proportion of engineers already accredited in the building industry.[16] As noted above, this accreditation is beyond membership alone, and refers to accreditation by an industry association through the NER or CIBSE. This cohort of accredited engineers already incur costs as part of their accreditation status in the base case related to issues such as mandatory CPD, which form part of the reform proposal.

4.1.4.2 Forecast estimates

The forecast growth of in-scope engineers over the assessment period is based on Deloitte Access Economics' forecasts of the aggregate workforce by occupational groups. These forecasts are based on Deloitte Access Economics' macroeconomic modelling framework and are internally consistent with in-house forecasts of Gross Domestic Product, Gross State Product, exports, consumption, industry value added and other macroeconomic variables.

Each ANZSCO 6-digit occupation is matched to its respective 4-digit occupation using the standard ANZSCO concordance. The forecast growth at the 4-digit level is then applied to the estimates derived from the occupational model. The forecast change in the number of in-scope engineers over the 10-year assessment period is illustrated in Chart 4.1.

Chart 4.1: Forecast number of in-scope engineers in the building industry over the assessment period



Source: ABS Census, Deloitte Access Economics

The forecast average annual growth rate over the assessment period by in-scope occupation is as follows:

- 0.6 per cent per annum for Civil Engineers
- 0.6 per cent per annum for Structural Engineers
- 0.2 per cent per annum for Mechanical Engineers.

[16] For the purposes of the break-even analysis, the estimated proportion of fire engineers accredited by an industry association is assumed to be 19% - the average of the other in-scope engineering occupations.

As there is no applicable ANZSCO occupation for fire engineering and systems designers, the growth rate is based on the average of the other in-scope occupations considered in the modelling (0.4 per cent per annum).

In addition to the core forecast number of in-scope engineers (based on Deloitte Access Economics' macro forecasts), Appendix A also presents the results of sensitivity tests against sharper forecast growth in the number of in-scope engineers over the assessment period. This is an important consideration in the WA context, given the population of engineers in the workforce tends to follow the state's pattern of volatile economic growth, which is tied to commodity price changes. These patterns of growth are difficult to model in a macroeconomic forecasting framework and hence, the growth rates applied above may underestimate possible changes in the population of in-scope engineers under conditions of strong economic growth fuelled by high commodity prices.

4.2 Net number of cost-incurring engineers in WA

4.2.1 Key assumptions

For the purposes of the study, the term 'net number of cost-incurring engineers' has been coined to describe the net cost incurred by in-scope engineers, where **this population of engineers are not already accredited by an industry organisation (IO)** such as EA or PA. Engineers in the building sector accredited by these IOs already incur certain costs under the base case, meaning there is no incremental change to the costs accrued by this group in the project case. An overview of the approach taken to estimate the net number of cost-incurring engineers is shown in Figure 4.2.

Figure 4.2: Methodology to calculate the net number of cost-incurring engineers

Source: Deloitte Access Economics

Several assumptions were made to develop estimates of the net number of cost-incurring engineers over the assessment period:

- **Industry Organisation (IO) accreditation:** The number of in-scope engineers already accredited by an IO in the building industry is estimated by applying the equivalent proportion of engineers accredited across all industries, by occupation, to the number of in-scope engineers in the building industry. These proportions for each occupation are discussed in Section 4.1.4.1.

- **Migration and industry transfers:** the occupational model is used to determine the size of the initial cohort of engineers required to undergo IO assessment. From this initial estimate of current workforce, the total number of in-scope engineers in future years is assumed to grow at the rate applicable for each occupation, as outlined in Chapter 4.1.4.2. As these forecasts are based on Deloitte Access Economics' labour market forecasts for the macroeconomy, the growth rates include the effects of workers entering and exiting the labour force and/or building industry through effects such as migration, retirement, lateral movements across sectors, new qualification etc.

- **University graduates:** university graduates and those with few years of experience are excluded from the proposed registration scheme but are expected to eventually incur the costs of the scheme as their length of experience meets the threshold. However, no adjustment to account for this timing effect has been made in the modelling, meaning this cohort is treated identically to other in-scope engineers. Including those engineers without sufficient experience to fall under the proposed registration scheme in the modelling results in slightly higher estimates of the in-scope workforce. This has the effect of increasing the potential costs of the reforms; and is therefore a conservative assumption for the purpose of the BEA.

5 Costs

Three material costs related to the proposed reforms are the focus of quantification in the study: initial accreditation costs, the ongoing cost of meeting CPD requirements, and the initial and ongoing cost of registration to engineers.

5.1 Summary of estimated costs

Three sources of cost are considered in this analysis according to the proposed reforms:

1. **COST 1:** the initial accreditation costs – the total cost to engineers to have their qualifications and experience assessed and accredited by industry organisations
2. **COST 2:** the ongoing cost of meeting CPD requirements – the total ongoing cost for engineers to meet the CPD requirements set out by the proposed registration scheme
3. **COST 3:** the initial and ongoing cost of registration to engineers – the total administrative cost to DMIRS' Building and Energy division of implementing and managing the registration scheme.

These costs are described in the following sections, along with the approach that has been applied to estimate value.

5.2 Cost 1: Initial accreditation costs

5.2.1 Summary

Under the proposed registration scheme, applicants' qualifications and experience will be assessed against a benchmark. This will form part of the accreditation process to determine an applicant's competency for registration.

As engineering work is highly technical - and DMIRS does not have the expertise internally to assess the competence of engineers - it is proposed that the assessment is undertaken by industry organisations. As outlined in consultation with DMIRS, this is proposed to be undertaken through an approved industry-based scheme by an authorised member of an International Engineering Alliance, or equivalent. Examples include Engineers Australia, Professionals Australia and the Chartered Institute of Building Services Engineering.

The specific functions of the industry organisation will include:

- assessing qualifications
- assessing the length and breadth of experience
- assessing competence for independent practice
- managing ongoing CPD requirements (refer Chapter 5.3 for further detail on CPD).

The fees that industry organisations expect to charge to assess engineers' qualifications and experience is applied as a proxy to determine these aggregate costs to industry. The methodology and assumptions that underpin this analysis are detailed below.

5.2.2 Methodology

The methodology used to estimate this cost is outlined in Figure 5.1. As illustrated, the initial industry organisation assessment costs are equal to the net number of cost-incurring engineers multiplied by the standard fee for assessment charged by industry organisations.

Figure 5.1: Methodology to estimate industry organisation assessment costs

Source: Deloitte Access Economics

5.2.2.2 Net number of cost-incurring engineers

The net-number of cost incurring engineers is derived from Deloitte Access Economics labour market model. The detail on how this is calculated is set out in Chapter 4.2.

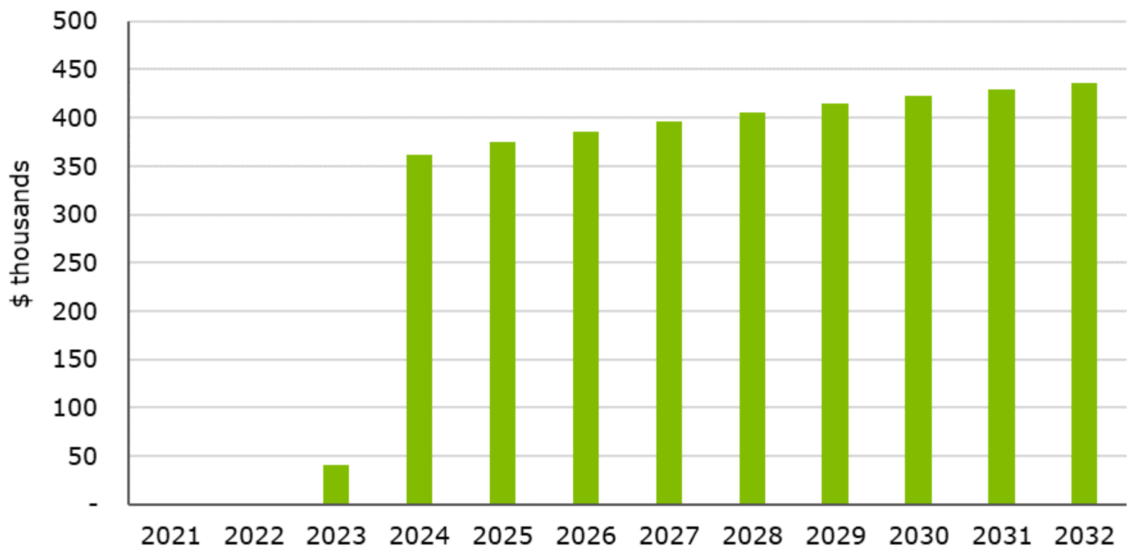
5.2.2.3 Cost of assessment

While several assessment providers exist, the fee charged by Engineers Australia to non-members to undertake an assessment as part of the *National Engineering Register (NER)* was used to estimate this cost. This fee ($577.50 per assessment)[17] was chosen as it is higher than other assessment providers, meaning the costs calculated are higher and therefore more conservative from the perspective of the BEA.

5.2.3 Estimation

In present value terms, the initial accreditation costs are estimated to total approximately $435,410 over the assessment period. Chart 5.1 illustrates the pattern of change in this cost.

Chart 5.1: Cumulative costs of initial accreditation, 2021 – 2032, (2021 $, present value terms)



Source: Deloitte Access Economics

As illustrated in Chart 5.1, the cost in 2023 (approximately $41,500 in present value terms) is small relative to other years. This reflects the two-stage implementation process of the proposed reforms, where the registration of structural, fire, civil and mechanical engineers occur at different times. The fire and structural engineers required to register in the first stage (i.e. in 2023-24) only account for approximately 11 per cent of the total in-scope engineers, whereas civil and

[17] Engineers Australia, *Information on the NER* (2021) <https://www.engineersaustralia.org.au/Engineering-Registers/National-Engineering-Register/NER-Info>.

mechanical engineers account for approximately 89 per cent, and are only required to register in the second stage (i.e. in 2024-25).[18]

5.3 Cost 2: Ongoing cost of meeting CPD requirements

5.3.1 Summary

Applicants seeking to renew their registration to provide professional engineering services in WA will be required to demonstrate that they have undertaken appropriate levels of continuing professional development (CPD). For the purposes of the modelling, it is assumed that in-scope engineers already accredited by an IO in the base case already undertake appropriate levels of CPD regardless of whether the proposed reforms were in place or not.

The D-RIS outlines that under the proposed registration scheme, a building engineer must undertake a total of 150 hours of CPD across a three year period. This is consistent with other jurisdictions and industry standards, and is considered necessary for engineers to maintain up-to-date knowledge of industry developments and requirements.[19] Additionally, this amount will include the 4 hours of mandatory CPD on the National Construction Code (NCC) each year that will be imposed as part of adopting the best practice guidance developed by the Australian Building Codes Board (ABCB) in Western Australia.

Under the D-RIS, it is proposed that CPD requirements are monitored and enforced by industry organisations. Additionally, as outlined in consultation with DMIRS, guidance on CPD requirements for registered engineers will be developed in consultation with industry to determine the number of hours that may be claimed for different types of CPD activities.[20]

Industry organisations currently provide guidance on the number of hours that may be claimed for different types of CPD activities. There are a variety of activities that may be considered valid for CPD including formal learning, unstructured or self-directed learning, on the job-learning, mentoring, research work, preparing and delivering presentations and writing articles.[21]

The methodology and assumptions that underpin the estimation of CPD costs required under the proposed reforms are detailed below.

5.3.2 Methodology

The methodology used to estimate this cost is outlined in Figure 5.2 below. As illustrated, the ongoing CPD costs are equal to the net number of cost-incurring engineers multiplied by the standard fee for ongoing industry organisation CPD assessment, and the standard ongoing cost of meeting CPD requirements. These concepts are defined further below.

Figure 5.2: Methodology to estimate ongoing CPD costs

Source: Deloitte Access Economics

[18] For the purposes of this analysis, it is assumed that engineers across each category will register in the first year available. However, it is recognised that in practice, registration will most likely flow over the two-year period. Due to the impact of discounting, this is deemed to be a conservative assumption.

[19] Department of Mines, Industry Regulation and Safety, *Consultation Regulation Impact Statement – Registration of Building Engineers in WA* (2020).

[20] Department of Mines, Industry Regulation and Safety, *Decision Regulatory Impact Statement – Registration of Building Engineers in Western Australia* (2021).

[21] Engineers Australia, *CPD – Types and conditions* (2014).

5.3.2.2 Net number of cost-incurring engineers

The method for calculating the net-number of cost incurring engineers is outlined in Chapter 4.2. In the absence of the proposed scheme, engineers that are already accredited by an industry organisation are assumed to already be undertaking appropriate levels of CPD as part of their accreditation (and therefore do not incur any incremental cost under the proposed scheme).

5.3.2.3 Ongoing industry organisation fee

While several assessment providers exist, the fee charged by Engineers Australia for non-members to maintain their NER registration has been applied to estimate this cost. This is adopted as engineers currently have CPD assessed as part of their NER registration. The fee that Engineers Australia charges to maintain this registration is $179.00 per annum.[22] As with the benchmark adopted to estimate the initial accreditation cost (Chapter 5.2.2), this fee is higher than that charged by other assessment providers, meaning the costs calculated are higher and therefore more conservative from the perspective of the BEA.

5.3.2.4 Ongoing CPD costs

As previously mentioned, industry organisations currently provide guidance on the number of hours that may be claimed for different types of CPD. Engineers Australia allow a maximum of 75 hours of CPD in any three-year period to be claimed for "learning activities in the workplace that extend competence in the area of practice".[23]

The form of CPD undertaken is a key consideration as 'learning activities in the workplace' often bears little to no cost to the individual as learning occurs in the normal course of work, with limited financial cost to the individual (e.g. to attend courses etc.). Meanwhile employers – while absorbing the opportunity cost and / or financial cost of enabling workplace learning, would rationally set such learning requirements to a level that allows the employer to derive a net benefit (in the form of a more loyal, engaged, experienced and skilled workforce).

However, professional development undertaken in the form of structured learning is likely to have both opportunity and financial costs for both the individual, and the employer if the training occurs during business hours. CPD undertaken outside of work hours may represent both an opportunity cost and financial cost to the individual, though employers would benefit from such investment of time.

Given the uncertainty over the form of CPD likely to be undertaken by engineers, and therefore the incidence of the cost, the above stipulation by Engineers Australia was used to formulate a key assumption for this study. Of the 150 CPD hours, 50 per cent (i.e. 75 hours over 3 years) is assumed to be undertaken in the workplace and therefore represents no additional cost to engineers for the purposes of this study. The additional 50 per cent (i.e. 75 hours over 3 years or 25 hours per annum) is undertaken in the engineers' own time.

Therefore, the cost of undertaking 75 hours of CPD (or 25 hours per annum) is calculated by estimating the opportunity cost of engineers' time to complete the CPD. This assumes that working in paid employment represents the next best use of an individual's time. Data from *Hays Salary Guide* was used to estimate the average hourly wage for a site and project engineer in the construction building sector in Western Australia - equating to $59.2 per hour. [24]

As it is recognised that there are alternative approaches to estimating the ongoing cost of meeting CPD requirements, two alternative approaches are tested as sensitivities to this approach (see Appendix A).

5.3.3 Estimation

In present value terms, the ongoing cost for engineers to meet CPD requirements is estimated to total $8.2 million over the assessment period. This comprises approximately $0.9 million in

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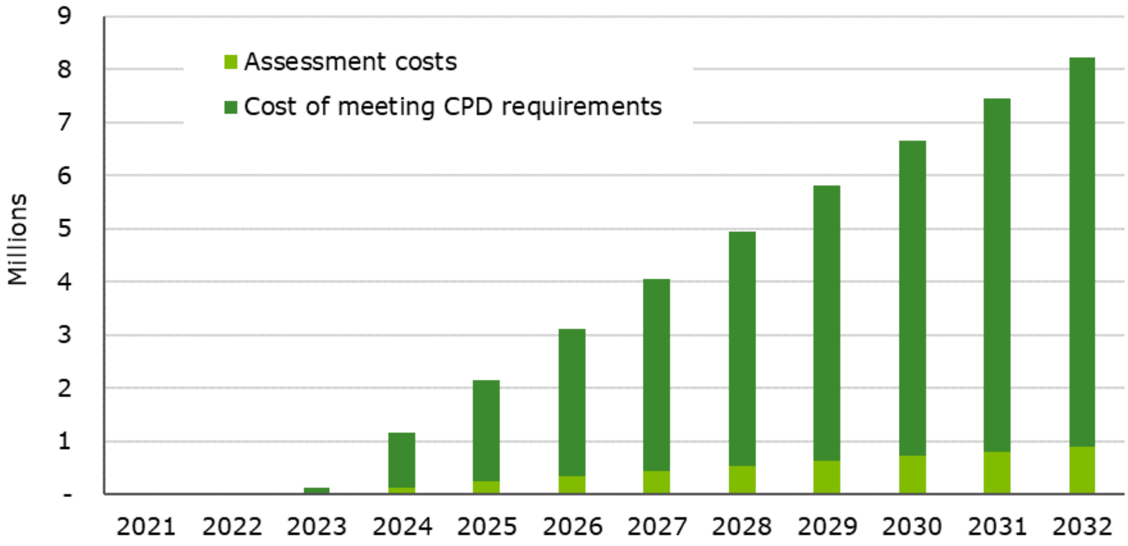
[22] Engineers Australia, *Information on the NER* (2021) <https://www.engineersaustralia.org.au/Engineering-Registers/National-Engineering-Register/NER-Info>.
[23] Engineers Australia, *CPD – Types and conditions* (2014).
[24] Hays, *Salary Guide FY21/11 Australia and New Zealand* (2021).

ongoing *assessment costs* and $7.3 million in ongoing costs *to meet CPD requirements*. Chart 5.2 illustrates the profile of this cost.

Chart 5.2: Cumulative ongoing CPD costs, 2021 – 2032, (2021 $, present value terms)



Source: Deloitte Access Economics

As discussed in Chapter 5.2.3, the assessment cost in 2023 (approximately $12,900 in present value terms) is expected to be much smaller than the following years due to the two-stage implementation process.

5.4 Cost 3: Initial and ongoing cost of registration to engineers

5.4.1 Summary

Individuals seeking registration must apply to DMIRS' Building and Energy division for registration once their initial accreditation is processed by an industry organisation.

Under the proposed regulatory model to register engineers, Building and Energy will be responsible for:

- assessing suitability and equivalence of industry-based accreditation
- assessing fitness and propriety (e.g. police clearance)
- assessing insurance requirements and financial capacity of contractors
- monitoring and auditing registered engineers
- receiving and investigating complaints
- undertaking disciplinary inquiries and actions (including applying to SAT for negligent engineers to be fined, or their registration to be suspended or cancelled).

Building and Energy expects to recover the cost of undertaking the bulk of these activities through both initial application fees and ongoing registration fees (charged every three years). Fees would be on a cost-recovery basis, determined and reviewed annually in accordance with Government requirements and Departmental fees and charges.[25] The methodology and assumptions that underpin this analysis are detailed below.

5.4.2 Methodology

The total administrative cost incurred by Building and Energy in implementing and managing the registration scheme is assumed to reflect the initial and ongoing cost of registration to engineers, given that this cost is expected to be recovered from engineers' application and registration fees.

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[25] Department of the Premier and Cabinet, *Expenditure Review Committee – handbook* (2020).

5.4.2.1 Licensing and compliance staff

Estimates prepared by Building and Energy indicate that two additional licensing staff will be required to administer the registration scheme for engineers. As outlined in Table 5.1, annual costs for these staff are estimated to be $184,700 by the third year of the scheme's operation.

Table 5.1: Estimated licensing staffing costs to administer registration for engineers annually (undiscounted)

Staff	Level	Year 1	Year 2	Year 3
Licensing Officer	L2	$63,000	$65,000	$66,000
Licensing Officer	L3	$72,000	$74,000	$76,000
On costs (30 per cent of salaries)		$40,500	$41,700	$42,700
Total		**$175,500**	**$180,700**	**$184,700**

Source: DMIRS

Compliance activities are estimated to require three additional staff:

- a structural engineer to undertake investigations and auditing
- a fire engineer to undertake investigations and auditing
- a technical officer to investigate disciplinary matters.

The three compliance staff will be recruited in stages, to reflect the staged implementation and transition periods, and to allow for potentially reduced staffing requirements if the actual number of engineers registered is lower than estimated. Complaints lodged are anticipated to be minimal at first, then slowly increase as community awareness of registration implications increases. As outlined in Table 5.2, annual costs for these staff are estimated to be $619,618 by the third year of the scheme's operation.

Table 5.2: Estimated compliance staffing costs to administer registration for engineers annually (undiscounted)

Staff	Level	Year 1	Year 2	Year 3
Structural engineer	SCL7	$184,637	$184,637	$184,637
Fire engineer	SCL7	-	$184,637	$184,637
Technical Officer	L6	-	$103,966	$107,355
On costs (30 per cent of salaries)		$55,391	$141,972	$142,989
Total		**$240,028**	**$615,212**	**$619,618**

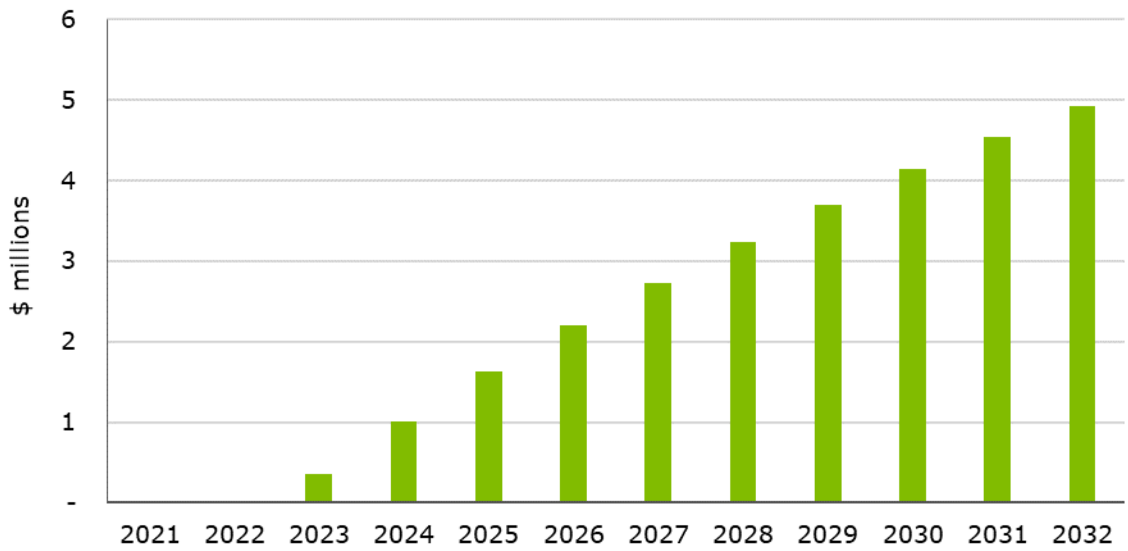
Source: DMIRS

The salary levels and employment start dates for the compliance staff are estimated quite conservatively. In practice, employment start dates may be delayed if many engineers wait until the end of the transition periods to register, and actual job descriptions may support lower salary levels.

5.4.3 Estimation

In present value terms, total application and registration costs are estimated to total $4.9 million over the assessment period. Chart 5.3 illustrates the pattern of this cost.

Chart 5.3: Cumulative initial and ongoing registration costs, 2021 – 2032, (2021 $, present value terms)



Source: Deloitte Access Economics

Building and Energy's administrative costs will be met through a combination of registration fees and the building services levy. Based on Deloitte Access Economics' estimation of total in-scope engineers, this represents an annual administrative cost of $680.6 per engineer.[26] This cost is high in comparison to annual registration fees in other jurisdictions.[27]

5.5 Qualitative costs

5.5.1 Maintaining adequate professional indemnity insurance

Under the proposed registration scheme, both engineering and building surveyor contractors will be required to hold 'adequate' levels of professional indemnity (PI) insurance. For engineers who do not currently hold PI insurance or do not hold 'adequate' levels of PI insurance, the introduction of the scheme will require them to purchase insurance, representing an additional cost.

However, it is difficult to reliably quantify this cost for a variety of reasons:

- The proportion of engineers who do not currently hold PI insurance is unknown
- The proportion of engineers who do not currently hold 'adequate' levels of PI insurance is unknown
- The adequacy or otherwise of coverage is based on the nature and value of work undertaken by a contractor, for which it is difficult to formulate assumptions
- It is difficult to determine how much an adequate level of insurance would cost engineers as the amount of insurance deemed to be adequate cover will vary based on individual circumstances.

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[26] This is based on the total cost of licensing and compliance staff in 2032 divided by the total number of in scope engineers in 2032.

[27] Consumer Affairs Victoria, *Fees and forms* (2021) <https://www.consumer.vic.gov.au/licensing-and-registration/professional-engineers/fees-and-forms>; NSW Fair Trading, *Registration fees* (2021) <https://www.fairtrading.nsw.gov.au/trades-and-businesses/construction-and-trade-essentials/professional-engineers/registration-fees>; Tasmanian Government, *Licence registration and accreditation fees* (2021) <https://cbos.tas.gov.au/topics/licensing-and-registration/fees>; State of Queensland, *Professional Engineers Regulation 2019* (2019).

For these reasons, the cost of attaining adequate PI insurance could not be reliably estimated for the purposes of this study. However, PI insurance is a common contractual requirement as well as a commercial risk management mechanism for professionals, including engineers. It is therefore anticipated that most engineers hold some level of PI insurance coverage, meaning regulatory requirements for 'adequate' PI insurance are unlikely to impose significant additional costs on the industry or the community.

6 Break-even analysis

This Chapter presents the outcomes of the break-even analysis, including a qualitative description of the likely benefits arising from the scheme.

6.1 Summary of outcomes

Based on the costs estimated in this study (as outlined in Chapter 5), the proposed registration scheme is estimated to generate approximately $13.6 million of costs over the assessment period, in present value terms. Table 6.1 summarises the costs estimated in the study.

Table 6.1: Summary of break-even analysis outcomes (2021 $, present value terms)

BREAK-EVEN ANALYSIS	Value ($, present value)
Initial accreditation cost	**$435,410**
Industry organisation accreditation	$435,410
Ongoing costs of meeting CPD requirements	**$8,220,391**
Assessment costs	$886,539
Cost of meeting CPD requirements	$7,333,852
Initial and ongoing cost of registration to engineers	**$4,928,298**
Licensing staff	$1,196,213
Compliance staff	$3,732,085
TOTAL INCREMENTAL COSTS	**$13,584,098**

Source: Deloitte Access Economics

The cost estimates presented in Table 6.1 imply that the benefits arising from the proposed scheme need to at least equate to $13.6 million in present value terms over the 10-year assessment period in order for the policy to be cost-neutral to the economy, or 'break-even'.

This represents a total economic cost, over the 10-year assessment period, of $19,083 per engineer (undiscounted), where the number of engineers refers to all new engineers accredited by an IO over the assessment period in the project case (assumed to be 1,117 engineers based on the modelling undertaken). These engineers are those likely to incur additional costs under the proposed registration scheme.

A variety of sensitivity tests were undertaken by varying key assumptions in the analysis. The results of these sensitivity tests are summarised in Appendix A.

6.2 Break-even analysis

This section considers the likelihood of the benefits associated with the scheme exceeding or meeting the estimated costs. In doing so, it takes into account data, case studies and a range of qualitative benefits to assess possible benefits against the monetised costs.

6.2.1 Reducing the incidence of rectification and remediation

The avoidance of rectification and remediation costs related to defects is a key reason for the implementation of the scheme. Rectification costs reduce builders' profit margins and are a major contributing factor to builder insolvencies. For example, the NSW Master Builders Association indicates that the average size of remediation contingency may be around 5-10 per cent of project contract price.[28]

This would equate to an average of approximately $313 million to $626 million of contingency costs being built into new WA residential property building projects alone, based on an annual average of the value of building approvals for the 10 years ended December 2019.[29] While not aiming to completely avoid this cost, the purpose of the proposed reforms are to improve the quality of building work in WA and subsequently reduce the size of these contingency costs built into new building projects.

Relative to the lower end of the spectrum of annual contingency costs budgeted for rectification - as estimated by the NSW Master Builders Association (i.e. an annual average of $313 million in WA for the 10 years ended December 2019) - the annual average cost of the proposed registration scheme is just 0.7% per annum. This is based on the total, undiscounted scheme cost of $21.3 million over the 10-year assessment period.

As a further comparison point, the $2.1 million average annual cost (undiscounted) of the scheme over the 10-year assessment period adds around $93 per dwelling approved in WA over the year to December 2019. This is based on an annual average of 22,968 dwelling approvals granted in WA over the 10 years ended December 2019.[30]

6.2.2 Qualitative benefits

Qualitative benefits are real or perceived benefits that are difficult to accurately measure. In this analysis, not all benefits could be reliably quantified. However, these benefits should still be considered as part of the analysis to provide policymakers with a comprehensive understanding of the proposed reforms. Some of the primary benefits associated with the proposed reforms include:

- **Improved public safety:** Engineers are often involved in designing the highest risk elements of a building structure. Improving engineering standards through reforms is likely to result in improved public safety and consumer protection
- **Improved industry transparency:** Registration provides a mechanism to define work that must be undertaken by qualified persons and the standard of qualifications, experience and conduct that must be met by registered persons. The reforms also require that registered engineers operate in their area of competence
- **Improved consumer confidence:** Registration provides benchmarks for competence and experience, giving the public, employers, and clients' confidence that the skills and experience of a registered person have been assessed and verified. Registration also ensures that competence is assessed regularly, as registered engineers meet and maintain recognised minimum standards of qualifications, experience, continuing professional development (CPD), conduct and insurance.

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[28] Based on consultation with builders; Master Builders Association of New South Wales, Response to the NSW Government's *Building Stronger Foundations* Discussion Paper, July 2019

[29] Based on ABS Catalogue 8731.0 Value of building Approved in Western Australia, Total value of building jobs for new residential buildings; The 10 period to December 2019 reflects an average period without COVID-19 and the associated policy measures that have impacted building activity

[30] Based on ABS Catalogue 8731.0 Total Number of Dwelling Units Approved in Western Australia, private sector houses and total buildings across all sectors

- **Reduced remediation contingencies:** Reduction in defect remediation and repair contingencies built into cost estimates, through greater confidence in building quality and lower anticipated risk of structural defects
- **Improved industry communication:** Enable Building and Energy to communicate directly with building engineering practitioners, for the purpose of information sharing and providing guidance in the form of technical bulletins
- **Complementary to other proposed reforms:** Provide a pool of suitably qualified people to undertake third-party review and inspection work, as proposed in a separate consultation process currently being undertaken by Building and Energy called *Reforms to the approval process for commercial buildings in Western Australia.*[31] It is expected to reduce costs for Building and Energy to implement the reforms necessary to introduce third-party review of engineering design work, and mandatory inspections for construction work. Registration will make the process to identify suitably qualified people to undertake this work simpler and more robust
- **Better manage unsuitable industry participants:** Registration also provides a mechanism to manage those operating in the industry who do not meet the defined standards. Registration of engineers can reduce the risk of building failure through limiting professional misconduct and reoccurrence
- **Professional standards for new entrants:** Registration also establishes benchmarks to ensure that engineers who come to work in the WA building industry from overseas or interstate have appropriate qualifications and competencies to carry out work to the required. This sets a default standard against which all industry participants must adhere to.

6.3 Case studies

Several case studies have been developed as an additional aid to gauge the value of potential benefits against the estimated costs. While some prominent and major building faults attract media attention, there are likely many more instances of building faults and defects which do not attract public attention. Of those that do, there are often limitations to the information and data that can be obtained regarding the estimated cost of defects. However, below is a series of case studies that help to frame the expected economic costs of implementing the proposed reforms.

6.3.1 Opal Towers (NSW)

The Opal Tower is a high-rise residential building located in Sydney Olympic Park, NSW. Construction of the 36-storey building was completed in 2018 and occupation of the 392 residential apartments commenced in the second half of 2018.

In December 2018, residents were evacuated due to safety concerns after residents reported observing major cracks across three floors in wall panels, floor slabs and hobs. Significant rectification works were necessary to ensure that the building and all its structural components satisfied the *National Construction Code* and the *Australian Standard for Concrete Structures.*

Residents returned during 2019 after a series of building rectification works. The Federal Court decision noted that, as of 28 February 2020, the builder Icon, had paid out in excess of **$31 million** as a result of the damage, including **$17 million in property rectification costs**, $**8.5 million in alternative accommodation costs** for residents and **$530,000 in legal fees** defending a class action launched last year.

NSW Minister for Planning and Housing commissioned an investigation into the causes of structural damage to the Opal Towers. One of the recommendations that formed part of the

[31] Department of Mines, Industry Regulation and Safety, *Consultation Regulatory Impact Statement - Reforms to the approval process for commercial buildings in Western Australia* (Government of Western Australia, Dec 2019)

Opal Tower Investigation report was the creation and development of a government Registered Engineers database in partnership with an appropriate professional body.

Source: UniSearch[32] Clyde&Co[33]

6.3.2 Non-compliant apartments (NT)

In 2019, a review undertaken by the *Department of Infrastructure, Planning and Logistics* revealed that nine multi-storey residential complexes in Darwin and Palmerston were structurally non-compliant with the *National Construction Code.*

The complexes were reported to contain non-compliant concrete structures known as "transfer slabs", which is essentially a reinforced, suspended concrete slab used to transfer the floor loads from above the transfer slab level, to the supports below, typically concrete columns or walls. If designed incorrectly, the columns can punch through the slab, compromising the structural integrity of the building.

These defects have impacted approximately 200 unit owners. It will be the owners' responsibility to undertake rectification works to ensure the buildings are compliant with the National Construction Code and rectify the situation at their own cost.

Reports estimate that it could cost owners in one of the affected buildings more than **$1.5 million** to undertake extensive rectification works.

Source: DIPL[34]; Australian Broadcasting Corporation[35]

6.3.3 Westralia Bridge (WA)

The Westralia Bridge is a key thoroughfare in Perth CBD, connecting the Alluvion and Westralia buildings. In 2019 the bridge collapsed, leading to questions concerning the structural integrity of the buildings adjoined on either side of it. While the area was cordoned off prior to the collapse, if the visible cracking had gone unnoticed, it is possible that the collapse would have yielded catastrophic impacts to people and property underneath or adjacent to the walkway. There is little publicly available information regarding the cause or rectification costs of the building faults and subsequent collapse.

Source: OBPR[36]; The West Australian[37]

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[32] Unisearch, Opal Tower Investigation Final Report Independent Advice to NSW Minister for Planning and Housing (2019).
[33] Clyde&Co, Opal Tower Coverage Decision: Icon Co (NSW) Pty Ltd v Liberty Mutual Insurance Company Branch (2020), https://www.clydeco.com/en/insights/2020/11/opal-tower-coverage-decision-icon-co-nsw-pty-ltd-v , accessed 4 November 2021.
[34] Department of Infrastructure, Planning and Logistics, *Non-compliant transfer slabs in Darwin buildings* (2019).
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[37] The West Australian, *Walkway collapses between Alluvion building and Westralia Square in Perth CBD* <https://thewest.com.au/news/disaster-and-emergency/walkway-collapses-between-alluvion-building-and-westralia-square-in-perth-cbd-ng-b881226387z>.

6.3.4 Curtin University (WA)

In 2019, a steel and glass canopy five stories above Curtin University's new School of Design and Built Environment building 418 collapsed. The incident resulted in the death of one person and the serious injury of two others who were hospitalised.

Worksafe, who had entered the worksite three times prior to the collapse, is reconstructing the roof canopy to investigate the cause of the incident. The results of the investigation are yet to be made public.

Source: ABC News[38]

[38] ABC, *Curtin University roof collapse leaves worker dead and two others injured in Perth Hospital* (2020), <https://www.abc.net.au/news/2020-10-13/curtin-university-roof-collapses-reports-casualties/12762640>

Appendix A Sensitivity Analysis

Three sensitivity tests were undertaken by varying the key assumptions in the study. The three sensitivity tests undertaken include:

- **TEST 1:** Varying the discount rate
- **TEST 2:** Varying the cost for engineers to undertake CPD
- **TEST 3:** Varying the growth rates of the in-scope engineering occupations.

TEST 1: Varying the discount rate

As noted in Chapter 3.3, the study applies a real discount rate of 7 per cent in accordance with guidance published by the Office of Best Practice Regulation (OBPR).[39] This sensitivity test investigates the impact of varying this discount rate on the calculated costs. Alternative discount rates of 3 per cent and 10 per cent are applied, in line with OBPR guidance. The results of this test are shown in Table 6.2.

Table 6.2: Outcome of discount rate sensitivity test (2021 $, present value terms)

BREAK-EVEN ANALYSIS	Discount rate: 3.0%	Discount rate: 7.0%	Discount rate: 10.0%
Initial accreditation cost	$500,211	$435,410	$394,893
Ongoing costs of meeting CPD requirements	$10,656,607	$8,220,391	$6,851,308
Initial and ongoing cost of registration to engineers	$6,280,570	$4,928,298	$4,161,257
TOTAL INCREMENTAL COSTS	**$17,437,388**	**$13,584,098**	**$11,407,458**

Source: Deloitte Access Economics.

TEST 2: Varying the cost for engineers to undertake CPD

As noted in Chapter 5.3.2.4, the study estimates that CPD costs will equate to $59.2 per hour and that engineers will be required to undertake 50 per cent of their CPD in their own time. However, it is recognised that there are alternative ways to estimate this cost to engineers. Two alternative approaches were tested as a sensitivity to assess the impact on the BEA results. These approaches included:

1. **Engineer Australia (EA) estimates –** Engineers Australia estimates that the cost for engineers to complete 50 hours of CPD is approximately $500 per annum. This estimate is based on the assumption that CPD can be achieved through various means, most of which are either free, inexpensive, or provided on the job. Examples of CPD that Engineers Australia lists include reading technical journals, work-based training, attending presentations and private study.[40]

[39] Department of Prime Minister and Cabinet, Office of Best Practice Regulation, Cost-benefit analysis Guidance Note, March 2020, https://obpr.pmc.gov.au/sites/default/files/2021-09/cost-benefit-analysis.pdf
[40] Engineers Australia, *Registration of Engineers: The case for statutory registration* (2020).

2. **Victorian Parliamentary Budget Office (VPBO) estimates** - VPBO outlines that the largest cost impact to engineers registered under the Victorian scheme is CPD, which is estimated to cost $6,000 per annum for each registered professional engineer. [41]

Table 6.3 outlines the results of this sensitivity test. The VPBO estimate increases the expected cost of the proposed scheme significantly. However, concerns were raised with this estimate around governments and regulators failing to understand how CPD works, the connectedness of the engineering industry, and the role that industry organisations play in providing CPD options for members and non-members. Further commentary was made that the VPBO estimate did not take into account that engineers would complete CPD either during lunch hours or after hours and that companies also allow engineers to undertake CPD during work hours without being required to earn income for that period of time.[42]

Table 6.3: Outcome of CPD cost sensitivity test (2021 $, present value terms)

BREAK-EVEN ANALYSIS	Baseline BEA result	EA estimates	VPBO estimates
Initial accreditation cost	$435,410	$435,410	$435,410
Ongoing costs of meeting CPD requirements	$8,220,391	$3,362,904	$30,602,925
Initial and ongoing cost of registration to engineers	$4,928,298	$4,928,298	$4,928,298
TOTAL INCREMENTAL COSTS	**$13,584,098**	**$8,726,612**	**$35,966,633**

Source: Deloitte Access Economics.

TEST 3: Varying the growth rates of the in-scope engineering occupations

As noted in Chapter 4.1.4.2, the total number of in-scope engineers over the assessment period is based on forecast growth determined by the Deloitte Access Economics' macro model. These growth rates consider the impacts of general macroeconomic and demographic drivers, but by its nature, the labour forecasting model cannot foresee or predict events such as a commodity price boom and the rapid economic expansions that typically accompany such events.

To consider the potential impact of a similar such event, several sensitivity tests were conducted whereby the forecast growth in the number of each in-scope occupation is based on its historical growth rate over the period between 2006 – 2011 and 2006 - 2016. The results in Table 6.1 indicate that the growth rates implied from these periods (where growth was as high as 30 per cent per annum on average for Civil Engineers during the 5-year period between 2006 and 2011), result in total incremental costs in the sensitivity test that are around 1.6 and 1.7 times greater than those in the core scenario respectively, due to a greater number of in-scope engineers. In 2032, these two higher growth scenarios would equate to a total of 3,007 and 3,268 in-scope engineers respectively, relative to 1,180 in the core scenario. These higher costs reflect the higher initial accreditation costs and ongoing costs of meeting CPD requirements, driven by a higher total number of in-scope engineers.[43]

[41] Victorian Parliamentary Budget Office, *Proposed Engineers Registration Bill 2019 – Independent advice based on public information* (2019).
[42] Engineers Australia, *Why CPD is key to unlocking an engineer's full potential* (2021).
[43] These do not account for the higher costs of licensing and compliance staffing requirements necessary to register and monitor this greater number of engineers.

Table 6.1: Outcome of different labour forecast growth rates sensitivity test (2021 $, present value)

BREAK-EVEN ANALYSIS	Baseline BEA result	2006 – 2011 growth rates	2006 – 2016 growth rates
Initial accreditation cost	$435,410	$1,078,974	$1,179,135
Ongoing costs of meeting CPD requirements	$8,220,391	$17,701,238	$19,163,573
Initial and ongoing cost of registration to engineers	$4,928,298	$4,928,298	$4,928,298
TOTAL INCREMENTAL COSTS	**$13,584,098**	**$23,708,510**	**$25,271,006**

Source: Deloitte Access Economics.

Limitations of our work

General use restriction

This report is prepared solely for the use of Department of Mines, Industry, Regulation and Safety. We acknowledge this report will be issued to the WA Government to the extent necessary in connection with the purpose. However, this report is not intended to and should not be used or relied upon by anyone else and we accept no duty of care to any other person or entity. The report has been prepared for the purpose set out in the engagement contract dated 8 September 2021. You should not refer to or use our name or the advice for any other purpose.

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