



# Better Value Transport



Committee  
for  
Sydney



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Cover image: Sydney Metro tunnel at Castle Hill.  
Source: Sydney Metro



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# Introduction



Source: Sydney Metro

**Sydney needs more transport infrastructure, particularly as the city grows. It provides clear social and environmental benefits, and creates economic opportunities by connecting more people to more job opportunities. But transport infrastructure is expensive and becoming more so.**

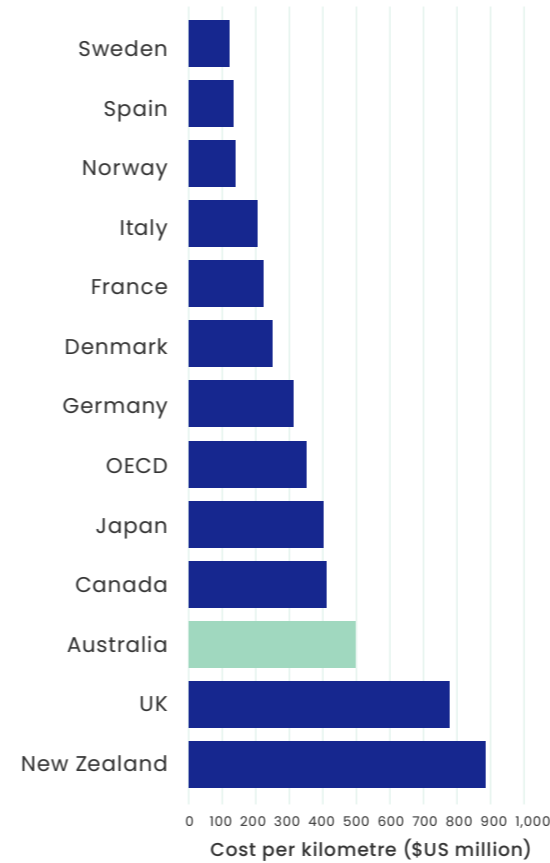
A decade ago, Sydney's largest planned transport infrastructure project was the Sydney Metro North West, which came in at a cost of \$7.3 billion. A decade later, there are a number of more expensive transport projects in Sydney, with the most expensive – Sydney Metro West – estimated to cost around \$27 billion.

International benchmarks show that while Sydney is not a global outlier, building new transport infrastructure is more expensive here than necessary.

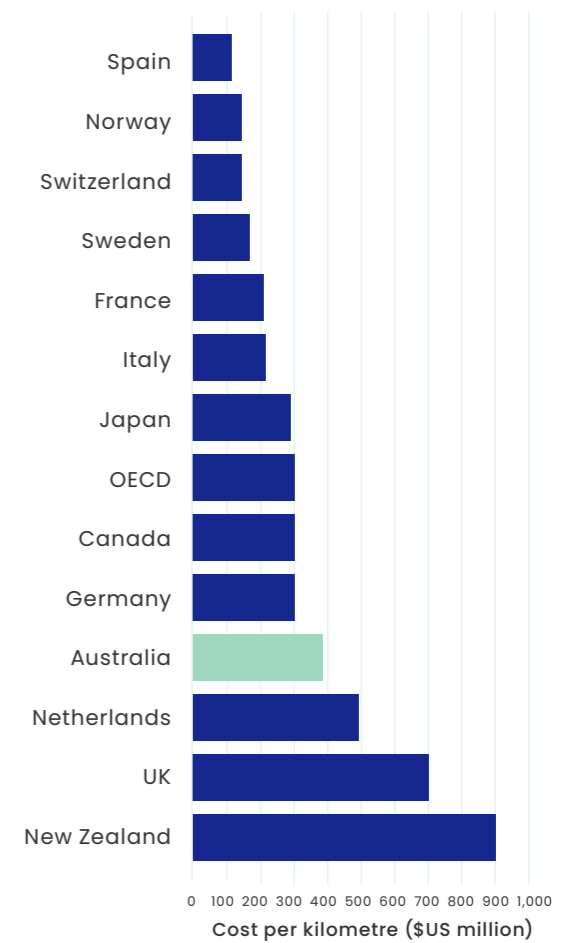
Not only is this a problem in itself, but there is a significant opportunity cost for government and the wider community. The more resources we invest in individual projects, the more we limit the opportunity to deliver more infrastructure or invest in other community needs, and the more we increase the fiscal burden on government and taxpayers.

We all benefit from the foresight of previous generations investing in long enduring infrastructure assets. The challenge for us now is to make sure we are making the best decisions we can to improve this city, with the scarce resources we have.

**Figure 1 - Cost comparison of rail projects across selected countries**



**Figure 2 - Cost comparisons of rail projects with 100% tunnels across selected countries**

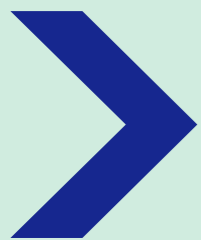


Source: data drawn from Terrill, M., Emslie, O., and Fox, L. (2021). Megabank for Megabucks: Driving a harder bargain on megaprojects. Grattan Institute.



Kellyville station, Sydney Metro Northwest.

Source: Sydney Metro



Australia has some characteristics that increase the cost of infrastructure:

- Geographic isolation increases the costs of procuring skills and materials
- Geographic size increases costs due to the requirements for travel and transport across large distances
- Relatively high labour costs increase the costs to employ workers
- High import taxes make it more expensive to import materials and equipment
- A highly urbanised population means many projects require expensive tunnelling.

Some other countries where infrastructure tends to be comparatively more expensive, like NZ and even the UK, are also island nations. However, Australia is not performing as well as comparable countries, particularly Canada and Japan.

**Transport infrastructure in Sydney is more expensive than it could be, and there are a range of things governments and industry can do to improve the value for money equation.**

Importantly, the size of the prize is significant. Considering NSW has committed \$112.7 billion in infrastructure funding over four years – a 5% improvement in cost

efficiency unlocks \$5.6 billion and a 10% improvement in the cost efficiency would provide over \$11 billion in funding, enough to pay for the next extension of the Metro network. (Note that nearly 60% of this overall infrastructure spend in NSW is on transport.)

Many of the recommendations in this report will generate incremental improvements to project delivery and project costs. Combined, they offer the opportunity to not only do more, but do it better.

To write this report, we have drawn on the expertise and experience of people delivering infrastructure in Sydney, as well as academic and think tank reports. We have held workshops, conducted interviews and engaged experts in both the public and private sector. We have done our best to come up with practical, actionable recommendations for government, drawing on the deep, real-world experiences of people involved with major projects in Australia and beyond.

Our focus is *not* on the variation between announced and final costs (what is normally reported in the media as going ‘over budget’), but rather on what we can do to reduce the actual final cost – or, more precisely, to deliver greater lifecycle value for the money invested.

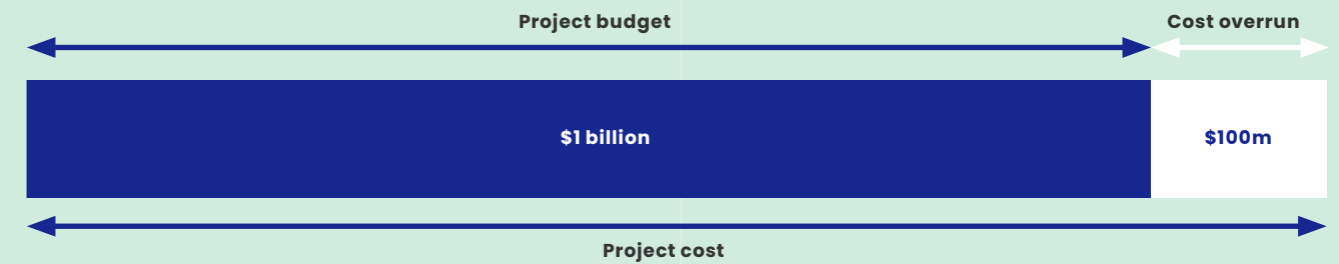


Figure 3 – Literature review: problems and solutions identified

	ACA	Grattan Megaprojects	Grattan Transport	IA	IA 2022	Infralegal	Jacobs /G20	Lean Construction	McKinsey	Mott MacDonald	NSW Action plan	WSP/ UTS
<b>Government capability</b>												
Improve procurement process	*			*	*	*	*	*	*	*	*	*
Transparent reliable pipeline of projects	*	*	*	*	*	*					*	
Strengthen gov't and political engagement	*			*		*	*		*			*
Increase transparency		*	*	*	*	*	*		*			*
Project governance, accountability		*	*		*	*	*			*		*
Capacity building within gov't.					*	*	*	*		*		*
<b>Industry capability</b>												
Capacity building within industry, incl. training	*			*	*		*		*	*	*	*
Industry diversity					*		*			*	*	
Industry culture	*						*		*	*	*	*
Project management (capability)					*		*	*	*	*		
<b>Project set up and establishment</b>												
Project selection, prioritisation			*	*	*		*		*	*		
Project design, planning		*	*	*			*		*	*		*
Improve bidding process				*	*	*	*		*		*	
Stronger tender evaluations		*	*		*	*	*	*	*			*
Reward high performance					*	*					*	
Contract design and implementation	*	*		*	*	*	*	*	*		*	*
<b>Project delivery</b>												
Project management (execution)					*		*	*	*	*		
Incorporate Building Information Modelling (BIM)					*			*	*	*		
Better dispute resolution processes						*						*
<b>Overarching</b>												
Improve risk management	*		*	*	*	*	*		*	*	*	
Increase collaboration and communication	*	*		*	*	*	*	*		*	*	*
Incorporate greater review, evaluation		*	*	*	*	*		*			*	*
Increase innovation	*			*	*		*	*	*	*		*

See key sources consulted on page 54.

Figure 4 – The focus of this report is total project cost, including projected budget and cost overrun



This report looks at cost drivers in four categories:

1. Deciding what to build – and whether building is even necessary or whether it is the right time to build
2. Designing infrastructure – how we specify what projects should comprise and to what standards and specifications

3. Buying infrastructure – the procurement process
4. Productivity of the sector – strategies to increase the capacity of the infrastructure delivery industry.

Our report is somewhat NSW-centric, however, many of our recommendations could be applied to other jurisdictions in Australia and overseas.

CASE STUDY:

## Saving money through engagement at Siglap Station, Singapore

### Summary

- Construction of Siglap Station on Singapore’s Thomson East Coast Line involved the excavation of a large station box beneath a busy six-lane road lined with large apartment blocks
- Concerned about stakeholder engagement, the Land Transport Authority developed a design that included nine different road possessions over the life of the construction project, making the project lengthy and complex
- Once on-site, the contractors engaged heavily with the apartment owners, whose main concern was the length of the construction timeframe over many years.

### Outcome of early consultation

- In response, the project team developed an option that would see the road diverted into the front gardens of the apartment complex for a number of years to accelerate and de-risk the construction, and then later moved back to give the apartments a new and improved front garden
- The project team encouraged the apartment owners to put the issue to a vote, which passed overwhelmingly
- This change meant the project went from nine traffic switches over the course of the project to a single switch, saving many months from the total program – it is a powerful example of public engagement that led to time and cost savings.



# 1. Deciding what to build

Of all the opportunities to drive down the cost of major transport infrastructure, deciding what to build offers the greatest potential reduction in costs and uplift in community benefit.

## 1.1 Optimising current assets before building new ones

Consider a new growth area being master planned by the government to accommodate new housing stock at the edge of Sydney. It may seem self-evident that a new transport project is required, but the first step is to determine whether there are ways to use the existing transport system to cater for the projected demand or shift the demand in such a way that the infrastructure is not in fact needed.

‘Sweating’ the existing assets is one way to achieve this. Perhaps instead of building new roads to enable growth at the fringes, population growth could be shifted to a set of rail stations that already exist or jobs added to the precinct to reduce total flows of people. Better land use planning to take advantage of existing infrastructure is a profound way to avoid having to build new infrastructure.

Ways to make existing assets more productive may include more frequent services, upgrading capacity (for example, signalling and train control upgrades in the ‘More Trains More Services’ program), investment in active transport and micromobility, or using pricing to manage demand.

It’s always a difficult judgement call whether new infrastructure is ‘worth it.’ We build transport to improve access, the ability of people to reach valued destinations. Access enhances places and stimulates economic activity. But where the goal is to generate more value for the money invested, it is essential to ask whether there is an acceptable no-build option.



Surry Hills light rail.

Source: Transdev / Darren Daly

### Recommendation:

- 1.1.1. Ensure business cases always have a ‘do nothing’ and a ‘sweat the asset’ option before projects are decided on. These options should always be presented to Ministers before a final decision.

## 1.2. Choosing the right technology

Once it is evident to policymakers a new transport solution is required, selection of the mode is crucial.

Most of the time, the right process to follow will be to identify what likely patronage is, then decide the best technology to meet the demand. Other factors to consider when selecting the mode include connectivity to

the rest of the network, speed required for the service, and urban design and amenity. Assets also need to consider carbon reduction alternatives that will contribute to net zero by 2050.

Although the current process includes this type of analysis as part of the NSW business case review process, in many cases the mode is chosen without serious examination of the options.

### Recommendation:

- 1.2.1 Before any new transport project is decided on, price the costs and benefits of alternative transport technologies and present decision-makers with these alternatives. These alternatives should be subject to public consultation.





### 1.3. Avoiding premature announcements

In many cases, infrastructure projects are publicly announced before plans have been fully vetted and tested. Once governments have decided to proceed with a project, they are inclined to announce that project to the public. This practice is a positive from the perspective of government transparency.

However, early in a project's life, many of the details have yet to be worked through, and there are many unforeseen issues that will have a major bearing on the time needed to plan and deliver the project, and of course its cost.

We support government transparency on transport projects. In most circumstances, we believe it is not only acceptable for the government to announce a potential project at this early stage, it is inevitable.

However, the nature of potential announcements requires careful consideration. Problems can arise when too much detail is provided too early—for example, announcing key details of the proposed project that will be subject to change, particularly the cost. Premature announcements of project costs and other details that turn out to be incorrect erode public trust in the competence of government to deliver infrastructure and can set projects up for failure, by short-circuiting the early investigations necessary to develop the options. Premature announcements can also increase the cost to acquire land for transport corridors.

As Infrastructure NSW puts it in the Information on Infrastructure Projects Guide:

“There is public interest in community impacts, benefits, costs and delivery timetables. An early announcement of intent naturally creates questions, and, in

the case of small and simple projects, those questions can often be answered from the beginning. However, in the case of larger and more complex projects, the level of reliable detail about community impacts, costs, benefits and delivery program increases over time and project stages. Confidence in project details grows as options are considered, concepts are refined, site conditions are investigated, designs are progressed and construction contractors are engaged in the process.”

The guide explains what can be said about scope, cost and timeline at each stage in the process. However, it is not always followed.

Other things can be done to manage the process of announcing projects. For example, a rapid top-down assessment of scope, interfaces, community impact, cost (based on benchmarks) and schedule can be carried out with the right data and expertise. Ministers should allow departments to have this capability but in turn should allow reasonable time for top-down reviews to occur before announcement.

**Recommendation:**

- 1.3.1. Communicate project intent and exploration without committing to specifics that are unknown to preserve public trust in government and allow for the full development of options.

### 1.4 Productive stakeholder engagement

Choosing the right time to commence stakeholder engagement can be a dilemma: go too early and stakeholders may say, “They don’t know what they’re doing;” go too late and they’ll say, “It’s not a real consultation.”

Stakeholder engagement should commence as early as possible. Governments need to be honest with local residents. When people say, “They don’t know what they’re doing,” governments need to be confident to respond, “That’s right, we’ve not decided on a solution, and that’s why we’re talking to you now.”

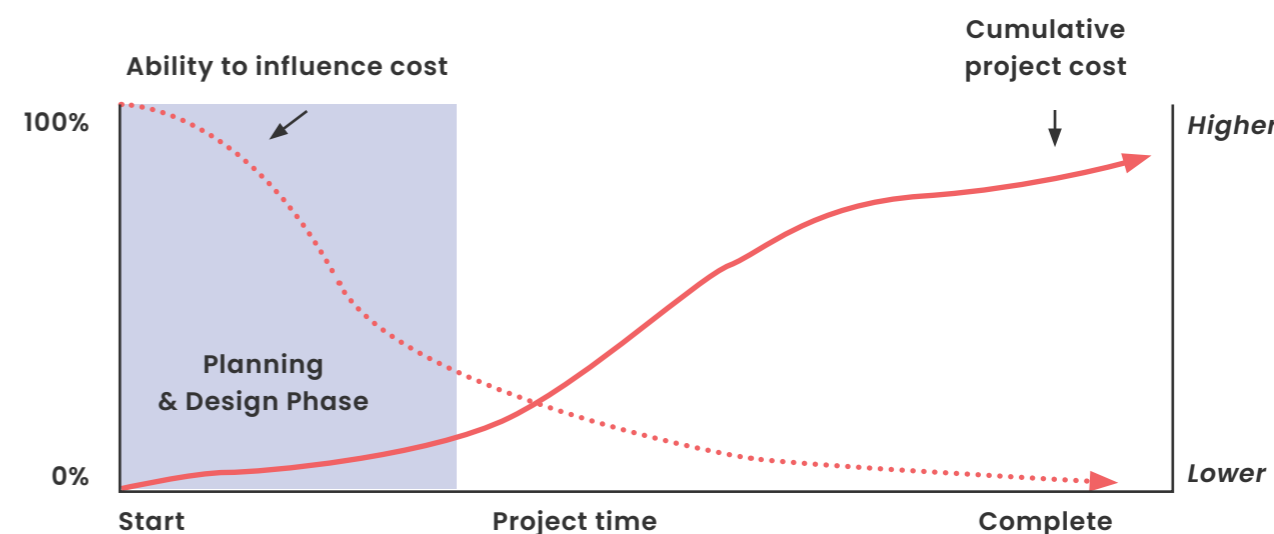
Transformation is required in the way the public and stakeholders are engaged. Communities and stakeholders often have sophisticated, well-informed views that project teams can miss, and they have an

it is easier to influence costs earlier in project development.

Engaging with communities after a business case decision has been made is too late. We want to get all the ideas out early, so they can inform the options, alternatives and value enhancements that are studied.

Early consultation not only opens up potential alternative options, but builds trust, particularly with First Nations communities whose view on cultural impacts and opportunities are often overlooked until it's too late to meaningfully engage.

Figure 5 - The opportunities to influence project costs decrease as the project progresses



expectation of being part of the process. Additional value can often be unlocked through working with stakeholders to identify alternative project options and flushing out any show-stopping barriers.

The improvement comes from getting to the right solution as soon as possible, and avoiding re-work. If a solution is going to be unworkable, the community often knows this, and it is far better to get to that point as early as possible. This follows the classic cost vs influence curve, which observes that

While the decision for the CBD and South East Light Rail to traverse Surry Hills was a controversial one, it was one that involved very significant consultation. Transport for NSW made it clear to the community there was no option other than a surface alignment through Surry Hills, but wanted the community's feedback on which route was most appropriate. Multiple options were presented to the community to provide feedback before eventually settling on Devonshire Street.



**Recommendation:**

- 1.4.1. Engage the community and stakeholders early in the development of projects to drive better outcomes, commencing no later than the strategic business case stage.

**1.5 Corridor preservation based on long-range transport plans**

Early preservation of a corridor of land for a transport project enables the most suitable alignment to be secured and avoids the need for costly tunnelling later, or suboptimal corridor alignments.

Although it's challenging for government to come up with the funds, and sometimes unpopular with residents, corridor preservation is one of the most effective ways to reduce costs in a transport infrastructure project.

Sydney did this many times in the past. From the 1950s, Sydney laid out long-term plans for road and rail development and preserved corridors that later became essential parts of our transport network. Examples include the M4, M5 and M7 motorways.

While corridor preservation often requires upfront purchase of land, this can save billions of dollars down the track. When places are developed without reserving transport corridors, the options tend to be sub-optimal: more indirect routes, expensive tunnelling, increased compulsory acquisition, or even giving up on the project.

Australia has a long history of successfully preserving transport corridors. In the 1950s, the NSW government enshrined the M2 and M4 motorway corridors in the overarching land use plan for Sydney, the County of

Cumberland Scheme.<sup>1</sup> This trend continued in the 1960s and 1970s with land use strategies, such as the Sydney Region Outline Plan,<sup>2</sup> continuing to protect major transport corridors, including proposed extensions of the rail network. Construction of transport links within these preserved corridors was able to progress efficiently and without significant acquisition in the 1990s and early 2000s.

Other states, particularly WA and Victoria, also established transport corridors within city-wide and regional land use planning instruments, such as the M1 and EastLink motorways in Victoria (through the Melbourne Metropolitan Plan) and the Kwinana Freeway and Mandurah Rail Line (through various schemes for the Peel Region). Melbourne's EastLink corridor was protected in the early 1970s but only delivered in 2015. During this time, urban development expanded rapidly in the wider area. Without the corridor preservation, this link would have been built out by housing.

However, more recently government has not seized the opportunity to safeguard the land required for the ongoing investment in transport that is essential for our cities.

Infrastructure Australia called out this lack of action with the 2017 report, 'Corridor Protection: Planning and investing for the long term,' which outlined the case for effective corridor protection for future infrastructure projects by demonstrating that a relatively modest investment today can pay substantial dividends tomorrow:

"To prove the scale of the opportunity, Infrastructure Australia has modelled a number of scenarios for the seven transport corridor protection initiatives in the 2016 Infrastructure Priority List.

<sup>1</sup> The planning scheme for the County of Cumberland, New South Wales / the report of the Cumberland County Council to J.J. Cahill, 27th July 1948  
<sup>2</sup> Sydney region: Outline plan 1970-2000 A.D. : a strategy for development / a report by the State Planning Authority of New South Wales, March, 1968

According to the independently audited model, the protection and early acquisition of just these seven corridors could save Australian taxpayers \$10.8 billion in land purchase and construction costs (measured in discounted 2016 dollars)."

Corridor preservation should also be undertaken in urban renewal projects, allowing for future transport hubs within the project area. If a transport route or stop/station isn't built immediately, there are urban design approaches that can safeguard the construction and operation of future transport infrastructure. Simple measures might include allowances in road medians for future light rail or rail viaduct; or interim commercial uses where leases can be ended with adequate notice for a future station.

However, major corridor preservation depends on having a plan in place that tells government which land to buy. This requires something more detailed than the diagrams in the NSW Future Transport Strategy. To actually go out and buy land early means having a delivery plan with enough work done to know where the routes are likely to be.

Corridor preservation needs to be done well in advance of actual business cases and investment decisions, to be effective. After projects are announced, property prices, and hence land acquisition costs, skyrocket. Corridor preservation in the North West Growth Area, undertaken in the mid-2000s, is a good example of where this has been applied at a legible scale and then used successfully for Sydney Metro Northwest, as well as providing for a future rail extension to Marsden Park. While there is risk the reserved corridor will never end up being used, the land will almost always end up being valuable for government regardless.

To further safeguard government's ability to use a preserved corridor, it will be important to proactively manage activities, uses, and even public perception of the space. While there are many reasonable interim uses of land, which may in the future be used for major transport infrastructure, there have been cases where development, including housing, has occurred within or immediately adjacent to corridors. There are also examples, like the M5 Motorway, where the community have become accustomed to open space and successfully rallied against any change in use.

This kind of advanced planning and corridor preservation is not easy for governments to do, but it would have an enormous impact on project costs.

**Recommendation:**

- 1.5.1. Develop a transport delivery plan with enough detail to enable corridor preservation, and then bring the proposals to government for action.
- 1.5.2. Fund a corridor preservation plan as a high priority way to increase the value for money in transport infrastructure over the long term.
- 1.5.3. Reserve a component of the proposed Regional Infrastructure Contributions collected to fund corridor preservation plans.
- 1.5.4. Include a proactive activation and management strategy to identify appropriate interim uses to manage the expectations of the community about preserved corridors.



# 2. Designing infrastructure

Once a preferred solution has been identified, it needs to be scoped and designed, and here again we find many opportunities to drive down cost.

Major scope decisions are often made without the appropriate scrutiny or consideration of alternatives, particularly when they are highly technical in nature. Sometimes these decisions are made at a relatively junior level within the procuring agency and are built into project costs early, and from then on are considered a done deal.

Across Australia there are countless examples of projects having to build additional infrastructure that was not approved as part of the business case process. This might include unanticipated utility upgrades, recreational facilities to appease stakeholders, or funding public transport services because other operators are not ready for an integrated approach.

Broadly speaking, these design issues can be classified into two groups:

1. **Strategic design considerations** – including scoping decisions around what the project must achieve and how to deliver it
2. **Technical design considerations** – including design life specifications and application of technical standards.

It is always tempting for governments to mollify critics of projects by spending more money, and sometimes this is justified. But if we want to get better at building infrastructure at a lower cost, we need a project delivery system that is better at making judgments about how we design projects to maximise value to the public.

## 2.1. Strategic design considerations

It is during the project planning and appraisal phase that high-level costs are determined and funding expectations are set. There are difficult judgment calls about how to scope projects, what to include, and how to deliver the most value for money.

Typical questions that might fall into this category include:

- How many rail stations should the project have and which locations are best served by them?
- How many commuter car spaces should we provide?
- How frequent should the services be and within what operating hours?
- How quickly does the project need to connect different places?
- What is the optimal capacity of the rail line, which impacts trains/trams length, and therefore the station size?
- Should the alignment be underground, at grade or on a viaduct? What level of urban design and public realm will be included in the project?



Metro train testing on the Windsor Road Bridge.

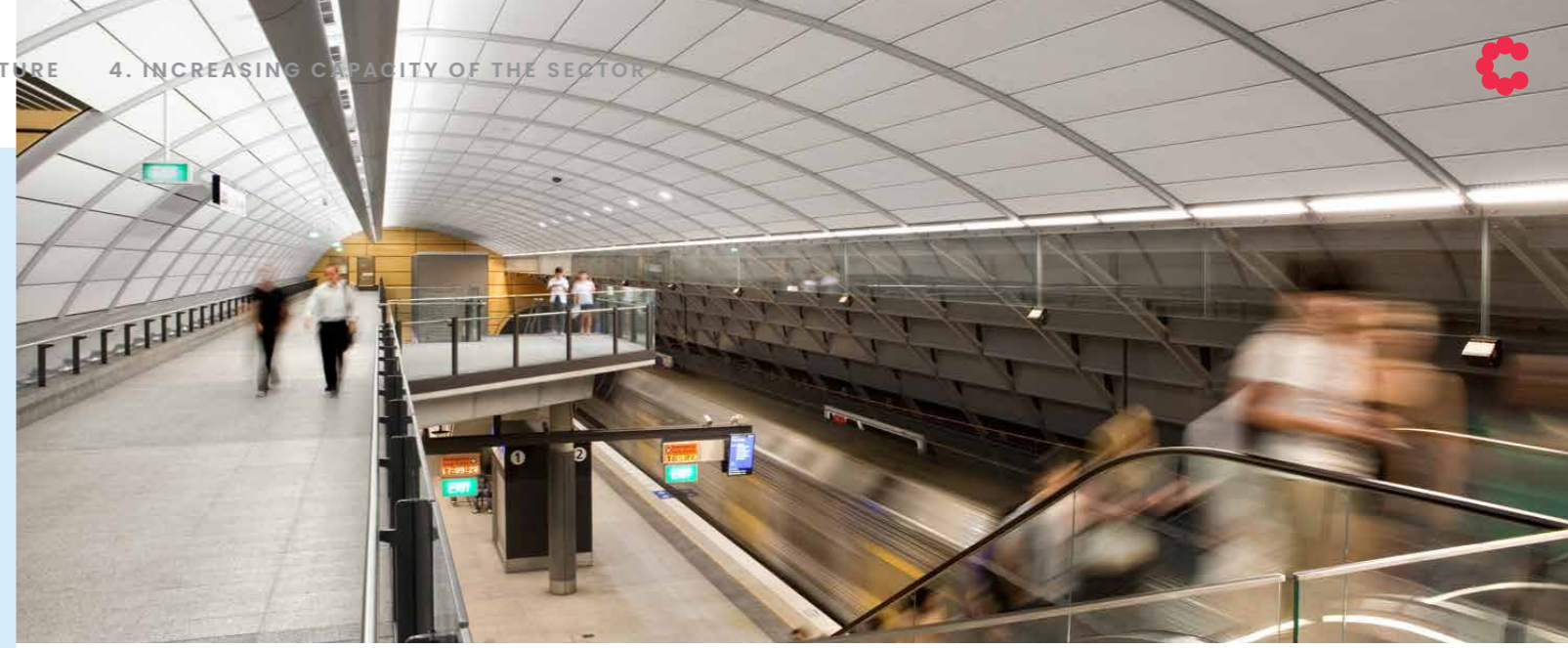
Source: Sydney Metro

- Should the project include a new active transport alignment?
- How many traffic lanes should be in the tunnel?
- What connections should be provided to the traffic network and what ancillary road network upgrades are required?

These decisions have major implications on a project's time, cost, and, of course, its value. While these decisions are generally assessed through the prism of a cost-benefit analysis, the process of doing so often aggregates all the strategic decisions and assesses the project as a whole. This process leaves gaps where an individual decision may not have the appropriate level of consideration, particularly with regard to direct and indirect cost.

A positive example of doing this would be CBD and South East Light Rail, for which big decisions were explored in detail, including where to have 'wire free' operation and how to cross Moore Park. Another example is Sydney Metro Northwest, which switched from the traditional double deck to single deck trains during the project planning phase.

However, sometimes big decisions fly under the radar and get locked in without the proper understanding of cost. For example, insisting that a regional road has a speed limit of 110km/h instead of 100km/h could dramatically increase the cost of the project, because at-grade intersections are prohibited for the higher speed.



In our view, the process for making strategic design decisions needs to be transparently explained and documented. A poorly developed or narrowly viewed long-list of strategic options can be the ‘Achilles’ heel’ of an otherwise well-developed infrastructure project.

As a project progresses and the design matures, strategic options start to come to the forefront. Sometimes these add cost, such as providing a new station, the desire to acquire a larger amount of land, or supporting infrastructure like pedestrian bridges, cycleways or parks.

In many cases, these are worthwhile endeavours. However, the design process may present opportunities to save money on projects through value-engineering. When options are presented to decision-makers to add scope to a project, they should also be accompanied with offsetting measures to save money. This simple process enables a level of discipline around keeping to project cost.

The process of adding scope to a project is compounded by the consultation between the project lead and other agencies. It is a common observation that multiple agencies use the occasion of a big infrastructure project to implement their own wish list, especially where they have consent rights.

It’s not always wrong for a project to benefit multiple agencies. However, if agencies don’t have to pay for the cost of the additions and justify them with their own cost/benefit analysis, then they have no incentive to economise or make real trade-offs to keep overall project costs down.

Sometimes business cases are constructed based on assumptions that change markedly through the process. Major additions and costs are added (or sometimes key elements are value engineered out). It would be sensible to revisit the key decisions in light of the business case, and sometimes to update the business case, so decision makers understand what kind of value for money they are accountable to deliver.

Traditionally, governments have kept far too much of the business case secret. One reason may be concerns about undermining their negotiating position with contractors. But the commercial aspects of business cases can be kept separate and redacted. This is a theme we will return to in this paper: we need to overcome the culture of secrecy within government in order to help infrastructure projects deliver better value for the money invested.

**Recommendation:**

- 2.1.1. Be transparent about reasoning and evidence for major strategic decisions in the business case. If project sponsors wish to test decisions later on they have a clear understanding why the original choices were made.
- 2.1.2. Create a register of major scope and design choices made in development, updated as they are made. Make prior versions of the business case available to the project team and the public.
- 2.1.3. Require third parties to justify and pay for improvements they wish to make to their assets as part of a transport infrastructure project.

CASE STUDY:

## Epping to Chatswood Rail Link

**Summary**

- In the early 2000s, the NSW Government embarked on building a new rail link between Epping and Chatswood
- Part of the project involved the construction of a bridge over the Lane Cove River, within a National Park, which was opposed by local environmental groups, but was the optimal solution for the project for a range of reasons.

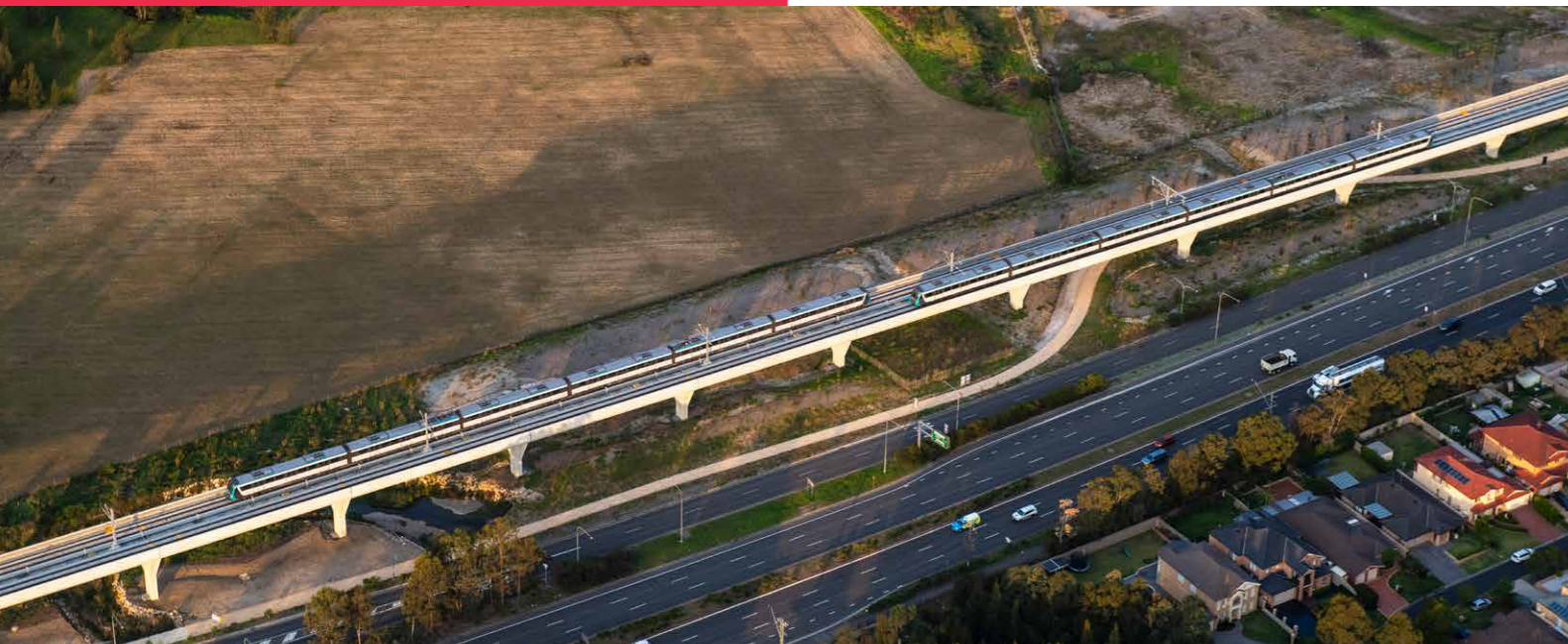
**What happened**

- Eventually, government sympathised with environmental groups and announced the project would instead be built with a tunnel under the Lane Cove River
- This required a re-engineering of the project, which caused several issues
- First, it created an additional four-kilometre, 3.2% grade down which trains had to brake, then accelerate hard out the other side
- Consequently, the planned Ku-ring-gai TAFE station was too deep to be built and deleted from the alignment – all other stations were deepened, substantially adding to their construction cost

- It was also discovered that a number of different trainsets on the network would be unable to operate on the line, either due to their inability to traverse the grade or due to the noise that would be made in the tunnel from the train braking.

**Outcomes**

- The change was a significant cost to the project
- In the years since, the project has become part of the Sydney Metro network, where trains are still required to travel under the Lane Cove River, and services operate at a peak frequency of trains every four minutes
- This means that every four minutes, a train is drawing significant electricity from the grid to power up a steep incline, adding cost to taxpayers for the ongoing operation of the line
- Given the location, this was a hard call to make. But the example serves to show how critical these decisions of strategic scope can be, and how long-term their implications.



CASE STUDY:

# Sydney Metro North West viaduct and stations

## Summary

- In 2011, the original plan for the Sydney Metro North West (then the North West Rail Link) was to have six stations and terminate at Rouse Hill
- During the community engagement process in 2011, it became clear there was significant benefit in the addition of two more stations – one at Samantha Riley Drive (now Kellyville Station) and the other at Cudgegong Road (now Tallawong Station)
- Another station would be moved to service the Bella Vista area
- As a package of enhancements, this would increase the walking distance catchment of residents by approximately 16,000 people, provide a rail station within walking distance of more than 5,000 additional jobs in Norwest business park, provide approximately 1,000 additional parking spaces and provide a station within the North West Growth Centre.

## What happened

- The total cost of these enhancements was anticipated to be around \$400 million
- However, the project team did not seek to add \$400 million to the total cost of the project, but undertook a process of scope optimising to look for opportunities to offset this cost
- An opportunity was found to save significant cost by taking sections of the rail line that were planned to be in embankments, cuttings or tunnel, and to instead build them as a single viaduct structure above the ground
- Ultimately, this decision was approved and the savings offset the additional cost of the two extra stations.

## 2.2 Technical design considerations

Technical design specifications create a foundation for both the procurement and delivery phases of a project and are used to determine technical compliance.

Typical issues that might fall into this category include:

- The acceptable design life for the project
- Specification of the country of origin of materials (e.g. steel)
- Mandating the use of technical standards
- Mandating structural elements (e.g. concrete thickness)
- Whether to use pavers or concrete on footpaths/plazas
- Maturity of trees to be planted
- Whether to require ‘world class’ architectural solutions
- How to reduce embodied carbon in projects.

The world of technical design considerations is vast. Progress on cost requires that the right standards are selected, rather than more excessive standards. This will always require a judgment call. But the instinct on the client side to always choose the highest possible technical standards makes construction more expensive.

Another commonly observed problem with technical design standards is a focus on detailed solutions rather than ‘performance requirements’. Often government project teams will develop traditional technical specifications that prescribe both what is to be delivered and how. This provides little

opportunity for innovation that may lead to reduced cost and improved standards. A better approach is to use performance requirements or output specifications<sup>3</sup> to ensure projects meet expectations without curtailing innovation.

Often, the specifications are the last part of the ‘Request for Proposals’ to be finalised, and it is claimed there is not sufficient time for an independent review. This should change. Specifications can have massive impacts on the cost and they are not usually simple or obvious. A third-party review of specifications could help shine a light on choices made, benchmark against other similar transport systems, and identify opportunities for cost reduction in specifications.

Ultimately, costs can be driven down in this area of design through an avoidance of over-specification, and making sure to avoid mandating things beyond what is actually necessary.

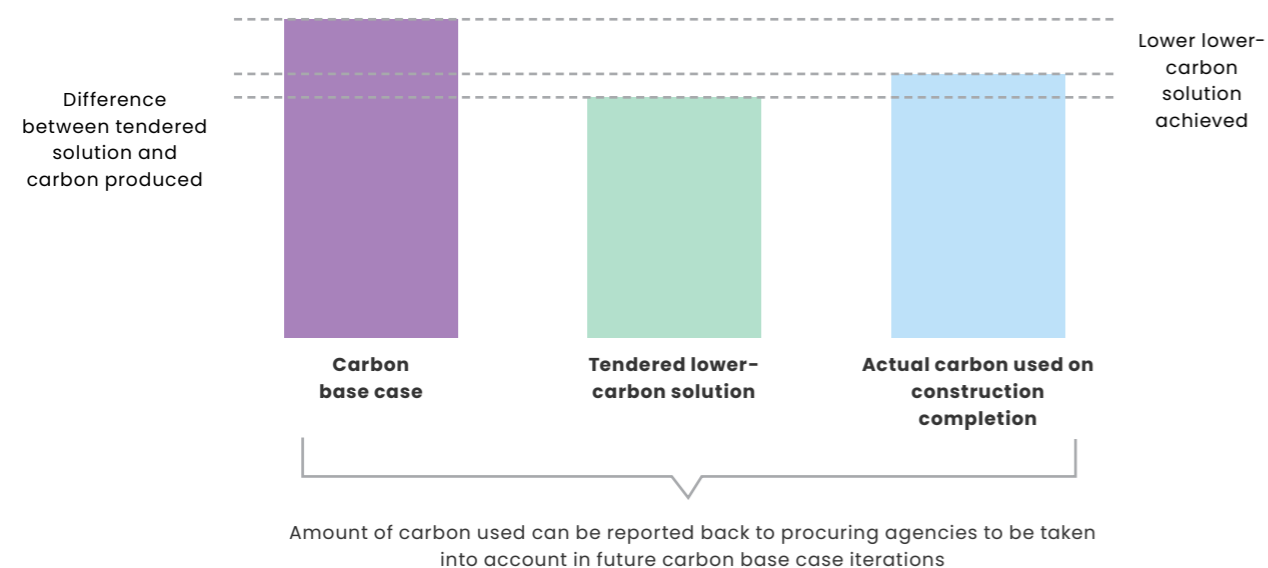
### Recommendation:

- 2.2.1. In most cases, adopt international or national standards. Only implement mandatory requirements that go beyond these technical standards where these standards are insufficient and doing so is necessary.
- 2.2.2. Avoid over-specification and allow sufficient flexibility to allow contractors the scope to innovate.
- 2.2.3. Ensure sufficient time in the procurement stage for a third-party review of the design specifications. The review should identify options to remove unnecessary prescription to enable better value for money.

<sup>3</sup> <https://www.github.org/news/new-guidance-to-assist-the-development-of-quality-infrastructure-output-specifications/>



Figure 6 – Using a carbon base case in procurement



Source: Infrastructure Partnerships Australia, Decarbonising Construction, 2022

### 2.3 Decarbonising construction

Construction represents 11% of global emissions.<sup>4</sup> Five materials (asphalt, concrete, steel, aggregates and pipes, including concrete pipes) account for ~97% of embodied carbon in Australian infrastructure projects, making construction one of the more difficult sectors of the economy to decarbonise.

The infrastructure we build today can be a gift to future generations (where it provides them with a better material base for their lives) and a burden (if it makes their future climate hotter).

What does this have to do with infrastructure costs? A lot, actually. One of the most effective ways we have to reduce the embodied carbon in construction is using the design process to reduce what we build, then reducing the volume and carbon content of the materials that go into what we build. Keeping embodied carbon front of mind from project inception is effective for both cost considerations and to maximise carbon mitigation.

It is possible to achieve 5–18% reduction in embodied carbon while also achieving a 0.4–3% reduction in material costs for typical building and infrastructure projects.<sup>5</sup> Lower embodied carbon materials often come with a price tag slightly higher than their conventional counterparts – a cost premium of up to approximately \$175 per tonne of CO<sub>2</sub>-e abated. Geopolymer concrete, concrete admixtures, recycled materials, and high strength steels have emerging potential to mitigate substantial embodied carbon emissions when appropriately implemented on projects.

The good news is that work to reduce carbon emissions for infrastructure is starting to happen in Australia, and specifically in NSW. Infrastructure NSW has worked closely with Transport and developed a new guide to decarbonising infrastructure.<sup>6</sup> It's time we move to place carbon right at the centre of the infrastructure design process – in business cases and in tenders.<sup>7</sup>

<sup>5</sup> See Clean Energy Finance Corporation, Australian buildings and infrastructure: Opportunities for cutting embodied carbon, November 2021. <https://www.cefc.com.au/media/ovrkk513/australian-buildings-and-infrastructure-opportunities-for-cutting-embodied-carbon.pdf>

<sup>6</sup> Infrastructure NSW, "Decarbonising Infrastructure Delivery," 2022: <https://insw.com/media/3696/infr9941-decarbonising-infrastructure-delivery.pdf>

<sup>7</sup> Infrastructure Partnerships Australia, "Decarbonising Infrastructure," April 2022: <https://infrastructure.org.au/decarbonising-infrastructure/>

#### CASE STUDY:

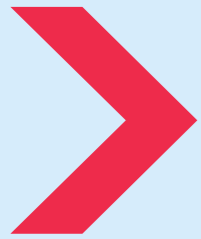
## Swedish Transport Administration

- In 2016, the Swedish government agency responsible for planning, building and operating state roads and railways (the Swedish Transport Authority<sup>8</sup>) introduced carbon reduction requirements in the procurement of their infrastructure projects. The policy requires consultants and contractors working on projects with a budget of five million Euro (AUD\$7.3m) or more to use an official carbon calculation tool to calculate the 'carbon baseline' in the planning or design phase of a project.
- In Sweden, the carbon reduction requirements are based on estimated operational start date, ratcheting up from 15% reduction before 2024 to 30% between 2205 and 2029. The baseline must be verified by a carbon declaration based on the climate calculation tool by end of the project, and certified Environmental Product Declarations (based on applicable standards) required for cement/concrete, reinforcement steel and construction steel.<sup>9</sup>

<sup>8</sup> Anna Kadefors, Stefan Uppenberg, Johanna Alkan Olsson, Daniel Balian and Sofia Lingegård, 2019, Procurement Requirements for Carbon Reduction in Infrastructure Construction Projects - An International Case Study. [https://issuu.com/infrapshipaus/docs/\\_web\\_major\\_report\\_-\\_putting\\_carbon\\_in\\_the\\_business?r=sYTE3ZjUzMTM4MDQ](https://issuu.com/infrapshipaus/docs/_web_major_report_-_putting_carbon_in_the_business?r=sYTE3ZjUzMTM4MDQ)

<sup>9</sup> [https://issuu.com/infrapshipaus/docs/\\_web\\_major\\_report\\_-\\_putting\\_carbon\\_in\\_the\\_business?r=sYTE3ZjUzMTM4MDQ](https://issuu.com/infrapshipaus/docs/_web_major_report_-_putting_carbon_in_the_business?r=sYTE3ZjUzMTM4MDQ)





Government should be presented with the carbon impacts of various infrastructure options, and each option should be measured against a base case.

And bidders should know they are more likely to win work if they present real low carbon solutions.

NSW uses a discount rate of 30 years when evaluating potential investments, while requiring a design life of a century. The over-engineering of certain infrastructure designs, which is deeply connected to the natural risk aversion of governments, needs a countervailing force, and we think carbon could be that.

**Recommendation:**

- 2.3.1. Include embodied carbon as an element of business cases when government is deciding what to build.
- 2.3.2. Include embodied carbon as an important criteria to evaluate, reward and drive lower carbon outcomes when scoring bids (and provide clear guidelines in tender assessment criteria for preferring low embodied carbon products).
- 2.3.3. Develop common standards and guidelines for calculating a carbon base case in Australia.

**2.4 Thinking about whole of life**

Designing infrastructure is not just about getting a project to opening day. Infrastructure assets are there to deliver a service and be used by citizens for decades. Considering how an asset will be used, and the needs of the staff and customers that will deliver and use the services the infrastructure provides, is critical to the success of a project.

Ongoing maintenance and operating costs are significant, and good design and materials choices can manage these costs over the long term. Sometimes that should involve specifying harder wearing materials that may cost more upfront but will last longer. In other cases, it can be about optimising energy use.

Finally, thinking about and 'building in' capacity to expand over time can reduce costs in the long run. While projects are often sized for the population and demands of today, building in low cost options to expand when service demand requires it can be significantly cheaper than having to duplicate an asset later. While it is often unnecessarily expensive to build in excess capacity from day one, good design can create options to expand when needed.

**Recommendation:**

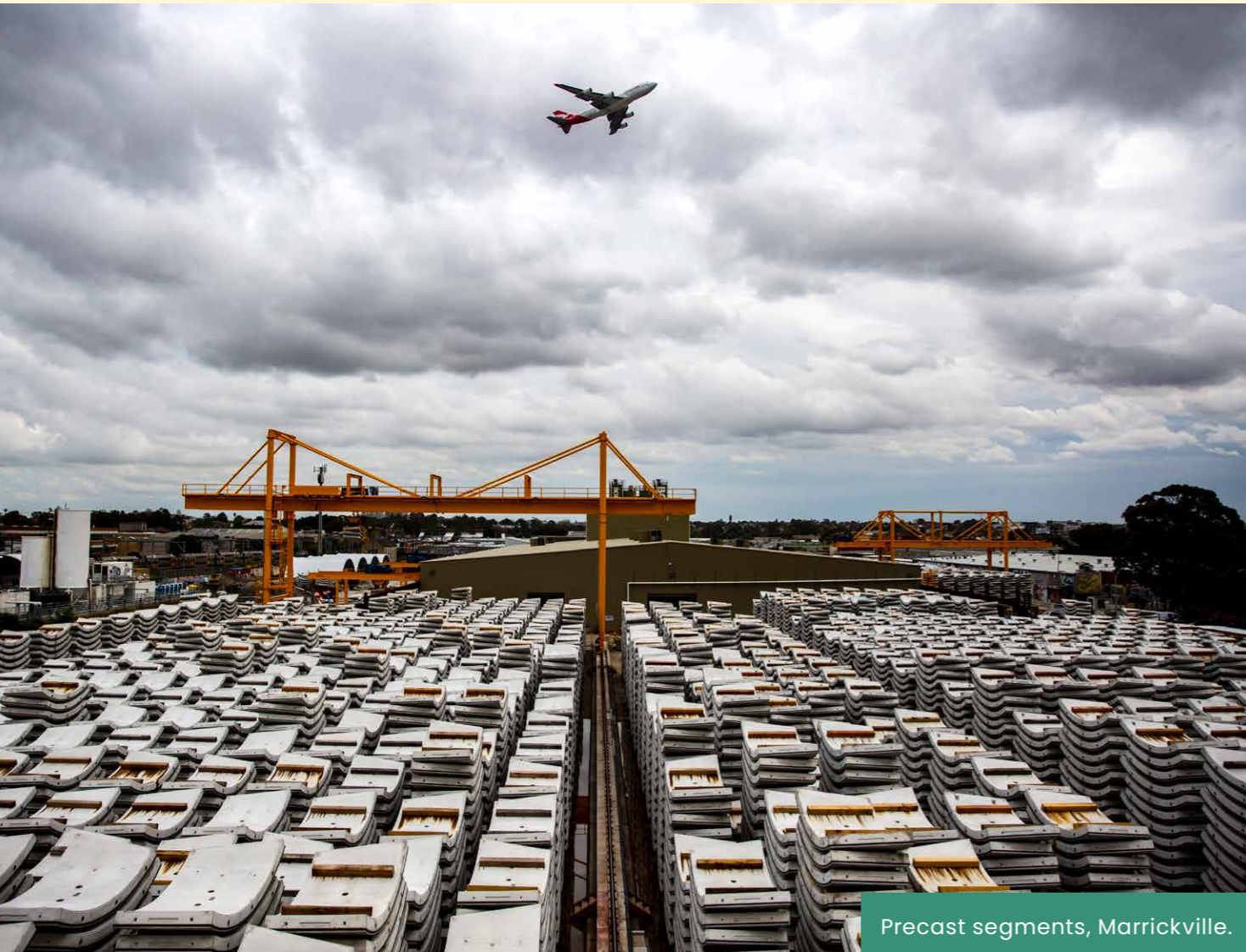
- 2.4.1. Explicitly include an assessment of whole of life costs, and capacity expansion as part of the design process for infrastructure assets.



Light rail, Surry Hills.



# 3. Buying infrastructure



Precast segments, Marrickville.

Source: Sydney Metro

**The third key driver of transport infrastructure costs, which follows ‘what we build’ and ‘how we design it’, is ‘how we buy it’ – in other words, the procurement process. We think a new approach is in order, especially on large, complex projects.**

## 3.1. Changing the approach to procurement

NSW relies heavily on competitively tendered, fixed price contracts to procure transport infrastructure. Government uses the competitive bidding process to ‘drive a hard bargain.’

Sometimes this is exactly the right approach. The more the parameters of the work are understood by all parties, the more possible it is to drive down costs by asking firms for fixed prices and holding them to those prices in the delivery phase.

But sometimes the savings from competitively tendered fixed prices are illusory. On complex projects that involve integrating multiple systems delivered by different firms and many interfaces with third party assets, the fixed price approach sometimes backfires. It can result in contractors underpricing tenders to win contracts with a view to recovering additional money through the change orders that will inevitably be required to properly interface its work with systems provided by others. Fixed prices for discrete systems can also incentivise system providers to focus only on the system(s) for which they are responsible, rather than the project as a whole.

For complex projects, contracting approaches that are specifically designed to encourage and reward collaboration between the different system providers can sometimes achieve better results.

The most collaborative form of contracting is a multi-party ‘project alliance’ that:

- Creates a single ‘integrated project team’ comprising individuals from the key project participants
- Aligns commercial interests by covering direct costs of the non-owner participants and tying their profit margin and contribution to overheads to how the project performs against the desired outcomes
- Enables the government project owner to engage certain project participants at an earlier point in the project development process
- Contains a ‘no blame’ clause that make it hard for participants to take legal action when things go wrong, and instead incentivises them to resolve disputes and work together to overcome the (inevitable) problems
- Creates a commercial framework in which the participants either win together, or lose together.

We would note that the attractiveness of alliance style contracts to industry depends significantly on the overhead rates and cost multipliers that governments use, so it’s not always financially attractive to industry. By the same token, financiers often prefer fixed price contracts as a way to provide greater confidence on cost and delivery times. But collaborative models can sometimes perform better on projects with greater uncertainty or greater potential for innovation from collaboration.

There is a spectrum of options in between tendered fixed-price contracts and the project alliance model. Governments need to become a lot more sophisticated about matching the right contract model to the job.





Figure 7 – Comparing delivery models

	Lump Sum D&C Contract with cooperation obligations	Incentivised Target Cost	Managing Contractor	Delivery Partner	Project Alliance
<b>Contract structure</b>	Owner engages D&C contractor to design and construct works that meet Owner’s performance specifications.  D&C contractor may engage subcontractors	Owner engages ITC contractor. ITC contractor must subcontract all construction work to others (with close owner control), but may self-perform the design work	Owner engages Managing Contractor. Managing Contractor must subcontract all design and construction work to others (with close owner control)	Owner engages Delivery Partner. Owner separately engages design and construction contractors (or Delivery Partner engages as agent for owner)	Owner, designer and key contractors and suppliers enter into a single multi-party agreement
<b>Cost</b>	Generally fixed price lump sum	Reimbursement of subcontract costs + fixed price or % fee (for profit and contribution to overheads) + share of cost savings/overruns.  Fixed price or schedule of rates for self-performed design work	Reimbursement of subcontract costs + fixed price fee	Reimbursement of direct costs + fixed price fee+ gainshare/ painshare payment linked to KPIs	Reimbursement of direct costs + fixed price fee + gainshare/painshare payment linked to KPIs
<b>Time</b>	Hard obligation to complete on time with LDs	Hard obligation to complete on time with LDs	Soft (best endeavours) obligation to complete on time	Soft (best endeavours) obligation to complete on time, supported by gainshare/painshare payment linked to time KPI	Target date for completion is supported by gainshare/painshare payment linked to time KPI
<b>Quality</b>	D&C contractor provides fit for purpose warranty and single point of accountability	ITC contractor provides fit for purpose warranty and single point of accountability	Varies. Managing Contractor sometimes provides FFP warranty and single point of accountability.  Other times, no single point of accountability. Each subcontractor is responsible for its own defects. MC provides due care and skill warranty	No single point of accountability. Each separate contractor responsible for their own defects (but defects may mean more time + cost- affecting DP gainshare payment). DP provides due care and skill warranty	All participants collectively responsible for defects. The cost and time pain of defect rectification is shared via gainshare/ painshare regime
<b>Liability</b>	Traditional liability framework (often with caps and exclusions)	Traditional liability framework. Cost overrun painshare is usually capped at amount of fee (i.e profit and contribution to overheads)	Traditional liability framework (often with caps and exclusions)	Traditional liability framework. Painshare of Delivery Partners is usually capped at loss of fee (ie profit and contribution to overheads).	No blame no disputes. Painshare is usually capped at loss of fee (i.e profit and contribution to overheads)
<b>Self- performance / competitive tendering of subcontracts</b>	D&C contractor can self-perform construction work, or subcontract to others.  No obligation to competitively tender subcontracts	No self-performance of construction work without consent. Subcontracts must be competitively tendered. Pain of cost overruns is shared.	No self-performance of construction work without consent. Subcontracts must be competitively tendered.	No self-performance of construction work without consent. Subcontracts must be competitively tendered.	Participants may self-perform construction work. No obligation to competitively tender subcontracts, but pain of cost overruns is shared
<b>Project control</b>	Owner controls specifications, date for completion and variations. D&C Contractor decides final design, construction methodology and subcontractors	Owner controls specifications, date for completion, variations and selection of subcontractors. ITC contractor decides final design, construction methodology and program	Owner controls most project decisions, including final design, cost plan, construction methodology, program and selection of subcontractors	Owner controls most project decisions, including final design, cost plan, construction methodology, program and selection of subcontractors	Joint control of all decisions
<b>Dispute/ litigation potential</b>	High - fixed price and traditional liability regime encourages blaming others not problem solving	High/Medium – removing the lump sum price removes some of the commercial tension.	Medium – softening the cost and time obligations reduces commercial tension. The second approach to quality risk can further reduce tension.	Medium –softening the cost, time and quality obligations reduces commercial tension	Low – No blame regime and painsharing encourages problem solving.
<b>Facilitates earlier involvement of contractor</b>	No. Early involvement of contractor makes it harder to obtain competitively tendered fixed priced	No. Early involvement of contractor makes it harder to leverage competition to reduce target cost	Yes	Yes	Yes

Less collaborative



More collaborative

Source: Based on Infralegal, Collaborative Contracting and Procurement, 2021.



Sometimes fixed price contracts will be the right option. Sometimes more collaborative forms will be better. Sometimes the optimal contract design will rely on a mix of approaches for different parts of the project.

We would like to see more sophistication when it comes to matching the contract type to the project, and more willingness to set up relationships with delivery partners that rely on trust.

**Recommendation:**

- 3.1.1. Ensure delivery strategy is developed by practitioners who have expertise in a variety of procurement contracting models to inform the choice of an appropriate contracting model.
- 3.1.2. Make the selection of contract types a primary element of the delivery strategy.

**3.2 Engaging with bidders before tender**

If the first time a government client engages with the market on a major project is at the Expression of Interest (EOI) phase, value has already been lost. This is because the contract packaging and contract type are typically chosen before the EOI stage. Governments should engage with industry before contract packaging and types are chosen.

There is a need to improve and deepen industry engagement, particularly before the tender process actually starts. Such engagement should include:

- Input on the strategic and final business cases
- Ideas and preferences on the delivery model, contract packaging, contract types and procurement approach

- An opportunity to contribute to the proposed scope, specifications and design outcomes
- Identifying key risks and constraints to be overcome
- Opportunities for innovation.

Other jurisdictions have structured and regular engagement opportunities that are easily accessed by industry actors. For example, Infrastructure Ontario (Canada) has a policy of transparency for major projects, regularly engaging and issuing a 'Market Update.' The update is commonly referred to as a project pipeline, and highlights future projects at the planning stage as well as opportunities for industry to contribute well in advance of procurement processes.

This should become the standard practice in NSW.

**Recommendation:**

- 3.2.1. For major projects, engage with industry before formal procurement processes to help inform delivery models, contract packaging options and contract types.

**3.3 Using business cases to inform the procurement**

Business cases are often kept confidential. This occurs when government agencies or project teams are concerned about sensitive decisions, potential community or environmental impacts, or even lack of evidence in early phases of the project.

We understand some emerging decisions must be kept confidential, particularly if they relate to property or commercial aspects that might undermine the government's bargaining position. However, the current process should be far more transparent.

A failure to adequately engage with stakeholders prevents broad input into the options, as discussed above. It also undermines stakeholder, and ultimately public, understanding of why decisions were made.

What's even more surprising is when business cases are kept secret even during procurement processes – which means bidders, and ultimately contractors, do not understand key parameters that define success from the perspective of Cabinet.

The business case contains important information that should inform development of the procurement and contracting strategy, including objectives, expected benefits and their quantification.

The quantification of expected benefits can inform KPIs, potential gainshare and painshare payments (to align commercial interests).

Publication of business cases (at the very latest after the relevant Cabinet decision has been made) would assist with the handover process.

**Recommendation:**

- 3.3.1. Publish all business cases and enable stakeholders and other interested parties to make submissions on both the strategic and final business cases before they are considered by Cabinet. Anything confidential can be confined to a single chapter and redacted.
- 3.3.2. Use business cases to help define project KPIs and structure incentives with contractors.



Parramatta light rail.



### 3.4 The right way to think about risk

Reflecting on executed contracts for recent complex transport projects, government tends to prefer a higher contract price that is more certain over a lower contract price that is less certain. Consequently, government often likes to allocate as much risk – that could affect the final contract price – as possible to private contractors.

It's not unusual for transport agencies to wholly or partially allocate the following risks:

- Latent ground conditions
- Contamination that is disturbed by the contractor
- Price escalation for materials and labour
- Adjustments to utilities and other

infrastructure owned by third parties

- Interfaces with government's other contractors
- Change of law
- Requirements of government authorities (other than those arising from a failure of the contractor to comply with legislative requirements)
- Delay by government authorities not caused by the contractor
- Industrial disputes
- Inclement weather
- Delay, disruption and price increase due to other factors (e.g. Covid-19).

The first obvious problem is that the contractor, designer or private sector investors may not be in the best position to manage or control many of these risks.

There are two ways risk can be priced on projects. One option is to fully price in the maximum allowable cost of all of the risks that are possible. This would protect the delivery partner from losing money if something goes wrong, but results in governments effectively paying for a worst case scenario and for risks that private sector parties may find it prohibitively expensive or impossible to manage.

Alternatively, contractors may not fully price in the risks they are being asked to take. In order to win work in a competitive market, bidders can price as if delivery will go to plan, and then hope to make up losses from change orders. In effect, this reduces cost and shares delivery risk with the state, but when things go wrong, the state and its delivery partners can find themselves misaligned.

The end result for government is the initial gain it obtains from a lower price is offset by subsequent claims that benefit the contractor. The 'great deal' obtained by government when it signed the contract(s) often turns into a cost blowout, particularly on complex megaprojects where it is almost inevitable that variations will be required to manage issues that couldn't be fully designed, specified or foreseen at the time the contract(s) were signed.

Instead of seeking to transfer these risks to a supply chain that finds it challenging to adequately allow for them in its fixed price, government agencies should instead look to share these risks with its supply chain in a manner which incentivises the parties to cooperate in finding the optimal least cost and 'best-for-project' solution to each risk.

This can be achieved by sharing the adverse cost and other impacts of risks between key

project participants, rather than seeking to allocate specific risks to particular participants.

If and when a risk eventuates that will result in additional work, the parties will be incentivised to develop the solution that will optimise project's performance against cost, time and other objectives. The participant(s) that end up doing the additional work to implement the agreed solution are not disadvantaged by this, as the additional costs that they incur will be reimbursed. Rather, it is in the joint interests of all participants to allocate the additional work in a manner that favours the outcomes the owner is seeking.

Public agencies can also drive down costs by working harder to de-risk projects by getting upfront approvals, having agreements in place with utility companies, and generally clearing the way for regulatory speed.

Transport for NSW and Sydney Metro have begun to experiment with 'Incentivised Target Cost' contracts that replace the fixed price remuneration regime with a cost reimbursement regime that involves the sharing of cost savings or cost overruns against an agreed target cost and a lump sum amount on account of margin. But these contracts tend to prioritise the objective of minimising capital costs above government's other objectives (such as timely completion, quality/operating performance, whole of life cost, sustainability, community engagement, stakeholder satisfaction and so on). They tend to be two-party contracts and, as such, can't align the commercial interests of other key project participants around agreed whole of project objectives.



**Recommendation:**

3.4.1. Design contracts to allocate risk to the party that can control it. For risks that no one can control, use contract models that align the commercial interests of key project participants with the agency’s project objectives.

**3.5. Fostering trust through long term relationships with industry partners**

The current preference of government for a separate tender competition for every contract package means infrastructure projects are rarely procured under longer term contracts that cover more than one project. Consequently, credible long term revenue streams that can underwrite investments aimed at delivering productivity improvements over the longer term don’t exist. Instead, new teams, systems and processes are developed for each specific contract, resulting in waste and unnecessary expenditure.

Tendering competitions for every contract package also place significant demand on resources. Although competitions generate innovation and value, the costs incurred by losing tenderers can be quite large, and these are priced into the cost of doing business.

One of the problems with the current model is it inhibits learning. Teams disband and move on, and everything that was learned on the project diffuses. Some of this experience benefits the broader construction industry. But it would be more powerful if the teams that built one rail line could pivot to the next one, bringing with them the lessons and working to improve delivery efficiency over time by going through multiple learning curves.

Collaborative contracting models have shown how project owners can achieve value for money outcomes on a single project without competitively tendered fixed prices. Often this is done by linking the profit margin of key project participants to the extent to which the owner’s desired outcomes are achieved. But the application of these contracting models beyond a single project or discrete program of projects is relatively rare. Rarer still is the application of such models beyond the delivery phase of a project (or each project in the program) into the operation and maintenance phase.

Australian examples of long-term collaborative contracts that break the cycle of lost learning and harness the power of aligned interests are few and far between. The Major Roads Victoria Project Program Delivery Approach, Victoria’s Level Crossing Removal Project, and Sydney Water’s Partnering for Success (P4S) approach are notable exceptions.

Long term collaborative contracts could:

- Record strategic outcomes the parties are seeking to achieve over the term of the contract, including improving value for government and generating fair returns for the contractors
- Align the commercial interests of the parties to the achievement of the long-term strategic outcomes through KPIs and incentives
- Commit the parties to working collaboratively towards achieving long-term strategic outcomes
- Capture current and future proposals from preferred contractors (panel members) for achieving those outcomes, including proposed investments to improve productivity

- Provide the machinery needed to develop a timetable of strategic actions to improve integration, information sharing, productivity, value and outcomes – for example, using modern methods of construction, digital technologies, early supplier involvement and supply chain collaboration
- Provide transparent project/work allocation procedures that reduce the need for discrete competitions and use of resources that could otherwise be invested in initiatives for improving value or reducing risk, or in optimising the delivery of projects already awarded
- Maximise consensus decision making that supports mutual understanding and effective problem solving. Minimising disputes or moving to quick resolution through a collaborative approach.

Longer term collaborative contracts (or extensions of existing contracts) would, of course, need to be conditional on clear performance metrics being met. The point is to extend and build on success.

This approach can help break the cycle of lost learning that occurs as project teams disband following each project and harness the power of aligned interests to continuously improve value and risk management.

**Recommendation:**

3.5.1 Implement long-term collaborative contracts to support industry learning and optimisation over time where there is better taxpayer value for money.



Caulfield to Dandenong Level Crossing Removal.

Source: Cox Architecture



CASE STUDY:

## The Scotland Hubs Framework

### Summary

- The Scottish Government identified that dispersed council-run infrastructure for services across the country (libraries, nurseries, primary, secondary education, social housing, fire stations, police, primary health facilities) were aging and not fit for purpose
- To enhance the attractiveness of the commercial proposition, the certainty of financing and the efficiency of construction, each council was grouped into one of five hubs geographically across Scotland
- These hubs signed a long term framework contract with a single provider (the HubCo), giving the HubCo exclusive rights to all projects the public bodies needed developing.

### What happened

- By aggregating numerous discrete community infrastructure projects, these opportunities were more attractive to private finance
- Predetermination of project finance costs and the use of standard risk apportionment

created certainty and developed relationships, resulting in the fast development of projects

- The Frameworks have a term of 20 years, with an option to extend for a further five years
- Individual projects are developed through partnerships using one of three options: Design & Construct (D&C) contract (capital cost), Design, Build, Finance, Operate, Maintain (DBFOM) (revenue cost land retained), or Lease Plus (land retained).

### Lessons learnt

- The framework allows projects to quickly move to contract without lengthy procurement process, reducing time and cost and increasing pace of overall program of works
- All parties cooperate to streamline the delivery of projects
- The framework contract has allowed the predetermination of project finance costs and the use of standard risk apportionment
- This in turn has created certainty for all participants and improved working relationships.

### 3.6 Using transparent evaluation criteria

The more the supply chain understands what the government is looking for, the better the proposed solutions will be. While this concept may seem obvious, tenders are often not sufficiently transparent to allow contractors to engage with government’s objectives. If contractors do not understand how price will be evaluated relative to the value included in the offer (design, construction methods, schedule, risk), then the owner risks value being lost as tenderers try to guess what really matters.

Often government agencies do not specify the weightings for evaluation criteria, and how price will be evaluated relative to non-price criteria, because they are unable to align internal stakeholders. Instead of working to achieve consensus before the ‘Request for Tender’ is issued— which involves difficult conversations and hard decisions — they ‘kick the can down the road’ and prioritise the evaluation criteria during the evaluation process.

This needs to change. Greater transparency needs to be injected into the evaluation process. The manner by which price (or target cost and margins) will be evaluated relative to non-price criteria should be disclosed, as well as the final assessments of bids.

If there is no way the government will accept a tender that is not the lowest price, it should say so. Conversely, if the government would be prepared to accept a tender that is superior to the others in its outcomes, and is similar in price to the competition, it should also make that clear.

Communicating the results of bid assessments is a key way to increase trust that public agencies are truly following their

own assessment criteria, rather than, for example, relying on lowest price when the official criteria said otherwise.

Giving this type of clarity to the supply chain means the solution will be more tailored to what the government is looking for.

We would note that this recommendation, like many in this report, is suggested in the NSW Government’s ‘Ten Point Commitment to the Construction Sector,’ but it is not being followed.

### Recommendation:

- 3.6.1. Provide tenderers their evaluation criteria and its weighting at the start of the tender process, if not earlier during market engagement.
- 3.6.2. Communicate the results of bid assessments to create transparency and trust in the process.

### 3.7. Standardising contracts

The use of different contract types for each project adds significant unnecessary cost, for both industry and government, to the process of tendering, documenting and administering each project, without adding commensurate value.

The issue here is not simply the number of different contract types government agencies use; it is also the countless diversity of contract approaches *within* each contract type.

Each government agency tends to have its own preferred form of contract for each contract type that it uses as a base. But the base is often amended by government lawyers for each project, seeming only to address the personal preferences of those involved in its preparation. Further, clauses



in the base document that could be identical across two or more contract types often differ for no reason other than the document starting from a different base.

Consequently, the detailed risk allocation and requirements between any two contracts is highly variable, even when they adopt the same contract type. The end result is that familiarity and learnings gained with a contract on a particular project can't be readily transferred to contracts on other projects. Those involved in tendering or managing the contracts need to carefully study and re-learn each contract more or less from scratch.

Variability of contracts is not the only issue. The length and complexity of the forms of contract used by government agencies has also become excessive. The form of Design & Construct contract used by Transport for NSW for large-scale projects is over 750 pages (ignoring the specifications). The complexity now embedded within these documents is so great that contractors cannot use or adjust them without advice from their lawyers every step of the way.

There are international construction contract suites suitable for use in Australia that can cover all of the delivery models commonly used by government agencies and all the sectors in which they operate. These include the NEC4 suite published by the UK's Institution of Civil Engineers<sup>10</sup> or the FIDIC suite published by the International Federation of Consulting Engineers.<sup>11</sup>

We are encouraged that Transport has been exploring greater use of standardised contracts through "project streamline." (The NSW Treasury 'PPP Toolbox' has some examples.) This may be a way of increasing the productivity of those involved in tendering for and administering transport infrastructure contracts. Project participants could more easily apply the contract knowledge and skills they learn on one project to the next one. Government's legal costs would be reduced, as project teams would be able to assemble, tailor and manage their contracts with much less assistance of expensive lawyers. Perhaps it would even make it easier for international firms to enter the Australian market, expanding the bidding pool and bringing in new knowledge.

**Recommendation:**

- 3.7.1. Consider greater use of a suite of contracts based on an international industry standard.

**3.8. Managing disputes**

Disagreements between clients and contractors are inevitable on major infrastructure projects. The question is how to resolve them.

Most infrastructure contracts have a tiered dispute resolution process that provides for specific stages and timeframes within which to resolve the dispute prior to commencing court proceedings or arbitration.

For example, it is common to see a process whereby:

1. Negotiations are held
2. Representative Dispute Meeting is held
3. Executive Dispute Meeting is held
4. Expert Determination or Mediation carried out
5. Litigation or Arbitration.

More thought should be given to resolution of disputes before they get to the first stage above. Larger infrastructure projects should consider mechanisms to bring the parties into alignment earlier, in an ongoing way, rather later when a 'dispute' crystallises. The very mention of the word 'dispute' conjures battle like ideologies and once external lawyers are involved, the proverbial horse has too often bolted.

One way of avoiding disputes is the engagement of a Dispute Avoidance Board (DAB). DABs have been recommended internationally but employed to a much lesser extent in Australia. A DAB usually comprises three experienced and well-regarded independent construction industry professionals (usually with sufficient legal training) who meet regularly and oversee the management of issues arising on the given project. Each DAB member is typically paid a monthly retainer and further fees are payable should a dispute arise and require resolution through the DAB. The DAB typically would have a chair who would have the deciding vote, if required, to resolve a dispute. The benefit in having a DAB is that each member is well versed in the history of the project and understands the parties'

interests and particular nuances that inevitably arise as the project progresses and things out of the ordinary occur. Regular DAB meetings can identify and address emerging issues before they become protracted disputes.

Having disputes resolved by a DAB can be more efficient and less 'adversarial' than when a judge or arbitrator is appointed with no background knowledge of the case. External lawyers and barristers are almost always engaged when court or arbitration proceedings are issued which tends to drive the parties even further apart. Costs escalate quickly once external law firms and barristers are engaged and the parties tend to 'go into their shell' for fear of compromising their position.

As in so many of the ideas we are discussing, the intent matters most here, not simply the formal existence of a Dispute Avoidance Board. On Sydney Metro's City and Southwest line, the DAB only has a role after a formal notice of dispute has been given, which is far too late to have an impact. The model we are suggesting would empower the DAB to assist the parties to amicably resolve emerging issues well before they escalate into formal disputes.<sup>12</sup>

**Recommendation:**

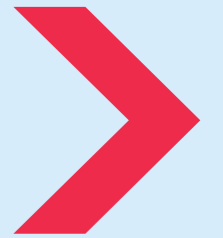
- 3.8.1. Use Dispute Avoidance Boards or similar mechanisms to resolve disagreements as early as possible, with the goal of avoiding escalation and litigation.

<sup>12</sup> Ron Finlay, Louise Hart and John Tyrill, 'Lessons Learned: The Use of Dispute Boards on a Public Private Partnership Project,' DRBF Forum, Volume 23, 2 May 2020: <https://acrobat.adobe.com/link/track?uri=urn%3Aaid%3Ascids%3AUS%3A5f6ef0e9-8df4-4e81-8b6f-20afd99ed813#pageNum=1>

<sup>10</sup> <https://www.neccontract.com>  
<sup>11</sup> <https://fidic.org/bookshop>



# 4.1 Increasing capacity of the sector



**Companies that deliver infrastructure are straining to meet the demands of the work. They do not have enough people in virtually every type of job the industry needs. Moreover, in many cases there are not enough firms capable of doing the work in the first place, such that major tenders are not drawing enough competition into the bidding pool.**

The industry will need to find ways to build up its labour force and/or find ways to become more productive with the workers it has. That will likely involve changes to the bidding environment to draw more firms into the market, as well as help smaller firms grow to take on bigger jobs.

## 4.1. Support people and leaders

Ask any industry leader these days and you will hear the number one problem is finding enough workers. Infrastructure Australia has projected a shortfall of 93,000 workers in the sector,<sup>13</sup> let's dig into why that is.

The 2021 report 'A Culture Standard for the Construction Industry'<sup>14</sup> notes:

- The Australian construction industry is the most male-dominated industry in the country
- 12% of the workforce is female
- Less than 2% of on-site roles are occupied by women
- 64% of workers report working more than 50 hours per week
- 59% workers are unsatisfied with work life balance
- The suicide rate is double the national average
- 75% report moderate to high stress levels
- 46% are experiencing burn-out.

This compares with the mining industry, which is now approaching 20% female participation in the workforce.

One of the most important cultural changes in the industry would be limiting the number of hours worked on jobs, and limiting the standard work week to Monday-Friday. This is obviously important to anyone who hopes to balance their career with having a family, and it's also essential for retaining trained workers in the sector for the long run.<sup>15</sup>

There are clear trade-offs here that are not easy. Limiting hours to more 'normal' working weeks will potentially drive up costs in the short run or make less effective use of equipment. And when firms are accountable to achieve hard deadlines, they may need to overcome delays by asking people to work overtime. But in the bigger picture, making careers in the construction industry more compatible with a balanced life means more people can choose these careers.

There are many positives to more 'normal' working weeks: increased female representation in the construction industry, and improved productivity through attention to detail, more effective planning, and better communication.

<sup>13</sup> <https://www.infrastructureaustralia.gov.au/sites/default/files/2021-11/Infrastructure%20Workforce%20and%20Skills%20Supply%20report%20211117.pdf>

<sup>14</sup> [https://cultureinconstruction.com.au/wp-content/uploads/2021/10/A-Culture-Standard-for-the-Construction-Industry\\_Consultation-Paper\\_October-2021.pdf](https://cultureinconstruction.com.au/wp-content/uploads/2021/10/A-Culture-Standard-for-the-Construction-Industry_Consultation-Paper_October-2021.pdf)

<sup>15</sup> <https://www.humanrights.unsw.edu.au/research/current-research/project-5-weekend-for-every-worker>



Numerous observers have called out the need to identify, measure and report on the diversity of the workforce in the construction sector and related trades, including the 'NSW Government Action Plan: A ten point commitment to the construction sector',<sup>16</sup> the Construction Industry Culture Taskforce,<sup>17</sup> and, most recently, Infrastructure Australia's 'Delivering Outcomes'<sup>18</sup> report. While government and industry have adopted ambitious participation targets, we need to support a shift from compliance to cultural reform.

**Recommendation:**

- 4.1.1. Support cultural change in the industry to make careers in infrastructure attractive to women.
- 4.1.2. Indicate to bidders that plans to limit hours of the workforce would be welcomed and accepted.
- 4.1.3. Implement policies to encourage opportunities for small to medium enterprises, many of which have a more diverse workforce. These can take place within larger contracts of various types.

**4.2 Building the skills of the workforce**

NSW must develop skills through training, at all levels, within all organisations, and within key parts of the supply chain. This might include upskilling teams on different elements of the project lifecycle, such as the investment decision process, program controls, digital transformation, and benefits realisation. Working toward nationally consistent accreditation schemes and network rules (e.g. safe working rules) will improve mobility around the country and increase resource availability.

When transport projects are being planned and delivered, they should allow for investment in formal training. For example, in 2017 the NSW Government invested \$4.97 million, and the Australian Government \$950,000, to support TAFE NSW to create a one-stop-shop for infrastructure jobs and skills training to meet the demands of Sydney's booming infrastructure program, including Sydney Metro and the Western Sydney Airport. This included equipment, pre-employment training courses, and a new skills centre. Tailored pre-employment training was made available to a range of cohorts including young people, Aboriginal and Torres Strait Islander peoples, culturally and linguistically diverse individuals, and women working in male-dominated industries.

Finally, public agencies can help by being less prescriptive about the skills and experience levels they require in certain roles. Why require project managers to be engineers, for example, which is very common. If the contractor is responsible for the project outcome they should be relied on to have competent project managers, of whatever background. Avoiding overly prescriptive personnel requirements in bids is another way to broaden the pool of talent in the sector.

**Recommendation:**

- 4.2.1. Support a culture of continuous learning, including dedicated funding for skills training through TAFE and universities as a key foundation of infrastructure investment. The outcome of funding should be monitored over time.

- 4.2.2. Avoid overly prescriptive skills requirements from bidding teams.

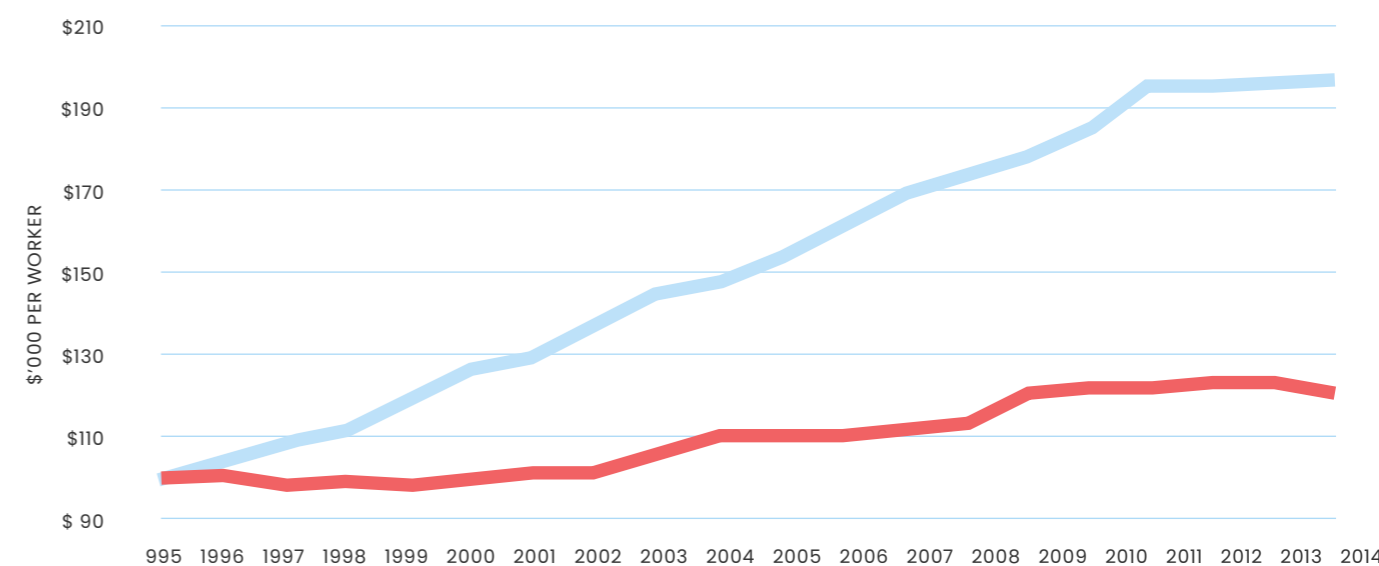
**4.3. Increasing innovation in the sector**

The construction industry is becoming less productive over time. While there have been major improvements on some matters, including worker safety, the sector has not delivered productivity gains anything like what we have seen in manufacturing over the past 30 years.

Turning this around will not be easy, but it is the most important way to deliver more value for the money invested across all types of construction.

**Figure 8 - Productivity in manufacturing has nearly doubled, whereas in construction it has remained flat**

Value added per worker in real \$2005



Source: ©McKinsey & Company, used with permission

<sup>16</sup> <https://www.infrastructure.nsw.gov.au/media/1649/10-point-commitment-to-the-construction-industry-final-002.pdf>  
<sup>17</sup> <https://www.constructors.com.au/advocacy/collaborations/construction-industry-culture-taskforce/>  
<sup>18</sup> <https://www.infrastructureaustralia.gov.au/publications/delivering-outcomes>





There are many promising examples of innovation in the construction industry:

- School Infrastructure NSW has progressed a Design for Modular Assembly (DfMA) approach. The goal is to simplify design to make it easier to construct and assemble their facilities – toward the goal of building more quality schools in less time, at lower cost. This is an example of the concept of ‘Modern Methods of Construction,’ which tries to shift some components of infrastructure into off-site factories instead of on-site.
- Sydney Metro is using standardised concrete lining segments in over 30km of tunnel on the Northwest and City & Southwest lines.
- Victoria’s Level Crossing Removal Project uses a prefabricated concrete U-Trough for the rail viaducts. Once delivered to site, the units are stitched together in a vertically segregated greenfield environment using an automated gantry system.

There is enormous opportunity to save money on assets such as rail stations through ‘Modern Methods of Construction’ – standardising the designs, using an interchangeable kit of parts, and producing as many components as possible in off-site factories.

The industry can do much more with building information modelling (BIM) and the use of digital twins. Digital technology and processes (sometimes referred to as the digital revolution and ‘Industry 4.0’) can greatly increase production and automate processes, freeing up humans to focus on leadership, creative problem-solving, and innovation.

The task is to create the conditions for this innovation to flourish, so that over time the sector can become more productive.

Government can encourage innovation by:

- making it clear in the bidding process that it welcomes new approaches and is willing to accept some risks in order to get it
- focusing procurements on outcome specifications rather than creating overly detailed specifications or requiring bidders to follow government reference designs.

Delivery teams are more likely to innovate when they know what must be achieved with relative freedom to find the right solutions.

**Recommendation:**

4.2.3. Set outcome specifications (rather than prescriptive requirements) to empower industry to devise the best, most cost-effective solutions possible.

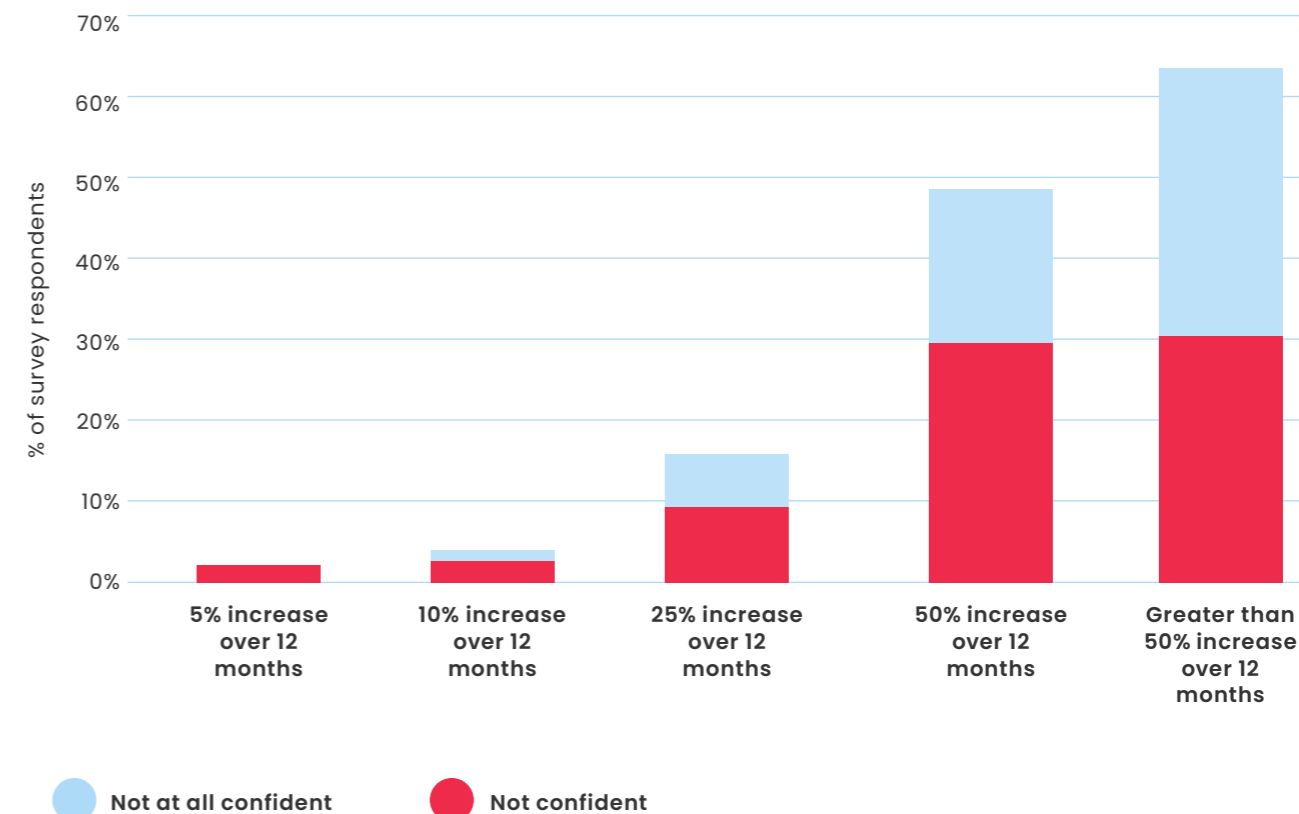
**4.4. Manage the pipeline of work**

In a sense, the immediate reason that costs to build things have gone up is the fact that there is not enough capacity in the industry to do all the work – not enough workers, not enough firms, not enough materials. But look deeper, and the constraint on industry capacity is really a reflection of the fact that the volume of work has increased so quickly, following a period when NSW was not investing as much in infrastructure.

It is the boom-bust nature of infrastructure – the variability in the overall quantity of work – that creates conditions in which the industry lacks the capacity to deliver.

Infrastructure Australia’s analysis of market capacity finds it is the rapid increase of demand that creates the problems of industry capacity. This translates directly into cost escalation for both labour and materials.

**Figure 9 - Industry confidence in its ability to deliver declines with significant increases in volume of work**



Source: Infrastructure Australia, ‘Infrastructure Market Capacity’, 2021, page. 28.

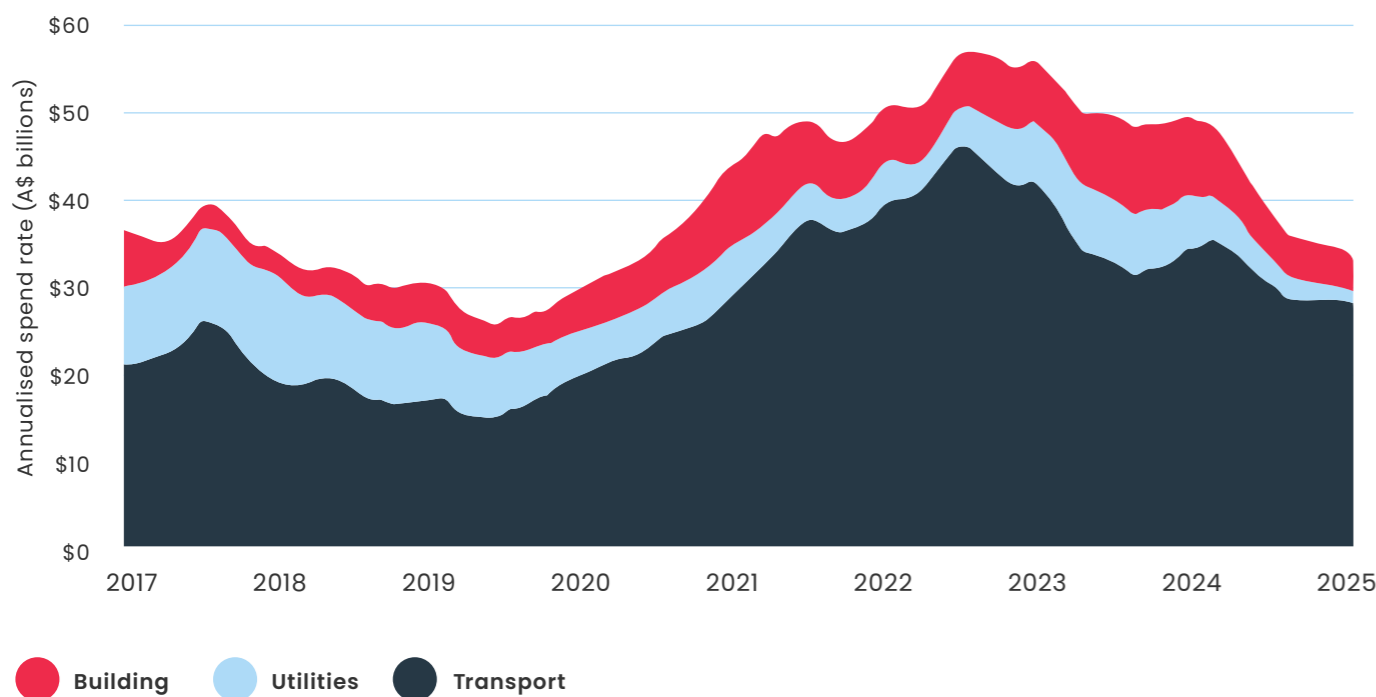




It is the variation in infrastructure spending that results in the industry being sized incorrectly in relation to the volume of work. If the infrastructure spend were stable over time, the industry would size itself to match the available work, the result of thousands of individual decisions about what to study at TAFE, whether to move to Australia for a job, whether to start a new firm in the construction industry, and so on. While one can say the forward projections showing a decline in infrastructure spending are not likely to be as dramatic as the graphs show – as new projects will come on line – the fact is there is great uncertainty about what the future pipeline will be, from the perspective of firms and individuals making career choices.

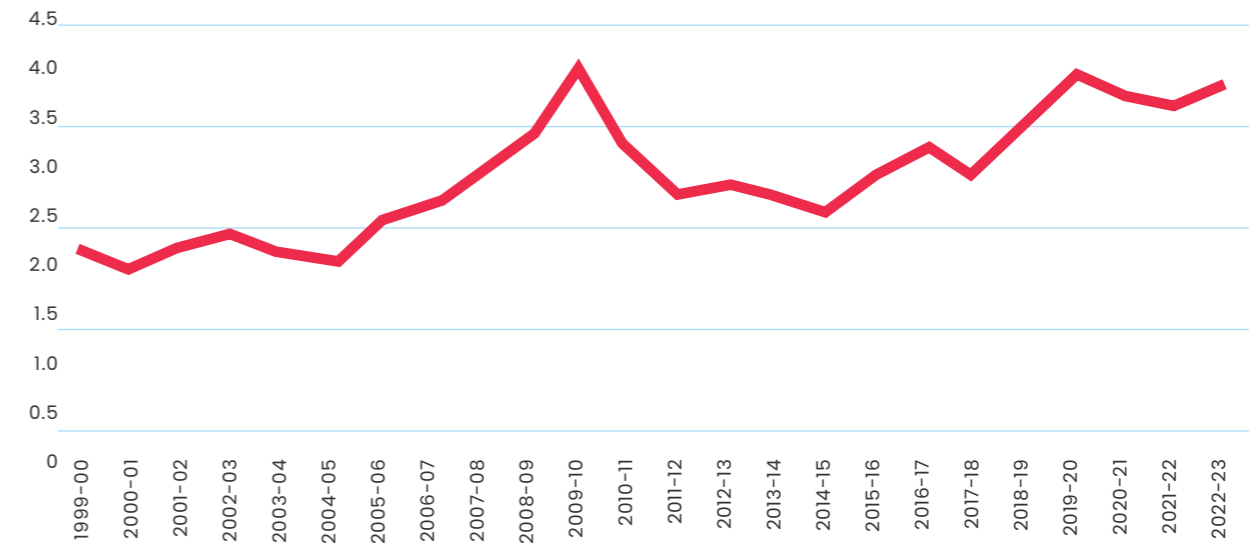
We are proposing a major change to address this uncertainty: the federal government and states should commit to a consistent infrastructure spend, as a portion of GDP. The types of projects could certainly vary over time, and this is a broader concept than just transport infrastructure, but the goal would be to make the aggregate size of the infrastructure spend more stable over time. Greater consistency in the pipeline of major projects would give confidence to the industry to invest in skills development and more innovative construction techniques, such as modular and digital delivery. Most fundamentally, it would allow the industry to size itself appropriately, as a key long-term solution to the staffing capacity constraints on infrastructure.

Figure 10 – Major project pipeline for Australia



Source: Infrastructure Australia, 'Infrastructure Market Capacity', 2021, page 25.

Figure 11 – NSW capital expenses as a percentage of Gross State Product



Over the past five years, NSW has spent an average of 3.8% of the gross state product on capital expenses. We believe one of the biggest things government could do to contain costs in the long run is commit to a continued investment at a similar level. If the current NSW infrastructure boom runs its course and leads to another 'lost decade' when little is built, we will lose all of those skills, both inside and outside government, and have to reconstruct the industrial capacity from scratch once again. Working now on the longer term pipeline of projects so they can be ready, and ideally adopting a spending policy that keeps a more consistent annual infrastructure investment, would prevent that happening.

Any progress in this direction would be helpful.

The other big opportunity to manage the flow of work is to sequence projects based on events rather than time.

For example, when stage 1 of Project X is complete, we could then allow stage 1 of Project Y to start because it will use the same skills/equipment and we don't want them to be competing for resources.

In this model, contracted deadlines are determined by when the projects start – using the equation: 'start time + project duration = deadline.'

This approach won't always work because jobs involve the interface of many different firms that need to coordinate around known dates, but it could have a role, especially as part of collaborative approaches. For example, on the City and Southwest Metro line, two tunnel boring machines were purchased (costing around a billion dollars each); we wonder if it would have been possible to wait to start one tunnel until after the first one was built. It would benefit everyone if teams working on one job could pivot to another one after the first is finished.

Source: NSW Budget Statement 2022-23, Page D4 Budget Paper 1. Numbers are Non-Financial Public Sector Operating Statement Aggregates.



Smaller sequencing improvements could come from better coordination of the pipeline in terms of bid timing. In recent years, there have been instances where major projects in different jurisdictions have their tenders due on the same day. This puts extreme stress on the contracting market and limits competition – as tenderers are more likely to not bid, to drop out, or to offer a less compelling solution.

**Recommendation:**

- 4.4.1. Commit to a consistent annual infrastructure spend as a portion of GDP.
- 4.4.2. When possible, schedule work based on events to better manage flow between projects.
- 4.4.3. Develop a national register of major project procurement dates to avoid major project tenders being due at the same time.

**4.5. Using project evaluation to improve productivity**

Our final recommendation is small, but important: a practice of rigorous post-completion evaluation would support a culture of continuous improvement and learning.

Of course, major projects already undertake any number of reviews. There are no fewer than seven clear policy documents in NSW related to benefit analysis and realisation, including:

- NSW Treasury business case guidelines and Guide to Cost Benefit Analysis
- NSW Department of Premier and Cabinet Program Evaluation Guidelines
- Infrastructure NSW’s Infrastructure Investor Assurance Framework
- Transport for NSW’s Cost-Benefit Analysis Guide
- Transport for NSW’s Benefits Realisation Management and Evaluation Guidelines
- The Department of Customer Service Benefits Realisation Management Framework
- Digital NSW’s ITC Assurance Framework.

A typical infrastructure project certainly tries to apply best practices and record lessons learned. The real challenge is translating knowledge and experience from one team to another. It is difficult to get beyond anecdotal or vague lessons, which limit the usefulness for project teams trying to apply the lessons to their specific activities.

For post-completion evaluations to be useful, delivery authorities and project teams must consider how lessons and data about benefits will be captured upfront. This should be a key element of the project business case, which links the investment decision to quantitative and qualitative benefits, with clear metrics that can be measured over time. In doing so, it will also assist in being clear about what a project is trying to achieve and what difference it will actually make. This is, of course, important not just for cost, but also for social outcomes, interrelated place benefits, and wider economic benefits.



Jordan Springs Public School, using School Infrastructure NSW’s Design for Modular Assembly approach.

Source: S&P

Over the last decade, we have seen important infrastructure projects move from delivery to operations. However, it is difficult to find any government-initiated post-completion review or a public report on the success in achieving the benefits. Lessons learnt are commonly shared amongst industry networks, but often at a high level and rarely with a view to systematically applying lessons to new projects.

Rigorous assessment of costs and benefits delivered can help the industry learn what actually worked, beyond anecdote.

Knowing projects will undergo this kind of post-completion evaluation might help nudge the culture of the industry in good directions as well: holding everyone accountable for outcomes, and supporting an attitude of continuous learning.

**Recommendation:**

- 4.5.1. Conduct and publish rigorous, transparent evaluations of completed projects including an analysis of success factors as well as recommendations on how to improve industry practice.



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### We would like to thank our Innovation Fund Partners for their support of the Committee for Sydney’s research.

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