

ENGINEERING AND DESIGN

Key lessons learnt	Achieving targeted engineering and design outcomes at appropriate stages within the project development lifecycle are critical to minimise delays, align stakeholders, optimise outcomes and provide comprehensive scope integration.
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Introduction

Engineering and design efforts need to support the various stages of the project development such that appropriate design and knowledge of the project is available at the correct time for critical path activities. The engineering works should be targeted such that effort is placed to identify and remove unknowns in the design providing a consistent level of confidence in the project scope.

Engineering and design scope can be wider than the product itself and must support activities such as planning applications, property strategies and stakeholder management including third party agreements. It is common practice for a project to undertake scope and commitments outside the isolated product scope to ensure a more integrated outcome and providing benefits to all stakeholders beyond the traditional users.

This guidance note is premised mainly toward major or high risk projects, however its principles apply generally.

Key considerations

Engineering and design should principally respond to the statement of service need (or needs assessment), the product brief and the business requirements specification. These elements will determine the option selected and the performance requirements to meet the original service need, leading to a robust and agreed business requirements specification.

Understanding the scope of the product required to meet the service needs sets the minimum scope and impact of the project which in turn informs strategies for the project

approval, planning applications, property management, standards application and assurance. From here the key stakeholders can be identified and a strategy to engage, manage and collaborate with these stakeholders can be implemented. A high level program showing the relationship of these activities will allow the critical path to be determined.

The engineering and design works must support the project baseline establishment and then target the required level of detail and timing required for each deliverable. Whilst this is typical of project development processes, the engineering and design functions of large complex projects are becoming more critical to achieving good project outcomes in the area of stakeholder management through capture of requirements, where appropriate, and demonstrating an integrated design outcome with stakeholder interests.

Planning applications rely upon engineering and design inputs to ensure impacts of construction, implementation and operation are well understood as part of any approval process.

Risk assessments are used to identify and focus engineering and design efforts to understand risk areas, develop and implement mitigation strategies to deal with these risk areas. Ultimately the aim is to have a similar level of confidence of the key assumptions and project scope at any stage to inform other activities such as scheduling, costing, risk management, impacts, interfaces, delivery and procurement strategies, community and stakeholder engagement.

Each project will have differing needs of the industry to develop the project. It is critical that as the project understanding develops, that a procurement and delivery strategy is developed, this should ensure that actions and engagements associated with the project development

do not detract from the ability for the industry to adequately support the delivery phase. There are multiple possible delivery models, the engineering and design function within development phases must be able to modify the approach to align with a best for project outcome.

Strategic Business Case

Considering that a strategic business case aims to gain approval to proceed to develop and complete the final business case, the engineering and design inputs to the project should demonstrate they; are formed from evidence-based solutions; provide increasing clarity and detail in defining the solution; and increase the understanding and clarity within the delivery agency of how to deliver the solution.

If appropriate consideration of stakeholders and their requirements is not given at this stage, the impacts to the project scoping at later stages may be significant, materially changing project extents, scope, costs and schedule.

Whilst at the strategic business case stage, it may be difficult to engage with stakeholders on details not yet developed, it is important that stakeholders of the project are identified, and the project develops an understanding of what their requirements of the project may be e.g. placemaking and urban design to local councils, integration with future projects and future-proofing. The engineering and design team should focus effort with appropriate key stakeholders in developing the approach to scope identification, controlling expectations and agreeing plans as to how the detail of the project interfaces will be developed and confirmed between parties during the final business case phase.

It should be noted that the planning for the works of the final business case takes place within the preceding phase of project development. Awareness of what is needed and when is critical to successfully minimising rework and incompatible design outputs.

Final Business Case

Within the final business case phase there is a lot of work that the engineering and design team need to plan and align with other parts of the project to ensure an efficient delivery of appropriate design inputs. Depending on the complexity, delivery strategy and timing of subsequent stages, key engineering and design inputs are needed for:

- ▶ Planning applications e.g. Environmental Impact Statements
- ▶ Property acquisition processes
- ▶ Stakeholder and third party agreements
- ▶ Investigation works, early stage works or enabling works
- ▶ Procurement planning
- ▶ Costing and value management
- ▶ Risk assessments

Ideally, these inputs will not need additional works but are planned during the strategic business case phase to be available at the appropriate time with the appropriate level of details to support the other works.

The way in which different portions of the project come together and are integrated and assured is critical, aiming for a consistent and appropriate level of confidence in each part of the project is ideal to be able to integrate the design. Planning the assurance of the final product should give some consideration to the complexity and the number of designers involved. Complex projects often have portions of the design which do not fit naturally, therefore having project wide assurance from only one discipline, or output lead, may generate challenges.

Constructability knowledge is required to support the procurement phase, scheduling and planning applications and is critical to understanding, minimising and mitigating impacts to the surrounding communities during construction and operations.

To optimise the final portion of a final business case design for the procurement phase, the project should aim to remove or reduce the unknowns and risks to the contractor, such as;

- ▶ Understand as much as of the existing state as reasonably practicable, i.e. consider if client investigation works can be undertaken prior to the definition design or tendering process to reduce risks to the tenderers
- ▶ Consider if gaining agreement on asset configurations and design review and approval processes with third parties will assist the design and delivery phase
- ▶ Establish, communicate and agree minimum standards where possible with stakeholders
- ▶ Ensure that the industry engagement clearly articulates the extent of the project scope and design, the key objectives of the project in integrating it within the precincts and minimising impacts.

Source material

Sourcing Guidelines and Templates:

- ▶ National Framework for Traditional Contracting Topic Specific Guide 1 Project Definition and Tendering September 2015
- ▶ Infrastructure NSW – Project Assurance Guidelines
- ▶ Transport for NSW – Engineering Management Manual

The above documents are reference points. Agencies have developed guidelines and advice which differ from one another and represent their expectations and needs regarding cost deliverables. It is advised that detailed queries relating to the development of robust cost advice should be referred to an appropriately experienced subject matter expert.

▶ About the author:

Mark Roberts is a Director of InfraSol Group with over 20 years of industry experience. Mark has worked across New Zealand, United Kingdom and Australia principally on transport projects. He has experience in project delivery, project development, project reviews, business case development and strategic planning. Notable projects that Mark has worked on include, London Underground PPP, Epping to Chatswood Rail Link, Southwest Rail Link, NSW Ports long term lease, the Sydney metropolitan network timetable changes and Parramatta Light Rail.