Global Infrastructure Hub

MOTT MACDONALD

REFERENCE GUIDE

Output Specifications for Quality Infrastructure

Practical guidance with a focus on PPPs and other long-term contracts

September 2019

A G20 INITIATIVE

Foreword

Infrastructure is an important driver of sustainable and inclusive economic growth and development globally. To achieve this growth, the G20 has recognised that it is essential to focus on quality infrastructure investment, in addition to increasing the quantity of investment in infrastructure.

The G20 Leaders stressed the importance of quality infrastructure investment to deliver high-quality infrastructure projects at the Hangzhou Summit in September 2016 , where it was defined as investment: "**which aims to ensure economic efficiency in view of life-cycle cost, safety, resilience against natural disaster, job creation, capacity building, and transfer of expertise and know-how on mutually agreed terms and conditions, while addressing social and environmental impacts and aligning with economic and development strategies**".

Quality infrastructure has been a G20 focus under the Japanese Presidency in 2019, during which this reference guide was developed. The aim of this reference guide is to help operationalise the dimensions of the quality infrastructure investment definition so that these are realised at the project level, through the consideration of how quality infrastructure objectives are incorporated in the output specifications of long-term infrastructure contracts. The guidance has been informed by examining how the dimensions of quality infrastructure investment have been included at contract level in 14 project case studies from a wide range of sectors and countries, and exploring the leading practices and lessons learned from these projects.

Agreement on the importance of quality infrastructure has recently been further strengthened by the endorsement of the *Principles for Quality Infrastructure Investment*[1] at the G20 Finance Ministers' and Central Bank Governors' Meeting (FMCBGM) in Fukuoka (June 8-9, 2019). The Communiqué[2] of the G20 FMCBGM stresses the importance of "maximizing the positive impact of infrastructure to achieve sustainable growth and development while preserving the sustainability of public finances, raising economic efficiency in view of life-cycle cost, integrating environmental and social considerations, including women's economic empowerment, building resilience against natural disasters and other risks, and strengthening infrastructure governance".

The agreed G20 Principles of Quality Infrastructure Investment (endorsed in June 2019) are:

Principle 1: Maximizing the positive impact of infrastructure to achieve sustainable growth and development

Principle 2: Raising Economic Efficiency in View of Life-Cycle Cost

Principle 3: Integrating Environmental Considerations in Infrastructure Investments

Principle 4: Building Resilience against Natural Disasters and Other Risks

Principle 5: Integrating Social Considerations in Infrastructure Investment

Principle 6: Strengthening Infrastructure Governance

These principles align very closely with the Hangzhou Summit definition, on which this reference guide is based, and encourage further development of this topic. The reference guide is designed for use by government practitioners and their partners, with an aim to help practically integrate these principles in the delivery of quality infrastructure which creates a virtuous circle of economic activities, integrates environmental considerations and enables social inclusion.

"This guide seeks to help governments to operationalise the G20 Quality Infrastructure Investment Principles and improve long-term infrastructure outcomes over the project lifecycle and for all end users. Output specifications are a key element to ensure projects are delivered according to expectations while boosting innovation."

Marie Lam-Frendo
Chief Executive Officer
Global Infrastructure Hub

"Combining the expertise and resources of the public and private sector to deliver infrastructure for the good of society is at the heart of future PPPs. This reference guide provides a baseline for leading practices across the globe and is a fantastic step forward in delivering this."

Paul Hammond
Global Infrastructure Development and Economics Practice Leader
Mott MacDonald

1 Now available at: https://www.mof.go.jp/english/international_policy/convention/g20/annex6_1.pdf

2 Available at: https://www.mof.go.jp/english/international_policy/convention/g20/communique.htm

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Part A:

Guidance

1. Introduction

The Global Infrastructure Hub (GI Hub) was established by the G20 with an assigned mandate that included to develop and disseminate a suite of 'leading practice' guidance documents for governments to use to improve the quality and quantity of their infrastructure programs. This particular guidance note (referred to as the 'Reference Guide') is designed to assist governments and public sector asset managers in developing output specifications to deliver Quality Infrastructure, as defined by the G20 Leaders at the Hangzhou Summit in September 2016.

The GI Hub engaged Mott MacDonald to help develop this Reference Guide with the aim to operationalise the definition of Quality Infrastructure agreed on at the Hangzhou Summit. This Reference Guide considers a wide range of Public-Private Partnership (PPP) models (under the broad definition of PPPs outlined in Chapter 4) and demonstrates, using real world examples, how output specifications support the delivery of Quality Infrastructure across a broad range of delivery modes using a life-cycle approach.

PPP projects are based on a collaboration between governments (as the procurers of infrastructure assets) and the private sector (as the designers, constructors, financiers, maintainers and sometimes operators of those assets). PPP projects have extended terms which often include the maintenance, rehabilitation/lifecycle and sometimes operation of the asset, in addition to the design and construction. The intent of PPP contracts is to achieve efficiencies and whole-life cost savings through the allocation of risk to the party best placed to manage it.

The core principle of an output specification is to specify the project in terms of measurable outputs, or 'performance requirements'; it focuses on what needs to be delivered, not how it should be delivered. This is in direct contrast to traditional technical specifications, where the design is developed by the public sector (typically with support from consulting firms) and documented in a specification for the project works that prescribes both what needs to be delivered and how, using 'prescriptive requirements'.

The intention is that output specifications provide an opportunity for the public sector to capitalise on private sector innovation, and align priorities by linking payment with contractual performance, to deliver a project that meets the public sector's objectives and values over the asset's life.

By adopting an output specification on a PPP project, the private sector team is incentivised to collaborate during the early stages of design to combine design, construction, maintenance and operations knowledge in making decisions on design solutions. This lifecycle approach to infrastructure design is considered a key driver in the achievement of quality outcomes and lifecycle efficiency.

On a PPP project, the output specification is arguably the most important contract document in delivering the project objectives, meeting stakeholder expectations and allocating project risk. There is a considerable body of knowledge that already exists regarding how to draft traditional prescriptive specifications, however there is an opportunity to further improve long-term infrastructure outcomes through properly drafted output specifications. This Reference Guide is designed to improve the global understanding of this subject to help governments provide their citizens with quality infrastructure assets and services.

In the context of this Reference Guide, Quality Infrastructure is an outcome that can be achieved through project outputs. Output specifications include the measurable project requirements (or outputs) that are informed by the project objectives or desired outcomes. Project outputs tend to be short term, discrete activities and initiatives which do not necessarily in isolation result in added value, or impact to the end user. Outcomes, on the other hand, are the medium- to long-term differences made to end users that can be influenced by the outputs or the relationship between multiple outputs. For example, the ability of the asset to withstand natural and other disasters is a project outcome, which can, in part, be achieved through an output specification that specifies the minimum seismic performance. Generally, the private sector is positioned to take the risk for the successful delivery of project outputs but has limited appetite to take the risks for project outcomes, as there are often external influences out of its control.

1.1 STRUCTURE OF THIS REFERENCE GUIDE

This Reference Guide consists of two parts:

- **Part A: Background information and lessons learned.** Provides the background principles and assumptions used in the development of this Reference Guide, including a definition of Quality Infrastructure, a definition of a PPP, a description of an output specification, an overview of a process to develop an output specification and a discussion on what makes a good output specification. This section also provides an overview of the methodology used to develop this Reference Guide and the case studies in Part B, and lessons learned and observations identified during the development of this Reference Guide.
- **Part B: Sector case studies and output specification examples.** This section contains a suite of case studies, across a range of jurisdictions and sectors, to provide real world examples of output specifications that deliver Quality Infrastructure.

This Reference Guide recognises there is no one global definition for a PPP, and the users of this tool will have a varying range of exposure to PPP projects. Sections 4 and 5 of Part A outline key principles so a reader who is not familiar with PPP projects can appreciate the relevance of the output specification and its role in project delivery. Where possible, definitions that are recognised by the World Bank PPP Knowledge Lab and APMG International's *PPP Certification Guide*[1], have been adopted to develop a document that is relevant to a range of jurisdictions.

1.2 ACKNOWLEDGEMENTS

This Reference Guide incorporates contributions from project Owners (government department or public sector authority), as well as Private Partners, who provided permission to use project content, commented on lessons learned, and identified examples to be included in the case studies.

Industry-recognised references such as the World Bank's '*PPP Knowledge Lab*'[2] and the '*4Ps A Guide to Contract Management for PFI and PPP Projects*'[3] supported the development of the definitions adopted in this Reference Guide, as did other GI Hub publications such as the *'Allocating Risks in Public-Private Partnership Contracts*'[4] and '*Managing PPP Contracts After Financial Close*'[5].

The GI Hub team was led by Morag Baird and Maud de Vautibault. GI Hub engaged a team of experts from Mott MacDonald, a global engineering, management and development consultancy, to help undertake research and development of the Reference Guide.

A workshop was held while this Reference Guide was in draft format. The workshop was attended by over 40 delegates from 10 countries, and questions, observations and feedback have informed the final structure and content of this document. The final draft of the Reference Guide was available for further comment and inputs for an open consultation period of four weeks.

1 The PPP Certification Guide can be downloaded here: https://ppp-certification.com/pppguide/download

2 Available at: https://pppknowledgelab.org/

3 Available at: http://archive.teachfind.com/ttv/static.teachers.tv/shared/files/10030.pdf

4 Available at: https://ppp-risk.gihub.org/

5 Available at: https://managingppp.gihub.org/

2. Development of this Reference Guide

The primary objective of this Reference Guide is to assist government and public sector asset owners in the development of Quality Infrastructure (QI). Specifically, this Reference Guide has considered the output specifications, performance measures, reporting and contractual mechanisms of 14 reference projects.

This Reference Guide focuses on commonalities and lessons learned which proponents and government stakeholders of PPP projects could utilise to further the Quality Infrastructure agenda. This section provides an overview of the process used to develop this Reference Guide.

Figure 1: Reference Guide development process

2.1 DEVELOP THE PROJECT LIST

This Reference Guide uses project examples to communicate the principles of good output specification development and how output specifications can contribute to the delivery of Quality Infrastructure. This Reference Guide includes case studies that were selected based on the following criteria:

- **Location:** The projects represent a range of jurisdictions to identify similarities, differences and best practices between different locations.
- **Asset class:** The projects cover the main infrastructure sectors – built environment (such as education, housing and healthcare), energy, information and communication technology (ICT), transportation, and water and waste.
- **Stage of development:** Projects are either in construction or operational, so lessons learned could be identified. This introduces some limitations as current best practice in emerging areas, such as building information modelling (BIM), climate change adaptation and mitigation, and flexibility to respond to disruptive technology, is unlikely to be fully reflected in the examples provided.
- **Information availability:** The project's output specification was required to be either publicly available or Owner permission was granted to include the project in this Reference Guide. Preference was given to projects where members of the Reference Guide development team had insights from past project involvement.
- **Alignment with Quality Infrastructure focus areas:** The project's output specification was required to demonstrate an active approach to address the Quality Infrastructure focus areas.

The project list and its alignment with the Quality Infrastructure focus areas are summarised in Table 1 over the page.

2.2 IDENTIFY QUALITY INFRASTRUCTURE FOCUS AREA EXAMPLES

After finalising the project list, a review was completed to identify potential Quality Infrastructure focus area examples for each project. The examples were then compared across the projects and selected for inclusion in the case studies where there were similarities between approaches to show trends and consistencies between asset class and location, or selected based on their novel approach to deliver Quality Infrastructure.

Each case study in this Reference Guide provides examples in three to five of the Quality Infrastructure focus areas. The exception to this is where a secondary case study was included to supplement examples in a primary case study. For example, the Presidio Parkway project was included to supplement the Central 70 Managed Lanes project to provide an example of seismic requirements on a highway project.

Case studies may not have an output specification example provided for every Quality Infrastructure focus area, however this does not mean that the project only delivered on some focus areas and not others; rather, examples of the demonstration and implementation of Quality Infrastructure focus areas were selected based on their strength, unique approach and leading practice elements. The intent of this Reference Guide is to provide a range of examples across a number of projects that collectively show how Quality Infrastructure can be delivered through intentional requirements in output specifications.

2.3 DEVELOP THE PROJECT CASE STUDIES

The project information has been collated via document review and interviews with the relevant project stakeholders, reviewed and case studies developed. Direct quotes from the output specifications have been included in the case studies where information was available and the examples were considered relevant. An alternative approach was to provide paraphrased requirements. Direct quotes are highlighted in italics text and project specific defined terms, which may be capitalised, have been kept. Although examples in the case studies may be applicable to other projects, the quoted and paraphrased text in the case studies alone is not considered sufficient to successfully implement the requirement on a project.

2.4 HOST A CONSULTATIVE WORKSHOP

A consultative workshop on this Reference Guide was held in Paris in partnership with Mott MacDonald on April 15, 2019. Over 40 delegates from 10 countries attended, including representatives from the European Union (EU) PPP Units or Ministry of Economy, in addition to the European Commission, the European PPP Expertise Centre (EPEC), the European Bank for Reconstruction and Development (EBRD), the Asian Development Bank (ADB), the Sustainable Infrastructure Foundation (SIF) SOURCE, the Private Infrastructure Development Group (PIDG), the Organisation for Economic Cooperation and Development (OECD), civil society organisations (CSOs) and private sector partners. Feedback from the workshop has been incorporated into the Reference Guide.

2.5 CREATE THIS REFERENCE GUIDE

This Reference Guide collates the background information on output specifications and Quality Infrastructure, and the project case studies, and presents lessons learned and observations. This Reference Guide adopts terminology, definitions and concepts from recognised global publications on PPPs and output specifications to develop a document that is not specific to one jurisdiction. This Reference Guide is not intended to be a substitute for proper technical due diligence. The Private Partners provided in the case studies are intended to reflect the team members at contract signing (prior to construction).

Table 1: Summary of case studies and QI focus area examples

Project (PPP model)	Sustainability & longevity/ Expectations of end users	Health & safety	Withstand natural & other disasters
BUILT ENVIRONMENT			
Milton Hospital - Canada (DBFM)	●	●	●
Mersin Integrated Health Campus - Turkey (DBFOM)	●	●	●
Pan Am Athletes Village - Canada (DBF)	●		
Lewisham Grouped Schools - United Kingdom (DBFM)	●	●	
PPP Prisons Program (Lots 1-3) - France (DBFM)	●	●	
ENERGY			
John Hart Generating Station - Canada (DBFM)	●	●	●
INFORMATION & COMMUNICATION TECHNOLOGY (ICT)			
Plan France Très Haut Débit (rural highspeed broadband) – France (DBFOM)	●		
TRANSPORTATION			
Central 70 (I70) Managed Lanes - USA (DBFOM)	●		
Complementary case study: Presidio Parkway - USA (DBFOM)			●
Gautrain Rapid Rail - South Africa (DBFOM)	●	●	
Complementary case study: Melbourne Metro Rail Tunnel - Australia (DBFM)	●		●
Madinah Airport Expansion Phase 1 - Saudi Arabia (BTO)	●	●	
Mactan-Cebu International Airport - Philippines (DBFOM) (includes comparison to Japanese airport concessions)	●	●	
WATER AND WASTE			
Organic Resource Recovery Centre - Hong Kong (DBOM)	●	●	●
Agadir Mutualized Desalination Plant - Morocco (DBFOM)	●		●

Job creation, capacity building, transfer of knowledge	Social impacts & inclusiveness	Environmental impacts	Economic & development strategies/ Respond to changes
●		●	
●	●	●	●
	●		●
	●		●
●	●	●	●
●		●	
●		●	●
●	●		●
●			
	●	●	
		●	
	●	●	●
●		●	●
		●	●

3. Quality Infrastructure definition

The G20 Leaders stressed the importance of Quality Infrastructure (QI) investment to deliver high quality infrastructure projects at the Hangzhou Summit in September 2016[6], where it was defined as investment:

"which aims to ensure economic efficiency in view of life-cycle cost, safety, resilience against natural disaster, job creation, capacity building, and transfer of expertise and know-how on mutually agreed terms and conditions, while addressing social and environmental impacts and aligning with economic and development strategies".

Since then the G20 Leaders have endorsed a series of documents and initiatives, such as the '*Roadmap to Infrastructure as an Asset Class*'[7], which highlight the necessity to advance a shared understanding of "quality infrastructure" within the G20. Quality infrastructure has also been a G20 focus under the Japanese Presidency in 2019.

For the purposes of this *Reference Guide on Output Specifications*, the definition of 'Quality Infrastructure' from Hangzhou is broken down into several focus areas which are closely related to the G20 discussions under the 2019 Japanese Presidency of the G20. The table below elaborates on the G20 definition of Quality Infrastructure and the key infrastructure considerations when identifying and developing case studies in this Reference Guide.

Table 2: Quality Infrastructure focus area descriptions

Alignment to the QI Definition (Hangzhou)[8]	Quality Infrastructure Focus Area	Description[9] and Considerations
That which aims to ensure economic efficiency in view of life-cycle cost	**Economic efficiency** requires that the asset efficiently addresses a clear need and end users' requirements through its lifecycle. **Sustainability and longevity** of an infrastructure asset	The relationship between the decisions made during design and construction, and how they aim to minimise the whole-life cost of the asset and meet the end users' requirements. Considerations include: • How the need for the asset has been identified and project objectives defined, and how these are translated into measurable requirements; • Processes and requirements that support reliable operation and maintenance, and economic efficiency in view of whole life cost; and • Requirements that promote good practice asset management and support the continued maintenance of an asset to meet the handback requirements.

6 Available at: http://www.g20.utoronto.ca/2016/160905-communique.html

7 Available at: http://www.oecd.org/g20/roadmap_to_infrastructure_as_an_asset_class_argentina_presidency_1_0.pdf

8 Defined as per the G20 description in the Hangzhou Communiqué

9 Descriptions in italics have been developed based on publications from the Center for Strategic and International Studies: https://www.csis.org/analysis/quality-infrastructure

Alignment to the QI Definition (Hangzhou)[8]	Quality Infrastructure Focus Area	Description[9] and Considerations
Safety	**Health and safety** considerations during both construction and operation of the asset	A design approach that considers the health and safety of those who construct, operate, maintain, modify and demolish an asset, as well as those who work in or with it, use it or are in the proximity of it (i.e. the public). Considerations include: • How hazard identification and risk assessment methods are integrated into the design requirements, with the intention to eliminate or minimise the risks of injury throughout the life of the asset; and • The requirement to conform with appropriate health and safety standards and, if appropriate, go beyond these by developing a proactive health and safety culture.
Resilience against natural disaster	Ability of the asset to withstand **natural and other disasters**, including climate change	The ability for an asset to demonstrate resilience and safety against natural disaster, terrorism and cyber-attack risks. Considerations include: • Implementation of best design practice processes and procedures to identify location-specific hazards and aim to mitigate the impact of natural disasters on the asset's condition and its users through design. This could include design requirements above minimum standards and specifying the required level of performance following an event.
Job creation, capacity building and transfer of knowledge, expertise and know-how on mutually agreeable terms	**Job creation, capacity building, transfer of knowledge and expertise**	Promoting job creation, capacity building, and transfer of expertise and know-how to national and local communities to deliver on economic development objectives. Considerations include: • How the requirements support participation by smaller (and local) and minority-owned firms as part of the project delivery in both the construction and operation phases; and • Requirements aimed at transferring project knowledge and developing skills in the local community to support the long-term operations and maintenance of an asset, particularly relating to handback.
Addressing social impacts	**Social impacts and inclusiveness**	*Social impact is the effect a development's actions have on the well-being of the community.* Considerations include: • How the project considers the impact it has on the local community, and the requirements in the contract to provide positive impact or mitigate the negative impact during both the construction and operations phases. Further defined in the GI Hub's '*Reference Tool on Inclusive Infrastructure and Social Equity*'[10].

10 Available at https://inclusiveinfra.gihub.org/

Alignment to the QI Definition (Hangzhou)[8]	Quality Infrastructure Focus Area	Description[9] and Considerations
Addressing… environmental impacts	**Environmental impacts**	*Environmental impacts may present themselves as temporary or permanent changes to the atmosphere, water, and land due to any development or human activities, which can result in impacts that may be either reversible or irreversible.* • How the project considers the impact it has on the environment, and the requirements in the contract to mitigate the impact during both the construction and operations phases. • Consideration is given to the mechanisms used to reduce energy consumption over the life of the asset.
Aligning with economic and development strategies.	Alignment of the project with **economic and development strategies** (SDGs, national policy, etc) Ability of the asset to **respond to changes** in resource availability, population levels, demographics and disruptive technology	Ensuring alignment with economic and development strategies, and ability to respond to changing priorities or needs including aspects of climate change, population growth and disruptive technology at the national and regional levels. Considerations include: • Identifying how the projects align with economic and development strategies and reflecting these in the project objectives and performance measures; and • How the requirements either foresee potential changes or refer to contractual mechanisms that allow future changes to be adopted.

4. Public-Private Partnership (PPP) project definition

4.1 REFERENCE GUIDE PPP DEFINITION

There are numerous definitions for PPP projects, with variations depending on jurisdiction. However, there is also consensus among key international organisations of a broad definition of PPP that typically includes "government pays" arrangements as well as "user pays" concession style arrangements. The APMG PPP Certification Program[11], the World Bank's '*PPP Knowledge Lab*'[12] and the PPP Reference Guide[13] define a PPP as:

"a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance".

This GI Hub Reference Guide has adopted this broad definition of a PPP, and considers examples across the following dimensions to develop a tool that is relevant to a wide audience, and to show how the specifications are influenced by the nature and scope of the project:

Figure 2: PPP dimensions

Asset class	**Social infrastructure**	**Economic infrastructure**
	Assets and services that typically support the delivery of social services such as healthcare, education, housing, and corrections and justice.	Assets and services that support the economic foundation of a city, region or country including transportation, energy, communications and water and waste.
Basis of payment	**Government pays**	**User pays**
	Payments (often termed "availability payments") are linked to the asset being available at a contractually-defined quality and services being provided in accordance with qualifiable performance metrics, regardless of level of use.	The Private Partner provides a service to users and generates revenue by charging users for that service, often under a concession contract. The Private Partner bears all or part of the "demand risk".
Current state of development	**New (Greenfield)**	**Existing (Brownfield)**
	A project where the Private Partner is responsible for the design and construction of a new asset and its related services.	Where the Private Sector assumes responsibility for the rehabilitation and/or maintenance of an existing asset and its related services. May also include components of a 'new' build.

11 Available at https://ppp-certification.com/

12 Available at https://pppknowledgelab.org/

13 Available at https://pppknowledgelab.org/guide/sections/83-what-is-the-ppp-reference-guide

This Reference Guide considers all types of PPP models that have long-term maintenance components, and recognises this is relevant for a broad range of jurisdiction specific contract structures, such as the '*Marché global de performance*'[14] contract in France, or the South African Public Finance Management Act Regulations (TR 16), concession contracts under specific local laws or regional definitions of PPP, such as 'P3' in Canada or private finance initiatives (PFI) in the United Kingdom.

4.2 PROJECT RESPONSIBILITIES AND PPP MODELS

The case studies in this Reference Guide consider a range of PPP procurement models based on the allocation of the following project responsibilities or functions:

- **Design** involves developing the project from initial concept and the development of the output specifications (typically the responsibility of the Owner) to the detailed design of an asset that is to be constructed in compliance with the specifications (typically the responsibility of the Private Partner).
- **Build** could be the construction of a new asset, or could be the rehabilitation of an existing asset, or a combination of both. The Private Partner is required to complete construction work in compliance with the output specifications. The build phase also includes the supply and installation of specified equipment.
- **Finance** is where the Private Partner is required to finance some or all of the construction of the asset, which is then repaid over the life of the asset through availability payments (government-pays model) or user-payments, or a combination of both. Private Partner financing supports risk transfer, as the Private Partner faces reduced financial return or financial loss if the services and scope are not delivered in compliance with the contract.
- **Operate** mainly relates to economic infrastructure and user-pays models and relates to operating an asset for its intended purposes to meet end user expectations (for example the delivery of clinical services in a hospital or driving trains in a transit system).
- **Maintain** can include a range of scope items aimed at maintaining an asset to a specified standard over the contract term. From the regular preventative and reactive maintenance of the physical asset to services that support the operations of an asset (such as cleaning, security and pest control). The 'maintain' component typically includes lifecycle and rehabilitation requirements, where elements of the asset are required to be replaced at the end of their useful life. The Private Partner may be responsible for maintaining all, or just specified elements, of the asset.

The project responsibilities transferred to the Private Partner typically define the 'type' of PPP, such as design-build-maintain (DBM), design-build-finance-maintain (DBFM), and design-build-finance-operate-maintain (DBFOM or concession contract), and the key components of the output specifications will be informed by the specific aspects of the scope of works. For example, a concession contract where the Private Partner operates the service is likely to have different output specifications (related to the level and the quality of service) to a design-build-maintain project where the service is operated by the government.

This Reference Guide focuses on the output specifications and the typical allocation of responsibilities and functions to the private sector under a PPP model, rather than the specific detail of other contractual aspects, such as contract term, allocation of certain project specific risks (such as financial market risks or insurance risks) or the contractual mechanisms that govern how the eventuation of project risks are to be managed.

However, for technical risks, there will always be an overlap between the output specifications and the contractual allocation of risks. For example, the output specifications may describe the required performance of a road surface; however, the Private Partner may incur additional costs and require additional time to deliver the performance required because of the eventuation of a risk (such as the discovery of archaeological findings), and the contractual risk allocation will describe which party bears the time and cost implications of managing that risk. The GI Hub's *Allocating Risks in Public-Private Partnership Contracts* tool provides detailed guidance on contractual risk

14 In 2015, France created a new category of global contract called the 'Marché global de performance', with specific and measurable performance commitments. "The global performance contract combines operation or maintenance with the construction or design and construction of an asset in order to fulfil quantified performance objectives. These objectives are defined in terms of level of activity, quality of service, energy efficiency or environmental impact." Article L2171-3 Public Procurement Code

in a PPP contract allocation by sector, and further guidance on translating these to the contract can be found in the World Bank's *Guidance on PPP Contractual Provisions*.

A contract that combines the scope from design through to operation (e.g. a DBFOM scope) can help drive efficiencies by focusing on the entire lifecycle of the project. The private sector is better placed to influence the public sector outcomes over the life of the asset (sometimes referred to as a 'lifecycle approach') than in a traditional public procurement where the design, construction, operations and maintenance functions are delivered separately. The integration of the design, construction, operations and maintenance functions in a single contract shifts the needs and expectations of the public sector from the delivery and completion of the asset to the service and functionalities offered by the asset to serve the final end users.

In some jurisdictions, specific output-based performance procurement contracts exist, for example, in France with the "Marché Global de Performance" where the Private Partner is in charge of the design, build and maintenance of the infrastructure with output-based specifications and performance-based remuneration linked to the achievement of measurable performance commitments.

The ordinance of the 23 July 2015 (codified at the article L2171-3 and R2171-2 of the "Code de la Commande Publique") created a new category of global contract the "*Marché global de performance*", with specific and measurable performance commitments in terms of output specifications.

"*The global performance contract combines operation or maintenance with the construction or design and construction of an asset in order to fulfil quantified performance objectives. These objectives are defined in terms of level of activity, quality of service, energy efficiency or environmental impact. The global performance contract has measurable performance commitments.*"

5. Output specifications

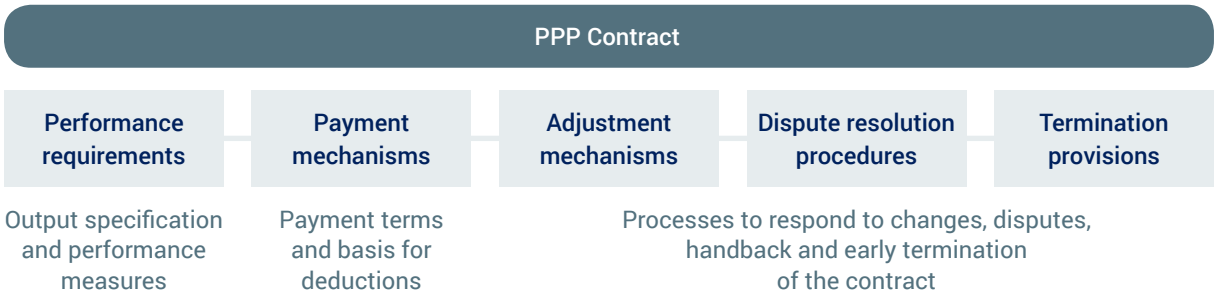
An output specification is a technical specification that predominantly adopts performance-based requirements to define the project scope. It is the technical foundation of both the procurement and delivery phases and is used to determine technical compliance. This section describes an output specification, provides an overview of a typical output specification structure, and presents a framework to identify requirements. It also describes the relationship between an output specification, the payment mechanism and the performance measures, and outlines the qualities of a good output specification.

5.1 WHAT IS AN OUTPUT SPECIFICATION?

The technical specifications are a component of the overall contract between the Owner and the Private Partner. The technical specification is the part of a contract that defines the performance requirements of the project: the functional requirements, the minimum technical requirements for the design and construction, and the scope and level of performance for services. It is the technical foundation of the procurement, delivery and – in a PPP – the operational phases of the contract, and is used to determine compliance at all phases of the project lifecycle.

Figure 3 demonstrates the relationship between the performance requirements and related key components of the contract (normally schedules to the contract) that should be developed in parallel.

Figure 3: Relationship between the output specification and PPP contract



Source: Adapted from the PPP Knowledge Lab 'Designing PPP Contracts'[15]

The requirements within a technical specification typically take two forms: prescriptive or performance.

Figure 4: Types of technical specification requirements

Prescriptive requirement	Performance requirement
Describes or defines, using written specifications and design drawings, **what** needs to be delivered and **how** it is to be delivered. It focuses on solutions rather than expected outcomes or results.	Defines the requirements in terms of measurable outcomes or objectives. The focus is on what needs to be delivered, but **does not detail how** or specific solutions.

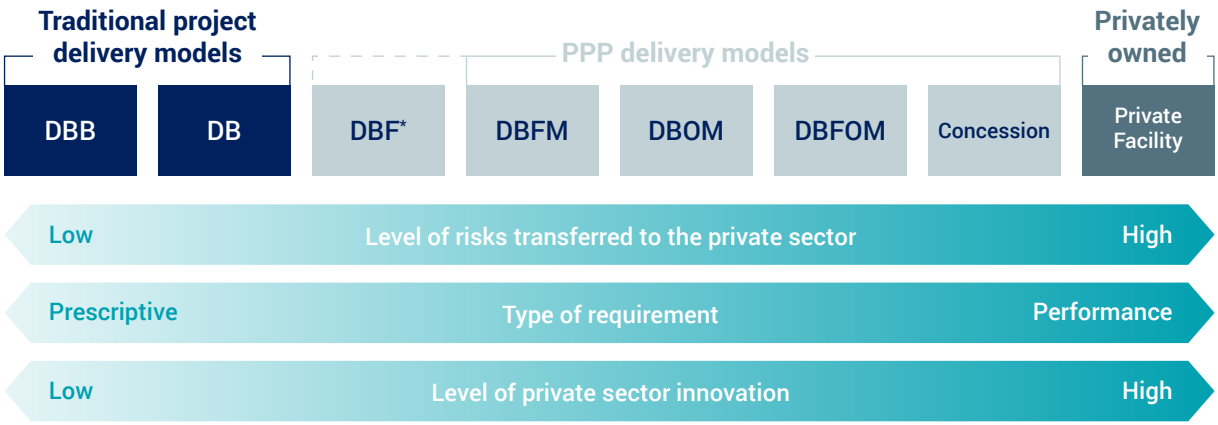
An *output specification* is a form of technical specification that intentionally adopts predominantly **performance requirements** to define the project scope for both the design-construct and operational phases of a project.

15 Available at https://pppknowledgelab.org/guide/sections/61-designing-ppp-contracts

A further defining characteristic of an output specification is the deliberate effort to deeply integrate operation, maintenance and handback performance requirements directly into the technical specifications, rather than aiming to accomplish these objectives *indirectly* through prescriptive design/construct obligations as is typical in traditional delivery models.

The type of specification is one key distinction between projects delivered as a PPP and projects delivered through traditional procurement models. Figure 5 demonstrates the relationship between project delivery models, the level of risks transferred to the private sector and the type of requirements in the specification to achieve innovative solutions.

Figure 5: Relationship between the project delivery model and type of requirements



* In some jurisdictions DBF is considered a PPP, but this is not included in the Reference Guide's PPP definition as it does not have a long-term contract.

Output specifications can also be adopted on design-build (DB) and design-build-finance (DBF) projects, however the level of prescriptiveness tends to be much higher than an output specification on a PPP project. The long-term maintenance risk is retained by the Owner, so prescriptive requirements are typically used to incorporate whole-life decision making into the design, and to manage construction quality risk.

Definitions of technical specifications by the law

In some jurisdictions, the technical specifications have been defined by the "law". The annexe VII of the procurement Directive 2014/24/EU of the European Parliament and the Council of 26 February 2014 on public procurement defined the technical specifications for a public work contract as: "*the totality of the technical prescriptions contained in particular in the procurement documents, defining the characteristics required of a material, product or supply, so that it fulfils the use for which it is intended by the contracting authority; those characteristics include levels of environmental and climate performance, design for all requirements (including accessibility for disabled persons) and conformity assessment, performance, safety or dimensions, including the procedures concerning quality assurance, terminology, symbols, testing and test methods, packaging, marking and labelling, user instructions and production processes and methods at any stage of the life cycle of the works; those characteristics also include rules relating to design and costing, the test, inspection and acceptance conditions for works and methods or techniques of construction and all other technical conditions which the contracting authority is in a position to prescribe, under general or specific regulations, in relation to the finished works and to the materials or parts which they involve (…)*"

5.2 OUTPUT SPECIFICATIONS ON PPP PROJECTS

Given the long-term nature of PPP contracts, the output specification includes both design and construction requirements, as well as lifecycle, maintenance and sometimes operations requirements. The transfer of responsibilities, and therefore risk, over an extended period incentivises the private sector to work in an integrated approach from early in the design to combine maintenance and operation into the design and construction of the project. The integration of both the design and construction and operating period requirements into a single specification suite is intended to promote the Private Partner to develop innovative solutions that minimise whole-life costs of the project.

Although an output specification aims to detail the scope of the project in terms of the desired performance requirements, the reality is an output specification for a PPP remains a balance between performance requirements and prescriptive requirements. Output specifications that are too prescriptive have been shown to dampen innovation and can be precluding to potential private sector partners, while those that are too vague are often associated with assets that do not meet the public sectors' needs or that cannot be effectively and competitively priced during the procurement process. A properly crafted output specification requires striking a balance between:

- having certainty that the procured solution aligns with the vision for the project and meets commitments made (internally and to end users and third parties) during the planning phase (prescriptive requirements); and
- allowing the private sector freedom to generate a value-for-money solution through effective management, team structure, financing and innovation in response to an appropriate risk allocation (performance requirements).

Most of the case studies in this Reference Guide demonstrate output specifications that have a combination of both performance and prescriptive requirements.

Input requirements may be adopted where an owner has an interest in delivering a specific solution to mitigate risk. For example, permit requirements, physical interfaces between new and existing structures, interfaces with third parties, or highly specialised or regulated areas where an owner may have more knowledge than the private sector (e.g. finishes and equipment).

Output requirements would then be developed for all other elements including structural design, mechanical and electrical systems and energy performance where the private sector has more knowledge and can develop innovative, long-term solutions.

The level of prescriptiveness in the output specifications and performance indicators vary across jurisdictions. For example, the Mersin Integrated Health Campus Project (and more generally in Turkish PPP and Latin American PPP projects) are more prescriptive than other European or Canadian PPP projects. The case studies provided demonstrate the range of prescriptiveness currently seen in PPP output specifications.

5.3 STRUCTURE AND CONTENTS OF AN OUTPUT SPECIFICATION

Although the overall contract structure may be similar from project to project, the output specifications should be actively tailored to be project-specific to ensure that key project objectives, functional requirements, minimum technical requirements and performance parameters are detailed to meet the end user requirements and recognise what is affordable within the project budget.

While the structure of output specifications varies across projects and jurisdictions, the typical components would include: 1) functional/development requirements, 2) management requirements required throughout the contract term, 3) design and construction requirements, 4) maintenance, lifecycle and handback requirements, and 5) operations requirements (if the contract transfers operations scope).

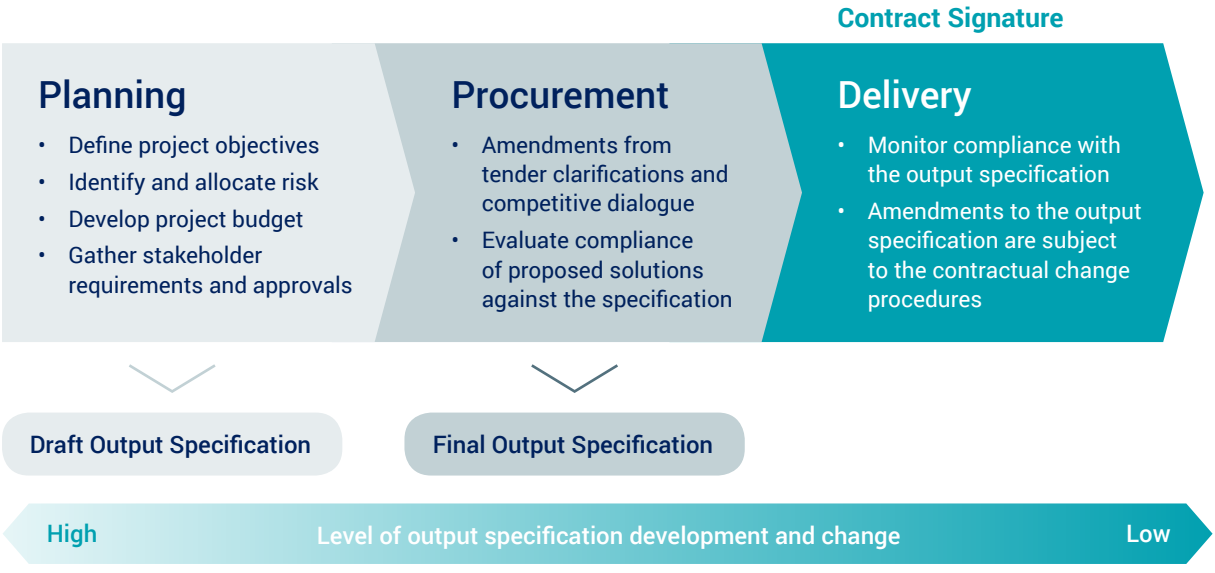
Figure 6: Components of an output specification

Functional/development requirements	• Project description, vision and objectives • Functions, purpose and objectives of the asset • Operational/functional interfaces
Management requirements	• Health and safety, communications, information, risk, quality, and sustainability and environmental requirements
Design and construction requirements	In addition to the design and construction scope, requirements may include: • Phasing, access and scheduling • Management and reporting • Permitting and third party requirements • Commissioning and testing
Maintenance, lifecycle, handback requirements	In addition to the maintenance scope, requirements may include: • Asset condition inspections • Management and reporting • Maintenance planning • Performance measures • Handback process
Operations requirements	The operations scope define the minimum level of service and how service will be measured.

5.4 A PROCESS TO IDENTIFY REQUIREMENTS AND DEVELOP AN OUTPUT SPECIFICATION

The output specifications are drafted by the public contracting authority, often with support from their consultants, during the planning stage of the project. A draft of the output specification forms a core component of the procurement documents and will form the basis for the private sector to develop their technical and financial offer. Throughout the procurement process, the output specification may be amended through private sector clarifications, and it is finalised prior to contract signature as permitted by the terms of procurement process.

Figure 7: Output specification development process



The planning phase is where the requirements are identified and the output specification formed. The amendments to the output specifications during the procurement and delivery phases typically clarify uncertainty and afford flexibility, rather than change core requirements or objectives. Changes following contract signature must be managed through change mechanisms (or variation procedures) within the contract.

The procurement strategy is developed alongside the output specifications and is informed by the project objectives, scope, requirements and risk allocation. An owner may develop response requirements and select proponent evaluation criteria based on the project objectives to promote alignment between the proponent proposals and the project priorities. The aim of the procurement process is to select a project partner that has the skills and experience to not only build an asset that is compliant with the output specification, but also has the skills and experience to effectively deliver the services and manage end user interfaces during the operating period.

Adopting a structured approach to developing project requirements in the planning phase helps facilitate knowledge transfer throughout project delivery and the contract term by clearly documenting both performance priorities and minimum standards, which are informed by the intended outcomes or project objectives. Engaging a range of stakeholder perspectives during the requirement development process helps to mitigate risks from inconsistent end user expectations, complex interface management challenges, and incompatibility between expectation and overall project affordability. Figure 8 outlines a progressive approach to develop requirements.

Figure 8: Requirement development process

It should be anticipated that the eventual Private Partner will aim to propose the solution with the lowest whole-life cost necessary to satisfy the output specification requirements (subject to the weighting of the bid evaluation scoring criteria[16]). When reviewing the output specification in advance of procurement, if the hypothetical lowest cost option does not meet the Owner's, end user's or third-party expectations, the project objectives, or introduces new risks, the requirement should be refined to limit the acceptable solutions. Additional performance criteria should be considered prior to adopting a prescriptive requirement.

As mentioned in Section 5.2, prescriptive requirements have their purpose, and should be used with intent. Prescriptive requirements are valuable, for example, where it is important to manage a critical interface with adjacent infrastructure or operations, a mandatory regulatory or permitting requirement, or a complex stakeholder interface.

A structured requirement development approach also allows the consideration from an early stage of other opportunities to facilitate quality infrastructure outcomes in project delivery, such as building information modelling (or 'BIM').

BIM and beyond – better information, quality outcomes

Building Information Modelling (BIM) brings vast benefits across the lifecycle of an asset from conceptual design optioneering to informed operations. BIM is a process, enabled by technology, that enables the efficient production, sharing and management of digital asset information which leads to improved whole-life performance, cost reduction and better risk management. However, establishing this approach as "business-as-usual" can be challenging, requiring new ways of working, unfamiliar processes and deployment of new technology. Policy makers are increasingly recognising that the value of information as a resource is driving the opportunity for more efficient infrastructure. To achieve this, governments and project procurers are seeking to apply the latest principles and thinking that drive collaboration and openness whilst retaining robust data security. BIM will increasingly become the industry standard and benefit every participant in the process, but its true value will only be achieved if stakeholders develop and follow consistent approaches and use a common language.

BIM adoption has grown in the last decade, particularly in the past five years. Many nations have opted to mandate its use through public procurement mechanisms, strengthening relationships across the many supply chains to drive genuine alignment through information. Challenges have often stemmed from the varied nature and maturity of the parties involved, mutual understanding has been mixed and capability has been fragmented. A focus upon technology has long been perceived as the priority, yet more effort is essential towards the people and process aspects. The advent of a new global standard for information management – ISO 19650 – now provides clearer direction and structure.

There are five steps to successfully realising the benefits of BIM:

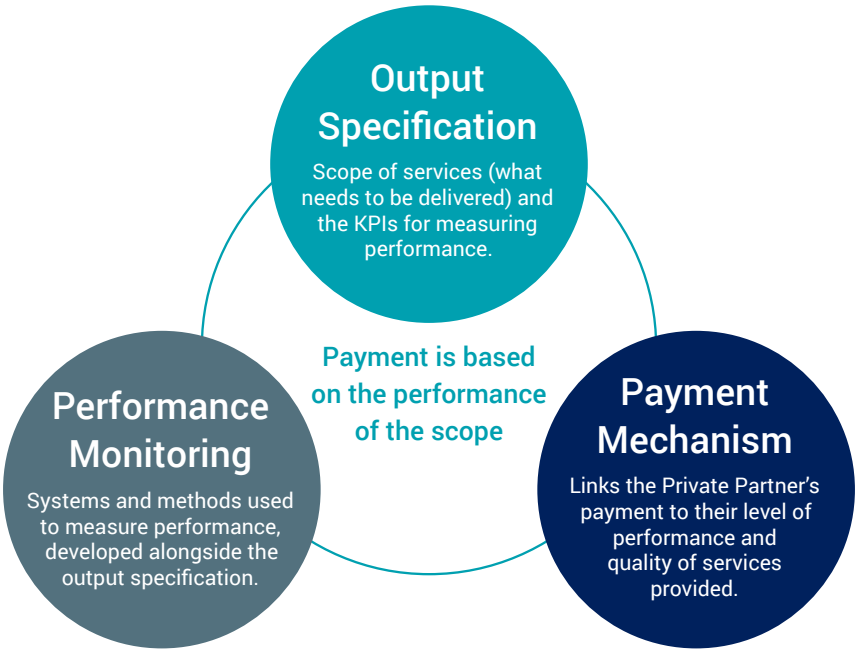
1. **Shape** – informed by overall business plan objectives, a bespoke strategy sets the vision, acknowledges the current position and outlines the actions needed to deliver the change.
2. **Define** – articulate the governance standards and protocols to clearly capture the requirements, putting the strategy into practice across project delivery and asset operations.
3. **Embed** – put the plan into practice through structured pilots, testing and iterating to ascertain an approach that achieves the best fit and results in the biggest impact.
4. **Perform** – operating with a new business-as-usual, building capacity across teams and realising the benefits at scale.
5. **Optimise** – feedback, measure and scale operations further across the enterprise, checking for progress against the goals of the strategy.

16 The bid evaluation scoring criteria can influence the quality of the responses. For example, if the evaluation rewards the lowest price then the quality is likely to be the lowest whole-life cost, compliant solution. However, if the evaluation is more qualitative where the proponents have to provide the best solution within an affordability threshold, or if points for innovation are weighted so they could influence the outcome of the evaluation, then the proponents may provide solutions that exceed the minimum standards.

5.5 THE RELATIONSHIP BETWEEN THE OUTPUT SPECIFICATION, PAYMENT MECHANISM AND PERFORMANCE MONITORING

Performance requirements describe the scope in terms of outputs or performance requirements and should be measurable using objective, quantifiable metrics in order to be enforced through the contract. By defining quantifiable requirements in the output specification, performance can be measured, and objectively linked to payment such that the Private Partner's compensation is commensurate with the quality of the service performed. Figure 9 demonstrates the three components of the contract that should be developed in parallel to implement an effective performance-based contract.

Figure 9: The relationship between the output specification, performance monitoring and payment mechanism



Source: Adapted from the 4Ps Contract Managers Guide[17]

The output specifications should be developed alongside the performance monitoring regime and the payment mechanism to align public sector and Private Partner priorities. When priorities are aligned, the performance monitoring and payment mechanism regimes can reduce the need to prescribe requirements. When developing integrated contract documents the following questions should be considered in parallel:

- **Output Specification:** Is the requirement a priority to deliver a project objective? How does the priority relate to other requirements? What is the impact if the requirement is not achieved?
- **Performance Monitoring:** How and when will compliance be assessed or measured? What evidence is required to assess compliance and monitor performance? What are the contractual mechanisms that can be used to incentivise compliance?
- **Payment Mechanism:** What are the financial deductions or bonuses that will incentivise the Private Partner to meet the output specification requirement? How are they calculated?

Achieving energy performance using performance monitoring and the payment mechanism: Canadian social infrastructure approach

At bid stage, proponents are required to provide an energy consumption target that is considered in the price evaluation.

Energy consumption is measured against the target throughout the operating term.

The costs and savings of energy consumption above or below the target are shared between the Owner and the Private Partner.

Aligned priorities limit the need for specific performance requirements.

17 Available at: http://docplayer.net/9794015-A-guide-to-contract-management-for-pfi-and-ppp-projects.html

For example, the volume and water quality KPIs for the Agadir Mutualized Desalination plant are tracked daily from a remote service station. Any deviation from the production quality and quantity immediately impact revenues. Repeated deviations, both in terms of gravity and of length in time, may lead to warning, and replacement of the Operator if needed (see case study).

In the US Central 70 Managed Lanes project, a Baseline Asset Condition Report formed the basis for maintaining the existing asset during construction and post-construction at a more onerous standard than that applied for the output specification requirements for the operating period to maintain the longevity of the asset (see case study for examples of the requirements in the contract). The performance measures are combined with a payment mechanism that assigns non-conformance points for defects to calculate financial deductions. Non-compliance points are only incurred where the defect is not rectified within the remedy period. There are two classifications of output specification defects which have corresponding defect remedy periods depending on how significant or severe the defect is.

5.6 QUALITIES OF A GOOD OUTPUT SPECIFICATION

There are common qualities of good output specifications. In summary these are:

- **Outcomes focused:** The requirements respond to the project objectives and functional requirements of the asset. The desired outcomes are clearly articulated so the Private Partner understands the end user objectives and their relative priorities.
- **Refer to codes and standards:** Owner, local, national, industry or international codes and standards should be used to specify the minimum level of compliance. Codes and standards should be cited rather than quoted or paraphrased and listed in order of precedence. Exceptions to codes and standards should be clearly articulated in the output specification, including the rationale for the exception. Time should be invested during the planning stage to select codes and standards based on their relevance and the performance they can deliver, rather than listing all potential codes and standards which could limit the possible solutions. In addition to looking at international codes, countries can look at which other national codes from other jurisdictions may be relevant and could offer good practice beyond their existing minimum requirements.
- **Achievable:** Requirements need to be constructible and feasible, and there is at least one solution that can realistically be delivered within the affordability threshold. The requirements, informed by background studies and investigation, recognise the starting position of the project (greenfield versus brownfield), the operational interfaces, and specific project risks. The requirements do not rely solely on "innovation" to solve an intractable challenge.
- **Quantifiable:** Describe the vision, objectives and requirements in a manner that the outputs (project solution) can be measured. Where key performance measures (KPIs) are used, they should be specific, measurable, achievable, realistic and time bound (or 'SMART').
- **Observable compliance:** Where a requirement is not quantifiable, there is a clear understanding of what evidence is required to prove the solution is compliant with a requirement, and how a reasonable agreement between the Owner and Private Partner can be developed. For example, an option would be to define the studies and their methodology that should be completed by the Private Partner to prove compliance, alongside appropriate price adjustment measures.
- **Simple:** Present objective requirements, in simple language, in as few words as possible. Each requirement should focus on a single aspect of the project as compound requirements are more difficult to adjudicate. Requirements should be coordinated across different sections to avoid conflicts within the document.
- **Coordinated:** The output specification is coordinated with other contract documents, including the glossary of definitions. It adopts logical structuring that considers how the output specification will be used to administer the contract throughout the operating term.

Reliance on standards

Industry standards and codes, which vary between locations, are typically used to define the minimum standard. The output specifications are then used to define requirements above standards, or to specify standards from other jurisdictions. The common International Standards (ISO) adopted across asset classes and jurisdictions include:

- **ISO 9001:** Quality management systems
- I**SO 14001:** Environmental management systems
- **ISO 55000:** Asset Management management systems
- **ISO 10002:** Quality management – customer satisfaction
- **ISO 14064 and ISO14065:** Greenhouse gas quantification, validation and verification
- **ISO 19650:** Information management
- **ISO 39001:** Road traffic safety management systems

Some jurisdictions may have their own best practice guidelines on the development of output specifications as demonstrated in the example below from the European Union.

Example: European Union Public Procurement Directive 2014/24/EU 26 February 2014

The following is quoted from Article 42 'Technical specifications':

1. The technical specifications as defined in point 1 of Annex VII shall be set out in the procurement documents. The technical specification shall lay down the characteristics required of a works, service or supply.

   Those characteristics may also refer to the specific process or method of production or provision of the requested works, supplies or services or to a specific process for another stage of its life cycle even where such factors do not form part of their material substance provided that they are linked to the subject-matter of the contract and proportionate to its value and its objectives.

   The technical specifications may also specify whether the transfer of intellectual property rights will be required.

   For all procurement which is intended for use by natural persons, whether general public or staff of the contracting authority, the technical specifications shall, except in duly justified cases, be drawn up so as to take into account accessibility criteria for persons with disabilities or design for all users.

   Where mandatory accessibility requirements are adopted by a legal act of the Union, technical specifications shall, as far as accessibility criteria for persons with disabilities or design for all users are concerned, be defined by reference thereto.

2. Technical specifications shall afford equal access of economic operators to the procurement procedure and shall not have the effect of creating unjustified obstacles to the opening up of public procurement to competition.

3. Without prejudice to mandatory national technical rules, to the extent that they are compatible with Union law, the technical specifications shall be formulated in one of the following ways:

   a. in terms of performance or functional requirements, including environmental characteristics, provided that the parameters are sufficiently precise to allow tenderers to determine the subject-matter of the contract and to allow contracting authorities to award the contract;

continued...

b. by reference to technical specifications and, in order of preference, to national standards transposing European standards, European Technical Assessments, common technical specifications, international standards, other technical reference systems established by the European standardisation bodies or - when any of those do not exist - national standards, national technical approvals or national technical specifications relating to the design, calculation and execution of the works and use of the supplies; each reference shall be accompanied by the words 'or equivalent';

c. in terms of performance or functional requirements as referred to in point (a), with reference to the technical specifications referred to in point (b) as a means of presuming conformity with such performance or functional requirements;

d. by reference to the technical specifications referred to in point (b) for certain characteristics, and by reference to the performance or functional requirements referred to in point (a) for other characteristics.

4. Unless justified by the subject-matter of the contract, technical specifications shall not refer to a specific make or source, or a particular process which characterises the products or services provided by a specific economic operator, or to trade marks, patents, types or a specific origin or production with the effect of favouring or eliminating certain undertakings or certain products. Such reference shall be permitted on an exceptional basis, where a sufficiently precise and intelligible description of the subject-matter of the contract pursuant to paragraph 3 is not possible. Such reference shall be accompanied by the words 'or equivalent'.

5. Where a contracting authority uses the option of referring to the technical specifications referred to in point (b) of paragraph 3, it shall not reject a tender on the grounds that the works, supplies or services tendered for do not comply with the technical specifications to which it has referred, once the tenderer proves in its tender by any appropriate means, including the means of proof referred to in Article 44[18], that the solutions proposed satisfy in an equivalent manner the requirements defined by the technical specifications(…).

18 Article 44 Test reports, certification and other means of proof
Contracting authorities may require that economic operators provide a test report from a conformity assessment body or a certificate issued by such a body as means of proof of conformity with requirements or criteria set out in the technical specifications, the award criteria or the contract performance conditions.

Where contracting authorities require the submission of certificates drawn up by a specific conformity assessment body, certificates from equivalent other conformity assessment bodies shall also be accepted by the contracting authorities.

For the purpose of this paragraph, a conformity assessment body shall be a body that performs conformity assessment activities including calibration, testing, certification and inspection accredited in accordance with Regulation (EC) No 765/2008 of the European Parliament and of the Council.

6. Lessons learned and observations

For a project to deliver Quality Infrastructure outcomes, it should have a clearly defined project objective that is supported by the project sponsor. The project objectives should inform the project requirements, performance measures and the payment mechanism to align the private and public sector priorities. The output specifications can be used to deliver Quality Infrastructure by aligning expected project requirements with measurable performance requirements to harness private sector innovation and deliver solutions that respond to the project objectives. This section summarises the lessons learned on the output specification development process documented in Section 5, as well as those from the case studies.

An output specification is a technical specification that predominantly adopts performance-based requirements to define the project scope. However, the reality is an **output specification for a PPP project remains a balance between performance requirements and prescriptive requirements**. As outlined in section 5.2, a properly crafted output specification requires striking a balance between performance requirements that allow the private sector the freedom to innovate and drive value-for-money through life-cycle efficiencies; and more prescriptive requirements that may be effective in providing certainty on specific commitments made during the planning stage for some parts of the scope. Where prescriptive requirements are used, it should be with a specific intent and rationale.

The output specification is composed of a series of documents within a PPP contract that define the functional requirements, minimum technical requirements for the design and construction and the scope and level of performance of services during the operating term. Although the overall contract structure may be similar from project to project, **the output specification should be actively tailored to be project-specific** to ensure that key project objectives are detailed to meet the end user requirements and recognise what is affordable within the project budget.

The output specification is the technical foundation of both the procurement and delivery phases and is used to determine technical compliance. During the planning phase, the public sector will identify their requirements and develop the output specifications which are included in the procurement documents. The amendments to the output specifications during the procurement and delivery phases are typically minor. **The output specification is typically finalised prior to contract signature** and any subsequent changes to it would be administered through the change mechanisms in the contract.

Adopting a structured approach to develop project requirements in the planning phase helps facilitate knowledge transfer throughout project delivery and the contract term by clearly documenting both performance priorities and minimum standards. **Engaging a range of stakeholder perspectives during the requirement development process helps to mitigate risks** from inconsistent end user expectations, complex interface management challenges, and incompatibility between expectation and overall project affordability.

It is essential the output specification is well-developed, clear, measurable and technically feasible. **A good output specification will have the following qualities** (detailed in Section 5.6 of this Reference Guide):

- **Outcomes focused:** responds to the project objectives and functional requirements of the asset;
- **Refers to codes and standards:** owner, local, national, industry or international codes and standards specify the minimum requirements;
- **Achievable:** the requirements are constructible and feasible and are informed by background studies and investigations;
- **Quantifiable:** the vision, objectives and requirements are described in terms of measurable outputs;
- **Observable compliance:** where a requirement is not quantifiable, there is a clear understanding of what evidence is required to prove the solution is compliant with a requirement;
- **Simple:** requirements are communicated using simple language and as few words as possible; and
- **Coordinated:** the structure considers how the output specification will be used and is coordinated with other project documents.

In addition to developing well defined and achievable output specifications, they should be **linked to payment mechanisms and termination provisions** to incentivise the greatest level of service delivery.

6.1 LESSONS LEARNED ON QUALITY INFRASTRUCTURE FOCUS AREAS

The G20 Leaders stressed the importance of Quality Infrastructure (QI) investment to deliver high-quality infrastructure projects at the Hangzhou Summit in September 2016[19], where it was defined as investment: "*which aims to ensure economic efficiency in view of life-cycle cost, safety, resilience against natural disaster, job creation, capacity building, and transfer of expertise and know-how on mutually agreed terms and conditions, while addressing social and environmental impacts and aligning with economic and development strategies*". This Reference Guide adopts this definition of Quality Infrastructure, and has broken it down into seven focus areas:

1. **Sustainability and longevity** of an infrastructure asset. Ability of the asset to address the needs and meet the expectations of end users.
2. **Health and safety** considerations during both construction and operation of the asset.
3. Ability of the asset to withstand **natural and other disasters**, including climate change.
4. **Job creation, capacity building, transfer of knowledge and expertise.**
5. **Social impacts and inclusiveness.**
6. **Environmental impacts.**
7. Alignment of the project with **economic and development strategies.** Ability of the asset to **respond to changes** in resource availability, population levels, demographics and disruptive technology.

Development of this Reference Guide identified observations and lessons learned that can be applied to PPP projects regardless of the asset class or location. This section defines the Quality Infrastructure focus areas and presents lessons learned that align with the focus areas, with relevant examples (cited as sub-bullet points) from the Part B case studies.

1 Economic efficiency in view of life-cycle cost - Sustainability and longevity of an infrastructure asset, while addressing the needs and meeting the expectations of end users.

The relationship between the decisions made during design and construction, and how they aim to minimise the whole-life cost of the asset and meet the end users' requirements. Considerations include:

- How the need for the asset has been identified and project objectives defined, and how these are translated into measurable requirements;
- Processes and requirements that support reliable operation and maintenance, and economic efficiency in view of whole life cost; and
- Requirements that promote good practice asset management and support the continued maintenance of an asset to meet the handback requirements.

- **Ensure that performance measures reflect the project objectives and the end user priorities:** Developing a clear vision and defining objectives through stakeholder engagement during the planning phase improves the quality of the output specification. Where this had been completed, the output specification, performance measures and the payment mechanism clearly communicated the project priorities, either through measurable key performance indicators or through payment mechanisms that incentivised the private sector to focus on the project priorities.

19 Available at: http://www.g20.utoronto.ca/2016/160905-communique.html

- **Plan France Très Haut Débit (Rural Highspeed Broadband):** The performance measures focus on meeting end user requirements. The main end user requirements are: 1) 'Access', where any internet service provider shall be able to use the network to commercialise internet subscriptions to the end users, and 2) 'Level of Service', where the network must provide satisfactory access to the internet. There are key performance indicators for each performance measure which are linked to payment if they are not achieved.

- **Consider customer satisfaction surveys:** Satisfaction surveys are good practice and are a common approach across asset classes and locations to evaluate whether the Private Partner is meeting the end user's expectations. Stakeholder feedback suggests it can be difficult to hold the Private Partner to measurable performance criteria as the surveys can be insufficiently prescribed and subjective. Adopting an industry recognised process to complete the surveys is one option that could improve the implementation of the customer survey, for example the Mactan-Cebu International Airport referenced an industry standard.
  - **Mactan-Cebu International Airport:** The Private Partner is required to undertake a passenger satisfaction survey every quarter. The industry benchmark for customer satisfaction surveys is the Airport Service Quality (ASQ) survey which has been developed by Airports Council International (ACI). It is a standardised survey which is completed by passengers at the airport once they have completed their journey through the terminal.
- **Be clear on handback requirements and condition assessments:** The handback requirements and condition assessments throughout the operating term are key mechanisms to support the longevity of the asset. In addition to regular lifecycle condition reviews, handback condition inspections typically commence five to seven years ahead of the end of term and will often be conducted by an independent third party. Depending on the jurisdiction, there will typically be a mechanism of financial retention leading up to handback to incentivise an acceptable handback condition.

  Recent projects have had more detailed requirements for the asset condition at the end of term and prescribing the residual life of key asset components is one way the output specification can promote asset quality beyond the end of the contractual term.
  - **Mersin Integrated Health Campus:** Prior to handback, an independent building survey shall be completed to assess the outstanding works required to meet the handback standards. On this project, it shall take place up to three years prior to the expiry date and involves the Owner and the Private Partner appointing a third party to undertake a condition survey of the facilities.
  - **Hong Kong Organic Resource Recovery Centre:** The project has a 15-year operating period term which is shorter than typical solid waste management PPP projects which are usually closer to 25 years. The Owner specified both the design life and residual life to promote long-term decision making during the design and construction phases.
- **Consider international standards for asset and information management:** International standards are increasingly being used to specify requirements for information quality and consistency and asset management. The introduction of these requirements points to the value of information in monitoring performance on an asset and administering a contract, and the need for a structured approach to plan, implement and review the asset management activities to promote a whole-life approach. Building information modelling (BIM) and emerging information management practices will continue to provide opportunities to improve asset delivery. The process starts by defining organisation (rather than project) objectives and developing governance standards and protocols to support implementation.

2 Health and safety considerations during both construction and operation of the asset.

A design approach that considers the health and safety of those who construct, operate, maintain, modify and demolish an asset, as well as those who work in or with it, use it or are in the proximity of it (i.e. the public).

Considerations include:

- How hazard identification and risk assessment methods are integrated into the design requirements, with the intention to eliminate or minimise the risks of injury throughout the life of the asset.
- The requirement to conform with appropriate health and safety standards and, if appropriate, go beyond these by developing a proactive health and safety culture.

- **Local law and regulations typically form minimum standards:** Local law and regulations typically form the minimum health and safety requirements, although there is the opportunity in the output specifications to include requirements above the minimum standards. When a project includes private finance, the private financing party may choose to impose their own minimum requirements to mitigate the risk of delay if a serious health and safety incident were to occur.
  - **Mactan-Cebu International Airport:** The output specification cited national legislation, however since the Asian Development Bank (ADB) was one of the lenders, the Private Partner was also required to comply with the ADB's safeguarding policy which includes occupational and community health and safety provisions.
- **Ensure proactive monitoring and intervention:** Owners typically prioritise health and safety planning and performance monitoring. Safety management plans are typically required to be in place within a defined period (dependant on the project schedule) after contract signature, and prior to construction commencing and are typically subject to Owner review. Depending on the Owner's project delivery experience, it is common for them to appoint external consultants to review the safety management plans. Persistent poor health and safety performance is typically linked to a contract default and which is monitored through monthly reporting. The Owner typically retains the right to audit health and safety performance at any point during construction and operations.
  - **Gautrain Rapid Rail:** Although the responsibility for health and safety is transferred to the Private Partner, the Owner takes a proactive interest in monitoring health and safety performance and the implementation of the health and safety management systems. A Safety Management Plan is required to reflect good industry practice. The Private Partner is then required to report on performance against the management plan.
- **Safety by design:** Where the Owner retains responsibility for the operation of an asset, there is an opportunity to incorporate "safety by design" requirements. The output specification can describe the operating functions and define constraints with the intent to reduce or eliminate long-term occupational hazards through decisions taken during the design process.
  - **John Hart Generating Station:** The Owner identified ways to incorporate "safety by design" principles into the project requirements. As an example, the design and construction requirements included general and specific requirements for operability and maintainability, confined spaces, isolation and lockout, isolation of mechanism apparatus, work at height, limits of approach, electromagnetic field, arc flash and constructability.

- **Consider requirements for system redundancy:** Output specifications can use performance requirements to specify the level of system redundancy required to ensure the healthy and safe operation of an asset. This is particularly relevant on healthcare projects, as the ability to deliver quality patient care is directly dependent on the reliability of the building systems. Under contract, the outage of critical building systems is typically subject to financial deductions in order to incentivise the private sector to prepare a resilient design and to undertake preventative maintenance to mitigate the likelihood of a system outage.
  - **Milton District Hospital Expansion Project:** The output specification includes provisions for selected equipment, devices or systems to be provided in sufficient quantity and capacity such that should the largest unit fail, the design load of the system served will still be met.

Additional industry example: Transport Infrastructure Safety Standards

In support of the United Nations (UN) Sustainable Development Goals to halve road deaths and injuries (Goal 3.6) and build Safe and Sustainable Cities (Goal 11.2), UN Member States have agreed on 12 Global Road Safety Performance Targets[20]. Targets three and four relate to transport and road infrastructure safety standards including the specification for all new roads to meet a three-star or better star rating for all road users.

Governments around the world have now adopted Star Rating targets for new and existing roads. The targets are being used for both public and private sector infrastructure including the Wellington Gateway Project in New Zealand where a minimum four-star standard was specified; Highways England with a target of 90% of travel on three-star or better roads; Concession Roads in Brazil where three-star or better standards are being specified and Indonesia where toll increases will be subject to meeting a four-star standard.

Development institutions are also encouraging client countries to meet the UN targets with the World Bank, Asian Development Bank, Millennium Challenge Corporation, Caribbean Development Bank and others including three-star or better targets on transport and road projects.

In 2018 the online Star Rating for Designs (SR4D) tool was released to "empower designers and road engineers to assess the road safety of a design and improve its safety star rating before the implementation of civil works"[21]. The SR4D tool can also "strengthen the road safety audit process, complementing it with an objective and repeatable qualification of road user fatality and serious injury risk and support the wider and more immediate application of Star Ratings as a safety performance metric" and could be considered as a requirement when developing output specifications for highway projects.

Further information can also be found at https://www.irap.org/ and a 'Business Case for Safer Roads' is found at https://www.vaccinesforroads.org/business-case-for-safer-roads/

20 https://www.who.int/violence_injury_prevention/road_safety_status/2018/en/ (page 19)

21 Further information available at: https://www.irap.org/2018/11/new-star-rating-for-design-sr4d-tool-set-to-revolutionise-road-design-safety/ An example of the application of the iRAP standard can be found at: http://www.saopaulo.sp.gov.br/spnoticias/governo-de-sp-lanca-maior-concessao-rodoviaria-do-pais/

3 Ability of the asset to withstand natural and other disasters, including climate change.

The ability for an asset to demonstrate resilience and safety against natural disaster, terrorism, and cyber-attack risks. Considerations include:

- Implementation of best design practice processes and procedures to identify location-specific hazards and aim to mitigate the impact of natural disasters on the asset's condition and its users through design. This could include design requirements above minimum standards and specifying the required level of performance following an event.

- **Understand the site-specific risks:** During the planning phase, owners have the ability to mitigate the impact of natural disasters by considering the potential exposure when selecting a project site. The Owner is typically required to complete background research and site investigations to identify risks that can then be translated into requirements in the output specification. If the risks can be quantified, the Owner then has the option to transfer the risks to the private sector through an appropriate risk sharing model.
  - **Presidio Parkway:** The Private Partner is responsible for the first USD10 million of extra work and delay costs (in aggregate during the project term) incurred to repair or replace tangible property damage caused by seismic events. All un-insured costs above this will be borne by the Owner. By sharing the risk, the Private Partner is incentivised to develop a design that mitigates repairs for a minor (and more likely) event.
  - **Melbourne Metro Rail Tunnel:** The Owner has identified and documented projections and scenarios in a Climate Change Risk Assessment and Climate Change Adaptation Plan. The output specification includes climate resilience requirements that respond to the location specific risks. The Private Partner is responsible for delivering a design that "*must include measures for all high and extreme climate change risks to ensure the infrastructure, stations and precincts are resilient to the projected impacts of a changing climate over the relevant asset's Design Life.*"

- **Performance-based seismic requirements:** The **John Hart Generating Station** and **Presidio Parkway** case studies demonstrate how seismic requirements can be incorporated in the output specification using performance-based criteria. By adopting a performance-based design approach, the Private Partner has the flexibility to design a solution that best mitigates the risk. The output specification describes the required level of performance, depending on the defined seismic event. Typically, the seismic requirements refer to location-specific industry standards, for example the Presidio Parkway seismic requirements consisted of industry requirements (American Association of State Highway and Transportation Officials Load and Resistance Factor Design (AASHTO-LRFD) Standard), Owner requirements (Caltrans Seismic Design Criteria) and project requirements.

Best practice is evolving

The projects documented in the case studies were selected based on their current stage of development (typically either operational or nearing construction completion), and therefore do not necessarily represent current best practices to respond to climate change risks. Transportation projects in North America now increasingly refer to a base design level (for example, a one-in-100 year event) and then require a supplemental allowance for sea level rise and flooding (for example, an additional two feet). The allowance for sea level rise and flooding is based on site specific analysis of the risk and will vary between projects. There are also jurisdictions that have developed their own design guidelines to respond to climate change risks, for example:

- **British Columbia (Canada) Ministry of Transportation and Infrastructure (MoTI):** MoTI requires the potential impacts of climate change be considered during the design stage of a project. In March 2019, MoTI issued a Technical Circular providing guidance to the engineering community on how climate change risks should be considered on maintenance, rehabilitation and new construction projects.

4 Job creation, capacity building, transfer of knowledge and expertise

Promoting job creation, capacity building, and transfer of expertise and know-how to national and local communities to deliver on economic development objectives. Considerations include:

- How the requirements support participation by smaller (and local) and minority-owned firms as part of the project delivery in both the construction and operation phases.
- Requirements aimed at transferring project knowledge and developing skills in the local community or Owner to support the long-term operations and maintenance of an asset, and particularly relating to handback.

- **Consider job creation and local business targets:** Quantifiable performance measures (linked to financial deductions) are the typical way for projects with job creation objectives to align the Owner and Private Partner priorities. Good practice is to include requirements for both the construction and operating term, and to have a monitoring program in place to measure performance.
  - **Gautrain Rapid Rail:** Socio-economic development (SED) was a main objective of the project. The Owner developed a SED strategy which identified 22 elements, with targets, for the project and developed a specific schedule to document the requirements. To achieve the targets in the strategy, the Owner used the output specification to align their priorities with the Private Partner's priorities. Measurable requirements were included in the specification and independent reviews were required to determine if the objectives had been achieved and a penalty and reward regime was included to promote performance above the minimum requirement.
  - **John Hart Generating Station Replacement Project:** During the project planning phase the Owner entered into impact benefit agreements with local First Nations (traditional inhabitants of the land). The output specifications reflect this priority with the inclusion of a specific First Nations output specification schedule and requirements for Private Partner reporting, as well as potential financial deductions or contract default for non-compliances with the requirements.
  - **The Central 70 Managed Lanes project** provides another example of construction and operations period local business targets that promote job creation.
- **Ensure project knowledge is documented in plans and procedures:** Clear and current project documentation is an important element of effective knowledge transfer. The private sector is typically required to document their operating policies and procedures as well as maintenance plans prior to construction completion. The specifications typically describe the intent and content of the policies, plans and procedures, the development process (due dates and need for stakeholder input) and how and when the documents need to be updated. Typically, policies, plans and procedures are updated annually to capture lessons learned and are subject to Owner review.
- **Include a handback/handover plan:** The requirement for a 'Handback Plan' is typically included on most PPP projects, with asset documentation a key part of this. Increasingly, there are requirements for building information models (BIM) to be maintained throughout the operating term to improve asset management and the transfer of knowledge at handback.
  - **Hong Kong Organic Resource Recovery Centre:** The output specification includes requirements for BIM to mitigate construction risks and improve asset management and transfer of knowledge. At an organisation level, the Owner has defined their requirements for BIM, which in turn inform the project requirements. The Private Partner shall adopt BIM during the design, construction, and operations stages of the facility.

5 Social impacts and inclusiveness

Social impact is the effect a development's actions have on the well-being of the community. Considerations include:

- How the project considers the impact it has on the local community, and the requirements in the contract to provide positive impact or mitigate the negative impact during both the construction and operations phases. Further guidance is provided in the GI Hub's '*Reference Tool on Inclusive Infrastructure and Social Equity*'[22].

- **Establish social inclusiveness initiatives during the project planning phase:** A common approach is for an owner to engage with stakeholders to identify priorities and develop social inclusiveness initiatives during the planning stage that can then be translated into requirements in the output specification. Meaningful social initiatives take time to implement. Without the Owner leading the initiative development during the planning phase, the Private Partner is unlikely to have adequate time between contract award and construction commencement to develop meaningful programs and to deliver the project on schedule.
  - **Pan Am Games Athletes' Village:** The project addressed job creation and social inclusiveness through cooperation with the Waterfront Toronto Employment Initiative (WTEI). The Owner took a proactive approach and set out initiatives that the Private Partner could take advantage of. The project worked with WTEI, who was committed to connecting un/under-employed Torontonians with the employment and training opportunities that were generated through this revitalisation.
- **Ensure accessibility provisions:** From healthcare facilities to transit systems, current relevant standards and codes are typically used to specify the minimum accessibility provisions. For example:
  - **Mersin Integrated Health Campus:** The facility must comply with the Turkish disability legislation, and the Private Partner is required to "*ensure access routes comply with disability legislation*". More specifically, the output specifications highlight that the facility must "*include access provisions for cars or minibuses to set down disabled or elderly people at entrances, safely and without hindrance*".
  - **Pan Am Games Athletes' Village:** All accessibility requirements listed in the *International Paralympic Committee, Accessibility Guide July 2009* and the *Ontario Building Code 2006* were required to be met. In the case of conflicting requirements, the most stringent applied.

6 Environmental impacts

Environmental impacts may present themselves as temporary or permanent changes to the atmosphere, water, and land due to any development or human activities, which can result in impacts that may be either reversible or irreversible.

- How the project considers the impact it has on the environment, and the requirements in the contract to mitigate the impact during both the construction and operations phases.
- Consideration is given to the mechanisms used to reduce energy consumption over the life of the asset.

- **Use of Environmental Management Systems:** Globally ISO 14001 accreditation is a commonly used standard for environmental management. ISO considers adopting a standardised approach can have an effective role in support public policies[23]. It is worth noting that in some jurisdictions the full accreditation is required, whereas in other jurisdictions the Private Partner is required to comply with ISO 14001, but is not contractually required to obtain the formal accreditation. This distinction can be due to the depth of local knowledge in the implementation of the standard, or an assessment of the relative cost and value of pursuing certification.

22 Available at: https://inclusiveinfra.gihub.org/

23 Additional information available at: https://www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/iso_action_plan_2016-2020_en_ld.pdf

- **Consider requirements for third party certification:** Industry recognised third party certifications are a common approach to promote energy efficiency and asset sustainability. The available certifications vary by location. The certifications referenced in the case studies include LEED[24], ENVISION[25], EDGE[26] and BREEAM[27].

  A good practice approach is to define in the output specification the credits that the Private Partner must achieve to ensure that the certification achieved aligns with the Owner's objectives. Alternatively, Owners (or governments) may have their own green building standard, for example:

  - **Hong Kong Organic Recovery Centre:** The output specification includes a requirement to comply with the Government of Hong Kong's '*Green Building Performance Framework set out in the Development Bureau Technical Circular (Works) No 2/2015*'.
  - **North American Airport:** A current airport redevelopment project in North America requires both LEED Silver Certification (for design and construction and the operations and maintenance) and ENVISION Gold certification. The same project also references international standards (ISO14064 and ISO14065) for greenhouse gas quantification, validation and verification.
  - **Milton District Hospital Expansion:** The output specifications require the Private Partner to achieve the LEED 'New Construction' Silver rating certification. There is an onerous CAD2 million penalty in the form of liquidated damages to the Owner if the Private Partner fails to achieve the LEED certification within 24 months of substantial completion.

- **Consider energy targets:** Energy efficiency can be promoted by linking energy consumption to the payment mechanism. Rather than prescribing requirements, an energy painshare/gainshare approach can promote the private sector to incorporate energy saving measures into their design. Typically, the proposed energy consumption is considered during the bid evaluation process (part of the financial assessment). During the operating term the private sector performance is then measured against the target. It is essential that the Owner invests in developing their understanding of the energy usage of their asset during the project planning phase to establish a realistic energy benchmark.
  - **Infrastructure Ontario model:** In the Infrastructure Ontario model, the energy unit pricing is a risk borne by the Owner, however the energy consumption risk is shared using a painshare/gainshare mechanism. On this basis, actual energy consumption is measured annually against the energy target for that year.
  - **Agadir Mutualized Desalination Plant:** The output specification requires the energy that powers the asset to be generated from renewable sources. The Owner also desires to minimise energy consumption and the output specification incentivises the Private Partner to optimise the plant and minimise energy use by linking payment to energy consumption; the Private Partner can increase their profit by reducing their energy consumption. This approach allows the Private Partner to make trade-offs between energy costs over the term and a design solution which exceeds minimum requirements. As a result, the Private Partner decided to include an energy harvesting turbine which reduces the overall energy use of the facility.

24 Further information available at: https://www.buildinggreen.com/leed

25 Further information available at: https://sustainableinfrastructure.org/

26 Further information available at: https://www.edgebuildings.com

27 Further information available at: https://www.breeam.com

7 Alignment of the project with economic and development strategies (SDGs, national policy etc) Ability of the asset to respond to changes in resource availability, population levels, demographics and disruptive technology.

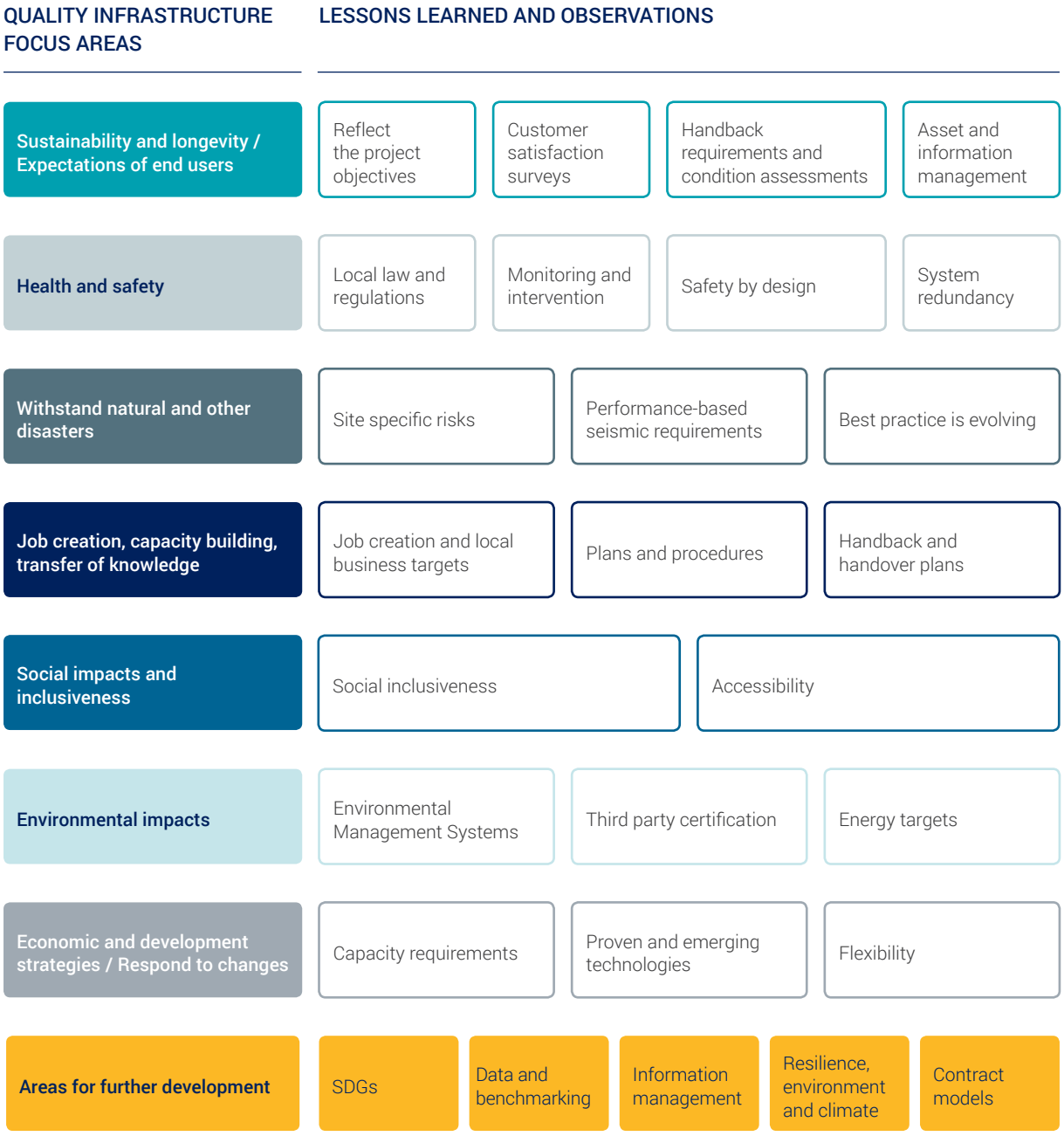
Ensuring alignment with economic and development strategies, and ability to respond to changing priorities or needs including aspects of climate change, population growth and disruptive technology at the national and regional levels.

- Identify how the projects align with economic and development strategies and reflect these in the project objectives and performance measures.
- How the requirements either foresee potential changes or refer to contractual mechanisms that allow future changes to be adopted.

- **Ensure that output specifications define capacity requirements:** The scale and scope of the asset is developed by the Owner during the planning stage and is informed by studies and assessments. The output specification then details the scale and scope in terms of measurable outputs. One approach to respond to growth and expansion is to develop mechanisms in the contract (rather than the output specification) that describes the process to deal with specific changes, and how those changes will be priced if they were to occur. An alternative approach is to build in additional capacity during the initial construction project. The approach will depend on the project and on the understanding of the likelihood and impact of demographic changes.
  - **Mersin Integrated Health Campus:** The design objectives indicate provision of a total capacity of 1,259 beds within the campus. The expectation was that the facility would not operate at full capacity in the earlier years but would allow for population growth. Volume-related services were provided under the payment mechanism with a guaranteed minimum capacity (70%) with occupancy above that level managed through a monthly adjustment and an annual reconciliation of actual occupancy. Expansion is to be managed through the variation procedure in the contract.
  - **Plan France Très Haut Débit (Rural Highspeed Broadband):** The Private Partner is required to take into account potential demographic growth providing an additional capacity of 20% in the design of the network and is also required to check with local authorities if real estate developments are planned in the area.
- **Consider both proven and emerging technologies:** For projects that have a critical technology component, such as waste, water and energy projects, it is common for the output specifications to require proven technology. The contract then typically incorporates mechanisms to allow changes in the future to incorporate new solutions at the Owner's cost.
  - **Agadir Mutualized Desalination Plant:** The Private Partner can propose new technologies throughout the project term to allow the Owner to incorporate new and emerging technologies. This is accommodated in the contract, not in the output specifications.
- **Consider flexibility in rapidly changing areas, such as by the Owner retaining the ICT risk:** To address technology developments associated with services in the built environment, a current approach is for the Owner to retain the ICT, or a short-term contract is awarded, often three to five years, during which the needs are more predictable.
  - **Lewisham Grouped Schools:** The Private Partner's involvement with ICT is limited to provision and maintenance of the infrastructure, while the Owner retains control of hardware (initially provided by the Private Partner through the equipment schedule, but maintained and replaced by the Owner), software and internet provision.
  - **PPP Prisons Program (Lots 1-3):** For the new prisons contracts, the expected performance levels for rapidly evolving technology equipment (such as CCTV or security) have been reformulated to allow private partners more flexibility in defining technical characteristics so they can focus on performance objectives for each equipment.

The SDGs were published in 2015 and given that the case studies selected were nearing construction completion or in operation, the specifications reviewed do not explicitly mention the SDGs. The alignment of output specifications with the SDGs and other global agencies is an appropriate area for further study as discussed in the conclusion.

Figure 10: Summary of QI focus areas and lessons learned



7. Conclusion and areas for further development

The Reference Guide focuses on leading practices in establishing output specifications to deliver quality infrastructure through harnessing the advantages of long-term contracts that adopt a life-cycle approach. While most case studies reviewed are projects delivered under a broadly defined PPP approach, many of the lessons learned will also be applicable to other types of long-term contracts.

The output specification is central to ensuring the government policies aimed at developing quality infrastructure are translated into the contractual documents to be delivered at a project level. However, a quality, project specific output specification is only one element that supports successful project delivery. The output specification should be considered alongside other elements that, when combined, will improve the infrastructure quality and project success. These include:

- **Business case development:** a robust approach that promotes project appraisal where project objectives and outcomes are defined, affordability thresholds are established, and sponsor support is received.
- **Stakeholder engagement:** a structured approach throughout project planning and delivery to identify the end user requirements, and promote buy-in.
- **Risk based approach:** identifying, analysing and evaluating risks and using the knowledge of the risks to inform project decisions throughout project delivery.
- **Project governance:** structured to align with the organisation's governance and appropriate for the stage of project delivery, with clear roles and responsibilities, communication protocols, issues management and ultimately a single point of accountability.
- **Procurement approach:** selection of the procurement model is informed by an unbiased view of the project risk and the procurement evaluation process supports the selection of a capable Private Partner.
- **Contract structure:** the payment terms (including progress payments, completion payments, performance-based payments) will influence the Private Partner's priorities, so should be aligned with the Owner's project objectives.
- **Performance monitoring:** Owner contract administration, including commissioning and compliance checks, audits and reviews, and condition assessments, is required to confirm the Private Partner is delivering the scope they are contracted to deliver.
- **Asset and information management:** how the asset will be operated and maintained should be a focus of the planning phase and should be reflected in the risk identification process, the procurement process and evaluation and the output specification development.

While the Reference Guide focuses on output specifications as a driver of private sector innovation, efficiency and alignment with government aims, the case studies also highlighted that there are times when more prescriptive requirements are appropriate. In short, if prescriptive requirements are used, they should be used with intent - for a specific reason and a rationale that delivers value-for-money rather than as a default position. The use of prescriptive requirements should be informed by the project objectives, risk identification and allocation, the procurement model and contract term.

The research for the Reference Guide also highlighted that some areas of good practice have emerged more recently, such as on information management, climate adaptation, and adoption of the SDGs. The following paragraphs present some areas for further development, to promote greater alignment with economic and development strategies and deliver more and better quality infrastructure. The GI Hub hopes that this Reference Guide will be a stimulus to further operationalising the principles of quality infrastructure investment and welcomes any reader feedback and suggestions.

7.1 AREAS FOR FURTHER DEVELOPMENT

Further alignment with economic and development strategies including the SDGs: The United Nations' SDGs are a current approach to spearhead sustainable development and help support consistency in the way projects and governments promote alignment with economic and development strategies. The SDGs were published in 2015 and there is now industry guidance, such as the United Nations Economic Commission for Europe (UNECE) international PPP standards[28], that align with and promote the SDGs. Given the projects were selected based on the stage of development (nearing construction completion or operation), the specifications reviewed do not explicitly mention the SDGs, and this is an area which could be further explored[29].

Establishing data management, benchmarking and measurement for quality infrastructure: While the G20 has made progress in defining and developing principles for quality infrastructure, metrics of quality infrastructure that could be used to inform KPIs at the project level are still in the early stages of development. Improvements in data management and analytics offer the potential to strengthen the measurement and implementation of performance requirements. A consistent approach for the development and implementation of metrics could enable stakeholders at the project level to benchmark performance, which, in turn, could feed into improved lessons learned at a policy level.

Using established and emerging information management approaches to improve project outcomes: Over the past five years, a number of jurisdictions have begun to use BIM in a more consistent and strategic way to enable the efficient production, sharing and management of digital asset information which leads to improved whole-life performance, cost reduction and better risk management. Progress is underway on the development of international standards and the implementation of programs that aim to capitalise on the benefits of BIM adoption. For example, the UK Foreign and Commonwealth Office (FCO)[30] is currently (as of January 2019) delivering the BIM Pathfinder Programme. The program is delivered with partner countries including Colombia, Vietnam, Indonesia, Brazil, Mexico and Peru, and will conclude with the rollout of BIM on selected pilot projects which will form the case study for BIM adoption in each country.

Mainstreaming of resilience, environment and climate: In recent years, countries have become increasingly aware of the interrelationship between environment, climate and infrastructure and a number of countries have declared a climate emergency. This policy imperative is starting to feed more explicitly into contract requirements and best practice is evolving. As outlined above, some jurisdictions have developed their own design guidelines to respond to climate change risks, for example the Ministry of Transportation and Infrastructure in British Columbia, Canada, which has recently issued a new Technical Circular providing guidance to the engineering community on how climate change risks should be considered regarding maintenance, rehabilitation and new construction projects. We expect the output specifications to be increasingly aligned to the new policy objectives and sharing of approaches could help strengthen their broader adoption.

Consideration of broader contract models with flexibility to future change: The speed of change and uptake of certain disruptive technologies, such as in ICT, has led Owners to adopt a range of approaches to maintain flexibility, such as retaining the ICT components or adopting shorter term contracts. This Reference Guide has focused largely on projects adopting a range of PPP approaches, and while the lessons learned are broadly applicable, it could be useful to further explore other types of innovative contractual models that allow more flexibility to respond to change.

28 Further information available at: https://www.uneceppp-icoe.org/about-us/

29 Examples and further context can be found at: https://www.globalgoals.org/

30 Further information available in the downloadable report at: https://www.thenbs.com/knowledge/national-bim-report-2019

Glossary

8. Glossary

Where applicable, terms and definitions from the GI Hub *PPP Risk Allocation Tool 2019 Edition*[31], APMG International's *PPP Certification Guide*[32] and other globally accepted definitions have been adopted for consistency across the global reference documents.

Acronym	Description
Applicable laws	The laws and legal frameworks that apply to a given PPP contract and project. The applicable laws may depend on the country and jurisdiction in which the project is located, the law of the PPP contract, or some other consideration.
Authority/Owner/ Contracting Authority	The public sector or government agency that ultimately owns the asset constructed during the project and will take over control at the end of the PPP contractual period.
Availability based projects/payments	Projects which entitle a Private Partner to receive regular payments from a public sector client to the extent that the project asset is available for use in accordance with contractually agreed service levels.
Bankability	The ability of a project to be accepted by lenders as an investment under a project financed structure, or the ability of the project to raise a significant amount of debt financing by means of long-term loans under a project financed structure, due to the creditworthiness of the project in terms of sufficiency and reliability of future cash-flows.
Case Study	The case studies or projects that were reviewed as a part of the development of this Reference Guide.
Commercial Operations/ Service Commencement	The date on which the construction phase of the project is successfully completed (typically determined by some form of independent certification and/or testing regime); the scheduled commercial operation date represents a target date for such successful completion with failures to achieve that date having commercial consequences (typically delay liquidated damages and/or termination).
Conditions Precedent to Service Commencement / Total Completion	Defined minimum requirements for achieving Service Commencement/Total Completion. Service Commencement/Total Completion are linked to availability payments that are used to repay the project finance partners. The Private Partner is incentivised to deliver the project on time and to the required standard to receive payment.
Concession Agreement	The agreement outlining the terms on which the project will be undertaken (e.g. BOO, BOOT, BOT).
Construction phase/ D&B Phase	The period from when the Private Partner takes control of the project site (typically by reference to the date of signing or effective date (if conditional) of the concession agreement or the commencement of construction by reference to certain works) until the commercial operations date.
Deductions	A method set out in the payment mechanism by which payments to the Private Partner are reduced if it fails to meet the key performance indicators. Sometimes called 'Abatements'.
Demand risk projects	Projects which rely on demand forecasting (e.g. road and rail use) to determine the bankability of the project.

31 The Risk Allocation Tool can be found here: https://ppp-risk.gihub.org/

32 The PPP Certification Guide can be downloaded here: https://ppp-certification.com/pppguide/download

Acronym	Description
Default Points	Similar to the NPE Points, Default Points are assigned when defined events occur. Default Points have potentially higher consequences than the NPE Points, as contractual default could occur due to poor performance. Default Points are typically assigned to incidents that relate to health and safety, security, environment, quality and external communication/ commitments.
Default termination	Where an innocent party exercises its contractual right to terminate the concession agreement in whole or in part due to the other party's actual or anticipatory failure to perform its contractual obligations.
Design-Build-Finance-Operate/DBFO	The project structure whereby the Private Partner designs and then builds the project asset in question. It then finances and retains the responsibility to operate the project.
Final/Total Completion	The milestone that typically follows Substantial Completion once all outstanding non-conformances have been closed. The project is typically already in commercial operation at this stage.
Financial close	The point in time at the end of the procurement phase where the PPP contract has been signed, any conditions precedent for financing are met and financing is in place so that the Private Partner can commence construction.
Force majeure	An event, outside the control of the contracting parties, that results in one or both of the parties being unable to fulfil their contractual obligations. In common law jurisdictions the definition of force majeure is typically a matter of drafting and negotiation whilst in civil law jurisdictions is normally set out in the relevant civil or commercial code.
Handback	The transfer of the project assets, and responsibility for those assets, to the government or to a new Private Partner or new operator upon the termination or expiry of the PPP contract.
Investors	An independent third-party normally appointed by both the Private Partner and the Procuring Authority, whose remit is to certify that the construction works comply with the specifications and standards set out in the PPP contract.
ISO	Parties who provide capital to the project enabling it to commence, seeking to make gains on the monies provided in the form of interest payments or a proportion of profits from the project (i.e. equity return).
LEED	Leadership in Energy and Environmental Design (LEED) is one of the most recognised green building certification programs used worldwide. It includes a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes, and neighbourhoods that aims to help building owners and operators be environmentally responsible and use resources efficiently.

continued...

Acronym	Description
Lenders	Institutions that provide lending or debt capital to the project: mainly banks through loans and institutional investors through project bonds.
Liquidated damages/LDs	A specified monetary amount paid for a specific contractual breach that aims to compensate the injured party for the loss it suffers for such breach. Such amounts are agreed up front and in many common law jurisdictions must be a genuine pre-estimate of loss to withstand challenges that such regimes are unenforceable. Liquidated damages are also commonly referred to as agreed delay damages or penalties.
Non-Performance Event (NPE)/NPE Point:	A NPE means a failure by the Private Partner to meet a specific Performance Measure. Performance Measures relate to both the construction period and the operating term, and are quantifiable KPIs that are used to enforce the requirements by linking Private Partner performance to payment. Each NPE is assigned a pre-defined number of NPE Points to indicate the relative priority, and to increase payment deductions for more significant events.
Operations & Maintenance (O&M)	Operation and maintenance – where a party is responsible for the continual functioning of the project after the commercial operations date.
Operating term/ Operations phase	The functional stage of the project after the construction phase when it adequately operates, finishing with the end date of the agreement.
Output specification	The document outlining the levels of capacity from the project from a technical and financial perspective that are required in order to ensure the projected is built to the desire standard and is profitable.
Payment mechanism	The formulae used to assess performance of the project and to calculate the payments to be made to the Private Partner assessed against their compliance with the performance indicators
Performance indicators/ KPIs	Benchmarks to measure performance and of the project, or the parties' contribution to the project. These are typically referenced to the output specification and are the benchmark against which the Private Partner is incentivised to perform. If the Private Partner falls short of the performance indicators then typically deductions will be made and in persistent or material circumstances a right of termination may arise. It is imperative that the Contracting Authority runs a sensitivity analysis in the payment mechanism to calibrate the deductions.

Acronym	Description
Public-Private Partnership/PPP/P3	A long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance. See also Public-Private Partnership project definition in the introductory sections.
Private Partner/ Concessionaire/SPV/ Project Co	The entity from the private sector that undertakes the project typically through the use of a special purpose vehicle incorporated specifically and only for the purposes of undertaking the project.
Procurement agency	The agency acting on behalf of the Owner to manage the procurement of the project including qualification phase, proposal phase, award of the Project Agreement, construction phase and the concession period.
Project Developer/DB Contractor	The entity employed by the Private Partner or subsidiary to build the project. The entity employed by the Private Partner or subsidiary to build the project. Also often referred to as the design and build (DB) contractor or engineering, procurement and construction (EPC) contractor.
Review Procedure	Although the Owner transfers the risk of developing a compliant design, and successful construction to the Private Partner, the Review Procedure provides the avenue to provide comments, and review risks, throughout the project. The output specification typically identifies the deliverables that are subject to the Review Procedure. The Private Partner is incentivised to develop designs and deliverables that are compliant with the output specification to avoid potential schedule delays and rework to address comments.
Sponsor	The party that is the ultimate owner of the Private Partner. It invariably includes the major project parties such as construction contractor and commonly includes financial investors or funds. Sponsors will limit their liability to the project through the Private Partner but may need to give limited support or guarantees to the lenders of the senior debt, particularly during the construction phase.
Substantial Completion	The stage of a project where construction is sufficiently complete, in accordance with the contract documents, so that the Owner may use or occupy the asset (or portion of the asset) for the intended purpose and often signals the start of the operating term.

Part B:

Case Studies

Contents

Summary of Case Studies

	Sustainability & longevity/ Expectations of end users	Health & safety	Withstand natural & other disasters
BUILT ENVIRONMENT CASE STUDIES			
Milton Hospital - Canada	●	●	●
Mersin Integrated Health Campus - Turkey	●	●	●
Pan Am Athletes Village - Canada	●		
Lewisham Grouped Schools - United Kingdom	●	●	
PPP Prisons Program (Lots 1-3) - France	●	●	
ENERGY CASE STUDIES			
John Hart Generating Station - Canada	●	●	●
ICT CASE STUDY			
Plan France Très Haut Débit (rural highspeed broadband) – France	●		
TRANSPORTATION CASE STUDIES			
Central 70 (I70) Managed Lanes - USA	●		
Complementary case study: Presidio Parkway - USA			●
Gautrain Rapid Rail - South Africa	●	●	
Complementary case study: Melbourne Metro Rail Tunnel - Australia	●		●
Madinah Airport Expansion Phase 1 - Saudi Arabia	●	●	
Mactan-Cebu International Airport - Philippines (includes comparison to Japanese airport concessions)	●	●	
WATER AND WASTE CASE STUDIES			
Organic Resource Recovery Centre - Hong Kong	●	●	●
Agadir Mutualized Desalination Plant - Morocco	●		●

Job creation, capacity building, transfer of knowledge	Social impacts & inclusiveness	Environmental impacts	Economic & development strategies/ Respond to changes
●		●	
●	●	●	●
	●		●
	●		●
●	●	●	●
●		●	
●		●	●
●	●		●
●	●	●	
		●	
	●	●	●
●		●	●
		●	●

Source: Mott MacDonald

BUILT ENVIRONMENT CASE STUDY: CANADA

Milton District Hospital Expansion

Location
Milton, Ontario, Canada

Owner
Halton Healthcare

Private Partner
Plenary Health Milton LP (Plenary Group (Canada) Ltd, PCL Constructors Canada Inc.)

PPP Model
Design-build-finance-maintenance (DBFM)

Operating Term
30 years

Contract Value
CAD 512 million/USD 380 million[1]

Asset Class
Built Environment (Healthcare Facility/Hospital)

Awards

- 2018 Silver Infrastructure Awarded by the Canadian Council for Public Private Partnerships for its value for money, design, technological innovation and the role the hospital is expected to play in empowering medical excellence

The project by Halton Healthcare/Infrastructure Ontario was to expand the Milton District Hospital to keep pace with the unprecedent growth of Milton, Ontario, one of the fastest growing municipalities in North America. The hospital opened to the public in the fall of 2017. Infrastructure Ontario is the provincial procurement agency in Ontario, and Halton Healthcare is a multi-site healthcare organisation that operates three community hospitals, with the Milton District Hospital Expansion being their second PPP (P3) facility procured with the design-build-finance-maintain (DBFM) model.

1 Assumed conversion rate of CAD/USD = 1.35 as at May 15, 2019.

- The Milton District Hospital redevelopment project was intended to increase services most in demand including emergency, surgical, critical care, maternal newborn and diagnostic imaging. The project also includes increasing the overall capacity from 63 to 129 inpatient beds, with 80% single-patient rooms.
- The construction took place on a brownfield site and fully functional hospital site without disruption to essential and life-saving clinical services.
- Substantial Completion was reached on time and Final Completion was achieved seven months after Substantial Completion.
- The Private Partner is responsible for the provision of Facilities Management and Lifecycle Replacement for the duration of the 30-year operating period.
- The Project achieved the LEED New Construction (NC) Gold certification, a globally recognised sustainable accomplishment. The project has exceeded the contractual requirement of LEED NC Silver certification.

Output Specifications Development Approach Used

- The design and construction specifications are consistent with Infrastructure Ontario standard specifications. They were tailored for the project by drawing on lessons learned from previous healthcare projects.
- The Private Partner is required to work collaboratively with the Owner – during both construction and operations – to ensure seamless integration of infrastructure and systems. The output specifications clarify the delineation of responsibility for maintenance and lifecycle of the existing systems and the interfaces to the new systems.
- The IT, access control and security systems for the new facility also require full integration and interoperability between all three of the Owner's hospitals, which was translated into prescriptive requirements in the output specifications.
- **Lean design:** The project is intended to apply "lean" thinking and methods to maximise customer value while minimising waste. The overarching principle is to enhance clinical workflow, promote the efficient use of staff resources and improve the patient experience. As such, the design for the facility must demonstrate travel distance efficiency, separation of flows, line of sight, standardisation and process mapping.
- **Evidence-Based design (EBD) parameters:** Defined by the Centre for Health Design, EBD is the process of basing decisions about the built environment on credible research to achieve the best possible outcomes. The Private Partner must demonstrate the quality of their design for the facility through EBD parameters of natural light, view of nature and surroundings of the hospital (including requirements such "*generously proportioned exterior windows that allows the patient an obstructed view of the exterior landscape when viewed from a reclining position in the patient bed*"), patient control of indoor environment (including ability for occupants to make "*local temperature adjustment" by adjusting "room set point within limits set in temperature range field*"), patient and staff access to landscaped areas, intuitive wayfinding, quality of interior design, organisation and fit-out of patient and family accommodations.
- **OASIS standards:** The Ministry of Health and Long Term Care of Ontario is committed to its OASIS standards, which must be a founding principle of planning in all areas of the building and in all key operational processes in the province of Ontario. OASIS stands for: **O**perational efficiency, **A**ccessibility, **S**afety and security, **I**nfection prevention and control, **S**ustainability of the healthcare system.

Alignment to QI Focus Areas

Sustainability and longevity of an infrastructure asset

Ability of the asset to address the needs and meet the expectations of end users

Sustainability and longevity of the asset is mandated through the development and implementation of a maintenance program during a 30-year operating period, whereby the Private Partner must maintain the site and the facility per the service standards identified in the output specifications, maximising reliance on industry-recognised standards. An independent inspector is also appointed by both parties to assess the condition of the facility prior to handback at the end of the term and to confirm compliance with the Expiry Transition Requirements.

Key documents that the Private Partner must develop to ensure longevity of the infrastructure include the Preventive Maintenance Schedules (one year and five year), the Five-Year Maintenance Plan, and the Lifecycle Replacement Schedule. The Private Partner must also report on the activities undertaken in relation to the stated plans.

Expiry Transition Procedure: The Project Agreement includes an Expiry Transition Procedure for an Independent Inspector to carry out inspections of the facility. The Independent Inspector will perform an inspection of the facility and produce a Facility Condition Report not less than seven years prior to the end of the operating term and provide an update annually thereafter. A final Facility Condition Report will be delivered within 30 Business Days after the end of the operating term. The key aspects of the Facility Condition Report include:

- Assessing the Private Partner's business case related to capital replacement;
- Identifying "*any works required to ensure the Facility will meet the Expiry Transition Requirements, which are defined as each element of the Facility being:*
  - *in good operating order (and capable of performing in accordance with the performance specifications; and*
  - *in a condition where such element of the Facility will have a reasonable likelihood of completing its operating order*".
- Specifying the Independent Inspector's estimate of the costs that would be required to perform the Expiry Transition Works.

Reliance on industry-recognised standards: For all disciplines, the output specifications include a section on Legislation, Codes, Standards and Authorities.

The design, construction, commissioning and maintenance must be compliant with industry standards, such as the CSA Group standards (previously Canadian Standards Association). Some examples are provided below:

- CSA Standard Z32, Electrical Safety and Essential Electrical Systems in Healthcare Facilities;
- CSA Standard Z8000, Canadian Health Care Facilities;
- CSA Standard Z8001-13, Commissioning of Health Care Facilities;
- IEEE 519, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems; and
- IEEE Standard 1346, Recommended Practice for Evaluation Electric Power System Compatibility with Electronic Process Equipment.

The ability of the asset to continue to meet the end user expectations is measured throughout the operating period, through the availability mechanism that measures compliance with functional requirements, as well as satisfaction surveys and the Owner's ability to address significant or persistent non-performance of the Private Partner. Prescriptive requirements have been developed where required to ensure that the key priorities of the end users, including the Owner, are met. Examples of this include:

- **Customer satisfaction surveys** during the operating period to assess satisfaction with the services delivered by the Private Partner. The results of the Service Satisfaction Survey shall be provided to the Owner within 30 days following the completion of the Service Satisfaction Survey. The results shall include analysis of the results. The Private Partner must develop and implement an action plan if the ratings show poor or decreasing customer satisfaction.

Mechanisms used to achieve QI alignment	Market Comparison Analysis

Expiry Transition Procedure: In its Facility Condition Report, the Independent Inspector will estimate the costs that would be required to perform the Expiry Transition Works. If the costs estimated by the Independent Inspector are greater than the Private Partner's costs allocated to lifecycle works pursuant to the financial model, the difference shall be apportioned equally over the Payment Periods from the date of the Facility Condition Report to the end of the operating term. The Owner may deduct these amounts from each Monthly Service Payment and pay into a separate escrow bank account (upon escrow terms acceptable to the parties). As an alternative, the Private Partner may provide a bond or letter of credit in favour of the Owner. If the final Facility Condition Report identifies any Expiry Transition Works, the Owner may withdraw from the escrow account or call upon the letter of credit an amount equivalent to the cost of the Expiry Transition Works and return any remaining security to the Private Partner. Provided the funds in the Escrow Account and/or the Expiry Transition security are adequate to meet the Private Partner's obligations, the Private Partner will have no further liability.

Measurable performance requirement: Use of measureable Service Failures, which have associated failure points and deductions for each failure, which promote compliance with the Scheduled Maintenance Plan each month:

- *100% of all regulatory testing and maintenance completed in accordance with the Scheduled Maintenance Plan: 1 Minor Service Failure per month for non-compliance;*
- *Minimum of 85% of all other Scheduled Maintenance completed within the planned month and any deferred Scheduled Maintenance completed within the following month along with associated CMMS records.*

Customer satisfaction surveys: Failure to meet baseline ratings or a decrease in ratings is linked to Performance Indicators (Quality Failures), with associated Failure Points and Deductions.

Below is an example of a performance indicator associated with customer satisfaction:

% satisfaction score on the customer satisfaction survey no more than 5% lower than previous customer satisfaction score of the Baseline Survey, whichever is higher (per service).

Performance Action Plan (PAP): The Private Partner may be penalised if it fails to submit a Performance Action Plan or if it fails to implement the Performance Action Plan. The following penalties have been developed to incentivise the Private Partner's behaviour:

- *Where a complete PAP is not submitted within 5 Business Days ("Initial PAP due date"), a PAP Deduction of $1,000 applies as of the Initial PAP due date;*
- *For each subsequent week following the due date ("Subsequent PAP due date"), where the PAP is not submitted, a PAP Deduction of $1,000 applies as of the Subsequent PAP due date; and*
- *Where the key activities listed in the PAP (8-9 activities per PAP) are not implemented according to the milestone dates included in the PAP, a PAP Deduction of $500 per milestone date that is not achieved is applicable.*

Across asset classes in developed markets, it is common to have an independent party involved in the asset condition reviews leading up to handback. It is also common to commence these inspections years ahead of the end of term to allow the Private Partner to improve the asset condition if it does not meet the required standard.

The Availability Failure regime is considered to be a relatively standard approach across social infrastructure projects. Although the terminology may be different, and there are nuances in the application, the principle that the Private Partner shall have a defined time period to respond to and rectify a failure prior to incurring financial deductions is a typical approach. The response and rectification periods are classified based on the relative priority of the area.

Recent Infrastructure Ontario healthcare projects include a new type of availability failure called a 'System Failure'.
The System Failure responds to the increasing reliance on communication and information systems to effectively operate a hospital. It also reflects the impact of an outage, where multiple areas and rooms may be affected.

Alignment to QI Focus Areas	
	• **Performance Action Plan:** The Owner can request the development of a Performance Action Plan if it observes a significant or consistent non-performance of any services by the Private Partner during the operating period. • **Use parameters:** In the availability-based IO model, failure to achieve the use parameters may result in Availability Failures, whereby any of the following criteria are not compliant: – the "Accessibility Condition", – the "Safety Condition", or – the "Use Condition". • **Intentional prescriptive requirements in the Output specifications:** – **Smart Hospital Technology:** The Owner operates three healthcare facilities and requires the integration of ICT and security systems between all facilities. Interoperability between all three of the Owner's hospitals and homogeneity of ICAT systems, such as nurse call, patient wandering, infant abduction, duress, CCTV/security, real-time location and bed management systems, are key features of the Milton Hospital's Smart Hospital technology[2]. The technology allowing over 20 disparate systems to talk to each other intelligently is the Enterprise Service Bus (ESB), which captures all the alerts and alarms generated by these systems and shuttles them to the right destinations as defined by staff. – **Spaces designed for the unique prisoner population:** The project includes spaces designed to care for the hospital's unique prisoner population. The Town of Milton is home to two large correctional facilities, and prisoners from these facilities are frequent patients of the hospital. The facility's design includes a separate and discrete entrance, as well as a secure holding area in the lower level for prisoners attending hospital for outpatient services such as diagnostic tests. Two secure treatment rooms located inside the Emergency Department are available for prisoners requiring emergency care. These spaces were planned with inputs from Correction Services staff so that care could be taken to meet their unique needs while respecting the dignity and confidentiality of the prisoners.
Ability of the asset to withstand natural and other disasters, including climate change	The output specifications require a building to be developed that can respond to extreme weather conditions. The output specifications detail the physical requirements to accommodate the Owner's response to a large-scale disaster. • **Building testing and commissioning:** Through a comprehensive commissioning process, the Private Partner must demonstrate that the facility can withstand extreme weather conditions. These include wind uplift testing, flood testing and thermographic surveys of the roof to ensure acceptable level of tightness after exterior envelope has been completed. • **Accommodation for large scale disasters:** The Ontario Ministry of Health and Long-Term Care has implemented a program to equip all hospital sites that offer emergency/urgent care with a standardised package of chemical, biological and nuclear exposure supplies and equipment. In order to meet these requirements, the Private Partner is required to meet a number of criteria to satisfy accessibility criteria of the tent. For example, the Private Partner must provide 200 square feet of storage space for the Owner's chemical, biological and nuclear exposure tent. The door shall be able to be connected to one of the doors of the ambulance garage.

2 Smart Hospital technology supports efficient work flows and creates a safer environment for care, by using and integrating state-of-the-art technologies.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Availability Failures: The Private Partner may be subject to deductions from its monthly service payments if an event is not rectified within the relevant Rectification Time and which causes a Functional Part to be Unavailable – this is the definition of an Availability Failure, which is a key aspect of the Infrastructure Ontario model. In addition to financial deductions, the Private Partner is subject to Failure Points, which may be awarded in respect of the Private Partner's Service. If the Private Partner accrues Failure Points in excess of pre-defined thresholds, then the following step-in rights are triggered: • Warning Notices • Monitoring Notices • Owner Remedial Rights • Private Partner Events of Default However, the Private Partner may be relieved from Failure Points and Deductions if it can do any of the following: • Temporary Repairs: "*[…] if the Temporary Repair is effected within the specified Rectification Time and the Permanent Repair is effected by no later than the Permanent Repair Deadline, no Service Failure or Availability Failure will occur, and no Deduction may be made, in respect of the Event*". • Temporary Alternative Accommodation: "*if Halton Healthcare accepts the Private Partner's offer of Temporary Alternative Accommodation, no further Deductions shall be made or Failure Points awarded in respect of a Functional Part vacated by Halton Healthcare while the Temporary Alternative Accommodation replacing that Functional Part if being used by Halton Healthcare*"	
Condition precedent to Service Commencement Building testing and commissioning is condition-precedent to achieving Substantial Completion. An individual licensed and authorised by the Association of Professional Engineers of the Province of Ontario shall undertake the role of "Commissioning Authority" as specified in the CSA standard Z320-11 [Building Commissioning Standard and Check Sheets]. This standard specifies commissioning requirements for newly installed building systems.	Across asset classes in developed markets, it is common to have independent parties validating compliance with the output specifications, in particular during construction and commissioning. Third parties, such as the Commissioning Authority/Agent or the Independent Tester/ Certifier (which are typically selected through a competitive process and jointly funded by the Owner and the Private Partner to provide independent oversight and monitoring of construction progress and quality), are safeguards to monitor compliance with the output specifications.

Alignment to QI Focus Areas	
Health and safety considerations during both construction and operation of the asset	Patient safety is paramount in the output specifications for the Milton District Hospital. As such, the Private Partner must provide a complete security management system. In addition, all security systems have UPS and emergency generator power to support the operation of the system in the event of a power loss. Healthcare organisations are expected to provide safe and reliable services to their patients. Mechanical and electrical systems constitute the operational infrastructure that permits safe patient care. As such, planning appropriate response and recovery activities for a failure of the facility's mechanical and electrical systems is essential to satisfy this expectation. **Reliable utilities with N+1[3] redundancy:** The output specifications include provisions for selected equipment, devices or systems to be provided in sufficient quantity and capacity such that should the largest unit fail, the design load of the system served will still be met. Some of the most important systems that require redundancy include heating and steam systems, cooling plant main equipment, exhaust high efficiency particulate air (HEPA) filters for air-borne precaution room exhaust ductwork, and mechanical systems that support the medical gas systems (i.e. medical gas room ventilation fans). In addition, computer room air conditioning (CRAC) units must be provided in sufficient quantity to provide a redundancy level of 2*N units, where the number of CRAC units required to service the room cooling load is n. **Elevators:** Similarly, the functionality and availability of elevators are key to ensure the health and safety of building occupants. The Private Partner is required to measure, record and report on elevators' availability. Given the nature of the facility and potential poor health conditions of patients, in the event of a mechanical failure during the operating period, elevator occupants must be released from the elevator as soon as practicable and in any event within 45 minutes.
Job creation, capacity building and transfer of knowledge and expertise	Knowledge transfer from the Private Partner to the Owner occurs at three stages during the project: • during commissioning and prior to operations; • as part of the Services provided by the Private Partner; and • prior to handback at the end of term. The training and transfer of knowledge applies to both the general facility users, as well as the Owner's staff that will be operating the equipment and systems designed and constructed by the Private Partner. • **General orientation and training support:** As such, the Private Partner must develop and implement, in collaboration with the Owner, a service orientation program for relevant Owner staff which they will conduct initially and then when the Owner changes key staff at the facility. Similarly, the Help Desk Services also include ad-hoc training as may be required to ensure the Owner's occupants are aware of procedural updates. • **Specialised training:** The Private Partner must provide specialised training to the Owner's staff to facilitate the appropriate operation of the facility. As it relates to the operation of security systems, the Private Partner provides a plan and procedures for training and subsequent re-training of Halton Healthcare staff on the security and surveillance system. The Private Partner will provide the Owner's employees with appropriate cleaning services training and guidance on the techniques and products to use in the care of all surfaces and fixtures.

3 N+1 redundancy is a technical term that means there is one independent back-up to run the system.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Key Performance Indicator (KPI) The provision of reliable utilities to the facility is a KPI of the Private Partner's performance, and in the event that there is a disruption from the Utility Company, backup systems shall function as intended. In the event the Private Partner fails to comply with this key performance indicator, material financial penalties will be applied to its monthly service payments. **Elevator Availability Failures:** Should the Private Partner fail to rectify an Elevator Availability event within the applicable time period, and the event is impacting the Owner's ability to use the elevator in question, the Private Partner will be subject to a deduction from its monthly service payment. The amount of the deduction is based on the number of elevators that remained operational. The output specifications also include a performance indicator whereby in no case will scheduled maintenance be allowed to take more than one elevator out of service at a time.	Redundancy requirements for key mechanical and electrical equipment are common for healthcare facilities in developed markets, and the Private Partner is often exposed to hefty penalties in the event of outages. Similarly, elevators are of critical importance in the healthcare sector, and elevator availability mechanisms are often incorporated in the contractual structure to incentivise a quick response to unavailability events.
Review procedure: Training, and orientation materials and Policies and Procedures are subject to Owner review. **Performance Indicators:** There are performance indicators associated with the provision of training and orientation to the Owner's staff. Failure to comply with the performance indicators is subject to deductions from the monthly service payments during the operating period. Similarly, failure of the Private Partner to comply with Policies and Procedures is subject to deductions from the monthly service payments.	Across asset classes in developed markets it is common practice for the Owner to be given the opportunity to review, provide comments, and request changes to the operational policies, procedures, training and orientation material, to ensure the interfaces between both parties are managed. Annual reviews of these documents are also standard to incorporate any lessons learned or updates. Additionally, it is common practice for the Private Partner to provide training to the Owner staff on the operation of equipment prior to Service Commencement, as part of the commissioning process.

Alignment to QI Focus Areas	
	• **Operational policies and procedures:** Prior to the start of the operating term, the Private Partner was required to develop policies and procedures including manuals intended to guide the on-going operations and maintenance activities of the Facility. The policies and procedures were developed in collaboration with the Owner. The output specifications set out the process to develop project-specific policies and procedures 18 months prior to the start of the operating term, with time for the parties to identify and develop specific interface requirements and ensure that expectations of end users are taken into consideration in the day-to-day management of the facility. By starting their development so early in the project, the output specifications introduce an opportunity for proactive coordination between the facility owner and the Private Partner in the development of Policies and Procedures. The policies and procedures are to be updated annually during the operating term, giving an opportunity for the parties to assess whether the needs of end users are appropriately addressed, build on lessons learned, and make any changes where required. The policies and procedures address, for example, "communication procedures", "operational issues resolution", and the management of all services performed by the Private Partner.
Environmental impacts	Environmental objectives are core priorities of the Infrastructure Ontario PPP model for healthcare facilities, and a robust incentivisation mechanism has been implemented to ensure the objectives are met. • **Third party certification (Leadership in Energy and Environmental Design (LEED) New Construction (NC) certification[4]):** The output specifications require the Private Partner to achieve the LEED NC Silver rating certification at a minimum. Targeting LEED certification addresses climate and site-specific design issues that help it to achieve a sustainable and resilient design, while built-in adaptability allows for future flexibility. • **Energy target:** During competitive procurement in the Infrastructure Ontario model, all proponents have to demonstrate, by way of a Forecast Energy Model, that their facility shall have an annual energy intensity no greater than 2.0 GJ/m^2/year (= the mandatory energy target), including End User Loads and Secondary Facility Loads. The Forecast Energy Model is used solely for comparisons of the proponents' predicted building energy performance. – In parallel, all proponents (at bid stage) are also required to submit an Aggregate Energy Model, which is used to measure the Annual Energy Target for the facility. The Annual Energy Target subsequently becomes the first year Annual Energy Target for the facility. Variations to the Aggregate Energy Target are calculated each year if changes are implemented that change facility load or energy usage, and changes to inputs of the energy model, such as weather data or equipment rations, are updated each year. • **Environmental Management System:** The Private Partner must develop an environmental management system manual for the operating period, with environmental objectives and targets. The environmental operating procedures must comply with ISO 14001:2004 guidelines[5]. The Private Partner must also provide the Owner with environmental objectives and targets on an annual basis, which are reported on.

4 LEED, or Leadership in Energy and Environmental Design, is the most widely used green building rating system in the world. LEED provides a framework to create healthy, highly efficient and cost-saving green buildings. https://www.cagbc.org/

5 ISO 14001:2004 [Environmental Management Systems], by the International Organization for Standardization, specifies requirements for an environment management system to enable an organisation to implement policy and objectives which take into account legal requirements and other requirements to which the organisation subscribes, and information about significant environmental aspects. It does not state itself environmental performance criteria.

6 ENVISION is a standard for sustainable infrastructure and incentives higher performance goals, beyond minimum requirements https://sustainableinfrastructure.org/

Mechanisms used to achieve QI alignment	Market Comparison Analysis

LEED NC certification: there is an onerous CAD 2 million penalty in the form of liquidated damages to the Owner if the Private Partner fails to achieve the LEED NC silver certification within 24 months after the Substantial Completion Date.

Energy Painshare/Gainshare: In the Infrastructure Ontario model, the energy unit pricing is a risk borne by the Owner, however, the energy consumption risk is shared using a painshare/gainshare mechanism. On this basis, actual energy consumption is measured annually against the energy target for that year:

- Consumption between 95% and 105% of target = Private Partner risk (no painshare or gainshare)
- Consumption between below 95% of target = gainshare, with a split of the savings between the Owner and the Private Partner;
- Consumption exceeds 105% = the Owner will deduct all additional energy costs from Private Partner's monthly service payments

If the Private Partner is subject to an adjustment, then the Private Partner will submit a detailed remediation plan to the Owner to explain how it will reduce the energy consumption for the subsequent year.

Environmental Management System (EMS):
There are specific performance indicators associated with compliance with the Environmental Management System manual and compliance with ISO 14001:2004 guidelines. As such, the Private Partner is subject to material penalties if it fails to:

- perform Services in accordance with the Environmental Management System on an ongoing basis in a careful and environmentally responsible fashion to minimise effects on health and the environment;
- maintain appropriate records and audit processes; or
- develop and implement environmental operating procedures in the EMS manual that comply with ISO 14001:2004 guidelines.

Third party certification is a common approach to promote energy efficiency and building sustainability. The available certifications vary by location. A good practice approach is to define the credits that the Private Partner must achieve in the output specification, so the certification aligns with the Owner's objectives. ENVISION[6] is a newer certification process for civil infrastructure projects and is increasingly being considered by Owners in North America. Alternatively, Owners (or governments) may have their own green building standard. For example, the Hong Kong Organic Recovery Centre was required to comply with the government's 'Green Building Performance Framework set out in the Development Bureau Technical Circular (Works) No 2/2015'.

The use of energy targets and consumption painshare/gainshare is common across markets and sectors but is not standard (for example it is not used in Turkey, where the requirement is limited to monitoring consumption).

BUILT ENVIRONMENT CASE STUDY: TURKEY

Mersin Integrated Health Campus

Location
Mersin, Turkey

Owner
Ministry of Health (MoH), Turkey

Private Partner
CCN Health (Construction and Concession Nexus)

PPP Model
Design-build-finance-operate (DBFO)

Operating Term
25 Years

Contract Value
EUR 270 million/USD 303 million[1]

Asset Class
Built Environment (Healthcare)

Awards

- Best PPP Project award in the Middle East and Eastern Europe region at the EMEA Finance awards 2014

Opened on February 3, 2017, Mersin Integrated Health Campus (IHC) Project was the first and largest project within the Turkish Ministry of Health PPP program to reach financial close and become operational. Project financing amounting to EUR70 million was provided by three local and foreign banks.

The hospital was assessed by the international non-profit organisation HIMS (Healthcare Information and Management System) for digital hospital qualifications and rated as an EMRAM (Electronic Medical Record Adoption Model) Stage 6 or Digital Hospital.

1 Assumed conversion rate of EUR/USD = 0.89 as at May 15, 2019.

Services delivered under the PPP agreement included a full package of hard and soft FM services including: Building and Grounds Maintenance; Cleaning, Pottering, Catering; Hospital Information Management System (HIMS) and Linen and Laundry; and some clinical support services (such as rehabilitation, disinfection and sterilisation, imaging and laboratory services).

The Project is part of the Administration of Health of the Republic of Turkey's Health Transformation Programme, supported by the World Bank, which aims to:

- Renovate the insufficient healthcare infrastructure that will not meet increasing healthcare demands;
- Bring together smaller hospitals under one campus; and
- Increase service quality and efficiency.

The Mersin IHC – PPP has a total capacity of 1,259 beds, consisting of: 25-bed Core Hospital; 458-bed General & Oncology Hospital (Tower 1); 396-bed General, Cardiovascular & Psychiatric Hospital (Tower 2); and 380-bed Women's & Children's Hospital (Tower 3). In total there are 264 polyclinics, 138 Intensive Care Units (ICU) and 59 new-born ICU units.

Output Specifications Development Approach Used

The detailed output specifications used for the Mersin IHC project are in standard form and consistent with those used across the Turkish Ministry of Health PPP program, including design and construction (specific to each site), general facilities management (FM) services and clinical support services. The design and construction specifications list the design requirements for the building supported by a Schedule of Accommodation, which is an indicative size guide, a proposed number of beds and additional comments regarding expectations for the operation of the area, along with a list of permits to be obtained by the Private Partner. The output specifications also refer to the Turkey Healthcare Buildings Minimum Standard Guidelines, which provide a measurable standard from which to develop the Mersin IHC project.

Alignment to QI Focus Areas	
Sustainability and longevity of an infrastructure asset	Longevity of the asset is assessed and sanctioned towards the end of the operating term through the assessment of compliance of the facility with handback requirements. The handback requirements are tied to three criteria: • The facility has been maintained throughout the operating term in compliance with the "Maintenance Repair Services and Method Statement"; • The facility complies with the "design life requirements set forth in the Technical Specifications"; and • With respect to commercial areas (as opposed to health facilities), the facility complies with the Turkish Commercial Code Prudent Tradesman Provisions in relation to similar facilities' condition, except for the wear and tear caused by usage.
Ability of the asset to address the needs and meet the expectations of end users	**Scope of services transferred:** The clinical support services have been transferred to the Private Partner to minimise the interface risk. In fact, given the large scale of hospitals in Turkey more generally, the transfer of clinical support services reduces the contract management risk for the public sector. **End user needs and expectations:** End user needs and expectations were taken into account at all stages of the project's development – in the initial business case, which led to the development of project-specific output specifications, through the ongoing assessment of end users' satisfaction during the 25-year operating term – by aligning requirement with performance measures, and through the ability to make changes to the facility and/or the services provided by the Private Partner with a formal Variation Procedure: • The scope of works was developed as part of the initial business case based on the needs of the local population and anticipated growth statistics, enabling the amalgamation of several smaller health facilities into one larger campus. The merger of multiple small facilities into large campuses was the aim across the PPP Health program in Turkey. • User satisfaction surveys are given prominence by the inclusion as a monitoring method, with an additional requirement to undertake a quarterly survey for some services. • There is a formal Variation Procedure which enables changes to be made to the buildings or services, subject to agreement by the Owner and the Private Partner. More details on the Variation Procedure under the QI Focus Area: Ability of the asset to respond to changes in resource availability, population levels, demographics and disruptive technology. • Each service requirement applicable during the operating term has a corresponding performance parameter that describes the criteria used to determine whether the Private Partner has provided the service to the required standard.

2 The monitoring methods include the submission of reports, comparison with agreed method statements, comparison against agreed criteria (benchmarks), self-monitoring, user satisfaction surveys (administration staff, visitors and patients), review and reports by statutory bodies, and audits by the Owner (analysis of complaints, random visits, validation checks of the Private Partner's data, deliberate testing, etc.).

Mechanisms used to achieve QI alignment	Market Comparison Analysis

Independent building survey: A component of the handback process is an independent building survey. Prior to handback an independent building survey is to be undertaken to assess the outstanding works required to meet the handback standards. This typically takes place up to three years prior to the expiry date and involves the Owner and the Private Partner appointing a third party to undertake a condition survey of the facilities.

If it is found that any component of the facility is not consistent with the handback requirements, the Private Partner shall provide the following within 10 business days, which is subject to review by the Owner:

- *The works required to meet the handback requirements (the "Handback Works");*
- *The method and schedule for carrying out the Handback Works (the "Handback Programme"); and*
- *The cost estimate for carrying out the Handback Works (the "Handback Costs").*

The Private Partner is required to provide a bond to the value of the Handback Works which is released on acceptance of the Handback condition.

User satisfaction surveys: User satisfaction is one of the listed monitoring methods in the output specifications, with user surveys of Owner staff, company personnel, visitors and patients to be undertaken four times a year. The surveys are managed electronically through the Private Partner help desk and are provided to patients in hardcopy. Where satisfaction falls below 85%, the Private Partner must develop and implement an action plan.

In addition, a range of meetings (including weekly, monthly, bimonthly, quarterly and annually depending on the attendees) are held with all project stakeholders to assess satisfaction with the level of service delivery and any additional needs.

KPIs and mechanisms to address poor performance:
Each performance parameter (or KPI) has a specified service response time in which to respond to a service failure or service request, and a service correction time in which to take the necessary corrective actions to rectify the service failure or complete the service request. The response and service correction times are measured once the event is registered in the Private Partner's helpdesk system. Each performance parameter has also been allocated a monitoring method[2] that describes how the parameter can be measured. If, in any given month, the Private Partner is given "*more than the number of Service Failure Points listed for the relevant Service*", as defined in the Project Agreement, then "*the Administration shall give a written notice to the [Private Partner]*". If the Private Partner receives three or more written notices in any three-month period in relation to any service, the Owner may increase the monitoring level of the Private Partner's performance.

The output specifications and performance indicators for the Mersin IHC project, and more generally in Turkish P3 and Latin American PPP projects, are more prescriptive than on many other European or Canadian PPP projects. This is primarily associated with the politics, culture and perspectives of the country. One public sector perspective, found in Europe and Canada, is that each party will act with professional integrity and "act reasonably" in the delivery of works and the approach to partnering, resulting in more performance-based requirements. The alternative public sector perspective, found in Turkey and Latin America, is that unless a requirement is written down exactly it won't be done leading to more prescriptive requirements.

The service scope is consistent with other Health PPP projects in Turkey/Middle East and Southern Europe; however, in other mature PPP markets, including Northern Europe and Canada, it is not so common to flow down this scale of services, with many countries limited to just hard FM-type services.

Alignment to QI Focus Areas	
Health and safety considerations during both construction and operation of the asset	The output specifications for the Mersin IHC project address health and safety considerations at both the construction and operational phases of the project. • **Legislative requirements:** Generally, the Private Partner must "*comply with the provisions of the Labour Law and the legislation on the worker's health and safety in effect for all works performed by it during the Construction Period and the Operation Term*". As such, the project's design and construction must comply with the Turkey Healthcare Buildings Minimum Design Standard Guidelines. • **Health and Safety Manual:** As it relates to the operating term, the Private Partner must develop and maintain a "Health and Safety Manual" and must ensure that service delivery complies with the policies and procedures therein. Some key health and safety requirements include the provision of personal protective equipment (PPE), frequent (at least annual or as required) risk assessments, and training for all staff.
Ability of the asset to withstand natural and other disasters, including climate change	**Designing for seismic risk** In the event of an emergency, the facility would be of critical importance to respond to the increased healthcare requirements of the community. This was a key factor that was considered when developing the output specification to ensure that the structure can support clinical service delivery in the event of an earthquake. There has been significant investigation into the seismic risk for the site. The ground conditions encountered across the site are categorised as a lower-risk zone under the Turkish Earthquake Code (2007). The seismic design requirements follow the standard applicable requirements of the Turkish Earthquake Code. Seismic isolators[3] were initially included as a requirement in the output specifications issued to the bidders. However, the Private Partner carried out a study and concluded that because the site is located in a low-risk seismic zone, the required performance level can also be achieved without seismic isolators. The Owner ultimately approved the Private Partner's approach and removed the requirement for seismic isolators. **Disaster Recovery and Emergency Action Plans** In the Owner's Disaster Recovery Plan and Emergency Action Plan, some key duties have been transferred to the Project Company. The Private Partner's responsibilities are as follows: • "*The [Project] Company shall fulfil its duties and responsibilities in the "Hospital Disaster Plan" prepared by the Administration and shall provide all kinds of support in the preparation stage. It shall update the tasks assigned to it in the Hospital Disaster Plan in each year or in the context of the changing situations in order to comply with the changes in the Administration Practices, technological developments and changes in legislation, when necessary:* a. *The [Project] Company shall provide the fire exercises and evacuations containing the fire prevention procedures and the [Project] Company shall provide the Services in compliance with this contingency plan, including staff training and awareness, and fire drills/evacuations;*

3 Seismic isolators, also called base isolation system, are one of the most popular means of protecting a structure against earthquake forces.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Performance indicators: The payment mechanism includes deductions from the Private Partner's payments should the Private Partner fail to comply with Occupational Health and Safety and Emergency Planning performance indicators (with reference to health and safety standards and practices of the Owner). KPIs include: • *"A comprehensive and up to date health and safety manual is available; used by all Project Company Staff and Administration Staff, and service provision is delivered in accordance with the current health and safety manual""* • *"Operate and adhere to reporting procedures for accidents and/or breaches of statutory health and safety obligations are available, known and understood by all staff and adhered to as agreed with the Administration";* • *"Staff are provided with suitable, appropriate and Turkish Standard or EU equivalent compliant personal protective equipment (PPE) and clothing including but not limited to:* *a. Uniforms* *b. Gloves* *c. Safety Glasses* *d. Plastic Aprons* *e. Shoes"*	Specifying compliance with legislation is consistent with other global projects and is typically the minimum requirement. Some projects specify specific health and safety requirements, particularly if there are access or operational constraints (i.e. an extension to an existing asset). In addition, the requirement to work alongside the Owner to produce plans consistent with policies is also included in many projects (health and other sectors).
Detailed surveys and geotechnical site investigations: Detailed surveys of the whole area were executed jointly with the geotechnical site investigations (boreholes, surface water and groundwater studies, in situ tests, geophysical tests, laboratory tests, seismicity and assessment of earthquake hazard, etc.) in preparation for the commencement of the detailed design. The Private Partner is required to design and deliver a facility that complies with the output specification to receive the service payment.	It is typical that a PPP project would include a Force Majeure clause that includes earthquakes. In Canadian projects, the Force Majeure clause typically only applies if the damage caused exceeds a defined threshold (depends on the project but is linked to insurance values). This approach can also incentivise the Private Partner to design for and mitigate the risk. Refer to the John Hart Generating Station Case Study in the Energy Case Study section for an example of an output specification that adopts a performance-based requirement for seismic design.

Alignment to QI Focus Areas	
	b. *"Emergency Action Plan" defining how [the Project] Company will manage each risk specified in the Hospital Disaster Plan and identifying any required remedial actions to be taken. This shall include communication protocols with the local emergency services for the development of the Disaster Plan;* c. *Service Specific Risk Assessments.* *"Each plan shall be developed in co-operation with the individuals listed below:* *1. Administration's fire safety officer* *2. Local authority fire department manager* *3. Emergency services units"* **Earthquake risk allocation** Despite the above Private Partner responsibilities, the Project Agreement includes provisions for relief as it relates to Force Majeure. Force Majeure includes events that "occur (directly or indirectly) due to a natural cause or a human act or a negligence beyond the Project Company's control and which do not arise as a result of any act of negligence or fault by the Project Company or the occurrence of which the Parties could not avoid or timely prevent or mitigate using their best efforts and diligence, and which prevent the Project Company from fulfilling any or all of its obligations hereunder partially or fully: a. *natural disasters* b. *legal strikes, or civil rebellion that may affect the country* c. *epidemics* d. *declaration of partial or general mobilisation and war.*
Job creation, capacity building and transfer of knowledge	**Transferring knowledge to the Owner in preparation for handback** Knowledge transfer is a core element of the handback requirements at the end of the 25-year operating term when the site will transfer back to the Owner. The Handover Plan is required to include detail on employee retention and training. Similarly, the Handover Plan shall ensure that all asset documentation (for example as built drawings, operational manuals, warranties still valid) would be handed over to the Owner to ensure asset knowledge is not lost. It is worth noting that at contract expiry, the Private Partner operational staff may also transfer to the Owner to ensure continuity.
Social impacts and inclusiveness	**Accessibility provisions in the output specifications** The facility is intended to be inclusive, with accessibility provisions incorporated in the output specifications. As such, the facility must comply with the Turkish disability legislation, and the Private Partner is required to "*ensure access routes comply with disability legislation*". More specifically, the output specifications highlight that the facility must "*include access provisions for cars or minibuses to set down disabled or elderly people at entrances, safely and without hindrance*".
Environmental impacts	During the operating term, the Private Partner is responsible for the performance of Environmental Management services with responsibilities as follows: a. *"Environmental policy;* b. *inspections of regular intervals of organization's environmental aspects;* c. *setting objectives and targets to improve environmental impacts;* d. *operational control procedures;* e. *monitoring and recording;* f. *role allocation and training;* g. *non-conformity and corrective action processes;* h. *review of system audit and management."*

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Handover Plan: The details of the Handover Plan are not laid-out in the contractual requirements, but will be developed by the Private Partner in collaboration with the Owner towards the end of the operating term.	The requirement for a Handover Plan is typically included on most PPP projects, with asset documentation a key part of this. Increasingly, there are requirements for building information models (BIM) to be maintained throughout the operating term to improve asset management and the transfer of knowledge at handback.
Review procedure: During construction, the MoH's internal technical team monitors construction progress against the program, key milestones and the quality elements of the output specification (using Schedule of Accommodation, Room Data Sheets and the Design and Construction requirements). This allows inconsistencies, defects, failures or derogations to be highlighted throughout the construction phase, with the technical team visiting the site typically on a monthly basis.	Accessibility provisions are standard practice in healthcare PPP projects, and local standards and regulations form the minimum requirements.
Performance indicators: Alignment with environmental requirements is assessed and sanctioned during the Operating Term through the performance indicators, which are an integral part of the Payment Mechanism. The performance indicators address compliance with ISO 14001 accreditation, as well as the integrity and functionality of energy supply. Energy monitoring is only required for specific volume related services and therefore there are no energy consumption targets, and there is no general pain/gain share mechanism associated with energy consumption. However, there are performance indicators associated with the optimisation of the supply of energy to the assets, whereby failure to rectify the loss of energy supply within one hour is subject to hefty penalties.	Globally ISO 14001 accreditation is a commonly used standard for environmental management. It is worth noting that in some jurisdictions the full accreditation is required, whereas in other jurisdictions (including Ontario, Canada), the requirement is for the Project Companies to comply with ISO 14001, but they are not contractually required to obtain the formal accreditation.

Alignment to QI Focus Areas	
	The output specification adopts an international standard to define the level of performance. • **ISO 14001 [Environmental Management]:** The output specifications for the project require the Private Partner to obtain and maintain accreditation to ISO 14001 [Environmental Management][4]. Compliance with ISO 14001 at all times helps control environmental aspects, reduce impacts and ensure legal compliance.
Ability of the asset to respond to changes in resource availability, population levels, demographics and disruptive technology	The design objectives indicate provision of a total capacity of 1,259 beds within the campus. The expectation was that the facility would not operate at full capacity in the earlier years but would allow for population growth. Volume-related services were provided under the payment mechanism with a guaranteed minimum capacity (70%), with occupancy above that level managed through a monthly adjustment and an annual reconciliation of actual occupancy. Expansion is to be managed through the Variation Procedure process. Hospital occupancy is based on local population statistics examined during the scoping phase for the project with a view to some future proofing to allow for expanding population if applicable. The project combined several smaller local facilities into one campus meaning that local hospital occupancy statistics were available. Managing volume-related services, such as catering, linen, and clinical support services, at 70% guaranteed minimum occupancy means the Owner pays only for the required services in the early years but incentivises the inclusion of future proofing into the facilities.

4 ISO 14001 [Environmental Management] is a globally-recognised standard, and the principal management system standard which specifies the requirements for the formulation and maintenance of an Environmental Management System.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
The following are examples: • *"The integrity of electrical supply to essential circuits and distribution networks is maintained at all times":* • *"The integrity of water supply is maintained at all times";* • *"The integrity and functionality of the sewage and effluent disposal system are maintained at all times".*	
Variation procedure: The Owner and the Private Partner are required to comply with the Variation Procedure. As such "*in case of a Qualifying Variation […], in the event that the Administration and the Project Company agree to adjust in relation to the Availability Payment, the Administration shall compensate the Project Company for the relevant capital expenditure by adjusting the Availability Payment*". As such, the Owner and the Private Partner shall come to an agreement on the following matters: • *"Monthly payment schedule reflecting the amount and timing of the costs to be incurred by the Project Company in carrying out the Qualifying Variation […]";* • *"The evidences that confirm the due performance of the portion that corresponds to each situation where the maturity date of a payment is due, within the framework of the Qualifying Variation payment schedule".*	Although occasionally 'soft' FM services are transferred to the Private Partner, the typical approach is to transfer only the 'hard' FM services. The demand for soft FM services is driven by occupancy, which is out of the Private Partner's control. Where 'soft' FM services are included in the PPP contract, it is typical to have a regime that guarantees a minimum payment but also allows services to be ramped up, as required, to meet occupancy.


Source: EllisDon

BUILT ENVIRONMENT CASE STUDY: CANADA

Pan Am Games Athletes' Village

Location
Toronto, Ontario, Canada

Owner
Infrastructure Ontario

Private Partner
Dundee Kilmer Developments LP (Dundee Realty Corp., Kilmer Van Nostrand Co. Ltd, EllisDon Corp., Ledcor Design Build (Ontario) Inc.)

PPP Model
Design-build-finance

Operating Term
N/A

Contract Value
CAD 514 million/USD 694 million[1]

Asset Class
Built Environment (Housing)

Awards

- Ontario General Contractors Association (OGCA), 2017 Ontario Builder Award[2] Brownie Awards, 2013 Best Overall Project[3]
- National Association of Home Builder, 2013 Urban Gold Community of the Year
- Canadian Architect, 2012 Award of Excellence Outstanding Architectural Design[4]
- Canadian Urban Institute, 2012 Brownie Award, Public Realm: Flood Protection Landform

1 Assumed conversion rate of CAD/USD = 1.35 as at May 15, 2019.

2 Further information available at: https://ogca.ca/builder-awards/

3 Further information available at: https://myemail.constantcontact.com/2013-CUI-Brownie-Award-Winners-Announced-.html?soid=1112321893260&aid=aEbTCalqiV8

4 Further information available at: https://www.newswire.ca/news-releases/canary-district-garners-prestigious-canadian-architect-award-of-excellence-511980341.html

The project was developed to serve the athletes of the 2015 Pan American and ParaPan American Games, and to advance Waterfront Toronto's award-winning plan for the West Don Lands area by providing a beautifully designed, sustainable mixed-use riverside community.

The Project scope included the design, build and financing of seven high-rise buildings which initially provided accommodation for 7,787 Pan American Athletes, 2,200 Parapan American Athletes, and Team Officials. Following the Games, they were converted to long-term accommodation facilities as part of the region's social housing plan.

The project consisted of:

- site work (including all earthwork, excavation, grading, stockpiling and movement and removal/disposal of impacted fill/soil);
- design and construction of the residential and administrative facilities for the Games;
- design and construction of the associated Municipal Works in the area of the site; and
- design and construction of the temporary services to support the temporary facilities provided by Toronto 2015 (TO2015), the organising committee for the Games.

During the period when the facilities were turned over to TO2015 for the Games (also called the "Operational Term"), the Private Partner was responsible for operational services including the management and maintenance of buildings, and the maintenance of the site's roads and grounds.

Following the Games, the Project was to achieve legacy requirements for the residential property market and converted as follows:

- **YMCA** – Sports facility;
- **George Brown College Student Housing** – accommodation for 500 Students and 8 Dormitory Supervisors;
- **Affordable Rental[5] units** – 253 units; and
- **Market residential condominium units** – 787 units.

Output Specifications Development Approach Used

Infrastructure Ontario is the procuring agency leading the procurement of PPP projects in the province of Ontario with standardised procedures and PPP contractual templates between the Owner and the Private Partner (also called Project Agreement). The project is a good example of how a standard, market-tested PPP model can be adapted to deliver the project objectives. The Output Specifications considered two end user groups with different needs:

1. the athletes, support staff and coaches of the 2015 Pan Am and Parapan Am Games who required temporary accommodation and facilities for the duration of the Games, and
2. the future residents of the Don Valley community who will need a mix of affordable and market housing, and sustainable mixed-use spaces.

Access to information to complete a suitable market comparison was not available.

5 Affordable rental housing is defined in the Project Agreement as an "affordable rental condominium unit where the total monthly shelter costs, at initial occupancy, is at or below the average market rent in the City of Toronto as reported by [the Canada Mortgage and Housing Corporation for similar condominium units.

Alignment to QI Focus Areas

Sustainability and longevity of an infrastructure asset

Ability of the asset to address the needs and meet the expectations of end users

The project delivered a **sustainable, long-term** solution through integration of Infrastructure Ontario's Design Excellence requirements, combined with other design requirements set out in the output specifications, including sustainability and accessibility. The architectural and urban realm design requirements, the protection of heritage buildings and the requirement for Leadership in Energy and Environmental Design (LEED) New Construction (NC) Gold certification[6] are examples of output specification requirements that aligned the project well with the QI agenda, as further set out below.

Architectural and Urban Realm Design Requirements

The design needed to effectively respond to sustainability to create a community that achieved improved architectural quality in Toronto. The output specifications provided both guidance and requirements for neighbourhood character, street character and interface, built form, courtyards and building materials. Examples of these include:

- *"The neighborhoods shall express a diversity of character, within a cohesive identity for the West Don Lands Precinct. Specifically, each neighborhood shall express unique characteristics within the Precinct Plan Neighborhoods framework, outlined in the Block Plan";*
- *"Vehicular entrances for parking, servicing and loading access shall be minimized within the street wall of a block";*
- *"A cohesive overall effect shall be provided, but no two buildings shall appear identical. Repeated buildings are not permitted unless they are part of a row whose design relies on repetition to create a cohesive streetscape";*
- *"Ground floor spaces in all buildings, the local streets, shall be designed to accommodate a range of retail/commercial uses, future market flexibility and change of use";*
- *"Rooftop gardens shall be used to achieve green roof performance criteria in a way that maximizes overlook opportunities from adjacent buildings".*

Protection of heritage buildings

The existing site included two heritage properties that needed to be incorporated into the development to preserve historic places in Canada:

- 409 Front Street, a former Palace Street School/Canary Restaurant
- 420 Front Street/425 Cherry Street, a former Canadian National Railway Office.

The Authority provided the Private Partner building condition assessments, Heritage Conservation guidelines and a heritage analysis and interpretation plan that provided guidelines and requirements for the design integration. The output specifications referenced the Standards and Guidelines for the Conservation of Historic Places in Canada, and provided specific integration and refurbishment requirements for the buildings such as:

- *"420 Front Street/425 Cherry Street shall be conserved and integrated in a meaningful way into the overall development of Block 1 & 14 and having function in the Legacy development as a part of the YMCA, retail or other program, and shall be fully functional for the Games and accommodate a component of the Games functional program".*

Prior to any work that could alter heritage attributes, the Private Partner was required to provide a Heritage Impact Assessment to the satisfaction of the Authority, having jurisdiction based on the format outlined in the ORC Heritage Management Process Handbook document.

Two types of end users

The project was developed with two different types of end users in mind:

- Pan Am and Parapan Am athletes, support staff and coaches; and
- the West Don Valley community.

6 LEED, or Leadership in Energy and Environmental Design, is the most widely used green building rating system in the world. LEED provides a framework to create healthy, highly efficient and cost-saving green buildings. https://www.cagbc.org/

7 Further information available at: https://www.propertyobserver.com.au/finding/residential-investment/17667-newington-olympic-story.html

8 Further information available at: https://www.terrapinbrightgreen.com/blog/2008/06/sydney-2000-olympic-athletes-village/

9 Further information available at: https://www.dailymail.co.uk/property/article-3725436/The-property-legacy-London-2012-Four-years-s-like-live-Olympic-village.html

Mechanisms used to achieve QI alignment

Reference to industry standards: There were numerous design requirements described in the output specifications including:

- LEED Gold: "*Project Co shall perform the Works so as to achieve the prerequisites and credits required to achieve the LEED Gold Rating […]*";
- Waterfront Toronto Green Building Requirements;
- Standards and Guidelines for the Conservation of Historic Places in Canada. As such, "*the heritage conservation guidelines are to be prepared by a qualified heritage conservation consultant*"; and
- Ontario Realty Corporation Heritage Management Process.

Conditions precedent to completion: Completion is linked to payments that are used to repay the project finance partners. The Private Partner is incentivised to deliver the project on time and to the required standard to receive payment. The payments to the Private Partner are linked to the completion of the works.

For example, the "Substantial Completion Payment" is made upon the "Project Substantial Completion", which requires the certification, by an Independent Certifier, that the following have been achieved:

- *"Occupancy Permit";*
- *"certificate of substantial performance";*
- *"all requirements for Project Substantial Completion described in the Project Substantial Completion Commissioning Program*".

Review procedure: Although the Private Partner retains the risk of developing a compliant design, there are certain deliverables that are subject to the Authority's review procedure set out in the Project Agreement. This provides the Authority an opportunity to review design development and compliance prior to completing the design and starting construction. This includes the following formal submissions:

- "50% design development stage", including, for example "interior finishes colour and materials, selection boards for all Third Party Facilities, which includes 3 complete options for interior finishes for each of the Facilities", and "preliminary door and hardware schedules".

Design excellence review panel: The Private Partner was required to obtain support from the Panel comprised of leading Canadian design professionals that included experts in architecture, landscape architecture, urban planning and sustainability.

Reference to industry standard:
The design requirements described in the output specifications were based on the *IOC Technical Manual for the Olympic Village*.

Market Comparison Analysis

The athlete's village for the Sydney Olympic Games was also delivered as a design, build, finance contract. The scope also included the reinstatement work to reconfigure the village following the Olympics, and market and sell the properties. Proceeds were shared between the Owner and Private Partner[7], and long-term project objectives were translated into the output specifications. The Olympic committee advocated for environmental sustainability, and features included solar panels and water recycling facilities which reduced potable water and energy use by 50% below industry standards. All major building materials and systems were required to undergo a lifecycle analysis to determine their resource use[8].

Like Toronto with the Pan Am Games, London used the Olympics as an opportunity to promote urban renewal through the athlete's village development. The post-Games community in London has 3,000 units and is a combination of both affordable and market housing[9].

Alignment to QI Focus Areas

During the Games

The project envisioned that the Athletes' Village would create a 'home away from home' for the athletes, allowing them to relax in a convenient environment and optimally prepare for competition. As such, planning and operating was very athlete-focused and was translated into designs, policies and practices that respected the athletic and administrative requirements, traditions, cultures, abilities, languages and cuisines of all residents.

The design requirements outlined in the Output Specifications were based on the 'International Olympic Committee Technical Manual on Olympic Village' and outlined the layout of the site and surrounding access ways for the Pan Am and Parapan Am Athletes Village. The output specifications provided guidance and requirements for residential supports, accommodations, service centres, polyclinic, fitness centres, various room types and a variety of other requirements for the development of each of the classified zones:

- Residential Zone –Mixed use buildings to be completed by the Private Partner
- Village Plaza Zone –Retail and recreational areas
- Operational Zone – Athlete/NOC Transport
- Operational Zone – Facility Services
- Operational Zone – Main Entry
- Operational Zone – Welcome Centre

Long-term post Games

The development was handed over to the Private Partner to complete development for the final end users, the residents of the Don Valley community. It was acknowledged that any damage to the permanent buildings, City Facilities and grounds arising as a result of the Pan Am and Parapan Am Games athletes beyond reasonable wear and tear would be compensated to the Private Partner. The output specifications outlined what constituted reasonable wear and tear for features of the development, such as walls, doors, flooring, finishes and external landscape, and included:

- *"In the case of hard flooring, scuffs, shallow impressions and superficial scratching would constitute reasonable wear and tear";*
- *"In the case of plaster board walls and doors, scuff marks and shallow dents would constitute reasonable wear and tear, whereas gouge marks in and penetrations through plasterboard and surface finishes would constitute damage. Damage to paintwork from the use of and/or removal of adhesive tape is not reasonable wear and tear".*

As part of the project, a YMCA Community Centre and George Brown College Student Housing (GBSH) were developed. The output specifications provided a clear vision and objectives for the developments in order to meet the expectations of the end users. The GBHS functional program provided guidance and requirements on the mix of residential and administrative areas, and detailed space requirements that were tailored to student housing.

The YMCA functional program also provided guidance and requirements for space allocation, detailed space requirements and general requirements, such as a minimum amount of at grade bicycle racks, emergency call buttons and CCTV cameras through the facility. Guidance based on previously built YMCA facilities was also provided for aspects of building design, including interior spaces for consistency between various facilities throughout the city and country.

The project envisioned a mixed-use community in which residential uses were complemented by live/work and employment uses, retail, community services, such as medical clinics and childcare centres, and amenities that would help establish an environment that would support and attract a diversity of residents and family types.

Project plans, reinforced by zoning provisions, required that ground floor building frontages be composed primarily of a range of street-related retail and service services, such as community services, retail, restaurants, cultural and other non-residential uses.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Conditions precedent to completion: Completion is linked to payments that are used to repay the project finance partners. The Private Partner is incentivised to deliver the project on time and to the required standard to receive payment. **Review procedure:** Although the Private Partner retains the risk of developing a compliant design, there are certain deliverables that are subject to the Authority's review procedure set out in the Project Agreement. This provides the Authority an opportunity to review design development and compliance prior to completing the design and starting construction.	

Alignment to QI Focus Areas	
	The output specifications provided guidance and requirements for the design, programming and tenanting of retail and commercial spaces that were supported by a comprehensive Retail Strategy to address the following issues: • *"Tenanting of retail and commercial space in line with the retail, commercial and Ground Floor Animation objectives of a vibrant, economically sustainable, mixed use community as set out in the West Don Lands Precinct Plan";* • *"A sustainable mix of destination and neighborhood-focused retail and service uses, as well as commercial uses such as medical clinics, cultural, entertainment and community amenities, with minimal redundancy in focus and service provision";* • *"Parking strategies that will support the proposed retail, commercial and other Ground Floor Animation uses";* • *"Methods for adapting the preferred strategies to respond to market conditions and challenges, without precluding long-term options for achieving the desired range and distribution of retail, commercial and Ground Floor Animation uses".*
Job creation, capacity building and transfer of knowledge and expertise	The project addressed job creation and social inclusiveness through cooperation with the Waterfront Toronto Employment Initiative (WTEI) and inclusion of Affordable Rental Housing units and Affordable Ownership Housing units. Job creation was a successful part of the project as the Authority took a proactive approach and set out initiatives that the Private Partner could take advantage of. The project worked with WTEI, who was committed to connecting un/under-employed Torontonians with the employment and training opportunities that were generated through this revitalisation. WTEI partners played a leadership role in designing, managing and delivering employment and training initiatives. Their services included: • *"Employment Strategy Design and Implementation;* • *Project Management and Co-ordination;* • *Engagement and Outreach;* • *Program Design;* • *Program Delivery;* • *Facilitating Access to Funding; and* • *Monitoring and Evaluation."* WTEI partners also assisted in engaging, pre-screening and supporting city residents from a diverse group of candidates, including youth, aboriginals and newcomers. The Private Partner and its contractors collaborated with WTEI partners to provide apprenticeship and pre-apprenticeship placements, enabling residents to access training opportunities that led to skilled careers. The output specifications for the project did not specify any quantifiable requirements for the employment initiatives; instead they provided an open-ended requirement for the cooperation of the Private Partner and WTEI. These requirements included: • *"Project Co will collaborate with Waterfront Toronto, Infrastructure Ontario and the WTEI partners to create and deliver an employment plan that meets the objectives of the WTEI. The goals and extent of the plan will be determined by Project Co's needs and must ensure training and employment opportunities are made available for un/under-employed groups throughout Toronto";* • *"Project Co will be responsible for ongoing data collection and providing regular program status updates to WTEI".* Following the Games, part of the project was turned into Affordable Rental Housing, which means housing units rented at or below 80 percent of Canadian Mortgage Housing Corporations (CMHC) average market rent for the City of Toronto, for a minimum of 20 years. The owners of these units were selected by Infrastructure Ontario and are non-profit housing corporations.

Mechanisms used to achieve QI alignment	Market Comparison Analysis

Conditions precedent to completion: Defined prescriptive requirements and minimum requirements for achieving completion, which typically include a wholesale requirement to deliver the project in accordance with the specification and a list of required documents and plans to support the handover from construction to operations. Completion is linked to payments that are used to repay the project finance partners. The Private Partner is incentivised to deliver the project on time and to the required standard to receive payment.

Review procedure: Although the Private Partner retains the risk of developing a compliant design, there are certain deliverables that are subject to the Authority's review procedure set out in the Project Agreement. This provides the Authority an opportunity to review design development and compliance prior to completing the design and starting construction.

There are two main features of successful job creation requirements, one of which is demonstrated on the Pan Am Athletes' Village project where the Owner established training and skills development programs that can be utilised by the Private Partner. The other feature is measurable performance targets - refer to the Gautrain Rapid Rail Link and Central 70 project case studies in the transportation section for examples.

Alignment to QI Focus Areas	
	This requirement was successfully implemented in the output specifications by specifying quantifiable and prescriptive requirements for unit mix, size, location, durability and requirements for internal areas and rooms. Examples are: • *"The amount of Affordable Rental Housing will be no less than 253 units and exceed the minimum requirement of 20% of the total residential units to be built";* • *"The Affordable Rental Housing units shall not be confined to a single block, but provided in multiple buildings";* • *"Affordable Rental Housing units shall be provided in their own distinct building and shall not be mixed into buildings with other housing types".* The Affordable Ownership housing program was another strategy to implement social inclusiveness of lower income earners into the community. It was intended to assist low to moderate income households to purchase their principle residences in the project by providing down payment assistance in the form of a forgivable loan. The output specifications required: • *"5%, up to a maximum of 100 units of all residential units built to be Affordable Ownership units";* • *"The maximum purchase price of an Affordable Ownership unit could not exceed the average new home price in the Greater Toronto Area as determined by CHMC";* • *"Affordable Ownership Housing units were to be distributed within the market condominium buildings across the Site in multiple buildings rather than confined to a single building or block";* • *"Affordable Homeownership Housing units were to be priced such that purchasers whose annual household income levels were at or below the 60th percentile level for the Greater Toronto Area or the Province of Ontario, whichever was lower, can afford the units with the down payment assistance provided by the Ministry of Municipal Affairs and Housing* (MMAH)".
Social inclusiveness	The Authority defined the project to be built on the principles of inclusiveness and envisioned Fully Integrated Accessibility so that accessible features became part of the overall functionality and a benefit to both the Pan Am and Parapan Am athletes and post-Games users. A high level of accessibility was also required to minimise future retrofits to accommodate an increase in accessibility needs that are projected for a changing/ageing demographic. The design for accessibility considered the needs of athletes, officials, guests and staff who were attending the Pan Am and Parapan Am Games. It considered the needs of persons with a wide variety of abilities, including people with mobility or physical disabilities who may use scooters, manual or motorised wheeled-mobility devices, crutches, walkers or canes; people who are blind, have low vision or are color blind; people who are deaf, deafened or hard of hearing; people with environmental sensitivities; people with cognitive or intellectual disabilities; people who use the assistance of service animals or personal attendants. Guidance was provided by the Authority through the use of principles of Universal Design. The seven principles of Universal Design include: equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use. This ensured that if accessibility is considered early and often in the design process, with checkpoints along the way, the result will be a well-designed Facility with minimal need to add specialised design or features to accommodate specific people's needs. The output specifications provided specific requirements with regards to exterior accessible routes, wayfinding and signage, ramps, entrances and exits, doors, and elevators and lifts, accessible bathrooms, accessible seating and public washrooms, but also provided general requirements for the Private Partner to adhere to such as: • *"Provide an inclusive approach that does not exclude anyone from using the Facility. The Site and buildings must be usable and by all people to the greatest extent possible, without the need for adaptation or specialized design";*

10 Further information available at: https://gihub-webtools.s3.amazonaws.com/umbraco/media/2437/gih_inclusiveinfrastructure_full-document_web_art_hr.pdf.

Mechanisms used to achieve QI alignment	Market Comparison Analysis

Reference to industry standard:
All accessibility requirements listed in the International Paralympic Committee, Accessibility Guide July 2009 and the Ontario Building Code 2006 were required to be met. In the case of conflicting requirements, the most stringent applied.

Conditions precedent to completion: Defined prescriptive requirements and minimum requirements for achieving completion. Completion is linked to payments that are used to repay the project finance partners. The Private Partner is incentivised to deliver the project on time and to the required standard to receive payment.

Review procedure: Although the Private Partner retains the risk of developing a compliant design, there are certain deliverables that are subject to the Authority's review procedure set out in the Project Agreement. This provides the Authority an opportunity to review design development and compliance prior to completing the design and starting construction.

Typically output specifications adopt codes and standards to specify minimum accessibility requirements.
In the case of the Pan Am Athletes Village Project, the Provincial standard formed the minimum requirements, which were supplemented by organisation-specific and project-specific requirements to raise the level of accessibility above minimum requirements.

The London Olympic Delivery Authority developed the Inclusive Design Standards. Refer to the GI Hub's *Inclusive Infrastructure and Social Equity* guidance document and the standard[10] for more information.

Alignment to QI Focus Areas	
	• *"The needs of all users shall be considered equitably. The design of access routes, entrances, exits, space layouts, functional spaces and amenities must consider all needs without discrimination";* • *"Where only portions of some amenities are fully accessible (such as accessible seating or washrooms) they must be integrated into the overall design, dispersed throughout the building and not simply grouped together. Where only a portion of amenities are accessible (such as wheelchair seating areas), there must be a choice of locations";* • *"All amenities shall be usable by everyone as independently as possible. Facilities that require outside assistance (such as attendant controlled lifts) are not acceptable".* In addition to the broader facilities, Fully Integrated Accessibility measures were required to be incorporated into 10% (+/-1%) of the Affordable Rental Housing. The output specifications detailed requirements for doorways, unit hallways and entries, lighting, living spaces and kitchens, bathrooms and balconies. The output specifications also outlined adaptability requirements for the 90% Affordable Rental Housing units that were not Fully Accessible which would allow units to be easily modified in the future to meet peoples' changing needs over time allowing them to age in place or to accommodate different needs.
Environmental impacts	**Requirement for LEED Gold certification** Additional green and efficiency standards were required to achieve sustainability accreditation. Each newly constructed building was designed and constructed to meet LEED Gold certification and Waterfront Toronto's green building requirements. Waterfront Toronto's green requirements involved components of long-term flexibility, green roofs, and bicycle parking and storage. Output specification examples include: • *"Project Co Facilities and Third Party Facilities are required to be designed for long-term flexibility. Specific height and structural loading capacity for various areas are required";* • *"Green Roofs must be installed for all buildings (except townhouses) over 3 storeys in height and all above grade parking garage structures in the Village";* • *"For all buildings, provide bicycle parking or storage space for 15% of the off-street parking capacity provided for cars for those buildings".*
Ability of the asset to respond flexibly to the introduction of disruptive technology	The project was required to meet Waterfront Toronto's initiative for an Intelligent Community that aimed to obtain a reliable and flexible Intelligent Community that was economical to build and maintain. Ultra-high-speed internet access was to be available to all residences and businesses through fibre optic cabling infrastructure and wireless networking. This open access network provided residents and businesses a variety of services from which to choose from and a variety of service providers for such things as high-definition TV programming, internet protocol television (IPTV), voice over internet protocol (VOIP), video and security systems and other internet-connected services in the future. A cash allowance for Intelligent Communities was identified in the Project Agreement to account for costs to the Private Partner in coordinating Beanfield, the exclusive Designated Provider, to perform various services pertaining to the Intelligent Community system, including: • *"Beanfield acting as the technical consultants and providing feedback on the technical design";* • *"Beanfield providing and installing all outside plant fibre and riser fibre";* • *"Beanfield inspecting all telecommunications pathways and spaces";* • *"Beanfield testing and commissioning the Intelligent Community system".* The Private Partner was then to ensure each residential condominium corporation entered into a services agreement with Beanfield for a term of 10 years at a designated cost per unit per month. The specifications prescribed the Intelligent Community system, rather than focus on the system performance. The specifications clearly defined requirements for the system components: manufacturer, structured cabling, telecommunications pathways, telecommunication spaces, main telecommunications rooms, telecommunications entrance rooms, and outside plant pathways.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Liquidated damages: In the event that a LEED Gold Rating was not obtained for any or all of the LEED Facilities within 24 months after the Project Final Completion Date, liquidated damages would have been assessed against the Private Partner up to an aggregate amount.	On Canadian social infrastructure projects, the typical requirement is for LEED Gold for 'New Construction' with liquidated damages if certification is not achieved. The Authority may specify credits that must be achieved (this is considered the best practice approach). There are examples in Quebec where the Private Partner was required to obtain LEED certification in the 'Existing Buildings: Operations and Maintenance' category. This has presented challenges as it requires input from the Authority, which has resulted in delays.
Conditions precedent to completion: Defined prescriptive requirements and minimum requirements for achieving completion. Completion is linked to payments that are used to repay the project finance partners. The Private Partner is incentivised to deliver the project on time and to the required standard to receive payment. **Review procedure:** As a technical consultant, Beanfield was responsible for the review of the Private Partner design development, in accordance with the Project Agreement, Schedule 10-Review Procedures and tested and commissioned the Intelligent Community system prior to Project Substantial Completion.	Refer to the ICT case study on a French Broadband project for further information on output specifications to deliver ICT projects.

Source: Mott MacDonald

BUILT ENVIRONMENT CASE STUDY: THE UNITED KINGDOM (UK)

Lewisham Grouped Schools Project

Location
London Borough of Lewisham, UK

Owner
London Borough of Lewisham

Private Partner
BY Education (Lewisham) Ltd
(Bouygues UK, Ecovert FM, HCBC Infrastructure)

PPP Model
Design-build-finance-operate (DBFO)

Operating Term
30 years

Contract Value
GBP 60.6 million/USD 76.7 million[1]

Asset Class
Built Environment (Education)

In August 2006, the London Borough of Lewisham awarded a contract for the 'Lewisham Grouped Schools Modernisation PFI project' to modernise several schools for the Borough of Lewisham.

This included the design, build and provision of hard and soft facilities management (FM) services for a period of 30 years for four schools: Greenvale Special Needs School, Prendergast Ladywell–Field College, City Learning Centre Facilities - Crofton campus, and Forest Hill Secondary School. The project's objective was to provide educational facilities for over 4,000 children located in the Lewisham area. Greenvale Special Education Needs School became operational in September 2007, while Crofton Secondary School, Phase 1, Forest Hill Secondary School, Phase 1, and the City Learning Centre became operational in January 2008.

The key criteria for the project were:

- design and construction of schools within the London Borough of Lewisham;
- building remodelling to ensure the facilities are fit for purpose; and
- provision of hard and soft FM services to enable education staff to focus on delivery of the pedagogical services instead of building-related issues.

1 Assumed conversion rate of GBP/USD = 1.27 as at May 28, 2019.

Output Specifications Development Approach Used

A detailed output specification for both design and construction and service delivery was used, based on a market-tested specification used in the United Kingdom. The design and construction specification listed the design requirements for the building supported by a Schedule of Accommodation and detailed Room Data Sheets. The service specification is consistent with the standard form of service requirements established as part of the 'Building Schools for the Future' program in the UK, which was used for most education PPP projects between 2004-2012, with some additional requirements in relation to cleaning and waste for the additional-needs school and limited ICT provision to maintenance and infrastructure.

Alignment to QI Focus Areas	
Sustainability and longevity of an infrastructure asset	The **longevity of the asset** is ensured through handback provisions. After the 30-year design-build-finance-operate contract, the site will be transferred back to the Owner, with the condition on return governed by a specified handback standard.
Ability of the asset to address the needs and meet the expectations of end users	Lifecycle risk is fully transferred to the Private Partner meaning that the Owner is not responsible for replacing or renewing any element of the building during the operating term. The exception to this is Information, Communication and Technology (ICT)-related infrastructure (referred to later on in this case study). Additionally, the Private Partner is to provide a planned maintenance function designed to not only minimise breakdowns but also extend asset life. This includes: providing an annual planned preventative maintenance (PPM) plan for each school, and agreeing it with the Owner; maintaining full records of all tests and inspections and ensuring that materials and parts are of the same quality or better as the original element or fitting. User feedback is sought quarterly from the Authority, Service Users and key staff at the schools in terms of assessing current needs and whether or not the assets are fit for purpose and **meeting the needs of end users**. Additionally, the school spaces were set up to require flexibility to meet the changing educational curriculum needs. As such, the contract includes a portering service, which includes the requirement to move and re-set up equipment to meet daily educational needs. The scope for this item also includes performing all necessary manual handling risk assessments in relation to porterage activities undertaken at the request of the Owner.
Health and safety considerations during both construction and operation of the asset	The output specifications require compliance with applicable national health and safety legislations. The Private Partner shall "*Produce, maintain and implement fire and emergency management procedures in accordance with statutory and insurance requirements.*" The scope of the fire and emergency management system is heavily integrated with the Owner, including providing training to the Owner. • *"Project Co shall provide personnel who are briefed and trained to act as emergency co-ordinators and who will manage the Fire Wardens' operations and liaise with the Fire Brigade and any relevant Statutory Authorities."* • *"The London Borough of Lewisham shall provide personnel who are to be briefed and trained as fire wardens by Project Co."* In addition, the Private Partner "*shall allow usage of the School Facilities in case of local or national emergency as and when requested by the London Borough of Lewisham or its representative or on request by the emergency services*."

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Independent building survey: An independent building survey is to be undertaken to assess the outstanding works required to meet the handback standard. This typically takes place up to three years prior to the expiry date. Following this inspection, a schedule of works is produced which is required for the facility to achieve the handback standards. The Owner has the option to inspect the facility again or request that the independent surveyor visits once the works are complete. **Asset Documentation:** The handback plan ensures that all asset documentation is handed over to the Authority as part of the handback at expiry to ensure that asset knowledge is not lost. **Right to audit:** The Owner receives monthly performance reports and attends monthly meetings; however, they can attend site and review service performance, documentation or procedures/policies as they want. **Performance measures:** There are several performance indicators that promote long-term performance of the assets. Examples include: • *"No occasion of failure to deliver PPM and life cycle replacement schedules in accordance with the Project Agreement".* • *"No failure to replace materials and parts to the same, better or agreed standard or quality as the original part."* • *"No failure to achieve Acceptable Elemental Standards within stated rectification periods."* **Customer feedback:** Customer feedback is sought quarterly via feedback questionnaires either in hard copy or electronic. Questions include the following: • *"Where you have contacted the helpdesk to report an incident or make a service request, how satisfied were you with the response received?"* • *"How satisfied are you with the quality of the environment within the school?"* • *"How satisfied are you with the quality of the outdoor spaces at the School?"* Respondents are asked to respond based on categories 1-5, where 1 is not satisfied at all and 5 is very satisfied.	A 30-year concession period is consistent with other UK and European PPP projects. Twenty-five to 30 years is consistent with other mature markets, but this period can be shorter (15-20 years) in emerging markets. Handback standards and provisions are consistent with the UK market for this date of project. Earlier projects and projects in emerging markets typically have a lower standard at handback (in the early days, the focus was on delivering the projects with less thought as to what would happen at the end many years ahead). Handback requirements became more of a focus for later projects including this one, with the standards more clearly defined. This includes a higher standard for residual life provisions, meaning that the facility has to be capable of delivering to the standards required under the output specification with limited lifecycle spending for a given period following expiry.
Performance measures: The health and safety requirements are monitored by performance indicators. • "*Project Co should produce the initial procedures within six months of the Commencement Date*", failing which penalties apply immediately with no applicable response and rectification periods. There are specific disaster management and fire and emergency management performance indicators that require compliance and support of the Owner policies, including the joint development of the fire safety plans and other emergency plans. Example performance indicators are as follows: "*Once the agreed disaster management plan is in place, Project Co shall carry out those actions associated with their identified responsibilities within the procedures routinely and in the event of the occurrence of an emergency. The annual programme will be agreed with the London Borough of Lewisham and the Schools."* *"Project Co will produce detailed fire procedures in conjunction with the London Borough of Lewisham. These procedures must be continually updated and reviewed as circumstances demand."*	Compliance with national health and safety legislation is consistent with other education projects across Europe and other developed markets where such legislation is present. In addition, the requirement to work alongside the Owner to produce plans that are aligned with local policies is also included in many social infrastructure projects, where consistency of approach to procedures of this nature is seen as beneficial.

Alignment to QI Focus Areas	
Social impacts and inclusiveness	The school facilities were built to support and benefit the education needs of the entire community at large. The Project Agreement allows for community use of the facilities outside of "core operating hours", or non-school hours. Core hours are specifically detailed within the payment mechanism with times outside of this available for community use – this includes using the facility for community groups and meetings, sporting events and public events. Additionally, one of the schools includes a hydrotherapy pool, which can be effective at treating chronic illnesses. The pool is also available for use by disability groups, as part of an effort to support the needs of all community members.
Alignment of the project with economic and development strategies (SDGs, national policy etc) Ability of the asset to respond to changes in resource availability, population levels, demographics and disruptive technology	Interestingly, the way that the asset was determined to most effectively respond to changes in technology was by keeping ICT with the Owner for the duration of the PPP agreement. For the project, the Private Partner's involvement with ICT is limited to provision and maintenance of the infrastructure, while the Owner retains control of hardware (initially provided by the Private Partner through the equipment schedule, but maintained and replaced by the Owner), software and internet provision.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
"Project Co must carry out training for all wardens, and other officers, who perform a function under the procedures." *"Project Co will produce detailed procedures for a variety of emergency situations in conjunction with the London Borough of Lewisham. These procedures must be continually updated and reviewed as circumstances demand."* Requirements also include provisions for testing of the plans in accordance with legislation and regulations, with record keeping required to show adherence to legislation, plans and policies.	
Performance indicators: Requirements are managed through performance measures in the payment mechanism, which include examples such as: • *"These tables set out the Core Sessions and Additional School Periods requirements for the Schools. In order to provide a simple but effective basis for calculating financial deductions Core Sessions during the school day have been split between morning and afternoon […]".* • *"[…] Core Sessions, each School may book Additional School Periods for the use of designated areas, during which the provisions of this Schedule 6 shall apply. This table will be reviewed annually, and adjustments made to the Service Payment if greater or less hours are required. […]".* A**vailability Failures:** The use of the hydrotherapy pool is managed through Availability Failures in the Payment Mechanism, for example: • *"No occasion of light flickering effect on pool water surface to an extent which may prove a problem for those with epilepsy."* • *"No failure to maintain hoists and other lifting equipment in accordance with manufacturers' recommendations."* • *"No occasion of pool water temperature exceeding or dropping +/- 2ºC from the required levels at set out in the Room Data Sheets."*	The concept of community use outside of core school hours is a typical provision on school PPP projects in the UK, Europe and in Australia and New Zealand. Some projects have attempted to incorporate public use during the school day (for example, as sports and leisure facilities) however this has proved difficult regarding safeguarding.
ICT provisions retained by the Authority.	Keeping ICT provisions with the Owner follows lessons learned from previous education projects in the UK, whereby long-term ICT provision was difficult to detail in specifications and pricing, leading to significant premiums being put onto the costing of the service due to the difficulty in predicting ICT needs in the future. The current approach is that ICT is either retained by the Owner or let as a short-term provision, often three to five years, during which the needs are more predictable. This approach to retain ICT responsibility has also been observed in other jurisdictions following similar lessons learned, including in Canada (some second wave of projects in the Infrastructure Ontario model).

Source: Ministère de la Justice

BUILT ENVIRONMENT CASE STUDY: FRANCE

PPP Prisons Program (Lots 1-3)

Location

Various locations in France (six sites)

Grantor

French Ministry of Justice

Private Partner

THEMIS / THEIA (Bouygues Group and investment funds)

PPP Model

Long-term Lease / Public-Private Partnership (PPP)

Operating Term

30 years

Contract Value

Lot 2: €155 million CAPEX

Lot 3: €165 million CAPEX

Asset Class

Built Environment (Correctional)

These projects are part of a major program of modernisation of the penitentiary estate initiated by the "*Loi d'orientation et de programmation judiciaire*" (LOPJ) of 9 September 2002, representing a total of 13,200 places to increase the national prison capacity by approximately 18%.

The specifications include reference to this program, which aims to improve working conditions of staff and living conditions of inmates, by implementing individual cell accommodation and facilitating access to social services such as legal advisory, healthcare or vocational training.

The following analysis considers the second and third batches of these prison PPP projects in France, awarded to two consortiums led by Bouygues subsidiaries. They were commissioned by the Ministry of Justice and comprise the financing, design, construction and maintenance of six new prisons across France, with the following nominal capacity:

- Lot 2:
  - Sarthe: Le Mans-Coulaines (400 cells)
  - Seine-Maritime: Le Havre (690 cells)
  - Vienne: Poitiers-Vivonne (600 cells)
- Lot 3:
  - Loire Atlantique: Nantes (570 cells)
  - Seine et Marne: Réau (798 cells)
  - Nord Pas de Calais: Lille - Annœullin (688 cells)

The construction period of each prison spanned between two and three years and all the prisons were completed by the end of 2011.

The facility management (FM) services provided are essentially hard FM, including security systems maintenance, cleaning of common areas (excluding the kitchen and cells), maintaining outdoor areas and waste management. The Lot 3 specifications also comprised soft FM, including production in workshops, vocational training, inmates catering, laundry, an internal shop, transportation, employees' accommodation, visitors' management, and employee catering. The overall contract duration is 30 years for both projects.

Output Specifications Development Approach Used

Both contracts are availability payment-based PPPs. The contract for the Lot 2 (DBOM) is based on an authorisation for temporary occupation (AOT in French) of the State domain and a long-term lease, while the Lot 3 contractual scheme (DBFOM) is based on a partnership agreement ("Contrat de Partenariat"). For both projects, the private sector is responsible for the financing, design, construction, maintenance and lifecycle works, while Lot 3 also includes operation.

On both projects, the specifications focus on performance objectives that are required to be provided by the Consortium for the following elements:

- Security, including passive security (walls, fences, etc.), security systems and fire prevention;
- Facilities infrastructure management, including finishing, fittings, heating and cooling, structure, utilities, electricity, communications, lifts and furniture;
- Facilities management to the estate, including legislative compliance, cleaning (internal and external), waste management, grounds management and authority works;
- Program maintenance, including lifecycle servicing and reporting;
- Services to people (Lot 3 only), including prisoners' work, vocational training, prisoner catering, accommodation services, canteen, transport, housing authority per-sonnel, reception of families and staff cafeteria;
- Contract management, including management of incidents, authority interface, quality management, reporting and contract reviews.

The specifications exclude regalian missions of the prison administration i.e. security, safety, health, inmates management.

The Lot 2 and Lot 3 projects are the second and third batches of prison PPP projects in France, and as such, the specifications were non-standard at the time of the procurement procedure. Newer projects' specifications were built from feedback from these projects and have kept a similar structure. Lessons learned from Lot 1, which proceeded the procurement of Lot 2 and Lot 3, allowed the specifications to be improved, including the dialogue procedure with the Private Partners.

Alignment to QI Focus Areas	
Sustainability and longevity of an Infrastructure asset. Ability of the asset to meet the needs of end users	The Project is based on a 30-year design-construct-finance-maintain-operate contract. Once the contract period is over the facilities will be handed over to the Grantor. The specifications are informed by end user priorities and set out a detailed evaluation system and associated financial penalties to en-sure the Grantor's requirements are met. Furthermore, the output specifications were based on feedback from end users of similar penitentiary projects in France (namely on safety and usability requirements). The maintenance and lifecycle providers were involved in the development of the design solution from an early stage to ensure that maintainability and global cost of the solution is considered throughout design development. The lifecycle program ("*Plan de Pérennité*") has been put together to achieve the stand-ards required by the Grantor in accordance with an estimation of likely wear and tear, based on statistical lifespan and experience of similar contracts and works streams. This document provides details of the life expec-tancies and the required replacement periods for each of the building elements including superstructure, security elements and furnish-ings. Clause "Transfert des actifs" of the contract outlines the building handover procedure, which requires that the facilities are handed back to the Grantor at the end of the concession period in a condition that enables the Grantor to operate the facilities in accordance with the operations and maintenance program appended to the contract in conditions equivalent to those of the contract, without requiring an abnormal amount of renewals. Another clause of the contract sets out the required guarantees to be provided by the contractor to cover any condition shortfalls at the end of the concession period.

Mechanisms used to achieve QI alignment

The Grantor will be able to call upon the contractor guarantees under the conditions set out in the project agreement, in the event of a failure by the Private Partner to comply with the handback obligations. These guarantees can be utilised for failures noted up to the end of three years following the expiry of the term.

Appendix 11 of the contract details the service payment mechanism related to maintenance, renewals and operating costs: the rent is based on a fixed annual amount, covering investment and financing costs, to which a variable semi-annual amount is added, indexed based on a range of indices. This variable part of the payment can be adjusted according to the average occupancy level of the prison over the preceding six-month period.

The contract states that, during the two years following the end of the works and take-over of the facilities ("prise de possession"), the Private Partner is fully re-sponsible for any work that does not meet the output specifications, and the Grantor can decide to reject the take-over of the facility. Penalties can be charged on the availability payments until the snagging issues are fixed.

This phase is coupled with a take-over period for the first year of operation, during which some technical penalties are reduced to consider the challenges faced by the Private Partner in the operation and maintenance of these complex projects.

The project agreement also defines the services to be provided in the project period and obligations between the parties with respect to the maintenance of the new building facilities.

Furthermore, based on feedback from end users of similar penitentiary projects in France, the output specifications highlight the importance of end users' quality of life, for both on-site staff and inmates, and especially insist on performance targets linked to the reduction of anxiety-provoking situations (i.e. access to natural light, safety measures), as well as the ergonomics of work-stations.

Similarly, the output specifications consider specific prison constraints and translate them into intervention time requirements (e.g. increased deadlines to address access difficulties, specific working hours), which are associated to levels of severity of the defects and relative importance of the premises impacted.

Market Comparison Analysis

The handback requirements are considered standard for PPP projects in France. A period of three years after contract expiry or termination for a latent defect liability on the handback works is considered a long period compared with other PPP accommodation projects but is nonetheless favourable for the Grantor.

The complexity of the contract monitoring requires strong engagement both from the public authority and the private partner (numerous and precise indicators), and continuous support and training of administrative penitentiary staff must be implemented to ensure consistent application of the contract requirements across all sites. A national PPP unit has thus been created within the Penitentiary Administration to centralise issues and provide cross-functional support for delegated management and PPP prisons.

However, the large number of indicators allows for a better response to the wide range of issues that can be encountered in prisons. The needs and expectation of end users are a particularly sensitive issue of penitentiary facilities, which explains the emphasis of the output specifications on ergonomics and the reduction of anxiety-provoking situations.

Finally, the service payment indexed partially on occupancy level is unique to Prison projects.

Alignment to QI Focus Areas	
Health and safety considerations during both construction and operation of the asset	The output specification requires a health and safety plan to be followed, as required by French law. This plan is to include identification, control, and mitigation for hazards during construction, operation, and maintenance of the facility. Emergency procedures are also identified. Safety and security issues are a central focus of the output specifications and are closely monitored. The specifications include references to applicable regulations (labour laws, code of construction and housing, Health, Hygiene and Safety regulations, etc.). These regulations require a health and safety plan to be followed during construction and operation, which is updated annually. It should, however, be noted that penitentiary facilities are subject to a specific safety regulation in France (included in the specifications). The output specifications also include a focus on health protection measures for both prison staff and inmates, regarding acoustics, lighting, thermal comfort and ventilation (specific measures to avoid salmonella for instance).
Job creation, capacity building and transfer of knowledge and expertise	The Grantor's specifications require local staff, skilled and unskilled, to operate during construction and operation. The Lot 2 and Lot 3 projects were used as pilot programs by the Grantor, to improve its procurement procedures and standardise its output specifications. The Private Partner is also responsible for the training of the Grantor's staff on the handling of equipment provided under the project agreement. The contract states that 40% of the amount of construction works is to be provided by Small and Medium Enterprises (SMEs), as defined in article 8 of the Ordonnance 2004-559 of 17 June 2004 on partnership agreements. A small percentage of the Operation and Maintenance rent is also to be provided by SMEs under the project agreement, and this commitment is to be reassessed every three years.
Social impacts and inclusiveness	The project integrates social aspects, such as contributing to reinsertion and employment opportunities for inmates, prevention of recidivism, and the reliance on SMEs to support local industries and employment. The "Dossier des Engagements de l'État", which is part of the project output specifications, stipulates that during construction works, the Private Partner shall participate in a professional integration program (e.g. hiring people who have been unemployed for more than six months, integration internships). The number of hours is fixed. Simultaneously, during construction works and throughout the operation phase, the Private Partner must carry out a sponsorship action aimed at young inmates to facilitate their professional integration. In addition, during the operation phase, the contract stipulates that the Private Partner must hire inmates (from a pool selected by the Grantor) to perform basic operation tasks, such as routine maintenance, preparation and distribution of meals, or laundry services. The Private Partner is also required to provide them with training to facilitate their reintegration.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
The Private Partner is required to implement health and safety measures for its own staff during construction and operation. Under applicable regulations, an inde-pendent health and safety coordinator shall be nominat-ed to review and approve the Private Partner's health and safety plan, who also ensures that the plan's measures are implemented on site. However, the Pri-vate Partner is not in charge of the health and safety of prison staff and inmates during operation, as it is the Grantor's responsibility. On the other hand, security issues are central to peni-tentiary projects specifications, and a specific section of the program is dedicated to security measures and sys-tems and their monitoring. Large penalties are awarded for security faults and failures, and the Grantor closely monitors the achievement of security performance goals.	For public facilities projects in France, contracts always refer to Health and Safety requirements meeting national legislation, and many have specific requirements, particularly around vehicle deliveries to the construction site, where staff from potentially multiple organisations are entering the facility. For penitentiary facilities, the security issue is especially critical and closely monitored. Fire safety regulations are also specific to these types of projects.
If the Private Partner fails to reach the SME objectives during construction and operation, the contract allows for associated penalties. Regarding the operation of the projects, the contract stipulates that the Private Partner shall provide training for all prison staff involved in the operation of the facility prior to commissioning. This training shall allow the han-dling of all technical equipment or functions that are no longer managed by the Partner after the take-over.	This is typical for large scale public projects in France, as there are often specifications about the number of staff which must be recruited from SMEs and within the local area (usually 20% for infrastructure projects). Requirements for training of operations staff prior to take-over is now standard for PPP projects in France.
If the Private Partner does not comply with the Grantor's requirements, the contract plans for associated penalties. Furthermore, when the prison workshops are managed by the Private Partner, work activities are proposed for the inmates with associated performance targets (number of hours and salary amount) for which the underperformance leads to a penalty. It should however be noted that the reintegration process and the support of the detainees themselves are managed by the supervisors and staff of the Penitentiary Service for Integration and Probation (SPIP), and not by private partners.	Professional integration program requirements during construction works are standard for public projects in France. However, penalties related to detention work are specific to PPP prisons projects. The delegation of prison work management predates PPP projects since it has been created in 1987 (Loi Chalandon on Delegated Management). Private partners in France have a strong business culture in this area, which is seen as an opportunity to employ more inmates. When compared to other countries, experience shows that there is no standard practice related to the transferring of professional integration and detention work activities to the private partners. In most countries, rehabilitation programs are supported by public sector probation services, but others delegate rehabilitation program management to the private sector to a larger extent. Attempts have for instance been made in the United Kingdom, where privately-owned companies were commissioned to manage low- and medium-risk offenders, introducing 'payment by results' based on KPIs related to reducing reoffending. In France, the so-called sovereign missions (direction, guard and registries) are never delegated.

Alignment to QI Focus Areas	
Environmental impacts	The project takes environmental issues into consideration, with a sustainable development approach applied to construction and operation activities, incorporating energy saving solutions and the implementation of a high-quality environment label (HQE) for some components of the project. The "Dossier des Engagements de l'État", which is part of the project output specifications, states that, during construction works, the project must minimise waste, and includes recommendations on the management and treatment of materials to avoid illegal dumping. The program also requires the project to meet environmental targets as per the French standard High Environmental Quality (HQE) targets ("Low-level construction site", "Energy management" and "Operation and maintenance management"). The French regulations, in terms of thermal and acoustic standards, impose strict rules that allow the proposal of effective solutions in terms of comfort and energy management.
Ability of the asset to respond to changes in resource availability, population levels, demographics and disruptive technology	At the design stage, the output specifications include flexibility requirements for premises by avoiding rigid structures and enabling partitioning evolutions. The specifications also include flexibility and scalability requirements for the equipment: the Private Partner shall implement solutions that allow re-partitioning without important structural works, and the sizing of all technical networks and equipment (e.g. electricity, ventilation and air conditioning, plumbing) must include an extra capacity of at least 20% (up to 40% for some equipment). During operation, the issue of equipment performance evolution is included in the lifecycle plan and part of the payments made to the Private Partner is adjusted according to the average occupancy level of the prison.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
The contract includes energy consumption targets based on occupancy, with a monthly evaluation and a pain-gain share mechanism that encourages the Private Partner to reduce its energy consumption (KPI based on overall consumption with a variable part based on occupation).	These requirements are standard for prison projects in France, but for newer social infrastructure projects, energy consumption by end users is often excluded from energy consumption targets, since they are considered to be out of the direct control of the Private Partner.
At the design stage, flexibility and scalability requirements are reviewed and approved by the Authority along with the design package. During operation, evolution of the equipment's performance over the duration of the contract is a key issue for penitentiary institutions, especially for security systems. However, the cost of technological change is not often considered in PPP contracts in a formal way and is often addressed during operation using the lifecycle budget, unless there is a change of technology, for which case variation orders can be made.	Requirements on the flexibility of premises and extra capacities of the technical networks are typical for such projects. PPP contracts generally allow good management of equipment renewal over the duration of the contract by setting up lifecycle budgets: the technical expertise offered on these subjects by private partners provides support to the prison administration services. However, lessons learned have shown the importance of defining accurate equipment renewal times when drafting the contract, especially for technologies that are rapidly evolving, such as security and CCTV equipment. Indeed, the frequency of equipment renewal stipulated in the contract must allow the Private Partners to evaluate the expected levels of performance at the bidding stage. The formulation of expected performance levels for equipment has thus been reformulated in new contracts to allow private partners more flexibility in defining technical characteristics so they can focus on performance objectives for each equipment. Another challenge is the inclusion of specification changes during the Project's life in the contract, which should ensure good responsiveness and rapid implementation of the expected changes: consideration should be given to a clause with a bonus or adjustment on requests for amending work.

Source: BC Hydro

ENERGY CASE STUDY: CANADA

John Hart Generating Station Replacement Project

Location
Campbell River, British Columbia, Canada

Owner
BC Hydro

Private Partner
InPower BC (SNC Lavalin)

PPP Model
Design-build-finance-maintain (DBFM)

Operating Term
15 years

Project Value
CAD 1.1 billion/USD 815 million[1]

Asset Class
Energy

Awards

- Canadian Council for Public-Private Partnerships 2014 National Gold Award for Project Financing winner;
- P3 Bulletin 2015 awards for the 'Best Waste/ Water/Energy Project' and the 'Projects Grand Prix';
- Outstanding Project award from the Canadian Hydropower Association;
- Tunnelling Association of Canada: Canadian Innovation Project of the Year 2018; and
- BC Hydro received an 'Award of Excellence' from the Canadian Electricity Association of their 'Next-Generation Seismic Analysis of Concrete Dams' project: BC Hydro is the first non-nuclear utility in North America to elevate seismic hazard assessment of its dams using processes similar to those used by the U.S. Nuclear Regulatory Commission.

1 Assumed conversion rate of CAD/USD =1.35 as at May 15, 2019.

The project involves replacing the existing John Hart Generating Station, which was built in 1947, with one designed for improved seismic performance and reduced environmental impact.

Specifically, the update of the hydro power generating station includes:

- A new underground powerhouse with three 46 MW generating units to replace the existing above-ground powerhouse;
- The replacement of three 1.8 kilometre (km) woodstave and steel penstocks with a single 8.1 metre (m) diameter, and a 2.2 km power tunnel;
- A new water intake at the existing John Hart Dam; and
- A new water bypass facility that protects the downstream Campbell River and its fish habitat from flow reductions even when the generating units are shut down.

During the operations phase, the Owner retains responsibility for operations, however the Private Partner is responsible for all maintenance and rehabilitation. However, the Private Partner is required to use the Owner's staff to complete the routine/ planned maintenance activities.

The project has a phased completion process, with percentages of the availability payment assigned to the follow discrete phases:

- The completion of each turbine and generator;
- The commencement of the operating phase; and
- The completion of the bypass system.

The new facility has been generating power since 2018 and work is currently underway to decommission the existing facility.

Output Specifications Development Approach Used

The project is a good example of how a standard, market-tested PPP model (Partnerships BC[2] model) can be adapted to deliver project specific objectives. BC Hydro has a history of delivering hydro generating projects and has in-house technical expertise, however this project was the first one sourced as a PPP. At the time of procurement, BC Hydro also believes the project was the first hydro power facility PPP in Canada, and if not North America. Accordingly, to develop the specifications, a team was formed that consisted of in-house BC Hydro technical experts, with support from Partnerships BC and consultants with experience in the development of output specifications.

In developing the output specifications for this project, BC Hydro consulted international output specification examples, as well as recent, local projects, before finalising the project-specific specification. On this basis, the output specification development process focused on developing a clear vision, minimum requirements and measurable outcomes, prior to developing requirements and performance measures.

2 Partnerships BC (PBC), the provincial procurement agency in British Columbia has the mandate to support "the public sector in meeting its infrastructure needs by providing leadership, expertise and consistency in the procurement of complex capital projects by utilising private sector innovation, services and capital to deliver measurable benefits for taxpayers". To date PBC has participated in 52 projects with a combined capital value of almost CA $18 billion. Partnerships BC has developed and promoted a P3 model that adopts standard process and documentation to minimise bid costs and the time taken to get a project to market and financial close (typically 12-18 months from request for proposal to financial close).

Alignment to QI Focus Areas	
Sustainability and longevity of an infrastructure asset. Ability of the asset to meet the needs of end users	The asset management requirements adopt a plan-do-check-act cycle[3] through the project term, which involves both the Private Partner and the Owner. A key document is the Asset Management Plan (AMP). "*The objective of the AMP is to provide BC Hydro with plans and programs that demonstrate Project Co's compliance with the performance obligations in respect of the Services under the Agreement. The AMP should clearly describe Project Co's understanding and detailed approach to delivering all aspects of Services relative to the specified Performance Indicators.*" Below is an overview of the interrelated asset management requirements that aim to maintain the longevity of the asset. **Plan:** Planning for the management of the asset starts before construction is complete (an AMP is required 60 days prior to service commencement). The AMP is intended to support the achievement of performance obligations and to ensure that handback conditions are achieved. **Do:** Project Co is required to implement all maintenance and rehabilitation work in the AMP. For example, in the case of planned maintenance for this project, Project Co is required to identify and plan annual maintenance activities and document them in the Maintenance Plan and Schedule (MPS)[4], which forms part of the AMP, and which is the baseline for measuring performance. **Check:** "*The performance of the Asset Management Plan shall at a minimum be monitored monthly; reviewed annually; and updated or modified based on the experience of Responses and Rectifications and other relevant experience arising from the performance of the Services or mutually agreed upon changes.*" Specific tools include: • **Monthly Facility Performance Scorecard**, using quantitative data where possible to measure performance. • **Annual Asset Management Report:** summary of the performance from the previous year including (but not limited to) performance statistics, third party audit results, maintenance statistics, completed non-routine and capital projects, regulatory compliance, and a review of the program effectiveness. • **Service Period Joint Committee (SPJC) Annual Asset Review:** The SPJC meets yearly to conduct an asset review, including a review of past performance measured against the AMP. • **Condition Assessments:** Condition assessments are required to be completed in years 4, 8 and 12, which are used to monitor the effectiveness of the AMP. "*The condition assessment evaluation of Generation Systems will be made based on The Corps of Engineers hydroAMP methodology*" and are completed by an independent third party. **Act:** Revisions to the AMP: "*Updates to the Asset Management Plan shall be submitted annually on the anniversary date of Service Commencement Condition Assessment*".
Ability of the asset to withstand natural and other disasters, including climate change	BC Hydro identified the existing facility was likely to fail under low to moderate seismic loading, and an objective of the project was to provide a facility that met modern seismic guidelines. The output specification achieved this by specifying the design requirement and the performance requirement by project element. The National Building Code of Canada (NBCC), Canadian Dam Association (CDA) guidelines and Institute of Electrical and Electronics Engineers (IEEE) standard IEEE693 were the adopted standards that governs the seismic design requirements, and additional minimum standards were included in the output specification. Specifically, a hazard analysis was conducted to determine the appropriate site-specific ground motion to be used in conjunction with the adopted codes and standards.

3 Also known as The Deming Cycle, which describes a continuous feedback loop that allows improvements to be identified and changes implemented.

4 The Maintenance Plan and Schedule includes three rolling periods; one year, three years and 15 years.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Review and Consent Procedure: The AMP is subject to Owner Consent both prior to Service Commencement and annually for document revisions. Consent is required before the Private Partner can proceed with implementation. The Asset Management Report is also subject to Owner Consent. **Condition Precedent:** Service Commencement cannot be achieved if the Owner has outstanding objections on AMP. **Non-Performance Event:** The late delivery (more than five days late) of the defined asset management plans and reports is a Non-Performance Event (NPE) which can result in deductions. NPE deduction points persist until the deliverable is submitted. **Performance Measure:** There are several performance indicators to promote performance. For example, "*Maintenance performed as part of MPS at the times permitted per Schedule 7*", and "*100% of Planned Maintenance on life safety, emergency systems, and statutory/regulatory requirements completed within the times scheduled in the Annual Asset Management Plan*", **Owner Audit:** "*BC Hydro may at all times, without notice, access, audit and inspect the Facility and Project Co's delivery of the Services*." **Condition Assessment Retention:** The Owner can retain a portion of the availability payment equal to the remedial costs identified in the 12-year condition assessment, and is authorised to retain payment based on the four-year and eight-year condition assessments in certain circumstances.	**ISO 55000 compliance:** Increasingly, ISO 55000 is being adopted in multiple jurisdictions and across multiple asset classes around the world as best practice. The development of an asset management plan in accordance with this standard is a significant step change for many organisations but is increasingly seen as the way forward.
Review and Consent Procedure: Although the Private Partner retains the risk of developing a compliant seismic design, there are a number of deliverables that are subject to Owner Consent to discuss design development and compliance prior to completing the design and starting construction: • Design Basis Memorandum • Design Management Plan • Proposed Checking Team (with independent checkers) • Interim Designs	The impact of climate change is increasingly being acknowledged as a key consideration in infrastructure development. Several jurisdictions have varying degrees of formal policy in place to support those initiatives that encourage climate resistance. For example, in 2018, Infrastructure Canada (Government of Canada) released the Climate Lens which requires climate change to be considered as a core part of Canada's infrastructure planning.

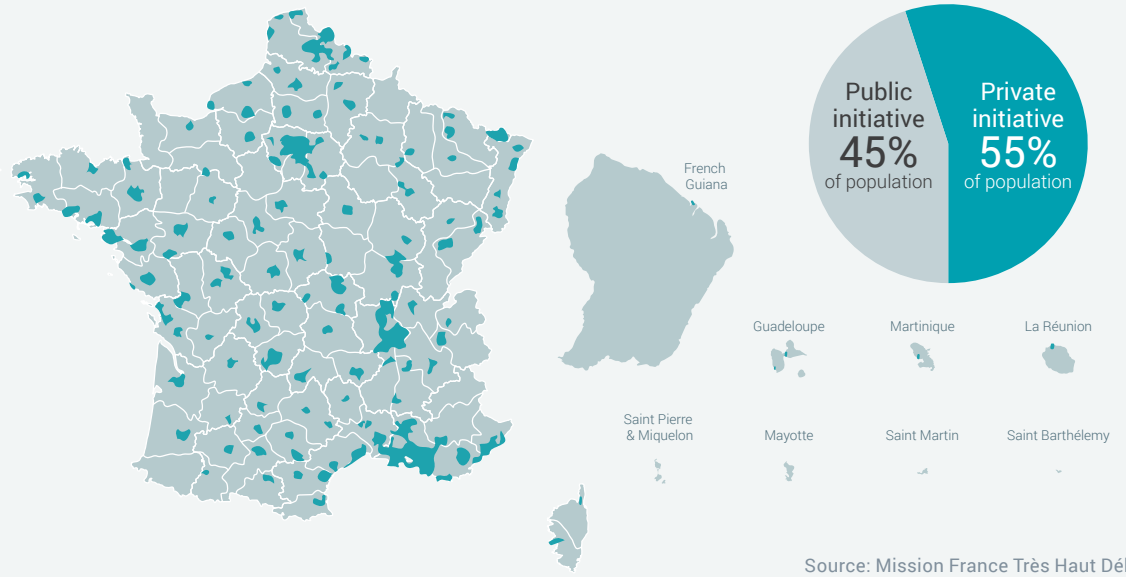
Alignment to QI Focus Areas	
	Post-Disaster Facility: The powerhouse is designated to have a NBCC Post-Disaster Facility Importance Factor of 1.5. This means the seismic forces used in designing the powerhouse are essentially 1.5 times greater than those used to design a 'normal' building. The intention is that the buildings and facilities remain safe for immediate human occupancy. The output specifications provide measurable criteria for the required post-seismic event operating condition. For example: • "*Facility shall remain safely operable during and after an Operating Basis Earthquake and shall be capable of **132.5 MW of generation** at the Maximum Normal Powerhouse Flow immediately after an Operating Basis Earthquake.*" • "*The Facility shall be able to be safely shutdown following a Design Basis Earthquake and be readily reparable and safely returned to service **within 30 days** after a Design Basis Earthquake.*" • "*Low Level Outlet capable of passing at least **124 m^3/s** after a Maximum Design Earthquake event.*" Design earthquakes (which link to the required operating condition) are specified based on the annual exceedance frequency (AEF): • Maintain operations or serviceability limit state: "*The Maximum Design Earthquake (MDE) corresponds to a mean Annual Exceedance Frequency (AEF) of 1 in 10,000.*" • Minor impact to operations (serviceability limit state): "*The Design Basis Earthquake (DBE) corresponds to a mean AEF of 1 in 2,475.*" • Life-safety or ultimate limit state: "*The Operating Basis Earthquake (OBE) corresponds to a mean AEF of 1 in 475.*" The output specification does not include specific requirements to address climate change, however during the planning phase the Owner considered the future operational risks and the ability for the existing dam to structure accommodate increased flows to validate the project's feasibility.
Health and safety considerations during both construction and operation of the asset	The Owner identified ways to incorporate "safety by design" principles into the project requirements in all stages of the project development – procurement, design and construction as well as attempting to futureproof the project for future industry standard development. As an example, the design and construction requirements included general and specific requirements for operability and maintainability, confined spaces, isolation and lockout, isolation of mechanism apparatus, work at height, limits of approach, electromagnetic field, arc flash and constructability. "*A recognised human engineering/human factors standard shall be used to demonstrate that operator and maintenance interfaces have been designed to minimise Hazards, human error and mis-operation. In addition, ergonomic considerations shall be integrated into the Design Work and Construction. The Facility shall conform to the Human Factors Principles set out in Appendix 1.3A [Human Factor Design Principles] of this Schedule.*"
Capacity building, transfer of knowledge and expertise	The Private Partner is responsible for the maintenance of the asset, whereas the Owner is responsible for the operations. Knowledge transfer during the commissioning period focuses on training the Owner's team to successfully takeover operations, whereas the training at the end of term focuses on preparing the Owner to maintain and rehabilitate the asset. Knowledge transfer from the Private Partner to the Owner occurs at three stages during the project: **Commissioning** The Private Partner is required to "*provide training and education for BC Hydro staff sufficient to enable persons with appropriate qualifications and experience to operate and maintain the Facility*". Since the training requirements are specific to the design, the output specification puts the onus on the Project Co to develop a training plan that meets the performance requirement.

5 Further information available at: https://www.canada.ca/en/office-infrastructure/news/2018/06/backgrounder-applying-a-climate-lens-to-infrastructure-projects.html

Mechanisms used to achieve QI alignment	Market Comparison Analysis
• Final Design Submission Reports • Report sealed by the Checking Team • Design Certificate • Final Designs	*"Applicants seeking federal funding for new major public infrastructure projects will now be asked to undertake an assessment of how their projects will contribute to or reduce carbon pollution, and to consider climate change risks in the location, design, and planned operation of projects"*[5]. The methodology to complete the climate change resilience assessment should employ the principles of the ISO 31000:2018, Risk Management – Guidelines standard.
Review and Consent Procedure: The Private Partner is responsible for developing a design that is compliant with the project requirements, and to maintain the facility so it continues to be compliant with the requirements. **NPE/Default Points:** The Private Partner is incentivised to minimise safety risk to avoid incurring NPE or Default Points. For example, there are 13 different performance measures relating to safety and security with assigned NPE points and two incidents that would incur Default Points. The project has surpassed 3.5 million person hours of work without a lost time accident.	Contracts will typically include mechanisms that deduct for minor non-performances but allow the Owner to intervene, or in extreme cases for the contract to be terminated, in response to bad performance especially as it relates to health and safety, environmental or public relations performance. One approach in the Canadian model is to adopt the Non-Performance Event and Default Point regimes that allow the Private Partner to respond prior to the Owner intervening.
Review Procedure: Training materials are subject to Owner review. **Condition Precedent to Commercial Operation:** Once planned and documented in the Commissioning Plan, the completion of training requirements is a condition precedent to commercial operation. **Non-Performance Event:** If the commissioning or handback plans, which include the training plans, are delivered more than five days late, NPE points will be assigned and persist until a plan has been received.	Training and transfer of asset-specific skills to facilitate operations is generally considered standard as part of the development process. The challenge is coordinating the implementation of the plans with commissioning and completion activities. Typically, planning for operations will commence 12 to 18 months prior to service commencement, and important plans will have financial deductions if delivered late.

Alignment to QI Focus Areas	
	Training forms part of the Commissioning process and training activities are documented in the Commissioning Plan which is required be submitted to the Owner 6 months prior to target operation dates. The Owner then reviews the plan which, once accepted, forms the requirement for the Private Partner to deliver. To coordinate Owner participation, there is a defined 15-day notice period for training and education sessions. **Service Period** The training plan developed during the commissioning process is taken forward into the service period and forms the basis for the Private Partner's training requirements. The Private Partner is required to continue to provide training to the Owner's personnel during the service period. The Owner retains the responsibility for ensuring their personnel have the appropriate levels of skill, training and experience for the planned work activities. **Handback** The Private Partner develops a plan, issuing it to the owner within six months of handback, who must comment no later than 90 days before the scheduled handback date. The Owner identifies gaps that may restrict its personnel's ability to operate and maintain the facility, and the Private Partner then revises the training program within 60 days.
Environmental impacts	A key project objective is to provide flow continuity in the Campbell River by installing a bypass system. This was successfully incorporated into the output specifications by specifying quantifiable requirements, which could be measured through a performance-based payment mechanism. The requirement does not, however, prescribe the design of the bypass system. Instead, it focuses on the required system performance. The payment mechanism adopts an availability approach, and the output specifications clearly define what 'availability' means for the bypass system. For example: • **Quantifiable requirement:** "*The Bypass System shall be connected to the Water Conveyances upstream of the Turbine Inlet Valves and provide a means of safely, efficiently, accurately and reliably delivering a compensating flow (matching the real-time decrease in Powerhouse Flow, up to the maximum capacity of the Bypass System) to the Tailrace area* ***within 3 minutes*** *of the occurrence of any Generating Unit Outage […]*" • **Definition of 'Available':** "*Bypass System Non-Availability Event" means (a) the failure of the Bypass System to be Available (up to* **80m³/s** *between September 22 and June 30, or up to* **36m³/s** *between July 1 and September 21, as such flows may be revised from time to time in accordance with GOO 4G-44), due to a Monthly Test Failure, equipment condition or maintenance activities; or (b) the failure of the Bypass System to meet the Bypass System Response Time*". • There were also requirements to protect water quality within the John Hart Reservoir, with the domestic water intake for about 35,000 people about 300 metres away from the work zone. The water bypass is operating as intended following a four-year construction period without any water quality incidents.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Mechanisms promote both the successful construction and continued operational performance of the asset **Availability Payment** (Construction): A percentage of the total availability payment was linked to the successful completion of the bypass, with the value of the payment greater than the construction cost **Non-Performance Event** (Construction): Points linked to financial deductions, are assigned if construction deficiencies are not rectified within 30 days of completion. Deficiencies are both defects in the work or incomplete design or construction scope. **Non-Availability Events** (Operations): If the bypass is not available, there is a payment deduction consisting of: • a flat rate per occurrence to incentivise proactive maintenance to prevent an unavailability event; and • a time dependent component that is measured to the minute to incentive timely response should an unavailability event occur. **Default Points** (Operations): If the bypass is working but does not meet the performance requirement (i.e. takes longer than three minutes), default points are assigned. Default points can accumulate if there is repeated poor performance which can lead to Project Co default. **Non-Performance Event** (Operations): To incentivise preventative testing of the bypass, points are assigned that are linked to financial deductions, if required monthly tests are not completed successfully.	Refer to the comment in the '*Health and safety considerations during both construction and operation of the asset*' section of this case study on the principles behind Default Points.



Source: Mission France Très Haut Débit

ICT CASE STUDY: FRANCE

Plan France Très Haut Débit (Rural Highspeed Broadband)

Location

Grand Est Region, France (rural areas)

Owner

Région Grand Est

Private Partner

Losange (Caisse des Dépôts et Consignations, Fonds Quaero Infrastructure, Fonds Marguerite (22%), NGE Concessions, Altitude Infrastructure)

PPP Model

Design-Build-Finance-Operate-Maintain (Concession contract)

Operating Term

35 years

Contract Value

EUR 900 million/USD 1 billion[1]

Asset Class

Information and Communication Technology (ICT (Broadband))

Awards

- Infrastructure Journal – European Telecoms Deal of the Year (2018)

In 2013, the French government launched the *Plan France Très Haut Débit*; a high-speed broadband development strategy aimed at connecting 100% of households and companies by 2022. The program had EUR 20 billion public investment from the French government and European Union.

Since 2014, several Public-Private Partnership (PPP) projects under concession contracts were signed to allow broadband network roll-out and operation in the rural areas of France between local authorities (regions and departments) and Private Partners (construction companies, network operators and infrastructure investment funds). As the density in rural areas in France is very low (average of 25 inhabitants per square kilometre for some departments), the investment cost is high, and network operators cannot reach financial profitability. Therefore, PPP contracts providing public subsidies are signed to allow deployment in these areas.

1 Assumed conversion rate of EUR/USD = 1.12 as at May 15, 2019.

At the end of 2018, 12% of the network in the rural areas were deployed through these PPP contracts. At the end of the government's program, it will represent 17 million individual connections (households or companies). This strategy will result in France, which was in the low-ranking part of Europe in terms of high-speed broadband availability, becoming one of the first European countries to achieve a 100% coverage of its territory. This project has become the country's largest fibre to the home (FTTH) broadband PPPs and one of the largest PPPs in Europe.

The Grand Est Region, located in Eastern France, awarded a PPP contract in July 2017 for the design, construction, maintenance and operation of the network in the rural areas of the region. At the end of the construction period, lasting six years with the target completion in 2022, almost one million connections (households and companies) will have access to a high-speed broadband network across more than 3,000 municipalities.

Output Specifications Development Approach Used

The PPP contracts are concession agreements signed between the local authority (region or department) and the Private Partner. It states that the Private Partner is responsible for the design, construction, financing, maintenance and operation of the high-speed broadband network in the rural areas. In particular, it includes the lifecycle operations and the handback of the network to the local authority after the end of the concession agreement (between 20 years and 35 years). The Private Partner is in charge of the commercial development, meaning the commercial risk is transferred to the Private Partner during the operating term.

A global standard specification has been elaborated by the France Mission Très Haut Débit, an entity of the French Ministry of Economy and Finance, notably in charge of advising local authorities on the procurement of projects. During the procurement process development, local authorities also develop their own output specifications, depending on their needs and the local context. They are usually supported by companies specialised in advisory to public entities, as well as information and communication technology (ICT). The output specifications are then further detailed in the cahier des charges (technical specifications), included in the procurement documentation and attached to the PPP contract.

In some areas of the project, the specifications are highly prescriptive and similar to technical specifications adopted on projects delivered using traditional delivery models.

Alignment to QI Focus Areas

Sustainability and longevity of an infrastructure asset.	The PPP contract has a 35-year term which incentivises the Private Partner to make long-term maintenance and lifecycle decisions. The performance measures are then intended to align these long-term decisions with Owner objectives and end user expectations.
Ability of the asset to meet the needs of end users	Once the 35-year term has expired, the assets will be transferred back to the local authority. Therefore, the Owner has an interest in promoting and tracking lifecycle investment, as well as the management of asset information. The contract includes the renewal of active equipment during project life, with the same technology. The average active equipment lifetime is seven years. The costs include equipment, staff, subcontracting and overheads. The performance measures focus on meeting end user requirements. The main end user requirements are: • **Access:** Any internet service provider[1] shall be able to use the network to commercialise internet subscriptions to end users. • **Level of service:** The network must provide satisfactory access to the internet (level of service, incidents monitoring, intervention delay).

1 The Private Partner provides bandwidth to the Internet Service Provider, who will provide the Internet subscription to end users. The Private Partner is not allowed to commercialise the Internet subscription itself.

2 Futher information available at: https://mvflproject.com/faqs/

3 Further information is available in the MVFL feasibility study summary: https://www.fin.gov.nt.ca/sites/fin/files/Communications_Summary_Document_Mackenzie_Valley_Fibre_Link_Aug_02_2011.pdf. Refer to: https://mvflproject.com/faqs/

4 Refer to: https://mvflproject.com/faqs/

Mechanisms used to achieve QI alignment

Monitoring lifecycle spend and asset information in preparation for handback: The Private Partner must provide the list of renewal works and their amount in its annual report to the Owner. All invoices related to these works must be provided.

Once the renewal works have been undertaken, design documentation must be updated accordingly. Renewal works need to be integrated in the annual report provided to the Owner. If the annual report or updated design documentation is delayed by more than a month, financial deductions may be applied.

In addition to the renewal works plan over the project duration, the Private Partner and the Owner meet to elaborate the lifecycle plan for the three last years of the project, in anticipation of the handover. This handover process also includes a preventive maintenance plan with actions for the last three years of the project.

If these actions are not undertaken by the Private Partner, the Owner will be able to retain a holdback on the guarantee scheme provided by the Private Partner.

Performance measures for level of service: The three main KPIs observed related to the level of service are:

- Availability rate: measuring the time during which the network is unavailable for any reason. The rate of availability must be above 99.5%;
- Guaranteed Intervention Time in case of an incident occurring on site: between one hour and eight hours depending on the type of client; and
- Guaranteed Restoration Time of the network following an incident: between 2 hours and 24 hours depending on the type of client.

Penalties can be applied if one of these KPIs are not observed.

Performance measure for access: A key requirement of the project is to provide high-speed broadband connection access to 100% of the territory, including isolated companies and households (located more than 1km from another premises). The following are the network access requirements:

- All premises of the territory must have access and the option to have an internet subscription. It will be checked by the Authority through visual inspection on site, and signature of take-over documentation; and
- There is an exception for isolated sites, for which another technological solution (satellite) can be proposed, in accordance with the authority.

Market Comparison Analysis

The contract term of the concession agreements in the ICT industry in France usually ranges from 20 to 35 years.

By comparison the Mackenzie Valley Fibre Link (MVFL) Project in the Northwest Territories in Canada is a PPP (design-build-finance-operate-maintain) project with a 20-year term. The MVFL is a 1,154km cable[2] which was developed to deliver a high-speed service to the Inuvik Satellite Station Facility, while also providing connections to remote communities to improve programs and services such as distance education and telehealth. The design took into account anticipated permafrost conditions along the proposed route and considered the potential for forest fire events[3]. Where permafrost was present, the cable was placed within the active layer, reducing potential effects on permafrost[4].

Alignment to QI Focus Areas	
Job creation, capacity building and transfer of knowledge and expertise	To encourage local job creation, the Private Partner is required to organise training in relation to the project. The Private Partner can choose how to implement the training policy. The types of training are specified in the contract (e.g. design technician, optical fibre worker). In addition to the training policy, the Private Partner has obligations related to social integration clauses (employment of long-term unemployed people and previous detained people). The number of hours of social integration varies from 5% to 20% of the total worked time. The clause observed in the concession contracts is: "*the Project Company must comply with the 20% of hours (i.e. 1,922,000 hours) in line with social integration criteria, up to 380 staff.*"
Ability of the asset to respond to changes in resource availability, population levels, demographics and disruptive technology	The Private Partner is required to take into account potential demographic growth during the design and construction phase, and be technologically adaptive in case of change of technology. The concession contract stipulates that: "*the Project Company must, over contract duration, ensure the technological evolution of the network to comply with the current state-of-the-art and offer the required level of service.*" To take into account demographic growth over the duration of the project, the Private Partner should: • provide additional capacity of 20% in the design of the network; and • check with local authorities if real estate developments are planned in the future.

5 Further information available at: https://www.pppcouncil.ca/web/pdf/mackenzie_fibre_link_news_winter2015.pdf

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Termination events: Consistently failing to meet the performance requirements could lead to termination of the contract. The major termination events are: • *Dysfunction of more than 50% of the plugs over 60 consecutive days;* • *Failure to comply with connection delivery schedule over two consecutive years;* • *Failure to meet the public service conditions defined in the project agreement;* • *Reaching the penalty cap defined in the project agreement;* • *Takeover cumulated period of 6 months;* • *Reaching a delay of 12 months to meet the overall delivery date (5 years and 6 months).*	
The Private Partner must provide a monthly report recording the number of people trained. The Private Partner is required to report the number and ratio of employees working on the project (subcontractors included) respecting the integration clauses. A penalty per hour may be incurred if the objectives are not met.	On other ICT projects in France, the Private Partner creates partnerships with local training centres (public and private). Wider benefits are also reported as quite typical in ICT projects. For example, in addition to the jobs created during the construction of the MVFL project, the long-term project benefits include: improved telecommunications and internet access to communities in the Mackenzie Valley; the provision of jobs, training and economic growth for local communities; the enabling of improved delivery of health, education, and social services programs[5].
If the Private Partner fails to meet these compliances, the subsidies that make the project commercially viable could be retained.	The same requirements are observed in other ICT projects in France, especially the additional capacity of 20%.

Source: Colorado Department of Transport

TRANSPORT CASE STUDY: UNITED STATES

Central 70 (I-70) Managed Lanes

Location

Denver, Colorado, USA

Owner

Colorado High Performance Transportation Enterprise (HPTE) and Colorado Department of Transport (CDOT)

Private Partner

Kiewit-Meridiam Partners, LLC (Meridiam, Kiewit Development Co.)

PPP Model

Design–build-finance-operate-maintain (DBFOM)

Operating Term

5-year construction period which includes operations and maintenance (O&M) plus a 30-year O&M period

Contract Value

USD 1.2 billion

Asset Class

Transportation (Highway and Bridge)

Awards

- P3 Bulletin Best Road/Bridge/Tunnel Project 2018
- P3 Bulletin Best Project Financial Structure 2018

The existing I-70, between I-25 and Chambers Road, is one of Colorado's economic backbones with 1,200 businesses, and a regional connection to Denver International Airport accommodating 200,000 vehicles per day.

According to Colorado Department of Transportation, by 2040 the number of people living in the Denver metropolitan region is expected to soar to eight million people, thus making trips taken on the I-70 twice as long as they are now. The Central 70 Project involved upgrades to 10-miles of highway between Brighton Boulevard and Chambers Road, including one toll managed lane in each direction. There will be up to five lanes in each direction and there is the potential to add a further tolled lane at a future date. In addition, an existing ageing viaduct will be removed and the new highway will be constructed in a 'cut and cover' trench, which will allow for the development of a new sports area for a local school, as well as a four acre public park for the community.

The project commenced construction in 2018 and is scheduled to be completed in 2022. Revenue risk is retained by the Owner and the payment regime is availability-based.

Source: Colorado Department of Transport

Output Specifications Development Approach Used

The design and construction requirements in the specifications take a prescriptive approach and are based on existing CDOT Standards and Specifications, which are used by CDOT on its traditional design-bid-build projects. The output specification then incorporates performance measures, which align with the CDOT Standards and Specifications and reflect the project priorities, in order to administer an availability-based payment regime. The operation and maintenance requirements take more of an output specification approach than the prescriptive approach in the design and construction requirements. Failure to comply with these output specifications is classified as a "defect" which must be remedied to the required standard by the Private Partner within a certain period of time depending on the severity of the defect.

The Owner has made several commitments to the local community as part of the Central 70 Project and these are reflected in the output specifications. These cover a range of issues, from mitigating the impacts of construction noise and dust, to contributing funding to affordable housing and fresh food access and local business opportunities. The output specification reflects these commitments, for example, there are performance measures for local business/employment opportunities (small business, disadvantaged business enterprise, emerging small business and on-the-job training) that result in financial deductions if not achieved.

The Private Partner is responsible for the operations and maintenance of the asset during the construction period as well as the subsequent operating term. The standard to which the asset must be maintained during construction is based on the existing condition of the asset as detailed in a baseline asset condition report (BACR) which the Private Partner must produce prior to commencement of the work. The BACR is subject to approval by CDOT.

Alignment to QI Focus Areas

Sustainability and longevity of an infrastructure asset

Ability of the asset to address the needs and meet the expectations of end users

By transferring the operations and maintenance of the existing road to the Private Partner during the construction period, the Private Partner was enabled to balance construction phasing and schedules with the need to maintain an operational asset and minimise traffic disruption. The Owner established different performance measures for the construction period and the operating period to reflect the maintenance goals (short-term maintenance vs. long-term asset life). This was implemented through the Baseline Asset Condition Report (BACR) methodology described further below. By the end of the construction period, the whole asset was required to meet the operating period output specifications. Large amounts of the existing asset were demolished or upgraded as part of the construction work, therefore the Owner did not want the Private Partner undertaking redundant maintenance work during construction on parts of the asset that were identified for removal.

Operations and Maintenance During Construction

Prior to commencing construction, the Private Partner produced a BACR. The BACR formed the basis in determining the performance standards to which the existing asset would be maintained during construction and was translated into output specifications in the contract. Although the BACR was developed by the Private Partner, it was subject to Owner review. Here is an example of the measurable O&M requirements during construction and how they relate to the BACR:

- *"**Element: Pavement:** All roadways, including ramps, detours, and shoulders (mainline including the bridge deck, covers, gratings, frames, expansion joints and boxes)*
  - ***General Requirement:** Smooth and quiet surface course with adequate skid resistance and free from Defects.*
  - ***Category 1 Defect Remedy Period:** 2 hours.*
  - ***Category 2 Defect Remedy Period:** 12 hours*
  - ***Measurement Criteria:** a) Localized deficiencies: Physical measurement, […] d) Instances of pavement failures: Visual Inspection of roadway surfacing, e) Edge drop-offs: Physical measurement of edge drop-off level to adjacent surface.*
  - ***Target:** Maintain or exceed condition as identified in the BACR; No instances of drop-off greater than 1.0 inch; No instances of failure, including potholes, greater than 1.0 sq ft and 1.5 inch in depth; No instances of base failures, punch-outs and jointed concrete pavement failures; Maintained roadway (including shoulder) free from instances greater than 2"."*

Operating Period Output Specification

The output specification requirements for the operating period require a higher standard of maintenance to maintain the longevity of the asset. It is also a new asset being maintained, so instead of referring to the BACR, industry recognised standards are used as the baseline.

- ***Element: Pavement** - All roadways, including ramps, detours, and shoulders (mainline including the bridge deck, covers, gratings, frames, expansion joints and boxes)*
  - ***General Requirement:** Smooth and quiet surface course with adequate skid resistance and free from Defects.*
  - ***Category 1 Defect Remedy Period:** 2 hours.*
  - ***Category 2 Defect Remedy Period:** 12 months.*
  - ***Measurement Criteria:** a) Ruts: Percentage of wheel path length with ruts greater than 0.40 inches in depth. Depth of rut at any spot location b) Ride quality: Measured International Roughness Index (IRI) calculated according to ASTM E-1926 using equipment meeting AASHTO M-328 and operated in accordance with AASHTO R-57, using equipment verified and operators certified according to AASHTO R-56. Localized roughness […] c) Instances of Pavement Failures: Visual Inspection of roadway surface. Specific Defects are defined in Publication No. FHWA-RD-03-031, Long-Term Pavement Performance Program's Distress Identification Manual.*
  - ***Target:** 80% of project has ruts less than 0.40 inches; Not greater than 0.55 inches; Throughout 80% of maintained roadway area less than or equal to 95 inches per mile on a contiguous 1/10th mile basis; […];No instances of failure including potholes, base failures, delamination of pavement layers, blow-ups, faulting (> 0.12"), punchouts; […]."*

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Financial deductions (Non-compliance Points): The performance measures are combined with a payment mechanism that assigns non-conformance points for defects to calculate financial deductions for defects. Non-compliance points are only incurred where the defect is not rectified within the remedy period. There are two classifications of output specification defects which have corresponding defect remedy periods depending on how significant or severe the defect is: • **Category 1 Defects** – which require "Immediate Action" to address an immediate hazard, risk and/or nuisance. • **Category 2 Defects** – which require "Permanent Repair" which relates to rehabilitation work and has a longer response time, however must not progress to a Category 1 Defect.	Large-scale urban transportation PPP projects around the world often have to contend with the best way to transfer operations risk during construction. The risks will depend on the project and whether it is a new asset or an extension or replacement of an existing asset. Typically, at a minimum, there would be a requirement to manage traffic during construction. Mechanisms have their trade-offs, for example, a maximum queue length could be specified, however this requires a high level of administration. Alternatively, work hours could be limited, resulting in less disruption and lane closures, which can increase cost and impact on the schedule. Project-specific requirements should be considered during the planning phase and included in the cost estimate.

Alignment to QI Focus Areas	
	Handback and Inspections The Private Partner is required to handback the asset to the Owner on the expiry of the contract such that the applicable output specification for each respective part of the asset is met or exceeded; the residual life for the various elements within the asset must meet or exceed their residual life minimum requirement; all renewal work identified as needing to be performed in accordance with the most recently accepted renewal work plan has been completed; and all associated inspections have been completed to verify the asset meets the various performance requirements. For example, specific handback requirements for bridge decks include a prediction of deterioration due to reinforcement corrosion over time based on the various regularly scheduled mandatory bridge inspections undertaken over the course of the contract. Such inspections are undertaken by independent consultants who must be approved by the Owner.
Social impacts and inclusiveness	The project applied lessons learned which were identified through audits of two previous PPP projects (the US 36 P3 Project and the Eagle P3 Rail Project) to improve community engagement through project delivery. The Owner of this project aimed to reconnect communities by removing the viaducts and replacing them with a community park, and promoting corridor-wide economic and community vitality. To achieve these benefits, the output specification requires the Private Partner to deliver community development programs. **Community development program requirements:** • *"Establish a college scholarship program that will benefit students enrolled during the Construction Period as students of good standing at Swansea Elementary school. The scholarship program shall be designed for students who go on to successfully obtain a high school degree or equivalent, and who subsequently are accepted to and enrol in a two- or four-year associates or bachelors degree program. The Developer may partner with a foundation or other non-profit in the management and allocation of such scholarships;* • *In partnership with Swansea Elementary school, develop and/or fund a construction education curriculum for the school designed to impart math and engineering concepts relevant to the construction of the Project; and* • *Establish any other programs that it considers appropriate for the purposes of achieving the community development objective referred to above in relation to such neighbourhoods."* In addition, the Private Partner shall "*provide a full-time Spanish/English bilingual Community Liaison with experience in and knowledge of the Swansea-Elyria neighborhoods […] and be responsible throughout the CC Term for ensuring that local residents, businesses and non-profit groups are informed about the Project and have a single point of contact for all questions and concerns*".
Job creation, capacity building and transfer of knowledge and expertise	As part of the community development program (refer to 'Social impacts and inclusiveness'), the Private Partner is required to "establish an organized program to assist businesses in taking advantage of the significant business opportunity provided by the local workforce during the Construction Period". This is in part due to the lessons learned from previous projects and the need to improve community engagement. • **Community development program:** The program includes "*a commitment to work with restaurants, food vendors and catering businesses that are located within such neighbourhoods and are likely to be impacted by the Construction Work. (The) program may include the following elements:* – *Business investment revolving loans and/or grant programs;* – *Property access agreements for food carts and food trucks;* – *Coupon programs;* – *Advertisements; and/or* – *Partnerships with food-access non-profits."*

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Financial deductions (Non-compliance Points): The Private Partner is required to develop plans that detail how the work will be delivered in compliance with the output specifications. They are then required to implement the works in accordance with the plans. Failure to do so would result in a Non-compliance Event (with associated Non-compliance Points). For example, the Non-compliance Event for communications does not specifically mention the requirement for the "Spanish/English bilingual Community Liaison", however the Communications Plan is specifically mentioned and the "Community Liaison" requirement is included in this plan. Therefore, this requirement is captured in the following non-compliance event: • *"Prepare, maintain and implement the Construction Period Communications Plan (the requirements for which are detailed in Section 5 of Schedule 14 (Strategic Communications) or the Crisis Communications Plan (the requirements for which are detailed in Section 7 of Schedule 14 (Strategic Communications))."*	The National Environmental Policy Act (NEPA) in the United States typically requires a comprehensive assessment of the project development be conducted with respect to its environmental and social impact on the local community. This also can include a public engagement exercise which can result in particularly prescriptive commitments being generated which need to be adhered to. This is not always the case and will largely depend on the location and scale of the project.
Financial deductions: The Private Partner is exposed to financial deductions if the local business targets are not met. The deductions are calculated per Work Category and are different for the construction period and operating term to reflect the relative value of the opportunity lost. During the operating period, the deduction refers to an independent source of labour rates to determine the value of the deduction. **Construction Period** • Failure to Achieve Construction Work Small Business Goals "*Relevant Construction Work Small Business Goal Percentage less Actual Percentage of Relevant Participation Achieved) x (Total Dollar Value of, as applicable to the relevant goal […]*" • Failure to Achieve Construction Period On-The-Job-Training (OJT) Goal deduction = *(Construction Period OJT Goal less Actual OJT Employment Hours on Other Construction Work during the Construction Period) x $28.50*	Quantifiable performance measures are the typical way for projects with job creation objectives to align the Owner and Private Partner priorities. There are similarities in approach between this project and the Gautrain Rapid Rail Link project case study, found below. Good practice is to include requirements for both the construction and operating term.

Alignment to QI Focus Areas

The State of Colorado also wanted to use the project to improve job opportunities in the area, which historically has had low-income levels and high unemployment. To achieve this, the Owner specified measurable local business targets for both the construction and operations phases.

- **Local business targets:** The percentages identified in the table below are a percentage of the total value of the work associated with the project under the particular Work Category.

Work Category	Disadvantaged Business Enterprise	Emerging Small Business	On-the-Job-Training	Local Hiring
Construction Period				
Design Services	11.6%	3%	N/A	760,000 total employment hours with 380,000 employment hours performed by new hires
Other Construction Work	12.5%	3%	200,000 employment hours	
Routine O&M Work	N/A	3%	N/A	
Operating Period				
Routine O&M Work	N/A	$[..] (indexed) for each five Contract Year period	N/A	N/A
Renewal Work	% to be established for each five Contract Year period	N/A	Number of employment hours to be established	N/A

Ability of the asset to respond to changes in resource availability, population levels, demographics and disruptive technology

During the planning phase, the Owner recognised that the requirements, and what is considered good practice, will likely change over the operating term. There is a mechanism in the contract for either the Private Partner or Owner to propose changes to the performance requirements.

- **Updates to the performance requirements:**
  - *"Developer may submit to the Department for Approval proposed updates, if any, to the Performance and Measurement Table no later than 90 Calendar Days before the then anticipated Substantial Completion Date to reflect Good Industry Practice and specific attributes of Developer's final plan set (for example, where the final plan set incorporates a feature that is not included as an Element in such Performance and Measurement Table). Developer may thereafter submit to Department for Approval any proposed updates no later than 60 Calendar Days before the start of each subsequent Contract Year to reflect Good Industry Practice.*
  - *"The Department shall be entitled at any time to require the Developer to adopt amendments to any of the Performance Requirements in such Performance and Measurement Table where such amendments are required to comply with then-current Good Industry Practice and under the following conditions:*
    - *The measurement scale associated with the original Measurement Criteria is superseded and no longer complies with Good Industry Practice; and*
    - *The new Target shall be determined using the principle that compliance with the new Target shall achieve the same standard of performance, frequency of O&M Work and User satisfaction as would have been achieved through Developer's compliance with the original Measurement Criteria and Target."*

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Operating Term • Failure to Achieve Routine O&M Work Emerging Small Business (ESB) Goal • Failure to Achieve Renewal Work Disadvantaged Business Enterprise (DBE) Goal • Failure to Achieve Renewal Work OJT Goal = *(Renewal Work OJT Goal less Actual OJT Employment Hours on Renewal Work during applicable Contract Year) x ((the then-current* ***Davis-Bacon Minimum Wage*** *(Basic Hourly Wage + Fringe Benefit) for a "Power Equipment Operator, Backhoe/Loader combination" in Denver County))"*	
There is no performance measure associated with this requirement. However, the contractual process is time-bound and specifies when and how often (no later than 60 days before the end of the contract year) the changes can be considered.	Incorporating a mechanism to review and update the performance requirements over the operating term is good practice. The first review is typically done during the operational readiness phase where the requirements are updated to reflect the constructed asset, then updates are typically done annually or because of a change.

TRANSPORT CASE STUDY: UNITED STATES

Presidio Parkway

Location

San Francisco, California, USA

Owner

California Department of Transportation (Caltrans) and the San Francisco County Transportation Authority (SFCTA)

Private Partner

Golden Link Partners, LLC (GLP) (Hochtief PPP Solutions North America, Meridiam Infrastructure, Flatiron West, Inc., Kiewit Infrastructure West, Co.)

PPP Model

Design-Build-Finance-Operate-Maintain (DBFOM)

Operating Term

30 years

Contract Value

USD 856.6 million (Phase I of USD 496.3 million and Phase II of USD 360.3 million)

Asset Class

Transportation (Highways)

Awards[1]

- Geotechnical Project of the Year Award 2011, and Outstanding Structural Engineering Project of the Year Award 2015, American Society of Civil Engineers San Francisco Section
- P3 Project of the Year 2012, American Roads and Transportation Builder Association
- Structural Project of the Year 2013, 24th Annual California Transportation Foundation Transportation Awards
- Infrastructure Project Award 2016, National Council for Public-Private Partnership (NCPPP)

1 A detailed list of awards can be found at: http://www.presidioparkway.org/about/awards.aspx

The Presidio Parkway project is a replacement of Doyle Drive, a 1.6-mile segment of Route 101 in San Francisco that is the southern access to the Golden Gate Bridge. The road connects Marin County on the north with San Francisco County on the south and provides a major regional traffic link between the peninsula and North Bay Area counties.

Originally built in 1936, the asset no longer met highway standards and was seismically deficient. Thus, the replacement was not only critical for seismic and public safety, but also provided an opportunity for major design improvements. The Presidio Parkway is a six-lane facility with a southbound auxiliary lane between the Presidio Park Interchange and the new Presidio access at Girard Road.

The project was developed in two phases. California Department of Transportation (or "Caltrans") is responsible for the design, financing, and construction of Phase I, which was delivered through a traditional design-bid-build process. Through a competitive procurement process, Caltrans selected a private consortium, the Golden Link Concessionaire, to deliver Phase II as a design, build, finance, operate, and maintain availability-payment concession. This case study focuses on the Phase I project only.

Construction of Phase I began in late 2009 and was completed in 2012. In April of 2012, traffic was shifted onto a seismically-safe temporary bypass that carried traffic until the final roadway was opened on July 12, 2015. Construction activity continued through 2017 and included the removal of the temporary bypass, reconstructing Halleck Street, covering the tunnels and landscaping.

Particular features of the project:

- California's first PPP transaction under its new (2009) legislation;
- California's first availability payment contract for transportation infrastructure;
- First U.S. project with direct Federal-aid participation in availability payments;
- First Transportation Infrastructure Finance and Innovation Act (TIFIA) loan to be repaid in part with a milestone payment following substantial completion; and
- Incorporation of numerous Context Sensitive Design features to minimise traffic impacts and to protect and enhance environmental and cultural resources.

Output Specifications Development Approach Used

This case study focuses on the seismic performance requirements to compliment the content of the Central 70 project case study.

The output specification adopts industry and Owner standards, and project specific requirements, to define design requirements. The output specification defines a performance-based design approach for the seismic design of the structures. Performance is based on two levels: Safety and Functionality (referred to as the Safety Evaluation Earthquake or 'SEE' and the Functionality Evaluation Earthquake or 'FEE'), corresponding to the 'upper' and 'lower' level earthquake events.

Alignment to QI Focus Areas	
Ability of the asset to withstand natural and other disasters, including climate change	The seismic requirements in the output specification refer to location-specific industry standards. By adopting a performance-based design approach, the Private Partner has the flexibility to design a solution that best mitigates the risk. The output specification requirements are informed by: • **Industry requirements:** American Association of State Highway and Transportation Officials Load and Resistance Factor Design (AASHTO-LRFD) Standard; • **Owner requirements:** Caltrans Seismic Design Criteria[2] (SDC); and • **Project requirements:** Detailed below. The output specification describes the required level of performance, depending on the defined seismic event. The general seismic performance parameters are: • **Serviceable Performance** after a seismic event requires immediate full traffic access after a short period of inspection or minor repairs. A maximum delay of 72 hours is permitted. See Functionality Evaluation Earthquake (FEE) performance level below; • **Repairable Performance** after a seismic event requires limited immediate access for emergency vehicles, with only repairable damage. The asset shall be repaired within seven days to full capacity. "Repairable Damage" can be defined as allowing moderate inelastic response to occur. Concrete cracking, reinforcement yield, and spalling of cover concrete is expected at this level of inelastic response. The extent of damage should be sufficiently limited to permit restoration of the structure to essentially the pre-earthquake condition without replacement of any portion of the structures. See FEE performance level below; and • **No-Collapse Performance** three days after the seismic event, the structure shall be stable for public safety in accordance with ductility demand and capacity values documented in the SDC. See Safety Evaluation Earthquake (SEE) performance level below. There are two levels of seismic event: • **Functionality Evaluation Earthquake (FEE):** Damage is repairable and the asset is returned to service, with or without traffic restrictions. Immediate access to emergency vehicles following inspection. • **Safety Evaluation Earthquake (SEE):** Although there may be significant damage, there is no-collapse and life safety assured. Limited service post event. Per the guidelines adopted by the Owner and the return period risk determined for the project, site-specific hazard analyses shall be performed to establish the design response spectra and ground motions for the FEE and SEE as follows: • **Functionality Evaluation Earthquake (FEE):** The lower level event to be used for the design shall be based on a probabilistic hazard acceleration response spectrum (ARS) for an event, with a mean return period of 108 years (i.e., 50% probability of exceedance in 75 years); and • **Safety Evaluation Earthquake (SEE):** The upper level event to be used for the design shall be based on the ARS derived from the envelope of the median (50th percentile) deterministic Maximum Credible Earthquake (MCE) ARS and a probabilistic hazard ARS for an event, with a mean return period of one thousand years (i.e., 7.5% probability of exceedance in 75years). The output specification also considered the required level of performance during construction. Seismic performance requirements of structures under construction shall meet the SDC requirements for temporary bridges or bridges under temporary conditions carrying public vehicular traffic. The Owner also has existing requirements for temporary structures ('Division of Engineering Services (DES) Memo to Designer 20-12 Site Seismicity for Existing and Temporary Bridges carrying Public Vehicular Traffic').

2 The Owner's Seismic Design Criteria: https://dot.ca.gov/programs/engineering-services/caltrans-engineering-manuals

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Management plans The Private Partner is required to design and construct the project in accordance with their Project Management Plan. The Project Management Plan includes a Quality Management Plan, which is required to be approved by the Owner, which documents the systems and processes to manage the quality of the project scope. The plan details the process for the Private Partner to submit design packages to the Owner for review and approval. In addition, the Owner shall have the right to perform oversight and auditing of the work to determine that it is performed in accordance with the contract documents. The intent of these measures is to monitor and manage the risk throughout design development, when changes are easy to make, rather than waiting until completion inspections to identify non-compliances. **Seismic event deductible** The Private Partner is responsible for the first USD10,000,000 of extra work and delay costs (in aggregate during the project term) incurred to repair or replace tangible property damage caused by seismic events. All un-insured costs above this will be borne by the Owner. By sharing the risk, the Private Partner is incentivised to develop a design that mitigates repairs for a minor (and more likely) event. A seismic event would be considered a Force Majeure Event and thereby a Permitted Closure which would not be subject to an Unavailability Deduction. Typically, it would be a combination of the Owner, third parties (police) and the Private Partner working together to close the road. It would then depend on the reason for the closure as to whether the Private Partner would be eligible for relief.	Performance-based design is a common approach across sectors (for example, refer to the John Hart Generating Station case study in the Energy Case Study section). The 'seismic event deductible' (or similar) is also a common way of sharing the seismic risk. The value of the threshold depends on the project value.

Source: South African Tourism

TRANSPORT CASE STUDY: SOUTH AFRICA

Gautrain Rapid Rail Link

Location
Gauteng Province, South Africa

Owner
Gautrain Management Agency (GMA)

Private Partner
Bombela Consortium (Bombardier, Bouygues Travaux Publics, Murray & Roberts, Strategic Partners Group)

PPP Model
Design-build-finance-operate-maintain (DBFOM)

Operating Term
15 years

Contract Value
ZAR 25.4 billion/USD 1.8 billion[1]

Asset Class
Transportation (Rapid Rail Passenger System)

Awards

This is a list of some of the project Awards achieved:

- Best Global Project to Sign – PPFA Awards in 2008 (London)
- 2007 SAICE Photographic Award (South Africa)
- 2007 International Association for Public Transport – UITP Youth Project Award
- SAACE Glenrand MIB Excellence Award
- 2007 IABC Gold Quill Award
- 2008 Bentley Empowered Award
- 2008 PRISA PRISM Award
- 2010 Media Liaison Officer of the Year Award
- 2011 CineRail Award (Paris)
- 2018 Internal Audit Award
- 2018 Africa Silver Quill
- 2019 Africa Gold Quill

1 Assumed conversion rate of ZAR/USD = 14.1 as at May 15, 2019.

The Gautrain is a dedicated medium- to high-speed rail transport service linking the city of Johannesburg Tshwane with the International Airport at OR Tambo in South Africa.

There are two main routes on the system: a north-south line from Hatfield to Park Station and an east-west line from Sandton Station (via Marlboro) to Johannesburg International Airport. The transport system operates from 10 stations along 80 kilometres (km) of rail and the service operates at a top speed of 160 km/hr.

The project was conceptualised to essentially reduce the dependency on private vehicles, create a safe dedicated public transport service and therefore reduce congestion on the main corridors in Gauteng. The service was not intended as a low-income commuter service but rather an alternative means of business travel to private vehicle usage to achieve the project's three main objectives:

- **Stimulate:** Economic growth; investment; new development; job creation.
- **Promote:** Public transport; small, medium and micro enterprises (SMME) and broad-based black economic empowerment (BBBEE) development; tourism; business development.
- **Design to:** Reduce travel distances, time and cost; restructure urban areas; improve city sustainability.

Construction started in 2006, with works taking place on both routes with the aim of commercial services starting in 2011. Gautrain started operations between Or Tambo International Airport and Sandton in June 2010 and between Rosebank station in Johannesburg and Hatfield in August 2011.

This PPP is run through the Bombela Consortium (the "Private Partner") which has held a 19.5-year concession (including construction) since 2006. This project is a design-build-finance-operate-maintain (DBFOM) project and is in accordance with the regulations prescribed by South African Public Finance Management Act Regulations (TR 16).

The scope also included the supply of rolling stock. The Owner retained most of the demand risk by guaranteeing a minimum ridership, and the Private Partner was required to provide a service that was on time and to specified headways (time between trains, 10 minutes during peak hours and 20 minutes in the off-peak periods), while taking some demand risk.

Output Specifications Development Approach Used

The project was the first South African transportation PPP to use the South African National Treasury guidance on output specification development. There were limited reference specifications to use as a basis for the output specification, so the Owner used the South African National Treasury guidance and guidance from the United Kingdom (UK) on the principles for developing an output specification to develop the output specification from first principles. The output specification evolved throughout the procurement process. Updates were made after the submission of the request for qualifications, request for proposal, and the best and final offer processes, and ultimately the preferred bidder stage to incorporate private sector knowledge and to develop a bankable project. The main components of the output specification are the design and construction requirements, the system service requirements and the socio-economic development (SED) obligations.

Alignment to QI Focus Areas	
Sustainability and longevity of an infrastructure asset. Ability of the asset to address the needs and meet the expectations of end users	End users expect a comfortable, efficient and reliable service. The Gautrain connects to a bus network with approximately 26 bus routes and effective mode integration is required to promote ridership. On-time performance of trains is a key component of this. The Owner also requires the Private Partner to maintain an asset that supports the on-time performance of trains and meets the handback requirements in 20 years. The Owner achieves this by linking payment with train performance and requires measurement and monitoring systems to track performance and asset condition. **Measurement and monitoring systems** The Management Information System (MIS) is the basis for collecting and collating information on the Private Partner's performance and is self-reported. It is used to determine if deductions should be applied and whether the patronage guarantee limit has been met. The MIS includes information on ridership and financial performance; performance surveys; service performance; and asset management and maintenance. • **Ridership and passenger experience:** – Rail ticket sales and patronage report; – Route and trip usage reports; – Reconciliation of booking office machine reports; – Monthly passenger flows; – Trip details and statistics; – Monthly and annual origin-destination matrix of all passenger trips; – Service delivery reports; – Equipment performance reports; and – General financial reports. • **Service performance:** – Monthly train operating reports; – Overcrowding report (utilisation during the peak hour shall not exceed the overcrowding threshold by more than 5%); and – Continuous monitoring of the system and achievements against the timetable. • **Performance surveys:** – Annual, independent revenue collection survey; and – Independent passenger satisfaction surveys. • **Asset management and maintenance:** – Annual maintenance, repair and replace report for each asset class that includes conditional assessments, activities carried out, complaints and completed replacements; and – Annual state of the assets report to manage the condition of the asset once in preparation for handback.
Health and safety considerations during both construction and operation of the asset	Although the responsibility for health and safety is transferred to the Private Partner, the Owner takes a proactive interest in monitoring health and safety performance and the implementation of the health and safety management systems. The Private Partner is responsible for health, safety and security during construction and operations. A Safety Management Plan is required to reflect good industry practice. The Private Partner is then required to report on performance against the management plan. The scope of the Safety Management Plan includes "*Infrastructure, Facilities, and services for the system shall be provided and operated to ensure sufficient safety and security with respect to:* • *Passengers and personnel;* • *Buildings, facilities and amenities within the specified station precincts;* • *Trains and the movements of Train sets;* • *Vehicles used for the provision of dedicated feeder and distribution services;* • *Cars parked in the parking areas of the specified stations".*

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Contract breach and deductions Non-reporting, non-compliance and under performance result in a breach of the Concession Agreement. The Owner requires annual reliance statements to support the invoices being raised by the Concessionaire. The Owner also audits both the MIS and the asset reporting system. The Private Partner is then required to close out audit findings. There are deductions that are calculated from the overall Patronage Guarantee (component of the payment that is at risk of deductions) provided by the Owner, which is calculated across all of the specifications and performance targets set through the concession agreement.	Typical performance metrics include on-time performance (in compliance with a schedule), trip completion (train stops at all stations, and the stations are accessible and safe to use) and ride quality (such as noise and vibration).
Breach in contract Non-compliance results in a breach in the Concession Agreement. Although a contract breach does not have a financial penalty, it carries the risk of termination, which would have a financial impact.	It is typical for Owners to prioritise health and safety planning and performance monitoring. Safety management plans are typically required to be in place within a defined period (depends on the project schedule) after contract signing and prior to construction commencing. Safety plans are typically subject to Owner review. Performance measures typically link poor health and safety performance to contract default.

Alignment to QI Focus Areas

Job creation, capacity building, transfer of knowledge and expertise

Socio-economic development (SED) was a main objective of the project. The GMA developed a SED strategy, which identified 22 elements, with targets, for the project and developed a specific schedule to document the requirements. To achieve the targets in the strategy, the Owner used the output specification to align their priorities with the Private Partner's priorities. To do this, measurable requirements were included in the specification, and independent reviews were required to determine if the objectives had been achieved.

- **SED requirements:** The SED objectives included jobs created by the project during construction, and jobs created to operate and maintain the asset of the 15-year concession period. Of the 22 SED targets, nine required contributions from the Private Partner to be achieved. These targets can be broadly categorised and measured as follows:
  - **Job Creation:** Employment of local people; targets measured in person months;
  - **Capacity Building:** BBEEE procurement and subcontracting opportunities; targets specified by project phase and measured in Rand; and
  - **Transfer of Knowledge:** BBEEE staff secondment opportunities, targets specified by project phase and measured in person months.

  The SED objectives are a good example of how the project objectives influence the output specification requirements. The output specification requirements are performance-based, with clearly defined (capitalised terms are defined in the project agreement) and measurable targets. For example:

  - *Employment of Local People: 3,510 person months during the operating term.*
- **Reporting and independent review of SED requirements:** The Owner required the Private Partner to implement a comprehensive monitoring process to the report progress and performance against the SED targets. The two main components were:
  - Monthly self-reporting; and
  - Independent review of results by an Independent Socio-Economic Monitor (ISEM).

  The ISEM is jointly appointed by the Owner and the Private Partner and is intended to streamline the review process by avoiding disagreements on the SED target performance. The Private Partner is required to develop and submit a monthly report, which is then submitted to the ISEM for review and verification. This approach also minimises the Owner's resource requirements to effectively manage the contract.

Although the penalty and reward regime is administered quarterly, monthly reporting allows trends to be identified and ensures an early response to poor performance, benefiting both the Owner and the Private Partner. The monthly SED report not only provides performance against the target, it also identifies positive developments, areas of concern, challenges and interventions introduced, and forms the basis of continuous improvement exercises.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Penalty and reward regime The Owner identified the need for a contractually sound penalty and reward regime to promote the Private Partner to meet, or preferably exceed, the SED requirements. The penalty and reward regime is administered quarterly. Penalties are imposed should the set targets not be met, but there is also a benefit should these targets be exceeded. The Private Partner's payment from the Owner was deducted if the SED obligation target was not achieved. If the SED target was exceeded, then the Private Partner received performance credits that could be allocated against future target short-falls. The penalty and reward regime was successfully implemented as the targets were exceeded. For example, 34,800 local jobs were created during construction, which exceeded the target of 16,800, and R3,590m was procured from BEE and SMME suppliers, which exceeded the target of R1920m.	Jointly appointing an independent party to administer a contract requirement is a common way to limit disputes. Other instances where an independent party may be engaged include: payment certification during construction, completion and commissioning, asset inspections during the operating period, and asset inspections at handback.


Source: Mott MacDonald

TRANSPORT CASE STUDY: AUSTRALIA

Melbourne Metro Rail Tunnel

Location
Melbourne – Australia

Owner
Rail Projects Victoria (RPV) (previously named Melbourne Metro Rail Authority)

Private Partner
Cross Yarra Partnership (Lendlease Engineering, John Holland, Bouygues Construction and Capella Capital)

PPP Model
Design-Build-Finance-Maintain (DBFM)

Operating Term
25 years

Contract Value
AUD 11 billion

Asset Class
Transport (Urban Rail)

With the target of freeing up space in the city loop to run more trains to and from the suburbs with a less crowded and more reliable train network, Rail Projects Victoria (RPV) (established by the State Government) took charge of the Metro Tunnel project.

The project includes the construction of twin nine-kilometre (km) rail tunnels with five new underground stations. The project will allow for the operational separation of various existing lines and increase the capacity of the rail network to metro-style frequencies. The project is part of the Public Transport Victoria (PTV) Network Development Plan.

Some of Melbourne's busiest metropolitan train lines – Sunbury, Cranbourne and Pakenham – will run exclusively through the new tunnel. By taking these lines out of the City Loop, other lines will be able to run more services. As a result, capacity will be created on the network to enable 504,000 more passengers to use the rail system during each peak period. The Metro Tunnel is the first step towards a 'metro style' rail network for Melbourne with the 'turn up and go' train services that are the hallmark of the world's great cities such as London, New York, Hong Kong and Singapore, and the largest investment in Melbourne's CBD rail capacity since the City Loop was completed 30 years ago.

The project comprises of:

- Twin 9km rail tunnels from the west of the city to the south-east as part of a new Sunbury to Cranbourne/Pakenham line;
- New underground stations at Arden, Parkville, Domain and two new CBD stations directly connected to the City Loop at Flinders Street and Melbourne Central stations;
- Train/tram interchange at Domain;
- High capacity signalling to maximise the efficiency of the new fleet of High Capacity Metro Trains; and
- Wider network enhancements with a range of works, including infrastructure to facilitate access to sidings[1], train turn backs, signalling headway improvements, other works to support service frequency across the existing network, and some changes to the operation of the tram network.

There are four major works packages associated with the project:

1. An Early Works Managing Contractor arrangement, which includes utility service relocations and works to prepare construction sites;
2. The Tunnel and Stations PPP, which includes the design and construction of the twin 9kmtunnels under the CBD, five underground stations and certain maintenance services;
3. The Rail Systems Alliance (RSA), which includes design (including conventional signalling, high capacity signalling, train and power control systems and operational control systems), installation works, rail systems integration and commissioning along the Metro Tunnel Project alignment; and
4. The Rail Infrastructure Alliance (RIA), which includes works at the eastern and western portals, including cut and cover tunnelling, decline structures, turnbacks and local reconfiguration and realignment of existing lines.

Early enabling works commenced in late 2016. In late 2017, sections of the Melbourne central business district, including City Square and parts of Swanston Street, were closed to enable construction of the tunnel and stations. The project was originally expected to be completed in 2026, but has now been revised to late 2025.

Output Specifications Development Approach Used

Prior to proceeding with procurement, the Owner developed a detailed reference design to provide certainty to the bidders that a solution was achievable. The reference design was then translated into the output specification for the Tunnel and Station Public-Private Partnership (PPP) project.

Scheme development was mature and included the preparation of a detailed reference design to provide certainty to bidders. The output specification[2] included the main tunnelling works, five underground stations, station fit-out, mechanical and electrical systems and specific maintenance services for the infrastructure delivered by the package, and commercial opportunities at the new stations.

The output specification section structure is consistent the structure of documents from other jurisdiction and sectors:

- Vision: Scheme objectives and Authority requirements;
- Management: General management requirements including quality, environment, sustainability, monitoring
- Protocols and procedures: Implementation requirements including design life, implementation plan, design standards, design management, communication, code of construction practice, testing and communication, and documentation;
- Technical Requirements (systems, buildings and structures, stations, tunnels, urban design);
- Operation and maintenance requirements;
- Interface management: Support to other contract packages;
- Customer feedback;
- Traffic management during construction;
- Environment; and
- Sustainability and climate change.

1 A short section of track that allows trains to pass or to store rolling stock.

2 The project agreement including output specifications is publicly available at: https://www.tenders.vic.gov.au/tenders/contract/view.do?id=28571&returnUrl=%252Fcontract%252Flist.do%253F%2524%257Brequest.queryString%257D

Alignment to QI Focus Areas	
Sustainability and longevity of an infrastructure asset	Performance requirements align with end user expectations and include: quality of service; customer service; accessibility and interchange; design quality; safety and security; environment and sustainability; and 'good neighbour'.
Ability of the asset to meet the needs of end users	• Good neighbour was given emphasis given the potential scale of construction disruption in Melbourne CBD. One aspect was additional safeguards for the public (safe walking routes) and collision avoidance and mitigation measures applied to construction vehicles. • Designs included specific requirements to demonstrate achievement of minimum standards for passenger circulation/capacity through level of service thresholds. The preferred bidder's proposal become part of the output specification to capture proposed solutions (above minimum requirements) that were used to win the project. For example, the proposed solution included reduction in embedded carbon and a commitment to source at least 20% of energy requirements from sustainable power sources. Other indicators included a 45% reduction in embedded carbon and a 24% reduction in material lifecycle impacts through rainwater capture, LED, solar and use of natural daylighting. The project was required to achieve Green Star and Infrastructure Sustainability Council of Australia (ISCA) ratings. To achieve these ratings, comprehensive sustainability assessments were required. The Owner evaluated the bidder's sustainability assessments to assess whether an ISCA score of over 84 (out of 110) and a 5 Star Green Star rating was achievable.
Ability of the asset to withstand natural and other disasters, including climate change	The output specification includes climate resilience requirements that respond to location specific risks. The Private Partner is responsible for delivering a design that "*must include measures for all high and extreme climate change risks to ensure the infrastructure, Stations and precincts are resilient to the projected impacts of a changing climate over the relevant asset's Design Life.*" The Owner has identified and documented projections and scenarios in a *Climate Change Risk Assessment and Climate Change Adaptation Plan*.
Social impacts and inclusiveness	The output specification refers to the standards and codes to define the access and accessibility requirements for mobility impaired people. There is also a requirement for the inclusion of cultural and community identity infrastructure (CCII). CCII requirements include: • *"Stations and public realm must incorporate cultural and community identity infrastructure and enhancements in the public realm that are tailored to the needs of each local area; are coordinated with local public arts programmes; and offer meaningful additions to the precinct".*

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Bidder proposals became project requirements: The output specification was updated to include proposed solutions from bid stage that exceeded the minimum requirements. The overall project compliance regime (design reviews and completion process) can be used to deliver expected outcomes. **Customer surveys:** Monthly and annual customer surveys are required including: • service reliability and performance; • customer information; • cleanliness and repair; • information provided during disruption; • customer interface; • ease of buying a ticket/ticketing options; • comments and complaints handling; • security (personal security and Park and Ride security); • use of help point equipment; • comfort; • accessibility and interchange; • customer feedback; • overall satisfaction; and • network extensions. The customer surveys are not specifically subject to financial deductions, however the Private Partner is required to self-monitor performance in accordance with the agreed Performance Monitoring Plan (which is subject to quality failures).	The project output specification represents lessons learned from other metro schemes – e.g. Sydney Metro and Crossrail. Customer satisfaction surveys are a standard approach across markets and sectors to measure if the end users' needs are being met.
Design Report: The Private Partner is required to produce a Sustainable Design Report at each stage of design that "*demonstrates that climate change mitigation and adaptation measures or changes have been implemented in design*".	The extent of the climate resilience requirements on the Melbourne Metro Rail Transit project are significantly more detailed than the other case studies. Best practice is constantly evolving, and as regional governments take increasing leadership to identify and respond to the climate change risks, asset owners will be further enabled to identify project specific risks.
Standards and certifications: Compliance with the Disability Discrimination Act (DDA) is required. An Infrastructure Sustainability Council of Australia (ISCA) rating is also required, and the requirements specify the credits for social impacts and inclusiveness: "*Achieve a minimum of Level 2 for each of the ISCA Community Health, Wellbeing and Safety Credits and the ISCA Stakeholder Participation Credits*". **Financial deductions:** The minimum service requirements also reflect the importance of accessibility. A failure that affects the lifts or escalators (and which is not considered a risk to health and safety) shall be considered a 'Level B' failure; the second highest level after health and safety. The level of failure is linked to the value of the potential financial deductions. The failure level also informs the time in which the Private Partner has to respond (in this case 15 to 30 minutes, depending on the time of day).	Refer to the Mersin Integrated Health Campus and the Pan Am Games Athletes' Village case studies in the Built Environment Section for other examples where codes and standards have been used to define minimum accessibility requirements.

Alignment to QI Focus Areas	
Environmental impacts	Prior to procurement the Owner developed the Living Infrastructure Plan[3] for the Metro Tunnel which "*sets out design, implementation and applied learning solutions to help ensure the project results in healthy, resilient and biodiverse green urban landscapes to support the future liveability of Melbourne*". The development of the plan included stakeholder engagement and enabled the Owner to clearly articulate their project vision and requirements. The Living Infrastructure Plan was then translated into the output specifications, requiring the Private Partner to: • *"Demonstrate excellence in the design, construction and management of urban landscapes and ecosystems by applying the principles outlined in the Living Infrastructure Plan to deliver resilient, climate-proof urban landscapes;* • *deliver a post-construction net increase in vegetated surfaces, whereby Project Co must construct at least one tree plot for every tree removed […]".*

3 Available at: https://metrotunnel.vic.gov.au/__data/assets/pdf_file/0016/111832/Metro-Tunnel-Living-Infrastructure-Plan.pdf

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Conditions precedent to completion: By incorporating the Living Infrastructure Plan into the output specification and identifying specific measurable requirements, the overall project compliance regime (design reviews and completion process) can be used to deliver expected outcomes. **Industry standards/financial deductions:** The Private Partner is required to maintain and operate an ISO 14001 certified Environmental Management System. Failure to achieve this at any point throughout the contract term could result in financial deductions through the application of quality failures.	Urban design is a key element in delivering successful urban infrastructure projects, but it is subjective and difficult to define using measurable requirements. Another approach is to include a design guide with the procurement documents and specifications, with the intention of showing what would be acceptable solutions (and why they are considered acceptable) to still allow innovation.


Source: Tibah Airports Development Co

TRANSPORT CASE STUDY: KINGDOM OF SAUDI ARABIA

Madinah Airport - Prince Mohammad Bin Abdulaziz International Airport (PMIA)

Location
Madinah, Kingdom of Saudi Arabia

Owner
General Authority of Civil Aviation (GACA)

Private Partner
Tibah Airports Development Company (TAV Holdings of Turkey, Al Rajhi Holding Group, Saudi Oger)

PPP Model
Build-transfer-operate (BTO)

Operating Term
25 years

Contract Value
USD 1.2 billion

Asset Class
Transport (Aviation)

Awards

- World's Top 100 Airports by Skytrax (ranked 96th) – 2018
- Best Airport in Middle East (5-15 MPPA) – 2017
- Middle East & Africa Infra Financing Deal of the Year – 2012
- Best PPP Deal in the Middle East – 2012
- Best Project Finance Deal of the Year – 2013
- Best Transport Project MENA – 2013
- Best Airport in MENA Region (4-20 mil pax) – 2014
- World's Best Airport Project – 2015

The Kingdom of Saudi Arabia recognises the importance of the air transport sector and under the direction of the King, the Prince Mohammad Bin Abdul-Aziz Airport in Medina was transformed into an international airport. The airport became one of the two major gateways to Saudi Arabia and the holy city of Madinah for Hajj and Umrah pilgrim and visitors to the Prophet's mosque.

The General Authority of Civil Aviation (GACA) of the Kingdom of Saudi Arabia set out a long-term plan to reform and liberalise the country's airport sector. A Public-Private Partnership opportunity arose for the expansion, rehabilitation, modernisation, operation and maintenance of the Madinah Airport, the fourth busiest airport in Saudi Arabia.

The project investment was obtained through the Islamic fund from Arab National Bank, National Commercial Bank and the Saudi British Bank. The US $1.2 billion expansion plan consists of state-of-the-art facilities built in accordance with the highest international standards. The project comprises a three-level terminal covering 156,940 square metres, with 16 aircraft stands, 20 remote apron stands and 31 passenger boarding bridges. The project included the widening and extension of the runway, and construction of new taxiways for accommodating A380-size aircraft. Facilities including construction of a mosque that can accommodate 1,000 worshippers, and 20 ancillary buildings that include Hajj facilities, administrative buildings, a VIP terminal, power station and a new aircraft rescue and firefighting building.

Phase one of the airport can handle 8 million passengers per year, with the second and third phases able to handle passengers of 14 million and 27 million respectively.

In October 2011, the Build, Transfer and Operate Agreement (BTO) was signed between the General Authority for Civil Aviation and Tibah Airports Development Co. to become the first airport project in the Middle East to be fully built under a PPP structure. The project was inaugurated in July 2015 and has been awarded several prestigious awards.

The new Madinah Airport is not only a major part of the Holy City's infrastructure, it also plays an eminent role in the socio-economic development of the region by encouraging international commerce and tourism and by generating employment opportunities.

Output Specifications Development Approach Used

The approach taken with the output specifications was to set out technical requirements for operations and maintenance that were based on international best practices and combined with local regulations which are to be updated periodically during the concession term. These requirements included plans that, once developed, the Private Partner had to comply with during implementation. For example:

- **Operation and Maintenance Manual:** First submission within 360 days of the effective date then updated every three years starting from 2015 ('PMIA Aerodrome Manual' can be found on the official Concessionaire`s website);
- **Master Plan:** First submission within 360 days of the effective date then update every five years starting from 2017;
- **Environmental Management Plan:** First submission within 360 days of the effective date then updated every five years starting from 2017;
- **Emergency Plan:** First submission within 360 days of the effective date then updated every five years starting from 2017; and
- **Strategic Marketing Plan:** First submission within 90 days of the effective date then updated annually.

A market sector comparison is provided in the Mactan-Cebu International Airport case study.

Alignment to QI Focus Areas	
Sustainability and longevity of an infrastructure asset. Ability of the asset to address the needs and meet the expectations of end users	One of the main project objectives is to provide customers and stakeholders with services and facilities that adhere to the highest standards of quality, ethics and corporate behaviour. The quality standards in safety, environment and operations are achieved through applying best national and international practices based on continuous assessment of satisfaction with passengers and stakeholders. • The output specifications required the Private Partner to establish an Integrated Management System (IMS) that complies with the **ISO 9001, ISO 14001 & ISO 10002** standards. This IMS provides a framework for measuring and improving performance towards quality, environment, operations and end user satisfaction. Customer satisfaction was also a priority of the Owner. The Private Partner developed the following guiding principles to achieve the goal of customer satisfaction through quality services, processes, facilities and business decisions: • Regular collection and analysis of **customer feedback**; • An efficient customer complaints/suggestion handling procedure; • Selection of reliable suppliers and regular review of their performance against set criteria; • Training and career development for employees; • Regular audit program; • Measurable quality objectives which reflect business objectives; and • Management reviews of audit results, customer feedback and business performance. The internal procedures have been developed and integrated into the operations and are held in the IMS Manual which is made available to all employees. In 2018, Madinah Airport has been named as the Best Airport by Size and Region: Middle East (5–15 MPPA) by Airport Council International (ACI). The ASQ award ranks Madinah Airport's customer experience among some of the best airports in the world.
Health and safety considerations during both construction and operation of the asset	The Private Partner developed and maintains a safety management system manual (SMSM) meeting the standards and requirements defined in the International Civil Aviation Organization (ICAO) Safety Management Manual, and the requirements of the General Authority of Civil Aviation Regulations – Safety Management System. • The Safety Management Systems (SMS) for the project introduced an evolutionary process in system safety and safety management. SMS is a structured process with the obligation to manage safety with the same level of priority as other core business processes. The SMSM implementation strategies focus on: – Process safety culture; – Compliance with standards, codes, regulations, and laws; – Hazard identification and risk analysis; – Asset integrity and reliability; – Engage management; and – Measurement and metrics for safety awareness and as a product.

1 Information available at: https://aci.aero/customer-experience-asq/asq-awards/asq-awards-categories/

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Passenger surveys: • The Passenger Satisfaction Surveyor reports are conducted every four months, including once annually in respect of a peak calendar month with respect to Hajj traffic (either arrival or departure) during the concession term. • Airport Service Quality (ASQ) Survey is conducted annually during the concession term. The objective is to achieve a ranking among the top five airports in its category (as defined by ASQ[1]). **International standards:** The Private Partner was required to obtain the (a) ISO 9001 Quality Management System, (b) ISO 10002 Complaints Management System and (c) ISO 14001 Environmental Management System certifications in respect of the airport within two years of the concession term and maintain these certifications throughout the term. **Owners right to audit:** The ability to review actual versus reported performance is a key tool in promoting the Private Partner to fulfil the output specification requirements. The Private Partner shall "*permit the [Owner] or its representatives or advisors, during normal business hours, to inspect the books, plans, financial records and other records and documents belonging to or kept by or on behalf of the [Private Partner] with respect to the Project for the purposes of ensuring compliance by the [Private Partner] with this Agreement. At its own cost and responsibility, the [Private Partner] shall also procure and install an electronic information network that will permit the [Owner] continual access to key PMIA financial, operational, maintenance and administrative information*".	Most modern greenfield and brownfield airport projects globally are increasingly being required to focus on sustainability. While there is no uniform guidance, the sustainability requirements involve energy efficiency, clean air, noise control and proper handling of environmental hazards including effluents and fuels handling. The Owner's right to audit is a typical requirement across sectors and jurisdictions. Most payment mechanisms rely on the Private Partner self-reporting performance. The Owner's right to audit creates some tension and promotes accurate self-reporting. The Canadian and United Kingdom PPP models also include additional penalties if the Private Partner does not report issues or does not accurately report performance. The ASQ survey is an industry standard survey used by airports across the globe. The standardised approach allows performance to be benchmarked between airports.
Industry standards: The Private Partner is required to develop and operate a facility that complies with international standards. During the design phase, detailed engineering packages shall be submitted to the Independent Engineer for approval.	All modern greenfield airport developments are required to adhere to local and international health and safety regulations applicable to construction. The requirements are typically included in the concession contract. During the operation phase of the project, all modern concession contracts adhere to international health and safety standards published by ICAO and ACI, as well as local regulations that are generally imposed by the local civil aviation authority.

Alignment to QI Focus Areas	
	• Occupational injuries and illnesses can be prevented through continuous improvement and dedication to its Zero Accident Policy. The Private Partner's Occupational Health & Safety Manual to address the following areas: – Providing appropriate facilities for welfare at work; – Identifying hazards and implementing risk assessments in order to avoid the occurrence of injury; – Consulting with and involving employees in matters relating to their own health and safety; – Ensuring that control measures and emergency procedures are in place; – Providing training to ensure that employees are aware of any work-related hazards, as well as the protection measures; – Providing the necessary organisation, expertise and resources to ensure that there is effective management of health and safety throughout the Airport.
Environmental impacts	Madinah Airport has been awarded Leadership in Energy and Environmental Design (LEED) Gold Certificate for the recent terminal expansion from the U.S. Green Building Council (USGBC). The award makes Madinah Airport home to the first LEED Gold Certificate for an airport in the Middle East/North Africa region. The output specification requires an Environmental Management System that meets ISO 14001 international standards.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
International standards: By adopting LEED and ISO to promote environmental performance, third parties are involved in assessing compliance. • ISO 14001 Environmental Management System certification • LEED Gold certification	A current airport redevelopment project in North America requires both LEED Silver Certification (for design and construction and the operations and maintenance) and ENVISION Gold certification. The same project also references international standards (ISO14064 and ISO14065) for greenhouse gas quantification, validation and verification.

Source: Mott MacDonald

TRANSPORT CASE STUDY: THE PHILIPPINES

Mactan-Cebu International Airport (MCIA)

Location
Cebu, Philippines

Owner
Mactan-Cebu International Airport Authority (MCIAA) and Department of Transport (DOTr)

Private Partner
GMR-Megawide Cebu Airport Corporation (GMCAC) (GMR Infrastructure Ltd, Megawide Construction Corporation)

PPP Model
Design-Build-Finance-Operate-Maintain (DBFOM)

Operating Term
25 years

Contract Value
USD 390 million

Asset Class
Transport (Airport)

Awards

- Best Transport Deal for Asia Pacific in the 2015 Partnership Finance International (PFI) Awards
- CAPA's 2016 Best Regional Airport in Asia Pacific award

Mactan-Cebu International Airport Authority (MCIAA) and Department of Transport (DOTr) proposed the construction of a new world-class international passenger terminal, including all related facilities, to efficiently handle the increasing air traffic demand, ensure convenience of passengers, and promote aircraft operational efficiency.

The project aimed to increase the level of convenience and service to passengers in the existing passenger terminal and decongest the terminal facility to allow future growth.

This airport was tendered to the private sector in a PPP arrangement based on the Philippines Build-Operate-Transfer (BOT) Law. The scope of the project included operation of the apron[1], existing terminal and the landside/commercial facilities, as well as the design, construction and operation of a new international passenger terminal. The current airport operator MCIAA continued to operate the remaining airport facilities (such as the runway and taxiways) and also acts as the joint grantor of the project together with DOTr (formally the Department of Transport and Communications).

In 2014, a Filipino-Indian consortium, consisting of Megawide Construction Corporation and GMR Infrastructure Limited forming the Special Purpose Vehicle (SPV) (called GMR-Megawide Cebu Airport

1 Aprons are the areas at the airport which permit the parking of aircraft for the purpose of on- and off-loading passengers, cargo or mail, as well as the servicing of aircraft without interfering with the airport traffic.

Corporation (GMCAC)), was awarded the concession and this project reached financial close in January 2015 with Banco de Oro (BDO) as the lead arranger. The lender group included other Filipino banks, as well as the Asian Development Bank (ADB).

Shortly after the handover of the project assets in 2015, GMCAC commenced the renovation of the existing mixed use (domestic and international) terminal to provide enhanced facilities and increased service standards. The first phase of the new international terminal was opened in July 2018. The design of the new terminal features timber structures and striking arches in reference to local Filipino buildings in response to the requirement to "*capture the aesthetics and spirit of traditional architecture of the Philippines*"[2].

Output Specifications Development Approach Used

The output specifications are mainly contained in the contract schedule relating to the Minimum Performance Specifications and Standards (MPSS). There is one schedule of 24 pages that covers the operation and maintenance standards of the assets. The MPSS includes both objective (asset availability, queue times and customer service) and subjective (passenger surveys) performance parameters, both of which can lead to financial deductions if not achieved.

A different schedule to the contract covers the design requirements for the new terminal, airside and landside facilities. The requirements refer to an international standard to specify the level of service. The International Air Transport Association (IATA) publishes the Airport Development Reference Manual (ADRM), which includes detailed guidelines around the design and operation of key airport facilities including passenger terminals. IATA Level of Service C is specified in the contract, which relates to guidelines on space per passenger for each process and acceptable waiting times at these processes. The Owner considered Level of Service C to provide a balance between providing economical facilities and a comfortable service level for the majority of passengers. It should be noted that Level of Service C was changed to Level of Service Optimum in the updated versions of the ADRM and the number of service levels was reduced from six (A-F) to three (Over-Design, Optimum and Sub-Optimum). Additional specifications are provided for the apron, terminal and landside facilities.

Since the Private Partner will only operate and expand the assets linked to the passenger terminal, there is a key interface with the current airport operator (MCIAA) who continues to operate the remaining airport facilities. MCIAA are required to operate the facilities under its control according to the required standards to mitigate negative impacts to the Private Partner (e.g. the runway is not properly maintained, which results in flight cancellations, which have commercial impacts for the Private Partner). To respond to this, the contract also contains MPSS related to the Owner's performance, such as the requirement to provide air traffic control services or undertake frequent inspections of runway pavements. The Private Partner would be eligible for compensation where the Owner does not meet the performance requirements.

Market comparison

The MCIA project has been compared to Japanese airport transactions for the purpose of highlighting differences and similarities. Starting in 2014 with the Sendai and Kansai Airports transactions, Japan has brought 10 airport deals to market and more are to follow. This is driven by the Japanese Government and the "Act on Operation of National Airports Utilising Skills of the Private Sector", which was passed in 2013 to respond to the need to increase the efficiency of national airport management due to population decline and minimal growth in domestic passengers. The format and structure of each transaction is very similar as in most cases the Operating Right Holder (Private Partner) will operate the terminal, airfield and some ancillary facilities and is able to expand facilities based on demand.

There are considerable differences between the overall framework and contracting structure of the MCIA project and the Japanese transactions, from the scope of the projects to the level of prescriptiveness in the specifications.

For example, most Japanese airport transactions resemble operations and maintenance contracts that focus on efficiency improvements, with no significant new development (either new terminals or runways). In contrast the MCIA project required the construction of a new terminal at the start of the concession, prior to an ongoing O&M term.

In the context of output specifications, the Owner in the Philippines specified a very prescriptive, detailed and extensive list of performance indicators and targets which are linked to non-performance penalties during the operations period. Whereas for the Japanese transactions, the Owner puts less emphasis on including specific performance targets and penalties into the project agreements. The different approaches typically stem from the level of PPP maturity and the culture of contract administration – a trend also observed on 'built environment' projects (refer to the Mersin Integrated Health Campus project).

2 ANNEX TP-5: Conceptual Architectural Design for the Project in Instruction to Bidders, 29 May 2013.

Alignment to QI Focus Areas

Sustainability and longevity of an infrastructure asset

Ability of the asset to address the needs and meet the expectations of end users

As the Private Partner operates the facility over 25 years, there is an inherent incentive to minimise maintenance costs. The availability targets act as a driver to ensure appropriate quality of systems and equipment to avoid financial penalty. Once the contract period is over the assets will transfer back to the Owner, or an extension of up to 25 years can be negotiated.

Asset availability targets promote proactive maintenance

The KPIs in the MPSS include availability targets defined in percentage terms for key airport facilities. Availability targets have been set for passenger boarding bridges, flight information display systems, lifts/escalators, automated services (including the baggage handling system), internet and Wi-Fi services. The target is set at 95% availability for these facilities. The target considers any planned maintenance that may have to take place by specifying the calculation method which consists of actual operational hours and planned operational hours excluding scheduled downtimes. While not specified in the contract, to measure this target accurately, appropriate systems should be in place that automatically record and log the actual hours of operation.

Performance reflects end user priorities and is linked to demand and capacity

Airport terminals are usually designed to accommodate the demand that is slightly below the absolute peak to balance an acceptable service level to the majority of passengers and project costs. Since there are instances where the facility is expected to be under capacity for the passenger numbers, the KPIs related to waiting times are not applicable to 100% of passengers but to 90% or 95% of passengers (depending on the process). As a result, a low proportion of passengers may experience waiting times that exceed the specified waiting time standards, but the intention of these KPIs is to ensure that this proportion remains low and does not increase as the airport traffic grows. The following examples demonstrate how the KPIs relate to the Owner (and end user) priorities:

- **Wait times:** There are specific wait time targets applicable to passenger processes (e.g. check-in, security, immigration). The maximum waiting time in the queue is specified for each of these processes and varies between five to 15 minutes depending on the type of process.
- **Baggage delivery:** The time that the first bag should be delivered to the reclaim belt, as well as the maximum time the last bag should have been delivered to the reclaim belt are specified. Different targets are defined depending on the type of flight (domestic or international) and type of aircraft (narrow or wide-body).
- **Customer service:** Targets include availability of customer information desks, availability of services for handicapped and special needs passengers, as well as maximum response time for any complaints that the Private Partner receives from users.

Industry standard surveys to measure end user satisfaction

The Private Partner is required to undertake a passenger satisfaction survey every quarter. The industry benchmark for customer satisfaction surveys is the Airport Service Quality (ASQ) survey which has been developed by Airports Council International (ACI). It is a standardised survey which is completed by passengers at the airport once they have completed their journey through the terminal. According to the ACI website, the ASQ survey is currently undertaken at 388 airports worldwide[3]. The contract specifies a requirement to participate in the ASQ survey but on the condition that the Private Partner is not admitted as an ACI member, the Independent Consultant is required to develop a similar questionnaire to measure customer satisfaction. According to the ACI website[4], the full survey consists of 34 key service areas and includes eight major categories, such as access, check-in, security, airport facilities, food and beverage providers and more that align the customer experience.

3 Information available at: https://aci.aero/customer-experience-asq/asq-participants/

4 Information available at: https://aci.aero/customer-experience-asq/services/asq-departure-survey/methodology/

Mechanisms used to achieve QI alignment

Owner audits: Both the Owner and the Independent Consultant appointed by the Owner can undertake audits of project assets to inspect and test any facility or process. The Owner has to give reasonable notice to the Private Partner in advance of such audits.

Performance indicators are linked to financial deductions: The performance indicators are part of the MPSS sections in the contract. The MPSS specifies subjective performance parameters for end user surveys and 24 objective performance parameters which have been split into two categories: primary and secondary, which have different deductions (primary parameters carry double the deductions of secondary). The deduction regime consists of two broad categories:

- passenger survey rating (calculated quarterly); and
- waiting times and facility availability (calculated monthly).

The majority of KPIs are in the primary category. These KPIs cover a range of aspects such as waiting times at particular passenger processes, availability targets of key airport equipment, terminal ambiance and customer service. The KPIs are prescriptive and detailed but involve performing measurements in fluent and dynamic environments, such as a queue at a passenger process. The Private Partner is required to submit a measurement plan for the KPIs which is subject to Owner's approval. An Independent Consultant is appointed to measure the KPIs and monitor performance.

A minimum satisfaction score must be obtained in the survey. The contract specifies a slightly lower minimum rating for the existing domestic terminal compared to the new international terminal. This is in recognition of the domestic terminal being an existing facility with some inherent inefficiencies.

Market Comparison Analysis

Typical concession terms in the Japanese airport industry range between 20 to 30 years. The concession period for Japanese Airport Concessions is typically 30 years, but longer or shorter terms have also been implemented. The shortest is 15 years (Takamatsu Airport) and the longest 44 years (Kansai Airports). The difference in concession terms is driven by a number of factors, such as the assumed return of investment and required time to implement the proposed efficiency measures.

Requirements are specified in the form of Required Standards (RS). There are standards for environment, building facilities, airfield, security, etc. Examples of standards include for the Operating Right Holder (ORH) to follow particular security regulations in order to prevent mixing of screened and unscreened passengers and ensure the screening of passengers and their bags.

The RS do not tend to contain numerical KPIs. Instead, the RS prescribe the way in which the operation and maintenance should be undertaken, such as daily inspections of key equipment to ensure they are safe to use and fully functional. These inspections should be undertaken following the guidelines provided by the State. The RS are formulated by the Owner, who in the case of the national airports, is the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), or in the case of regional airports is either the prefectural or city government.

The Owner undertakes their own compliance monitoring to ensure that the ORH adheres to the requirements. The Civil Aeronautics Act and Airport Act are the principle acts to be complied, with but also include a large number of other legislation including environmental laws (on noise regulation, vibration, soil contamination, etc.) and general standards for the airport's civil engineering facilities.

In addition, the ORH is required to propose service quality performance indicators for airport users. In one particular concession agreement, short (five years) and long-term (end of concession period) targets had to be set by the ORH. These targets do not constitute an obligation on the ORH, i.e. they are not linked to penalties or events of default. However, in order to encourage the setting of efficient targets, the proposed targets were evaluated as part of the overall bid evaluation process by the Owner. Self-reporting of performance is required in periodic intervals. In addition, the Owner will monitor if the ORH complies with the RS and all applicable regulations and standards.

If the Owner determines that the project is not implemented in line with the requirements, the ORH needs to submit an improvement plan. If the ORH does not provide this plan or improves its performance in the case that it is found it does not comply with the RS, the Owner may cancel the concession contract.RS specify that a customer satisfaction survey must be undertaken once a year, but no specific guidance is given on the categories or a minimum score. The results should be published on the airport's website. There is no specific instruction as to the format of the survey or the its content and no requirement to adopt the industry standard ASQ survey.

Alignment to QI Focus Areas	
Health and safety (H&S) considerations during both construction and operation of the asset	The contract states that all works must be undertaken in compliance with all relevant health and safety (H&S) legislation. Regular construction reports by the Private Partner include reporting on H&S performance. The output specification cited national legislation, however since the Asian Development Bank (ADB) was a one of the lender's, the Private Partner also had to comply with the ADB's safeguarding policy which includes occupations and community health and safety provisions. In addition to health and safety, security is also a key consideration on aviation projects. The contract specifies a large number of aviation specific regulations, as well as national regulations (including security regulations) that the design needs to comply with, as well as any required licences and permits, particularly in relation to the construction of the new terminal. The operations and maintenance of the airport shall also be carried out in line with these regulations.
Social impacts and inclusiveness	The Private Partner is required to undertake an Environmental and Social Impact Assessment as part of the new terminal development. The output specification specifies that the design shall take into account the needs of mobility impaired end users. There is a KPI addressing the availability of assistance for passengers with special needs/requirements.
Environmental impacts	The design requirements state that the new terminal should aim to be carbon neutral. It should be noted that such a requirement is not realistically achievable as noted on the Airport Carbon Accreditation website[5], which states that offsetting would be required for an airport to become carbon neutral. In terms of terminal design, it is recommended that a particular building certification standard such as Leadership in Energy and Environmental Design (LEED) is used instead. Potential alternatives to LEED are EDGE (Excellence in Design for Greater Efficiencies)[6], an online platform developed by the International Finance Corporation (IFC) and Building Research Establishment Environmental Assessment Method (BREEAM) developed by the Building Research Establishment (BRE)[7].
Alignment of the project with economic and development strategies. (SDGs, national policy, etc) Ability of the asset to respond to changes in resource availability, population levels, demographics and disruptive technology	The design specifications state that the development should be modular and scalable to provide flexibility to accommodate future changes in the demand profile. It is further stated that the facilities should be efficient to handle fluctuations in passenger demand. It should be noted that this requirement is not easily achieved with regard to some facilities and equipment such as the baggage handling system or other centralised systems. These systems are not modular and would need to be reconfigured to be expanded.

5 Information available at: https://www.airportcarbonaccreditation.org/airport/4-levels-of-accreditation/neutrality.html

6 EDGE is a green building standard and a certification system which helps to determine the most cost-effective options for designing a 'green' facility within a local climate context: https://www.edgebuildings.com

7 BREEAM is an international scheme that provides independent third-party certification of the assessment of the sustainability performance of individual buildings, communities and infrastructure projects: https://www.breeam.com

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Contract termination/default: Failure to meet the operation and maintenance obligations which result in a material risk to the health of passengers is considered a reason for Private Partner default. The contract mentions the Private Partner shall direct special attention to the safety of passengers. Any action or inaction of the Private Partner that affects the safety of the facilities may constitute a breach of the agreement. **Review and audit:** During construction, the Independent Consultant reviewed the construction and operational plans and completed site visits to monitor compliance. The Owner also has the ability to undertake audits during operations.	In Japan, at the bid stage, the Private Partner is expected to provide its proposals for implementing safety and security, as well as measures on dealing with emergencies. Compliance is, in principle, based on self-reporting but audits may also be undertaken by the Owner.
Performance indicator: There is a KPI for the percentage of time assistance for Passenger with Disabilities is available. The KPI requires the Private Partner to provide assistance to all disabled passengers within a specified timeframe (measured in minutes).	In Japan, the RS mandates that facilities for the handicapped, elderly or mobility impaired users should be carefully considered when undertaking modification or expansion works. The ORH is required to collaborate with stakeholders and local communities throughout the concession period and participate in local community meetings, etc.
There is a design requirement for the new terminal to aim to be carbon neutral and minimise water and energy consumption, as well as carbon emissions through the use of efficient technologies.	In Japan, there is a set of RS on environmental impacts. One key aspect is noise, where the Private Partner is typically expected to fund or contribute to the sound proofing of residential properties or other mitigation measures. In one example, the total amount that the ORH has to contribute to support noise mitigation measures over the concession period is explicitly stated in the contract.
Independent design review: The Preliminary and Detailed Design was reviewed by an Independent Consultant. The scope of this review was to determine whether the designs substantially follow the tender design developed in line with the output specification requirements, and whether the agreed changes have been incorporated following discussion with stakeholders.	The requirement for innovation does not tend to be directly stated, but it is expected that the Private Partner will employ its experience and 'know-how' to improve the existing facilities and operate the assets more efficiently through employing the latest technologies, etc.

Source: Organic Resources Recovery Centre Phase 1 (OPARK1, previously known as ORRC1)
Image courtesy of Environmental Protection Department

WATER & WASTE CASE STUDY: HONG KONG

Hong Kong Organic Resources Recovery Centre

Location

OPARK1: Siu Ho Wan in North Lantau, Hong Kong

ORRC2: Sha Ling in North District, Hong Kong (pending funding approval from the Legislative Council)

ORRC3: Shek Kong in New Territories, Hong Kong (planning and feasibility study stage)

Owner

Environmental Protection Department (EPD)

Private Partner

OPARK1: OSCAR Bioenergy (Suez Environment, ATAL Engineering Limited, SITA Waste Services Limited, RosRoca)

ORRC2: Currently in procurement

PPP Model

Design-build-operate-maintain (DBOM)

Operating Term

15 years

Contract Value

Phase 1 – HKD 1.53 billion/USD 195 million[1]

Phase 2 – Estimated HKD 2.45 billion/USD 312 billion

Asset Class

Waste and Water (Solid Waste Management)

In 2009, Hong Kong disposed of about 3,700 tonnes of organic waste to landfill every day, of which 1,000 tonnes originated from commercial and industrial sources. The damaging long-term environmental effects and depletion of the limited landfill void space meant that the development of a sustainable solution was urgently required.

Building on the success of a pilot composting facility commissioned in 2008, Hong Kong's Environmental Protection Department (EPD) sought to develop Organic Resources Recovery Centres (ORRCs) in several phases. The first two phases use anaerobic digestion technologies, followed by composting, to transform the organic waste into useful compost products and biogas for energy recovery.

The project was developed by EPD to treat source-separated organic waste (mainly food waste) arising in Hong Kong, thereby reducing the reliance on landfills and producing renewable heat/power and compost. The Government of Hong Kong is developing a network of around five to six ORRCs with a total recycling capacity of about 1,300 – 1,500 tonnes per day (tpd), over a number of years, using a similar approach each time, for achieving waste reduction targets. The phased development should allow for increasing treatment of separated food waste, as awareness and uptake of waste separation grows.

1 Assumed conversion rate of HKD/USD = 7.8 as at May 15, 2019.

The first ORRC called OPARK1 has been operational since July 2018 with the capacity to treat 200 tbd of food waste. As of May 2019, ORRC2 is in procurement and will be able to treat up to 300 tbd, the feasibility of ORRC3 is being assessed and the remaining ORRC's are under review.

Output Specifications Development Approach Used

The output specification is based on the standards and publications of the Government of Hong Kong's Civil Engineering and Development Department, the Development Bureau and relevant statutory requirements. A detailed specification was developed, listing the type of technology and processes required, and covering both the outputs required and some of the input specifications more typically found in other types of contracting structures. The Private Partner is responsible for design, construction, operation and maintenance, as well as handback. The specification used was bespoke for the contract, although the output specification produced for OPARK1 has been mainly reused for ORRC2 with some flexibility in the surplus renewable energy export (electricity or biogas). Future ORRCs may follow a similar approach, with the potential for refinement from lessons learned. The level of prescriptiveness was considerably higher than other solid waste management PPP projects in Europe and the Middle East. This was intentional as the client had undertaken work prior to procurement to select their preferred technology, and used the contract to deliver the specified technology, with specific performance requirements typically seen in input specifications. There is a balance between the level of prescriptiveness and the requirement for the private sector to offer value for money, and in the case of Hong Kong, the contracts are more prescriptive than seen in other countries for waste PPP contracts.

Market comparison

Typical waste PPP projects, such as Edinburgh Energy from Waste in the United Kingdom (UK), Mexico Energy from Waste, United Arab Emirates (UAE) Energy from Waste, and North London Waste Authority in the UK have a high-level output specification, where the amount of waste to be treated, and a few performance targets are set, but the Private Partner is free to determine the specific technology and the method for achieving the performance standards. Examples of performance requirements would be percentage (by mass) of incoming material which is recycled, percentage which is diverted from landfill and recovery. Recovery can typically be in the form of material or energy (such as compost in an organic treatment plant and electricity and heat production in the thermal treatment plant). The quality of outputs may also be stipulated, but the method for reaching that quality standard has not been seen to be specified in PPPs other than the Hong Kong one.

For this Hong Kong project, an initial environmental permit was applied for before procurement commenced, so technology was relatively fixed for all bidders. The Private Partner was able to suggest changes, but it took the risk of applying for a permit variation. Specifications on the amount of material to be treated, the products to be produced, hours of operation, how air quality requirements are to be met, staff qualifications and further details were included.

It is unusual that a PPP contract targets commercial waste; more typically municipal waste streams are targeted, as this is what local authorities are responsible for managing (e.g. Cardiff and Edinburgh in the UK). There is not a single approach to the classification and regulation of commercial solid waste. For example, in some countries such as Bahrain commercial waste is included in the municipality's responsibility. However, in other countries, particularly in Europe, because of the way the European Union regulations are set up, commercial waste falls under separate regulations. Commercial waste may be treated at facilities which are developed as part of a PPP project, but this waste would be through separate contracts, (such as Cardiff, West Sussex, Hampshire and Kent in the UK).

In Hong Kong the Owner took the decision that the largest source of food waste would be targeted first. This makes sense, as more people regularly eat at restaurants/food markets in Hong Kong than in other parts of the world. It is also important to take into consideration the responsibility of waste management in each country. In some places, such as the UAE, almost all waste is the responsibility of the government, whereas in much of Europe, only municipal waste (i.e. not commercial and industrial waste) is the responsibility of the government.

No guarantee was provided regarding input waste quality/composition. This is a key issue for waste contracts, with a number of approaches taken. The most typical approaches are to either guarantee composition or characteristics within bands (such as bands of organics, recyclables and inert materials), such as in Serres in Greece, or to guarantee the collection method and material targeted will not change, such as in Wakefield in the UK, with the Private Partner taking the risk on changes due to lifestyle/new materials entering the waste streams.

Alignment to QI Focus Areas	
Sustainability and longevity of an infrastructure asset Ability of the asset to address the needs and meet the expectations of end users	By specifying design life, and remaining service life, the Owner promoted long-term decision-making even though the operating term is short compared to other PPP projects. The Owner has the option to appoint the same (or a different) contractor at the end of the term, which also incentivises the Private Partner to provide a quality service. The performance indicators are intended to measure the Private Sector's performance against the priorities and expectations of the end users and the Owner. Examples of performance indicators from ORRC2 include: • *"To operate the facilities of the ORRC2 24 hours a day and operate the waste reception facilities between 0800 to 2200 daily to treat up to 300 tonnes food waste;* • *To ensure the compost produced shall comply with the relevant quality standards;* • *To produce, in compliance with the above requirements, sufficient energy to meet the internal need for the facilities of the ORRC2 and export any surplus energy as electricity or biogas;* • *To prohibit flaring of biogas produced under normal operation;* • *To comply with the relevant occupational safety and health legislations and practices so as to avoid related accidents;* • *To comply with the conditions of the environmental permit, the requirements on effluent and air emission quality, and environmental monitoring, etc.;* • *To comply with other operational requirements in the specifications, such as site cleanliness and housekeeping, relevant legislations, life saving and fire fighting equipment, maintenance and inventory record, etc."*
Health and safety considerations during both construction and operation of the asset	As for any industrial site, the output specification requires a health and safety plan to be followed. This plan is to include identification, control and mitigation for hazards during construction, operation and maintenance of the plant. Emergency procedures are also identified. This contract had the input of multiple departments within the government, so specifications from different departments were included. A more typical approach is to specify national legislation along with a small number of additional requirements. Accidents and incidents reportable to the Hong Kong Government Labour Department shall be counted as non-compliances with the environmental and safety performance requirements. Such non-compliances will be measured monthly, based on frequency and severity.
Ability of the asset to withstand natural and other disasters, including climate change	The Owner transfers geotechnical risk to the Private Partner, who shall carry out all the necessary geotechnical investigations. Design submissions, construction and maintenance of man-made geotechnical features, and natural terrain hazard study and mitigation works shall be in accordance with the Government of Hong Kong's Civil Engineering and Development Department Project Administration Handbook for Civil Engineering Works, Appendix 4.8[3]. The output specification also addresses site specific risks. For example, during inclement weather events such as strong winds, heavy rains or typhoons, the Private Partner shall take all reasonable measures necessary to ensure that all facilities within the site, including but not limited to skips loaded on mobile plants and skips stored at the waste reception area, are safely secured in order to prevent the facilities from causing damage to any plant, mobile plant and all persons on the Site.

2 Further information available at: https://www.devb.gov.hk/filemanager/technicalcirculars/en/upload/19/1/C-2005-19-0-1.pdf

3 Further information available at: https://www.cedd.gov.hk/filemanager/eng/content_80/PAH-2018-Chapter-4-Rev-00-Clean-181026.pdf

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Performance Reviews: For ORRC2, the Owner intends to engage consultants to undertake contract administration, site supervision of the works, and carry out operational performance reviews upon completion of the construction. Independent operational performance reviews are one way to validate the accuracy of the Private Partner's self-reporting. **Financial Deductions:** The following are examples of mechanisms and penalties that have been included in the contract to address the unsatisfactory performance of the Private Partner during operation. The financial deductions align with the end user and Owner priorities: • *Suspension of operation: If ORRC2 fails to operate on any days, the Government will deduct the corresponding operational fees for that period;* • *Operational requirements: If the contractor fails to comply with any or all of the operational requirements in the contract for any month, the Government will deduct the relevant fees from the operational fees of the month on a pro rata basis;* • *Environmental requirements: If the contractor fails to comply with any or all of the environmental requirements in the contract for any month, the Government will deduct the relevant fees from the operational fees of the month on a pro rata basis;* • *The Government can terminate the contract according to the contractual procedures if necessary.*	A 15-year contract is shorter than typical solid waste management PPP projects (terms in the range of 25 years are more common) but operations are likely to continue after handback. This may give the client more flexibility over the management of the facility once the operating term of the contract is complete. The ORRC has a higher level of external checking than for many waste management PPP projects, including those developed in the UK and France. Handback is typically required if the site belongs to the authority, such as in Hong Kong, and not if it is owned by the contractor (which is less common but seen in West Sussex in the UK). The benefit of the authority owning the site is that it encourages as many bidders as possible, as they are not required to find and purchase a suitable site themselves. Compared to the solid waste sector, the water and wastewater sectors typically show leadership in the field of asset management. Although output specifications do not always require compliance with the international standard for asset management (ISO 55000), there is a level of maturity in the market that means Private Partners sometimes offer an ISO 55000 compliant solution on their own accord. For example, the Private Partner (Samra Plant Co) on the As-Samra wastewater treatment plant project in Jordan recently obtained ISO 55000 certification.
Payment linked to safety performance: The Owner had existing technical guidance that informed the requirements for construction safety management[2]. The payments on safety cover both the task-tied payment items for the implementation of stipulated safety measures, such as provision and updating of safety plan, attending safety meetings and safety walks, provision of safety officers and safety training, etc., and the performance-tied payment items, which are measured according to the Private Partner's achievements in the performance indicators, such as no reportable accidents in a month, accident frequency rate, no notice of safety and environmental prosecution, etc.	Some contracts (predominantly in countries with well-developed health and safety regulations such as in the UK and Singapore) limit health and safety requirements to meeting national legislation, but many have specific requirements (for example, in Brazil), particularly around vehicle deliveries to a site, where staff from potentially multiple organisations are entering the facility.
There are no specific mechanisms to achieve this, rather it is stated in the contract requirements so would be the Private Partner's risk of non-compliance.	Increasingly, particularly in the UK and USA, risks, such as flood risk, are specified (no longer an unforeseen risk) so it is possible to allocate the risk to the Private Partner. To do so, the risk needs to be quantifiable and the basis for measuring it clearly defined.

Alignment to QI Focus Areas	
Job creation, capacity building and transfer of knowledge	Operation and maintenance of the facility requires local staff, both skilled and unskilled. When the asset is transferred back to the Owner at the end of the term, there is a benefit to the Owner if the operations and maintenance staff are retained to improve the transfer of knowledge. A Handover Plan is the formal document required to transfer knowledge from the Private Partner to the Owner and is required to provide details on employee retention and training. The output specification includes requirements for building information modelling (BIM) to mitigate construction risks and improve asset management and transfer of knowledge. At an organisation level, the Owner has defined their requirements for BIM[4], which in turn inform the project requirements. The Private Partner shall adopt BIM during the design, construction, and operations stages of the Facility. The output specification provides estimates of the number of technicians and apprentices that may be employed based on the capital cost of the project. Available, skilled labour is a key component to successfully delivering the services. Providing an indication of the number of staff means all proponents are bidding on the same basis, although this can stifle innovation, such as process automation. However, if the Owner's objective is to create jobs, it provides a level of certainty that the outcome will be achieved. It is estimated that the proposed works will create about 465 jobs (400 for labourers and 65 for professional/ technical staff) providing a total employment of 12,400 person-months for ORRC2. The experience level of specific staff is prescribed, including degree type and number of years' experience. This is not just for senior management but a range of posts.
Environmental impacts	The Owner was responsible for obtaining environmental permits, but the responsibility for meeting the requirements in the permits was then transferred to the Private Partner. An Environmental Impact Assessment (EIA) was undertaken by the Owner prior to procurement and included expected technology, performance, emissions and output management. The Private Partner had to perform as well or better than the performance stated in the EIA, or apply for a variation to the Environmental Permit. The Private Partner will be required to ensure compliance with the requirements of the Environmental Permit including Environmental Monitoring and Audit (EM&A) requirements. For ORRC2, the requirements also consider ways to mitigate environmental impacts at each stage of the project development. For example: • **Planning and design stages:** Consider ways to minimise the generation of construction waste; reuse inert construction waste (e.g. excavated soil) on site or in other suitable construction sites as far as possible to minimise the disposal of inert construction waste at public fill reception facilities (PFRF); maximise the use of recycled/recyclable inert construction waste, and the use of non-timber formwork to further reduce the generation of construction waste. • **Construction stage:** At the construction stage, the Private Partner is required to submit for approval a plan setting out the waste management measures, which will include appropriate mitigation means to avoid, reduce, reuse and recycle inert construction waste. Day-to-day operations on-site will need to comply with the approved plan, and the contractor will be required to separate the inert portion from non-inert construction waste on-site for disposal at appropriate facilities. The disposal of inert and non-inert construction waste at PFRF and landfills respectively will be controlled through a trip-ticket system. • **Operations:** There is strict control over odour nuisance which may arise during the operation stage from both the facility and food waste collection vehicles (FWCVs). Waste water generated during the operation will first be treated by on-site sewage treatment facilities to meet relevant discharge standards before being discharged through public sewers to public sewage treatment facilities for final treatment and discharge. The plant is predominantly electrically self-sufficient, with power being produced using biogas generated at the facility. For OPARK1, surplus electricity is exported. For ORRC2, either (1) surplus electricity is exported to the grid, or (2) surplus biogas is exported.

4 Further information available at: https://www.devb.gov.hk/filemanager/technicalcirculars/en/upload/366/1/C-2018-18-01.pdf

Mechanisms used to achieve QI alignment	Market Comparison Analysis
There are no specific mechanisms such as KPIs or measurable targets for the job creation requirements, however there is a requirement for the Owner to approve all resumés.	It is typical that expertise is included in the handback plan. In some contracts, more typically in the early waste management PPP contracts in the UK, (e.g. Isle of Wight and West Sussex), a community liaison officer was a requirement in the contract. This is less common in more recent contracts, with community liaison under the control of the Owner. Waste management facilities require operational staff, and there are often specifications about the number of staff who must be recruited from within the local area. Typically, only senior roles will be specified, as it may limit scope for job creation if specifications are prescriptive. Some European contracts specify the number of staff who must be employed from within a certain radius of the facility, with the aim of encouraging local labour. Alternatively, there are other projects that do not have the same prescriptive requirements for qualifications and length of experience. In countries where there is age discrimination legislation, specifying the number of years' experience may not be possible or appropriate.
Financial deductions: If the Private Partner fails to comply with any or all of the environmental requirements in the contract for any month, the Owner will deduct the relevant fees from the operational fees according to the contract provisions.	The requirements in the output specification go beyond simply meeting local legislation. This has been seen, on a lesser scale, in other facilities in the UK (such as for odour treatment technologies), but varies depending on the country. In newer projects in countries with less developed legislation, including additional requirements beyond the existing legislation to meet good practice, such as meeting World Bank standards, depends on the recommendations provided by the Owner's advisers. This may also be a funding requirement from some development banks. The bidders, and subsequently the Private Partner, in this project were limited in the changes to the design which could be made to the specification detailed design and materials, etc. This is not typical for a waste PPP project, where usually the bidders are invited to come up with the most environmentally beneficial design possible, within affordability limits, and this is part of the evaluation scoring, such as Cardiff Organic Waste Treatment Project in the UK.

Alignment to QI Focus Areas	
Ability of the asset to respond to changes in resource availability, population levels, demographics and disruptive technology	Proven technology was required, which is typical for waste PPP projects. However, food waste composition is different in Hong Kong to other countries, due to different eating habits and food eaten. The design of internationally proven technology had to take this into consideration to develop a facility that could optimise biogas yield based on the expect food waste composition. In addition, the site areas were small, so innovations were required to meet the capacity specifications (200tpd for OPARK1 and 300tpd for ORRC2). The Owner defined the required capacity, which is a small proportion of the total estimated food waste arising in Hong Kong, so waste availability is unlikely to impact the project. The government is taking an innovative approach to procurement by letting a number of contracts over a period of time, so that capacity is developed as source-segregated organic waste collections are introduced.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Non-compliance event: The Private Partner would be exposed to potential financial deductions if the specified capacity is not achieved.	The ORRC projects are unusual in not guaranteeing exclusivity, waste composition or waste tonnages. The two risks (composition and tonnage of waste) are the key issues when developing a PPP project. For a food waste contract, the risk of change of composition is lower than for residual waste, as foods do not change as quickly as packaging and consumer preferences for items such as clothes and electronic goods. There is no single model used but typical approaches include having a guaranteed minimum tonnage (take or pay) (Cardiff Organic Waste Treatment Contract), exclusivity of waste provision to the PPP facility (Wakefield residual waste treatment project) or no guarantee but the inclusion of the responsibility for collection (Hong Kong Waste Electronic and Electrical Equipment PPP project).


Source: Abengoa

WATER & WASTE CASE STUDY: MOROCCO

Agadir Mutualized Desalination Plant

Location
Agadir region, Morocco

Owner
Ministry of Agriculture, Fisheries, Rural Development, Water and Forests/Office National de l'Electricité et de l'Eau Potable (ONEE)

Private Partner
Abengoa and InfraMaroc (CDG Capital Infrastructures group)

PPP Model
Design-Build-Finance-Operate-Maintain (DBFOM)

Operating Term
30 years

Contract Value
EUR 309 million/USD 346 million[1]

Asset Class
Water and Waste (Water Supply)

Water stocks in the farming areas of Agadir, Morocco were seven times lower in 2008 than in 1982, and the average rainfall is expected to decline in the coming decades.

Much of the water goes to tourism and agriculture, the industries upon which the region's economy depends but which are currently being held back by water shortages. The Chtouka region employs about 100,000 people in the agricultural sector, and the tourist industry is booming, leading to ever greater demand.

Thus, Agadir is alleviating a drought crisis by building a mutualised (drinking and irrigation water) desalination plant with an initial 275,000 m^3 total production capacity of desalinated water per day, which will make it, at the time of construction, the world's largest desalination plant designed for drinking and irrigation water that will run entirely on solar energy. The project design also allows for a possible capacity expansion to up to 400,000 m^3/day. This seawater desalination plant is expected to secure the supply of drinking water for 2.3 million inhabitants by 2030, 20% of whom live in rural areas.

1 Assumed conversion rate of EUR/USD = 1.12 as at May 15, 2019.

This is a single project for two Owners; Office National de l'Electricité et de l'Eau Potable (ONEE), and the Ministry of Agriculture, Fisheries, Rural Development, Water and Forests of Morocco, which has been created by combining two projects: one for drinking water and one for irrigation.

The first one requires a 50% expansion of drinking water production capacity under the contract that Abengoa has been developing for ONEE, thereby increasing plant capacity to 150,000 m^3/d of drinking water. The second project calls for the additional production of 125,000 m^3/d of irrigation water, as well as the construction of the corresponding irrigation network for a total of 13,600 ha, promoted by the Ministry of Agriculture. Construction of the first phase started in July 2018. Works are still in progress with the anticipated commissioning date in 2020.

Output Specifications Development Approach Used

The output specification is detailed and builds on the regional experience delivering desalination projects. The specification details the type of technology and the required processes.

The "Programme fonctionnel" or specification includes general requirements for a mutualised project and requirements for sea water intake, civil engineering works, hydro-electrical and mechanical works, electrical works, and control and supervision of operation and maintenance.

Alignment to QI Focus Areas	
Sustainability and longevity of an infrastructure asset. Ability of the asset to address the needs and meet the expectations of end users	An objective of the project is to provide a secure source of clean water to the farming and tourism sectors in the Agadir region. There are two main performance requirements, which are linked to payment, to support this objective: 1) water quality and 2) volume. These KPIs are output-based, allowing the Private Partner to develop a solution that they consider best balances risk mitigation and project cost. The output specification also includes redundancy requirements to minimise the likelihood that end users are impacted by outages. This also supports asset maintenance as it improves the Private Partners' access to complete planned maintenance and their ability to quickly respond to reactive requirements. The output specification achieves this by requiring a buffer equivalent to five hours at full production.
Ability of the asset to withstand natural and other disasters, including climate change	The project provides essential infrastructure that will lead to population growth and economic development in the Agadir region. The Owner recognised the need to develop resilient infrastructure that could withstand the location-specific risks, such as flooding and sea level rise. For example: • **Flood/sea level rise:** The Owner recognised the best mitigation for flood risk was site selection. The project is therefore located on an elevated site 40 metres above sea level. The requirements also address climate change adaptation: • **Adaptation:** In the event of sea water temperature rises, the specification requires the quality of water to be maintained, however the volume can be reduced. The contract specifies a sea water temperature of 13 to 25°C (estimated average is 20°C) but doesn't detail consequences of water above 25°C, which is considered improbable, given the depth of the sea intake.
Environmental impacts	The Owner required that the energy to power the asset was to be generated from renewable sources, and also wanted to minimise energy consumption. Rather than including a specific requirement for energy consumption, the output specifications incentivise the Private Partner to optimise the plant and minimise energy use by linking payment to energy consumption. This approach allows the Private Partner to make trade-offs between energy costs over the term and a design solution above minimum requirements. As a result, the Private Partner decided to include an energy harvesting turbine, which reduces the overall energy use of the facility.
Ability of the asset to respond to changes in resource availability, population levels, demographics and disruptive technology	The Owner considers technology risk, changing demographics and demands and new technology opportunities in the output specification. • **Proven technology:** The output specifications require only the use of Reverse Osmosis to be used for the desalination process, with relatively detailed design specifications. • **Changing demographics and demands:** An asset that provides both drinking and irrigation water provides more flexibility to respond to changing water demands. The plant has been designed, based on the output specifications, to allow a capacity increase by installing more industrial equipment. It also allows de facto a redundancy that allows for balancing both productions if need be. • **New technology:** Redundancy in the design allows for partial insertion of new desalination technology in case new and more efficient technologies come to market during the asset lifetime.

Mechanisms used to achieve QI alignment	Market Comparison Analysis
Performance KPIs: The volume and water quality KPIs are tracked daily from a remote service centre in Seville, Spain. Payments to the Private Partner are subject to deductions based on the KPI performance. The Private Partner is responsible for self-reporting performance on a monthly basis in order to administer the contract and payments, and calculate the deductions. The plant team (located on-site) includes the Private Partner representatives to allow for a timely response to issues. Any deviation from the production quality and quantity immediately impacts revenues. In case of repeated deviations, both in terms of gravity and of length in time, may lead to warning, and replacement of the Operator if needed. **Serious breach:** The Private Partner remuneration is partially based on the volume and quality of water produced. The Volume KPI is used to track if the plant delivered the expected daily volume as asked for by the Public Water Agency, ONEE. Moreover, any lack of production implies a lower revenue from the Authority as the variable remuneration lowers. The Quality KPI is based on a range of quality items – any deviation out of the quality ranges is penalised. This quality range is the one prescribed by the national water office, using the NM 03.7.001 standard (Moroccan Standard for the Quality of Water for Human Consumption), which clarifies water quality standards, and that was included in the tender files.	The output specifications require a mutualised desalination plant for both drinking water and irrigation water. This is a unique approach, using two production lines in parallel on the same site, compared to other desalination projects, and allows for greater redundancy, and ultimately resilience of the asset and the service it delivers.
Design Compliance: The Private Partner is responsible for delivering a compliant design in order to receive the service payments. The Owner had the opportunity to review the design at stages throughout the design development process. Although the Owner reviews the design, they do not assume any of the risk that the design is still deemed non-compliant through the construction completion process.	Compared to other sea-side desalination plants, this plant is at a higher elevation above sea level. Strategic decisions on the approach to address resilience would typically be addressed at the business case stage and the project budget developed to reflect additional design and construction or land costs.
Energy Performance: A financial performance incentive links remuneration to energy consumption. The Private Partner can increase their profit by decreasing energy consumption through technology or management processes. However, if the energy consumption is greater than expected, the Private Partner is exposed to the additional costs.	The approach to use energy targets or incentive payments (as opposed to specification requirements) is a common approach across different asset classes to promote the Private Partner to reduce energy consumption.
Technology watch: The Private Partner can propose new technologies throughout the project term to allow the Owner to incorporate new and emerging technologies. This is allowed in the Concession agreement, not in the output specifications. The Private Partner can introduce new technologies as long as it does not modify the economic equilibrium of the project, unless the technology initially used is not available on the market anymore.	For projects that have a critical technology component, such as waste projects, it is common for the Owner to require proven technology. This is often considered at the request for qualifications stage, where teams are shortlisted on the basis they have completed projects of similar scope and scale. This prevents bidders who do not have the relevant experience from proceeding to the request for proposal stage, and provides increased confidence that multiple compliant bids are received.

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