

Key Performance Indicators in Public-Private Partnerships

A State-of-the-Practice Report



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16. Abstract This report provides a state-of-the-practice description of domestic and international practices for key performance indicators (KPIs) in public-private partnerships (PPPs). The report is based on a comprehensive literature review and eight case studies from Australia, British Columbia, the United Kingdom, and the United States. The concept for this report came from an implementation strategy in <i>Public-Private Partnerships for Highway Infrastructure: Capitalizing on International Experience</i> , as well as <i>Linking Transportation Performance and Accountability</i> and <i>Construction Management Practices in Canada and Europe</i> . The report identifies how government-developed performance measures reflecting societal goals such as congestion management or environmental impact are translated through KPIs and included in project documents for designing, constructing, operating, and maintaining transportation facilities. The report shows that it is possible to align projects with these higher goals. The findings are applicable to agencies that wish to align overarching organizational and societal performance measures through KPIs not only to PPP projects, but also to conventionally bid projects.			
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Key Performance Indicators in Public-Private Partnerships

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International Technology Scanning Program

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Executive Summary

Overview

This report provides a state-of-the-practice description of domestic and international practices for key performance indicators (KPIs) in public-private partnerships (PPPs). The report is based on a comprehensive literature review and eight case studies from Australia, British Columbia, the United Kingdom, and the United States. The concept for this report came from an implementation strategy in *Public-Private Partnerships for Highway Infrastructure: Capitalizing on International Experience* (FHWA-PL-09-010), as well as *Linking Transportation Performance and Accountability* (FHWA-PL-10-011) and *Construction Management Practices in Canada and Europe* (FHWA-PL-05-010). The report identifies how government-developed performance measures reflecting societal goals such as congestion management or environmental impact are translated through KPIs and included in project documents for designing, constructing, operating, and maintaining transportation facilities. The report shows that it is possible to align projects with these higher goals. The findings are applicable to agencies that wish to align overarching organizational and societal performance measures through KPIs not only to PPP projects, but also to conventionally bid projects.

The following summary conclusions provide a basis for the recommendations of this study. The report contains the background, methodology, and details on which these findings are based. Chapter 6 discusses the conclusions and recommendations in greater detail.

Summary Conclusions

Alignment of Agency Goals With Performance Measures and PPP Project KPIs

Ideally, agencies will be able to align their higher level goals with performance measures and individual PPP KPIs. All agencies are striving for this goal. This report documents several examples of this alignment, but none of the agencies has achieved a completely

seamless alignment of project KPIs with its overarching agency performance measures. The largest challenge in this goal is the evolving and dynamic nature of both the agency performance measures and the project KPIs.

Dynamic Nature of KPIs and Performance Measurement Over Time

Some cases illustrate the necessity of a dynamic approach to performance measurement because service or asset requirement expectations are likely to change over time. In some instances, the measure and the indicator used have an inherent ability to evolve because the indicator is oriented toward trends in particular measures. In other instances, provisions are put in place to modify measures over the contract period.

Alignment of Performance Data With Agency Performance Management System

As U.S. highway agency performance management systems continue to mature, PPP performance data will need to be integrated with these systems to ensure optimal network operations. It is important to collect performance data during the concession period in a manner consistent with the agency's network management approach. This implies that the data will also be used to verify PPP performance. The alignment of these measures is challenging. As these systems evolve, PPP project data collection formats and reporting structures will also need to evolve to be consistent with the overall network management approach.

Use of Asset Management Plans in Addition to KPIs

Although specific performance measures or key performance indicators are used to categorize and track the quality of operations and maintenance services, the asset management plans proposed at time of selection, agreed to at time of contract close, and modified (per contract provisions) over the contract period are clearly a significant dimension of the overall approach to asset management in a PPP arrangement.



Focus on Outcomes Rather Than Outputs

The agencies are evolving performance measures for use in internal operations and with their contractors' measures. Increasingly, these measures focus on outcomes rather than outputs. In some cases, this has evolved from the agency promulgating a lengthy set of prescriptive measures to negotiating key outcomes. This negotiation provides the local government or the contractor more latitude in how to achieve results, rather than dictating that the contractor or local government achieve many detailed performance indicators.

Emphasis on Service Requirements Versus Asset Condition

Specific performance measures and KPIs used across the cases vary, but more recent cases illustrate more emphasis on service requirements than asset condition.

Use of Incentives

Incentives used are positive and negative, with the latter appearing to be more prevalent. In general, positive incentives are more associated with overall contractor performance, while negative incentives are more associated with compliance to specified service or asset requirements. Some projects include a strong emphasis on incentives for outcomes, such as rewarding the availability of travel lanes. Penalties and deductions to payments are also included, but the contract emphasizes rewards for performance above negotiated minimums.

Creation of an Asset Management Culture

A theme in all of the case studies is creating an ongoing asset management culture in the PPP organization that fosters a high level of service during the life of the contract and that attempts to preserve a substantial remaining service life at the handback point.

Opportunity for More Use of KPIs in Design and Construction

While the use of KPIs for operations and maintenance is pervasive in this study, the application of performance measurement during design and construction is noticeably absent in the case study projects. Given that many PPP projects are upgrades of existing networks, there is an opportunity to apply KPIs to measure network performance during design and construction. The broad agency performance measures that apply to operations and maintenance

should also apply to projects during design and construction. As performance-based management systems mature, they can be broadened to cover design and construction of PPP projects and more traditional forms of project delivery.

Focus of Handback Provisions

Handback provisions are generally asset focused and rely almost exclusively on residual service life specification. This practice introduces a significant auditing effort at the conclusion of the contract and the potential for disputes. The nature of these provisions also tends toward negative, compliance-oriented incentives.

Recommendations

This study offered considerable insights into the evolution and application of performance measurement for PPP projects. Obvious trends toward the application of performance-based management systems were found in many sectors, including transportation. Examination of the PPP agreements showed trends in how agencies mandate performance measures and KPIs while allowing for flexibility in changes that will occur over the term of the agreement. The case studies demonstrate the viability of PPP projects for meeting critical infrastructure needs. The interviews with agency officials also provided insights on how the agencies and projects have evolved to better meet the goals of their customers and society.

The results of this study can be summarized in the following recommendations gleaned from literature, case study document analysis, and interviews.

1. Align project performance measures and KPIs with overarching agency goals.
2. Plan for the dynamic nature of performance measures throughout the PPP life cycle and handback.
3. Do not rely completely on KPIs to align agency goals and project performance, but strive to create an asset management culture through asset management plans that are continuously improved throughout the concession period.



4. Similarly, keep the number of programmatic and project-level measures and indicators to a manageable number. Focus on measures and indicators that result in outcomes instead of data outputs.
5. Consider asset management plans during procurement and concession agreement negotiation.
6. Continue to develop and apply KPIs during design and construction to help align all types of projects to agency goals.
7. Explore outcomes-based handback provisions rather than compliance-oriented means.
8. Recognize that KPIs are not the only means of ensuring contract compliance during decades of design-build-operate-and-maintain projects.
9. Focus on customer needs and societal goals in addition to asset condition.
10. Unique agency locations and user demands necessitate unique agency goals, performance measures, and strategies, which are developed most effectively by involving upper management, stakeholders, community residents, and end users in the process.

Chapter 1: INTRODUCTION

1.1 Report Purpose

This report provides a state-of-the-practice description of domestic and international practices for key performance indicators (KPIs) in public-private partnerships (PPP). The report is based on a comprehensive literature review and eight case studies from Australia, British Columbia, the United Kingdom, and the United States. While the report focuses on PPPs, projects of all delivery methods, traditional and innovative, can benefit from the findings.

The primary audience for this report is State and Federal agencies that are developing PPP programs and wish to align these programs with the overall strategic objectives of their agencies. The use of definitive performance measures to drive agency decisions and resource allocation is a relatively recent development in the U.S. highway industry. Likewise, the use of PPPs as an integral part of highway networks is relatively new in the United States when compared to the international community. The U.S. highway industry can benefit from the experience of the international community in the development of KPIs for PPP projects and their alignment with overarching performance measures because international agencies have applied these practices for a longer time than the United States.

1.2 Definitions

Clear and consistent definitions for performance measures and KPIs are critical to appropriate application, but the definitions for performance measures and KPIs differ from country to country and even in a single country. The research team synthesized definitions from a number of sources.^(1,2,3,4) The following definitions are provided for purposes of this report:

- » **Performance measures** are derived from the programmatic levels of service sought by the transport agency and imposed contractually as broad classifications of desired outcomes required of the contractor.

- » **Key performance indicators** are more specific milestones in or components of performance measures that serve as precursors to indicate progress toward the eventual achievement of the desired performance measures.

Performance measures are the broad classifications of desired outcomes required of the contractor. They are reflected by contractual goals and statements of increasing and decreasing specifics ensuring a specific, establishing a specific, or implementing a specific for a project. Key performance indicators typically include, but are not limited to, elements such as project benchmarks, targets, milestone dates, numbers, percentages, variances, distributions, rates, time, cost, indexes, ratios, survey data, and report data. These definitions are useful in understanding the results of and conclusions on the information gathered from each case study.

1.3 Study Approach

The core findings of this research are based on eight international and domestic case studies. The study approach involved three primary phases: (1) literature review—reviewing existing documentation for PPP projects and literature containing KPI information, (2) data collection—obtaining detailed information via communication with foreign practitioners, and (3) synthesis—synthesizing final results and documentation.

The literature review collected data on current international and domestic approaches to performance management and KPIs. The literature review included both transportation and nontransportation sectors. From this review, the team captured theory and practice on performance-based management systems. The results of this review provided an understanding of the need for performance-based management systems, a summary of theoretical and applied models, and a basis for developing a comprehensive case study protocol. The literature review findings are reflected throughout the report and in the annotated bibliography in Appendix A.



Chapter 1: Introduction

Data collection involved gathering information from eight PPP project case studies and information from the agencies in which they operate. The team developed a data collection instrument in the form of a case study protocol to collect comprehensive and consistent information from the foreign and domestic practitioners. Many of the detailed findings derive from a rigorous content analysis of the PPP agreements. The content analysis of the documents was augmented by discussions with project and agency personnel when available. Table 1 summarizes the eight case studies.

TABLE 1. Case study overview.

Project Name	Owner	Location
I-595 Corridor Improvements	Florida Department of Transportation	Broward County, Florida, United States
Golden Ears Bridge	TransLink	Metro Vancouver, British Columbia, Canada
Kicking Horse Canyon Phase II	British Columbia Ministry of Transportation	Golden, British Columbia, Canada
EastLink	Victoria State Government	Melbourne, Australia
Capital Beltway	Virginia Department of Transportation	Northern Virginia, United States
CLEM7 North-South Bypass Tunnel	City Council of Brisbane	Brisbane, Australia
M25	Highways Agency	London, England
Airport Link	Queensland State Government	Brisbane, Australia

The research team synthesized the data by exploring patterns across the literature and case studies. The team used the categories discovered in the content analysis to organize the results. The results were

presented to the Federal Highway Administration (FHWA) oversight panel for this research as an additional form of validation. The following categories were used for analysis and presentation of results:

- ▶ Operations and maintenance
- ▶ Design and construction
- ▶ Handback requirements and KPI evolution

1.4 Guide to the Report

This research report contains six chapters, including this introduction, and three appendices. This organization is meant to provide a context for the research, describe the basis for its findings, and present the results and recommendations in a concise format. The following is a summary of the sections and appendices for this report:

- ▶ **Chapter 2: Background**
The background summarizes the findings from the literature review. It takes a broad approach to examining performance-based management systems to provide a context for the study. It discusses the need for performance-based management, the relationship between PPPs and performance-based management, who is using performance-based management systems, and the outcomes of measuring performance.
- ▶ **Chapter 3: Performance Management Models**
After discussing the fundamental principles of performance-based management systems, this section presents models developed by the Dutch Ministry of Transport, Public Works, and Water Management and the American Association of State Highway and Transportation Officials (AASHTO) Task Force on Performance Management. It also includes insights from the literature on how to develop performance measures.
- ▶ **Chapter 4: Case Studies**
After describing the approach to the literature review and content analysis, this section provides the case study approach and a summary of the case studies. The case study summaries are limited to a high-level description of the project context and PPP agreement.



► **Chapter 5: Case Study Findings**

This section presents the raw data for each case study. The information consists of a blend of KPIs and performance requirements from the language in the PPP agreements.

► **Chapter 6: Results and Conclusions**

The research findings are presented in this section. The results and conclusions are based on the patterns and trends found in the literature review, case studies, and discussions with agency and private sector personnel.

► **Endnotes**

This section includes the references to the citations in the report.

► **Appendix A: Annotated Bibliography**

This section expands on the references and provides an abstract for relevant journal articles, agency plans and reports, research reports, government articles, and Web site gateways.

► **Appendix B: Case Study Protocol**

This section includes the case study protocol used for the content analysis and agency interviews.

► **Appendix C: Example Summary Operations and Maintenance KPI Tables**

This section includes KPI tables from the PPP case study agreements.



Chapter 2: BACKGROUND

2.1 Introduction

The purpose of the background is to define the state of practice in the use of performance measures and KPIs in PPPs for highway design, construction, maintenance, and operations. The background demonstrates the need for and benefits of using performance-based management systems in PPPs to fund and manage U.S. transportation network improvements. It also offers a brief history and evolution of performance-based management systems in transportation agencies.

Poor road conditions cost motorists \$67 billion a year in repairs and operating costs and cost 14,000 Americans their lives. One-third of America's major roads are in poor or mediocre condition and 36 percent of major urban highways are congested.⁽⁷⁾

The background presents highway agencies in the United States and abroad that use performance measures to successfully manage their highway systems and provides the framework the organizations use to apply these measures to their management process. It also provides valuable insight for creating useful and effective performance measures to anchor the management framework. Finally, the background describes the challenges and benefits of using performance-based management practice to govern highway systems.

2.2 Public-Private Partnerships and Performance-Based Management

PPPs are a delivery method that is integrally linked to performance management systems. PPPs generally, but not always, use capital acquired by the private sector partner to supplement or, in some cases, replace the need for publicly arranged financing of highway design, construction, operations, and maintenance.

Performance measures and the PPP project delivery method are relatively new concepts in the United States. A possible justification for the PPP concept is the ability to attain high-level societal or performance measures related to environmental improvement, congestion mitigation, trip reliability, quality enhancement, or public safety improvement. In many cases, the linkage is an integral part of the solicitation, award, and monitoring of the project throughout its life.

This report examined case studies from around the world to determine if it was possible and beneficial to link performance goals to specific project goals.

Raising the Grades

5 Key Solutions

- ★ **INCREASE** federal leadership in infrastructure to address the crisis.
- ★ **PROMOTE** sustainability and resilience in infrastructure to protect the natural environment and withstand natural and man-made hazards.
- ★ **DEVELOP** national and regional infrastructure plans and complement a national vision and focus on system-wide users.
- ★ **ADDRESS** life-cycle costs and ongoing maintenance to meet the needs of current and future users.
- ★ **INCREASE AND IMPROVE** infrastructure investment from all stakeholders.

FIGURE 1. American Society of Civil Engineers guiding principles on infrastructure improvement.



2.3 Background of Performance-Based Management in Highway Agencies

Performance-based management was initially referred to as a “transportation asset management system” by practicing foreign countries. Australia, Canada, Great Britain, Japan, and New Zealand are recognized as innovative leaders in performance-based management and have applied this methodology for nearly two decades.^(1,5) Several of these countries’ infrastructure agencies established themselves on principles of performance measurement, such as Japan’s Ministry of Land, Infrastructure, and Transportation (MLIT) and Queensland, Australia’s, Department of Transport and Main Roads. Others attained this program by way of government policies and acts requiring the use of measurable standards and targets for government ministries and agencies, similar to the British Columbia Ministry of Transportation.⁽¹⁾ No matter the journey, various developed countries around the world are profiting from its use while others, including the United States, are only beginning to realize the system’s effectiveness and potential for inducing success.

The approach of using performance measurement to manage highway systems is a more recent phenomenon for a number of U.S. highway agencies.⁽⁵⁾

Built on the notion of better understanding and controlling outcomes, the concept of using performance measurement to manage the efficiency of services and programs has been in the United States for over half a century. It was introduced under titles such as “RAND Corporation’s system analysis” in the 1950s and “planning-programming-budgeting systems” in the 1960s.⁽⁶⁾ However, the approach of using performance measurement to manage highway systems is a more recent phenomenon’ for a number of U.S. highway agencies.⁽⁵⁾

The process has been in development for about 40 years, but has made only incremental advancements each decade in the transportation sector. The 1970s and 1980s found Ohio, Pennsylvania, Washington, and Wisconsin creating maintenance management systems using performance indicators to reflect the scope and scale of the programs being performed at

that time.⁽⁶⁾ In the early 1990s, Florida, Minnesota, Oregon, and Utah defined an early set of performance benchmarks for transportation after realizing that broader performance measurement focusing more on the outcomes of government programs was needed.⁽⁶⁾ In the mid-1990s, more State departments of transportation (DOTs) and metropolitan planning organizations (MPOs) began to establish and apply more comprehensive approaches to performance measurement in transportation systems.

Over the past 10 years, more State DOTs and MPOs have turned to performance-based management in response to the limited resources for transportation systems and the resounding plea from the public for increased accountability in government programs before more tax dollars are spent on highway projects.⁽⁶⁾ All State DOTs now track asset condition and safety data, vital elements of a comprehensive performance management system, and are progressing toward a full and successful application of this system.⁽⁸⁾

2.4 Who Uses Performance-Based Management Systems?

Performance-based management systems have been proven effective for a range of scenarios. As a result, a wide variety of programs and organizations outside the transportation sector use this technique. In 2002, the Office of National Drug Control Policy implemented and executed a performance measurement system with an overall goal of reducing the supply of and demand for illegal drugs in the United States with great success.⁽⁹⁾

A similar management system based on overall goals and daily manageable control objectives was introduced to a small division in a growing Hewlett Packard company; in 5 years, the division became the company’s most profitable.⁽¹⁰⁾ Outside the United States, Japanese businesses for years have applied a similar management procedure termed “policy deployment” (a strategic, direction-setting methodology used to identify business goals as well as formulate and execute major change management projects throughout an organization) and have continually achieved goals.⁽¹⁰⁾

Observing the success of such an approach, the executive and legislative branches of the U.S.



government adopted the same policy in the 1993 Government Performance Results Act and have used it to govern planning in cabinet-level departments with success.⁽¹⁰⁾

Noting this success, some U.S. transportation agencies have begun to use performance-based management systems. California's DOT (Caltrans) has used performance management and performance measures extensively in program areas such as maintenance and operations, programming and budgeting, and project delivery.⁽⁶⁾

The Missouri DOT (MoDOT) also uses performance-based management extensively and has implemented an effective user information tool called "Tracker" to monitor and publicly report its performance results.⁽¹¹⁾ An example from Tracker system is shown in figure 2. Former MoDOT Director Pete Rahn said the purpose of the Tracker tool is to inform the public of "what we [MoDOT] do well, what we don't do so well and what we are doing to get better."⁽¹¹⁾

The New York State DOT (NYSDOT) is expanding its performance management program from individual units in the DOT to the entire agency. This DOT uses "dashboards" to track and report performance measures to the public, stakeholders, and agency.⁽⁶⁾

For more than 10 years, Maryland's State Highway Administration has been using performance management. It now uses its measures for program areas such as budgeting and programming, program management and project delivery, operations, and monitoring of results, feedback, and communication.⁽⁶⁾

The Florida DOT (FDOT) is recognized as a national leader in performance measurement and has a systematic approach to decisionmaking that is both driven by policy and supported by data collection, key elements of a successful performance management system.⁽⁶⁾

Finally, the Virginia DOT's (VDOT) performance management program uses a "dashboard" similar to NYSDOT's to report performance results (figure 3). Using a performance-based management system has resulted in commendable benefits for VDOT. Since implementing a more focused performance

Since implementing a more focused performance measurement system, VDOT's construction ontime performance has improved from 20 percent to 90 percent and construction on-budget performance has improved from 51 percent to 90 percent.⁽⁶⁾

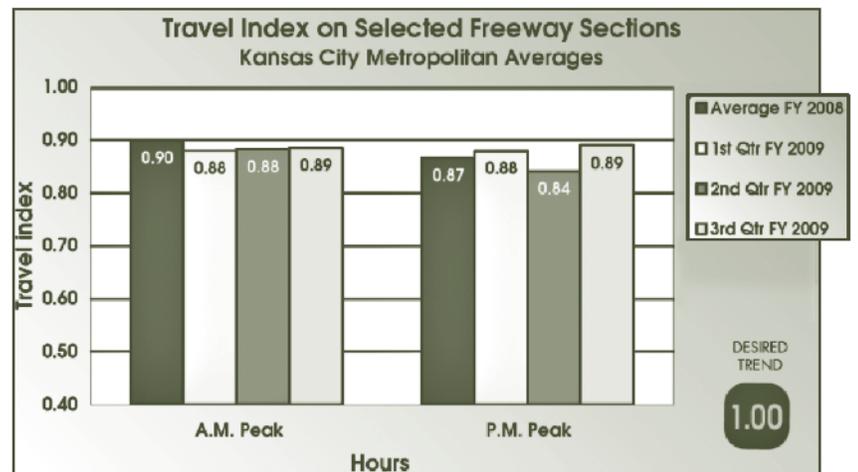


FIGURE 2. MoDOT Tracker system.

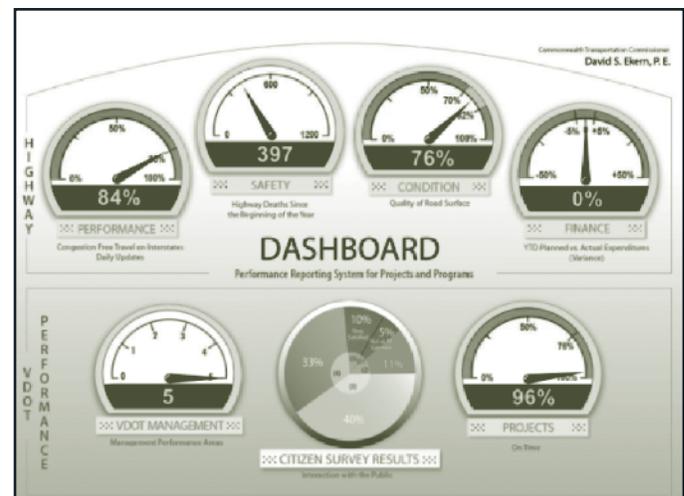


FIGURE 3. VDOT Dashboard system.



measurement system, VDOT's construction ontime performance has improved from 20 percent to 90 percent and construction on-budget performance has improved from 51 percent to 90 percent.⁽⁶⁾

2.5 Outcomes of Measuring Performance

Performance measurement system application offers both challenges and benefits. A major challenge of applying a performance-based management system is coming to a reasonable agreement in an agency on common goals and the strategies to achieve them.⁽¹²⁾ In addition, the magnitude and complexity of currently operating transportation networks poses issues for implementation. These issues will arise specifically in the areas of organization, analysis, consistent data collection, and application of information based on performance measures.⁽⁶⁾

Performance measures are only part of the solution. Managers and elected officials need to make good decisions based on these measurements for the process to be a success.⁽⁶⁾

Along with the challenges are limitations to the performance-based management system for transportation agencies. First, performance data alone do not answer the question of why certain outcomes occurred (i.e., they may not tell the story behind the numbers). Second, some outcomes, such as the prevention of undesirable events, cannot be measured directly. Third, performance measures are only part of the solution. Managers and elected officials need to make good decisions based on these measurements for the process to be a success. Last, each agency has different issues and problems based on specific locations and unique underlying circumstances. It is unrealistic to develop a one-size-fits-all performance management system that will create absolute solutions for every DOT or MPO.⁽⁶⁾ Therefore, different methodologies are likely necessary for individual agencies.

Although performance management systems have limitations, the benefits clearly outweigh the challenges. Highway agencies using the system view it

as an essential management tool that allows them to prove and improve their performance in delivering service with the benefit of making better decisions.⁽²⁾

[Performance-based management systems] hold government agencies accountable to road users and the public at large for funding, constructing, maintaining, and operating the highway network.⁽⁶⁾

Performance-based management facilitates communication within the agency and with the public, improves accountability, and yields a more balanced and sustainable transportation system.⁽³⁾ Agencies using the system are also experiencing a much-needed increase in investment from stakeholders and the public in their transportation projects and programs.⁽³⁾ Performance measurement systems create strong partnerships between the agency and its stakeholders and the general public that assure better transportation systems are developed while existing systems are improved.⁽¹⁾

AASHTO has determined, from numerous examples of success, that the system allows for more efficient allocation of increasingly scarce resources while assisting in the development and justification of budget and project proposals. Most important, it holds government agencies accountable to road users and the public at large for funding, constructing, maintaining, and operating the highway network to an increasingly higher standard.⁽⁶⁾ This ultimately leads to a better transportation system for today and tomorrow.

2.6 Conclusion

The application of performance-based management systems has the potential to improve the nation's transportation network. The use of performance measures and KPIs in PPP projects is imperative because contract terms must align the partners over the course of the project, which in some cases can be more than 30 years. The use of performance-based management systems has increased rapidly in the transportation sector over the last decade, and this section of the report highlights some of the leading agencies' successes and challenges.

Chapter 3: PERFORMANCE MANAGEMENT MODELS

3.1 Introduction

Performance-based management systems are based on a set of common principles and strategies. This section provides a discussion of these concepts to aid understanding of performance measures and key performance indicators. After a discussion of nonindustry-specific performance-based management systems, this section presents a fundamental performance management model developed by the Dutch Ministry of Transport, Public Works, and Water Management and ends with a presentation of an applied model developed by AASHTO.

3.2 Performance-Based Management System Principles

An examination of performance-based management strategies in use across many different disciplines and organizations yields a general framework for the system. Before all else, the general purpose of a performance-based management system is to cultivate accountability. To achieve this purpose, the formula for the system must contain four components: strategy, community, budget, and evaluation.⁽⁹⁾ Strategy, founded on the organization's mission, contains specific goals tied directly to specific targets and benchmarks used to set the direction for the organization. This element is subject to continual refinement. Community is the involvement of stakeholders in establishing these goals and targets. Stakeholders have a strong notion of what is realistic for these objectives, so their input should be highly valued. The budget element assures that resources are properly aligned with program activity in a manner that is consistent with the strategy. The results of the program performance indicate the best allocation of resources to reach the targets. Finally,

Before all else, the general purpose of a performance-based management system is to cultivate accountability. To achieve this purpose, the formula for the system must contain four components: strategy, community, budget, and evaluation.⁽⁹⁾

evaluation is the element that dictates what changes need to be made to the strategy based on the performance results and feedback. Evaluation should force the interests of budget and community to converge in the creation of strategy.⁽⁹⁾ To be successful, performance-based management should contain these four components and be a cyclical process.

3.3 Fundamental Highway Performance Model

The Dutch Ministry of Transport, Public Works, and Water Management developed a model (figure 4, see next page) that defines performance in terms of levels.⁽¹³⁾ The performance levels begin at the most basic specification level of material and processing and range through systemwide performance measures. Moving from one level to another in the model involves the transfer of risk through a contract between the agency and the designer, builder, or operator, depending on how the project delivery system is defined.

Starting from the bottom, the Dutch model outlines five levels for highway construction, maintenance, and systems operations:

5. **Basic materials and processing** involve current standard specification requirements, including individual material selection and processing issues.
4. **Materials properties** are specified by the agency in traditional project delivery and include items such as elasticity, plasticity, fatigue, and compactibility—elements of a project that can be optimized by the contractor.
3. **Construction behavior and practices** involve the behavior of the construction in terms of engineering properties. For example, elastic and plastic deformation and durability can be specified by the agency. Under performance specifications, construction and materials may be left to the discretion of the contractor.

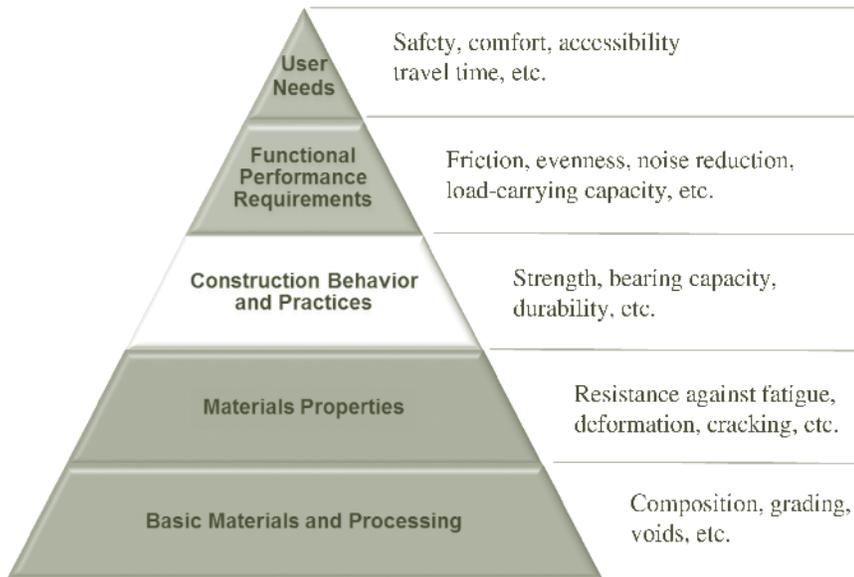


FIGURE 4. Pyramid of relationships.

structures. Performance requirements that link to road users are translated into requirements for the pavement surface, such as skid resistance, smoothness, noise reduction, and evacuation of precipitation. Traditionally, this is the owner’s responsibility, but it may be transferred to the contractor through an alternative contract delivery method.

1. User and societal demands are the highest level of the pyramid. The driver wants a road that is usable, safe, environmentally sound, and reasonably accessible via different modes of traffic and demand. This level involves an alignment of high-level project goals with broad agency performance requirements. This is fundamentally the owner’s responsibility in traditional delivery, but portions of this are transferred to the concessionaire in a PPP delivery.

Examples include labor placement, equipment selection, and time to construct to best address weather and environmental conditions.

2. Functional performance requirements look at specific aspects of the products included in the contract—from embankments to drainage to

The model developed in the Netherlands further establishes a relationship between the form of contract and levels of requirements, although not a straightforward (one-to-one) relationship. As shown in table 2, level 2 requirements are applicable in maintenance performance, design-build (D-B), design-build-maintain (DBM), and PPP contracts.

TABLE 2. Requirement levels used in different delivery methods.

Project Delivery/ Contract Type	LEVEL 1 User Demands/ Needs	LEVEL 2 Functional Performance Requirement	LEVEL 3 Construction Behavior and Practices	LEVEL 4 Materials Behavior	LEVEL 5 Basic Materials and Processing
Traditional	→	→	→	X	x
Maintenance Performance	→	X	x	x	x
D-B	→	X	X	Con	Con
DBM	→	X	Con	Con	Con
PPP	X	x	Con	Con	Con

KEY TO SYMBOLS

X: The first or highest level at which the owner can specify performance requirements.

x: In many cases these levels will be also used for considerable parts of the project. A contract for a typical highway project will always have a hybrid character in the sense that parts of a project must be specified on different levels.

→: During initial development of a project, the owner should always start with Level 1, reasoning down to the desired contract level.

Con: The contractor will have to translate contract specifications down to instructions for its personnel, on Level 5 or even lower.



But when desired lifetime is longer than the contract time under DBM and PPP contracts, there might be risks that make it necessary to use level 3 requirements, in which the contractor must ensure future construction behavior.

The Dutch performance model aids understanding of the relationship between highway performance at its most basic level and how that performance can be shared in a PPP delivery. In PPP contracts, the agency and concessionaire agree on terms at levels 1 and 2. The concessionaires work with their designer and constructor team members to encompass the performance of levels 3, 4, and 5.

In this model, the traditional design-bid-build contract specifications start at level 4 by describing the material requirements and methods used to place the materials. As the contract types move to alternative delivery, the specification requirements can be described at progressively higher levels that reflect functional performance requirements and, at the highest performance level, user demands or needs under a PPP contract.

3.4 AASHTO Performance Management Process

Nonsector-specific performance-based management systems and an understanding of fundamental performance issues in transportation provide a context for a highway-specific performance management framework. AASHTO’s Task Force on Performance Management has used this context to develop a basic framework specifically for transportation performance management. The association believes that a proper framework must be practical, focused, cost-effective, and consistent with what is measured, how it is measured, and how the measured data are presented while also quantifying agency performance, driving interest and participation in achieving improvement, and aligning the measurement activities with outcomes and objectives.⁽²⁾ As figure 5 shows, AASHTO’s fundamental process for performance management consists of five phases. The first phase is the selection of appropriate performance measures to evaluate the agency in critical program and service areas. This is followed by monitoring and reporting the performance results. The third phase consists of analyzing the results and identifying key factors that influence performance and opportunities for

improvement. Subsequently, resources must be distributed to the system in a manner that drives better results. Finally, progress in achieving results should continue to be monitored and reported. The process cycles back to the third step and repeats.⁽⁶⁾

According to AASHTO’s Task Force on Performance Management, for a highway agency to have a comprehensive performance management system, these basic principles of the performance management process must be integrated into every function in the agency, including the following:

- **Policy development and long-range planning**—Set the goals and objectives of the agency with input from elected officials, stakeholders, transportation interest groups, and the general public.

Performance Management Process

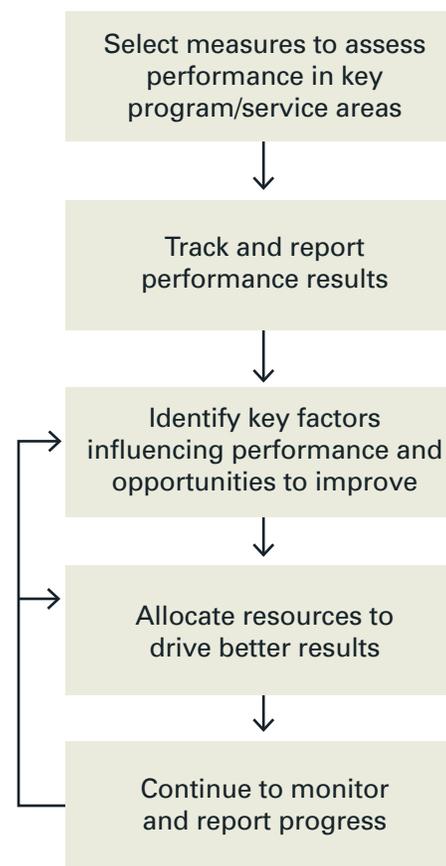


FIGURE 5. AASHTO performance management framework.

► **Programming and budgeting**—Use performance results to direct resources and effort where the potential for improved performance is the greatest and most important.

► **Program, project, and service delivery**—Measure an agency’s performance in delivering projects on budget and on schedule as an effective tool for establishing credibility and accountability.

► **Systems operations**—Address congestion and safety by measuring traffic conditions, delay, clearance time for incidents, work zone delay and safety, snow and ice removal, and other system parameters.

► **Monitoring and reporting results**—Track and report performance results to identify opportunities for improvement and allow adjustments to be made in the policy and long-range planning process, resource allocation, delivery, and operations.

If what is measured and presented is not understood, the system is inevitably ineffective.⁽¹⁾

The basic process of performance management presented by AASHTO is a key element to having a successful performance-based management system and can be implemented at the planning and decision-making levels in an agency. Along with this essential process, leaders in using performance management for transportation systems stress a few critical elements of the methodology. Stakeholder input in developing performance measures for the system, strong data collection strategies, benchmarking both inside and outside an organization, and development of a management system that is modally focused are just a few points of perpetual emphasis.⁽¹⁾ Furthermore, use of before-and-after studies of the highway system as additional feedback in any decisionmaking processes is strongly encouraged. These studies should be coupled with graphic and visual

Moving Minnesota Projects

Projects On Schedule • Status Report: November 2002

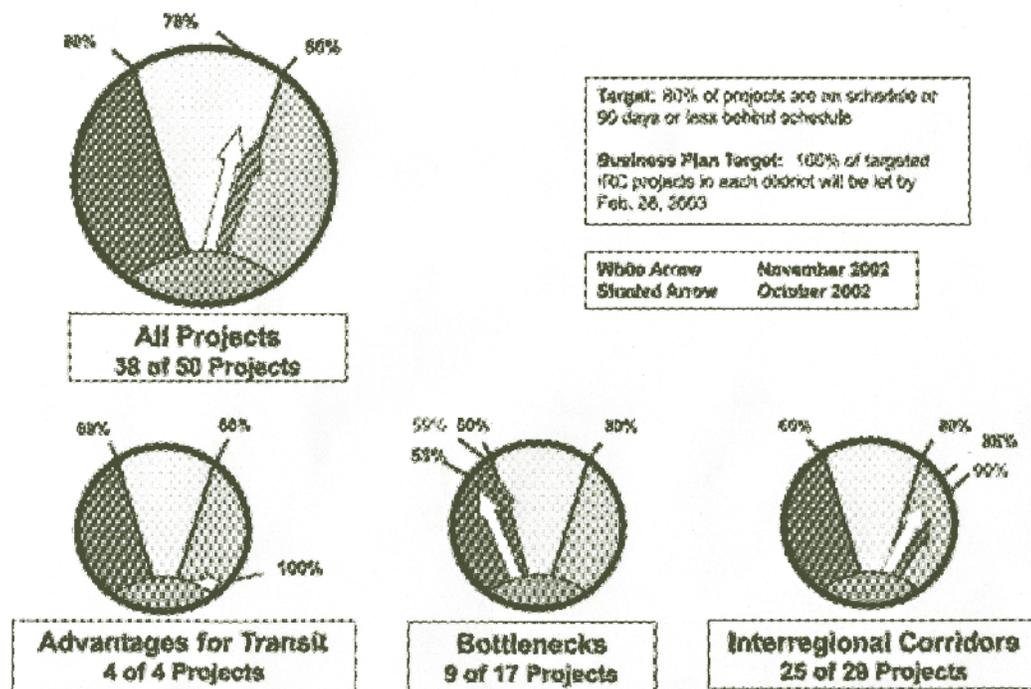


FIGURE 6. Minnesota DOT performance management measurement example.



presentations of performance results for the public and top agency decisionmakers to view because “if what is measured and presented is not understood, the system undoubtedly will be ineffective”⁽¹⁾ (see figure 6). The agency leaders also insist that collected performance data not lay dormant; they must be used in decisionmaking and improving performance for this system to be effective. Finally, many agency leaders have picked a handful of what they consider the most important performance measures, namely in the area of safety, and designated them “core performance measures.” They insist that these goals be met at the end of each cycle of the framework process. This is done while monitoring smaller, and still valuable, performance measures.⁽¹⁾

3.5 Performance Measure Development

Useful performance measures are requisite elements of a successful performance-based management system. In general, performance management system measures should be controllable, actionable, realistic, flexible, accurate, and credible. They should be conceived with the overall goals of the agency in mind while focusing on features such as revenue, cost, effectiveness, customer service, and public satisfaction.^(14,15) Each measure should be tied to a specific target to assure it makes a direct contribution to the overall agency goals.⁽¹⁰⁾ Balance is also important to performance measure development because seemingly smaller measures can be as important as larger ones in achieving agency goals and objectives. Most important, performance measure quality is substantially more influential than quantity; an overabundance of measures is overwhelming and can be destructive to the effectiveness of the system as a whole.⁽¹⁵⁾

The development of a performance measure specifically for transportation system management is similar to the general developmental case. Measures should have the ultimate goal of influencing decisionmaking and budget allocation in an agency and should be constructed with this goal in mind.⁽¹⁾ Also, they should add value and drive improvement for the agency while simultaneously being practical and cost-effective.⁽²⁾ Statistical evidence, both quantitative and qualitative, should be used to determine the progress of each measure in contributing to agency goals. This evidence is often labeled a “performance indicator” by many leading agencies and is attached directly

to a performance measure.⁽³⁾ Such indicators may include elements such as pavement smoothness, transportation-related fatalities and injuries, air and water quality, travel times and quality, fuel use, and customer satisfaction determined through survey responses.⁽³⁾ In addition, the number of measures and indicators should be kept to a concise and efficient minimum because too many measures can be overwhelming and confusing to monitor.⁽¹⁾ Finally, it should be realized that developing performance measures for a transportation system is an ongoing process. Some measures may need to be added as agency goals and objectives expand or change over time, while others may need to be deleted as goals are achieved or become outdated.⁽³⁾

In general, any measure of performance should be controllable, actionable, realistic, flexible, accurate, and credible and should be conceived with the overall goals of the agency in mind.⁽¹⁴⁾

3.6 Conclusions

This chapter presents a common set of principles and strategies on which performance management systems are based to aid understanding of performance measures and KPIs. At its most fundamental, performance can be organized into five levels: basic materials and processing, materials properties, construction behavior and practice, functional performance requirements, and user needs. These fundamental performance issues should be considered when defining a performance-based management system. This report uses the AASHTO performance management process as a generic model for performance management systems because it represents the current thinking of leaders in this area.



Chapter 4: CASE STUDIES

4.1 Introduction

A series of international and domestic case studies is the basis for the exploration of performance measures and KPIs in this report. Three primary research tasks were developed to complete this research. The subsequent sections discuss the tasks in detail. The rest of this chapter describes the case studies and their salient characteristics. Chapter 5 discusses the results of the case studies.

4.2 Research Approach

The research approach consisted of three primary tasks: (1) literature review—reviewing existing documentation for PPP projects and literature containing KPI information, (2) data collection—obtaining detailed information via communication with foreign practitioners, and (3) synthesis—synthesizing final results and documentation.

4.2.1 Literature Review

The research team conducted a thorough review of existing documentation for PPP projects. This task focused on collecting data on current national and international industry approaches to KPIs and more general performance measures. The objective of the data collection effort was to provide information to define the state of the practice. An extensive literature review was conducted using the following sources:

- ▶ General Internet search engines (Google, Google Scholar, Yahoo, etc.)
- ▶ Transportation Research Board’s Transportation Research Information Services (TRIS) database
- ▶ Academic engineering databases, such as LexisNexis® and Engineering Village
- ▶ Academic business databases, such as EBSCO Business Source Complete and Management and Organizational Studies
- ▶ American Society of Civil Engineers Civil Engineering database
- ▶ Selected transportation agency Web sites and reports

The team gathered more than 40 scholarly articles and research reports from these sources. The team extracted more than 1,700 performance measures and indicators in use or previously used by highway agencies relating to all aspects of a project, including design, construction, operations, maintenance, safety, and environmental stewardship. This extraction was useful both in defining performance measures and indicators for the purpose of this report and in familiarizing the team with possible measures and indicators for use in examining the case study projects. The information gathered was constructed into a review in an annotated bibliography format (see Appendix A) that addressed the essential elements of performance-based management for highway construction:

- ▶ The need for performance-based management and PPPs in highway construction
- ▶ The history of performance-based management in highway agencies
- ▶ Who uses performance-based management systems
- ▶ The proper framework for a performance-based management system
- ▶ How to develop a useful performance measure
- ▶ The outcomes of measuring performance

4.2.2 Data Collection

The scope of the data collection involved gathering information from eight PPP project case studies. The project case studies also required collecting agency data on programmatic performance measures. Before beginning the case studies examination, the research team conducted a content analysis of the literature and contract documents in its database. Subsequently, the team developed a data collection instrument in the form of a case study protocol to collect comprehensive and consistent information from the foreign practitioners.

The first step in obtaining detailed information was analyzing the content of relevant documents before or concurrent with creating the data collection



instrument. The purpose of the content analysis was to identify measures used in policy and implementation documents and minimize the burden on the international respondents. A formal content analysis involves collecting and organizing information in a standardized format that allows for the transformation of nonstructured information into a format that permits analysis. The basic steps of the content analysis method are (1) deciding to use content analysis, (2) determining what material should be included in content analysis, (3) selecting units of analysis, (4) developing coding categories, (5) coding the material, and (6) analyzing and interpreting the results. The result of the content analysis was a list of performance measures and KPIs that the team used as a basis for designing the case study protocol and supplementing data collection from foreign practitioners.

To preserve the quality of the research, the case studies were required to maintain trustworthiness, credibility, conformability, and data dependability. Four validity tests were used to determine the quality of the case study research: (1) construct validity, (2) internal validity, (3) external validity, and (4) reliability. Construct validity deals with people's opinions and biases; subjectivity should be avoided in the research. This study dealt with construct validity by using multiple sources to collect the data for the research (e.g., both agency and contractor representatives). Internal validity refers to the interpretation of the data, especially when some causal factors are not recognized or omitted during analysis of the data. To ensure the internal validity of this study, the team used the technique of pattern matching across the case studies. External validity in this study involved the transfer of the results to practice. The external validity test was met by replicating the findings developed in one case study in another. Reliability is the capability of replicating the findings if the same steps are repeated. The condition of reliability was met by drafting a detailed protocol that guided the formulation of propositions, research questions, case study design, and data collection.

The team worked together to develop the final case study protocol. The FHWA oversight panel reviewed and approved the protocol to assure it was not too burdensome for the foreign practitioners to answer. The approved case study protocol is in Appendix B.

4.2.3 Synthesis

The research team synthesized the data by exploring patterns across multiple case studies and literature. The team used the categories discovered in the content analysis to organize the results. The results were presented to the FHWA oversight panel as an additional form of validation. The following categories were used for presenting results. These categories were also chosen to align as closely as possible with AASHTO's performance management model.

- I. Operations and maintenance
 - A. Organizational structure for monitoring operations and maintenance
 - B. Use of performance points to track operations and maintenance
 - C. Remedies and dispute resolution procedures for poor operations and maintenance performance
 - D. Example operations and maintenance performance measures and KPIs
- II. Design and construction
 - A. Organizational structure for monitoring design and construction
 - B. Remedies and dispute resolution procedures for poor design and construction work
- III. Handback requirements and KPI evolution

4.3 Case Studies

The research team, with the concurrence of the FHWA oversight panel, selected 10 PPP case study projects for this research. Eight of the case studies are included in this report. The case studies were selected for their applicability to the research in terms of (1) containing design, construction, maintenance, and operations activities; (2) availability of contract documents; (3) previous and ongoing contact with key project personnel; (4) diversity of status in the project delivery process; and (5) diversity of geographical location. The case studies and pertinent information are in table 3. The text describes the salient characteristics of the case studies.

To set a foundation for understanding subsequent case study results, the following sections provide the salient characteristics of each case study, including the location, duration, and cost of the project, as well as the project owner and major partners involved in the contract. This is intended to provide a high-level description of the type and size of projects,



TABLE 3. Case study project summary.

Project Name	Owner	Location	Project Duration	Cost
I-595 Corridor Improvements	Florida Department of Transportation	Broward County, Florida, United States	Award: October 2008 Begin Concession: Spring 2014 Concession Term: 35 years	US\$1.2 billion
Golden Ears Bridge	TransLink	Metro Vancouver, British Columbia, Canada	Award: December 2005 Begin Concession: June 2009 Concession Term: 35.5 years	CA\$808 million
Kicking Horse Canyon Phase II	British Columbia Ministry of Transportation	Golden, British Columbia, Canada	Award: October 2005 Begin Concession: August 2007 Concession Term: 25 years	CA\$13 million
EastLink	Victoria State Government	Melbourne, Australia	Award: July 2003 Begin Concession: June 2008 Concession Term: 39 years	AU\$2.5 billion
Capital Beltway	Virginia Department of Transportation	Northern Virginia, United States	Award: December 2007 Begin Concession: December 2007 Concession Term: 80 years	US\$1.93 billion
CLEM7 North-South Bypass Tunnel	City Council of Brisbane	Brisbane, Queensland, Australia	Award: April 27, 2006 Begin Concession: 2010 Concession Term: 35 years	AU\$3.2 billion
M25	Highways Agency	London, England	Award: May 2009 Begin Concession: 2012 Concession Term: 30 years	£6.2 billion
Airport Link	Queensland State Government	Brisbane, Queensland, Australia	Award: May 2008 Begin Concession: 2012 Concession Term: 45 years	AU\$3.4 billion

using both PPP agreements and performance management systems in their contract to facilitate this understanding.

4.3.1 I-595 Corridor Improvements

The Interstate-595 highway project in Broward County, FL, is a corridor reconstruction and addition of auxiliary lanes. The project involves resurfacing the I-595 mainline and adding a reversible express lane system in the I-595 median. Florida’s Turnpike mainline and interchange will also be widened and new bicycle and pedestrian paths will be constructed as components of the county’s New River Greenway System. Thirteen sound barriers will be constructed to provide noise abatement for 21 communities in Broward County, and a bus rapid transit and express bus service will be added to the corridor to increase traffic mobility. The \$1.2 billion contract involves a 35-year concession for a total project length of 10.5 miles (mi) (16.8 kilometers (km)).

The PPP agreement is between FDOT and the private concessionaire I-595 Express LLC (created by ACS Infrastructure Development). The concessionaire’s design team consists of nine design firms, including AECOM; its construction team consists of five contractors, including GLF Construction Corp.; and its operations and maintenance contractor is Jorgensen Contract Services. FDOT’s management team is comprised of a public involvement team headed by Media Relations Group, LLC; a design oversight team made up of five firms, including Reynolds Smith & Hills; and a construction oversight team headed by the Corradino Group.

4.3.2 Golden Ears Bridge

The Golden Ears Bridge project is located in metropolitan Vancouver, British Columbia, Canada. The project consisted of constructing 4,656 meters (m) of bridge length and 112,000 square meters of bridge deck. Also, 13.3 km (8.2 mi) of roadway were constructed, including the bridge span, and 12.2 km (7.5 mi) of public streets were upgraded.

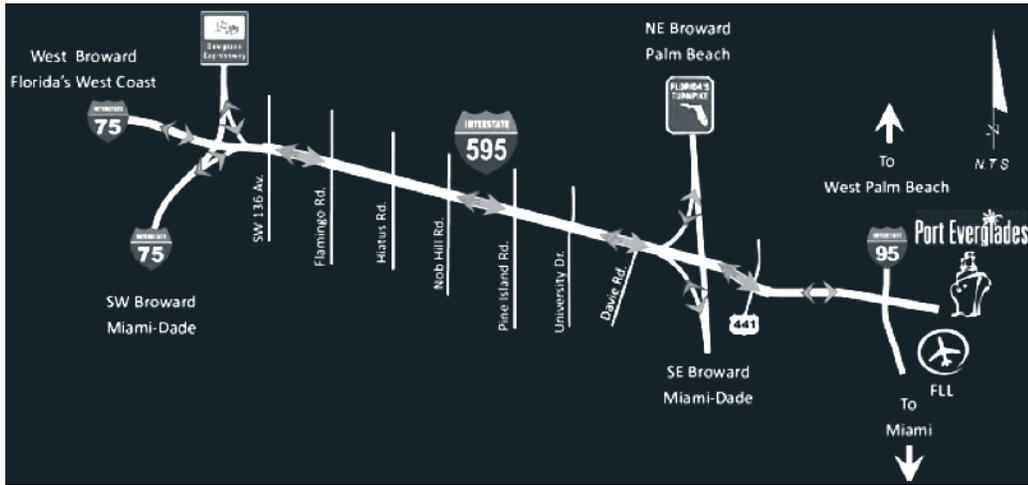


FIGURE 7. I-595 corridor improvements.

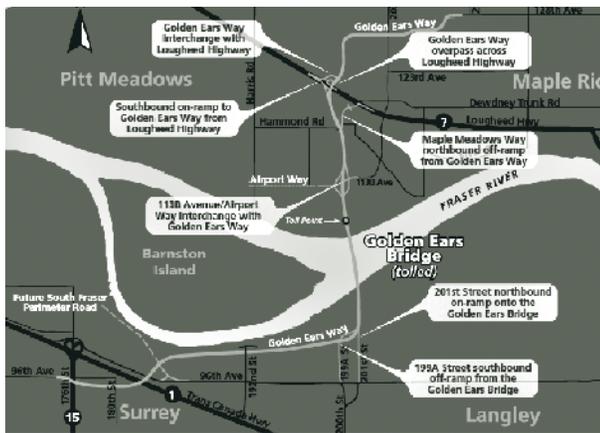


FIGURE 8. Golden Ears Bridge.

The project's PPP agreement is between TransLink, the owner, and a joint venture led by Bilfinger Berger and CH2M Hill. TransLink, British Columbia's South Coast Transportation Authority, was the sponsor and is the remaining project owner for the Golden Ears Bridge. The Bilfinger Berger-CH2M Hill partnership, calling itself the Golden Crossing General Partnership (GCGP), was awarded the project contract on Dec. 7, 2005. Construction started in June 2006. Golden Ears Bridge formally opened to traffic 3 years later on June 16, 2009. TransLink engaged GCGP to design, build, finance, and operate the project over a 35.5-year period under a contract totaling roughly CA\$808 million. GCGP, owned by Bilfinger Berger Project Investments, a branch of the Bilfinger Berger

organization, delegated the design and construction services to 20 British Columbia-based firms (including Bel Contracting, Imperial Paving, and Fraser River Pile and Dredge Ltd.) and acted as the design and construction project manager. The partnership elected Capilano Highway Services to maintain the bridge and road network in accordance with the contract's operations, maintenance, and rehabilitation agreement after it opened to traffic to complete the 35.5-year concession term.

4.3.3 Kicking Horse Canyon Phase II

The Kicking Horse Canyon Phase II project is located in Golden, British Columbia, Canada. This phase of the project involved the design, construction, and financing of 5.8 km (3.6 mi) of highway and the replacement of the Park Bridge. It also included a subcontracted agreement for HTMC Services Inc. to maintain, operate, and rehabilitate the entire project (phases I, II, and III), a total of 26 km (16.1 mi) of highway, for 25 years. The cost of the second phase of the Kicking Horse Canyon Project was calculated at CA\$143 million.

The PPP agreement between the British Columbia Ministry of Transportation and the Trans-Park Highway Group is a performance-based agreement used to govern the phases of design, construction, maintenance, and operations. The foundation of this system is the proper monitoring of performance, which for Kicking Horse Canyon was done by the province of British Columbia represented by the British Columbia Ministry of Transportation. The



British Columbia Ministry of Transportation has monitored performance since the late 1980s. The ministry monitored all aspects of the design, construction, completion, commissioning, testing, and maintenance of the works through inspections, testing, surveys, certifications, and review. The contract for the project was awarded to Trans-Park Highway Group on Oct. 28, 2005, and the project officially opened to traffic on Aug. 30, 2007. The Trans-Park Highway Group is a joint venture led and managed by Bilfinger Berger BOT Inc. The partnership includes other teams, such as Flatiron Constructors Canada, responsible for construction management, and Parsons Overseas Co. of Canada, leading design program and management. HTMC Services Inc. was subcontracted the task of ongoing operations and maintenance services for the project's lengthy concession term. The partnership also consists of smaller subconsultants and subcontractors providing specific designs, checks, and specialized construction.

4.3.4 EastLink

Mitcham-Frankston Freeway (EastLink) is an AU\$2.5 billion tolled freeway linking a large area through the eastern and southeastern suburbs of Melbourne, Australia. It is part of Melbourne's Metropolitan Ring Road project. The project includes a new 39-km (24.2-mi) roadway and 6 km (3.7 mi) of bypass roads at Ringwood and Dandenong. Three traffic lanes in each direction run for 33 km from the Eastern Freeway to Thomson Road at Carrum Downs. At the southern end, two traffic lanes in each direction run for 6 km (3.7 mi) from Thomson Road to the Frankston Freeway. Twin 1.6-km (0.9-mi) three-lane tunnels run through the Mullum Mullum Valley as a means of environmental protection. EastLink is electronically tolled with no toll collection booths.

The PPP agreement is between Victoria and ConnectEast. The Southern and Eastern Integrated Transport Authority (SEITA) was established to act on behalf of Victoria to plan, procure, and commission this facility. ConnectEast was selected as the concessionaire to fund, design, construct, operate, toll, and maintain the road for 39 years and was officially awarded the contract by SEITA in October 2004. ConnectEast contracted Thiess John Holland for the detailed design and construction, SICE for the tolling system, and United Group Infrastructure for mechanical and electrical work. Construction began in March 2005 and the freeway opened to traffic 3

years later in June 2008. Tolling for the freeway did not begin until July 2008, so motorists used it free of charge for the first month.

4.3.5 Capital Beltway

The Interstate 495 Capital Beltway project will build 14 mi (22.5 km) of new high-occupancy toll (HOT) lanes (two in each direction) on I-495 from the Springfield Interchange to north of Dulles Tollroad in Northern Virginia. These HOT lanes will allow the Capital Beltway to offer HOV-3 connections with I-95/395, I-66, and Dulles Tollroad for the first time. In addition to providing new travel choices, this project will also make a contribution to the beltway's 45-year-old infrastructure, replacing more than 50 aging bridges and overpasses, upgrading 10 interchanges, and improving new bike and pedestrian access. When completed, buses, carpools and vanpools with three

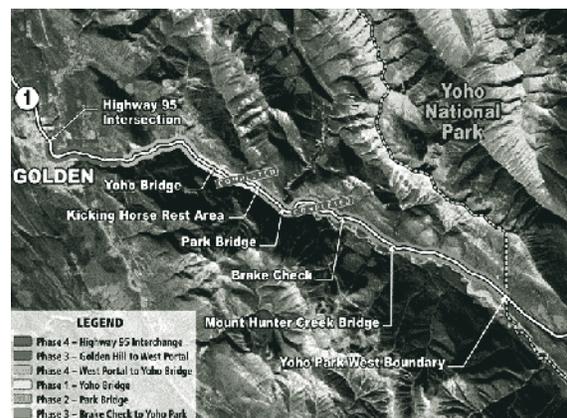


FIGURE 9. Kicking Horse.



FIGURE 10. EastLink.

or more people, and motorcycles will be able to ride in the new lanes for free. Vehicles carrying two people or fewer will either travel for free in the regular lanes or pay a toll to ride in the HOT lanes. Tolls for the HOT lanes will change according to traffic conditions, which will regulate demand for the lanes and keep them congestion free. The project will be electronically tolled using transponder technology.

In 2002, VDOT received an unsolicited PPP conceptual proposal from Fluor Daniel to develop, finance, design, and construct HOT lanes on the Capital Beltway. Although VDOT advertised for competing proposals, none were received. In spring 2003, VDOT submitted a grant application to FHWA to study HOT lanes and other value-pricing applications in Northern Virginia. In September 2007, VDOT and Capital Beltway Express, LLC, formed by Fluor and Transurban, reached an agreement in principle for the design, construction, operation, and maintenance of the

Capital Beltway HOT lanes. A comprehensive agreement was finalized on Dec. 20, 2007. Under this agreement, VDOT will own and oversee the HOT lanes and Capital Beltway Express will construct and operate them. The length of the concession is 80 years (5 years of construction and 75 years of operation).

4.3.6 CLEM7 North-South Bypass Tunnel

The Clem Jones Tunnel, formerly known as the North-South Bypass Tunnel, will be a 4.08-mi (6.5-km) tunnel in Brisbane, Australia, that links five freeways and arterials on the north and south sides of the Brisbane River. When it opened in 2010, it will operate with fully electronic tolls that rely on either vehicle transponders or license plate recognition photography. The project is also called the CLEM7 after its route designation. It will feature two twin tunnels of 4.8 km (2.88 mi). The Brisbane municipal government anticipates that it will be the first of five major projects intended to relieve congestion in the rapidly growing Australian metropolis. The CLEM7 is also the first section of the new M7 motorway in Brisbane. The M7 is expected to be completed in 2012 following completion of the Airport Link tunnel. That will be a 6.7-km (4.1-mi) tunnel that will connect the CLEM7 to the region's airport and growing northern suburbs.

The project is being built and managed by the RiverCity Motorway Group on behalf of the Brisbane, Queensland, City Council. RiverCity Motorway is a publicly traded company under contract to the Brisbane City Council. RiverCity Motorway, in turn, contracted the design and construction of the tunnel to the Leighton Contractors and Baulderstone Hornibrook Bilfinger Berger Joint Venture (LBB JV). The 35-year contract includes design-build-finance-operate (DBFO) provisions. Another firm, Brisbane Motorway Services, a joint venture of Leighton Services and Bilfinger Berger, will operate and maintain the CLEM7 during the concession period.

4.3.7 M25

As a hub of the United Kingdom's motorway network, the M25 is one of the busiest motorways in Europe and is the key strategic orbital route around London. Widening of the M25 began in May 2009. The project is designed to widen about 102 km (63.3 mi) of the M25 by adding a lane in each direction, making the majority of it a four-lane motorway. The widening will be done around the north side of London between Junctions 16 (M40) and 23 and between

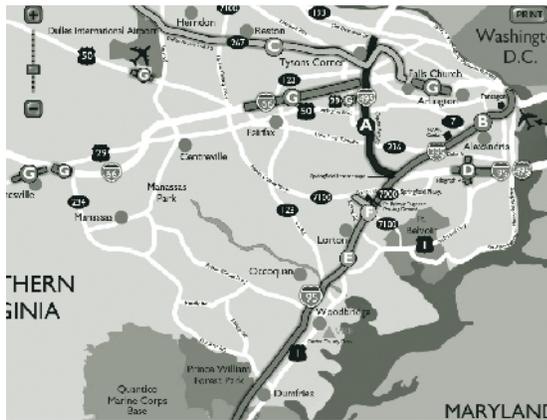


FIGURE 11. Capital Beltway.



FIGURE 12. North-South Bypass Tunnel.



Junctions 27 and 30 (A13 Interchange). Construction will take place over 3 years. In addition, the M25 may be widened between Junctions 23 and 27 and between Junctions 5 (M26) and 7 (M23) around southeast London. The decision on these two sections will be made later in the contract period. The total cost of the project, including the operations and maintenance, is £6.2 billion.

On May 20, 2009, the Highways Agency (HA) awarded the M25 DBFO contract to Connect Plus. Design and construction completion is expected in 2012 with a subsequent 30-year operating contract period. The PPP agreement for the M25 is based on the DBFO form of contract that has evolved in HA for more than 10 years. The agreement is based on previous agreements used for DBFO roads, but incorporates amendments to reflect the more complex nature of the M25 DBFO and to make the agreement compliant with Treasury's Standardization of PFI Contracts (Version 3). Because of heavy traffic on the M25, HA decided to apply an availability payment mechanism rather than a congestion management payment. Availability payments are subject to lane availability, condition criteria, and performance measures.

4.3.8 Airport Link

The Queensland government included a voluminous set of performance metrics and management system requirements to ensure that its 11-km (6.8-mi) Airport Link toll project will operate acceptably for 45 years. Airport Link is a mainly underground tollroad planned between Brisbane's northern suburbs, the airport, and the inner city. When completed in 2012, it will connect the North-South Bypass Tunnel, Inner City Bypass, and local road network at Bowen Hills to the northern arterials of Brisbane.

Airport Link will include one northbound and one southbound three-lane tunnel. It is expected to carry 95,000 vehicles soon after opening, with volumes predicted to reach 120,000 in 2026. It will allow motorists to avoid 18 sets of traffic signals in the rapidly growing city, which is expected to grow from 2.6 million today to 3.7 million by 2026. In May 2008, the Queensland government announced BrisConnections as the preferred bidder for the Airport Link and the adjacent Northern Busway and Airport Roundabout upgrade projects—all under a 45-year DBFO contract. Despite a controversial collapse of the project's original stock-financing plan, the project remains on schedule and its financing is guaranteed

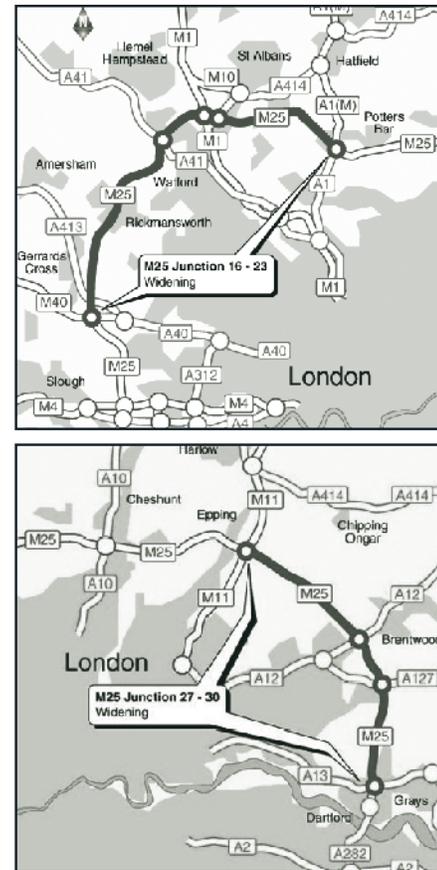


FIGURE 13. M25.



FIGURE 14. Airport Link.



Chapter 4: Case Studies

by major partners Macquarie Capital Advisors and Deutsche Bank.

BrisConnections is a publicly traded operating company under contract to the Queensland government to build and operate the facility. BrisConnections, in turn, contracted with Thiess-John Holland, a joint venture between Thiess and John Holland Group, to build the facility. Airport Link Motorway Services, a joint venture between Thiess Services and John Holland Services, will operate and maintain the tollroad on completion.

4.4 Conclusions

This section presented the case study approach for this research. The case study protocol is in Appendix B. The eight international and domestic case studies are the basis for the exploration of performance measures and KPIs in this report. This section presented a high-level summary of the cases studies. Section 5 of this report discusses the results of the case studies.

Chapter 5: CASE STUDY FINDINGS

5.1 Introduction

The research team collected a wealth of data from the content analysis of the PPP case study agreements and interviews with the project team members. This chapter summarizes the findings and presents the raw data from the case studies. Chapter 6 presents the interpretation of the overall results and conclusions from the findings. The information consists of a blend of KPIs and performance requirements from the language in the PPP agreements. While the performance requirement examples are not KPIs per se, they do provide insights into performance management in the key areas identified in the case study protocol. The results are organized into the following three categories:

- ▶ Operations and maintenance
- ▶ Design and construction
- ▶ Handback requirements and KPI evolution

Table 4 summarizes the findings for each category. Data were found for each category, but not in every project because of the nature of the data available for each case study. Much of the data in this section come directly from the actual contract language in the agreements. The section summarizes the data first by category and then by subcategories for each project.

In addition to the KPI data summarized in this section, Appendix C provides a summary of KPI tables for

TABLE 4. Overall summary of KPI information.

KPI Category	I-595 Corridor	Golden Ears Bridge	Kicking Horse Canyon	East Link	Capital Beltway	North-South Bypass	M25	Airport Link
5.2 Operations and Maintenance (O&M)								
5.2.1 Linking Agency Performance Measures With Project KPIs			✓			✓	✓	✓
5.2.2 Organizational Structure for Monitoring O&M	✓	✓	✓	✓	✓	✓	✓	✓
5.2.3 Using Performance Points to Track O&M	✓		✓	✓	✓	✓		✓
5.2.4 Remedies and Dispute Resolution Procedures for Poor O&M Performance	✓	✓	✓	✓	✓	✓		
5.3 Design and Construction (D&C)								
5.3.1 Organizational Structure for Monitoring D&C	✓	✓		✓	✓	✓	✓	✓
5.3.2 Remedies and Dispute Resolution Procedures for Poor D&C Work	✓	✓	✓	✓	✓	✓		
5.4 Handback Requirements and KPI Evolution								
5.4 Handback Requirements and KPI Evolution	✓	✓	✓	✓	✓	✓	✓	✓



I-595, Golden Ears Bridge, Kicking Horse Canyon, and the North-South Bypass. The Appendix C tables come directly from the project agreements.

5.2 Operations and Maintenance

The richest set of KPIs was found in the operations and maintenance categories of the PPP agreements. The agencies use KPIs to align project operations with network operations and overall agency performance measures. The KPIs for operations and maintenance are presented in the following subcategories:

- ▶ Linking project performance measures with agency and societal goals
- ▶ Organizational structure for monitoring operations and maintenance
- ▶ Using performance points to track operations and maintenance
- ▶ Remedies and dispute resolution procedures for poor operations and maintenance performance

5.2.1 Linking Agency Performance Measures With Project KPIs

Ideally, agencies will be able to link their higher level performance measures with individual PPP KPIs. These higher level performance measures typically deal with network operations and societal goals. For example, AASHTO strongly promotes reform for the entire U.S. highway system centered on reaching the six key national interests.⁽⁶⁾ AASHTO is in the process of developing and establishing a handful of broad, overall agency goals for the entire U.S. highway system on highway construction safety, mobility, and stewardship. These six key national interests appear to reflect the interests of American society and address the public's major concerns about and views of the transportation system. If the goals are accepted and implemented, AASHTO believes that every highway agency in the United States will be able to—and will be held accountable for—producing results that reflect and work toward realizing these goals. The challenge for each PPP is to link project KPIs to these higher level agency goals.

A number of the eight case studies reveal strategies foreign highway agencies are implementing to meet some of their unique performance measures. It is apparent that the agencies are attempting to align

KPIs with performance measures. This can be seen in individual project contract elements and the underlying strategies on which they are founded. However, the agencies have not found integration of the performance measures and KPIs to be seamless. Agency goals and performance measures can change over time in response to societal goals, while PPP agreements must be more rigid in defining KPIs. A good example involves agency goals on climate change issues that were not contemplated when the PPP contracts were executed. This section details the general alignment between project goals and agency goals, as well as between agency goals and wider societal goals. This linkage is built on the idea that many small and specific achievements (meeting project goals) will eventually lead to larger, more significant accomplishments (reaching societal goals).

Airport Link and CLEM7 North-South Bypass Tunnel

Linking Societal Goals to Project Performance

A linkage is evident between Brisbane's broad goals and the KPIs and other oversight mechanisms in the Airport Link and the CLEM7 North-South Bypass Tunnel projects. Although the contract documents do not directly reference the larger state strategic objectives, the many management systems, including quality plans and KPIs in the projects, appear to parallel or replicate many of the same strategic objectives articulated in the state transportation strategic plans. General strategic outcomes desired in the state transportation plan, such as environmental sustainability, traffic reliability, neighborhood quality of life, and safe transport, all have parallel requirements in the contract documents for both projects.

The Queensland Department of Transport and Main Roads (QDTMR) is the state transportation agency governing the projects. Both projects are linked to larger state transportation plans and objectives, although both projects were developed by spinoff government entities, not QDTMR, which is typical in Australia for large, multiyear toll facilities. The Airport Link project was developed by Queensland through a spinoff entity labeled City Infrastructure North (CNI). The CLEM7 North-South Bypass Tunnel was managed through the RiverCity Motorway Group. CNI is a government agency, while RiverCity Motorway Group is a publicly traded private company under a long-



term contract with the city of Brisbane. Both CNI and RiverCity motorway issued tenders for other firms to construct and operate the facilities.

While priority concerns from the state transportation plans are mirrored in the contract documents for the projects, the contract documents do not rely solely on a set of KPIs to ensure the concessionaire fulfills the state's strategic objectives for the project. Instead, the contracts rely on a more comprehensive approach that requires the concessionaire to develop management plans and management systems for all major aspects of the projects' planning, design, construction, maintenance, operations, toll collection, and community relations. At least 28 different management systems or plans are required for the projects, while only 19 individual KPIs are explicitly stated in the contract documents. Outside audits and an independent verifier are required as part of the contract to attest to the Brisbane City Council and Queensland that the many provisions of the management systems and plans are being followed. At least three management systems—project, environmental, and health and safety—must comply with the Australian provisions of the International Organization for Standardization (ISO) for these management systems. Also, a minimum of three performance bonds are required to ensure adherence to the performance specifications. These include bonds for design and construction, operations and maintenance, and the tollroad's condition at handover. Although KPIs are included in the project contracts, they comprise only a small part of the oversight framework for the complex and multiphased CLEM7 North-South Bypass Tunnel and Airport Link projects. For example, all 19 of the KPIs referenced in the contract documents relate to aspects of the operations phase, and none relate to the design and construction phase.

Underlying State Strategic Planning Process

QDTMR displays a well-articulated strategic management framework in which broad, catalytic state goals flow through a performance management process in the transportation agency down to the individual project and activity level. Although many of the issues addressed by the strategic management framework for QDTMR also are addressed in the CLEM7 North-South Bypass Tunnel and Airport Link projects, they are addressed in different ways. Generally, the state agency adopts objectives and metrics to guide its next 5-year period. With the 40-year horizons for

the CLEM7 North-South Bypass Tunnel and Airport Link projects, the contracts rely on longer term management systems and quality assurance processes that can adapt and change over time. One BrisConnections executive said, "The contract approach is intended to provide the owner with flexibility to evolve its oversight metrics over time while providing the concessionaire some certainty of performance to enable the concessionaire to predict and manage its costs."

In an interview, an official of BrisConnections, the concessionaire selected by CNI to build and operate the Airport Link, said that the most direct linkage between the state's strategic transportation objectives and the Airport Link contract documents is the actual construction of the project. The construction and operation of the facility fulfills a fundamental transportation objective of the state's strategic plan, which is to alleviate congestion and improve mobility in the rapidly growing urban area.

For more than a decade, QDTMR has operated under a state strategic transportation plan. In 2008, Queensland's minister for Transport, Trade, Employment, and Industrial Relations and minister for Main Roads and Local Government jointly developed the updated state transportation plan known as the Transport Coordination Plan for Queensland. This plan set the strategic direction for the highway and transit agencies before and after a recent merger to form QDTMR. It expresses the strategic context and challenges the state faces. The state is coping with rapid growth, high congestion, automobile dependency, environmental changes, high community expectations, a threatened quality of life, and diverse regions with differing transportation needs, according to the plan. The Transport Coordination Plan lays out 10 strategic objectives for the transportation agencies:

- ▶ Make the most of the existing transportation network by balancing demand and supply of infrastructure and services to maximize efficiency.
- ▶ Invest in Queensland's transport system by targeting investment to achieve best value for industry and community.
- ▶ Keep the system working well by ensuring the transport system performs well and accommodates the changing travel patterns and requirements of society and industry.



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- ▶ Get people walking, cycling, and using public transport by increasing the share of trips made by public transport, walking, and cycling and providing alternatives to private car use.
- ▶ Support regional and remote communities by connecting them to essential services that support economic development and social cohesion.
- ▶ Move freight efficiently by contributing to a strong and diverse trading environment.
- ▶ Make transport safer by reducing transport-related incidents, fatalities, and injuries.
- ▶ Make transport more secure by protecting personal security and the integrity of the transport network.
- ▶ Care for the natural and built environment by contributing to a cleaner, healthier, and more livable environment for all Queenslanders.
- ▶ Integrate transport planning and land use by matching transport and land use patterns to enhance livability and trade.

QDMTR converts these broad goals into an increasingly specific set of reports and metrics by which it can assess—and be measured on—how well it is implementing the state government’s overall transportation aspirations, including the following:

- ▶ Adopt a 5-year strategic plan derived directly from the 10-year state plan.
- ▶ Adopt a specific list of projects, called the roads implementation plan, that are intended to meet the strategic plan objectives.
- ▶ Annually, produce a highly detailed and quantified service delivery statement (SDS), which is a public report on what QDMTR plans to achieve in the upcoming budget year.
- ▶ Every quarter, produce a board of management report to the cabinet agency reporting on QDMTR’s progress on the SDS.
- ▶ Conclude each year with an annual report that specifies what QDMTR actually accomplished in the SDS and through overall efforts in the past fiscal year.

Translating State Goals Into Project Performance

Although QDMTR has its own set of departmental KPIs and objectives, they do not closely correlate to

the KPIs and objectives in the CLEM7 Tunnel or Airport Link contracts. There are, however, general similarities in that both the state agency and the project entities create systems and metrics for common transportation issues, such as safety, emissions, travel reliability, and asset conditions.

The QDMTR strategic plan has a key results area (similar to a strategic goal) of having “effective relations,” which are supported by key result indicators of “stakeholder satisfaction” and “effective relationship management.” The project deed for the CLEM7 North-South Bypass Tunnel project requires the concessionaire to have a relationship management plan facilitated by a third-party contractor to bring stakeholders together to create a shared mission, vision, and objectives for the project. A reporting system will be designed to keep all stakeholders informed throughout the project of key areas, such as cost, safety and health, environmental compliance, project quality, schedule status, and design status. Although both the state transportation department and the CLEM7 North-South Bypass Tunnel project organization have strategic objectives for customer relations, they approach them somewhat differently. The state agency approaches its objective with a 5-year timeframe and key results indicators, while the CLEM7 North-South Bypass Tunnel contract documents require a permanent, ongoing relationship management plan that evolves over the years as stakeholder requirements mature. The CLEM7 North-South Bypass Tunnel’s overall quality system also is paired with the project community relations plan and a corresponding community relations policy. All personnel must complete an induction, or training, on the community relations policy before beginning work on the jobsite. The community relations policy and its corresponding plan say, in part, that the concessionaires will adopt the following:

- ▶ **Company approach**—Demonstrably treat the community with sensitivity and respect in relation to its issues, views, and suggestions.
- ▶ **Community interaction**—Interact with the community in a way that is—and is seen to be—accessible, transparent, and responsive.
- ▶ **Mutual trust and respect**—Achieve a level of mutual trust and respect that leads to problem-solving and solutions that improve the overall project outcomes.



- ▶ **Shared recognition**—Leighton Contractors and the community will achieve industry recognition for world-best practice performance in project delivery.
- ▶ **Management systems**—Use innovative, people-focused management systems to achieve the above.

In the area and interest of safety, QDTMR has the following key result indicators:

- ▶ Safety of the state-controlled road network in line with national targets
- ▶ Efficiency of heavy vehicle operation on the state-controlled road network
- ▶ Travel efficiency and reliability on the state-controlled road network

In its 2009 SDS, QDTMR has a 2008–09 target fatal crash rate per 100 million kilometers of less than or equal to 0.57 and a target number of fatalities per 100,000 population of 3.97.

Comparable metrics on safety were not found in the contract documents for the CLEM7 North-South Bypass Tunnel or Airport Link projects. Instead, on the CLEM7 North-South Bypass Tunnel project, safety is based more specifically on the unique conditions of a highway tunnel. For instance, the fire and life safety systems must be reliable at least 99.995 percent of the time. The electrical system must be reliable 99.971 percent of the time, and the facility control systems must have total redundancy and have availability of 99.995 percent. The communication systems must have 99.99 percent availability and the ventilation system, at full capacity, must be reliable 99.954 percent of the time. Outages within those limits are not allowed to exceed 1 hour.

Roadway safety is addressed through continually improving processes instead of adhering to a specifically narrow metric. Safety audits are required by an independent and qualified party. They must be performed during the design phase, immediately before the public opening, and every 2 years during the operations and maintenance phase. The concessionaire must implement the recommended corrected actions or justify to the independent verifier why the actions cannot be implemented. Not evident in the contract documents for either the CLEM7 North-

South Bypass Tunnel or the Airport Link project were KPIs related to the number of crashes or a crash rate. Instead of a fixed numeric crash KPI, the project relies on the creation, operation, and continual monitoring of a project safety and health management plan that addresses all aspects of the project, including vehicular crashes, injuries to the project workforce, and the fire suppression and ventilation systems in the tunnel.

In the asset management areas, similar contrasts are evident between how QDTMR measures and manages its performance and how the contract documents provide for the measurement and management of the CLEM7 North-South Bypass Tunnel and Airport Link projects. QDTMR begins with a strong policy-based transportation asset management (TAM) program and relies on annual performance metrics to ensure the ongoing achievement of sound roadway and bridge conditions. The service delivery statement has a target that 95 percent of miles traveled on urban routes and 92 percent of travel on rural routes meet pavement smoothness standards. To sustain those levels, it measures whether its targeted number of miles of pavement that need to be rehabilitated or resurfaced are met. For bridges, its strategy is to continue retiring substandard timber bridges, the primary structures that reduce the quality of the overall bridge inventory. The QDTMR asset management processes produce a total needed level of expenditure to sustain roadway conditions, which in 2008–09 was AU\$461 million. In the SDS the department tracks whether it successfully delivers that program.

In the CLEM7 North-South Bypass Tunnel and Airport Link projects, a slightly different approach is taken. The contract documents do not prescribe specific condition levels for pavement smoothness, bridge conditions, or annual maintenance expenditure levels. Instead, they rely on a series of complementary and overlapping strategies to ensure that the project is designed, constructed, and maintained to ensure a high quality of condition throughout its service life and at its handover. The adequacy of the maintenance for the 31-year operations phase is controlled through extensive operations and maintenance requirements and adherence to an asset management plan. During the design stage, the designs for elements such as pavements and bridges are subjected to a mandatory review process by the independent verifier to ensure they meet current design specifications. Quality assurance plans throughout construction are required



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to ensure that construction means, methods, and materials are sound.

The concessionaire must establish and update an asset management system satisfying the project deed. The asset management system must record the current, historical, and projected future condition of each project asset. It must include detailed records of the repair or replacement of assets to assist in estimating the residual design life of the various elements. An asset inventory should be maintained that records the nature, extent, quantity, location, time, and type of any maintenance and repair. The asset inventory must be layered in terms of asset elements, types, items, and subitems, and the asset management system must document their regular inspection. The system must also trigger the necessary response defined in a code of maintenance standards for each asset element.

The *Operations and Maintenance Manual* covers more than 600 pages of how the operating company will perform maintenance throughout the life of the project. The manual is, in effect, a comprehensive maintenance management system. It describes the various maintenance elements, defines their adequate state of condition and inspection cycles, describes necessary corrective actions, and includes a reporting process to monitor the overall condition of the maintained items. It includes more than 200 pages of summary tables, each providing details on a maintenance subitem, how it is to be inspected, what its general performance characteristics should be, and how it should be repaired to bring it into serviceable operation. The items cover many general roadway elements, such as potholes, pavement markings, signage, lighting features, and bridge elements such as bearings, expansion joints, and scuppers. It also includes details on the ventilation system, fire-suppression system, electrical components, and other elements of the physical plant. Both internal and external audits of the operations and maintenance activities are required, which serve as the basis for determining compliance with the contract specifications.

Summary

In summary, Queensland and the Brisbane City Council ensure sound infrastructure conditions are maintained by the concessionaires, but they do not achieve that assurance by imposing a lengthy list of KPIs to address each roadway component throughout

the 4-decade contract life. Instead, they require creation of asset management and maintenance management systems to ensure that the projects remain in sound condition through each year of their contract life. The contract strategy for ensuring serviceability at the project handover is to require a remaining service life of about 50 percent for each asset component. Throughout the project's life, oversight of the independent verifier and other auditors is the principal means to gauge the adequacy of the asset management and maintenance management efforts.

Review of the contract documents for the CLEM7 North-South Bypass Tunnel and Airport Link indicate that KPIs are only one component of the contractual strategy to ensure quality. The other components include the following:

- ▶ Performance bonds
- ▶ Management system
- ▶ Hiring of an independent quality manager
- ▶ KPIs
- ▶ Audits of performance and finances
- ▶ Oversight of the independent verifier and other verifiers, such as the construction verifier

The contract documents for the Airport Link and the CLEM7 North-South Bypass Tunnel projects are very similar. In an interview, Airport Link project officials indicated that because the projects are close to each other and both are intended to operate as part of the Brisbane roadway network, the same attorneys drafted both sets of contract documents for the local transport agencies. The BrisConnection officials confirmed that KPIs are only a small part of the overall management structure of the contracts. They noted that the 19 KPIs all focus on long-term operational issues and do not pertain to the design or construction phase. They also noted that the other performance strategies listed in the bullets above create a comprehensive and overlapping series of strategies to ensure reliable operation of the facility over the 40-year life of the contract.



Kicking Horse Canyon Phase II Agency Goals and Objectives

The British Columbia Ministry of Transportation has mandated that it “is committed to opening up BC through innovative, forward-thinking transportation strategies that move people and goods safely throughout BC, while helping maintain our provincial economy.” Two strategies the ministry has adopted to accomplish this mandate are (1) maintaining highways at a high standard through contracts with private sector road maintenance providers and (2) managing funding for high-quality, modern public infrastructure that supports the development of strong communities by contributing to long-term economic growth and a clean environment. Closely related to these strategies are five goals the ministry lives by. Each goal contains its own objectives, strategies to accomplish the objectives, and a performance measure.

- ▶ Goal 1: Key infrastructure is improved to drive economic growth and trade.
 - Objective 1.1: Improve mobility servicing major economic gateways.
 - Objective 1.2: Identify and select priority improvement projects.
 - Objective 1.3: Use available provincial investment dollars as effectively as possible.
 - Objective 1.4: Improve road access for resource industries and rural residents.
 - Objective 1.5: Manage to build and improve infrastructure that contributes to their sustainable development.
- ▶ Goal 2: British Columbia’s transportation industries become more globally competitive.
 - Objective 2.1: Develop Canada’s Pacific Gateway.
- ▶ Goal 3: Greenhouse gases are reduced for the transportation sector.
 - Objective 3.1: Increase use of transit, cycling, and other alternative modes of personal transportation.
 - Objective 3.2: Improve supply chain efficiency for the movement of goods.
 - Objective 3.3: Reduce greenhouse gases through the adoption of new technologies.

- ▶ Goal 4: British Columbia is provided with a safe and reliable highway system.
 - Objective 4.1: Contractors maintain the provincial highway system to a high standard.
 - Objective 4.2: The main highway system is rehabilitated on a lowest life-cycle cost basis.
 - Objective 4.3: Improve highway safety and reliability.
 - Objective 4.4: Have effective road safety enforcement, education, and programs for the commercial transport industry.
- ▶ Goal 5: Excellent customer service is achieved.
 - Objective 5.1: Continue to improve service levels to the British Columbia business community.
 - Objective 5.2: Excellent customer service is provided to all British Columbians.

Each goal has an attached high-level performance measure with a target for the upcoming years in each area. The goal of increasing highway safety and reliability is the only one with two performance measures. These measures are presented in table 5 (see next page).

Translating Agency Goals Into Projects

To achieve these larger agency goals, the goals’ objectives must be passed down to individual ministry projects. For the Kicking Horse Canyon project, the ministry has required a number of management plans from the concessionaire. Each management plan has characteristics and attributes that contribute small portions to the achievement of the five overall goals of the agency. The ministry has also set project-specific operational performance measures, asset preservation performance measures, and operations, maintenance, and rehabilitation (OM&R) specifications. These performance measures and indicators must be monitored, collected, and reported to the ministry.

The concessionaire is required to develop seven management plans for the project concession. These plans, in the ministry’s *Highway Corridor Management Specifications for Highway Concessions*, include the following:

- ▶ Quality and OM&R management plan
- ▶ Five-year management plan



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- ▶ Asset management plan
- ▶ Communications and customer care plan
- ▶ Salt management plan
- ▶ Emergency response plan
- ▶ Safety management and intervention plan

Most of the management plan titles reasonably imply which of the five agency goals they reflect. These general management plans are built around agency goals four and five. Although there is no clearly defined link between these strategies and goals, there is an underlying tie between them and the management plans. A brief summary of the notable plans is in the next subsection of the case study findings for this project.

Along with developing these management plans, the concessionaire must also report its performance to the ministry in several different areas. These reports include the following:

- ▶ Monthly reports
- ▶ Asset condition reports
- ▶ Traffic incident reports
- ▶ Salt use reports (during the winter months)
- ▶ Highway condition reports
- ▶ Wildlife collision reports
- ▶ Operations and maintenance manual for special facilities
- ▶ A chargeable maintenance cost report

An example of the link from agency performance measures to project-specific KPIs can be seen for agency goal number four. The goal states that British Columbia is provided with a safe and reliable highway system. The first objective under this goal is that contractors maintain the provincial highway system at a high standard. The ministry required the concessionaire for the Kicking Horse Canyon Project to develop an asset management plan that includes

TABLE 5. British Columbia Ministry of Transport performance measures.

Agency Goal	Performance Measure	Description	2008–09 Actual	2009–10 Target	2010–11 Target	2011–12 Target
Key infrastructure is improved to drive economic growth and trade.	Project performance	The percentage of projects that meet their budget and schedule	91.1%	91.5%	91.5%	91.5%
British Columbia’s transportation industries become more globally competitive.	Container traffic growth	Growth in container volume handled at west coast ports in TEUs (20-foot equivalent units)	2.67 million TEUs	2.34 million TEUs	2.69 million TEUs	2.96 million TEUs
Greenhouse gases are reduced for the transportation sector.	Transit ridership	Annual public transit ridership in British Columbia	229 million	235 million	248 million	264 million
British Columbia is provided with a safe and reliable highway system.	Contractor assessment	Rating of the maintenance contractors’ performance using contractor assessment program	92.4%	92.5%	92.5%	92.5%
British Columbia is provided with a safe and reliable highway system.	Highway safety	Crash reduction after construction on safety improvement capital projects, with baseline of 152	18% reduction	20% reduction	25% reduction	30% reduction
Excellent customer service is achieved.	Customer service	Customer satisfaction survey: Stakeholder satisfaction with existing ministry services and delivery processes, rated on a scale of 1 to 5, with baseline of 3.89	4.05	4.10	4.10	4.10



an annual summary of the preceding year's completed maintenance work, a presentation of the results of the data collected, and an indication of the expected performance of the asset over the remainder of the concession period and how the concessionaire is ensuring that full contractual compliance will be achieved. It is the ministry's method of ensuring that the concessionaire is held to this high standard. The concessionaire is also required to report the asset condition in the asset condition report, providing the ministry with evidence that the concessionaire has complied with the asset preservation performance measures. A small sample of these asset preservation performance measures is in table 34 of Appendix C.

Summary

The British Columbia Ministry of Transportation has five clear goals for the transportation sector. Each goal has objectives and strategies for achievement. To reach these large goals, there are small connections to individual transportation projects. This connection is evident in the Kicking Horse Canyon project, and the link is created through project-specific management plans, reporting techniques, performance measures, indicators, and specifications.

M25

Highways Agency Overview

Established in 1994 as an executive agency of the Department of Transport, the Highways Agency (HA) is responsible for the country's strategic roadway network that includes 2,700 km (1,677 mi) of motorways and 4,350 km (2,702 mi) of all-purpose trunk roads. This network is only 3 percent of all roadways in the United Kingdom, but it carries one-third of all road traffic and two-thirds of all freight traffic and is valued at more than £85 billion.

Since its formation, HA has used private contractors to operate and maintain major portions of its existing network, and it has entered into multiple DBFO agreements with private entities to expand or enhance the network. Effectively, HA is the manager of the highway network, not the provider of it.

Agency Aim, Objectives, and Performance Measures

As the network's manager, HA conducts its business differently than a typical department of transportation. Quite simply, HA's principal focus is its customers. Accordingly, its aim is "safe roads, reliable journeys, informed travelers." These three principles guide all

agency efforts. This aim is manifested in several agency objectives:

- ▶ Reducing congestion and improving reliability
- ▶ Improving road safety
- ▶ Respecting the environment
- ▶ Seeking and responding to feedback from customers

To deliver on its aim and objectives, HA has established seven key program-level performance measures:

- ▶ **Reliability**—Implement a program of delivery actions that tackle unreliable journeys on the strategic road network.
- ▶ **Major projects**—Deliver on time and budget the program of major schemes on the strategic road network.
- ▶ **Safety**—Deliver HA's agreed proportion of the national road casualty reduction target.
- ▶ **Maintenance**—Maintain the strategic road network in a safe and reliable condition and deliver value for money.
- ▶ **Carbon emissions**—Contribute to national and international goals for a reduction in carbon dioxide emissions by lowering HA's emissions.
- ▶ **Customer satisfaction**—Deliver a high level of road user satisfaction.
- ▶ **Efficiency**—Deliver HA's contribution to the Department for Transport's efficiency target.

Across its network, HA has enacted a number of initiatives to deliver on its aims and objectives, and it uses performance measures to guide and monitor its actions at both programmatic and project levels.

Translating Agency Goals Into DBFO Projects

In HA's DBFO contracts, a consistent challenge is mapping the broader programmatic goals into the performance measures and indicators in these projects. Figure 15 provides an overview of how HA translates its broader goals into DBFO project performance measures and links these with the payment mechanisms used in the contracts. This figure



indicates the most current thinking because it corresponds to the structure of the performance measures and the payment mechanism in the agency's most recent (and largest) DBFO project, the M25 enhancement. The payment mechanism is described in further detail in Section 5.2.3 of the case study findings.

5.2.2 Organizational Structure for Monitoring Operations and Maintenance

Fundamental to the concept of a performance-based management system is a well-constructed monitoring approach that ensures all major performance objectives are consistently met. A variety of methods to monitor the operations and maintenance performance of a project exist, each technique offering its own unique benefits and structure to the project. A common monitoring tool used in the industry is a quality

management plan for operations and maintenance. Typically, the concessionaire develops this quality management plan and submits it for review and acceptance by the owner, or a third-party representative of the owner, before the system is cleared for application. The significance of the plan is to identify who is doing what operations and maintenance work, how well it is executed, and who is inspecting it. The owner continually reviews these results to assess the quality and performance of the concessionaire's operations and maintenance performance.

Along with operations and maintenance quality management plans, other tools and techniques such as asset management plans, monthly progress reports, monthly meetings, performance scorecards, inspections, audits, and the use of intelligent transportation systems (ITS) are commonly included in PPP agreements. Each one has a specific line of management that the results must go through before reaching the owner, creating a chain of accountability to keep the project operating and maintained at peak performance. Generally, the concessionaire is responsible for applying most of these techniques individually and honestly and reporting the results to the owner. In some instances, however, the results travel through the management chain, which may involve inspecting engineers, auditors, program directors, and other third-party entities that hold an interest in the project. In other instances, the owner conducts investigations to determine the extent of the concessionaire's success in meeting the project's objectives and performance standards. Most of the projects in this study use a combination of these techniques along with the operations and maintenance quality management plan to achieve results and ensure accountability.

Table 6 summarizes the KPIs and related contract provisions for operations and maintenance organizational structures. Example contract language is in the text that follows.

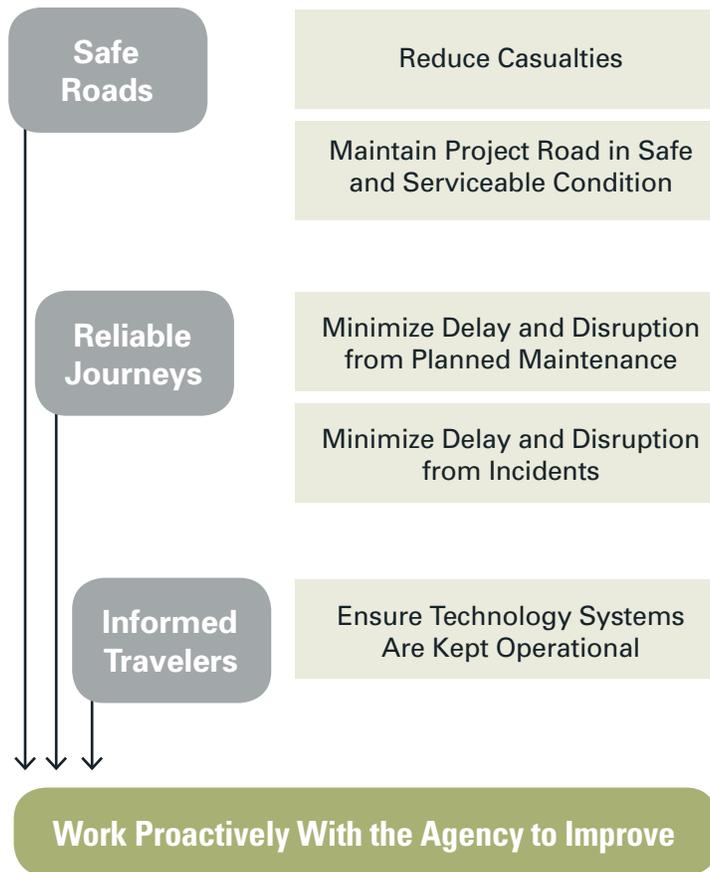


FIGURE 15. Relationship between HA goals and M25 DBFO performance measures.

I-595 Corridor Improvements Self-Monitoring System

The PPP contract agreement for I-595 requires the concessionaire to establish its own



TABLE 6. KPI information for organizational structures for operations and maintenance.

KPI Category	I-595 Corridor	Golden Ears Bridge	Kicking Horse Canyon	EastLink	Capital Beltway	North-South Bypass	M25	Airport Link
5.2 Operations and Maintenance (O&M)								
5.2.1 Organizational Structure for Monitoring O&M								
Self-Monitoring System	✓							
Monthly Maintenance Rating Program	✓							
Quality Management System Plans and Manuals	✓	✓	✓	✓	✓	✓		✓
Monthly Meetings and Reports	✓		✓					✓
Intelligent Transportation Systems	✓				✓			✓
Monitoring Highway Surfaces		✓	✓	✓	✓	✓		✓
Monitoring Highway Structures		✓	✓	✓	✓	✓		✓
Monitoring Drainage and Debris-Control Structures		✓	✓					
Joint O&M Protocols					✓			
Asset Management Plan	✓		✓		✓	✓		✓
Five-Year Management Plan			✓					
Safety Management and Intervention Plan			✓					
Corridor and Environmental Management			✓					
KPI Assessment Process				✓	✓	✓		✓
Customer Service and Complaint Reports and Scorecards			✓	✓	✓	✓		
Independent Verifiers and/or Auditors		✓	✓	✓	✓	✓		✓
Maintenance Data Management System				✓				✓



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self-monitoring system to oversee operations and maintenance. In this system, the concessionaire must develop two operations and maintenance plans, one for the construction phase and one for the concession (operations) phase. These plans detail the concessionaire's approach to executing the operations and maintenance requirements and, at a minimum, are required to include (1) a list of procedures to be used in the self-monitoring process to monitor compliance with the minimum performance criteria, (2) a bridge inspection and maintenance schedule, and (3) the method to be used to track and report noncompliance points (NCPs). These plans also describe the concessionaire's approach to meet what the contract calls the monthly maintenance rating program (MRP) requirements. See Appendix C, table 33, for KPI examples from the language in the agreement.

Monthly Maintenance Rating Program

The MRP is the primary tool the department uses to evaluate the overall quality and effectiveness of the concessionaire's execution of routine maintenance activities. The program uses a formal and systematic method of data collection to rate the maintenance level provided. The concessionaire is required to conduct MRP ratings on randomly generated locations of the project decided on by the department. The results of the monthly ratings are pooled into a single sample set and assessed every 3 months to determine the quarterly success or failure rating of the concessionaire in fulfilling the MRP requirements in the contract. See Appendix C, table 33, for KPI examples from the language in the agreement.

Quality Management System

As part of the self-monitoring system for operations and maintenance, the concessionaire must also develop a quality management system. This system must include both an operations manual and a maintenance manual. The operations manual must identify the procedures to be used to monitor elements such as incident response, express lane operation, and traffic events during construction and operation. Similarly, the maintenance manual must include procedures to be used for maintaining the project assets during the construction and concession periods. A detailed asset management plan to be used by the concessionaire's maintenance staff is a required element of this maintenance manual. In addition to these manuals, a quality management plan is required. It must (1) be reviewed by the

department before it is applied, (2) provide a means to evaluate the level of performance, (3) provide the necessary information to compare the operations and maintenance ratings to the minimum performance requirements so the department can determine if NCPs are in order, and (4) include a quality assurance plan to validate the information, accuracy, and results of the system itself. See Appendix C, table 33, for KPI examples from the language in the agreement.

Monthly Meetings and Reports

Monthly meetings and reports identifying recently executed operations and maintenance activities are also used to evaluate the concessionaire's performance. The monthly reports are used as confirmation that the concessionaire has performed its operations and maintenance duties in compliance with the minimum contract requirements. The important minimums to be included in these reports are a summary of the maintenance performed and completed during the month, a summary of NCPs assessed and the details of the assessments, and detailed results of all inspections, assessments, and testing activities, including the related procedures and forms used. The department is given full access to audit these reports and other operations and maintenance records. The department may also perform periodic inspections and testing at its own discretion to verify minimum performance requirements are being satisfied. Finally, the concessionaire and department conduct monthly meetings to discuss the assessment of any NCPs, the number of incidents or emergencies that occurred in the past 30 days, the planned maintenance schedule for next month, and any future lane closures necessary to repair and maintain the project.

Using Intelligent Transportation Systems to Monitor

ITS is also an integral tool for evaluating the concessionaire's performance via status reports, real-time video, and live streaming video of traffic conditions, incidents, and toll operations. The data collected from these devices are used to generate monthly, quarterly, and yearly performance measure reports to identify areas of operations and maintenance that are meeting standards and those that need improvement. The outputs from these devices are posted on a weekly, monthly, quarterly, and annual basis in SMART SunGuide on the department's Web site for public viewing. Publishing the results keeps concessionaire accountability high and the public well informed. The Florida Transportation Committee monitors the



department's operational productivity, performance, and fiscal management and, in turn, the department monitors the concessionaire using the results produced by the SunGuide software and ITS. See Appendix C, table 33, for KPI examples from the language in the agreement.

Golden Ears Bridge Quality Management System

The ministry requires the concessionaire to develop and implement a quality management system for operations and maintenance to monitor performance and document the processes and procedures used to meet the minimum criteria listed in the operations and maintenance performance measures. Innovation is strongly encouraged under the contract, and the concessionaire is expected to develop new and creative ways of providing services to achieve project goals and performance levels set in the contract's performance measures. The ministry reviews the proposed quality management system for approval before it is admitted for application. Quality management systems support the ministry in monitoring project assets during the concession term through audits and inspections performed by the ministry and/or independent third parties. All costs for performing these audits and inspections are included in the agreement. This system provides the ministry with information to assess concessionaire compliance with operations and maintenance standards.

The maintenance quality management system consists of (1) inspections at specified intervals, (2) rating of the structure or asset condition, (3) programming treatments, (4) physical remedial works when asset conditions fall below minimum standards, (5) inventory updating, and (6) reporting on achievements after any remedial work is conducted. If the data collected during steps one and two of the process reveal that physical remedial works are necessary to comply with the contract performance measure standards, the concessionaire must develop and report to the ministry a remediation strategy detailing an action plan to limit asset consumption within a specified response time. Strategies considered appropriate include excess monitoring, special inspection, investigation (which may include material testing), reevaluation, and physical remediation (maintenance, rehabilitation, and replacement). These phases are consistent with the provincewide approach for monitoring maintenance performance with subtle

differences between the highway running surfaces and structures data collection and inspection procedures specific to the Golden Ears Bridge Project. See Appendix C, table 34, for KPI examples from the language in the agreement.

Monitoring Highway Surfaces

The concessionaire is responsible for collecting annual pavement condition data for measuring performance achievement. Generally, these measurements are taken using high-speed data results collected at 50-m intervals along the paved travel lane. The data collected must be in accordance with the ministry's specifications so the ministry can enter the data into its own pavement management and monitoring system for performance verification. See Appendix C, table 34, for KPI examples from the language in the agreement.

Monitoring Highway Structures

Any condition data collected for the project's structures must also be in accordance with the ministry's specifications, specifically its bridge management information system (BMIS) program, for verification purposes. The concessionaire is required to employ a qualified bridge structural engineer (BSE) to take ownership of the structure assets and quality management plan and interpret any structure inspection data to devise acceptable remediation strategies. The BSE will interpret three types of structure inspections over the course of the concession (see table 7, next page). If one or more of these inspections identifies a defect in any project structure, the concessionaire's core structures management team will correct or engage a specialist staff (when the problem requires expertise outside the core management team) to correct the defect according to the BSE's newly developed remediation strategy. See Appendix C, table 34, for KPI examples from the language in the agreement.

Monitoring Drainage and Debris-Control Structures

Drainage and debris-control structures require another set of maintenance performance measures for this project's performance monitoring cycle. These measures are similar to the project's structures measures in that a BSE must take ownership for these assets and the quality management system governing them, as well as interpret inspection results and develop and apply an acceptable remediation strategy. However, the inspections for drainage and debris-control structures are slightly different and are presented in table 8 (see next page) for comparison. Considering



TABLE 7. Golden Ears Bridge inspection types for structures.

Type	Description	Maximum Inspection Frequencies
Superficial	Focus on road user safety and structure functionality; refer to the ministry’s Highway Maintenance Specifications for Highway Concession 8-850.	Refer to the response times in the ministry’s Highway Maintenance Specifications for Highway Concessions 8-850.
Routine	Focus on a general assessment of condition and developing a remediation program.	1 year
Detailed	Focus on producing a comprehensive assessment of condition and undertaking physical testing, if necessary.	5 years
Significant Natural Events	Focus on a general assessment of condition and developing a remediation program.	48 hours following a significant natural event (i.e., earthquake, rainstorm, snow)

TABLE 8. Golden Ears Bridge inspection types for drainage and debris-control structures.

Type	Description	Maximum Inspection Frequencies
Superficial	Focus on road user safety, waterway maintenance, and structure functionality.	Refer to the response times in the ministry’s Highway Maintenance Specifications for Highway Concessions 8-830 and 8-840.
Structure Condition Inspection	Focus on a general assessment of condition and developing a remediation program.	5 years
Significant Natural Events	Focus on a general assessment of condition and developing a remediation program.	48 hours following a significant natural event (i.e., earthquake, rainstorm, snow)

the large number of drainage and debris-control structures, it is expected that many staff members will conduct these inspections over the course of the concession. See Appendix C, table 34, for KPI examples from the language in the agreement.

**Kicking Horse Canyon Phase II
Quality Management Plan**

The Kicking Horse Canyon concessionaire is required by contract to submit a quality management plan (referred to as the “OM&R quality management system”) for monitoring and measuring the operations, maintenance, and rehabilitation activities of the project. The quality management plan must be in alignment with all operations and maintenance performance measures while defining the concessionaire’s approach to comply with the agreement requirements of these measures. To ensure that all

performance specifications and measures are met, the concessionaire must include procedures and process flow charts in the plan documenting who does the work, what they do, and what evidence is generated that they have done it correctly. The quality management plan must also identify a quality management representative selected by the concessionaire, likely an independent professional engineer or a certified auditor, who will work directly with the province’s representative. This project selected Morrison Hershfield, an engineering firm in British Columbia, as independent certifier. More important, the quality management representative is responsible for developing, implementing, and preserving the OM&R quality management plan and preparing quality audit plans, nonconformity and corrective action programs, and quality management system reports for the province’s representative to review.



The OM&R quality management plan details a performance measures compliance monitoring process to track the concessionaire's ability to meet all specified performance measures. This monitoring process, constructed by the concessionaire, must clearly describe the approach taken in assessing compliance and define the frequency and method used for monitoring and reporting compliance. The concessionaire must submit the proposed OM&R quality management plan to the province's representative according to the review process in the agreement. The review process allows the province's representative to request changes in the monitoring and measuring procedures to facilitate the accurate and appropriate monitoring and reporting of compliance with the performance measures. The concessionaire's monitoring process is subject to review by the province's representative throughout the entire agreement term. See Appendix C, table 34, for KPI examples from the language in the agreement.

Five-Year Management Plan

This management plan is described as "a rolling forward works program" that is meant to describe the preventive maintenance and rehabilitation, excluding routine maintenance, that the concessionaire plans to undertake over the next 5-year period. These plans are broken into two asset types: linear assets (shoulders, traffic lanes, etc.) and point assets (bridges, rock slopes, etc.). Among other things, the plan must contain details on field investigations completed, updated rehabilitation treatments and costs, and any advanced technical evaluations completed.

Asset Management Plan

The concessionaire must also develop an asset management plan for the pavement, structures, and related highway infrastructure that describes the concessionaire's procedures for achieving the key performance criteria in these areas. This plan includes elements such as a description of how key performance indicators will be achieved, the intervention criteria for each indicator, and the approach for asset condition inspection and work identification. This asset management plan is used to track all routine maintenance activities as well as the condition and disposition of the highway pavement assets. The concessionaire is required to keep files of all structure inspection records and associated remedial works for ministry review. See Appendix C, table 34, for KPI examples from the language in the agreement.

Communications and Customer Care Plan

The purpose of managing communications and customer care is to ensure that public perception of the project and its management is enhanced and positive. According to the ministry, this is done by treating all customers courteously, promptly, and in a professional manner. The ministry requires the concessionaire to include certain minimums for addressing requests for information, responding to public inquiries, conducting customer surveys, and advising the province and media of road conditions, among others.

Safety Management and Intervention Plan

The ministry has defined the purpose of these plans as improving the safety of the highway corridor and ensuring health and safety systems are established and implemented. At a minimum, these plans must include an understanding of compliance with laws, regulations, and Workers Compensation Board requirements; a crash database for recording and tracking incidents; and the application of crash data with inspections to identify safety hazards and improvements. Overall, the objective is to reduce risks related to safety and security on the corridor.

Corridor and Environmental Management

A set of key performance measures establish outcome criteria against which the concessionaire's performance is measured for the delivery of corridor and environmental management. The concessionaire is required to develop, implement, and manage corridor activities to achieve the outcomes specified in these measures. The objective of the corridor management measures is to maximize the reliability, safety, and availability of the corridor at all times. The environmental management key performance measures also aim to minimize the environmental impact of the activities carried out during the concession term. Table 35 in Appendix C offers a glimpse of these outcome-oriented performance measures.

Reporting

The ministry requires a number of reports from the concessionaire. These reports, provided at high level, include the following:

- ▶ **Monthly reports**—Provide the ministry with a status of the concession. They include an updated maintenance and rehabilitation program for the next 12-month period, status and audit reports, copies of relevant newspaper



clippings noting negative commentary on the highway, and a summary of key events occurring during the month.

► **Asset condition report**—Provides the ministry with evidence that the concessionaire has complied with the asset preservation performance measures through an asset condition survey. It includes details of the data collection survey on timing, data collected, procedures, and quality assurance measures employed.

► **Traffic incident report**—Provides the ministry with sufficient information to understand the nature of the incident within 24 hours of the crash. It includes information such as date, time, location, and description of the incident; weather and road conditions at the time; a crash history of the site; and suggested improvements.

EastLink

Operations and Quality Management

The concessionaire (ConnectEast) has obligations to develop project plans that explain how it will execute operations activities in accordance with the project deed. Project plans must be updated during the performance of operations activities to reflect events or circumstances that will or may affect the performance of these activities, and the plans must be prepared and updated in a way that ensures ConnectEast can comply with its obligations at all times.

Specifically, ConnectEast must prepare a traffic management strategy, an incident management plan, and operations and maintenance manuals. ConnectEast may amend its traffic management strategy only with the agreement of the state and in accordance with the project scope and requirements, and each traffic management plan must be consistent with the current traffic management strategy. It must prepare an incident management plan in consultation with the Incident Planning Committee and provide it to the state and the independent reviewer before completing construction activities. It must review the incident management plan at least once every 6 months in consultation with the Incident Planning Committee. ConnectEast also must develop operations and maintenance manuals in consultation with the state and provide copies to the state and the independent reviewer. It must ensure that the operations and maintenance manuals comply with the project scope

and requirements. It must also (1) ensure that the operations and maintenance manuals are maintained and revised in consultation with and take into account the reasonable requirements of the state, in accordance with the project scope and requirements and operations and maintenance best practices; (2) conduct a complete review (and revision when necessary) of all consistent with operations and maintenance best practices at least once every 2 years; and (3) provide the state and independent reviewer with copies of the manuals promptly after they are revised. ConnectEast must comply with the operations and maintenance manuals.

Monitor Freeway

Each concessionaire involved in operations activities must prepare and submit to the state for approval the traffic management plans mandated by the project scope and requirements. Each concessionaire must control, direct, manage, and protect all traffic in the leased area to ensure (1) the safe, efficient, and continuous passage of vehicles; (2) that the traffic-carrying capacity of local roads is maintained; (3) that any traffic congestion, delays, or disruptions to public transport or pedestrian or shared-use paths are minimized; and (4) that the concessionaires otherwise comply with the deed.

Maintenance Management

The concessionaire must comply with current operations and maintenance manuals. By the date the first freeway section is opened for public use, the concessionaire must establish a maintenance and repairs account, maintain that account with a financial institution nominated by ConnectEast and approved by the state, and give details of that account to the state. At least every 5 years during the concession period, the concessionaire must update the forecast maintenance program to comply with its operations, maintenance, and repair obligations.

KPI Assessment Process

Beginning with the first date of freeway section completion, ConnectEast must prepare a quarterly KPI report and deliver it to the state within 20 business days of the end of each quarter. The quarterly KPI report must include the KPI data and the information required or contemplated by schedule 5 and contain a certificate signed by a ConnectEast director that the report is accurate and complete.

Within 30 business days of the end of each financial year, ConnectEast must give the state an audit report



TABLE 9. EastLink customer service and complaints reporting system.

Report	Submit to	Frequency	Content
Custom Service and Complaints Report	State	Annually	
Quarterly KPI Report	State	Quarterly	p. 123
Annual Audit	State	Annually	p. 226
Periodic Reporting	State and Reviewer	Monthly	p. 226–227
Tolling System Information	State	On request	p. 229

prepared by a reputable independent auditor that has audited the accuracy, completeness, and correctness of the KPI data and quarterly KPI reports and the fitness for intended purpose of the KPI assessment system for that financial year.

ConnectEast must use these quarterly KPIs and the results of the annual customer services audit (described below) as a scorecard to assess its performance against the KPIs. The scorecard will be prepared on the basis of a combination of internal and independent measures of performance across KPIs. In addition to the assessment methods used by ConnectEast, the state will have the right to use other methods.

Customer Service and Complaint Reports

The project uses KPIs to monitor customer service complaints during operation. ConnectEast and any customer service contractor and subcontractors are subject to an annual audit to determine whether they are providing customer service and complaint resolution at the level required by the deeds. The state and ConnectEast must appoint an independent auditor to conduct the customer service audit for the previous 12 months. The state will pay reasonable costs of the auditor.

**Capital Beltway
Quality Management**

The concessionaire is responsible for all quality assurance and quality control activities necessary to manage the development, design, construction, operation, and maintenance of the project and any enhancements proposed by the concessionaire or VDOT. The concessionaire must develop and provide its plans, manuals, and procedures to VDOT. It also must also require its contractors, subcontractors, and suppliers to comply with the requirements of the quality management plans.

VDOT has the right to review the concessionaire’s quality management system, including the right to inspect work and activities and to verify the accuracy and adequacy of quality management documentation. The concessionaire must require its contractors and subcontractors to provide the access and assistance VDOT reasonably requires to conduct such reviews.

If the concessionaire’s performance during the O&M period results in 200 or more performance points during any 365-day cycle or maintains 45 (or any higher applicable number during the phase-in period) or more uncured performance points, part of the remedial action required by the concessionaire may include improvements to its quality management practices, plans, and procedures.

Intelligent Transportation Systems

The HOT lanes will use open road tolling facilities to charge, debit, and collect tolls for vehicular use. The facilities, equipment, and software for this purpose are referred to as the electronic toll and traffic management (ETTM) system. Provided that both parties agree, all tolling on the HOT lanes will be by electronic means, so no toll booths will be installed and the concessionaire will not be required to accept cash tolls. The tolling facilities will be physically located on the right-of-way or use Global Positioning System technology, remote sensing, or other technologies as long as such systems are interoperable with the E-ZPass network and, with reasonable notice from VDOT, any successor to E-ZPass used on Virginia highways.

With the approval of the concessionaire, VDOT maintains the right to perform ITS research and install ITS equipment on the HOT lanes right-of-way for public, nonrevenue-generating purposes, provided that the ITS equipment does not interfere with the functioning of the ETTM or ITS systems used for the HOT lanes and does not negatively impact toll



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operations or reduce the vehicle throughput capacity of the project. If VDOT's ITS activities result in damages to the concessionaire, it will be entitled to compensation as defined in the contract. VDOT will bear all installation, maintenance, operations, replacement, and other costs relating to the ITS equipment and research and all claims and liabilities.

Joint O&M Protocols

At the time of the Capital Beltway project agreement, the level of engineering and design for the project was not sufficient to allow the parties to specify all protocols that will define their operational relationship. VDOT and the concessionaire, therefore, established joint operations and maintenance protocols (JOMP), which describes how they will coordinate operation of the HOT lanes and the general purpose lanes. Essentially, JOMP established a process and procedures for finalizing operational issues related to operating systems, information sharing, data exchange, and asset maintenance.

Asset Management Plan

The Capital Beltway project requires the concessionaire to develop a baseline asset condition report and a life-cycle maintenance plan. No later than 18 months before the projected date for beginning operating services, VDOT and the concessionaire shall agree on baseline asset condition reports that evaluate (1) the four inner lanes of the Capital Beltway and maintenance and repair requirements, and (2) the HOT lanes and all other improvements and assets of the HOT lanes project and their physical conditions on the date of the report. This will serve as the baseline report.

No later than 90 days before the beginning of each calendar year after the service commencement date, the concessionaire shall prepare and provide to VDOT for its approval a 5-year period maintenance plan on a rolling basis that describes life-cycle asset maintenance for the HOT lanes project. The life-cycle maintenance plan shall include a description of all major maintenance to be undertaken during the 5-year period by component, item, or discrete project; the estimated costs and timing of each task; and other information that VDOT may request.

Every 5 years after the service commencement date, the concessionaire shall conduct a reassessment of the physical condition of the HOT lanes assets and prepare an analysis comparing the conditions to those reported in the baseline report. This analysis shall take

into account any changes in Federal requirements and safety standards. If the condition of any HOT lanes asset is determined by the concessionaire, VDOT, or the independent engineer to fall below its assessment rating in the baseline report (or the original condition of a project enhancement), the concessionaire shall, within 90 days of such assessment, develop and submit to VDOT a plan to restore the asset to its baseline or original condition, as applicable, subject to ordinary wear and tear. The plan will include a budget, timeline, and identification of the funding sources that will be used to restore the asset.

Independent Engineer

During the operations and maintenance period, VDOT may require the independent engineer to make routine inspections for monitoring and reporting any breaches or failures and provide written recommendations on whether performance points should be assessed. The cost of such services shall be paid by the concessionaire, subject to a maximum cost per calendar year. In addition, the independent engineer shall have the authority, when requested, to assess HOT lane assets to determine whether a deviation exists between the current condition and that in the baseline report.

VDOT may also request the independent engineer to determine whether any circumstances exist that warrant issuance of a safety compliance order and give VDOT and the concessionaire recommendations on such matters.

If either party submits a compensation event notice as described in section 13 of the agreement, the other party shall have the right to obtain from the independent engineer a comprehensive report on the concessionaire's estimate of the net cost impact attributable to the event.

While VDOT retains the right to carry out oversight services throughout the term of the agreement, it shall perform oversight services in cooperation with the independent engineer to minimize duplication or inefficiencies in the performance of such services.

CLEM7 NorthSouth Bypass Tunnel Quality Management System and Plans

The complex 35-year project does not rely solely on a set of KPIs for oversight and accountability, but uses a more comprehensive approach. It requires contractors



to develop management plans and management systems for all major aspects of the project's planning, design, construction, maintenance, operations, toll collection, and community relations. At least 28 management systems or management plans are required for the project. Adherence to these management systems and plans is enforceable under the contract. Outside audits and an independent verifier are required as part of the contract to attest to the Brisbane City Council that the many provisions of the management systems and plans are being followed. At least three management systems—project, environmental, and health and safety—must comply with the Australian provisions of ISO for those management systems. In addition, at least three performance bonds are required to ensure adherence to the performance specifications—for design and construction, operations and maintenance, and tollroad condition at handover. Although KPIs are included in the contracts, they comprise only a small part of the oversight framework for the complex and multiphased Clem Johnson Tunnel. See Appendix C, table 36, for KPI examples from the language in the agreement.

The independent verifier is a third-party contractor charged with verifying compliance with the major management systems and plans. The independent verifier was selected jointly by the concessionaires and the Brisbane City Council, which share the cost of the verifier. The independent verifier will function throughout the project, but provisions exist for the parties to end the verifier's services and rely on periodic audits once the project begins functioning to the satisfaction of the council, concessionaires, finance agencies, and performance bond providers.

Asset Management Plan

Adequacy of maintenance for the 31-year operation phase is controlled through extensive operations and maintenance requirements and adherence to an asset management plan.

The concessionaire must have in place and update an asset management system that satisfies the project deed. The system must record the current, historical, and projected future condition of each asset in the project. It must include detailed records of the repair or replacement of assets to assist in estimating the residual design life of the various elements. An asset inventory must be maintained that records the nature, extent, quantity, location, time, and type of any maintenance and repair. The inventory must include

asset elements, types, items, and subitems. The asset management system must document the regular inspection of the various elements, types, items, and subitems. The system must also trigger the necessary response defined in a code of maintenance standards for each asset element.

The *Operations and Maintenance Manual* has more than 600 pages covering how the operating company will perform maintenance throughout the life of the project. In effect, the manual is a comprehensive maintenance management system. It describes the various maintenance elements, defines their adequate state of condition, defines inspection cycles, describes necessary corrective action, and includes a reporting process to monitor the overall condition of the maintained items. It has more than 200 pages of summary tables that provide details on each maintenance subitem, how it is to be inspected, what its general performance characteristics should be, and how it should be repaired to bring it into serviceable operation. The items cover many general roadway elements, such as potholes, pavement markings, signage, lighting features, and bridge elements such as bearings, expansion joints, and scuppers. It also includes details on the ventilation system, fire-suppression system, electrical components, and other elements of the physical plant. See Appendix C, tables 36 and 37, for KPI examples from the language in the agreement.

Both internal and external audits of the operations and maintenance activities are required, which serve as the basis for determining compliance with the contract specifications.

M25

Performance Management Framework

The performance management framework for the M25 DBFO contract is founded on (1) performance management to achieve the project objectives; (2) performance planning; (3) performance monitoring, reporting, and reviewing; and (4) incentives and sanctions.

The primary objective of the project, as defined in the invitation to tender, is to provide high-quality service in accordance with the agency's aims, objectives, and values. The following are specific objectives of the project:



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- ▶ Delivery of high-quality, flexible service that puts customers first and helps reduce congestion, improve journey time reliability, and improve safety through the following:
 - Integrated operation of the whole of the project road in a way that minimizes delay to the traveling public
 - Timely, efficient, and safe management of incidents, crashes, road work, and winter service
 - Timely planning and delivery of trunk road improvements while minimizing disruption to the traveling public
 - Provision of proactive public relations service to customers and stakeholders
 - Accurate forecasting, planning, and implementation of road space management
 - Maintenance of the project road in a safe and serviceable condition
 - Use of state-of-the-art asset, traffic, and safety-related information recording, analysis, and presentation systems
 - Timely and accurate delivery of information to influence travel behavior and inform decisions
 - Delivery of continuous improvement in performance and processes
- ▶ Respect for the environment, promotion of a healthier community, and integration of sustainability principles into the project through the following:
 - Mitigation of the potentially adverse environmental impact of the project and, where possible, reduction of the existing impact
 - Proactive engagement with stakeholders to identify, develop, and implement environmental improvement measures
 - Delivery of sustainability as part of the capital works and operation and maintenance of the project in support of the Department for Transport Sustainability Action Plan
- ▶ Delivery of best value through the following:
 - Achievement of value for money for the widening works, asset management, and operations
 - Effective (and cost-effective) contract management

Central to the performance management framework is the performance management plan, which is reviewed and modified annually. This plan (1) is responsive to any changes in the project's objectives, (2) guides and informs management activities such as monthly performance reports and periodic progress meetings, and (3) uses information from contractual audits for subsequent adjustments. Contractual performance audits also provide routine feedback to periodic progress meetings, which may result in improvement planning and additional auditing requirements. These regular audits are closely linked to the payment incentives or sanctions that the DBFO contractor may receive periodically. Ultimately, the goal of this managerial and contractual performance management system is to ensure that the DBFO contractor delivers on the agency's aim of "safe roads, reliable journeys, informed travelers" throughout this project.

Airport Link

Similar to the strategy the Queensland government used for the North-South Bypass Tunnel, the voluminous Airport Link contract documents contain relatively few explicit KPIs. Instead, they rely on an extensive series of management systems and performance reviews to ensure the quality and performance of the project over its 45-year lifespan.

Manuals and Plans

The operator is required to adopt and abide by a comprehensive series of operating and maintenance manuals. These cover all major systems in the facility and include performance standards. The performance standards must include hazard and risk mitigation strategies and a comprehensive tunnel danger study. The operating and maintenance manuals must include the following:

- ▶ A pavement performance system, including pavement cracking, roughness, skid resistance, rutting, and deflection targets
- ▶ Response times for incident management
- ▶ Maintenance targets for timeliness of defect rectification and inspection, quality of maintenance work, and how to mitigate road user impacts as a result of maintenance activities
- ▶ Equipment reliability targets
- ▶ Tunnel noise limits



- ▶ Airflow velocity targets and limits
- ▶ Normal operating condition levels, including lighting, air quality, signage, and other features
- ▶ Unsafe operating thresholds that can trigger closure or response
- ▶ System capacities, including safety limits and protection levels
- ▶ Design life and durability strategies
- ▶ Load limits and ratings

The intention of the operations and maintenance requirements are to ensure safe, reliable operation of the facility and its remaining service life at the 46-year handover point. Among the first requirements is an incident response plan. This must include creation of a traffic management center, which must operate continuously to monitor traffic flow and respond to incidents. The incident response plan must include strategies, equipment, employee training, response protocols, and formal methods for coordinating with emergency responders and adjacent agencies to ensure prompt incident response. As noted in the KPIs, all incidents must be recognized within 2 minutes of occurrence. A maintenance operation traffic plan is required to address planned incidents involving maintenance. The plan must ensure that to the extent possible, maintenance occurs in offpeak, overnight periods. Maintenance must also occur, to the extent possible, when maintenance activities are not occurring on parallel local roads, which may rely on the facility as a detour. The maintenance traffic plan must also include protocols and practices for ensuring safe operating conditions and speeds through the facility during maintenance periods.

TABLE 10. Airport Link permitted maintenance closures.

Period	Maximum Allowable Full Closure, Including Ramps (hours/year)	Maximum Allowable Single-Lane, Partial Ramp, or Elevated Structure Closure (hours/year)
5 to 10 a.m.	0.2	0.4
10 a.m. to 3 p.m.	2	4
3 to 8 p.m.	0.2	0.4
8 to 10 p.m.	1	2
10 p.m. to 5 a.m.	84	42

The operators must present an annual schedule of planned maintenance closures, which must be approved. Each minute of additional maintenance closure time results in a \$1,000 penalty.

During the years of operation, the operator is required to participate in a Traffic Management Operations Liaison Group, which consists of other roadway operators such as the Queensland Department of Main Roads and local authorities. The group is intended to be an ongoing forum of communication and coordination to ensure that operations and incident response strategies remain coordinated for the tollroad, which is an integral link in the metropolitan transportation network.

The tollroad must also be operated to integrate into the regional traffic management system and ITS networks of the larger region. The operator must manage the tollroad in compliance with the local council's and QDMR's overall planning and management hierarchy, protocols, and processes for the Brisbane metropolitan network. The operator is required to coordinate its changeable message signs, variable speed limit signs, detector loops, closed-circuit television cameras, and communication systems with the ITS systems of the state and local councils. The operator also is expected to adopt a continuous improvement ethos. It must conduct debriefings of incidents and conduct tabletop planning exercises at least twice a year. The operations response plan is expected to mature and improve as a result of the continuous improvement efforts.

In an interview, a key project official said the reliability requirements are somewhat redundant for the concessionaire, for which traffic reliability is a critical customer requirement. Because the concessionaire is paid through the toll revenue of the project, it has an overriding interest in ensuring that traffic flows freely and that the route remains the preferred alternative for motorists.

Asset Management System

The operator must develop, maintain, and update an asset management system in accordance with the project documents. The system must be acceptable to the state and in a form that enables the state to assess the adequacy of the system. The system must accomplish the following:



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- ▶ Maintain a record of the current, historical, and projected condition of each asset, including detailed records of the repair and replacement of asset elements. They must be prioritized by criticality of safety, traffic capacity, and other criteria.
- ▶ Maintain a record of the nature, maintenance activity, extent, and actual work of all types of works performed or programmed for the assets.
- ▶ Include a method for reporting on the performance of any asset.
- ▶ Provide for the development and maintenance of models for monitoring pavement performance throughout the 45-year operating period. A model must provide for the expected pavement performance as the facility ages and traffic volumes increase.

The asset management system must document the regular inspection of the asset items and document any failure to meet the code of maintenance standards. Any documented failure to meet the maintenance schedule triggers a necessary maintenance response.

Auditing

The project deed requires quarterly audits of the KPI data and may also require a more extensive audit at least once a year if the owner questions the KPI findings. Road safety audits are also required every 2 years throughout the life of the project and after major incidents.

Maintenance Data Management System

The operator is required to create a code of maintenance standards and a maintenance management system to assure the continued maintenance of the facility throughout its life. It must include a routine maintenance schedule that details a systematic approach to performing the cleaning, preventive maintenance, inspections, and monitoring that comply with the maintenance code. The maintenance must extend to the safety appurtenances and facilities, such as the traffic control center, fire-suppression systems, incident-management systems, and other facility components.

It must also develop a nonroutine asset repair process to ensure the durability of assets approaching the end of their useful life. The systematic approach is required to ensure that the assets retain their required

residual design life throughout the life of the project. Detailed records of repairs and maintenance must be retained in a maintenance data management system. It must include records of all operations and maintenance activities undertaken, as well as assets that have been repaired, rehabilitated, and replaced. The system must track all parts and inventories necessary to maintain the facility and its systems.

Data Collection, Reliability, and Cost

In an interview, an official tied to the concessionaire revealed a simple approach to addressing the collection of accurate data to support KPI measurement: the concessionaire is responsible. The project deed requires the concessionaire to have a KPI assessment system, which must be audited periodically by an independent firm. The cost of producing the KPI data, the cost of the audit, and ensuring that the project continuously meets the KPI requirements are the sole responsibility of the concessionaire over the life of the project. The project official indicated that the question of how much KPI data collection costs is not one the concessionaire has frequently discussed. He noted that the cost of data collection is only one component of the much larger and more complex management systems and management plans.

The degree of risk the concessionaire assumes is substantial under the models used in both Australian case studies. The concessionaire assumes the traffic risk and agrees to provide the various management systems, audits, and performance bonds while paying its share of the independent verifier costs and abiding by the contract documents and appendices in the project deed. Project officials indicated that it cost the project team about AU\$30 million just to produce the winning proposal for the project. The costs of maintaining the facility at the high level required in the contract documents is solely the risk of the concessionaire, and its ability to increase toll rates is limited to escalation of the consumer price index. In the total scheme of the complex, multidecade projects, the cost of KPI data collection was not a significant issue.

5.2.3 Using Performance Points to Track Operations and Maintenance

Tracking operations and maintenance performance is often achieved through the use of a formal point system. A point-tracking system assesses points to an operations and maintenance concessionaire based on examinations of its success or failure in fulfilling



TABLE 11. KPI information for performance points to track operations and maintenance.

KPI Category	I-595 Corridor	Golden Ears Bridge	Kicking Horse Canyon	East Link	Capital Beltway	North-South Bypass	M25	Airport Link
5.2 Operations and Maintenance (O&M)								
5.2.2 Using Performance Points to Track O&M								
Noncompliance Point-Tracking System	✓		✓	✓		✓		✓
Calculation and Allocation of KPI Credits				✓	✓	✓		
Performance Point System	✓		✓	✓	✓	✓		✓
Demerit/Penalty Points	✓		✓	✓	✓	✓		✓
Payment Mechanisms							✓	

performance standards. If the system assigns points for successes in meeting requirements, it is generally referred to as a “compliance” point-tracking system, and the concessionaire is rewarded for meeting performance targets and benchmarks on schedule. In contrast, some systems assign points correlating to the concessionaire’s failure to meet performance standards. These are called “noncompliance,” “nonconformity,” or “demerit” point-tracking systems. In this case, the concessionaire is penalized for not meeting performance targets on time, and the penalty typically results in payment reductions, retentions, or credit to the owner. The owner must decide whether to use the funds obtained from poor concessionaire performance to refund frequent customers using the project, fund a new project, or reinvest in the current project.

Table 11 summarizes the KPIs and related contract provisions for using performance points to track operations and maintenance performance. Example contract language is in the text that follows.

I-595 Corridor Improvements
Noncompliance Point-Tracking System

A noncompliance point system is used to track the progress of satisfying the operations and

maintenance requirements for the I-595 highway project. The system is based on both the concessionaire and the department recognizing instances of noncompliance. The concessionaire is responsible for notifying the department, as soon as possible and in writing, of any noncompliance that matches Appendix 5 in the contract documents, which lists potential areas of noncompliance. The written notification must completely describe the noncompliance and the associated cure period given in Appendix 5. The cure period is critical because a noncompliance rectified within that time is not assessed any points if the concessionaire notified the department of the noncompliance before the department issued a notice of determination. A notice of determination, which the department issues if it believes there is a noncompliance in the project’s operations and maintenance procedures, describes the issue and the associated cure period. If the concessionaire overlooks or ignores a noncompliance in a notice, noncompliance points will be assessed to the concessionaire whether or not the issue is rectified within the cure period. However, both a fast-cure period and full-cure period are offered for each noncompliance. If the department notifies the concessionaire of a noncompliance before the concessionaire notifies the department but the concessionaire is able to rectify the issue within the fast-cure period, only half of the



noncompliance points will be assessed. Table 12 reveals how points are assessed based on different notification categories.

Penalties and Deductions for Noncompliance Points

If the concessionaire has accumulated more than 50 NCPs in a 1-year period, 100 NCPs in a 3-year period, or 75 instances of noncompliance in a 3-year period, the department is entitled to increase the level of monitoring, inspection, sampling, measuring, testing, auditing, and oversight of the project at the concessionaire's expense. These levels of oversight will be increased until the concessionaire can demonstrate that it has reduced the number of outstanding NCPs and is capable of performing the remainder of the project according to the agreement. Along with point allocation, specific instances of noncompliance result in monetary deductions, including liquidated damages to compensate the department for increased monitoring and inspection costs relating to a high number of NCPs, potential loss of toll revenues resulting from noncompliance, harm to the department's reputation, and potential harm to highway users. The department may also exercise its step-in and work suspension rights any time a noncompliance is not rectified within the associated cure period given in the contract documents.

Kicking Horse Canyon Phase II Nonconformity Point-Tracking System

The OM&R quality management system required by contract calls for the concessionaire to develop a nonconformity report log detailing any nonconformity identified to date and how it will be managed and remedied in the near future. If the province is notified or identifies (by audits, inspections, and investigations) that there is a nonconformity in the operation or maintenance of the project facilities, it may issue a nonconformity report to the concessionaire. This report will remain in the nonconformity tracking system until the concessionaire can provide satisfactory evidence that the identified issue has been acknowledged by the concessionaire's quality management system and is being corrected or has been remedied within the allotted timeframe. If one or both of these criteria are met, the province will remove the nonconformity report from its list of outstanding reports in the system. However, until the report is removed from the tracking system, the concessionaire is at risk for payment retentions and performance payment reductions.

Penalties and Deductions for Noncompliance Points

If a nonconformity report is not removed from the system and is related to poor asset condition, the concessionaire is subject to payment retentions according to the payment retentions process. If the report relates to the operation or maintenance of the project facilities, it will be taken into account in the calculation of annual and monthly performance deductions. Any outstanding nonconformity reports related to operations and maintenance in the tracking system will be allocated points according to a nonconformity report points (NCRP) table (see table 13). The table reveals repeat nonconformities and the failure to identify and record defects in the project to be the most costly for the concessionaire in terms of NCRPs.

After a nonconformity is assessed with an NCRP, the performance and safety deductions are calculated using the formula in figure 16. The deductions for the contract year depend on the monthly deductions, and the monthly deductions depend on the nonconformity report points collected by the concessionaire in a 30-day period.

The concessionaire is responsible for investigating all nonconformity reports and initiating corrective actions to remedy reported issues. The concessionaire has 7 days to respond to any issued nonconformity reports and either accept the report and provide a corrective action plan or appeal the report, in which case the matter will be solved according to the agreement's dispute resolution procedures. It is the concessionaire's responsibility to maintain records of each instance of noncompliance, the nonconformity report points allocated, the proposed corrective action plans, the times the nonconformities were identified, and the time the nonconformity report was rectified if the dispute resolution procedure was used.

EastLink Calculation and Allocation of KPI Credits

The EastLink agreement applies KPI credits. KPI points accumulate during each year, and once the total KPI threshold is reached in a year, it triggers a corresponding KPI credit to be applied to eligible customers. In the first and second years after the first date of tolling completion, the maximum credits (with the total KPI score exceeding 2,000 points) are \$5 million. In the third year, it is \$10 million, and in each subsequent year it is \$15 million. Table 14 (see page 52) provides an example of the EastLink KPI credit approach.



TABLE 12. I-595 noncompliance point notification approach.

Notification Category	Percent Assessed Before Expiration of Applicable Cure Period	Remaining Percent Assessed If No Cure Period or After Expiration of Applicable Cure Period Without Full and Complete Cure (totaling 100%)
Notification initiated by concessionaire under Section 7.2.1	0%	100%
Notification initiated by FDOT under Section 7.2.2	100%	0%

TABLE 13. Kicking Horse Canyon nonconformity report point approach.

Item	Standard	Nonconformity Report Points
Repeat nonconformity report	Four or more nonconformity reports relating to the same occurrence in a rolling 12-month period	6
Failure to identify and record defects	Inspection regimes are specified in Highway Maintenance Specification 8-830 to 8-850, including amendments. Compliance with the requirements for snow avalanche program, weather-monitoring program, and unstable slope mitigation program	6
Operational performance measures within the limits of the traveled lanes and sealed shoulders	As specified in the OM&R output specifications and OM&R requirements	3
Records and reporting	As specified in the reporting specifications and local area specifications	2
All other nonconformities	Any OM&R output specifications and OM&R requirements not covered above, or any other obligations relating to the operation and maintenance of the project facilities not covered above	1

Performance/safety deductions (\$) for the contract year n (PSD_n) are calculated as follows:

$$PSD_n = \sum_{m=1}^q \{PSD_m * [1 + (1F_{EASP} * PPI_n)]\}$$

Where:
 q = The number of months in contract year n , rounded to the nearest four decimal places
 PSD_m = The performance/safety deductions (\$) for month or part of a month m in contract year n , determined in accordance with the following formula:

$$PSD_m = \sum_{d=1}^{dm} NCRPR_d$$

Where:
 dm = The number of days in month or part of a month m in the contract year n
 $NCRPR_d$ = Nonconformity report points rate (\$) for day d in month or part of a month m in the contract year n determined in accordance with the following:

Aggregate Nonconformity Report Points	0–10	11–15	16–25	26–35	>35
$NCRPR_d$ (\$)	Private	Private	Private	Private	Private

FIGURE 16. Kicking Horse Canyon payment reduction formula.

The total credits will be allocated among each eligible customer by its use of the project during the year. Eligible customers are those who have a customer contract with ConnectEast at any time during the year to which the KPI credit relates. Casual users will not be eligible for the credits.

**Capital Beltway
Performance Point System**

The Capital Beltway agreement establishes a performance point system to measure the concessionaire’s performance level and identify certain concessionaire breaches or failures to perform its contractual obligations. The accumulation of performance points may trigger the remedies set forth or referenced in the agreement.

Each concessionaire breach is classified in one of three categories and assessed points, as shown in tables 15 and 16 (see page 54).

There are 32 measurement criteria classified into eight main categories to measure the concessionaire’s operations and maintenance performance.

Tolling

- ▶ Transactions
- ▶ Cross-reads
- ▶ Signage
- ▶ Privacy
- ▶ Transactions

Communications

- ▶ Public information
- ▶ Customer service

Project management

- ▶ Project plans

Concessionaire obligations

- ▶ Discrimination
- ▶ Subcontracting
- ▶ Suspension of tolls
- ▶ Permit fee
- ▶ Updates of financial model

TABLE 14. EastLink KPI credit approach.

Total KPI Threshold (Financial Year)	KPI Credit \$m (Indexed)			
	First full financial year after the first date of tolling completion	Second full financial year after the first date of tolling completion	Third full financial year after the first date of tolling completion	Each subsequent financial year after the first date of tolling completion
500 points	0.83	0.83	1.67	2.50
600 points	1.00	1.00	2.00	3.00
700 points	1.17	1.17	2.33	3.50
800 points	1.33	1.33	2.67	4.00
900 points	1.50	1.50	3.00	4.50
1,000 points	1.67	1.67	3.33	5.00
1,100 points	2.00	2.00	4.00	6.00
1,200 points	2.33	2.33	4.67	7.00
1,300 points	2.67	2.67	5.33	8.00
1,400 points	3.00	3.00	6.00	9.00
1,500 points	3.33	3.33	6.67	10.00
2,000 points	5.00	5.00	10.00	15.00



- ▶ Refinancing
- ▶ Operations and maintenance contractor
- ▶ Maintenance budget
- ▶ Department access and inspection

Operations

- ▶ Incident management
- ▶ Information sharing
- ▶ Systems control
- ▶ Work zone management

Inspections

- ▶ Qualification of inspection

Maintenance

- ▶ Performance requirements

Level of service

- ▶ Degradation of the facility

The total of uncured performance points assessed by VDOT shall be monitored by the department or its designee for the duration of the operating period. The cumulative total of cured and uncured performance points assessed by VDOT shall be monitored in rolling 365-day cycles from the time the breach has been cured for breaches in categories A and B and from the time the breach has occurred for breaches in category C. At the end of each 365-day

cycle, the performance points assessed for that specific breach will be subtracted from the cumulative total number of performance points the concessionaire has been assessed.

Penalties and Deductions for Noncompliance Points

If the concessionaire is assessed 135 or more performance points during any 365-day cycle or has 30 or more uncured performance points at any time, VDOT may increase the level of project monitoring. The concessionaire shall compensate VDOT for allocable costs incurred as a result of such increased monitoring. The concessionaire may submit a cure plan describing specific actions the concessionaire will undertake to improve its performance and avoid the need for increased monitoring, which VDOT may accept or reject.

If the concessionaire is assessed 200 or more performance points during any 365-day cycle or has 45 or more uncured performance points, VDOT may require the concessionaire to prepare and submit a remedial plan for VDOT’s approval. The remedial plan shall be delivered within 45 days of its request. The plan shall set a schedule and describe specific actions the concessionaire will undertake to improve its performance, demonstrated by incurring no additional performance points and reducing the number of uncured performance points. Such actions may include, but are not limited to, improvements in the concessionaire’s quality management practices, plans and procedures; changes in its organizational

TABLE 15. Capital Beltway performance point approach.

Category	Cure Periods	Assessment of Performance Points
A	Cure period shall be deemed to start on the date the concessionaire first obtained knowledge of, or first reasonably should have known of, the breach or failure. For breach or failure no later than the date of delivery of the initial notice to the concessionaire, as described in § 8.16(a) of the agreement.	Provided that the breach or failure is not cured, performance points shall first be assessed at the end of the first cure period, and shall be assessed again at the end of each period of the agreement, as described in § 8.16 of the agreement.
B	Cure period shall be deemed to start from the date on which the breach or failure occurred, whether or not an initial notice has been delivered to the concessionaire, as described in § 8.16(a) of the agreement	Performance points shall first be assessed on the date of the initial notification under § 8.16 of the agreement (the start of the first cure period). Provided that the breach or failure is not then cured, performance points shall be assessed again at the end of the first and each subsequent cure period.
C	No cure period applicable	Performance points shall be assessed on the date of the initial notification under § 8.16 of the agreement.

TABLE 16. Capital Beltway performance point examples.

Heading	Subheading	Breach or Failure	Category	Cure Periods	Maximum Points
Tolling	Transactions	The concessionaire transmits duplicate transactions or incorrect toll amounts to the Customer Service Center (to be determined on a per transmission basis).	C	None	5
Communications	Public information	The concessionaire issues information to the public or in news releases through variable message signs or other means that is factually incorrect.	C	None	5
Customer service		The concessionaire fails to respond within 7 days to customer inquiries and complaints about HOT lanes when contact details of customers have been provided, no matter whether the complaint is received directly from customers, the customer service center, or the department.	A	2 days	5
Project management	Project plans	The concessionaire fails to produce, review, and, if necessary, update plans during the operating period in accordance with the agreement including, but not limited, to (1) the concessionaire management plan; (2) the hazardous substances management plan; (3) the communication, public outreach, and community education plan; (4) the life-cycle maintenance plan; and (5) the operations and maintenance plan.	A	30 days	5
Operations	Work zone management	The concessionaire fails to meet requirements of I&IM 241 on work zone safety, management, maintenance of traffic, and diversion routes for regular maintenance during operations.	B	60 minutes	5
Inspections	Quality of Inspection	The concessionaire fails to identify material defects in the inspection reports, life-cycle maintenance plan, or work currently undertaken.	C	None	5
Maintenance	Performance requirements	The concessionaire fails to meet the performance requirements for each asset in cycles adopted in the industry for each asset.	A	30 days	5
Level of service	Degradation of the facility	The concessionaire fails to appropriately manage the dynamic tolling mechanism to ensure the level of service of the HOT lanes project does not become degraded, as required by law. In addition, and to be measured separately, upon receiving notice of a problem with the dynamic tolling mechanism, the concessionaire fails to submit a rectification plan to the department for approval.	B	7 days	5
Concessionaire obligations	Subcontracting	The concessionaire fails to include provisions in all of its subcontracts requiring its subcontractors to refrain from discrimination.	C	None	5



and management structures; increased monitoring and inspections; changes in key personnel; and replacement of subcontractors.

If the concessionaire fails to deliver the remedial plan within 45 days of the department’s request, fails to comply with the course of action in the plan, and incurs 245 performance points during any 365-day cycle or maintains 68 or more uncured performance points, VDOT may notify the concessionaire in writing that such failure is a breach of a material obligation under Section 17.01(c).

Performance points will accumulate and when they reach certain thresholds, the department will be granted certain rights, shown in table 17.

CLEM7 North-South Bypass Tunnel

The operating company must set up a KPI assessment system to measure how well the operations and maintenance concessionaire is meeting the KPIs. The system must identify each instance in which a KPI is not met and identify the remediation steps necessary to correct it. A quarterly KPI performance report is required to be given to the council. All reports and data must be kept for 7 years. Any time the council chooses, it can request an audit of the KPI data and the KPI assessment system.

Demerit Points

As indicated in the KPI demerit point column (see Appendix C, tables 36 and 37, for KPI examples from the language in the agreement), both positive and negative points can be accumulated. Negative points are actually positive to the concessionaire and can be used to offset other penalty points. Penalties are assessed at a rate of AU\$1,000 for every point. The penalties are used to reduce the concessionaire’s income, so they serve as a credit to the owner. The

owner can decide if the credits will be refunded to toll users, used for other projects, or used to correct the conditions that led to the penalty.

M25

Payment Mechanism

The payment mechanisms for this project are used to both reward and penalize the DBFO contractor based on its level of performance in five categories:

- ▶ Lane availability
- ▶ Route performance
- ▶ Condition criteria
- ▶ Safety performance
- ▶ Proactive management

Lane availability, correlated with the “reliable journeys” goal, evaluates the adequacy of traffic flow and the availability of travel lanes. Monthly adjustments to this payment mechanism element are made for delays to the traveling public due to traffic management actions during planned maintenance and repair activities. The idea is to incentivize the DBFO contractor to plan and execute maintenance and repair actions when the impact on travelers is minimal.

Route performance, also correlated with the “reliable journeys” goal, assesses the reliability of trip times and the impacts of incidents. Monthly bonuses are made when trip times are highly reliable, and monthly deductions are made when trip times show significant variance from the norm.

Condition criteria, correlated with the “safe roads” and “informed travelers” goals, assess ride quality, roadway defects, and technology systems. Monthly deductions are made for failure to meet ride quality

TABLE 17. Capital Beltway performance point implications.

Total Cumulative Number of Uncured Points	Total Cumulative Number of Cured and Uncured Points	Implications
30	135	Increased monitoring by the department
45	200	Remediation plan to be submitted to the department
68	245	VDOT may exercise its right under Section 1701 of the agreement



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standards or correct serious roadway deficiencies, as well as for any loss in technology systems that are in place primarily to inform the public or assist with roadway management.

Safety performance, associated with the “safe roads” goal, assesses roadway safety. Annual bonus payments or deductions are made if the roadway shows either positive or negative trends on the identified safety metrics.

Proactive management is linked with all three goals. The intent of this element is to reward the DBFO contractor for actively and productively working with HA to achieve its overall objectives and engaging with the agency as priorities or objectives change.

Airport Link

As with the CLEM7 North-South Bypass Tunnel project, the KPIs in the project deed are outcome oriented and focus on project aspects important to the everyday project user. KPIs focus on issues such as prompt response to customer calls, lane availability, air quality in and next to the tunnel, water runoff quality, operability of tunnel communication and safety systems, response times to incidents, and aesthetic appearance of the facility.

Demerit Points

The KPIs in the Airport Link project are very similar to those in the North-South Bypass Tunnel, which has been renamed the Clem Jones M7 Tunnel. The projects are contiguous, share many similar environmental and social impacts, and have similar DBFO structures. The Airport Link project uses a KPI assessment system to monitor performance. If the contractor fails to attain any of the major performance metrics, demerit points are applied. At the end of any financial year, the number of demerit points is multiplied by \$1,000 from a base year of 2008. The cost of the demerits rises over the life of the contract by the consumer price index.

The KPI assessment system is intended to record and report on the PPP company’s performance against those benchmarks. The assessment system must be adequate to determine whether the benchmarks have been made, each separate occurrence, the accumulation of demerit points, and all source information necessary to assess the issues surrounding achievement or nonachievement of the KPIs.

A quarterly report on KPI compliance must be generated.

5.2.4 Remedies and Dispute Resolution Procedures for Poor Operations and Maintenance Performance

Remedial procedures for poor operations and maintenance performance were included in the case study PPP agreements. Executing remedies for poor work is directly linked to performance point-tracking systems. If the concessionaire exceeds a set number of performance points in a given period, it is susceptible not only to monetary punishment, but also to the owner’s remedial rights. These rights allow the owner to continue operations and maintenance work on the project or repair project elements when the concessionaire fails to do so. The most common remedial right in a PPP contract that might be executed by the owner is the step-in right, in which the owner may take up any of the concessionaire’s responsibilities that are being neglected or hire another independent party to do so. The concessionaire is held responsible for reimbursing the owner for all costs incurred in such a step-in. The second most common remedial right is work suspension, in which the owner has the right to suspend any concessionaire operations and maintenance work it deems unsatisfactory until the concessionaire develops an approvable remedial plan. Since the concessionaire is typically charged for each day the project runs over schedule, work suspension can be extremely motivating.

Each PPP agreement also includes a dispute resolution procedure to solve issues that may arise between the owner and concessionaire on the operations and maintenance work. In the case study projects, these procedures begin at the lowest level of management before escalating to senior management and third parties. Contract procedures also leave room for legal entities and court cases to resolve issues. The purpose of these resolution procedures is to ensure that the owner and concessionaire can resolve their differences and continue the project work in unison before resorting to the more drastic measures of work suspension, step-in, default, or termination.

Table 18 summarizes the KPIs and related contract provisions for remedies and dispute resolution procedures for poor operations and maintenance performance. Example contract language is in the text that follows.



I-595 Corridor Improvements

Remedies for Poor Work

As stated in the I-595 agreement, persistent concessionaire operations and maintenance noncompliance will result in the department exercising its remedial rights. It is imperative that noncompliance issues are remedied because repeated or numerous instances of noncompliance will undermine the confidence and trust essential to the success of the public-private agreement. If the concessionaire collects 100 NCPs in a 1-year period or 200 NCPs in a 3-year period, the department may exercise its right to suspend, in whole or part, the concessionaire's operations and maintenance work. During this suspension, the concessionaire will have no right to extra work costs, delay costs, time extensions, or other relief costs. Before having work suspended, the concessionaire is likely to receive a warning notice from the department stating in detail the matters causing the notice and, if applicable, the amounts due from the concessionaire as penalty. On receiving a notice, the concessionaire is required to prepare and submit a remedial plan describing a schedule and specific actions it will take to correct the issue. Another common remedial right the department may exercise is the step-in right. This gives the department the right to pay another entity to perform all or any part of the concessionaire's obligations and work that relate to the concessionaire default. In turn, the concessionaire will be held responsible for reimbursing the department for all costs in connection with this step-in. Example faults that may result in these consequences for this project are in table 19 (see next page). The concessionaire's failure to meet the minimum performance requirements acts as a trigger for remedies to be put into action.

Dispute Resolution Procedures

The dispute resolution procedures for this contract begin with both the concessionaire and the department agreeing to resolve disputes as quickly as possible without involving a third party. However, if a dispute cannot be resolved at this lowest level of management, the issue will move to the disputes review board elected for the contract by both parties. The review board will be given all evidence and documentation necessary from both parties to make a fair and accurate solution recommendation. The evidence will be circulated to all players involved in the dispute. After the board recommends a resolution, each party will determine whether the board's recommendation is suitable. If either party decides to appeal the review board's recommendation, subsequent proceedings will take place with the initial recommendation admissible as evidence. The dispute resolution board will not be responsible for handling disputes related to final acceptance or the performance of value added. The Regional Disputes Review Board and Statewide Disputes Review Board will handle these issues, respectively. During the course of any dispute resolution, the concessionaire is required to continue performing all work, even in the subject area of dispute, as directed by the department.

Golden Ears Bridge

Remedies for Poor Work

This contract agreement exhibits remedies for concessionaire default related to poor operations and maintenance performance. The concessionaire is subject to operations and maintenance default if it fails to perform any of its obligations under the operations, maintenance, and rehabilitation (OMR) agreement and does so in a manner that jeopardizes the safety

TABLE 18. KPI information for remedies and dispute resolution procedures for poor operations and maintenance performance.

KPI Category	I-595 Corridor	Golden Ears Bridge	Kicking Horse Canyon	East Link	Capital Beltway	North-South Bypass	M25	Airport Link
5.2 Operations and Maintenance (O&M)								
5.2.3 Remedies and Dispute Resolution Procedures for Poor O&M Performance								
Remedies for Poor Work	✓	✓	✓	✓	✓	✓		
Dispute Resolution Procedures	✓		✓	✓	✓	✓		
Bond Safeguards				✓		✓		



TABLE 19. I-595 operations and maintenance availability faults examples.

Availability Faults	Minimum Performance Requirements	Availability Classification	Cure Period	Interval of Recurrence
Incident Response	Respond to and secure sites of incidents, emergencies, crashes, and other events that result in a condition that is unsafe or may present a life-threatening condition, such as, but not limited to, fuel spills, debris, pavement failure (e.g., potholes), flooding, guardrail failures, attenuator faults, and other elements as detailed in this matrix.	B	15 minutes	Hourly
Flexible Pavement Potholes	Pavement section meets the requirements in Division II, Section 6 of the Technical Requirements.	B	60 minutes	Hourly
Signs	Sign (single or multipost) on a given segment meets the temporary mitigation performance requirements in Section 4.6.2.	B	30 minutes	Hourly
Toll Gantry	Toll gantry on a given segment meets the temporary mitigation performance requirements in Section 4.6.2. This availability fault does not apply if a failure to meet the performance requirements interrupts toll collection on the express lanes, in which case it shall be deemed a toll collection interruption availability fault.	D	60 minutes	Hourly
Rapid Incident Scene Clearance	Respond to and provide the necessary equipment and personnel, as specified in Section 4.3.4.1.	E	60 minutes	Hourly

of the public, the facility lands or assets, or any facility occupiers. In any calendar quarter during the concession term, if the concessionaire receives three or more warning notices for the same failure to perform under the OMR agreement or in two consecutive calendar quarters it receives one or more warnings for the same failure, it will be subject to contractor default.

The remedial procedure for operations and maintenance default is as follows: The ministry may require the concessionaire to develop a reasonable schedule and plan for rectifying the default with details on the approach and the latest date it will be corrected. If the plan is considered unacceptable, the ministry and concessionaire will work together to develop a new strategy. When a plan is approved but the concessionaire does not remedy the default within the allotted time period, the ministry may move to correct the default itself or engage an independent third party to do so with the concessionaire fully reimbursing the ministry for all costs associated with the remedial procedure. Ultimately, the ministry may move to terminate the contractor and agreement if the contractor is unwilling to correct any defaults according to a reviewed and accepted remedial plan.

Kicking Horse Canyon Phase II Remedies for Poor Work

If the concessionaire stops maintaining or operating the project facilities in accordance with the agreement, it will be subject to default. If the concessionaire defaults, the province has the option to apply the following remedies: First, the province may make any payment retentions in accordance with the agreement or suspend the concessionaire’s work (specifically the functions subject to default) until the concessionaire can demonstrate to the province’s satisfaction that it has the capability and willingness to perform its obligations under the OM&R agreement correctly. If the concessionaire’s work is suspended, the concessionaire is required by contract to reimburse the province for all costs incurred to perform or engage others to perform the functions of the concessionaire under suspension. The concessionaire is also required to develop a program to rectify the default and submit it to the province for review. If the program is deemed acceptable, it will be allowed for implementation and the suspension will be released. However, if the province and concessionaire cannot agree on an appropriate program to correct the



default, the matter is subject to the dispute resolution procedure. In that case, termination of the agreement is the ultimate, worst-case possibility.

Dispute Resolution Procedures

The dispute resolution procedure for operations and maintenance starts with resolution at the lowest level of management before reaching an independent certifier or senior executives. If these three levels of resolution do not yield an acceptable decision on the dispute, a trio of experts, identified as the operations and maintenance panel, will be selected by the province and concessionaire to resolve the dispute. The panel's decision is considered final and binding unless the consequences total more than \$250,000 for either party, in which case the dispute can be referred to the arbitration procedure.

Arbitration Procedures

Either a single arbitrator or a panel of arbitrators selected by both parties will perform the arbitration process. The arbitrators will be provided with all the necessary documents required to resolve the dispute, and both parties will be eligible to be represented by legal counsel. Any witnesses selected for questioning may be examined, reexamined, and cross-examined by either party at the arbitration. Within 30 days of the arbitration, a written conclusion of the hearings will be sent to both parties. The decision will be final and binding unless the result awards either party more than \$5 million, in which case the decision may be appealed and the process repeated.

EastLink

Actions and Remedies Available to State

The agreement provides the state broad and specific rights on actions it can take in the event of poor performance by the concessionaire. Broadly, if a concessionaire fails to comply with the terms of the deed at any time after the first date of freeway section completion, the state may issue a notice to the concessionaires specifying the noncompliance and requiring that it be corrected as soon as practicable but, in any event, within 12 months of the date of the notice. If the noncompliance is not corrected, the state may issue a further notice requiring ConnectEast to replace the operation phase bond.

In addition, the state has rights to audit the operator, outside of the normal reporting and auditing requirements, any time up to 12 months after the end of the

concession period. It may give notice (KPI audit notice) to ConnectEast requiring an audit of the KPI data, quarterly KPI reports, or KPI assessment system to verify their accuracy, correctness, completeness, and fitness for the intended purpose.

If the state gives a KPI audit notice, it will appoint and notify ConnectEast of the entity to conduct the audit at the state's expense. The concessionaires must, within a reasonable period, make the KPI data, quarterly KPI reports, and KPI assessment system available for the audit.

If the report of the KPI auditor concludes that the KPI data or a quarterly KPI report is not accurate, complete, or correct or that the KPI assessment system is not fit for its intended purpose, ConnectEast must (1) fix the inaccuracy, incorrectness, incompleteness, or lack of fitness for intended purpose in the affected data, report, or system and reissue the data or report to the state or advise the state of any change to the system; (2) reassess any KPI affected by the inaccurate, incorrect, or incomplete data or report or lack of fitness for intended purpose in the affected system, and notify the State of and pay any necessary adjustment to the KPI points or KPI credit; and (3) pay the costs of the KPI auditor or reimburse the state for any costs. If the KPI auditor's report concludes that the KPI data or a quarterly KPI report is materially inaccurate, incomplete, or incorrect or that the KPI assessment system is not fit for its intended purpose, the state may require ConnectEast to pay \$500,000 (indexed) within 5 business days.

Dispute Resolution Procedures

The concession agreement has a number of instances in which it refers to potential disputes. Typically, any dispute between the state and a concessionaire that relates to the deed or the concessionaire's obligations under this deed (including if the state or concessionaire disagrees with the decision of the independent reviewer) shall be resolved through negotiation and subsequent expert determination, unless the contract expressly provides that the dispute is to be referred directly to expert determination. Under certain circumstances, resolution may also involve arbitration proceedings.

In the event of expert determination, the state and the concessionaires must exchange written lists of at least three qualified persons, in order of preference, within 7 business days of the notice date. Any person who



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appears on both the state's and the concessionaires' lists will be appointed as the expert to determine a dispute. If more than one person appears on each list, the person given the highest order of preference by the party that gave the notice will be appointed. If no person appears on both lists, the party that gave the notice must ask the national president of the Institute of Arbitrators & Mediators Australia to nominate a person to act as the expert. The expert may meet or have discussions with the parties together, but not separately.

Bond Safeguards

The concessionaire must procure an operation phase bond of \$5 million (indexed to inflation) within 10 business days of the issue of the first certificate of freeway section completion. If the concessionaire fails to comply with the contract terms at any time after the first date of freeway section completion, the state may issue a notice specifying the noncompliance and requiring that it be corrected as soon as practicable, but in any event within 12 months of the date of the state's notice. If the noncompliance is not corrected, the state may issue a further notice to the concessionaires requiring ConnectEast to replace the operation phase bond with a replacement bond of \$20 million (indexed) within 10 business days.

Capital Beltway Remedies for Poor Work

If the concessionaire does not meet the minimum standards for operations and maintenance work, the department may require the concessionaire to prepare and submit a remedial plan for the department's approval. The remedial plan shall set a schedule and describe specific actions the concessionaire will undertake to improve its performance as demonstrated by incurring no additional performance points and reducing the total number of uncured performance points it has accumulated. Such actions may include, but are not limited to, improvements in the concessionaire's quality management practices, plans, and procedures; changes in its organizational and management structures; increased monitoring and inspections; changes in key personnel; and replacement of subcontractors. If, 180 days after the implementation of the remedial plan, the concessionaire can demonstrate that (1) the remedial plan has reduced the number and frequency of performance points assessed compared to the period before the implementation of the remedial plan, (2) the concessionaire

is complying with the course of action described in the remedial plan, and (3) the concessionaire has no uncured performance points, the total number of performance points assessed over the 180-day period shall be reduced by 50 percent. If the rolling 365-day cycle ends during the 180-day period, the number of performance points the concessionaire has cured during that 365-day cycle shall carry over to the next 365-day cycle. However, if the total number of performance points assessed over the 180-day period is reduced by 50 percent as described above, the number of previously cured performance points that were carried over also shall be subtracted from the concessionaire's cumulative total of assessed performance points.

If the concessionaire fails to deliver the remedial plan within 45 days of the department's request, or fails to comply with the course of action in the remedial plan and incurs a total of 245 performance points during any 365-day cycle, or maintains 68 (or any higher applicable number during the phase-in period) or more uncured performance points at any time, the department may notify the concessionaire in writing that such failure is a breach of a material obligation. Such failure shall become breach of a concessionaire default unless cured within the time period specified.

Dispute Resolution Procedures

In the event of a disagreement or dispute relating to a life-cycle maintenance plan, VDOT and the O&M contractor shall try to resolve it within 60 days. Any disagreements or disputes raised by VDOT on the life-cycle maintenance plan must be based on whether the assessment and the underlying assumptions are reasonable, realistic, and consistent with good industry practice, project experience and condition, technical requirements, and applicable law. If no agreement is reached in 60 days, either party may submit the dispute to the dispute resolution procedures in Section 17.06 of the agreement. Until resolution of any disagreement, the treatment of the disputed tasks in the most recently approved life-cycle maintenance plan shall remain in effect and govern the requirements relating to such tasks.

The parties shall attempt in good faith to resolve a dispute within 15 days or other time period specified in the agreement. If the parties are unable to resolve the dispute within that timeframe, the dispute shall be referred to mediation or any other form of alternative dispute resolution acceptable to both. They must



share equally the expenses of the mediator or other alternative dispute resolution process. If after 180 days (or 60 days in the case of disputes relating to the I-495 HOT lanes in Virginia project arising before substantial completion) following the date of the referral the dispute remains unresolved, either party may litigate the matter in court. All litigation between the parties arising out of the agreement or its breach shall be filed in the Circuit Court for Richmond, VA, Division I, which shall have exclusive jurisdiction and venue. Each party shall bear its own attorneys' fees and costs, and no party shall seek or accept an award of attorneys' fees or costs, except as expressly set forth in the agreement.

CLEM7 North-South Bypass Tunnel Bond Safeguards

In the CLEM7 North-South Bypass Tunnel, the operations and maintenance bond is for an inflation-adjusted \$20 million. If after 12 months of notice the operations company fails to correct documented maintenance deficiencies, the council has the option of calling the bond and using the proceeds to correct the deficiencies. The operations and maintenance requirements demand that the operating company perform the following:

- ▶ Keep all lanes of traffic open at all times, except as permitted for planned maintenance and incidents.
- ▶ Meet the roadway and bridge performance specifications.
- ▶ Meet the required design life.
- ▶ Meet the handover requirements, which require at least 50 percent remaining design life for each element of the facility.
- ▶ Correct defects as soon as possible.
- ▶ Operate and maintain the tollroad in accordance with operations and maintenance best practices.
- ▶ Operate the project in accordance with the project deed.

5.3 Design and Construction

Agencies use design and construction KPIs to set performance expectations during facility construction. The use of design and construction KPIs is not as prevalent as operations and maintenance KPIs

because of the nature of the design-build contract in the concessionaire agreement and the fact that the concessionaire operates the facility for such a significant period before its eventual handback. However, agencies do use high-level design and construction KPIs to align design and construction operations with overall agency performance measures. The KPIs for design and construction are presented in the following subcategories:

- ▶ Organizational structure for monitoring design and construction
- ▶ Remedies and dispute resolution procedures for poor design and construction performance

5.3.1 Organizational Structure for Monitoring Design and Construction

Similar to the monitoring structure for operations and maintenance, PPP agreements require a formalized and structured method for monitoring the design and construction processes of a project. In the case study projects, this is done using a design quality management plan and a construction quality management plan, both of which are developed by the concessionaire and submitted to the owner for review. Because the concessionaire has the freedom to develop these plans, each is unique to the project, the project's objectives, and the concessionaire's procedures. Although unique, these plans must have basic components that include important monitoring elements, such as inspection, investigation, and auditing techniques and procedures. The general concept for these management plans is the same as those used for operations and maintenance.

In contrast to the operations and maintenance monitoring structure, the design and construction structure often involves the use of quality milestones as both monitoring and incentive tools. The project owner and its representatives commonly set a number of milestones for project design and construction. Specific incentive amounts are set aside to reward the concessionaire for meeting these milestones. Before giving the concessionaire an incentive for meeting a quality milestone on time, the owner will either inspect the project's progress itself or hire a third party to do so. If the concessionaire has completed quality work by the milestone deadline, it will receive a specific amount of the overall bonus proportional to the significance, effort, and difficulty in achieving the milestone. This system aims to keep the project



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progressing on time by offering the concessionaire opportunities to be rewarded for ontime, high-quality work.

Table 20 summarizes the KPIs and related contract provisions for organizational monitoring structures for design and construction. Example contract language is in the text that follows.

**I-595 Corridor Improvements
Schedule and Progress Meetings**

Monitoring of the concessionaire’s design and construction performance begins in the early stages of the project with the department requiring a project schedule for both design and construction work to be submitted for approval. This project schedule is updated and continually submitted to the department

for approval throughout the entire design and construction process, and all design and construction work must comply with the set schedule at all times. Progress meetings, attended by both the concessionaire and the department, are conducted once a month during the construction period to ensure the work is conducted properly. If either party believes additional meetings are necessary to resolve any design and construction issues, they are scheduled on request. The contract agreement also requires the concessionaire to submit design and construction work reports to the department to be used as a supplementary evaluation tool.

Interim Milestones

During the course of the design and construction work, interim milestones were set for the project under Appendix 3 of the agreement. A total of

TABLE 20. KPI information for organizational structures for design and construction.

KPI Category	I-595 Corridor	Golden Ears Bridge	Kicking Horse Canyon	East Link	Capital Beltway	North-South Bypass	M25	Airport Link
5.3 Design and Construction (D&C)								
5.3.1 Organizational Structure for Monitoring D&C								
Schedule and Progress Meetings	✓				✓	✓		
Quality Management System Audits		✓	✓		✓	✓		
Design Quality Management Plan		✓	✓	✓	✓	✓		✓
Construction Quality Management Plan		✓	✓		✓	✓		✓
Road Safety Audits		✓	✓			✓		
Design and Construction Program				✓				
Review of Construction				✓	✓	✓		
Inspection and Test				✓	✓			
Milestones	✓			✓		✓		
Construction Management and Coordination				✓	✓	✓		
Management Systems and Plans					✓	✓		
Design Requirements				✓		✓		✓
Monthly Progress and Work Reports	✓	✓	✓	✓	✓			



\$50 million in potential bonuses, labeled “interim milestone works bonus,” is included in the first final acceptance payment. This incentive works when the concessionaire notifies the department it has achieved the completion of an interim milestone. The department will assess whether the milestone conditions have actually been met and notify the concessionaire of the assessment results. If the milestone has not been achieved by the milestone deadline, the result will be reductions from the milestone work bonus. The milestone deadlines are concrete unless the concessionaire can prove it was persistently working toward meeting a deadline, but was precluded by an uncontrollable event. In this case, the final milestone date or bonus may be modified.

Other significant milestones to assess design and construction progress are substantial completion and final acceptance. Two months before the scheduled substantial completion date, the department will review the condition of the constructed works to determine if all design and construction criteria have been met for standard completion approval. The first 2 weeks of these 2 months are dedicated to the department conducting inspections of the project, components, final design documents, construction documents, and other submittals necessary to evaluate whether substantial completion will be achieved. After these 2 months expire, the department will either issue a substantial completion certificate to the concessionaire or notify the concessionaire why it has decided not to issue the certificate (e.g., incomplete work found, repairs needed). Twenty days before final acceptance of the project, the department will conduct inspections of punch list items, as-built plans, and other submittals required for investigation. These inspections and investigations will determine whether a final acceptance certificate is issued to the concessionaire.

Kicking Horse Canyon Phase II Quality Management System: Audits

A design and construction quality management system submittal from the concessionaire to the ministry is the basis for monitoring the design and construction performance of the project. Quality audit plans are required for the management system and are a primary monitoring tool. The audit plans require concessionaire acceptance and scheduling of three audit types: concessionaire audits, province audits, and third-party audits.

The concessionaire’s audit plans detail the internal and external audits the concessionaire will conduct on the performance of its own contractors and subcontractors. The purpose is to confirm that all activities comply with those documented in the quality management plans previously submitted to the province and are in accordance with the design and construction output specifications and criteria. Internal audits are conducted on behalf of the concessionaire, while external audits are conducted by independent parties with an interest in the project. The province audits required in the quality management system are conducted by the province’s representative using two categories of auditing: surveillance and quality system management. Surveillance audits are performed by the ministry on an unscheduled, random basis to monitor the concessionaire’s work, workmanship, and general quality of materials. In contrast, quality management system audits are scheduled audits to assess the concessionaire’s performance and compliance with the previously submitted and accepted quality management system. Finally, third-party audits are conducted by external independent organizations, such as certification or registration bodies, on a scheduled basis. These audit reports are made available to the ministry on request. All audit plans must be implemented into the project within 90 days of the commencement date.

Design Quality Management Plan

A quality design management plan is developed by the concessionaire and submitted to the province’s representative to monitor the design of the project and ensure all the design criteria are fulfilled. The design management plan identifies procedures and processes for design input review, output review, verification that all input requirements are met, design changes, external and internal quality audits, and corrective and preventive action plans. The design management plans also contain important design documents, including drawings, notes, reports, and computations showing the design decision process, criteria, and assumptions used to develop the design, along with quality control reports, test results, and final record drawings detailing how the process complies with the design and construction output specifications. According to the design and certification procedure, the concessionaire is required to submit these design data documents in the form of progress reports for review by the province’s representative at 50 percent and 100 percent of detailed design completion to identify and address



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any nonconforming design elements. The province's representative will question or comment on the design, and the concessionaire is required to address these comments to the satisfaction of the province before the design is approved. The representative requires the concessionaire to have all design drawings and materials prepared and certified by a professional engineer of the appropriate discipline licensed to practice in British Columbia before they are submitted.

Construction Quality Management Plan

The concessionaire is required to submit a construction quality management plan describing how it intends to manage the construction process. The plan will include procedures and processes for construction safety audits; construction inspections and testing; contractor, subcontractor, and supplier of any tier quality assessment and procurement; external and internal quality audits; control of nonconforming products; and corrective and preventive action plans. These elements of the management plan will document who does the work, what they do, and what evidence is generated that they do it correctly. Also, the province's representative and any contractors or consultants affiliated with the representative are given unrestricted access during normal construction hours to inspect the works and the project site. The concessionaire is also obligated to provide an updated works schedule to the province's representative on a monthly basis reflecting the progress to date, a comparison to the previous works schedule, and a forecast to completion, whether changed or unchanged, as a method for monitoring construction performance.

Traffic Quality Management Plan

A traffic quality management plan is also an integral part of monitoring the concessionaire's construction procedures because managing traffic during construction is essential for completing the project safely and on time. The concessionaire is required to submit a traffic management plan to the province's representative for review to ensure construction is done safely and efficiently. The plan identifies the concessionaire's qualified traffic management personnel, including a traffic control supervisor (TCS), traffic engineer, and traffic manager who will monitor different aspects of the construction process. The TCS is responsible for overseeing all requirements of the agreement that contribute to the convenience, safety, and orderly movement of traffic during construction. The traffic engineer is responsible for signing off on the pro-

posed traffic management plan and ensuring all traffic engineering issues and requirements are accounted for. The traffic manager is appointed by the concessionaire and approved by the province's representative to finalize proposed traffic control measures and direct the application of the plan while communicating updates on traffic management to the province's representative. The manager reviews the TCS's daily activity and traffic control reports to make field modifications to submit to the province's representative.

Monthly Progress Reports

In addition to the quality management systems to monitor design and construction, the concessionaire and the province's representative agree that until the final completion certificate is issued, the concessionaire will submit monthly progress reports to the province's representative describing all relevant aspects of the works. These progress reports will include all actual or potential departure from the design and construction output specifications, the construction requirements, and the project and works schedules in the project agreement. The progress reports contain the concessionaire's new prediction for the substantial and final completion date of the works if the schedule is affected by the previous month's performance. The substantial and final completion date certificates will be issued only after an independent certifier has inspected and investigated the project on the quality and safety of the concessionaire's works. This independent certifier cannot be a partner or joint venture of any party in the agreement and must warrant to each party that it has expert and professional staff who are competent, experienced, and qualified to perform the inspections and investigations of the project construction.

Road Safety Audits

Road safety audits are required elements in monitoring the design and construction processes. These audits are performed by a safety audit team retained at the concessionaire's expense, but are completely independent of the concessionaire's design team to ensure that designs and constructed works meet a high safety standard. Audits occur at five stages: (1) on completion of the preliminary design, (2) at 50 percent of detailed design, (3) at 100 percent completion of detailed design and before construction begins on the relevant works, (4) as part of any design changes during construction, and (5) immediately before any of the concessionaire's works are opened



to the public. If the audit team is not satisfied that the concessionaire's design meets the standards set in the agreement or general safety requirements, the team will prepare a report for the province's representative identifying all aspects of the project that raise concerns. The concessionaire is required to address all issues and correct the design to meet the team's recommendations. These audits are extremely influential because the concessionaire is not eligible to receive a substantial completion certificate without a road safety audit certificate.

EastLink

Design and Construction Program

The EastLink project lists specific elements for the concessionaire to include in its design and construction program. On or before the commencement date, the concessionaire must submit a detailed design and construction program to the state of Victoria and the independent reviewer that includes the following:

- ▶ It must be in the form of a critical path network set to a time scale of calendar weeks.
- ▶ It must be compatible with the state's and the reviewer's software and other systems.
- ▶ It must include the content specified in the project scope and requirements.
- ▶ It must not include programming activities or methodologies that create false criticality or constrain the program from reacting dynamically to change.
- ▶ For the construction activities in each section, it must clearly demonstrate the actual, current critical path to achieving freeway section completion by the planned date.

If requested by the state, the reviewer must review and, if applicable, comment on the first program submitted within 14 business days of submission by the concessionaire. If the reviewer believes the program is not in accordance with the concession agreement, it may notify the concessionaire and the state of the reasons for that opinion. After receiving a reviewer's notice, the concessionaire must, as soon as practicable, revise the program to address the reviewer's concerns and resubmit it.

The concessionaire must review the program regularly (at least every month) to ensure that it reflects

the actual progress of construction activities, the effect of delays, and the current critical path to achieving freeway section completion by the planned date. The concessionaire must provide a copy of the most recent program to the state and the reviewer immediately after it is reviewed or updated and, at a minimum, within 3 business days after the beginning of each month.

Design Requirements

The concessionaire warrants—to the extent that it has relied on, used, adopted, or developed any part of the outline scope and project requirements or the reference design for any purpose—that it has checked the project scope and project requirements and that they are proper, adequate, and fit for their intended purposes. It also warrants that it has allowed for all risks and costs associated with carrying out all of its obligations.

In preparing the design of its works and temporary works, including the design documentation, the concessionaire warrants it has consulted with the operator and the tollroad service provider to ensure that it has incorporated their whole-of-life recommendations.

The design documentation for each discrete component or package of the works and temporary works must comply with the deed and be fit for the purpose of their construction.

Before starting construction of each component of its works, the concessionaire must submit proposed design documentation to the state and independent reviewer and 7 business days must have elapsed.

The design documentation submitted by each concessionaire must contain at least the following information: (1) identification of the component or package of the works to which it relates; (2) identification of the aspect of its design plan to which it relates; (3) a design development report demonstrating that issues of planning, design (including urban design), materials selection, constructability, and operations and maintenance have been fully coordinated and integrated into its design documentation; (4) all necessary design drawings and specifications for the component or package of works; and (5) any other information required by the deed.

If required by the independent reviewer, each concessionaire must make available the appropriate design



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personnel (including the design consultant or proof engineer and construction verifier) to explain its design documentation or to provide the requested information.

Construction Review

In the EastLink project, the reviewer reviews the program and the construction works and temporary works. If required, the concessionaire must make available the appropriate personnel (i.e., proof engineer and construction verifier) to explain or provide information on the review matters. If the reviewer believes the works are not being constructed in accordance with the agreement, it may notify the state and the concessionaire of its opinions. Within 5 business days of receiving the notice, the concessionaire must notify the state and the reviewer of any matters on which it disagrees with the reviewer's opinions or provide a plan for remediation if it agrees with the opinions. Within 7 business days of receiving a remediation plan, the reviewer may notify the state and the concessionaire whether the plan addresses its concerns.

Inspection and Testing

The state and any authorized person may, upon giving reasonable notice to the concessionaire (except in an emergency, when no notice is required), inspect the licensed area (any land over which a land license has been granted) and any other place where construction activities are performed or materials are prepared or stored, and inspect or test any part of the works or temporary works at any time. All costs of uncovering or making accessible the works must be borne by the concessionaire.

Milestones

The concessionaire must notify the state and the reviewer at each relevant milestone date whether the milestone has been achieved. If a milestone has not been achieved, the state and the concessionaire must, within 5 business days of the passing of that milestone date, enter into discussion. The concessionaire must do the following:

- ▶ Provide a detailed explanation of the reason for the failed milestone.
- ▶ Identify the action it will undertake.
- ▶ Develop a revised program.
- ▶ Identify any necessary reporting of the progress of the construction activities.

- ▶ Identify any consequential changes to any other construction milestone dates.

Defect Correction

If a concessionaire identifies any defect in construction activities, it must notify the state and the independent reviewer immediately and expeditiously correct the defect. If the state identifies any defect, it may notify the concessionaires and require them to correct the defect. If the defect could cause the works to be unsafe to the public or workers or relates to a freeway section or bypass open for public use, the state may specify a reasonable time by which this must be carried out. The concessionaire must expeditiously correct the defect and comply with any reasonable time for correction the state specifies.

Capital Beltway

Design and Construction Quality Management

The concessionaire shall provide oversight and management of the project to control its scope, quality, cost, and ontime delivery. If the work does not satisfy applicable performance or quality standards, the concessionaire shall increase its management and oversight efforts so that repair or replacement of nonconforming items does not require any increase in VDOT's limited oversight of the project.

The concessionaire will develop and provide to the department its quality management plans, manuals, and procedures for design and construction. The plans, manuals, and procedures shall be consistent with VDOT's quality assurance and quality control requirements, as well as the procedures and processes in the technical requirements.

The concessionaire will require each contractor, subcontractor, and supplier to comply with the requirements of the quality management plans. VDOT has the right to review the concessionaire's quality management system, including the right to inspect work and verify the accuracy and adequacy of quality management documentation. The concessionaire will require its contractors and subcontractors to provide any assistance VDOT reasonably requires in conducting such reviews.

Construction Management and Coordination

The project agreement for the Capital Beltway contains key performance requirements between the concessionaire and VDOT:



- ▶ The concessionaire and VDOT representatives shall be reasonably available to each other and shall have the necessary authority, expertise, and experience required to oversee and communicate.
- ▶ VDOT, the concessionaire's project manager and senior representatives, and other pertinent representatives of the parties shall meet within 7 days after the closing date to discuss issues affecting the administration of the work and implement necessary procedures, including those relating to submittals and approvals.
- ▶ The concessionaire shall hold monthly progress meetings with VDOT to review progress during the prior month. The concessionaire shall collect information from any key subcontractors and subconsultants responsible for work completed during the month and work scheduled during the upcoming month. The concessionaire shall be responsible for preparing and distributing meeting minutes to all attendees for review within 2 calendar days after the meeting.
- ▶ The initial baseline schedule shall be the basis for monitoring the concessionaire's work performance until VDOT has approved a baseline schedule. The baseline schedule shall provide for a guaranteed substantial completion date.
- ▶ Within 60 days of the date work commencement is approved, the concessionaire shall submit to VDOT a critical path method schedule. This schedule shall be resource-loaded, be broken down into work packages and deliverables generally completed within 30 days, identify the dollar value of each deliverable, and comply with the technical requirements of and in a form acceptable to VDOT.
- ▶ The concessionaire shall provide VDOT with any proposed update of the baseline schedule for the department's review and approval. It shall also provide a progress narrative that describes the overall progress for the preceding month; a critical path analysis; a discussion of problems encountered and proposed solutions; work calendars; constraints; delays experienced and any pending time impact analysis; float consumption as a result of department, concessionaire, or design-build contractor delays; and documentation of any

logic, duration, resource, or other relevant changes.

- ▶ If VDOT believes the baseline schedule needs a revision in logic, activity duration, manpower, or cost, it will request it from the concessionaire in writing. The concessionaire shall respond in writing within 7 days, either agreeing with the department's proposed revision and including it in the next baseline schedule update or justifying why it should not be accomplished.
- ▶ The concessionaire shall submit two copies in electronic format of the baseline schedule, including updates and narratives.
- ▶ Whenever VDOT requires, the concessionaire shall provide in writing a general description of the arrangements and methods it proposes to adopt to execute the work.

Inspection and Testing

VDOT, its authorized agents, and the independent engineer have unrestricted access at all times to inspect, sample, measure, and physically test any part of the project or rights-of-way. VDOT also has the right, upon reasonable written notice to the concessionaire, to inspect financial or other records relating to the project. If the concessionaire has failed to perform any of its construction, operating, or maintenance obligations, VDOT is entitled to increase the level of its monitoring during the work or operating period of the project until the concessionaire has demonstrated to VDOT's satisfaction that it is capable of performing its obligations. The concessionaire shall compensate VDOT for all costs of increased monitoring levels.

Clem-7 North-South Bypass Tunnel Management Systems and Plans

The contract requires the concessionaire to ensure that all aspects of the financing, design, construction, operation, maintenance, and repair of the project; collection of tolls; and interactions with the community meet the contract provisions. In many cases, the contract provisions are general statements, such as that the design of the project must comply with appropriate Austroads or Queensland Department of Main Roads standards. The contract lacks voluminous or detailed performance measures for many aspects, such as design and construction. Instead, the contract approach is to require the concessionaire to design and build the project according to professionally



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recognized standards and to rely on the independent verifier and auditors to ensure that the project meets the standards.

Through the various contract stages, the independent verifier is to control the adequacy of the concessionaire's efforts by issuing or not issuing a series of certificates. Approval and certification occurs at the following stages:

- ▶ At the acceptance of design documentation if the design plans meet the terms of the performance specification
- ▶ During and after construction to ensure that the construction meets the terms of the performance specification
- ▶ At the completion of the tolling system to ensure that it operates with the accuracy and speed required under the performance specification
- ▶ After the resolution of any disputes over defects
- ▶ When the customer service rollout program is sufficiently advanced to allow the operating company to comply with its obligations under the customer services and complaint provisions of the contract when customer audits are performed

The independent verifier acts independently of the city council, the security trustee, the concessionaire, and their associates.

The concessionaire's project management plan must detail how the concessionaire will ensure the delivery of the project by implementing a supervisory team, creating and updating a design and construction plan, managing resources, managing risk, ensuring project reporting, managing labor issues, engaging the community, and interfacing with key stakeholders, such as the Queensland Department of Main Roads or the adjacent railroad. The project management plan includes 17 components, such as traffic management, construction management, environmental management, and human resources management plans. In short, the project management plan requires a comprehensive and self-correcting series of plans, compliance checks, and corrective actions to ensure that the many phases of construction and operations meet the general statements of desired quality in the performance specification.

Each concessionaire must have its quality management, environmental management, and safety and health management plans audited every 6 months during the design and construction phase and every 12 months thereafter. The audits will be conducted by an independent auditor, acceptable to the city council but paid by the concessionaire. The independent verifier is to be present during the audits.

Design Requirements

In keeping with the other approaches to the project, the contract does not include KPIs, per se, for toll facility design. The contract documents include only general engineering details that must be met, such as lane width, shoulder width, superelevation, grades, and sight distances. For the most part, general language is used to describe project details, such as that the project must be constructed in a general location, connect existing named routes, accommodate an estimated 95,000 vehicles per day with sufficient lanes for adequate peak-time travel speeds, and provide service levels to prevent queuing at the terminals and connections. Table 21 summarizes the required design life for the named features, with a residual design life at handover of about 50 percent of each design life.

Durability requirements must be addressed throughout the design, construction, operation, and maintenance of all assets and must be reflected in the project plans and the operations and maintenance manual. The durability elements must describe how the design, construction, materials, operation, and maintenance will meet the durability requirements, ongoing condition requirements, and handback condition requirements. The plans must include the following:

- ▶ Describe the characteristics of the environment.
- ▶ Describe the potential deterioration mechanisms in the environment.
- ▶ Determine the likely rate of deterioration.
- ▶ Assess the material life.
- ▶ Define the material performance.
- ▶ Assess the need for further protection.
- ▶ Develop procedures for the replacement of assets at appropriate intervals.
- ▶ Determine inspection and monitoring requirements.
- ▶ Outline remedial procedures.



In addition to durability requirements, reliability requirements also are stated. For instance, the fire and life safety systems must be reliable at least 99.995 percent of the time and the electrical system must be reliable 99.971 percent of the time. The facility control systems must have total redundancy and have availability of 99.995 percent. The communication systems must have 99.99 percent availability and the ventilation system at full capacity must be reliable 99.954 percent of the time. Outages within those limits are not allowed to exceed 1 hour.

Safety Audits

Safety audits are required by a qualified independent party. They must be performed during the design phase, immediately before the project is opened to traffic, and every 2 years during the operations and maintenance phase. The concessionaire must implement the recommended corrected actions or justify to the independent verifier why the actions cannot be implemented.

Considerable detail is provided for the technical performance of tunnel ventilation. Neighborhood concerns about localized air quality from the exhaust stacks prompted considerable discussion during the environmental review and planning phases of the project. Internal air quality standards are set for carbon monoxide, nitrogen oxide, and particulate matter.

In addition, there are design requirements for the communication systems, traffic monitoring system, plant monitoring and control, and tolling system.

**Airport Link
Quality Management System**

The design and construction contractor is required to implement a quality system for the management of all aspects of its obligations under the contract. Again, the overall quality plan must be ISO compliant and meet the quality management system requirements of the Queensland Department of Main Roads. “Hold points” and “witness points” are points at which the contractor delays work to allow inspection by the owner and the owner’s surrogates, such as the independent verifier. The contract specifies the notice that must be given before the achievement of those points to allow the owner’s inspectors to review the work. The quality system plan must detail the contractor’s system for the following:

- ▶ Appointing and empowering personnel to oversee the quality system
- ▶ Identifying roles and responsibilities
- ▶ Identifying interfaces with other organizations that may need to be involved
- ▶ Process for risk management

TABLE 21. CLEM7 North-South Bypass Tunnel required design life for named features.

Required Design Life (Years)						
100	50	40	30	25	20	10
Tunnel structures	Buildings	Drainage structures	State pavements	Mechanical equipment	Lighting	Tolling hardware
Bridge structures		Tunnel, ramp pavements	City pavements		Local streets	Sign faces
Embankments, retaining walls		Architectural panels			Shared paths	Wearing surfaces
Buried elements		Noise barriers			Traffic control systems	
		Signage support, barriers				
		Tolling structures				

- ▶ Process for liaison with the independent verifier
- ▶ The designer's methodology and scope for reviewing and inspecting the construction
- ▶ Procedures for addressing nonconformance with the quality plan
- ▶ Independently certifying the effectiveness of the contractor's quality system and conformance to the project deed
- ▶ Having an independent auditor audit the quality plan on a 6-month basis throughout the construction phase

Design and Reliability Standards

The project deed and its addenda, known as annexures, have many implicit KPIs in addition to the handful of explicit ones mentioned above. The project is required to meet all design standards in effect in Australia. While in its design phase, the project also must undergo a safety-in-design assessment to reduce or eliminate hazards. Issues that must be assessed include roadway hazards, workplace health and safety, community health and safety, environmental issues, and the protection of the asset during all stages of its life.

The project design must accommodate the same design life standards as required in the North-South Bypass project. They include the following:

- ▶ One-hundred years for tunnel structures, bridge structures, reinforced embankments, and inaccessible elements, such as conduits for drainage, fire protection, and mechanical and electrical systems
- ▶ Fifty years for buildings
- ▶ Forty years for accessible drainage elements, pavements, architectural panels, noise barriers, tolling system structures, and signage support structures
- ▶ Thirty years for local road pavements
- ▶ Twenty-five years for mechanical and electrical systems
- ▶ Twenty years for lighting systems, traffic control systems, and busway station furniture
- ▶ Ten years for ITS equipment, tolling system hardware, fixed sign faces, and pavement wearing surfaces

The project deed design addenda require designs and continued operation of facility assets to ensure a high degree of reliability. Failure to meet the reliability standards can trigger audits, demerits, or even the calling of a performance bond to ensure that reliability standards are met. Because the facility is a tunnel with all of its associated safety concerns, the electrical, mechanical, and communication systems are required to operate with a significant degree of reliability. The following standards are required in the design and construction and the operations and maintenance documents:

- ▶ **Electrical power supply**—99.995 percent availability
- ▶ **Fire detection and suppression systems**—99.995 percent availability
- ▶ **Communication and closed-circuit television systems**—99.99 percent availability
- ▶ **All control systems**—99.995 percent availability
- ▶ **Ventilation system**—99.95 percent availability
- ▶ **Lighting systems**—99.95 percent availability

The standards are intended to lead to designs that have redundancies and no single-point-of-failure components, as well as robust maintenance practices throughout the life of the concession. The systems must also comply with the Australian versions of ISO requirements for safety and risk management systems. Maintenance schedules and management systems for these components are required.

Independent Verifier

The contract calls for the appointment of an independent verifier jointly engaged by the owner and the design and construction contractor. The role of the independent verifier is to assure that the design documentation the contractor submits complies with the performance deed. The independent verifier issues a formal certification after reviewing the design plan for conformance with the project deed. The verifier performs a similar function during construction when the firm conducts inspections and issues a certification that construction conforms with the deed. The verifier also reviews payment claims and the value of work completed by the contractor.



The firm also is involved in settling disputes between the owner and contractor, and it certifies whether all major milestones have been met and time extensions are warranted. The verifier is required to act independently of the owner, the contractor, the security trustee, and their associates.

The design of the tunnel and its communications, ventilation, and fire suppression systems are required to receive an independent assessment during the design phase of the project. The independent assessment by a competent safety assessment firm is intended to certify that the fire identification, suppression, and evacuation systems meet standards for safe facility operation.

5.3.2 Remedies and Dispute Resolution for Poor Design and Construction Work

Remedies for poor design and construction work serve the same purpose as those used for poor operations and maintenance work: to keep the project on schedule and repair damaged or problematic work. Because failing to meet design and construction standards has a severe impact on project schedule and budget, applying remedies to this phase of the project is a serious issue. Because of this, it is common to find an owner executing these remedies sooner and more strictly than in the operations and maintenance phase of the project. Some remedies the owner is able to execute change across project and country, but the common remedy is the step-in right of the owner. Because problems and issues may surface on project work or the execution of these remedies, each contract provides a dispute resolution procedure for design and construction to resolve issues to a level that

both parties can agree on to keep the project on schedule and on budget.

Table 22 summarizes the KPIs and related contract provisions for remedies and dispute resolution procedures for poor design and construction work. Example contract language is in the text that follows.

I-595 Corridor Improvements Dispute Resolution Procedures

The dispute resolution procedure for the I-595 agreement begins with both the concessionaire and the department agreeing to resolve disputes as quickly as possible without involving a third party. However, if a dispute cannot be resolved at this level, the issue will move to the disputes review board elected for the contract. The review board will be given the evidence and documentation necessary from both parties to make a fair and accurate recommendation. Any evidence given to the board will be circulated to all players involved in the dispute. After the board recommends a resolution, each party will determine whether it wishes to appeal the recommendation. If either party decides to appeal the review board's recommendation, subsequent proceedings will take place with the initial recommendation admissible as evidence. The dispute resolution board will be responsible for handling any disputes not arising from or related to final acceptance or the performance of value added, in which cases the Regional Disputes Review Board and Statewide Disputes Review Board will handle the issues, respectively. During any dispute resolution, the concessionaire is required to continue performing all work, even in the subject area of dispute, as directed by the department.

TABLE 22. KPI information for remedies and dispute resolution procedures for poor design and construction work.

KPI Category	I-595 Corridor	Golden Ears Bridge	Kicking Horse Canyon	EastLink	Capital Beltway	North-South Bypass	M25	Airport Link
5.3 Design and Construction (D&C)								
5.3.2 Remedies and Dispute Resolution Procedures for Poor D&C Work								
Dispute Resolution Procedures	✓			✓	✓			
Remedies for Poor Work		✓	✓	✓	✓	✓		
Bond Safeguards				✓	✓	✓		



Golden Ears Bridge **Remedies for Poor Work**

The contract agreement offers remedies the ministry may execute if the concessionaire does not meet the minimum requirements in its design and construction processes or performance. If the contractor fails to perform or observe any of its obligations under the agreement, or does so in a manner that compromises the safety of the public, adjacent property, facility assets, or occupiers, the ministry issues a default notice to the contractor. Following the notice, the ministry may require the contractor to provide within 20 business days a reasonable plan and schedule for correcting the default, including details on the exact process to be used and latest date the correction will be achieved. The plan must be submitted to the ministry and approved before the program can begin because a plan may not be deemed acceptable. In this case, the ministry and concessionaire will work together to create a new correction plan. If the concessionaire does not correct the default according to or by the time allotted in an accepted default correction plan, the ministry may move to rectify the default itself or hire a third party to do so. In this case, the ministry has the authority to suspend any concessionaire work to begin corrective work while holding the contractor responsible for reimbursing the ministry for all costs incurred in this process. These costs include administrative fees and any legal expenses. However, if the ministry elects not to pursue such a process and the concessionaire is unwilling to correct the defaults according to plan, both the concessionaire and agreement are eligible for complete termination unless there is an objection, in which case the termination issue will be settled according to the dispute resolution procedure in the agreement.

An example of the ministry implementing such measures may be seen in a concessionaire's failure to meet the substantial completion date for the project. If substantial completion of the facility is not achieved by the target date, the ministry may require the concessionaire, within 20 business days, to provide a written plan and schedule for achieving substantial completion with details on the precise manner and latest date it will be realized. This plan and schedule must be reviewed and approved by the ministry. The concessionaire also is subject to a weekly fee of \$20,000 for each day the project exceeds the substantial completion target date. Furthermore, if the

concessionaire fails to achieve substantial completion on or before the longstop date established in the agreement, the ministry is given the authority to terminate the agreement in full unless the concessionaire elects to have the issue reviewed by the contract's dispute resolution procedure.

Kicking Horse Canyon Phase II **Remedies for Poor Work**

If any inspections, audits, or investigations of the design or construction reveal a defect in the works or at any time the concessionaire's performance does not meet the obligations in the concession's agreement, the concessionaire is responsible for notifying the province's representative about such failures. Upon notification, the province's representative may issue a default notice to the concessionaire requiring it, at its own cost, to remedy the failure and any resulting damage. The remedial period for the concessionaire is 30 days. The concessionaire must show the province its plan for corrective action and implement the plan within the 30-day period. If the concessionaire continually fails to meet obligations set in the agreement, the province's representative may issue a warning notice to the concessionaire, which may result in performance payment deductions. If either notice is issued, the province's representative may increase the monitoring of the design and construction until the concessionaire can demonstrate it is capable of performing all of its obligations under the agreement.

Furthermore, if the concessionaire foresees any event that may delay or impede the construction process and meeting of construction milestones, it is required to notify the province's representative immediately. Upon notification, the concessionaire must detail the reasons for delay and the measures it has taken to mitigate the delay consequences, while also supplying the province's representative with reasonable facilities to investigate the delay's effect on the project schedule. These investigations are likely to include onsite inspections and meetings hosted by the province's representative. If the delay is a result of a force majeure, province change, or compensation event, the concessionaire may be entitled to compensation payments for the delay. However, if the delay is a consequence of the concessionaire's own performance failures, the concessionaire may be subject to a reduction in the performance payments.



Dispute Resolution Procedures

Both parties involved in the agreement have agreed to make bona fide efforts to resolve all disputes at the lowest level of management before engaging in the formal dispute resolution process. If an issue cannot be resolved at this level, either party has the authority to write a notice of dispute for review by the independent certifier identified in the agreement. The certifier will be provided with all records and documents necessary to make an accurate and fair decision on the dispute. If the issue is not within the authority of the independent certifier or cannot be resolved at this level, it is brought before senior executives from both parties. If the dispute is resolved by the senior executives, the decision is final and will be signed by an authorized representative of both parties. However, if the senior executives are unable to resolve the dispute within 5 working days, the dispute will be referred to an expert.

For design and construction disputes that exceed resolution by the parties' senior executives, the province and concessionaire will jointly appoint a construction panel of three experts. The experts selected will determine the appropriate process for a timely and cost-effective resolution of the dispute and have the authority to inspect any project facilities to make an accurate decision. Each agreement party will bear its own cost of the resolution process by an expert. The decision made by the expert panel is final and binding and is not subject to appeal or arbitration unless the decision has a monetary consequence totaling more than \$250,000, in which case referral to resolution by arbitration may be considered.

Arbitration Procedures

The arbitration will be performed by a single arbitrator or panel of arbitrators selected by both parties and is similar to the operations and maintenance arbitration procedures for this project. The arbitrators will be provided with the necessary documents required to resolve the dispute, and both parties will be eligible to be represented by legal counsel in any of the meetings for resolution. Any witnesses selected for questioning may be examined, reexamined, and cross-examined by either party at the arbitration. Within 30 days of the arbitration, a conclusion in writing of the hearings will be sent to both parties. The decision will be final and binding unless the result awards either party an excess of \$5 million, in which case the decision may be appealed.

EastLink

Remedies for Poor Work

If the independent reviewer believes that a design and construction program is not in accordance with the contract, the independent reviewer may notify the concessionaires and the state of that opinion and the reasons for it. On receipt of a notice, the concessionaires must, as soon as practicable, revise the design and construction program to address the independent reviewer's concerns and resubmit it to the state and the independent reviewer. An updated program must incorporate all changes in activities, methods, times, or sequence of activities and the concessionaires' planned progress toward the freeway section completion date or late completion date with the same level of detail as the original design and construction program.

Dispute Resolution Procedures

See the dispute resolution procedures described in section 5.2.3 on the operations and maintenance phase.

Bond Safeguards

The project's trustee must deliver to the state up to two bonds totaling \$87.5 million. Without limiting the unconditional nature of the construction bond, the state may demand any amount that (1) the state considers, or at any time may become, due from the concessionaire under a project document or (2) the state has incurred in connection with any default, wrongful act, omission, or failure to comply with an obligation or liability.

Capital Beltway

Generally, the concessionaire is responsible for monitoring and managing design and construction activities in accordance with the comprehensive agreement's conditions and standards and the conditions and standards established in the separate design-build agreement between the concessionaire and its design-build contractor. The agreement between VDOT and the concessionaire is the principal contract, and the design-build agreement is a subcontract between the concessionaire and its design-builder. VDOT has specific remedies for design and construction deficiencies, spelled out in Section 7.19, Section 8.07, Section 14.01, Section 14.04, and Articles 16 and 17 of its agreement with the concessionaire, and a dispute resolution process, delineated in Section 17.06.



Remedies for Poor Work

In the design-build agreement between the concessionaire and its design-builder, the concessionaire has a variety of remedies available to handle defects or poor work during design and construction. These include, but are not limited to, performance guarantees, warranty periods, and termination for cause.

Dispute Resolution Procedures

The design-build agreement has its own dispute resolution process. Any unresolved dispute between the concessionaire and the design-builder exceeding \$1 million shall be submitted to binding arbitration, as detailed in Section 19.1 of Exhibit F of the comprehensive agreement.

If any issue in dispute between the parties to the design-build agreement is also the subject of a concurrent dispute under the comprehensive agreement, the parties shall consolidate the dispute with the dispute resolution process occurring under the comprehensive agreement. If consolidation does not occur, any ongoing proceeding on the dispute shall be stayed pending final resolution of the dispute under the comprehensive agreement.

Letter of Credit

The design-build contractor must provide the concessionaire with a letter of credit from a qualified issuer equal to 7.5 percent of the contract sum as additional security for the contractor's performance of its obligations. Adjustments in these terms occur at substantial completion of the new HOT lanes and substantial completion of the entire project, as detailed in Section 4.9 of Exhibit F of the comprehensive agreement.

CLEM7 North-South Bypass Tunnel Bond Safeguards

In addition to the management systems, management plans, independent verifier, and audits, the contracts require performance bonds for the design and construction, operations and maintenance, and project handover phases. The design and construction bond is \$5 million. The concessionaire agrees not to enjoin the council from collecting on its bond and the council can use the proceeds of the bond as it desires if the design and construction plans are not produced or are deficient after a period of notice and opportunity for correction.

5.4 Handback Requirements and KPI Evolution

Public-private partnership agreements involve a handback requirement section to ensure the project will be handed over to the owner in a functional and healthy state after a long concession. These requirements generally target the remaining design life of different project elements, such as pavement and structure condition and ITS equipment functionality. Owners set a standard in these requirements that work will not have to be done on the handed-back project for a certain time period, generally 5 years. These requirements hold the concessionaire accountable for the operations and maintenance performance measures included in the contract during the concession period. The project will not be accepted for handback unless the concessionaire meets all the design life requirements. If not, the concessionaire is required to remedy the design life issues.

Table 23 summarizes the KPIs and related contract provisions for the handback requirements and KPI evolution. Example contract language is in the text that follows.

I-595 Corridor Improvements Handback Management

Before the project is handed back to the department after the concession term, the concessionaire must guarantee that it will be returned in a good and operable condition. This means all project elements in the operations and maintenance limits must comply with all handback requirements. One requirement is for the concessionaire to develop a capital replacement plan for all project equipment, systems, and assets to be replaced, overhauled, refurbished, or rehabilitated over the term. As part of the plan, the concessionaire must rehabilitate any asset that has reached the end of its design life or no longer functions correctly. The capital replacement plan will be developed jointly by the concessionaire and the department using the as-built drawings and inspection results during the last 5 years before handback to determine the performance of all project components. Moreover, the two parties will also work jointly to develop a handback evaluation plan that will be used to determine the condition, performance, and residual life of project assets. This determination process involves inspection



and testing processes. These processes and criteria are prepared by the concessionaire using a table provided in the contract as a guideline (see table 24). Finally, a handback renewal work plan will also be developed 5 years before the end of the term. This plan identifies the concessionaire’s plan for repairing, replacing, or renovating assets in response to the testing and inspection criteria results.

One handback requirement for this project is that the concessionaire must provide maintenance training to the department personnel who will take over operations and maintenance responsibility after the concession term ends. The concessionaire also must also provide all software, special tools, special equipment, and ITS spare parts and assemblies purchased to support the operations and maintenance work.

TABLE 23. KPI information for handback requirements and KPI evolution.

KPI Category	I-595 Corridor	Golden Ears Bridge	Kicking Horse Canyon	East Link	Capital Beltway	North-South Bypass	M25	Airport Link
5.4 Handback Requirements and KPI Evolution								
Handback Management	✓	✓	✓	✓	✓	✓		✓
Handback Bond				✓	✓	✓		
Changing KPIs Throughout the Agreement Term						✓		✓

TABLE 24. I-595 example handback requirements.

Asset Description	Asset Subsystem Description	Handback Evaluation Tasks	Handback Evaluation Criteria	Life Remaining at Handback (Years)
Rigid Pavement	Pavement section within O&M limits (operating period)	Inspection is in accordance with FDOT Performance-Based Specification 355 (value-added portland cement concrete pavement and FDOT’s <i>Rigid Pavement Design Manual</i> and <i>Rigid Pavement Condition Survey Handbook</i>).	Perform rehabilitation of the pavement to obtain a rigid distress rating of greater than 8.5 and rigid ride rating of greater than 7.5.	N/A
Bridges	Within O&M limits (operating period)	Pending the results of the testing and inspection criteria, each bridge under the responsibility of the concessionaire shall have an overall condition rating of six or better. This condition rating is in accordance with the National Bridge Inspection Standards and procedure 850-010-030 (Bridge and Other Structures Inspection and Reporting) or its successor.	If any bridge structure under the responsibility of the concessionaire is found to have an overall condition rating of less than six, the concessionaire shall be responsible for making any repairs necessary to improve the condition rating to six or better. All repairs shall be of a substantial and permanent nature.	N/A
ITS	Includes all ITS subsystems, communication, and ancillary components of O&M	The concessionaire shall purchase new hardware in the final year of the program and configure, test, deploy, and deliver it for handback. The department will retain manufacturer warranties (minimum of 4-year warranty) on the hardware.	99.99% of all ITS devices are operational.	4



**Golden Ears Bridge
Handback Management**

For project handback, the ministry requires that no rehabilitation work be needed on project assets for a minimum of 5 years. This requirement is intended to protect the ministry from asset consumption during the project term and ensure that the concessionaire has met all operations and maintenance performance criteria in the agreement. The contractor must demonstrate throughout the project term, through the submittal and reviews of OMR quality management systems, that it will achieve or exceed these handback requirements.

The ministry constructed a table of handback requirement standards that the concessionaire must meet. A sample section is in table 25. It lists project assets and the required remaining life for each at handback. The remaining life for an asset included in this project is calculated by multiplying the expected service life by the life adjustment rate and subtracting the age of the asset from this value. It is intended to ensure a relatively consistent forward workload beyond the end of the project term.

**Kicking Horse Canyon Phase II
Handback Management**

Within 40 to 43 months of the expiry date for the concession of the project, both the concessionaire and the province’s representative will conduct a joint inspection termed “the initial inspection” of all elements of the project and its facilities, including pavement and structure condition. Within 60 days of

the initial inspection, the concessionaire will provide the province’s representative with a report on the condition of the project, including its proposal for renewal works, a renewal schedule, and an estimate of the renewal amount to maintain the assets of the project. The concessionaire will then begin work on renewing the project and provide progress reports to the province.

After these renewal works and within 16 to 19 months of the expiry date, the concessionaire and province’s representative will conduct another inspection termed “the second inspection” of all project elements identified in the initial inspection. Within 60 days of the second inspection, the concessionaire will provide the province’s representative with revisions or additions to the renewal works in progress. These additions or revisions must be approved by the province’s representative before they are applied.

Both the initial and second inspections set the foundation for the end-of-term inspection required before the concessionaire can receive its end-of-term certificate. Within 30 days of the expiry date, the concessionaire and the province’s representative will conduct a final joint inspection of all elements of the project and its facilities. This inspection will determine if the concessionaire has met all the renewal program agreements and if the project meets all end-of-term requirements set in the agreement. If the inspection reveals the concessionaire has complied with the renewal program, the province’s representative will issue the certificate and distribute the end-of-term payment without any deductions.

TABLE 25. Golden Ears example handback requirements.

Infrastructure Component/ Detail	Minimum Expected Design Life	Condition			Remaining Life
		Asset Preservation Performance Measures Document 3-7	Operations and Maintenance Specifications Document 3-8	Special Provisions	
Roadway Surface—Asphalt Surface	14	II	1–100	PQI >7.5** rutting <20 mm	10
Shoulders—Paved	14	II	1–100	PQI >7.5** rutting <20 mm	10
Drainage—Ditches, Watercourses	75	II	2–250		35



Contractual Provisions for KPI Evolution

Schedule 13 of the contract documents sets the general conditions and requirements for a contract change procedure. A change in performance measures or KPIs is relevant to these change procedures, so Schedule 13 gives both the ministry and the concessionaire the ability to suggest and implement different measures and indicators as the concession term advances. Technology and societal standards change with time, and a 25-year concession contract needs provisions on changing how concessionaire performance is measured. The schedule calls for negotiations on the submittal and acceptance of a new measure and price. The larger and more complex the changed measures and indicators are, the more costly and time-consuming the change procedure is.

EastLink

Handback Management

If the state requires, the concessionaire must carry out a joint inspection with the state at least 3 years before the expected expiry of the concession period and every 6 months after the initial inspection until the end of the concession period.

ConnectEast must carry out the works and implement the program agreed on under the program and costs clause to achieve proper handover or determined in a dispute resolution. It must deposit into the handover escrow account all revenue it receives (after deducting operating and maintenance expenses of the project, payments, scheduled capital expenditure, and taxes) for the last 3 years of the concession period until the handover escrow account balance equals or exceeds the estimated total cost of the works. It also must provide a bond with a face value equal to the estimated handover costs.

During the final 3 months of the concession period, ConnectEast must train personnel nominated by the state in all aspects of the operation, maintenance, and repair of the freeway and maintenance and repair of the maintained off-freeway facilities.

Handback Bond

ConnectEast must carry out the agreed-on handover program and either (1) deposit into the handover escrow account all revenue it receives (after deducting operating and maintenance expenses of the project, payments, scheduled capital expenditure, and taxes) during the last 3 years of the concession period until

the balance of the handover escrow account equals or exceeds the estimated total cost of the work identified in the program or (2) provide to the state a bond with a face value equal to the estimated handover costs.

Capital Beltway

Handback Management

At the end of the term, the concessionaire shall hand back the HOT lanes project to VDOT, at no charge to the department, with asset condition having a remaining life of greater than 5 years or life within its normal life cycle. If VDOT requests, the concessionaire must dismantle the HOT lanes toll system to convert the lanes back to general-purpose lanes, provided VDOT notifies the concessionaire at least 1 year before the end of the term that the HOT lanes are to be converted. Any dismantling of the HOT lanes toll system shall be at the concessionaire's cost.

Beginning 20 years before the expiration of the term and every 5 years thereafter, the concessionaire, VDOT, and the independent engineer will jointly conduct inspections of the HOT lanes project to (1) determine and verify the condition of all assets and their residual lives and (2) determine and revise the life-cycle maintenance plan. Beginning 5 years before the expiration of the term, the concessionaire, department, and independent engineer will jointly conduct annual inspections of the HOT lanes to ensure that the handback requirements will be met.

Handback Bond

Starting 5 years before the expiration of the term, the concessionaire shall post a 10-year irrevocable standby letter of credit or performance bond to VDOT for a period of 5 years after expiration of the term. The letter of credit or performance bond must be equal to 50 percent of the nominal life-cycle cost expended in the previous 5 years under the most recent life-cycle maintenance plan approved by VDOT. The agency would draw on the letter of credit or performance bond only if, after termination or expiration of the term, the HOT lane assets fail to address the handback requirements and in the amount required to address such failures up to the full amount of the letter of credit or performance bond.

VDOT will determine whether the HOT lane assets meet the handback requirements based on routine inspections up to 5 years after termination or expiration of the term (handback period). If the



concessionaire disagrees with VDOT's determination, the concessionaire may, at its own expense, retain an engineer to inspect the facility and review the findings of the independent engineer. Resolution of the issue will be subject to the dispute resolution process.

CLEM7 North-South Bypass Tunnel Handback Bond

The handback bond value is determined by the cost to repair the facility to bring it into compliance with the specified handover conditions. Maintenance and operations features need to be in a condition specified in the O&M best-practice manual. Larger capital items, such as the tunnel, pavements, structures, and mechanical and electrical components, must meet a residual design life requirement. The residual design life generally is one-half of the design life. The design life is specified in the engineering design requirements. Three years before handover, an inspection will determine the value of the repairs necessary to meet the handover conditions. The concessionaire has the option of making the repairs, contributing all toll receipts during the last 3 years of the contract to pay for the repairs, or providing a bond to fund the repairs.

Changing KPIs Throughout the Agreement Term

In the CLEM7 North-South Bypass Tunnel, the key results areas and KPIs are used to assess compliance with the contracts over their life. The KPIs are the apex of a very large pyramid of performance mechanisms that include the management systems, management plans, audits, performance bonds, and activities of the independent verifier. While the KPIs are a primary mechanism for ensuring contract conformance, they are part of a larger system.

Four general, overriding outcomes are desired from the KPIs:

- ▶ Operate and maintain the CLEM7 North-South Bypass Tunnel to ensure its safe, continuous, and efficient operation.
- ▶ Ensure high levels of customer service to maintain the attractiveness of the CLEM7 North-South Bypass Tunnel and its part in the overall network.
- ▶ Maintain and repair all tollroad assets to ensure that the specified residual design life requirements are achieved at handover.

- ▶ Continually improve the standards and quality of the operations and maintenance services through benchmarking and the incorporation of technology advancements.

The concept of continuous improvement is ingrained into the operations and maintenance plan, asset management system, communication and consultation plan, and other aspects of the contracting system. Although the KPIs in the project deed will not change without a formal renegotiation of the contract, many other performance metrics, standards, and service levels are expected to be dynamic. The contract language notes that over the life of the project, materials, technology, techniques, strategies, and practices are likely to improve. The contract is designed to encourage the incorporation of such improvements into the operation of the facility. Therefore, the core KPIs tend to be outcome-based and not prescriptive on means and methods. The means and methods are expected to become more efficient and responsive over time, at least as envisioned by many of the contract objectives.

Airport Link Handback Requirements

The management systems and operating practices are intended to keep the facility in sound condition throughout the life of the project and to ensure that the residual design life requirements can be met at the handover point. Before handover, a series of inspections by independent firms are required on the major aspects of the project and its components. Inspections are to certify that the condition and residual service life conditions are being met. The project includes \$20 million in required bonds that can be used for many purposes, including ensuring that the facility is in proper condition at the handover point.

Assets are required to be built, maintained, rehabilitated, and replaced throughout the 45-year concession period so that all assets have 50 percent of their residual service life remaining at the end of the contract period.

Changing KPIs Throughout the Agreement Term

Inherent in the contract documents are several continuous improvement provisions that are based on the assumption that over time technology, materials, and strategies should improve. Five years after



the facility begins operation, the operator and the state are allowed to renegotiate the KPIs to recalibrate them. For the first 6 months of operations, demerit points are discounted by 50 percent. They are discounted 25 percent in months 7 through 12 and are in effect 100 percent 12 months after opening.

5.5 Conclusions

Chapter 5 of this report summarized the data collected from the content analysis of the PPP case study agreements and interviews with the project team members. The operations and maintenance data present the richest set of KPI examples. While KPI examples are also included for design, construction, and handback requirements, the majority of information in these analyses stems from performance requirements in the contract agreements and are not KPI examples per se. The information is helpful in determining trends across the case studies. Chapter 6 presents the interpretation of the overall results and conclusions from the findings.



Chapter 6: CONCLUSIONS

6.1 Introduction

The literature review, case studies, and interviews with agency and private sector personnel provided the basis for the research results and conclusions. The central theme of the results focuses on the alignment of broad agency performance measures with PPP project KPIs. All of the agencies involved in this study are evolving and working toward this goal, but no one model for ultimate achievement exists.

This section presents the conclusions, which are aimed at summarizing the state of practice in applying KPIs on PPP projects. A concise set of recommendations is also provided to help agencies apply performance-based management systems to align these PPP projects with their long-term network management strategies.

6.2 Conclusions

6.2.1 Alignment of Agency Goals With Performance Measures and PPP Project KPIs

Ideally, agencies will be able to link their higher level goals with performance measures and individual PPP KPIs. These higher level performance measures typically deal with network operations and societal goals. For example, AASHTO strongly promotes reform for the entire U.S. highway system centered on reaching six key national interests.⁽⁶⁾ AASHTO is in the process of developing and establishing these broad agency goals on construction safety, mobility, and stewardship of the entire U.S. highway system. These six key national interests appear to reflect the interests of American society and address the public's major concerns about and views of the transportation system. If the reform is accepted and implemented, AASHTO believes that every highway agency in the United States will be capable of and held accountable for producing results that reflect and work toward realizing these goals. For the system to be effective, accountability has been established as the driving force behind performance management. Therefore, accountability must be transferred from the concessionaire to the agency via PPP contracts, and from the agency to society via public outreach tools and

achievement of positive results. The challenge for each PPP is to link project KPIs to these higher level agency goals.

In general, none of the agencies or projects has completely achieved a seamless alignment of project performance measures and KPIs with its overarching agency goals. The largest challenge in this alignment is the evolving and dynamic nature of both the agency goals and the project performance measures. The evolving nature of performance measures is most apparent in the United States, where only a few agencies have mature performance measurement systems. In Australia and England, where the use of performance measures and PPP contracts is more evolved, the alignment of these measures is more apparent. The Highways Agency in the United Kingdom is perhaps the most progressive. It is moving toward negotiating KPI terms in agreements instead of mandating them in procurement documents through prescriptive means.

The Highways Agency provides one of the more advanced examples of linking agency performance measures to PPP KPIs. As the network's manager, the Highways Agency conducts its business differently than a typical U.S. department of transportation. Quite simply, the Highways Agency's principal focus is on its customers. Accordingly, its aim is "safe roads, reliable journeys, informed travelers." These three principles guide all agency efforts. This aim is manifested in several agency objectives:

- ▶ Reduce congestion and improve reliability.
- ▶ Improve road safety.
- ▶ Respect the environment.
- ▶ Seek and respond to feedback from customers.

To deliver on its aim and objectives, the Highways Agency has established seven key program-level performance measures:

- ▶ **Reliability**—Implement a program of delivery actions that tackle unreliable journeys on the strategic road network.

- ▶ **Major projects**—Deliver on time and budget the program of major schemes on the strategic road network.
- ▶ **Safety**—Deliver the Highways Agency’s agreed proportion of the national road casualty reduction target.
- ▶ **Maintenance**—Maintain the strategic road network in a safe and reliable condition, and deliver value for money.
- ▶ **Carbon emissions**—Contribute to national and international goals for reducing carbon dioxide emissions by lowering the Highways Agency’s emissions.
- ▶ **Customer satisfaction**—Deliver a high level of road user satisfaction.

- ▶ **Efficiency**—Deliver the Highways Agency’s contribution to the Department for Transport’s efficiency target.

Across its network, the Highways Agency has enacted a number of initiatives to deliver on its aims and objectives, and it uses the performance measures to guide and monitor its actions at both programmatic and project levels. Figure 17 provides an overview of how the Highways Agency translates its broader goals into PPP project performance measures and links them with the payment mechanisms used in these contracts. This figure indicates the most current thinking because it corresponds to the structure of the performance measures and the payment mechanism in the agency’s most recent (and largest) PPP project, the M25 enhancement.

6.2.2 Dynamic Nature of Performance Measures and KPIs Over Time

Some cases illustrate the necessity of a dynamic approach to performance measurement because service or asset requirement expectations are likely to change over time. In some instances, the measure and the indicator used have an inherent ability to evolve because the indicator is oriented toward trends in particular measures, while in other instances provisions are put in place to modify measures over the contract period.

In the CLEM7 North-South Bypass project, for example, the owner’s complex obligations under state and federal environmental laws are effectively shared with the PPP because of a requirement that the PPP develop a comprehensive environmental management plan that conforms to ISO environmental certification practices. The plan must include KPIs to indicate ISO compliance. In addition, the PPP is required to abide by the requirements of and to consult with the numerous environmental agencies with which the owner would normally interact. Compliance with environmental statutes and commitments is among the environmental performance indicators that the PPP must enumerate in its environmental compliance plan.

The system must be flexible at the performance measurement level. In British Columbia, the Ministry of Transportation developed a clear set of strategic goals to (1) maintain highways to a high standard through contracts with private sector road maintenance providers and (2) manage funding for

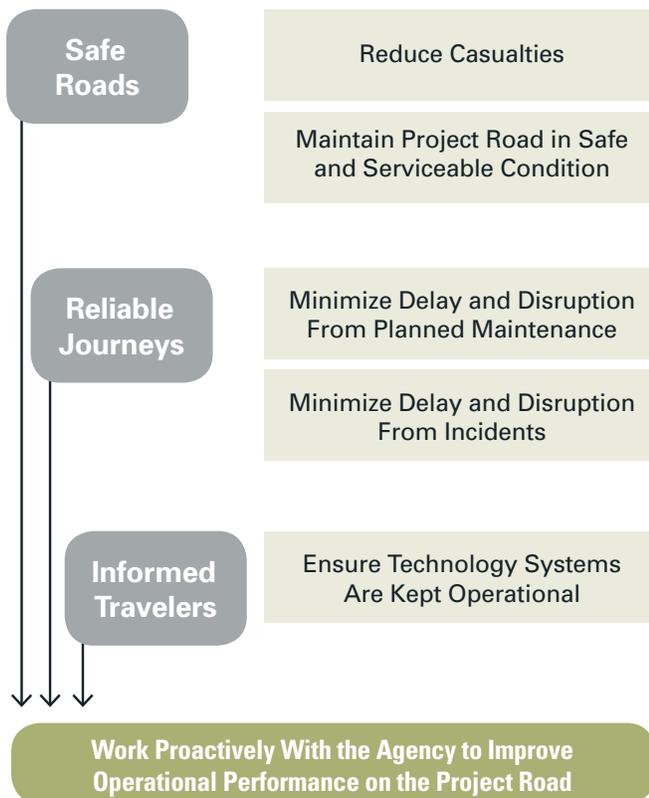
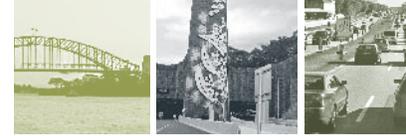


FIGURE 17. Linkage between agency goals, performance measures, and KPIs in the Highways Agency.



high-quality, modern public infrastructure that supports the development of strong communities by contributing to long-term economic growth and a clean environment. However, these goals were established after the execution of the Kicking Horse PPP agreement. For example, the transportation sector goal on reducing greenhouse gas emissions was not contemplated in the original project KPIs.

However, the contract does have provisions to make changes in the project KPIs so these goals can be met.

The system must also be flexible at the KPI level. The Florida I-595 project provides numerous examples of how PPP project data are tied to agency performance management systems. Table 26 is an excerpt from the KPI tables in the PPP agreement. The measurements

TABLE 26. Examples from FDOT I-595 KPI table.

Element Category	Required Task	Minimum Performance Requirements	Cure Period	Interval of Recurrence
Highway Running Surfaces: Pavement				
Category 1 Pavement (0–3 Years After Substantial Completion)	Maintain flexible pavement at acceptable level of safety for traveling public.	Meet the performance requirements set forth in Division II, Section 6 of the Technical Requirements for the following:		
		• Rutting maintained at less than a depth of 0.25 inches	90 days	Every 5 days
		• Ride maintained at a ride number (RN) greater than 3.5	90 days	Every 5 days
		• Settlement/depression at maximum depth of 0.5 inches	7 days	Daily
		• Cumulative length of cracking >30 feet for cracks >0.125 inches in a 0.1-mile lot	90 days	Every 5 days
		• Raveling and/or delamination of the friction course as defined and determined by the department in accordance with the examples at www.dot.state.fl.us/specificationsoffice/pavement.htm or its successor	90 days	Every 5 days
		• Potholes and slippage areas no greater than 0.5 square feet in area and 1.5 inches deep	24 hours	Hourly
Intelligent Transportation Systems				
ITS Operations	Monitor time required for roadway clearance.	I-595 express lanes quarterly average roadway clearance duration (in minutes) must be no more than 90% of FDOT District Four's ITS performance measures published quarterly at www.smartsunguide.com .	0	N/A
	Monitor time required for incident clearance.	I-595 express lanes quarterly average Incident/event clearance duration (in minutes) must be no more than 90% of FDOT District Four's ITS performance measures published quarterly at www.smartsunguide.com .	0	N/A



for the raveling and/or delaminating of the friction courses for the running surfaces are tied to online specifications. These items will change over time, and the PPP project will therefore be aligned with the other elements of the FDOT network. Similarly, the ITS KPIs are tied to a larger ITS program across Florida.

6.2.3 Alignment of Performance Data With Agency Performance Management System

As U.S. highway agency performance management systems continue to mature, PPP performance data will need to be integrated with these systems to ensure optimal network operations. It is important to collect performance data during the concession period in a manner consistent with the agency's network management approach. This implies that these data will also be used to verify PPP performance. The alignment of these measures is challenging. As these systems evolve, PPP project data collection formats and reporting structures will also need to evolve to be consistent with the overall network management approach.

An example can be found in the operations, maintenance, and rehabilitation Schedule 2 of the Golden Ears Bridge contract. The ministry requires an explicit standard for the concessionaire in collecting asset condition data as follows:

The Concessionaire is responsible for collecting annual pavement condition data for the purposes of asset management and measuring performance achievement. The annual data collection is required to be conducted in accordance with Ministry specifications for network level automated pavement surface condition surveys. All collected data must be provided to the Ministry for input into their pavement management system as per the prescribed Ministry specified data file formats.

6.2.4 Use of Asset Management Plans in Addition to KPIs

While specific performance measures or key performance indicators are used to categorize and track the quality of operations and maintenance services, the asset management plans proposed at selection time, agreed to at contract close, and modified (per contract provisions) over the contract period are clearly a significant dimension of the overall approach to asset management in a PPP arrangement.

In the Kicking Horse Canyon Phase II PPP, for example, the asset management plan includes elements such as a description of the how the KPI will be achieved, the intervention criteria for each indicator, and the approach for asset condition inspection and work identification. The plan is used to track all routine maintenance activities and the condition and disposition of the highway pavement assets.

The Airport Link and CLEM7 North-South Bypass Tunnel projects provide good examples of asset management plan application. While priority concerns from the state transportation plans are mirrored in the contract documents for the projects, the contract documents do not rely solely on a set of KPIs to ensure that the concessionaire fulfills the state's strategic objectives for the project. Instead the contracts rely on a more comprehensive approach that requires the concessionaire to develop management plans and systems for all major aspects of the projects' planning, design, construction, maintenance, operation, toll collection, and community relations. At least 28 management systems or management plans are required for the projects, while only 19 individual KPIs are explicitly stated in the contract documents. Outside audits and an independent verifier are

At least 28 management systems or management plans are required for the projects, while only 19 individual KPIs are explicitly stated in the contract documents.

required as part of the contract to attest to the Brisbane City Council and Queensland that the many provisions of the management systems and plans are being followed. At least three management systems—project, environmental, and health and safety—must comply with the Australian provisions of ISO for the management systems. Also, a minimum of three performance bonds are required to ensure adherence to the performance specifications. These include bonds for design and construction, operations and maintenance, and tollroad condition at handover. Although KPIs are included in the project contracts, they comprise only a small part of the oversight framework for the complex, multi-phased projects. For example, all 19 KPIs explicitly referenced in the contract documents relate to the



operations phase, and none relate to the design and construction phase.

6.2.5 Focus on Outcomes Rather Than Outputs

The agencies are evolving performance measures to use in internal operations and with contractors' measures. Increasingly, these measures focus on outcomes rather than outputs. In some cases, this evolution has shifted from the agency promulgating a lengthy set of prescriptive measures to negotiating key outcomes. This negotiation provides the local government or contractor more latitude in how to achieve results, as opposed to dictating that the contractor or local government achieve many detailed performance indicators. The consensus is that simply measuring and collecting data outputs do not achieve results. This is because performance measures and indicators must be developed, measured, and understood with a strong motivation to apply the data to achieve outcomes that significantly impact agency goals. Data application comes through development (and in some cases redevelopment, depending on performance data collection) of effective asset management plans that reflect the indicator results.

For example, travel time reliability appears to be a central performance outcome desired by the owners of these projects. While in the early years of PPP projects contractors may have been compensated for asset condition and travel volumes, now travel reliability has become a prime consideration. Reliability is measured through hourly, real-time calculations of not just travel speed, but also variability in travel speed. The contracts appear to incentivize advanced operations strategies to avoid delays during maintenance and respond quickly to incidents.

6.2.6 Emphasis on Service Requirements Versus Asset Condition

Specific performance measures and KPIs used across the cases vary, but more recent cases illustrate more emphasis on service requirements than asset condition. In the CLEM7 North-South Bypass Tunnel project, for example, the project deed includes generic performance requirements, but requires the concessionaire to develop service plans, maintenance manuals, and quality plans to ensure acceptable service levels. In the communication and consultation management plan, the concessionaire is required to develop and implement an ongoing process for community consultation. The plan calls for "open

and individual" response to community information needs as those needs evolve over the 35-year concession period. The plan includes not only communication channels, but also an oversight panel tasked with updating the communication process throughout the project's life.

6.2.7 Use of Incentives (Positive and Negative)

Incentives used are positive and negative, with the latter appearing to be more prevalent. In general, positive incentives are more associated with overall contractor performance, whereas negative incentives are more associated with compliance with specified service or asset requirements. Some projects include a strong emphasis on incentives for outcomes, such as rewarding the availability of travel lanes. Penalties and payment deductions are also included, but the contract emphasizes rewards for performance above negotiated minimums.

For example, the Highways Agency has moved toward the use of incentives to align the PPP contractor with overall agency goals. The overall intent of the KPIs in the M25 PPP is to incentivize the contractor to exceed minimum conditions of safety, condition, and reliability. As previously described, the three key outcomes the department seeks are safe roads, reliable journeys, and informed travelers. The incentives are tied to achieving these strategic outcomes.

While the Highways Agency has moved toward the use of positive incentives, the majority of case studies showed the application of negative incentives. Table 27 (see next page) is an example from the Capital Beltway performance point approach. The accumulation of performance points will result in the negative incentives of increased monitoring by the department, development of a remediation plan to be submitted to the department, or more serious legal actions.

6.2.8 Creating an Asset Management Culture

A theme in all of the case studies is to create an ongoing asset management culture in the PPP organization that seeks to provide a high level of service during the life of the contract and that appears to preserve a substantial remaining service life at the handback point. For example, the state and the Brisbane City Council ensure that sound infrastructure conditions are maintained by the concessionaires on the CLEM7 North-South Bypass Tunnel, but they do not achieve that assurance by imposing a lengthy list



TABLE 27. Capital Beltway performance point approach.

Category	Cure Periods	Assessment of Performance Points
A	Cure period shall be deemed to start on the date the concessionaire first obtained knowledge of, or first reasonably should have known of, the breach or failure. For breach or failure not later than the date of delivery of the initial notice to the concessionaire, as described in § 8.16(a) of the agreement.	Provided that the breach or failure is not cured, performance points shall be assessed first at the end of the first cure period and again at the end of agreement period. Subsequent cure period is as described in § 8.16 of the agreement.
B	Cure period shall be deemed to start from the date on which the breach or failure occurred, whether or not an initial notice has been delivered to the concessionaire, as described in § 8.16(a) of the agreement.	Performance points shall first be assessed on the date of the initial notification under § 8.16 of the agreement (the start of the first cure period). Provided that the breach or failure is not then cured, performance points shall be assessed again at the end of the first and each subsequent cure period.
C	No cure period applicable	Performance points shall be assessed on the date of the initial notification under § 8.16 of the agreement.

of KPIs to address each roadway component during the 40-year contract. Instead, they require the creation of asset management and maintenance management systems, which must ensure that the projects remain in sound condition through each year of their contract life. The contract strategy for ensuring serviceability at the project handover is to require a remaining service life of about 50 percent for each asset component. Throughout the project’s life, the oversight of the independent verifier and other auditors is the principal means to gauge the adequacy of the asset and maintenance management efforts.

Review of the contract documents for the CLEM7 North-South Bypass Tunnel and Airport Link indicates that KPIs are only one component of the strategy to ensure quality. Other components include the following:

- ▶ Performance bonds
- ▶ Management systems
- ▶ Hiring of an independent quality manager
- ▶ KPIs
- ▶ Audits of performance and finances
- ▶ Oversight of the independent verifier and other verifiers, such as the construction verifier

The clear communication of performance measures and the use of KPIs are only part of creating an asset management culture. The agencies must take a

long-term and holistic asset management approach to ensure this culture.

6.2.9 Opportunity for More Use of KPIs in Design and Construction

While the use of KPIs for operations and maintenance is pervasive in this study, the application of performance measurement during design and construction is noticeably absent in the case study projects. Given that many PPP projects are upgrades to existing networks, there is an opportunity to apply KPIs to measure network performance during design and construction. The broad agency performance measures should apply to projects during design and construction as they do during operations and maintenance. As performance-based management systems mature, they can be broadened to cover design and construction of PPP projects and more traditional forms of project delivery. Table 28 presents example KPIs from operations and maintenance that could be used in construction.

Most highway construction is done under traffic conditions, which provides the opportunity to apply operations and maintenance KPIs during construction. Application of these KPIs will help align design and construction teams with agency performance measures and societal goals.

6.2.10 Focus of Handback Provisions

Handback provisions are generally asset focused and rely almost exclusively on residual service life



specification. This practice introduces a tremendous auditing effort at the end of the contract and the potential for disputes. The nature of these provisions also tends toward negative, compliance-oriented incentives. Table 29 provides an example of handback provisions from the Golden Ears agreement.

Handback requirements generally require the concessionaire to develop a capital replacement plan for all project equipment, systems, and assets to be replaced, overhauled, refurbished, or rehabilitated over the term. As part of the plan, the concessionaire must rehabilitate any asset that has reached the end of its design life or does not perform correctly. The capital replacement plan will be developed jointly by the concessionaire and the department using the as-built drawings and inspection results during the last 5 years before handback to determine the functionality of all project components.

6.3 Application of Key Findings to Other Delivery Methods

Although the results of this research focus on PPP delivery, the results have potential application to multiple delivery methods. Table 30 (see next page) conveys how the key findings from this research relate to three other project delivery methods: design-build, design-bid-build, and maintenance contracting. The majority of the findings apply to all four delivery methods. The findings that do not apply to design-build and design-bid-build are those that are most applicable to long-term projects.

The delivery of maintenance through term maintenance contracts is relatively new in the United States. The majority of findings from this project apply directly to term maintenance contracts. The alignment of agency goals, alignment of performance data, use

TABLE 28. Capital Beltway performance point examples.

Heading	Subheading	Breach or Failure	Category	Cure Periods	Max Points
Communication	Public information	The concessionaire issues information to the public or in news releases, through variable message signs or other means, that is factually incorrect.	C	None	5
Operation	Work zone management	The concessionaire fails to meet requirements of I&IM 241 on work zone safety, management, maintenance of traffic, and diversion routes for regular maintenance during operations.	B	60 minutes	5
Inspection	Quality of inspection	The concessionaire fails to identify material defects in the inspection reports, life-cycle maintenance plan, or work currently undertaken.	C	None	5

TABLE 29. Golden Ears example handback requirements.

Infrastructure Component/Detail	Minimum Expected Design Life	Condition			Remaining Life
		Asset Preservation Performance Measures Document 3-7	Operations and Maintenance Specifications Document 3-8	Special Provisions	
Roadway Surface—Asphalt Surface	14	II	1–100	PQI >7.5** rutting <20mm	10
Shoulders—Paved	14	II	1–100	PQI >7.5** rutting <20 mm	10
Drainage—Ditches and Watercourses	75	II	2–250		35



TABLE 30. Application to other delivery methods.

Key Findings	Public-Private Partnerships	Maintenance	Design-Build	Design-Bid-Build
Alignment of agency goals with performance measures and project KPIs	✓	✓	✓	✓
Dynamic nature of performance measures and KPIs over time	✓	✓		
Alignment of performance data with agency performance management system	✓	✓	✓	✓
Use of asset management plans in addition to KPIs	✓	✓	✓	✓
Focus on outcomes rather than outputs	✓	✓	✓	✓
Emphasis on service requirements versus asset condition	✓	✓		
Use of incentives (positive and negative)	✓	✓	✓	✓
Creation of an asset management culture	✓	✓		
Opportunity for more use of KPIs in design and construction	✓	✓	✓	✓
Focus on handback provisions	✓	✓		

of asset management plans, and creation of an asset management culture are the findings that most obviously translate from PPP to maintenance contracting situations. Similar to long-term concessionaires, maintenance contractors are vital to network operations and their agreements should reflect this integration. If the lengths of maintenance contracts are significant (i.e., more than 5 years), the dynamic nature of KPIs and handback provisions should be considered in the maintenance contracts as well.

Although design-bid-build and design-build contracts are much shorter in duration and do not have maintenance components, the majority of the PPP research results apply. During design and construction, engineers, contractors, and design-builders impact the network. To the most reasonable extent, the goals of the design and construction team should be aligned with the goals of the agency. Their work will likely be done on highway assets that are in operation. The use of KPIs during design and construction can help mobility during construction and feed the agency’s performance management system in real time. As projects grow and builders are provided with more control over design and construction (i.e., through design-build delivery and performance specifications), the results of this research become more applicable.

6.4 Recommendations

This study offered considerable insight into the evolution and application of performance measurement for PPP projects. Obvious trends toward the application of performance-based management systems were found in many sectors, including transportation. Examination of the PPP agreements showed trends in how agencies mandate performance measures and KPIs while allowing for flexibility in changes that will occur over the agreement term. The case studies demonstrate the viability of PPP projects for meeting critical infrastructure needs. The interviews with agency officials also provided insights into how agencies and projects have evolved over time to better meet the goals of their customers and society.

The results of this study can be summarized in the following recommendations gleaned from literature, case study document analysis, and interviews:

1. Align project performance measures and KPIs with overarching agency goals.
2. Plan for the dynamic nature of performance measures throughout the PPP life cycle and handback.



3. Do not rely completely on KPIs to align agency goals and project performance, but strive to create an asset management culture through asset management plans that are continuously improved throughout the concession period.
4. Similarly, keep the number of programmatic and project-level measures and indicators to a manageable number. Focus on measures and indicators that result in outcomes rather than simply data outputs.
5. Consider asset management plans during procurement and concession agreement negotiation.
6. Continue to develop and apply KPIs during design and construction to help align all types of projects to agency goals.
7. Explore outcomes-based handback provisions rather than compliance-oriented means.
8. Recognize that KPIs are not the only means of ensuring contract compliance during decades of design-build-operate-and-maintain projects.
9. Focus on customer needs and societal goals in addition to asset condition.
10. Unique agency locations and user demands necessitate unique agency goals, performance measures, and strategies, which are developed most effectively by involving upper management, stakeholders, community, and end users in the process.

Endnotes

- ¹ MacDonald, Douglas, Yew, Connie, Arnold, Robert, Baxter, John, Halvorson, Randall, Kassoﬀ, Hal, Meyer, Michael, Philmus, Ken, Price, Jeffrey, Rose, Douglas, Walton, Michael, and White, William (2004). *Transportation Performance Measures in Australia, Canada, Japan, and New Zealand* (FHWA-PL-05-001). Federal Highway Administration, Washington, DC, 1–84.
- ² Measurement Working Group (2007). *Area Performance Indicator (API) Handbook*. Highways Agency, England, 1–60.
- ³ California Department of Transportation, Division of Transportation of Planning and Office of State Planning (2006). *California Transportation Plan 2025*. California Department of Transportation, Sacramento, CA, 1–75.
- ⁴ Transportation Research Board (2003). *A Guidebook for Developing a Transit Performance-Measurement System*. Washington, DC, 1–383.
- ⁵ Booz, Allen, Hamilton (2008). *Relationships Between Asset Management and Travel Demand*. Federal Highway Administration Office of Asset Management, Washington, DC, 1–99.
- ⁶ American Association of State Highway and Transportation Officials (2008). *AASHTO Authorization Policy Topic I Performance Management*. Washington, DC, 1–230.
- ⁷ American Society of Civil Engineers (2009). *Report Card for America’s Infrastructure*, www.infrastructurereportcard.org/report-cards.
- ⁸ American Association of State Highway and Transportation Officials (2007). *State DOT Performance Management Programs: Select Examples*. Washington, DC, 1–28.
- ⁹ Simeone, Ronald, Carnevale, John, and Millar, Annie (2005). “A Systems Approach to Performance-Based Management: The National Drug Control Strategy.” *Public Administration Review*, 65(2), 191–202.
- ¹⁰ Watson, Gregory H. (2005). “Design and Execution of a Collaborative Business Strategy.” *Journal for Quality and Participation*, 28(4), 4–9.
- ¹¹ Missouri Department of Transportation (2009). *Tracker: Measures of Departmental Performance*. Jefferson City, MO, 1–233.
- ¹² Gunaratne, Asoka K., and Plessis, Andries J. du (2007). “Performance Management System: A Powerful Tool to Achieve Organizational Goals.” *Journal of Global Business and Technology*, 3(1), 17–28.
- ¹³ Zwan, J. Th. van der (2003). “Functional Specifications for Road Pavements—A Question of Risk Assignment.” XXIIInd PIARC World Road Congress Proceedings, Durban, South Africa, October 19–25, 2003.
- ¹⁴ Miller, John (2005). “A Practical Guide to Performance Measurement.” *Journal of Corporate Accounting and Finance*, 16(4), 71–75.
- ¹⁵ Page, Sasha, and Malinowski, Chris (2004). “Top 10 Performance Measurement Dos and Don’ts.” *Government Finance Review*, 20(5), 28–32.

Appendix A: ANNOTATED BIBLIOGRAPHY

» Journal Articles

Gunaratne, Asoka K., and Plessis, Andries J. du (2007). "Performance Management System: A Powerful Tool to Achieve Organizational Goals." *Journal of Global Business and Technology*, 3(1), 17–28.

The authors reveal performance management as a system and not simply a once-a-year meeting to review the past year's performance and set goals for the next year. This article discusses a performance management system employed by a Fortune 500 company, how its employees rated the individual facets of the system, and their overall satisfaction with the total system after 5 years of implementation. It elucidates how the organization aligned the performance management system and articulated the company business objectives to individual goals.

Miller, John (2005). "A Practical Guide to Performance Measurement." *Journal of Corporate Accounting and Finance*, 16(4), 71–75.

The author emphasizes the role controllers, chief financial officers, and cost managers play in setting the overall performance measurement requirements in an organization and providing guidance in developing useful performance measures. Also presented is a generic performance management cycle consisting of (1) strategic planning and management to develop longer term business objectives and (2) short-term planning and budgeting to execute strategy and achieve strategic goals and accountability during the fiscal year.

Page, Sasha, and Malinowski, Chris (2004). "Top 10 Performance Measurement Dos and Don'ts." *Government Finance Review*, 20(5), 28–32.

From New York City to government entities of all shapes and sizes, the authors reveal that performance measurement continues to increase in popularity. To help governments make the most of their performance measurement efforts, the authors have compiled a top-10 list of performance measurement dos and don'ts, illustrated by case studies.

Simeone, Ronald, Carnevale, John, and Millar, Annie (2005). "A Systems Approach to Performance-Based Management: The National Drug Control Strategy." *Public Administration Review*, 65(2), 191–202.

The authors examined efforts by the Office of National Drug Control Policy to develop a National Drug Control Strategy. A theoretical model of performance-based management is developed within this context that allowed them to identify tensions inherent in any system of this kind. Given the generality of the model, it is possible the observations offered here are relevant to other policy problems requiring multiagency coordination.

Watson, Gregory H. (2005). "Design and Execution of a Collaborative Business Strategy." *Journal for Quality and Participation*, 28(4), 4–9.

The author argues that organizations that achieve their goals in the long term plan their work and work their plan. Realization of strategy—the long-term vision of an organization—is achieved by a disciplined approach to setting direction and executing that direction through the effective use of an organization's resources—its processes, capital, and people.



Appendix A: Annotated Bibliography

» Agency Plans and Reports (Including Federal Highway Administration, State Departments of Transportation, and Metropolitan Planning Organizations)

Booz, Allen, Hamilton (2008). *Relationships Between Asset Management and Travel Demand*. Federal Highway Agency Office of Asset Management, Washington, DC, 1–99.

This study seeks to determine how State departments of transportation (DOTs) use transportation asset management (TAM) and related techniques to address existing and anticipated future travel demand. Correspondingly, this study attempts to identify and document all cases in which State DOTs have incorporated travel demand measures in TAM and related analyses and decision-making processes.

Brown, Janice Weingart, Pieplow, Robert, Driskell, Roger, Gaj, Stephen, Garvin, Michael J., Holcombe, Dusty, Saunders, Michael, Seiders, Jeff Jr., and Smith, Art (2009). *Public-Private Partnerships for Highway Infrastructure: Capitalizing on International Experience* (FHWA-PL-09-010). Federal Highway Administration, Washington, DC, 1–80.

Public-private partnership (PPP) programs for highway infrastructure are not widely used in the United States. The Federal Highway Administration, American Association of State Highway and Transportation Officials, and National Cooperative Highway Research Program sponsored a scanning study to collect information about PPP programs for highway infrastructure in Australia, Portugal, Spain, and the United Kingdom, where PPP experience is more extensive. The scan team learned that PPPs are an effective strategy for delivering highway projects, and they are service arrangements as much as financial ones.

California Department of Transportation Division of Transportation Planning and Office of State Planning (2006). *California Transportation Plan 2025*. California Department of Transportation, Sacramento, CA, 1–75.

The California Transportation Plan 2025 (CTP) offers a blueprint for a thoughtful and reasoned approach for meeting California's future mobility needs. This plan examines some of the future trends and challenges the State faces. It presents strategies for improving mobility while strongly supporting a growing economy and healthy environment and providing equitable opportunities for all Californians. The CTP is a long-range transportation policy plan and provides a vision for California's future transportation system by defining goals, policies, and strategies to achieve the vision.

MacDonald, Douglas, Yew, Connie, Arnold, Robert, Baxter, John, Halvorson, Randall, Kassoff, Hal, Meyer, Michael, Philmus, Ken, Price, Jeffrey, Rose, Douglas, Walton, Michael, and White, William (2004). *Transportation Performance Measures in Australia, Canada, Japan, and New Zealand* (FHWA-PL-05-001). Federal Highway Administration, Washington, DC, 1–84.

A U.S. delegation reported that transportation agencies in the countries visited use performance measures for setting priorities and making investment and management decisions to a greater extent than is typical in the United States. The most impressive application of performance management was in road safety. Agencies included in the scanning study used performance measurement to provide greater accountability and visibility to the public and elected decisionmakers.

Measurement Working Group (2007). *Area Performance Indicator (API) Handbook*. Highways Agency, England, 1–60.

This handbook details the measurement system developed by the area maintenance community for delivering the agency's managing agent contractor contracts and enhanced managing agent contractor contracts. The measurement system is viewed as an essential management tool to allow the agency to prove and improve its performance in delivering service.



Missouri Department of Transportation (MoDOT) (2009). *Tracker: Measures of Departmental Performance*. Jefferson City, MO, 1–233.

Tracker is the public window into MoDOT. The Tracker document is posted on the department's Web site and available in printed format as a tool for the public to assess the department's performance progress. It reveals the measures the department has established to gauge this progress and provides information on what the department does well, what it does not do well, and what it is doing to improve.

» Transportation Research Board and American Association of State Highway and Transportation Officials Publications

American Association of State Highway and Transportation Officials (2007). *State DOT Performance Management Programs: Select Examples*. Washington, DC, 1–28.

State transportation agencies successfully use performance measurement to solve complex management challenges. This report illustrates the use of performance-based management approaches in select State DOTs.

American Association of State Highway and Transportation Officials (2008). *AASHTO Authorization Policy Topic I: Performance Management*. Washington, DC, 1–230.

A report on U.S. transportation funding reauthorization, which supports an increase in Federal transportation investment, but couples that recommendation with support for reforms. A specific reform area AASHTO proposes is implementing the methodology of performance management in transportation agencies.

American Association of State Highway and Transportation Officials Task Force on Performance Management (2008). *A Primer on Performance-Based Highway Program Management: Examples for Select States*. Washington, DC, 1–32.

This report by the AASHTO Performance-Based Highway Program Task Force examined performance-based surface transportation programs now being implemented in State DOTs. This report describes the basic principles involved in applying performance measurement to the State budgeting and program delivery process, and profiles how 11 States have applied these principles to improve performance and accountability.

Fishman, Edward, Kirkpatrick, Esquire, and Ellis, Lockhart Preston Gates (2009). "Major Legal Issues for Highway Public-Private Partnerships." *Legal Research Digest 51*. Transportation Research Board, 1–40.

The amount of public funding available to State and local transportation agencies has failed to keep up with the increasing need to invest in highway construction, operation, and maintenance projects. Government agencies are constantly searching for ways to fund or facilitate highway construction projects. This report presents public-private partnerships as one way to increase the availability of funds while also describing legal issues associated with this type of delivery.

Transportation Research Board (2003). *A Guidebook for Developing a Transit Performance-Measurement System*. Washington, DC, 1–383.

The guidebook provides a step-by-step process for developing a performance-measurement program that includes both traditional and nontraditional performance indicators that address customer-oriented and community issues.

Transportation Research Board (2009). *An Asset-Management Framework for the Interstate Highway System*. Washington, DC, 1–82.

This report presents a practical framework for applying asset-management principles and practices to managing Interstate Highway System (IHS) investments. A major challenge in managing these assets lies in developing usable management principles and strategies that can be accepted and applied by the



Appendix A: Annotated Bibliography

varied government agencies that share responsibility for the IHS. The report describes the scope of the challenge and presents specific asset-management practices that may be adapted to IHS management.

Transportation Research Board (2009). *Public-Sector Decision Making for Public-Private Partnerships*. Washington, DC, 1–138.

Public sector agencies are increasingly exploring the use of public–private partnerships to increase funding available for infrastructure improvement. This study examines the information available to properly evaluate the benefits and risks associated with allowing the private sector to have a greater role in financing and developing highway infrastructure.

» Web Site Gateways to Performance Information

American Society of Civil Engineers (2009). “Report Card for America’s Infrastructure.” ASCE Report Card for America’s Infrastructure, www.asce.org/reportcard/2009/grades.cfm.

This report is a summary written by ASCE members grading all aspects of the U.S. infrastructure system. According to ASCE, the current grade point average of America’s infrastructure is a “D,” and the estimated investment needed to raise this grade is about \$2.2 trillion. The report states which areas need improvement and offers five key solutions to raise the system’s grades.

American Road & Transportation Builders Association (2008). “Highways Policy.” Government Affairs, www.artba.org/advocacy/government-affairs/policy-statements/highways.

This association policy statement presents the issues with the current state of the National Highway System and possible solutions to address them. The association proposes a variety of possibilities as partial solutions, including pay-for-performance contracts, promotion of innovative

technologies and materials testing, Federal Highway Administration accountability, incentive and disincentive clauses in highway construction contracts, and use of public-private ventures.

Blain, Larry (2009). “Public-Private Partnerships in British Columbia.” Presentation, slides 1–55.

Partnerships British Columbia Chief Executive Officer Larry Blain presented the benefits and process of implementing PPP projects at a conference in Moscow, Russia. The presentation gives a broad overview of such partnerships and examples of successful PPP project case studies, specifically those in Canada.

» Government Articles

U.S. House of Representatives Committee on Transportation and Infrastructure (2007). Government Hearing, Washington, DC, pp. 1–8.

The purpose of this hearing was to receive testimony on innovative contracting and procurement techniques under PPP arrangements. The subcommittee heard from officials of FHWA, the Federal Transit Administration, the Utah Department of Transportation, TriMet (a transit agency in Oregon), and representatives of the engineering and construction industries and a transportation employee union.

Appendix B: CASE STUDY PROTOCOL

The research team developed a case study protocol with three primary categories: (1) design and construction of the facility, (2) operation of the facility, and (3) maintenance of the facility. These categories formed the basis for a questionnaire and served as categories for the content analysis of the literature and PPP agreements.

Key Performance Indicators Case Study Questionnaire

Background

The U.S. Federal Highway Administration (FHWA) is conducting research to develop a state-of-the-practice document to contrast and evaluate existing domestic and international practices for key performance indicators (KPIs). The purpose of this case study questionnaire is to collect information from international partners on their use of KPIs to improve transportation network construction and performance.

The definitions of performance measures differ from country to country and even in a single country. For purposes of this document, please relate your agency terminology the following two definitions.

Performance measures are derived from the programmatic levels of service sought by the transport agency and imposed contractually as broad classifications of desired outcomes required of the contractor.

Key performance indicators are more specific milestones or components of performance measures that serve as precursors to indicator progress toward the eventual achievement of the desired performance measures.

The research will examine public-private-partnership projects. This study defines a public-private partner as a contract between the public and private sector for the delivery of a project or service in which the private partner has responsibility for acquiring the majority of the necessary financing. Therefore, the team is looking for KPIs that relate to the following:

- ▶ Design and construction of the facility
- ▶ Operation of the facility
- ▶ Maintenance of the facility

This research focuses on KPIs at the project level, but an understanding of how these KPIs relate to and support each agency's strategic performance measures is essential. Therefore, the research team seeks to conduct case studies of specific projects, but a number of questions will be asked about each agency's strategic performance measures.

The questionnaire is divided into two main sections:

- ▶ **Part I: performance measure evolution and current state**
- ▶ **Part II: key performance indicators for case study project**

Performance Measure Evolution and Current State

The intent of the questions that follow is to gain an understanding of what connections, if any, exist between the performance measures your agency uses to monitor its performance and the key performance indicators you agency uses to measure the performance of contractors in public-private partnerships.

1. Please describe briefly the issues and challenges that were encountered in the original development of your agency performance measures.
 - a. What were the original motivations for developing performance measures?



Appendix B: Case Study Protocol

- b. What major issues did your country or agency need to confront to develop the performance measures?
2. How have your original performance measures changed over time?
3. Can you provide us with a list and definitions of your current performance measures for the following?
 - a. Design and construction
 - b. Operations
 - c. Maintenance
4. Can you share any reports or documents on your current performance measures that describe how they are collected or maintained?

Public-Private Partnership Project

The research team intends to develop a detailed case study on one of your public-private partnership projects that is now in the operations phase. This project should have components of design, construction, operations, and maintenance.

The research team will need a copy of the project agreement to complete the case study. Please refer the team to the contract agreement on the questions below if appropriate.

Project Information

5. Please provide the following project information:
 - a. Project name
 - b. Project location
 - c. Project duration (contract award to handback)
 - d. Size of project (length, dollar amount, etc.)
 - e. Major partners and organizational structure

Design and Construction KPIs

6. Please describe the KPIs used to measure and monitor design and construction of the project.
 - a. What KPIs did you include in your procurement documents?
 - b. What was the organizational structure for monitoring design and construction (e.g., independent engineers)?
 - c. Were performance points used to track the progress of design and construction? If so, how did the system work?
 - d. What measures were taken if the

concessionaire's designer-builder did not meet quality milestones? For example, do you use noncompliance points?

- e. What were your dispute resolution or arbitration procedures relating to design and construction?

Operations KPIs

7. Please describe the KPIs you measure and monitor during operations.
 - a. What KPIs are included in the contract to measure operational performance?
 - b. What is the organizational structure for monitoring operations?
 - c. Are performance points used to track operations? If so, how does the system work?
 - d. What are the remedies for poor service?
 - e. What are your dispute resolution or arbitration procedures relating to operations?

Maintenance KPIs

8. Please describe the KPIs you measure and monitor on maintenance procedures.
 - a. What KPIs are included in the contract?
 - b. What is the organizational structure for monitoring maintenance procedures?
 - c. Are performance points used to track the maintenance procedures? If so, how does the system work?
 - d. What are the remedies for poor work?
 - e. What are your dispute resolution or arbitration procedures?

Changes to KPIs and Handback Requirements

9. What is the mechanism to change KPIs during the life of the concession contract?
10. What handback requirements are included in the project and how do they relate to the KPIs?

Appendix C: EXAMPLE SUMMARY OPERATIONS AND MAINTENANCE KPI TABLES

Every public-private partnership (PPP) contract analyzed in this study implemented a performance measurement system. In the performance management system, performance measures are used to assess the progress and effectiveness of the concessionaire in meeting contract requirements. Some of these contracts contained specific sections with tables of key performance indicators (KPIs) attached to each measure to be used as a performance marker for that measure. Generally, these indicators include elements such as percentages, ratios, indexes, and condition states to verify if and when the concessionaire has met the required performance standards. These measures and indicators exist for a variety of project elements, including safety, environmental stewardship, design, construction, operations, and maintenance, but the focus here is on operations and maintenance KPIs. Some common examples in this category include pavement condition, incident response time, and tollway inspection ratings.

KPIs are only the tip of a much larger pyramid consisting of performance mechanisms such as quality management plans, audits, inspections, and independent verifiers. However, it is important to understand how these specific mechanisms work because they set the benchmarks the audits, inspections, and verifiers use for comparison and assessment.

This appendix contains tables of KPIs found in the PPP agreements. It is important to note that specific measures and indicators were extracted from the contract language to create each table. These tables are not a complete set of the measures and indicators for the contracts, but reveal details of a few, hand-selected measures and indicators. However, a complete list of the measures and indicators in the contract is provided for reference.



TABLE 31. I-595 categories for operations and maintenance performance measurement.

Operations and Maintenance Requirements (Construction Period)	Operations and Maintenance Requirements (Operating Period)
<ul style="list-style-type: none"> • Incident response • Fuel spill and contamination • Mowing, litter removal, road and bridge sweeping, reworking of shoulders, slopes, and roadside ditches • Flexible pavement • Raised pavement markers • Pavement markings • Pavement symbols • Guardrail • Attenuators • Signs • Drainage systems • National Pollutant Discharge Elimination System (NPDES) • Lighting • Bridges and bridge maintenance • Mast arm structure • Overlane sign structure • High mast light poles • Fence • Concrete sidewalk • Graffiti • Intelligent transportation systems (ITS) operations • Deliverables • ITS maintenance services • Backbone fiber network • ITS reliability • Transportation management center (TMC) operations • Severe incident response vehicle operations • Road Ranger operations 	<ul style="list-style-type: none"> • Maintenance rating performance • Flexible pavement • Rigid pavement • Fuel spills and contamination • Guardrail • Attenuators • Fence • Signs • Drainage systems • NPDES • Concrete sidewalk inspection • Barrier wall • Toll gantry system inspection • Toll equipment building and ITS hubs • Clear zone obstructions • Highway lighting • Navigation lighting • Mast arm structure • Overlane sign structure • High mast light poles • Bridges • Bridge maintenance • Painting steel structures • Graffiti • Pressure cleaning concrete surfaces • Vegetation control on concrete slopes and surfaces • Landscape areas • Chemical vegetation control • Fertilizer • Sound barriers • Roadway characteristics inventory • Customer service staff • ITS operations • TMC operations • Emergency access gates • Deliverables • ITS maintenance services • Backbone fiber network • ITS reliability • TMC operations • Traffic incident management operations • Road Ranger operations



TABLE 32. Golden Ears Bridge/Kicking Horse Canyon Phase II asset preservation performance measure categories.

Asset Preservation Performance Measures	
Highway Running Surfaces	<ul style="list-style-type: none"> • Paved traffic lanes • Paved medians • Paved pullouts, rest stop areas, side roads, and ramps
Structures	<ul style="list-style-type: none"> • Component condition • Structure condition • Stock condition • Network components: bridges • Network components: retaining walls • Network components: major culverts • Network components: tunnels • Network components: major signs
Drainage and Debris-Control Structures	<ul style="list-style-type: none"> • Structure condition • Network condition: on roadway • Network condition: adjacent roadway • Network condition: under roadway • Network condition: debris-control structures
Electrical Systems	<ul style="list-style-type: none"> • Ministry performance-based electrical maintenance specifications



Appendix C: Example Summary Operations and Maintenance KPI Tables

TABLE 33. I-595 corridor improvements example operations and maintenance KPIs.

Element Category	Required Task	Minimum Performance Requirements	O&M Violation Classification	Cure Period	Interval of Recurrence
Monthly Maintenance Performance Rating (MPR)					
Maintenance Rating Performance (MRP)	Conduct a monthly MRP cycle in accordance with the FDOT <i>MRP Handbook</i> .	Meet a minimum quarterly overall MRP rating as required in FDOT Procedure No. 850-000-015—Roadway and Roadside Maintenance.	D	0	N/A
		Meet a minimum quarterly rating as required in FDOT Procedure No. 850-000-015—Roadway and Roadside Maintenance for individual elements.	C	0	N/A
		Meet a minimum quarterly rating as required in FDOT Procedure No. 850-000-015—Roadway and Roadside Maintenance for individual characteristics.	B	0	N/A
Highway Running Surfaces: Pavement					
Category 1 Pavement (0–3 years after substantial completion)	Maintain flexible pavement at acceptable level of safety for traveling public.	Meet the performance requirements in Division II, Section 6 of the technical requirements for the following:			
		• Rutting to be maintained less than a depth of 0.25 in	B	90 days	Every 5 days
		• Ride to be maintained at RN greater than 3.5	B	90 days	Every 5 days
		• Settlement/depression maximum depth of 0.5 in	B	7 days	Daily
		• Cumulative length of cracking >30 ft for cracks > 0.125 in a 0.1-mi lot	B	90 days	Every 5 days
		• Raveling and/or delamination of the friction course as defined and determined by the department in accordance with the examples at www.dot.state.fl.us/specificationsoffice/pavement.htm or its successor	C	90 days	Every 5 days
		• Potholes and slippage areas cannot be greater than 0.5 square feet in area and 1.5 in deep	C	24 hours	Hourly
• Bleeding as defined and determined by the department in accordance with the examples at www.dot.state.fl.us/specificationsoffice/pavement.htm or its successor	B	90 days	Every 5 days		
Guardrail					
Guardrail	Maintain guardrail at acceptable level of safety for the traveling public.	Meet the performance requirements in FDOT Design Standards, Section 536 of Standard Specifications for Road and Bridge Construction, Standard Maintenance Special Provisions—ME536 or per the concessionaire’s design criteria.	B	3 days	Daily
		Inspect the guardrail system.	A	0	Daily
		Complete repairs identified in the inspection report.	B	30 days	Daily



Signs					
Overlane Sign Structure	Maintain overlane sign structures at acceptable level of safety for traveling public.	Meet the performance requirements set forth in the FDOT Design Standards and the Standard Specifications for Road and Bridge Construction or per the concessionaire's design criteria.	B	7 days	Daily
	Perform overlane sign structure inspection.	Complete the inspection in accordance with FDOT Procedure 850-010-030 or its successor.	A	0	Daily
		Complete repairs identified in the inspection report.	B	30 days	Daily
Toll System					
Toll Gantry System Inspection	Maintain toll gantry at acceptable level of safety for the traveling public.	Meet the performance requirements in the concessionaire's design criteria.	B	5 days	Daily
	Inspect toll gantry system.	Complete the inspection in accordance with FDOT Procedure 850-010-030 or its successor.	A	0	Daily
		Complete repairs identified in the inspection report.	B	30 days	Daily
Bridges					
Bridge Maintenance	Perform repairs generated from bridge inspections.	Routine: Complete repairs required to maintain an existing level of performance and to prevent additional deterioration or extend the service life of the structure.	B	180 days	Every 10 days
		Urgent: Complete repairs required to correct deficiencies or defects to protect the integrity of the structure or maintain a desired level of performance.	C	90 days	Every 5 days
		Emergency: Repairs must begin immediately to repair critical damage on the structure and to insure the safety of the traveling public. Work is initiated immediately and work shall be completed as soon as possible.	E	30 days	Daily

(continued)



Appendix C: Example Summary Operations and Maintenance KPI Tables

(Table 33 continued)

Element Category	Required Task	Minimum Performance Requirements	O&M Violation Classification	Cure Period	Interval of Recurrence
Intelligent Transportation Systems					
ITS Operations	Monitor time required for roadway clearance.	I-595 express lanes quarterly average roadway clearance duration (in minutes) must be no more than 90% of FDOT District Four's ITS performance measures published quarterly on www.smartsunguide.com.	B	0	N/A
	Monitor time required for incident clearance.	I-595 express lanes quarterly average incident and event clearance duration (in minutes) must be no more than 90% of FDOT District Four's ITS performance measures published quarterly on www.smartsunguide.com.	B	0	N/A
	Monitor time required for roadway clearance.	I-595 general-purpose lanes quarterly average roadway clearance duration (in minutes) must be no more than that of FDOT District Four's ITS performance measures published monthly on www.smartsunguide.com.	B	0	N/A
	Monitor time required for incident clearance.	I-595 general-purpose lanes quarterly average incident and event clearance duration (in minutes) must be no more than that of FDOT District Four's ITS performance measures published monthly on www.smartsunguide.com.	B	0	N/A
Lane Closures and Blockages					
TMC Operations	Maintain real-time data and video transfer to the department.	Provide real-time access to all video and data in the project limits.	A	1 Hour	Every 15 minutes
	Notify SMART SunGuide TMC of Lane and road closures.	Notify the SMART SunGuide TMC of lane and road closures in the O&M project limits within 5 minutes of confirmation.	A	5 minutes	Every 5 minutes
	Post DMS and HAR	Post DMS and HAR within 3 minutes of confirmed lane blockage or road closure.	A	3 minutes	Every 5 minutes
	Populate 511 ATIS system.	Send information to populate 511 ATIS system with lane blockage and road closure information within 3 minutes of confirmation.	A	3 minutes	Every 5 minutes
	Maintain minimum CCTV camera detection rate.	Meet a minimum CCTV camera detection rate of 30%.	A	0	Per quarter
Incident Response					
TIM Operations	SIRV operator must respond to an incident or emergency.	SIRV is required to respond in 15 minutes upon notification.	D	15 minutes	Every 15 minutes
	SIRV team incident reports must be submitted to the department by the 5th working day each month.	Provide summary of SIRV-related activities, including but not limited to number of events responded to, number of meetings attended, agency time savings, and list of equipment used.	A	0	Daily



TABLE 34. Golden Ears Bridge/Kicking Horse Canyon Phase II example asset preservation performance measures.

Performance Measure	Intervention Criteria: KPI	Action	Maximum Response Time	Basis of Measure
Highway Running Surfaces: Pavement				
Paved Traffic Lanes—Roughness	Where roughness exceeds an IRI (International Roughness Index) value of 2.5 over any 50-m length of traffic lane, excluding concrete bridge deck wearing surface, but including abutments	1. Confirm that high-speed data reflect actual site conditions. 2. Where roughness is confirmed, undertake physical works to address noncompliance.	12 months	Longitudinal profile roughness measurements, expressed as IRI, collected for each wheel path as per ministry survey specifications and averaged
Paved Traffic Lanes—Surface Deterioration	Where pavement surface deterioration over any traffic lane exceeds the limits shown in the Concession Local Area Specification—Cumulative Distribution Curve for PDI	Undertake physical works to address noncompliance.	12 months	Pavement surface distress ratings performed in accordance with the ministry Pavement Surface Condition Rating Manual and the Pavement Distress Index (PDI) calculated according to the Ministry Pavement Distress Index model
Paved Traffic Lanes—Rutting	Where pavement rutting deterioration exceeds 20 mm in depth for any 50-m length of traffic lane	Undertake physical works to address noncompliance.	12 months	Transverse profile roughness measurements, expressed as calculated rut depth in millimeters for each wheel path as per the ministry survey specification and averaged
Signs				
Major Signs—Painted or Galvanized Surfaces	Where more than 10% of the total number of major overhead sign structures has a condition state worse than poor	Undertake physical remedial works to address painted or galvanized surfaces that are not in sound condition and/or free of corrosion.	12 months	Visual assessment
Bridges				
Bridges—Coating	Where more than 10% of the total number of steel bridge girders, assessed by total deck area, has a condition state worse than poor	Undertake physical works to address painted surfaces in poor condition, including corrosion.	12 months	Visual assessment
Bridges—Wearing Surface	Where more than 1% of the wearing surface, assessed by total deck area, has a condition state worse than poor	Undertake physical works to address unsound wearing surfaces, cracks, and deterioration affecting structure functional life.	12 months	Visual assessment
	Where more than 5% of the wearing surface, assessed by total deck area, has a condition state worse than fair	Develop a remediation strategy or undertake physical works.		

(continued)



Appendix C: Example Summary Operations and Maintenance KPI Tables

(Table 34 continued)

Performance Measure	Intervention Criteria: KPI	Action	Maximum Response Time	Basis of Measure
Bridges—Deck Joints	Where more than 2% of the total length of deck joints, assessed by (number of spans+1) times total deck area divided by bridge length, has a condition state worse than poor	Undertake physical works to address structural damage, ineffective or inoperable joints, and projections affecting road users.	12 months	Visual assessment
	Where more than 10% of the total length of deck joints, assessed by (number of spans+1) times total deck area divided by bridge length, has a condition state worse than fair	Develop a remediation strategy or undertake physical works to address defective joints with potential to create unsafe conditions for road users and reduction of structure functional life.		
Bridges—Bearings	Where more than 2% of the total number of bearings, assessed by total deck area, has a condition state worse than poor	Undertake physical works to address structural damage and ineffective or inoperable bearings.	12 months	Visual assessment
	Where more than 10% of the total number of bearings, assessed by total deck area, has a condition state worse than fair	Develop a remediation strategy or undertake physical works to address defective bearings with potential to create unsafe conditions for road users and reduction of structure functional life.		
Bridges— Bank, Bed Scour, and Buildup	Where more than 1% of the total number of bridge spans has a bank, bed scour, or buildup condition state worse than poor	Undertake physical works to address scour, bank or approach instability, river channel blockage, and waterway alignments that cause high risk to the structure.	12 months	Visual assessment
	Where more than 5% of the total number of bridge spans has a footings and pilings condition state worse than fair	Develop a remediation strategy to address scour, bank or approach instability, river channel blockage, and waterway alignments that cause high risk of erosion to the structure.		

Note: Concessionaire is required to measure the condition for all traffic lanes, paved pullouts, stop areas, side roads, and entrance and exit ramp lanes annually.



TABLE 35. Kicking Horse Canyon Phase II example corridor and environmental management key performance measures.

Example Corridor Management Key Performance Measures		
Item	Key Performance Measures	Strategies
Public Relations and Customer Care	<ul style="list-style-type: none"> • Ensure that the public has a positive perception of the concession highway and its management. • Ensure that communication with all highway users is conducted promptly and in a professional manner • Achieve zero complaints on the processing of all communications 	<ul style="list-style-type: none"> • Answer general and specific enquiries or requests for information. • Interact proactively with stakeholders. • Advise the media of road conditions. • Coordinate with the Provincial Highway Condition Centre to provide information and display accurate and timely messages on signage systems. • Receive and process applications from the public including, but not limited to, closing a road, performing works on or below the road surface, and constructing a road access.
Emergency Response and Management	<ul style="list-style-type: none"> • Maximize road availability. • Achieve a timely, 24/7 incident response service. • Minimize disruption to highway users. • Ensure that travel lanes are safe. • Reinstate asset (i.e., repair damage). 	<p>The concessionaire is required to do the following:</p> <ul style="list-style-type: none"> • Ensure that staff contact information is available to the ministry, local governments, and emergency service providers and that notification required to respond to emergencies takes place. • Train employees in procedures on response and recovery and other types of emergency training required by the province. • Develop and apply an emergency response plan for emergencies such as, but not limited to, floods, avalanches, toxic spills, structural damage, and earthquakes.
Safety Management	<ul style="list-style-type: none"> • Reduce crash rate and number of fatalities. • Ensure that health and safety systems are implemented. 	<p>The concessionaire is responsible for the following:</p> <ul style="list-style-type: none"> • Reduce the number and severity of crashes by applying proactive, best-practice road safety engineering techniques. • Reduce the number of known road safety hazards on the highway route. • Provide a road that is safe, consistent, free of surprises, and forgiving. • Eliminate all serious and fatal crashes where road conditions are deemed to be a contributing factor (mitigate all significant safety hazards along road sections that are reconstructed under the concession).
Access to Corridor	<ul style="list-style-type: none"> • Ensure compliance with the Highways Act and limit access to the highway to designated intersections and interchanges only. 	<p>The concessionaire is responsible for the following:</p> <ul style="list-style-type: none"> • Monitor access onto secondary side roads by inspections every 6 months. • Conform with the operational performance measures.
Example Environmental Management Key Performance Measures		
Item	Key Performance Measures	Strategies
Identification of Environmental Impacts	<ul style="list-style-type: none"> • Develop, document, and maintain a register of identified areas of potential or known environmental hazards. 	<p>The concessionaire will operate, maintain, and rehabilitate the project in accordance with the following:</p> <ul style="list-style-type: none"> • <i>Best Management Practices Manual</i>, Ministry of Transportation, July 2004 • <i>Habitat Conservation and Protection Guidelines</i>, Fisheries and Oceans Canada, 1998 • <i>Standards and Best Practices for Instream Works</i>, Ministry of Water, Land, and Air Protection, March 2004 • <i>Land Development Guidelines for the Protection of Aquatic Habitat</i>, Department of Fisheries and Oceans Canada and Ministry of Environment, Lands, and Parks, 1992.
Assessment of Environmental Impacts	<ul style="list-style-type: none"> • Prioritize identified areas and activities of potential or actual environmental impact based on assessment of risk. 	
Mitigation and Management of Environmental Impacts	<ul style="list-style-type: none"> • Implement a program of environmental impact mitigation based on prioritized assessment of areas and activities of potential or actual environmental impact. Monitor and review effectiveness of environmental impact mitigation. 	



Appendix C: Example Summary Operations and Maintenance KPI Tables

TABLE 36. CLEM7 North-South Bypass Tunnel example project deed KPIs.

No.	KPI Description	KPI Benchmark	Level of Service	KPI Demerit Points	Assessment Period
Reporting Requirements					
1	Target level of service—A report to council every 3 months on the performance of KPIs	100%	<20 business days after quarter 20–40 business days >40 business days	0 2 4	Quarterly
Customer Service and Satisfaction					
2	Target level of service—Customer calls answered within 20 seconds	90%	1 point for every 100 calls not answered within KPI benchmark	1 point for every 100 calls not answered	Monthly
3	Target level of service—Customer accounts with financial institutions credited or debited with the correct accounts	99.999%	> 99.999% 99.99–99.999% 99.95–99.99% <99.99–99.95% <99.9%	0 5 10 20 50	Monthly
4	Complaint resolution target level of service—Customers contacted by the customer service staff within 2 business days of a customer complaint	90%	10 points per occurrence outside of KPI benchmark	10 points per occurrence outside of KPI benchmark	Monthly
5	Transaction accuracy target level of service—Timeframes for charging transactions to real-time accurate reading customers' account	99% within 2 days	>99% 97%–98% <97%	0 10 15	Monthly
6	Accounts not overcharged	0%	0.1%–0% 0.2%–0.1% 0.3%–0.2% >0.3%	10 20 30 40	Monthly
7	Correct toll or fee assigned to correct account of complying vehicles	0.1% variance	0.2%–0.1% 0.3%–0.2% 0.4%–0.3% >0.4%	10 40 60 80	Monthly
8	Applications for toll account correctly responded to in 5 days	99%	1 point for every occurrence outside of KPI benchmark	1 point for every occurrence outside of KPI benchmark	Monthly
Communication, Community Relations, and Consultation Management Obligations					
9	Weekly council "Issues and Activities Report" addressing issues, response times, complaints, and corrective actions	100%	<1 business day 2 business days >2 business days	0 1 2	Monthly
10	Free community enquiry line	99%	90%–100% 80%–90% <80%	0 5 10	Monthly
11	Project Web site	99%	90%–100% 80%–90% <80%	0 5 10	Monthly



Key Performance Indicators in Public-Private Partnerships

Operations and Maintenance Requirements					
12	Annual calendar of planned maintenance closures	100%	2 hours of additional closures	1 per additional 2 hours	Monthly
13	Maintenance at all times of ability of tunnel center to communicate with emergency services	99.99%	>99.99 99.9%–99.99% 99.8%–99.9% 99.7%–99.8%	0 2 4 6	Quarterly
14	Tunnel air quality (CO, NO ₂)	<2	<2 instances 2–3 instances 4–5 instances >5 instances	0 5 10 15	Quarterly
15	Ambient air quality (CO, NO ₂ , PM, TSP)	0	No violations 1 violation 2 violations 3 or more	0 5 10 15	Quarterly
16	Water from treatment plan at acceptable levels	100%	0–1 violation 2–5 violations 6–9 violations 10 or more	-10 0 10 20	Yearly
Incident Response					
17	Initial response time to detect incidents by operator	1–2 minutes	<1 minute 1–2 minutes 2–3 minutes 3–4 minutes >7 minutes	-10 0 10 20 30	Monthly
18	Service crew response time to incidents	10–13 minutes	<8 minutes 8–10 minutes 10–13 minutes 13–16 minutes 16–19 minutes >19 minutes	-20 -10 0 10 20 30	Quarterly
Aesthetics					
19	Rapid response time to nominate defects that impact aesthetics or public perception of tollroad or landscaping	0–2 days	<2 days 0–2 days 2–4 days >4 days	-20 -10 10 20	Yearly



Appendix C: Example Summary Operations and Maintenance KPI Tables

TABLE 37. CLEM7 North-South Bypass Tunnel example operating company KPIs.

KPI Area	KPI	Measures	Target	Frequency
Asset Condition	All management systems operating	Asset management response times Asset management inspections and routine maintenance Improvement initiatives investigated and proactive procedures and systems developed	To be based on equipment and materials selected in final design	Monthly
Compliance	Meet environmental coordinator general's conditions	Nonconformity with environmental management plan Environmental issues investigated and remediated	Nil Targets to be established	Monthly Quarterly
Commercial	Manage O&M costs	Achieve budget Benchmark top five expenditure firms	Nil Targets to be established	Monthly Yearly
Stakeholders	O&M relationship	Assessment against preagreed criteria: <ul style="list-style-type: none"> • Daily cooperation with emergency services • Handling of public complaints • General facility appearance • Handling of environmental issues • Proactive approach to safety 	Assessment matrix to be developed	Quarterly
Employees	Safety Satisfaction Engagement	Level of compliance to workplace safety	TBD	TBD



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