Value For Money, Civil Infrastructure Projects

DBFM Highway Projects

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INFRASTRUCTURE ONTARIO

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1.0 Introduction

Infrastructure Ontario (IO) is required to prepare Value for Money (VFM) assessments for a wide range of projects that may be implemented through an Alternative Finance and Procurement (AFP) approach. A component of the VFM assessment involves the identification, quantification and allocation of risks associated with traditional public sector procurements as compared to different methods of AFP.

This assignment was to review and update the risk matrices that were developed in 2008 and reviewed in 2011. This update reflects the extensive experience of the Ministry of Transportation of Ontario (MTO) in the delivery of major highway projects. The 2014 report examined distinct risk matrix features for a wide range of civil infrastructure projects. While there are many common risks inherent with these projects, each sub-sector has its own unique characteristics and risks that have been identified and considered. Risk workshops were undertaken to review the matrices in detail. Risk probabilities and expected impacts were developed to reflect specific conditions applicable to each asset class and delivery model. This report reflects the analysis conducted by MMM Group Limited to examine the risk matrices created for both transit and highway projects.

To assess risk by sector and model type, comprehensive risk matrices were developed, as follows:

Design, Build, Finance, Operate, Maintain:

i. Highways Risk Matrix
ii. Transit Risk Matrix

Design, Build, Finance, Maintain:

iii. Highways Risk Matrix
iv. Transit Risk Matrix

Design, Build, Finance:

i. Highways Risk Matrix
ii. Transit Risk Matrix

The risk matrices are intended to be used to produce a starting point or "template" for each asset class, with project specific adjustments made to recognize the unique considerations for a particular project.

The risk allocation and quantification exercise included the identification of industry specific risks and the development of applicable public sector comparator risk profiles associated with anticipated procurement options.

The risk matrices reflect experience gained on many recent IO AFP projects and on MTO Traditional (Design-Bid-Build) delivery projects. The experience of IO specialists, consultants with extensive AFP project experience and senior executives of leading AFP contractors and concessionaires have contributed to the matrices.

2.0 Approach

2.1 Participants

This update incorporates further discussions with IO staff and consideration of comments provided by MTO staff concerning the application of the risk matrices to both Traditional and AFP delivery of major transportation projects. This examination of the Risk Matrices was undertaken in a collaborative manner between Infrastructure Ontario, associated Ministries and Agencies. IO's advisors included MMM Group, Altus Group along with broader industry input and consultation with leading AFP contractors and concessionaires.

2.1.1 *MMM Credentials*

MMM Group Limited (MMM) has assisted Infrastructure Ontario (IO) on a number of projects related to Risk Analysis for the Value for Money (VfM) assessment of Alternative Financing and Procurement (AFP) projects for highway and transit/transportation projects. MMM has been instrumental in developing the risk assessment methodology adopted by Infrastructure Ontario in the assessment phase for AFP transportation and transit projects and has assisted Infrastructure Ontario in determining capital cost benefits of transit and highway related AFP projects.

Since the late 1980's MMM has provided P3 and AFP related advice, assistance and services both for project owners and for private sector teams. MMM's numerous government clients include the Ontario Government (Infrastructure Ontario), Metrolinx (Eglinton Crosstown), Translink (Canada Line-$2B, Millennium Line & Evergreen Line), Region of York (Rapid Transit Plan – Viva-$4B), City of Ottawa (North-South LRT-$750M), Government of Trinidad and Tobago (Trinidad Rapid Rail Transit System-$2B) and the province of Quebec (A-30 Autoroute). Working with the private sector, MMM has participated on numerous P3 projects such as the Ottawa Confederation Line LRT, Route 1 Gateway (New Brunswick), Sea to Sky Highway

(British Columbia), Kicking Horse Phase 2 (British Columbia), Highway 1 & Port Mann Bridge (British Columbia), Highway 104 (Nova Scotia), Highway 407 (Ontario), Fredericton-Moncton Highway (New Brunswick), Anthony Henday Drive (Alberta) and the Golden Ears (British Columbia).

Additionally, MMM has extensive experience with thousands of design-bid-build traditional delivery (TD) projects involving a wide range services for the owner, including route planning, preliminary design, environmental assessment, detail design and construction administration/owner's engineer services. This experience has been gained on linear infrastructure civil projects, including roads, highways, bridges, transit facilities, railways, trunk watermains, sewers and pipelines. As one of the major suppliers of engineering services in Ontario, we have been involved in many of the most significant linear infrastructure projects in Ontario as well as major projects elsewhere in Canada and internationally. The firm has played a significant role in over one hundred AFP/P3 projects.

For this assignment, the MMM team included Mr. Rob Wanless Mr. Bob Nairn and Mr. Hans VanPoorten.

Rob Wanless, P.Eng.

Rob is a Partner of the firm and manager of the transportation practice in the Thornhill office. He has over 40 years transportation experience, including 25 years on major design build and alternative delivery projects. Rob was a part of the MMM team that developed the transit and highway Risk Matrices for IO in 2007 and the 2015 review of the four risk matrices.

Bob Nairn, P.Eng.

Bob retired recently as a Transportation Director in the firm, and now acts for MMM as a specialist subconsultant and advisor. Bob is a professional engineer who is considered one of Canada's leading transportation experts. Bob's career in transportation engineering spans more than 50 years. Over the past 20 years, Bob has directly participated in the pursuit, development, design, management and delivery of some 19 major P3 transportation projects in Canada and the United States. Bob has participated in numerous risk assessment studies and was an expert advisor as part of the team that developed the transit and highway Risk Matrices for IO in 2007, and the subsequent 2011 and 2014 – 2015 reviews of the risk matrices

Hans VanPoorten, P.Eng., M.B.A.

Hans brought over 45 years of consulting experience with MMM to the project and over 25 years of personal involvement in various types of P3 assignments involving contractual,

financial and VfM services. Hans was part of the MMM team that developed the transit and highway Risk Matrices for IO in 2007 and the subsequent 2011 and 2014-2015 reviews of the four risk matrices.

3.0 Methodology

3.1 What is Value for Money (VFM)?

The Value for Money assessment employed by IO is designed to provide decision makers with a comparative assessment of the costs to government under different procurement approaches. Most importantly, it provides a basis to identify a holistic cost of a project, as adjusted for potential risks that may occur. Its' purpose is not to complement or replace a project budget. It is acknowledged that elements of it, namely the risk adjustments that flow from the assessment are subject to professional judgment.

3.1.1 *Key Assumptions of VFM at Infrastructure Ontario*

IO's Value for Money Assessment is a critical project evaluation and assessment tool informing the public sector's investment in a project. The VFM methodology is described in IO's *Assessing Value for Money: A guide to IO's Methodology* report where the risk matrices serve as input to the VFM calculations discussed in the report's methodology.

3.2 Risk Matrix Review – Approach

The approach taken assesses the risks considered during AFP and Traditional Delivery procurement processes, including risks that are transferred under an AFP procurement. The risk assessment provides a quantification of the potential costs and schedule impacts associated with the risks, which ultimately serve as an input to the Value for Money financial analysis.

3.3 Process Review

An initial review of Infrastructure Ontario's Risk Matrix templates as developed by MMM Group in 2007 was undertaken. This review identified potential areas of refinement, simplification or clarification across all aspects of the matrix template and supporting documentation, including:

i. Risk categories;
ii. Risk definitions and rationales;

iii. Risk allocation between public and private sectors; and
iv. Probabilities and impacts.

The template itself was re-organized with risk categories being grouped by the relevant phase of the project in which it is expected to occur, allowing for the rationalization, removal or re-allocation of related or redundant risks.

For each matrix, the following was undertaken:

i. develop the risk items to be included in the matrix to ensure all potential risks are documented;
ii. provide a definition of each risk item within the matrix;
iii. provide the estimated probabilities of occurrence and impact of occurrence for each risk item in the risk matrix;
iv. review of current Project Agreements;
v. internal workshops between advisors;
vi. industry consultation with knowledgeable panel;
vii. risk workshop between Ministry advisors and IO; and
viii. consultation and feedback from sponsors.

The risk matrices reflect a potentially significant difference in the risks associated with the long term operation of the asset. In the case of Design Build Finance (DBF) procurement, the contractor's responsibility typically ends on termination of the warranty period (normally 1-2 years following substantial completion). Typically the design-build contractor will attempt to optimize the construction phase; as a result, risk associated with the long term performance of the asset such as latent defects and future maintenance and operating cost all become the responsibility of the Owner. The effect of design and construction on future operating and maintenance considerations is captured in 4.05 (Design/Construction Optimization) of the DBF matrices.

Design Build Finance Maintain with or without Operations (DBF(O)M) procurement is significantly different from DBF procurement; (DBF(O)M) incorporates a long-term arrangement (typically 30 years) whereby the concessionaire accepts full contractual responsibility for design and construction as well as maintenance and capital asset preservation. The Owner typically has financial security in that bonding or letters of credit secure the obligations. It is IO practice to defer payment through a holdback throughout construction and following payment for Substantial Completion. Also, although the concessionaire is usually structured as a one-off special Limited Liability Corporation (with ownership by a number of large contractors), the project's financial obligations are not as easily separated from their normal operations. As a result, the financier provides a further and very significant level of certainty in that it is in their best interest to ensure that contractual obligations are fully adhered

to (non-adherence could result in the loss of their investment); also, concession contracts typically include an obligation for the financier to guarantee replacement of the maintenance/operations entity and, as such, the financier remains a last resort in case of contractual issues. The level of maintenance to be performed as well as any major capital expenditures required from time to time for asset preservation are contractually defined and are not subject to future owner budgetary constraints. This is an important consideration which is addressed in the risk matrices sections 10 and 11 (Maintenance and Operations).

The Process review was updated by a further review of detailed comments and issues raised by MTO concerning the application of the risk matrix. The MTO comments reflected the extensive experience of MTO with Traditional delivery, including recent innovations in delivery of design, construction and maintenance of major highways. It also reflected the experience MTO with the recent IO/MTO AFP delivery of projects such as the Windsor RHHG Parkway and the Highway 407 East extension Phase 1.

The risk definitions and rationale developed to reflect the risk matrices as they apply to this delivery model can be found in **Section 3.7** of this report**.**

3.4 Risk Analysis

The key differentiator between traditional and AFP project delivery is the allocation of risk between the public and private sectors inherent in each delivery model. A core principle of AFP is to appropriately allocate project risk to the party best positioned to manage the specific risk. This risk allocation is reflected in the various project agreements, and is critical in driving the VFM analysis.

Accounting for risk is recognized and accepted as a fundamental part of project planning and budgeting. In fact, it is not meaningful or accurate to discuss projects without accounting for risk.

There is no single comprehensive data base of public or private projects (traditional or AFP) that could be identified or relied upon for the estimation of risk. However, this does not prevent the application of a rigorous approach to project planning and delivery.

The recognized procedure to identify and quantify risks relies on the application of professional judgment by experienced engineering and construction professionals. Professional judgment is informed by actual project experience, together with access to various data points such as examples of cost overrun experienced on traditional and AFP projects, and discussion with industry experts including contractors and engineers.

Professional judgement is the accepted best practice for most budgeting exercises in the public and private sectors - including assessments of risk. In Ontario, the private sector engineering profession has over 55 years of experience with traditional delivery of transportation projects and over 20 years of experience with AFP project delivery.

The process followed to estimate risk is robust in that it was developed collaboratively with key stakeholders, each bringing their own experience to process. The risk matrices that have been developed are a starting point for assessing project risk (by asset class). On a project by project basis, the risk matrix should be reviewed and assessed for project specific circumstances and the estimation of risk should be adjusted accordingly.

For each identified project risk, a number of attributes are assessed and quantified in order to determine the impact on the overall Value for Money.

The following attributes are considered and included in the risk matrix templates developed for this assignment:

Risk Allocation: The risk allocation indicates who has ownership of the risk item, or if the risk is shared between the province and private sector partner. This varies based on the applicable project agreement and the inherent features for each asset class and delivery model.

Cost Base: For each risk category that is being assessed and quantified, the cost base is the value of the portion of the project cost that would be affected by that risk, should it be realized. It will vary by type of risk and point in time when the risk is likely to occur (construction period vs. concession period).

Probability: The Probability attribute reflects the likelihood that the risk will occur. It is expressed as a percentage representing the chance that a particular event (or set of events) will occur.

Impact: The impact is the result of the occurrence of an event on the project either positive or negative. This attribute reflects the cost impact as a result of the risk occurring, and is defined on a 10th percentile, typical and 90th percentile basis to reflect a best, median and worst case outcome. This impact is then averaged using statistical simulation, as described in IO's *Assessing Value for Money: A Guide to IO's Methodology*.

3.5 Stakeholder/Industry Consultation

In the preparation of an earlier report *budgeting Capital Costs in the Transit and Highway Sector* for Infrastructure Ontario on the comparative costs for both highway and transit projects delivered

conventionally (design, tender and construct) versus delivery using the AFP model one on one interviews with senior industry representatives (both major contractors and concessionaires) participating in the AFP market were conducted to ascertain and quantify the comparative differences between procurement models.

As this approach to the industry proved to confirm the benefits of the AFP procurement model over Traditional procurement, an outreach to a cross section of the industry was again undertaken for this review to seek valuable input on the identification, quantification and allocation of risks between various procurement models.

3.5.1 *Risk Methodology Questionnaires & Telephone Interviews*

In order to gather additional data in support of the assumptions and findings of this report, an 8-question questionnaire, including two risk methodology worksheets, was developed for confidential consultation with seven leading firms in the AFP industry. Senior executives of each firm were interviewed by telephone and were asked to return the completed questionnaire.

The telephone interviews were conducted to review the questionnaire itself as well as to gain additional insight on the risks commonly considered by bidders within the AFP and Traditional Delivery procurement processes.

The participants for this consultation are very senior representatives who are considered key industry players from seven Canadian and International companies that presently are very active in the AFP/P3 industry for Civil projects. The companies included in this exercise include Ellis Don, Fengate, Plenary, AECON, SNC Lavalin, PCL and Miller.

The participants consulted presently operate at managerial and executive levels at their respective companies which merit their input and valuable project experiences. Furthermore, the participants have played key roles on most, if not all, of Canada's largest AFP projects that include, but not limited to the:

- Windsor Essex Parkway, Ontario
- Original Highway 407 ETR, Ontario
- Sale of Highway 407 ETR, Ontario
- Highway 407 ETR Phase 1, Ontario
- Sea to Sky Highway, British Columbia
- Golden Ears Bridge, British Columbia
- South Fraser Perimeter Road, British Columbia
- Port Mann Highway 1, British Columbia
- A25, Quebec

- A30, Quebec
- Chief Peguis Trail, Manitoba
- Fredericton Moncton Highway, New Brunswick
- TransCanada Highway, New Brunswick
- Route 1 Gateway, New Brunswick
- Ottawa North/South LRT, Ontario
- Ottawa Confederation Line LRT, Ontario
- Disraeli Bridge, Manitoba
- Anthony Henday Drive SE, Alberta
- Anthony Henday Drive NW, Alberta
- East Rail Maintenance Facility, Ontario
- Eglinton Crosstown LRT, Ontario

The comments received supported the conclusions surrounding the risk methodology and rationale developed by the project team, as well as highlighted areas of importance for consideration by Infrastructure Ontario. Common themes highlighted in the "Budgeting Capital Costs" report included, but were not limited to:

- Relevance and associated weight of each risk category in the development of a bid price;
- Percent of adjustment to base bid prices to account for risk oversight;
- Ratios between the design / construction cost of a project versus the maintenance / rehabilitation cost;
- Value for Money calculations;
- Amount of scope creep typically observed during AFP project processes;
- Implementation of the 'Risk Premium' by Infrastructure Ontario; and
- How to adequately capture design innovation and design efficiency within the risk matrices.

A more comprehensive summary of the industry consultation exercise can be found in **the** "Budgeting" report.

3.5.2 *Risk Workshops*

A series of interactive workshops were held between representatives from IO and MMM to establish, verify and review the proposed risk allocation, probabilities, and impacts for each identified risk category for each risk template. These workshops were a critical component of this review, providing opportunity for comprehensive discussion and collaboration amongst a diverse group with extensive professional expertise in project delivery across a wide range of models and asset classes.

These workshops were used to verify the direction and findings of the independent reviews and establish appropriate benchmarks to ensure consistency and accuracy in quantifying the template risk profiles for each asset class and delivery model.

3.5.3 *MMM Internal Risk Matrix Workshops*

As an additional component of the industry consultation for civil projects, a review of the top ten risks was undertaken internally at MMM (December 17, 2013) to confirm the dominant risk categories and their corresponding impact to the total project value. The review was undertaken by highly experienced MMM staff that have played key roles in the bidding and execution processes of both Traditional Delivery and AFP projects. The participants in this review include:

- Rob Wanless, P.Eng.
- Bob Nairn, P.Eng.
- Hans VanPoorten, P.Eng., M.B.A.
- Dave Jull, P.Eng., FCSCE
- Chris Gauer, P.Eng., AVS
- Mark Waters, P.Eng.
- Dominique Quesnel, P.Eng.
- Andrew Hachborn, P.Eng., AVS

The workshop benefited from availability of a wide range of relevant project data by virtue of the MMM's active participation in most of the large Canadian AFP projects, in a variety of capacities as owners engineer, specialist advisor or technical consultant.

3.6 Infrastructure Ontario Consultation

IO conducted industry consultation with government ministries such as the MTO, MAG, MCSCS, MOH and MOI and included their feedback into the risk matrices/procurement models.

During late 2014/early 2015, IO and MTO held detailed discussions on the application of the risk matrix to major highway projects. The consultation reflected the deep experience of IO with AFP project delivery together the extensive MTO experience with traditional Design-Bid-Build-delivery and as well as MTO's evolving experience with Design-Build (DB) delivery and with DBFM delivery of current projects such as the Windsor RHHG Parkway and Highway 407 East extension. The discussions were focussed on several specific risk items and the potential cost implications as determined by the probability and impact of each risk. A detailed assessment of the relative strengths and weaknesses of AFP and traditional delivery was completed. In order to better reflect MTO experience related to traditional delivery, refinements were made to some probabilities and some impacts. In addition, some risk definitions and rationale descriptions were clarified or enhanced.

3.7 Risk Matrix Template

3.7.1 *Risk Definitions and Rationale*

	Risk Category	*Definition*	*Rationale*
	Policy / Strategic		
1.01	**Government Approvals for Program**	Risk that government approvals on a program level are not received in a timely manner and ultimately delay the issue of tenders.	-Sector specific, established programs for delivery through AFP with project 'pipelines' publicly announced and tracked well in advance, with organized communications and support. -Traditional Infrastructure projects are often part of a multi-year infrastructure investment program.
1.02	**Government Approvals for Project**	Risk that government approvals on a project level are not received in a timely manner and ultimately delay the issue of tenders.	-- For AFP delivery, it is necessary to secure approval at the overall program level before procurement could proceed. - For traditional delivery, government approvals may be split into individual approvals for each of the projects that make up the program. However, for purposes of this risk matrix, it has been assumed that approval of all projects within the program would be secured before an individual project procurement was initiated for the first project. This provides a common basis of comparison for DBFM and traditional delivery.

	Risk Category	*Definition*	*Rationale*
1.03	**Government Funding**	Risk of government changing funding priorities or methods adversely affecting the program schedule for individual sequentioal projects.	-The AFP process establishes a comprehensive budget and risk assessment for all aspects of the program and requires funding allocation/commitment the entire program before the AFP procurement can proceed. - Traditional / DBB program delivery remains much more vulnerable to changing funding priorities / availability. -This is particularly so for transportation programs valued at $500M to $1B. Under traditional delivery, the program would be constructed through multiple smaller projects (contracts) of $150M to $200M. After approval of the initial contract, funding for subsequent contracts is subject to the risk of delays or deferrals as provincial budgets are reviewed annually.
1.04	**Project Schedule**	Risk of a longer construction period and resulting in a higher total program cost due to escalation and inflation.	-The project design and construction will be significantly longer under traditional / DBB delivery (as summarized in IO's 'Budgeting Capital Costs in the Transit Sector' report). -Large projects of $500M to $1B would be divided into multiple smaller contracts of $150M to $200M to stage the work under a traditional delivery model. -Under AFP, a $500M project would be completed in three to four years and a $1 B project in four to five years. -In comparison, under traditional delivery, multiple contracts lasting two to three years each could extend a $500M project to 6 to 9 years and a $1B project to 10 to 15 years. -With inflation of 2% to 3% per year, extra costs could range from 10% to 15% with traditional delivery.

	Risk Category	Definition	Rationale
	Transaction / Tender Process		
2.01	**Due Diligence (by the owner in preparation of tender or RFP)**	Risk that an insufficient level of due diligence is undertaken and communicated to Bidders resulting in reduced tolerance to risk and higher bid prices.	For a DBB project, the due diligence is undertaken only by the owner and their design consultant to support the design and tender process. The due diligence process is thorough in a technical sense involving investigation of the risks associated with known and unknown stakeholders, site, design and construction conditions. However, the due diligence is limited to the design and construction approach and it is based on the owner/designer point of view only, which limits the extent and breadth of the due diligence effort to the owner's perspective.- -An AFP project is subject to the similar due diligence in terms of the physical site conditions. The key difference is that the AFP process allows for due diligence of the project scope and conditions by the three competing proponent teams. Within these extensive proponent teams are many experienced designers, contractors and maintainers, each with points of view relating to project feasibility, constructability, engineering, maintenance and other due diligence considerations. -The Lenders Technical Advisor oversees the work, providing a further level of due diligence. Each proponent team member would also have a bid and a check estimate, so there is additional duplication of the due diligence effort within each proponent team on the site conditions, cost and risks of the project. -AFP projects reflect on-going refinement and clarification of market tested AFP template transaction documents, the centralized approach through IO and the institutional knowledge gained through delivery of a wide range of AFP projects within and across sectors. -The intensive interactive approach with Bidders provides the opportunity for bidders to seek resolution of inconsistent / insufficient information. -Through the AFP procurement process, each proponent team member raises issues within the team and gathers information to better address risks due to the scope and the site conditions. This is a "self-informing" process where the project scope and

	Risk Category	Definition	Rationale
			performance requirements related to the due diligence work are improved through the procurement process. -This process results in information being provided to the owner, and issuance of addenda and modifications to the performance documents resulting in a far superior scope of work and minimizing risk due to due diligence omissions or unknowns. -Proponent teams that discover omissions during the procurement typically inform the owner of their findings through the RFI process. This is because each proponent does not want to be the only one pricing the risk due to an unclear project element. They use the RFI process as a means of having the other bidders work on a level playing field.
2.02	**Tendering Competition**	Risk that sufficient qualified contractors are not available resulting in a smaller than expected number of Bidders which could result in higher bid prices.	-AFP projects typically attract teams of the largest companies across all related sectors. These companies are organized to accommodate and participate in the AFP market, leveraging their global expertise and reputations to compete for project. -This increases the competition due to additional players, often resulting in diverse approaches to the project. The AFP contract has a higher level of flexibility and varied international experience can bring ideas that lead to innovation not only in design, but also innovation in how project teams are set up and how work is carried out from a scheduling and logistics perspective. They will bring in proven ideas and methods from other jurisdictions to address the project challenges within the context of the performance specifications. -Each proponent team typically has at least two major contractors as wells as sub-contractors competing internally to price the work. Therefore, beyond the competition of the three proponent teams, there is an internal competition within each team. Each proponent team also engages a number of engineering consultants involved in the bid process to assess the design requirements. This increases the level of competition, provides as resource for exchange of ideas, offers internal challenges to improve the design and brings in ideas from other jurisdictions to more

	Risk Category	*Definition*	*Rationale*
			economically and competitively respond to the AFP performance specifications. - Traditional DBB projects are typically tendered on a smaller scale, directly with one company or smaller teams without comparable expertise.
2.03	**Delays in Contract Award / Financial Close**	Risk of additional costs and schedule impacts resulting from a delay in Contract Award / reaching Financial Close.	- Fixed bid validity period obligating parties to reach FC within set time period provides significant incentive to reach FC on an AFP project. - Familiarity with AFP process on both sides facilitates closing process through knowledge and experience to meet schedule requirements and expectations.
2.04	**Termination prior to Contract Award/ Financial Close**	Risk of decision to not proceed with project occurring prior to Contract Award or Financial Close	- Rigorous due diligence and risk assessment reduce likelihood of project termination prior to FC. - Bid/Break Fees act as deterrent to project termination on AFP. - Cancelling an AFP project brings tremendous reputational risk and loss of confidence in the program - so there is an incentive not to cancel to the program.

	Risk Category	*Definition*	*Rationale*
	Project Agreement		
3.01	**Ambiguities In Legal Agreements**	Risk that ambiguities exist in legal agreements that could lead to disagreements at a later stage.	-With AFP, the PA is developed and continuously refined and maintained based on collective experiences from projects within and across related sectors. Has been market tested and challenged under a wide range of conditions. –Within the PA, the CCM process allows major issues of arranging financing and optimizing VFM for the project to be raised on a project specific basis, bidders give feedback to help improve PA for each project. -Traditional tenders are more likely to be customized with greater opportunity for ambiguity.
3.02	**Termination For Convenience During Construction**	Risk that government(s) will terminate the contract, for convenience, prior to Substantial Completion.	-AFP contract structure creates onerous compensation requirements (such as debt makewhole, financing break fees, compensation for loss of profit, stand down costs), discouraging termination. -DBB major highway projects in Ontario have rarely, if ever, been terminated for the owner's convenience. Therefore the risk of this occurring is very low. Compared to AFP delivery, any single DBB construction contract is expected to have a shorter duration (two to three years) and a smaller contract value ($150M to $200M). Therefore, the potential impact would be approximately one third that of the AFP delivery. -The AFP project value of $500M to $1B is much higher than any single DBB contract and the construction duration is longer (four to five years). The risk of termination for convenience for AFP delivery is low. However, considering the value of the 30 year concession in addition to the construction contract value, the potential impact of termination for convenience during construction would be greater than with DBB.

	Risk Category	*Definition*	*Rationale*
3.03	**Termination For Convenience During Operations / Maintenance Phase**	Risk that government(s) will terminate the contract, for convenience, prior to the expiration of the Operations / Maintenance phase of the contract.	-AFP contract structure maintains compensation requirements (such as debt makewhole, financing break fees, compensation for loss of profit, stand down costs) through concession thus discouraging termination.
	Design		
4.01	**Stakeholder Consultation Pre Financial Close**	Risks associated with fulfilling stakeholder consultation requirements and achieving sign-off where required.	-Requirement for early due diligence and approvals on all aspects of project in AFP encourage resolution of key issues raised through stakeholder consultation in order to effectively develop transaction documents, project agreement and technical specifications.
4.02	**Stakeholder Consultation - Post Financial Close and Tender**	Risks associated with fulfilling stakeholder consultation requirements and achieving sign-off where required.	-Under AFP, Project Co. assumes consultation risk during implementation, including any relevant sign-offs. Project Co is better positioned to adapt and manage issues arising from consultation to minimize impact on project cost and schedule.
4.03	**Scope Changes initiated by Owner During Tender Process & During Design**	Risk that scope of work is changed during the tender/bid process, resulting in diminished market confidence, higher bid costs, unforeseen	-Rigour and upfront due diligence on AFP projects reduces the likelihood of scope changes occurring once the transaction has been initiated. -Output based specifications typically require fewer scope changes. -The AFP model and contractual structure discourage scope changes. -Traditional contracts are less constrained and more flexible and have been historically prone to numerous scope changes.

	Risk Category	Definition	Rationale
		technical challenges, or misaligned qualifications of Bidders. Risk that scope of work is changed by the Owner during the Design phase, resulting in additional costs and schedule delays.	-For a DBB project, the tendering is undertaken by the owner. Scope changes can occur but are limited by an MTO internal review committee that must permit the scope changes. This limits the likelihood and extent of scope changes in the DBB tender process. However, there are situations and circumstances where the clearly defined scope provided by the tender drawings and specifications may result in gaps in the project requirements. This can lead to claims or delays during construction. -Furthermore, with DBB delivery, because the project would be implemented through multiple sequential contracts, there is a higher risk of scope and specification changes in the follow-on contracts. Experience gained from the first contract may result in changes to the scope and the specifications for the subsequent contracts. And there could continue to be more changes for the third, fourth contracts etc. -The AFP process defines the scope as agreed by IO and MTO in the Project Specific Output Specifications (PSOS) document. The related performance specifications are prepared by the MTO/IO consultant and they are documented in the PSOS schedule in the Project Agreement (PA). Typically, the major areas of work are defined including the number of bridges, culverts and the extent of the road improvements. -However, for AFP work, the scope definition remains at a higher level with less detail and a greater reliance on identification of the project needs and performance levels of the project. Because of this, there is less risk of missing a detailed scope element. -The PSOS asks the proponents to build a highway over the limits identified and to address all roadway, structure, electrical, drainage and pavements required to deliver the facility. The proponents in their bidding phase due diligence will work out how to deliver the project in accordance with the PSOS requirements. This results in a lesser likelihood of gaps in the specifications and the performance requirements. -The design scope for both Traditional and AFP is based on good design practice. However with AFP delivery, life cycle concerns are directly considered as required

	Risk Category	*Definition*	*Rationale*
			by the proponents' operations, maintenance and rehabilitation responsibility, thereby resulting in a design process that is fully integrated with the operations, maintenance and rehabilitation needs. -Scope creep is avoided with AFP as the designers work only to the PSOS requirements. Oversight efforts limit scope to the contract requirements. Selection of structure types, configurations and materials undergo significant scrutiny; a full life cycle optimization review balances the initial and long term costs of the various project elements. -The AFP proponent team oversees the design to minimize scope in such a way that work is only delivered as required by the PSOS and the conditions of the EA approval. It is quite likely in AFP delivery that the design scope will decrease over the duration to the design process given the design optimization process, scope controls, the optimization process and the design team's efforts to seek the most efficient design solution allowed by the performance requirements.
4.04	**Compliance with Codes and Standards - During Design**	Risk that design does not comply with relevant codes and standards.	-Output based specifications inherently have to comply with specified relevant codes and standards.
	Site Conditions / Environmental		
5.01	**Utility/Services Relocations**	Risk associated with inaccurate information provided during bid period or delay by third parties in approving or completing necessary	-The AFP program and associated commercial confidential meetings have established rigorous standards and due diligence requirements that mitigate to a greater degree risks associated with utility relocations and third party involvement.

	Risk Category	*Definition*	*Rationale*
		relocations.	
5.02	**Geotechnical**	Risk associated with incomplete / inaccurate information or delays associated with completing necessary investigations.	-The AFP program and associated commercial confidential meetings have established rigorous standards and due diligence requirements that mitigate to a greater degree geotechnical risk. The geotechnical baseline report establishes expected conditions against which the bidders take the risk for known and inferred geotechnical conditions.
5.03	**Existing Contamination**	Risk associated with incomplete / inaccurate information or delays associated with completing necessary investigations and remedial work.	-Under the AFP process, known contamination is generally defined and investigated prior to the bid process (both Level 1 and Level 2 investigation). Whereas under traditional delivery, typically only a Level 1 investigation is done during design and a Level 2 would be undertaken after contract award by the owner. -This risk is typically limited to the contamination identified in the bidding documentation leading to a sharing of risk beyond this point (subject to the conditions identified in the PA). -AFP projects provide more opportunity to work around contamination with less impact on project schedule than under traditional/DB delivery.
5.04	**Archaeological**	Risk associated with incomplete / inaccurate information or delay to completing necessary clearances	-The AFP program and associated commercial confidential meetings have established rigorous standards and due diligence requirements that mitigate to a greater degree archeological risk. -AFP projects provide more opportunity to work around archaeological sites with less impact on project schedule than under traditional/DBB delivery. -This risk is typically capped at the sites identified in the bidding documentation leading to a sharing of risk (subject to the conditions identified in the PA).

	Risk Category	*Definition*	*Rationale*
5.05	**EA Conditions of Approval**	Risk associated with satisfying specific EA Conditions of Approval	-The AFP team will be generally more effective in mitigating risks associated with EA Conditions of Approval. -AFP projects provide more opportunity to work around EA conditions of approval with less impact on project schedule than under traditional / DBB delivery.
	Construction		
6.01	**Adverse weather conditions**	Risk that unanticipated adverse weather conditions result in schedule delay or increased costs.	-Traditional / DBB projects typically consider adverse weather as a relief event, resulting in compensation to Contractor. - Under AFP adverse weather is managed and does not result in compensation.
6.02	**Construction Management Efficiency / Coordination**	Risk that contractor team does not effectively coordinate / manage construction activities to meet project schedule.	-Traditional use of progress payments reduces leverage and incentive to effectively manage construction to achieve Substantial Completion. -AFP multi-management structure facilitates completion of the project within the planned schedule.
6.03	**Resource Availability - Labour, Materials, Equipment**	Risk that required resources are not available, resulting in delay and increased costs.	-This risk is contractually transferred to Project Co for the concession period under DBF(O)M, who are better positioned to manage resourcing requirements in accordance with their schedule.

	Risk Category	*Definition*	*Rationale*
6.04	**Latent Defects**	Risk that latent defects result in operational difficulties, additional lifecycle maintenance costs or reduced asset residual value.	- Under AFP/DBF(O)M lifecycle and residual asset value is transferred to Project Co for a 30 year period, with latent defects remaining their responsibility.
6.05	**Default during Construction**	Risk of Project Co / contractor default, and subsequent replacement. This could result in delays and additional costs.	-Under the AFP program there are a number of mitigation measures that are undertaken to bring the project back on track for scheduled delivery such as Lender's longstop date, Lender's step-in rights, Liquidated damages regime. -Further, if Province had to step in and cure there would be access to the liquid security posted by the Constructor for the Lenders. - Under a Traditional program, Province would have access to less liquid bonding posted by the contractor, which could take much longer to recover costs.
6.06	**Scope Changes During Construction (directed by owner)**	Risk that the scope of work is changed by the Owner during the construction period.	-AFP model, and contractual and financing structure discourage scope changes during construction. -The AFP process involves construction of the work by a construction joint venture fully motivated to limit the cost of construction. The design scope and alternative design solutions continue to be examined during the construction process to find further efficiencies in design to reduce the cost of the work. The construction scope must deliver the project scope (such as number of bridges and extent of the road improvements) required by the PSOS. However, the designer and the contractor work together to find added efficiencies as the design and construction progress. Optimization is applied to key elements such as profile, detour configurations, traffic management requirements and staging. The value of time and the cost of work are

	Risk Category	Definition	Rationale
			balanced in the overall delivery of the project. -Experience on AFP projects has shown that innovations and efficiencies are found during the design and construction process as a result of the ongoing and effective interaction of the designer and the contractor. These interactions identify savings, manage construction risks and avoid quantity over runs related to the proposal estimates. In the AFP context, the designer and the construction joint venture are motivated to minimize cost and scope during construction, to manage and minimize stakeholder needs and to seek economies of design and scale well into the construction phase of the work. The IO AFP track record shows construction costs typically average 3% higher than the signed contract values. -Traditional contracts are historically prone to numerous scope changes. The construction is managed by the owner and their contract administrator. Construction scope changes may occur due to gaps in the design, and different quantities of work found during construction resulting from errors or omission in the design, or due to unknown conditions. The extent of scope changes in traditional projects is typically in the range of 10% to 15% of the contract value. Often, to minimize design changes or overruns during construction, an owner may produce a more conservative design, or undertake more extensive due diligence efforts (such as increased number of rock line boreholes or boulder field investigations) that may just shift the cost from construction overruns to added upfront engineering costs. -When any contractor bids a prescriptive contract in which they are directed on what to build by the owner, there is no incentive for the contractor to reduce the scope and cost of work during construction. The owner typically has a Change Proposal process but any resulting savings are limited, and shared, when a proposal is

	Risk Category	Definition	Rationale
			accepted. At the beginning of the fiscal year, MTO sets its overall construction budget at 85% - 90% of the funding allocated. This is done so as to have a contingency for project bids that are higher that the estimate and / or to cover potential contract over-runs during construction. -The structure of the DBB delivery model contract encourages the contractor to typically seek opportunities in the form of gaps and inconsistencies to justify scope changes and to add scope, thereby increasing the cost of work to the owner.
6.07	**Schedule Adherence**	Risk associated with incurring schedule delays and either having to rush construction (quality risk) or add resources (cost risk) to achieve schedule completion.	-In the AFP model, Lenders provide significant pressure to ensure project is completed on time, requiring contractor to manage and accelerate schedule to satisfy lending requirements and avoid liquidated damages. -Traditional project schedule is dictated by the owner who assume either acceleration cost risk or release from liquidated damages obligation if the schedule is changed.
6.08	**Quality Management**	Risk of added project costs to the owner for quality of work during construction affecting the long term performance of the facility.	- Under AFP/DBF(O)M lifecycle and residual asset value is contractually transferred to Project Co for the concession period, with quality issues remaining their responsibility in order to ensure asset maintains required standards, performance, and residual value. -The AFP project process involves construction of the work by a construction joint venture that is motivated by the Project Company (and lenders) and by the maintainer/operator to deliver quality work as they retain the long-term risks. An ISO 9000 quality process is set up on the project. The contractor or their subcontractors perform the Quality Control and the construction JV or the project

	Risk Category	Definition	Rationale
			company performs the Quality Assurance. This offers a check and balance situation because the project company is responsible for the maintenance and rehabilitation of the work for 30 years. - Many, if not most, of the construction deficiencies will emerge during the 30 year concession duration and the project company and their maintainer/operator are responsible for the repair of the work in accordance with the maintenance and rehabilitation performance standards. Experience working within AFP delivery teams shows that there is little tolerance for poor construction quality because the project company owns the risk of repair. The result is an enhanced level of accountability in the quality of design and construction (as compared to DBB) balanced by the maintenance and rehabilitation obligations. -In addition to the life cycle accountability associated with any AFP project, there are many more "eyes" on the work and levels of oversight. The project company and their agents perform the QC and QA. In some cases there is a third level of Quality Assurance (as on Highway 407 Phase 1) by the project company on the quality program undertaken by the construction joint venture. -Beyond the internal quality oversight, the project company must also satisfy the Lenders' Technical Advisor and the Independent Certifier on the quality of the work. Finally, the owner's staff and the owner's engineer/technical advisor also oversee the work identifying any deficiencies and quality concerns through reviews and quality audits. -Because of these multiple levels of oversight there is strict adherence to testing criteria and far less chance of "give and take" on project quality and construction standards. This results in the high quality standards enforced on an AFP contract in

	Risk Category	Definition	Rationale
			full compliance with every testing and quality requirement. In this way, the AFP work is held to a higher standard than traditional delivery (DBB) design and construction. -The warranty on Traditional / DBB projects is typically limited to two years. -For a DBB project, the construction is overseen by the owner and their contract administrator. Construction quality control is by the contractor and construction quality assurance is by the owner, or their representative. Full time inspection is not performed on all aspects of the work. Both the owner and the contractor perform testing of results and materials, but to different degrees. -On a traditional DBB construction project, the inspection is by a contract administrator retained by the owner who monitors the construction activity. They are the only organization reviewing the work from a quality context. On site, it is common practice for some "give and take" on the performance of the work to manage the relationship between the contractor and owner, and to cooperate in delivering the final product. Minor variations from specifications may be overlooked based on the professional judgment of the contract administrator, which is part of the normal "give and take" associated with the construction process on traditional contracts. There is no second "set of eyes" to oversee the work. -In most cases, their decisions are perfectly reasonable and justifiable, but there is a potential for some reduction in quality. As there is no full time inspection, there is the likelihood that things will be missed by the inspector. -Since the contractor is not responsible for the long term performance of the asset, the contractor's primary interest is to complete the work in the quickest and least costly way (sometimes at a lower level of quality) and have the work accepted by the owner. The work is typically subject to only a two year warranty so the contractor is not responsible to fix deficiencies that arise more than two years after substantial completion. -Because the work is paid by the owner by plan quantity and not actual quantity,

	Risk Category	Definition	Rationale
			there is an incentive to the contractor to minimize actual quantities used, where possible. Unless there is a rigorous process by the contract administrator to check line and grade and to verify the earthwork and paving quantities, small changes can reduce quantities resulting in savings to the contractor and possibly result in reduced performance. Significant and full time oversight is needed to ensure that the contractor always meets the contract requirements and does not skimp on materials and earthworks. -Given the above, quality issues can occur on traditional DBB delivery highway projects and any such deficiencies may not be readily identified by the contract administrator. Many of the quality issues are minor but there is a possibility that latent defects will become apparent after the warranty period in the form of frost heaves, pavement performance, settlements and structural performance.
	Specialized Equipment / Technology Risk		
7.01	**Availability**	Risk that specialized equipment procured by the Owner is not suitable for the required use, or is not delivered in compliance with the anticipated schedule.	-Risk impacts to be assessed based on project specific requirements.

	Risk Category	*Definition*	*Rationale*
7.02	**Equipment Selection Changes**	Risk that changes to the selected specialized equipment by the Owner resulting in delays and additional costs.	-Risk impacts to be assessed based on project specific requirements.
	Permits & Approvals		
8.01	**Regulatory Approvals**	Risk that there is a delay in obtaining relevant Regulatory Approvals by the Owner, resulting in schedule delays and additional costs.	-Assisting the owner in obtaining the necessary regulatory approvals.
8.02	**Implementation Approvals / Permits**	Risk that there is a delay in obtaining relevant Permits to the construction contractor, resulting in schedule delays and additional costs.	-In AFP, Project Co typically assumes risk for permits and approvals required during implementation, who are in a better position to manage and ensure permits/approvals are obtained in accordance with overall construction work/schedule.
8.03	**Title / Access / Title Encumbrances**	Risk that site access is not made available to Contractor within the prescribed timeframe.	-Rigour of AFP process helps to ensure that site is available and clear by FC.

	Risk Category	Definition	Rationale
	Completion / Commissioning		
9.01	**Commissioning**	Risk that commissioning delays could result in a delay to the handover of the facility resulting in additional costs.	-Under AFP, Project Co is responsible for ensuring that the commissioning process and requirements are satisfied and accounted for in its schedule, in order to achieve Substantial Completion, releasing payment. -The AFP project contract requires the commissioning of the work be undertaken prior to substantial completion and any payment for the work. The contractor is not paid for any work on the project until the commissioning requirements are addressed to meet PA requirements. Therefore, the owner has significant leverage given the substantial outstanding payment that incentivizes the project company to complete all required commissioning activities and address deficiencies. -Traditional/DBB approaches use progress payments, which diminishes incentives to ensure the commissioning process is managed and completed in a timely manner. - A DBB project is commissioned by the contractor prior to substantial completion. There are various tests and compliance requirements as well as QVE certifications required to complete the commissioning process. The road safety needs are a crucial elements of the commissioning process as a highway facility cannot go into operation until it meets the required safety requirements. -On a traditional DBB construction project, the substantial completion event is a requirement based on the extent of the work completed. This requirement does not include any requirement for commissioning of all aspects of the work. In DBB, the commissioning needs are relatively minor and some contractor payment is dependent on successful commissioning of the work (e.g. profileograph and pavement compaction). However, most of the work is paid for by the owner as work progresses and the requirements for commissioning may not be linked to payment. On a DBB project, much of the commissioning work is performed as the work is completed. With the work paid on a progress basis as the work is undertaken, the owner holds back 10% contract value to incentivize the contractor to complete the

	Risk Category	Definition	Rationale
			commissioning prior to the substantial completion date.
9.02	**Deficiencies**	Risk that there are deficiencies upon substantial completion resulting in additional cost to rectify deficiencies or overcome operational difficulties.	- Under AFP/DBF(O)M lifecycle and residual asset value is contractually transferred to Project Co for a 30 year concession period, with deficiencies remaining their responsibility. -The AFP project process requires rectification of all major deficiencies prior to substantial completion and prior to availability of the facility for use as a condition of full payment for the work. The contractor is not paid for any work until all major deficiencies are addressed. This requirement in the AFP contract is far more stringent than in a traditional contract. -Furthermore, as the major deficiencies are addressed, they are resolved through the project company's quality management system. Deficiencies are identified, a root cause analysis is undertaken and the means or rectification, replacement or repair is addressed through a non-conforming work (NCR) process. Major NCR's are identified for completion as a condition of the completion payment being issued. Therefore, the owner has significant leverage given the size and risk associated with not achieving the outstanding payment. This incentivizes the contractor to rectify and resolve deficiencies. -For AFP projects, the project company and their team is responsible for the quality control and the quality assurance. The lender's technical advisor is also interested in the quality of the asset over the life cycle as this is a project risk. Therefore, these parties monitor quality and project deficiencies and they are not interested in accepting deficient work that may increase their maintenance and rehabilitation costs. In addition to this, both the owner's staff and their consultants, and the owner's engineer, are involved in monitoring the project activities. Both the project company team and the owner's team identify deficiencies and work to resolve deficiencies using the clearly defined quality management process through the NCR process. -In AFP project delivery, there are multiple levels of oversight to identify, address

	Risk Category	Definition	Rationale
			and rectify deficiencies. This leads to the deficiencies being addressed prior the final completion of the work. While major deficiencies must be addressed before substantial completion, the AFP contract permits a set off for the cost of the minor deficiencies at 200% of the estimated cost of this work, which provides added security to ensure rectification of the work. -For a DBB project, the preferred course of action is to have deficiencies corrected by the contractor prior to substantial completion. The deficiency rectification process involves inspection of the work and rectification of work not in compliance with the project specifications. There are various inspections, reviews and certifications undertaken to identify and address deficiencies in traditional project delivery. -On a traditional DBB construction project, the substantial completion event is a requirement based on the percentage of work completed at the end of the project. The facility must also be available and safe for use prior to opening to traffic. The legal substantial completion event does not require resolution of deficiencies prior to the declaration of substantial completion. -The work on a DBB project is paid on a progress or work basis as the work is completed. There is only a 10% contract holdback to incentivize the contractor to complete and address deficiencies prior to substantial completion and release of the holdback. Therefore, rectification of minor deficiencies subsequent to substantial completion requires substantial effort by the owner to ensure that these deficiencies are addressed by the contractor. -Of note on a traditional DBB project, the contractor does the quality control and the owner's agent, the contract administrator, performs the quality assurance. This means that there is only one level of quality oversight to identify and address deficiencies. This can lead to deficiencies being missed or not being adequately addressed prior to completion of the final work. Overall, the risk is quite low.

	Risk Category	*Definition*	*Rationale*
	Maintenance, Life Cycle and Residual		
10.01	**General / Routine Maintenance**	Risk that general/routine maintenance is not performed to maintain the safety of the asset.	-Under DBF(O)M general/routine maintenance that is contractually transferred to Project Co for ~30 yr concession period, ensuring performance standards. The AFP payment mechanism could put the entire payment at risk. -Although there are budget constraints that may reduce the general maintenance program, this risk is largely reduced for transportation projects where the Province utilizes AMCs.
10.02	**Lifecycle Capital Maintenance**	Risk that capital maintenance is not performed when necessary throughout the lifecycle (concession period) of the asset to sustain the capital value of the asset.	-Under DBF(O)M capital maintenance is contractually transferred to Project Co for ~30 yr concession period, ensuring the asset is maintained to prescribed standard. -The AFP payment mechanism could put the routine maintenance payment at risk. -Under Traditional/DB contracts, budget limitations result in the deferral of necessary capital maintenance over a period comparable to the concession.
10.03	**Technology Changes**	Risk involving technology changes that could impact the delivery of systems and performance of maintenance activities.	-Under AFP/DBF(O)M, Project Co has incentive to embrace technological changes that may occur over the 30 yr concession that would improve the efficiency of performing obligations. - Under Traditional / DBB contracts, the public sector would be less likely to invest the capital necessary for technology updates.

	Risk Category	*Definition*	*Rationale*
10.04	**Default Of Maintenance Provider**	Risk of maintenance provider default and subsequent replacement. This could result in delays and additional costs.	-AFP contract transfers default risk of Maintenance Provider to Project Co which has the ability to manage risk without impact to delivery of services. - Lenders have step in rights and will not allow the project to terminate without corrective action. Project surety is put in place to minimize impact and protect the owner in case of default.
10.05	**Inflation Risk to Maintenance**	Risk of higher than anticipated inflation of maintenance related costs.	-Inflation risk generally retained. Under AFP/DBF(O)M, inflation above CPI or predetermined indexes would be responsibility of Project Co. -For traditional / DBB contracts, the AMC approach provides similar protection to the maintenance contractor.
10.06	**Asset Residual**	The risk that, at the end of the lifecycle, the asset residual value is less than expected because the quality of the asset is not equivalent to the handback requirements under a concession contract.	-Under DBF(O)M, the contract defines quality standards that are required to be achieved at the end of the concession period, along with rigorous Handback requirements, ensuring that asset is in a high quality condition. -The AFP process integrates the design, construction, maintenance, and rehabilitation aspects of the work under a single contract. All these activities are the responsibility of the project company under the oversight of the owner and their agents. The project company is required to develop and build the facility, then manage it over the 30 year concession. -This essentially gives the owner a 30 year warranty on the work performed. It is recognized that structures have a design life of 75 years. While other aspects of the project have a much shorter service life, experience indicates that the majority of design and construction defects will be detected within this 30 year concession period. The owner will receive a facility that is in good condition at the end of the 30 year concession. - Also, the maintenance and rehabilitation work is fully funded by the project company and the owner will oversee the concession to ensure that all required

	Risk Category	Definition	Rationale
			repairs are completed in accordance with the performance standards. If there are deficiencies identified prior to the 30 year handback, the project company is responsible for all repairs prior to the final handback acceptance. -The combination of the 30 year warranty, the overall life cycle responsibility and the fully funded rehabilitation program leading to handback reduces the risk of added cost to the owner. -Under a Traditional / DBB approach, the asset is more susceptible to neglect or inadequate major rehabilitation investment thus diminishing asset quality and expected service life. -For a DBB project, all work is constructed by a contractor and there is a two year warranty on the construction work. All operation, maintenance and rehabilitation work and the associated costs are the responsibility of the owner. Traditional delivery addresses the life cycle cost in the design of project, but there is no direct contractual link between design and the rehabilitation cost. The life cycle risk remains with the owner. With this disconnect between design and life cycle, there is a greater risk that the owner will incur added costs to rehabilitate the facility to the same standard that is required for an AFP project at the end of the 30 year concession period. -With traditional delivery, the owner is responsible for the life-cycle rehabilitation of the facility. There is a risk that future funding for the infrastructure rehabilitation may be less than optimal, or budget appropriations may not be available during times of tight budgets or when the need for asset rehabilitation becomes necessary. Therefore, there is a further risk that that the required work will not be performed in a timely fashion. -Even if there is full funding, the direct accountability between design-construction work and the long term rehabilitation is missing. The designer may make decisions with limited direct involvement of the asset manager and design decisions can tend to minimize short-term costs savings as opposed to the optimal balance between capital and rehabilitation costs.

	Risk Category	*Definition*	*Rationale*
			-It must be noted that when the optimum rehabilitation window is missed, there is not a linear increase in added cost to bring the facility to standard; often, the rehabilitation cost increases exponentially beyond that point. Therefore, it is important to design and construct the facility properly and to rehabilitate the work in a rigorous and planned way. The VFM approach used by IO models underfunding of traditional delivery by setting the rehabilitation allocation by the government at 60% of the expected full life cycle needs.
10.07	**Energy Consumption**	Risk of higher than anticipated energy consumption resulting in additional costs.	- AFP transfers energy consumption risk to Project Co. who is better positioned to manage usage and maintain efficiency.

3.7.2 *Risk Matrix – DBFM Highways*

2015 Mar 18 *DBFM Civil (Highways)*				Design Build Finance & Maintain Model							Traditional Model							Comments on Changes to Standard Matrix
		Cost Base		Probability	Impact						Probability	Impact						
	Risk Category	Portion of DBFM	Value	%	10th perct	Typical	90th perct	Province	Transfer	Shared	%	10th perct	Typical	90th perct	Province	Transfer	Shared	
	Project Budget																	
1.00	Policy / Strategic																	
1.01	Government Approvals for Program	Total Contract	$984	5.00%	5.00%	10.00%	25.00%	X			5.00%	5.00%	10.00%	25.00%	X			
1.02	Government Approvals for Project	Total Contract	$984	20.00%	5.00%	20.00%	40.00%	X			20.00%	5.00%	20.00%	40.00%	X			
1.03	Government Funding	Total Contract	$984	5.00%	1.00%	3.00%	10.00%	X			10.00%	2.50%	5.00%	15.00%	X			
1.04	Project Schedule	Design & Construction	$755	1.00%	2.00%	12.00%	15.00%	X			50.00%	10.00%	20.00%	25.00%	X			
	Subtotal																	
	Total for Policy / Strategic																	
	Design, Tender and Construction																	
2.00	Transaction / Tender Process																	
2.01	Due Diligence (by the owner in preparation of tender in RFP)	Total Contract	$984	10.00%	1.00%	3.00%	15.00%			X	20.00%	5.00%	10.00%	20.00%	X			
2.02	Tendering Competition	Total Contract	$984	5.00%	2.00%	3.00%	5.00%	X			10.00%	5.00%	10.00%	20.00%	X			
2.03	Delays in Contract Award/Financial Close	Total Contract	$984	5.00%	1.00%	2.00%	5.00%			X	10.00%	1.00%	2.00%	5.00%	X			
2.04	Termination prior to Contract Award/Financial Close	Total Contract	$984	5.00%	1.00%	3.00%	5.00%	X			10.00%	0.50%	1.50%	2.50%	X			
	Subtotal																	
	Total for Transaction / Tender Process																	
3.00	Project Agreement																	
3.01	Ambiguities In Legal Agreements	Total Contract	$984	5.00%	0.50%	1.00%	2.00%		X		10.00%	1.00%	2.00%	4.00%			X	
3.02	Termination For Convenience During Construction	Design & Construction	$755	1.00%	5.00%	30.00%	45.00%	X			1.00%	5.00%	10.00%	15.00%	X			
3.03	Termination For Convenience During Operations/Maintenance Phase	Operations & Maintenance	$230	3.00%	10.00%	30.00%	45.00%	X			10.00%	15.00%	30.00%	45.00%	X			
	Subtotal																	
	Total for Project Agreement																	
4.00	Design																	
4.01	Stakeholder Consultation Pre FC	Design & Construction	$755	3.00%	0.50%	1.00%	3.00%	X			10.00%	0.50%	1.00%	3.00%	X			
4.02	Stakeholder Consultation - Post FC and Tender	Design & Construction	$755	1.50%	0.50%	1.00%	3.00%			X	10.00%	1.00%	2.00%	6.00%	X			
4.03	Scope Changes initiated by Owner During Tender Process and Design	Design & Construction	$755	3.00%	0.50%	1.00%	3.00%	X			25.00%	2.00%	4.00%	10.00%	X			
4.04	Compliance with Codes and Standards - During Design	Design & Construction	$755	1.00%	0.50%	1.00%	3.00%		X		3.00%	1.00%	3.00%	10.00%	X			
	Subtotal																	
	Total for Design																	
5.00	Site Conditions / Environmental																	
5.01	Utility/Services Relocations	Design & Construction	$755	10.00%	2.00%	5.00%	10.00%			X	25.00%	3.00%	7.50%	15.00%			X	
5.02	Geotechnical	Design & Construction	$755	5.00%	1.00%	2.00%	5.00%		X		15.00%	2.00%	5.00%	10.00%	X			
5.03	Existing Contamination	Design & Construction	$755	5.00%	2.00%	5.00%	15.00%			X	5.00%	3.00%	7.00%	20.00%	X			
5.04	Archaeological	Design & Construction	$755	5.00%	2.00%	5.00%	10.00%			X	5.00%	4.00%	10.00%	20.00%	X			
5.05	EA Conditions of Approval	Design & Construction	$755	5.00%	2.00%	5.00%	10.00%		X		20.00%	2.00%	5.00%	10.00%	X			
	Subtotal																	
	Total for Site Conditions / Environmental																	
6.00	Construction																	
6.01	Adverse weather conditions	Design & Construction	$755	10.00%	1.00%	3.00%	5.00%		X		15.00%	3.00%	10.00%	20.00%			X	
6.02	Construction Management Efficiency / Coordination	Design & Construction	$755	5.00%	0.50%	1.00%	3.00%		X		15.00%	1.00%	2.00%	6.00%	X			

3.7.3

2015 Mar 18 *DBFM Civil (Highways)*				Design Build Finance & Maintain Model							Traditional Model							Comments on Changes to Standard Matrix
		Cost Base		Probability	Impact						Probability	Impact						
	Risk Category	Portion of DBFM	Value	%	10th perct	Typical	90th perct	Province	Transfer	Shared	%	10th perct	Typical	90th perct	Province	Transfer	Shared	
	Project Budget																	
6.03	Resource Availability - Labour, Materials, Equipment	Design & Construction	$755	5.00%	1.00%	2.00%	5.00%		X		10.00%	1.00%	2.00%	5.00%			X	
6.04	Latent Defects	Design & Construction	$755	5.00%	2.00%	5.00%	10.00%		X		15.00%	5.00%	10.00%	20.00%	X			
6.05	Default during Construction	Design & Construction	$755	1.00%	0.50%	1.00%	3.00%		X		5.00%	2.00%	5.00%	15.00%	X			
6.06	Scope Changes During Construction (directed by owner)	Design & Construction	$755	10.00%	5.00%	10.00%	15.00%	X			50.00%	20.00%	25.00%	30.00%	X			
6.07	Schedule Adherence	Design & Construction	$755	5.00%	0.50%	2.00%	5.00%		X		10.00%	1.00%	5.00%	10.00%	X			
6.08	Quality Management	Design & Construction	$755	5.00%	2.00%	5.00%	10.00%		X		15.00%	5.00%	10.00%	20.00%	X			
	Subtotal																	
	Total for Construction																	
7.00	Specialized Equipment / Technology Risk																	
7.01	Availability	FF&E	$30	5.00%	0.50%	1.00%	2.00%			X	5.00%	0.50%	1.00%	2.00%	X			
7.02	Equipment Selection Changes	FF&E	$30	2.00%	1.00%	2.00%	5.00%	X			5.00%	0.50%	1.00%	2.50%	X			
	Subtotal																	
	Total for Specialized Equipment / Technology Risk																	
8.00	Permits & Approvals																	
8.01	Regulatory Approvals	Design & Construction	$755	5.00%	0.50%	1.00%	2.00%			X	5.00%	0.50%	1.00%	2.00%	X			
8.02	Implementation Approvals / Permits	Design & Construction	$755	5.00%	0.50%	1.00%	3.00%		X		5.00%	1.00%	2.00%	5.00%			X	
8.03	Title/Access/Title Encumbrances	Design & Construction	$755	5.00%	2.00%	5.00%	10.00%	X			10.00%	1.00%	2.50%	5.00%	X			
	Subtotal																	
	Total for Permits & Approvals																	
9.00	Completion / Commissioning																	
9.01	Commissioning	Design & Construction	$755	5.00%	0.50%	1.00%	2.00%		X		10.00%	0.50%	1.00%	2.00%	X			
9.02	Deficiencies	Design & Construction	$755	2.00%	0.50%	1.00%	2.00%		X		5.00%	1.00%	2.00%	5.00%			X	
	Subtotal																	
	Total for Completion / Commissioning																	
	Maintenance																	
10.00	Maintenance, Life Cycle and Residual																	
10.01	General / Routine Maintenance	General Routine	$95	5.00%	1.00%	3.00%	5.00%		X		5.00%	1.00%	3.00%	5.00%	X			
10.02	Lifecycle Capital Maintenance	Design & Construction	$755	5.00%	5.00%	10.00%	25.00%		X		10.00%	5.00%	10.00%	25.00%	X			
10.03	Technology Changes	General Routine Maintenance & Lifecycle Capital Maintenance	$230	10.00%	1.00%	2.00%	5.00%		X		10.00%	1.00%	2.00%	5.00%	X			
10.04	Default Of Maintenance Provider	General Routine Maintenance & Lifecycle Capital Maintenance	$230	5.00%	5.00%	8.00%	10.00%		X		10.00%	5.00%	8.00%	10.00%	X			
10.05	Inflation Risk to Maintenance	General Routine Maintenance & Lifecycle Capital Maintenance &	$240	50.00%	2.00%	5.00%	10.00%		X		50.00%	2.00%	5.00%	10.00%	X			
10.06	Asset Residual	Design & Construction	$755	5.00%	5.00%	10.00%	20.00%		X		50.00%	20.00%	25.00%	35.00%	X			
10.07	Energy Consumption	Energy Consumption	$10	25.00%	3.00%	5.00%	10.00%		X		25.00%	5.00%	15.00%	25.00%	X			
	Subtotal																	
	Total for Maintenance, Life Cycle and Residual																	

NOTE: This risk matrix is confidential and commercially sensitive