

Analysis of Risks and Cost Overruns in Design-Bid-Build Highway Infrastructure Projects in Ontario

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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Abstract

Cost overruns commonly occur in infrastructure projects, and when the owner is a government entity, these overruns may disrupt the funding available for other projects.

Research on large projects indicates that actual project costs are on average 20% higher than estimates for road projects and 34% higher than estimates for tunnel and bridge projects.

Other studies that reiterate the presence of cost overruns report values between 3.9 and 10 percent.

Risk management can be used to identify and assess risks that may cause overruns and develop risk response plans to address them. The objective of this research is to use risk management knowledge to identify and assess project risks and their expected impacts on highway infrastructure projects in Ontario. The studied Ministry of Transportation of Ontario (MTO) projects have an average cost overrun of 5.2% of tender value for new construction projects, and 11.5% for rehabilitation projects.

The risk identification and analysis is followed by a comparison between MTO's risk management experience and other typical North American organizations that are involved in transportation infrastructure such as Infrastructure Ontario and the California Department of Transportation, as well as other contract delivery methods such as design-build and public-private partnerships.

From analyzing 986 risk events, this research identifies design scope changes, material, and latent conditions as the main risks that appear to influence cost overruns for rehabilitation projects. For new construction, the main risks are design scope changes, latent conditions, and permits and regulations.

Once the risks are identified and analyzed, action is required to manage the risks that are considered most important. This thesis touches lightly on possible risk management actions for the identified risks.

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Chapter 1

Introduction

1.1 Background and Motivation

Cost overruns, schedule delays, and quality issues commonly occur in infrastructure projects. According to research conducted by Flyvbjerg et al. (2003) on 258 large transport infrastructure projects in 20 nations, actual project costs are on average 20% higher than estimates for road projects and 34% higher than estimates for tunnel and bridge projects. Other studies that reiterate the presence of cost overruns report values between 3.9 and 10 percent (Siemiatycki, 2009; Gransberg et al., 2000).

The Ontario Ministry of Transportation (MTO) has awarded approximately 600 major capital projects (over \$1 million each) and 1,450 minor capital projects (under \$1 million) in the past five years (Office of the Auditor General of Ontario, 2016). It also funds projects on a yearly basis and “self insures” its projects, which means that contingency is not built into a project’s budget. Rather, it is built into the budget of the Ministry or completely absorbed by the contractor. Hence, cost overruns of the magnitude reported by Flyvbjerg et al. (2003) can have a detrimental effect on the funding of other projects if not planned for by MTO.

Risk management can be used to identify risks present during a project’s lifecycle, to determine the root causes of project deliverable deviations such as cost overruns, and to develop plans to address these risks. Caution is necessary when applying the data and results of risk research studies to projects occurring in a different country, because construction costs may be geographic and economic area or time period specific (Creedy et al., 2010). This makes risk data collected based on an organization’s own projects more valuable and

accurate than risk data collected elsewhere when analyzing a particular organization's risk profile.

The need for risk management is general, however, it is particularly critical given the existence of evidence that projects are not meeting their success criterion (Williams, 1993). In MTO's case, the projects provided for this research exhibit cost overruns and minor time overruns on a select number of projects. Additionally, a report by the Office of the Auditor General of Ontario raises concerns regarding pavement conditions due to premature cracks observed in completed highways projects (Office of the Auditor General of Ontario, 2016). This identifies the existence of life-cycle risks resulting from construction actions. Analysis of the MTO risk management experience is therefore worthwhile.

1.2 Problem Statement

Research into the reasons of cost overrun in transportation and transit infrastructure projects is prevalent (Siemiatycki, 2009; Taylor et al., 2012; Shane et al., 2009) but only a handful of papers apply risk management knowledge to identify the risks and uncertainties that materialize and cause the cost overruns and delays in projects (Creedy et al., 2010; Wilson et al., 2015). Our research indicates that an empirical-based approach to risk management could improve the government's ability to deliver transportation projects in Ontario, Canada. There are various risk management processes available to select from, however, the empirical data necessary to conduct risk management is not readily available.

For example, Infrastructure Ontario (IO) relies on external organizations to create the sector specific risk matrices used in their Value for Money (VFM) assessment to determine the feasibility of delivering the project through the Alternative Financing and Procurement (AFP) method. An Office of the Auditor General of Ontario report (2014) concludes that there is no

empirical data supporting the key assumptions used by IO to assign costs and impacts to specific risks. It relies on professional judgment & experience of external advisors for these cost assignments and probabilities, which makes it difficult to verify them. If experience is the only source of information, it is generally better than no information. However, experience can be subjective, anecdotal, filtered, and opaque in terms of temporal and conceptual scope of assessment, none of which are preferred in a scientific method. Statistical approaches if possible are generally considered more reliable.

An organization's risk management process focuses on assessing the project risks that are allocated to them. Risk distribution among stakeholders is defined by project delivery method, bonding requirements, and contract language details. Therefore, the risks incurred by the MTO will not necessarily be similar to other highway management programs, necessitating an assessment of their unique project delivery approach.

1.3 Research Objectives

The aim of this research is to start implementation of the general risk management process of risk identification, assessment, response, and monitoring and control, to identify, describe, and assess typical project risks and their expected impacts on highway infrastructure projects in the province of Ontario, Canada. Risk identification will be conducted by determining possible risk events based on a review of project documents, literature review, and consultation with the MTO. Risk assessment is limited to identifying the probability of occurrence and impact of the identified risk events in the available project sample.

This can be achieved through the following objectives:

1. Conduct a literature review on risk management and on cost overruns in highway infrastructure projects in Ontario.

2. Evaluate the risk management experience of MTO by developing and applying a risk identification and assessment approach to a set of MTO projects.
3. Compare MTO's risk management experience with that of organizations that use other project delivery and risk management methods, such as public-private partnerships (PPP) and design-build (DB) entities.
4. Identify possible methods to address the shortfalls of the risk management at MTO and to reduce cost overruns.

1.4 Research Scope

MTO is responsible for Ontario's provincial highway and bridge infrastructure, which consists of approximately 40,000 Km of highway lanes and 5,000 bridges and culverts. The Ministry has awarded approximately 600 major capital projects (over \$1 million each) and 1,450 minor capital projects (under \$1 million) in the past five years (Office of the Auditor General of Ontario, 2016). This research analyzes a small sample of the work that MTO executes with a set of projects consisting of three new construction and eleven rehabilitation projects. All of the projects, except for one, are classified as major capital projects.

1.5 Research Methodology

The proposed approach follows the general risk management process of risk identification, assessment, response, and monitoring and control with the main focus on the first two steps. The risks of interest are those that a department of transportation is responsible for in a Design-Bid-Build (DBB) project delivery method.

Risk identification involves the development of a risk register to identify possible project risks from past projects and to identify risks using new project specific knowledge. A literature review is conducted to create a basic risk register that is then compared with a

sample MTO project to determine if it captures the majority of generally experienced risks as well as MTO experienced risks. The resulting risk register is then applied to a larger number of projects that are also provided by MTO. The risk identification step is followed by risk assessment, which is the identification of the impacts and probabilities of the risks. This results in empirical evidence on the types and characteristics of risks that are the responsibility of the MTO.

1.6 Thesis Structure

This thesis is divided into seven chapters. Chapter 1 presents a description of the research background, motivation, objectives, scope, and methodology. Chapter 2 is a comprehensive literature review of risk management techniques, the industry's view on the application of risk management, and risk management application in different transportation projects and project delivery methods. Chapter 3 outlines the data collection process and characteristics of the data sample. Chapter 4 outlines the proposed risk management analysis approach, and describes the analysis of completed MTO projects. Chapter 5 presents the results of applying the proposed approach (Chapter 4) to the sample data collected (Chapter 3). Chapter 6 presents lessons learned from this research. Chapter 7 concludes the thesis with a summary of the results, contributions, and potential directions for future work.

Chapter 2

Literature Review

This chapter presents a literature review on current risk management processes, the construction industry's outlook on the application of risk management, and some examples of applying risk management in the transportation sector.

2.1 Risk Management Techniques

This section contains a brief overview of commonly accepted risk management processes and common risk management methodologies such as project risk analysis and management (PRAM) (Chapman, 1997).

General risk management steps are presented in Figure 2.1. Risk identification is the process of determining and documenting the characteristics of potential risks that might affect a project. Risk is defined as an uncertain event that may occur in the future and have a negative or positive outcome. The majority of risk assessment processes follow the qualitative or quantitative risk analysis process. These consist of qualitatively evaluating the presence and severity of risks or determining numerical probabilities and impacts of the identified risks and using tools such as Monte Carlo analysis to determine their potential impact on project outcomes. Once the risks are assessed, the common risk response strategies are acceptance, transfer, mitigation/control, exploitation, enhancement, or avoidance (Caltrans, 2012; Oberlender, 2014). The definition of each of these strategies is presented in Table 2.1.

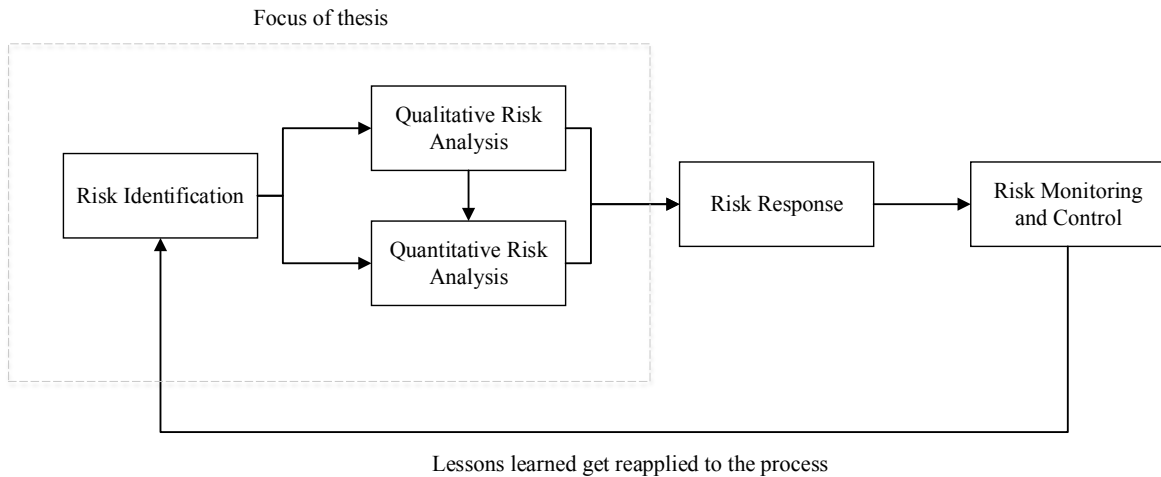


Figure 2.1: Risk Management Process (Haas, 2013)

Table 2.1: Description of Risk Response Strategies (Caltrans, 2012; Oberlender, 2014)

Risk Response Strategy	Description
Acceptance	The party responsible for the risk agrees to address it when it occurs. This is usually done for risks that have a low probability of occurrence and impact, or if they are difficult to control using the other strategies
Transfer	Transferring the responsibility of the risk to another party through contracts and third party guarantees (e.g. insurance or performance bonds)
Mitigation/Control	Reducing the probability of occurrence and/or impact of the risk
Exploitation	Taking on risks that have may have a positive impact
Enhancement	Increasing the probability of occurrence and/or impact of risks with an expected positive outcome
Avoidance	Changing the project parameters, such as scope of work and specifications, to avoid the source of the risk

The project risk analysis and management (PRAM) method (Chapman, 1997) was developed by the Association of Project Managers and includes nine different phases from defining the project, focusing on the risk management process at an operational level, identifying risks, providing a more complex structure to assumptions if possible, allocation of risk ownership,

estimates of likelihood and impact of risks, evaluating the results of the estimation, developing a contingency plan, and then managing the plan through monitoring and control (Chapman, 1997).

The Project Management Institute's (PMI) project risk management (PMI, 2013) includes identifying risks, performing qualitative risk analysis, performing quantitative risk analysis, planning risk responses, and controlling risks. Identifying risks involves determining the risks that may affect the project and documenting their characteristics. This includes the creation of a risk register from inputs such as risk, cost, schedule, quality, and human resources management plans, activity duration and cost estimates, scope baseline, and project documents. The inputs and tools and techniques such as documentation reviews, information gathering techniques (examples: brainstorming and Delphi technique), assumptions analysis, and SWOT (strengths, weaknesses, opportunities, and threats) analysis help with determining the risks that may affect the project and documenting their characteristics. The qualitative risk analysis involves prioritizing the identified risks for further analysis or action using their probability of occurrence and impact. This is performed using inputs such as scope baseline, risk register, risk management plan and tools and techniques such as risk probability and impact assessment, probability and impact matrix, risk data quality assessment, and risk categorization. The quantitative risk analysis involves numerically analyzing the effect of identified risks on project objectives. This is performed using inputs such as risk, cost, and schedule management plans, and risk register and tools and techniques such as data gathering and representation techniques (e.g., interviewing and probability distributions), quantitative risk analysis and modeling techniques (e.g., sensitivity analysis, expected monetary value analysis, and modeling and simulation), and expert judgment. This step is performed on risks that have been prioritized in the qualitative risk analysis step.

The goal of the risk response is to enhance opportunities and to reduce threats to project objectives. This can be accomplished through risk avoidance, transfer, mitigation, acceptance, exploitation, enhancement, sharing, or using a contingency plan to be executed under certain predefined conditions. Controlling risks occurs over the lifecycle of the project and includes implementing the risk response plans, tracking identified risks, and updating the risk register. Each of the inputs, tools and techniques, and outputs mentioned above are discussed in further detail in PMI's publication (PMI, 2013).

The World Bank's Public-Private Partnerships Reference Guide (2014) presents a risk management process that involves putting together a list of all the risks that could be associated with a project and then classifying the risks in terms of the likelihood of the risk occurring and the severity of its impact on project outcomes. This can be done quantitatively or qualitatively, however, in practice the qualitative approach is usually implemented. This step is followed by risk allocation with two goals in mind, to create incentives for the parties to manage risks well and to reduce the overall cost of project risk by 'insuring' parties against risks they are unwilling to bear.

Journal articles such as Zoysa & Russell (2003) and Williams (1995) present summaries that highlight other project risk management processes that relate to industries such as defense and business enterprises that may also be applicable to the construction industry.

Risk management processes provide a few quantitative risk assessment tools and techniques that can be used with evidenced-based probabilities of occurrence and impacts of risk factors. These include decision trees, sensitivity analysis, probability and impact matrix, and Monte Carlo simulation. This research focuses on the determining the evidenced-based probabilities

of occurrence and impacts of risk factors, which are the data necessary to use these tools and techniques.

2.2 The Application of Risk Management

This section presents a few examples of the application of risk management in the transportation sector.

Wilson et al (2014) applied a program risk management approach to data aggregated from three projects provided by the Washington State Department of Transportation (WSDOT). The approach involved utilizing the Monte Carlo simulation model at both the project and program level. The results of the approach are in terms of the impact of the identified risks on the total project cost. The presented results show that there are some statistical benefits to applying risk management at the program level rather than the project level, including an increase in cost certainty. However, the source of the risk data inputs (e.g., probability and impact) used in the model was not disclosed.

A case study conducted by Maria-Sanchez et al. (2011) demonstrates how the California Department of Transportation's (Caltrans) project risk management method is applied in practice to a bridge replacement or rehabilitation project. Two replacement and one rehabilitation alternative out of five alternatives were considered in the risk assessment. The Level 1 risk analysis, which includes a qualitative analysis that is a low to high risk rating based on the priority for risk response, exhibits the highest number of risks under the environmental or design categories for all alternatives. Level 2 is used to identify the number of critical risks per alternative and shows six critical risks for the rehabilitation alternative and six and seven risks for the replacement alternatives, respectively. Level 3 analysis, which

focuses on the critical risks, reveals that a higher contingency was needed for all three alternatives than the one proposed based on the project cost estimate.

2.3 Industry’s Outlook on Risk Management

Interviews and questionnaires conducted in the civil engineering industry generally come back with the consensus that risk management is important (Akintoye & Macleod, 1996; Diab et al., 2012). Its application is commonly limited to risk assessment and analysis in the early stages of a project when it can be a more dynamic process that is applied throughout the lifecycle of a project. Studying interviews and surveys, such as the study summarized in Table 2.2, help demonstrate why risk management is important and how it can be implemented.

Table 2.2: Results of Risk Management Survey

Background Information On Research Paper	Results
<ul style="list-style-type: none"> • Paper: Akintoye and Macleod, 1996 • Type: Questionnaire • Industry sector: Construction • Participants: 70 General Contractors (30 responses) and 30 Project management practices (13 responses) • Location: UK 	<ul style="list-style-type: none"> • Risk in construction projects: Contractors perceived risk as the likelihood of unforeseen factors occurring, that could impact the successful completion of the project in terms of cost, time, and quality. However, one contractor saw risk as an opportunity to make a profit. The Project managers (PMs) had similar risk perceptions and recognized that the consequences of risks directly affect the client and his objectives rather than their practices. This is expected because they provide consultancy services on a fee basis and do not commit large volumes of resources to construction projects. • Significance and need of risk management: The contractors generally agreed about the industry’s association with high risk and viewed risk management as essential to minimizing business losses and controlling costs from their construction activities. PMs are concerned with risk management in relation to their client’s objectives, legal responsibility, and reputation. • Risk premium in construction: risk sources central to the construction activities include physical, environmental, design, logistics, financial, legal, political, construction, and operations risk. A common risk premium strategy in the form of contingency allowance can be placed on these risks. This premium can depend on the risk exposure faced by individual firms from each of the sources; likelihood of occurrence; experience of the firm in dealing with the

	<p>particular type of risk; attitude of the firm to risk; and the extent of impact posed by the sources. The contractors identified financial, contractual agreement, construction, market/industry (availability of workload), and project (design information) risks as having the highest risk premiums and PMs identified financial, contractual agreement, project, and market/industry risks as having the highest risk premiums. The contractors and PMs have similar order of importance for the risk sources with financial and contractual risks being most important.</p> <ul style="list-style-type: none"> • Management of risk: Most contractors transfer risk to their subcontractors through ‘back to back’ sub-contract agreements and through insurance, while PMs use professional indemnity insurance and the wording of contracts conditions with client and designers to transfer risks associated with services provided to clients. • Current usage of risk management techniques: techniques of risk analysis: risk premium, risk adjusted discount rate, subjective probability, decision analysis (algorithms, mean end analysis, Bayesian theory, and decision trees), sensitivity analysis, Monte Carlo simulation, stochastic dominance, Caspar, and intuition. The surveyed participants generally use intuition/judgment/experience for risk management, which supports that risk analysis is largely based on the use of checklists by managers who try to think of all possible risks and take appropriate action (not a formal technique). Sensitivity analysis is the second most used technique because it provides answers to a whole range of ‘What if’ questions, is simple to use, has the ability to focus on a particular estimate, and provides information on the project risk variables that could have a serious potential impact on cost and time. Techniques such as subjective probability and Monte Carlo simulation are undertaken by only a small number of organizations because of the requirement to quantify the probability of occurrence and probability distribution of risk factors before beginning the analysis. Other computer based techniques like stochastic dominance, Caspar, mean end analysis, and algorithms are not used by the firms. One drawback of risk analysis techniques is that the more powerful and sophisticated the technique, the more data and time is required. This does not bode well for contractors since activities in the construction industry are constrained by time because construction production is mostly employed just in time for the client’s production requirement.
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2.4 Examples of Applying Risk Management in the Transportation Sector

The Ontario Ministry of Transportation (MTO) can look to other North American transportation departments for alternative risk management strategies. MTO’s current risk management process involves the use of a risk register, with probabilities and impacts, in

their scope and cost report to determine high and reasoned cost estimates for a project during the budgeting stage.

In the United States, the federal government's Moving Ahead for Progress in the 21st century Act (MAP 21) mandates that state departments of transportation (DOTs) have a formal risk management plan for the national highway system as part of their asset management system. In general, U.S. DOTs mainly address risk at the project level but the MAP 21 Act requires risk management at the program, system, and enterprise level (Boadi et al. 2015).

The California Department of Transportation (Caltrans) follows an in-house project risk management process that implements a minimum of a risk register for projects with a value less than 5 million USD (Level 1), a risk register with qualitative analysis for projects between 5 and 100 million USD (Level 2), and a risk register with quantitative analysis for projects over 100 million USD (Level 3). Level 1 includes a qualitative analysis that includes a low to high risk rating of risks based on the priority for a risk response. Level 2 adds on a predefined numerical impact and probability scale that corresponds to a very low to very high impact and probability rating for time and cost. Level 3 involves Monte Carlo simulation software to determine the impact of identified risks on the project's cost and completion date (Caltrans 2012).

In public-private partnership (PPP) projects, the public sector is theoretically able to transfer risks to the private sector that places their risk management methods at the forefront.

Infrastructure Ontario's (IO) Value for Money (VFM) assessment for projects valued above 100 million dollars compares the cost of the traditional Design-Bid-Build (DBB) approach as delivered by MTO to the total risk-adjusted cost to the public if the project is delivered through the Alternative Financing and Procurement (AFP) model also known as PPP in the

United States (Infrastructure Ontario, 2015). This assessment relies on a few components including retained risk, for which the province is accountable. To determine the risks retained by the public sector, IO conducts a project specific risk workshop that brings together key stakeholders and industry experts to assess the project attributes that may give way to certain risks and require an adjustment to the generic risk matrix estimation that was developed by the industry experts. The risk matrices along with risk impacts, probabilities, and a statistical simulation method are used to quantify the total risks retained (Infrastructure Ontario, 2015). IO relies on professional judgment & experience of external advisors for the risk cost assignments in the VFM assessment, which makes it difficult to verify the key assumptions used without the supporting empirical data (Office of the Auditor General of Ontario, 2014). Chapter 4 provides a comparison between the risk registers presented as a baseline by the project risk management guidelines of the departments of transportation mentioned above.

2.6 Examples of Cost Overrun Analysis in the Transportation Sector

This research is related to a few other recent studies into the causes of cost overruns in the transportation sector. Siemiatycki (2009) analyzed the results of independent government auditor studies on transportation-project cost overruns and identified the most frequently used explanations for these overruns as scope changes and change orders, poor project reporting and performance tracking, poor project management, project delays leading to cost escalation, incomplete studies before project approval, and unexpected inflation in materials. Similar research, conducted at the University of Kentucky, on 610 Kentucky roadway construction projects from the year 2005 to 2008, determined that the main causes of change orders included contract omissions, contract item overrun, owner-induced enhancement, and fuel and asphalt adjustments. The work items displaying a high frequency of occurrence and

high magnitude change for contract omissions are guiderail and barrier and asphalt bases; for contract item overrun the main work items are guiderail and barrier, asphalt bases, earthwork, and erosion control; finally, for owner-induced enhancement the main work items are guiderail and barrier, asphalt bases, and earthwork (Taylor et al. 2012).

Aside from these studies, there are relatively few examples of developing empirical risk probabilities from project data. Instead, many studies rely on interviews, surveys, and expert opinion (Office of the Auditor General of Ontario, 2014; Diab et al., 2012; Nasir et al., 2003).

2.7 Summary of Research Gaps

Based on the conducted literature review on risk assessment and management, a lack of literature exists on evidence-based likelihoods for transportation project risk factors. The risk management processes introduced in this chapter outline how this tool can be used and describes the data necessary for implementation. In instances where such probabilities of occurrence and impacts of risk factors have been published, such as Wilson et al (2014) and MMM Group Limited (2015), no data is available beyond the method used to determine the numerical values, making it difficult to verify their applicability to MTO's approach to project delivery.

Caution is also necessary when applying the data and results of risk research studies to projects occurring in different countries because construction costs may be geographic/economic area or time period specific. And as noted previously, the distribution of risks is specific to the project delivery approach, as well as the bonding requirements and all contract details. This makes risk data collected on an organization's own projects more valuable and accurate than borrowing estimates from other areas or agencies.

Chapter 3

Data

The first step in the analysis of the MTO risk management experience is data collection. The lifecycle stages of a capital project can provide many sources of data from each stage that may be used in the analysis, for example:

- Concept stage: project feasibility study, site investigation, estimated costs, project alternatives, environmental assessment, project delivery method, and past project experience.
- Design stage: detailed design, specifications, contracts, project schedule, bill of quantities, estimated costs and schedule, environmental assessment, geotechnical reports, site investigation, method of tender, bid enquires, bid submissions, and bid and performance bonds.
- Construction stage: change order requests, request for information, lab testing, estimated and actual costs and schedule, construction resources, contractual relationships, and liquidated damages and incentives.
- Operation and maintenance: project performance, warranty period, maintenance, and rehabilitation.

The data collection process for this research began with acquiring a set of documents for two MTO projects. Table 3.1 presents the type and description of the documents received. To streamline the data collection and analysis process for the remaining projects, the list was reduced to six key documents: (1) expenditure forecast summary, (2) project construction report, (3) scope and cost report or justification report, (4) request for proposal, (5) tender contract, and (6) design scope change orders.

Table 3.1: Descriptions of Documents Initially Provided by MTO

Document type	Document description
Scope And Cost Report Or Justification Report	The justification report is an earlier version of the scope and cost report. It includes the deficiencies in the structure, the construction and maintenance history, and the scope and estimated cost of the work required. The scope and cost report improves upon the main features of the justification report by including a more detailed cost analysis and a risk register.
Consultant Justification Report	It presents the project’s description, background information, relationship to other projects, benefits, risks if the proposed project is not implemented, estimated completion time and cost, availability of budget funds, and the weighing of consulting services versus Ministry staff.
Expression Of Interest (EOI) Posting Notice	It presents the consultant agreement number, MTO project manager contact information, the issuing office or section, group work project number, MTO district/highway/bridge site numbers, project length and location, project type, specialties required from consultant, description of project, assignment approximate start and completion dates, method of acquisition, and comments on the project and conditions for consultant EOI submissions. This document is posted on the Registry, Appraisal and Qualification System (RAQS).
Request For Proposal	It provides the design specifications for the different project elements, such as bridge, highway, and pavement engineering, and the proposal evaluation process. Projects are often grouped in this design contract and then awarded as separate tender contracts.
Public Information Centre Summary Brief	Addressing the comments and concerns of the public in regards to the project. As well as comments from external agencies such as the Region of Waterloo and City of Waterloo.
Guide Rail Highway Standards Team (HST) Exception/Funding Report	A field review inventory of the existing guide rail within the project limits and recommendations to replace/maintain existing guidrails. Exemption is required to allocate money to guiderail replacement or maintenance.
Design Scope Change Orders	These change orders mainly consist of work that cannot be done in-house so it must be passed onto the design firm in charge or additional work that was not included in the Request for Proposal’s scope of work.
Contract Drawings	Provided with tender contract
Design Criteria	The present conditions, design standards, and proposed standards for the highway infrastructure. As well as a summary of what is being considered for other design elements such as drainage, roadside safety, signing, traffic signals and so on.
Highway Costing System (HICO) Report	HICO is Ministry software with a large database of the three lowest bids from all of MTO’s contracts. It is used by the Consultant to create individual item cost estimates at the end of the design stage.

Document type	Document description
Working Days And Construction Schedule	Proposed project schedule
Constructability Review Memorandum	Construction staging information such as temporary traffic requirements and traffic control measures.
Tender Contract	It provides the construction specifications for the different project elements, such as utility relocation, item specifications and testing requirements, and notice to contractor provisions such as the seasonal shutdown that the contractor must be aware of.
Expenditure Forecast Summary	Summary of the change orders for the project and includes a description of the change, the type of change, the quantity, and the unit price.
Project Construction Report	This document is produced at the completion of a project. It provides a general overview of the issues relating to the design and contract documents, project construction, and contract administration. It also includes a change order summary.

MTO records were requested for thirty projects from the five regional corridor management offices. These offices represent the regions shown in Figure 3.1.



Figure 3.1: The Five MTO Regions (Source: Ministry of Transportation 2012)

In the past five years, the average major capital contract was valued at \$9.1 million (Office of the Auditor General of Ontario, 2016). The value of the requested projects was set as a range

from medium to large with emphasis on projects with a value around the \$50 million mark. The underlying rationale was that large projects may eventually be considered for delivery by Infrastructure Ontario using the Alternative Financing and Procurement (AFP) project delivery method, if the projects show potential positive value for money (VFM). Infrastructure Ontario currently only delivers projects costing over a \$100 million (Infrastructure Ontario, 2015). The characteristics of the projects for which documentation was received from MTO and calculated cost overruns are presented in Table 3.2. The expenditures occur between the years 2008 and 2015 and were not adjusted for inflation.

Table 3.2: Project Characteristics

Project	Project type	Tender value (\$)	Cost overrun (%)	Completion year	Project description
Eastern region project 1	Rehabilitation	\$5,778,000	13.0%	2015	Bridge deck rehabilitation with the use of a temporary modular bridge for traffic management.
Eastern region project 2	Rehabilitation	\$5,890,000	29.2%	2014	Bridge rehabilitation including girder repair, sidewalk and curb replacement, new steel barrier, deck repair, and culverts rehabilitation and replacement.
Eastern region project 3	Rehabilitation	\$2,579,000	10.7%	2014	Culvert Replacements and Resurfacing of highway.
Eastern region project 4	Rehabilitation	\$1,516,000	7.5%	2015	Road rehabilitation with full structure closure.
Eastern region project 5	Rehabilitation	\$819,000	43.5%	2015	Milling and replacement of surface course asphalt with reinstatement of granular shoulders, removal of concrete gutter and replacement with fully paved shoulder, and relocation of ramp closure gate.
Northwestern region project 1	Rehabilitation	\$5,577,097	3.1%	2011	In-place full depth reclamation of asphalt, placement Granular A throughout and paving with hot mix asphalt, and culvert replacement
Northwestern region project 2	Rehabilitation	\$6,126,106	2.5%	2012	Resurfacing to improve the ride quality and culverts and ditch cleanout.

Project	Project type	Tender value (\$)	Cost overrun (%)	Completion year	Project description
Northwestern region project 3	Rehabilitation	\$8,417,109	3.7%	2015	Grading, drainage, granular base, and hot mix paving on highway.
West region project 1	Rehabilitation	\$14,282,900	5.0%	2015	Pavement rehabilitation, lane widening, culverts rehabilitation and replacement, drainage improvement, and minor electrical work.
Northeast region project 1	New construction	\$52,809,912	4.4%	2010	Construction of four lanes on highway, an interchange, four new bridges, an access road, and a ramp at the highway interchange; resurfacing/realigning existing highway including a grade separation; completing construction of approach slabs and waterproofing on five bridges; and rehabilitation of Bridge Crossing.
Northeast region project 2	New construction	\$58,374,000	13.5%	2012	Four-lane expansion of a highway, involving grading, drainage, granular base, illumination, hot mix paving, and 15 structures.
Northeast region project 3	New construction	\$54,795,000	-2.4%*	2015	Four-lane expansion of a highway, involving grading, drainage, granular base, illumination, hot mix paving, and 11 structures.
Northeast region project 4	Rehabilitation	\$1,449,000	10.6%	2013	Construction of new alignment for a highway, involving grading, drainage, and warm mix paving, granular shouldering, removal of existing alignment, and rock protection works for rehabilitating river slopes.
Northeast region project 5	Rehabilitation	\$9,829,000	-2.1%*	2015	Work on a highway including improvements to a highway/road intersection and improvements to pavement condition of the road. Improvements of the pavement condition, ride quality, safety and operational characteristics of sections of another highway, bridge rehabilitation, treatment of pavement distress areas, culverts replacement and rehabilitation.

*Unresolved change orders and claims are present and worth approximately \$22 million for northeast region project 3 and \$2 million for northeast region project 5.

The three new construction projects have final construction values between 53 and 66 million dollars with an average cost overrun of 5.2% of tender value (ranging between -2.4 and 13.5%), a standard deviation of 8.0%, and median of 4.4%. The eleven rehabilitation projects

have final construction values between 1 and 15 million dollars with an average cost overrun of 11.5% (ranging between -2.1 and 43.5%), a standard deviation of 13.4%, and median of 7.5%.

3.1 Limitations

The limitations of this research approach's data collection process should be noted. This includes data collection difficulties, missing data, lengthy data processing times, a sample size that is too small for a robust statistical analysis of the risks from a project level perspective, and possible data selection bias.

The data collection process was difficult and spanned a time interval of approximately one year. Some MTO offices did not provide project data. This resulted in a sample size of 14 projects instead of the goal of 30. A couple of projects were excluded from the presented sample size because the project construction reports were not included. In addition, the expenditure forecast summary document, which was requested initially, was either missing or presented in the form of monthly project expenditures instead of the change order summary format that was observed in the first two projects. The lengthy data processing times were caused by the missing documents, use of the pdf format that needed conversion to excel, and the sheer number of change orders, which amounted to a total of 1,051 change order events for the 14 projects.

The analyzed projects were selected by the MTO, and therefore, the results may have been affected by selection bias (Siemiatyki 2009). The projects are thought to represent MTO's delivery process on a typical project (i.e., it is unlikely extreme outliers were provided).

Chapter 4

Risk Identification, Classification, and Analysis Methods

As discussed in Chapter 1, the main goal of the research is to apply risk management principles to analyze MTO highway infrastructure projects in order to identify, analyze, and address the project risks that may cause cost overruns. This chapter outlines the developed methodology for the risk management process, which entails the identification, assessment, and response to project risks. Risk identification involves the development of a risk register to identify possible project risks from past projects. Risk assessment is the identification of the impacts and probability of the risks followed by risk response strategies for the top risks that may include risk acceptance, transfer, mitigation, avoidance, and so on.

4.1 Risk identification

Risk identification is the process of identifying and documenting the characteristics of potential risks that might affect a project. Risk is defined as an uncertain event that may occur in the future and have a negative or positive effect on project objectives such as cost, schedule, scope, and quality. Risks can fall into many categories such as project (cost, schedule, scope, and quality) and human risks (environmental, health, and safety) (Oberlender 2014).

The purpose of identifying risks is to study the conditions under which a project or design could go wrong or experience undesirable performance. Information on past projects, organizational and employee knowledge, and literature can be used to understand the conditions that could lead to the risks. Past project information could include planned and actual project schedules with activity details, schedule and cost overruns.

Typical procedures for risk identification include:

- Experience based risk identification, which involves the use of a risk knowledge base that can be developed to include risks encountered in past projects, in order to assess the risk's applicability to the project.
- Brainstorming based risk identification, which involves the setting up of a project team meeting where the members brainstorm the risks that they think will arise throughout the project cycle.

A good starting point to create a foundation for the risk identification process is to look at literature as well as the organization's own contract strategy.

The approach taken towards risk identification in this research is unique to the way the MTO handles its project risks. The MTO's projects are completed using unit-price contracts, and MTO "self insures" them which means that contingency is not built into a project's budget. As a result, MTO takes on most of the risk. If any change is needed during a project's design or construction stages, a change order is prepared. In a traditional lump sum contract if a risk is realized, the funding to address it would come from the contractor's or owner's project contingency based on the exact terms of the contract.

The value of a change order determines the process followed for acceptance. If the change order is between 0 and \$50,000, the authority of dealing with this change order goes to the Contract Administrator (CA). If the change order is greater than \$50,000 the authority of dealing with this change order goes to MTO higher management. The CA is usually in-house or 3rd party. These change orders represent an unexpected cost, which can be considered as a materialized risk to the project owner. Unresolved change orders and claims that are in litigation are excluded from the risk identification and analysis process in this research due to the uncertainty of their final effects on projects. Any discrepancies in the difference between the

reported final and tender project cost and the total value of change orders present in a project are also disregarded in the analysis (i.e., “adding-up” errors).

Change order information was collected from each project’s documents as follows:

- Request for Proposal (RFP), provides the design specifications for the different project elements, such as bridge, highway, and pavement engineering, and the proposal evaluation process.
- Design change orders, captures changes to the scope, cost, or time requirements of a project during the design stage. These change orders mainly consist of work that cannot be done in-house, so it must be passed onto the design firm in charge or additional work that was not included in the RFP’s scope of work.
- Tender contract, provides the construction specifications for the different project elements, such as utility relocation, item specifications and testing requirements, and notice to contractor provisions such as the seasonal shutdowns.
- Project Construction Report (PCR) (ex-post), provides a general overview of the issues relating to the design and contract documents, project construction, and contract administration. These reports also include a summary of the construction change orders, which capture changes to the scope, cost, or time requirements of a project during the construction stage.

The contract structure does not clear the contractor from risks; for example the risks that they take on can include: project scheduling, subcontractor conflict, labor shortages, and inaccurate cost estimates. These risks are not included in this analysis because this research focuses on risks to the owner (i.e., MTO). In addition, time and schedule overruns are not considered in this research because they are rarely documented in the analyzed projects’ change orders.

Risk events were initially identified from the literature review (Creedy et al., 2010; Diab et al., 2012; Taylor et al., 2012; and Zou et al., 2006) and through consultation with MTO, and were then applied to a sample project provided by MTO to determine if there is an acceptable match between the identified risk events and the encountered risks. After changes based on the sample project, and further consultation with MTO, the risks events were finalized to create a risk register that is presented in the following sections and organized in principle by root cause type.

4.1.1 Risk Categories

The following sections will cover the risks that fall into three categories: (1) design risk, (2) construction risk, and (3) risks that have design and/or construction mixed causes. In each of the following sections a figure and a table are presented for each of the categories mentioned above. Each figure presents the main risk categories that are divided further into more specific possible risk root causes. Each table presents descriptions and/or examples for each of the possible risk root causes, which are based on the results of the risk classification of the projects provided by MTO. The risk classification process began with a brief and general description of what risk events can be categorized under each risk category and the tables were completed at the end of the risk classification process of the projects provided by MTO to provide a description and examples of what risk events can be classified under each risk category in future risk classifications in order to ensure consistency.

It should be noted that a risk could fall into more than one category, but the category that fits each risk best was selected in this study.

4.1.1.1 Design Risk Categories

Figure 4.1 and Table 4.1 present the design risk categories and their descriptions.

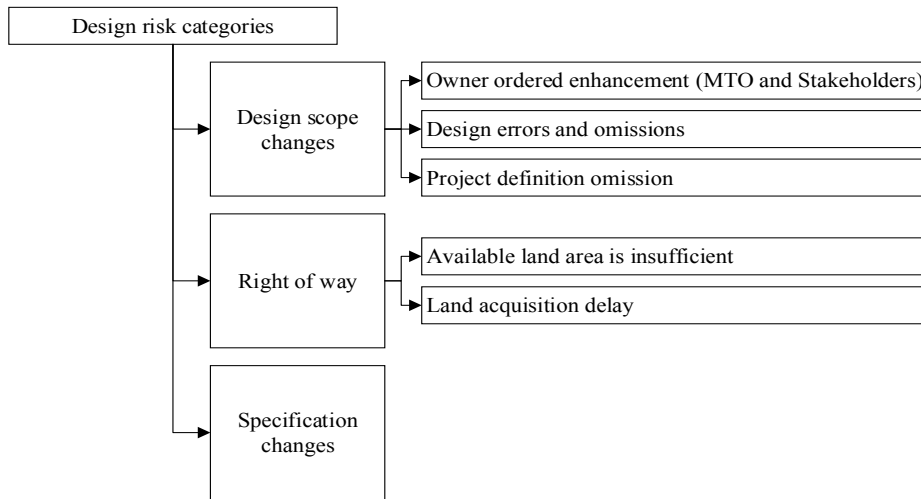


Figure 4.1: Design Risk Categories

Table 4.1: Descriptions of Design Risk Categories

Risk	Possible Root Cause	Description/Example
Design scope changes	Owner ordered enhancement (MTO and stakeholders)	<ul style="list-style-type: none"> Requirement change Demands of new material and new construction methods Additions to contract Work completed on a later contract being moved to this contract Additional work within contract limits that would not fall under other risk categories ex. Latent conditions Recommendation of additional work by departments Work added from other contracts
	Design errors and omissions	<ul style="list-style-type: none"> Incorrect item value in tender list Missed conflicts between design elements
	Project definition omission	<ul style="list-style-type: none"> Unclear requirements Incomplete design scope Missed specifications/contract items that would usually be included Missed provisions/items
Right of way	Land acquisition delay	
	Available land area is insufficient	
Specification changes	-	<ul style="list-style-type: none"> Inadequate standards and specifications Conflicts in writings of related specs and/or omissions

4.1.1.2 Construction Risk Categories

Figure 4.2 and Table 4.2 present the construction risk categories and their descriptions.

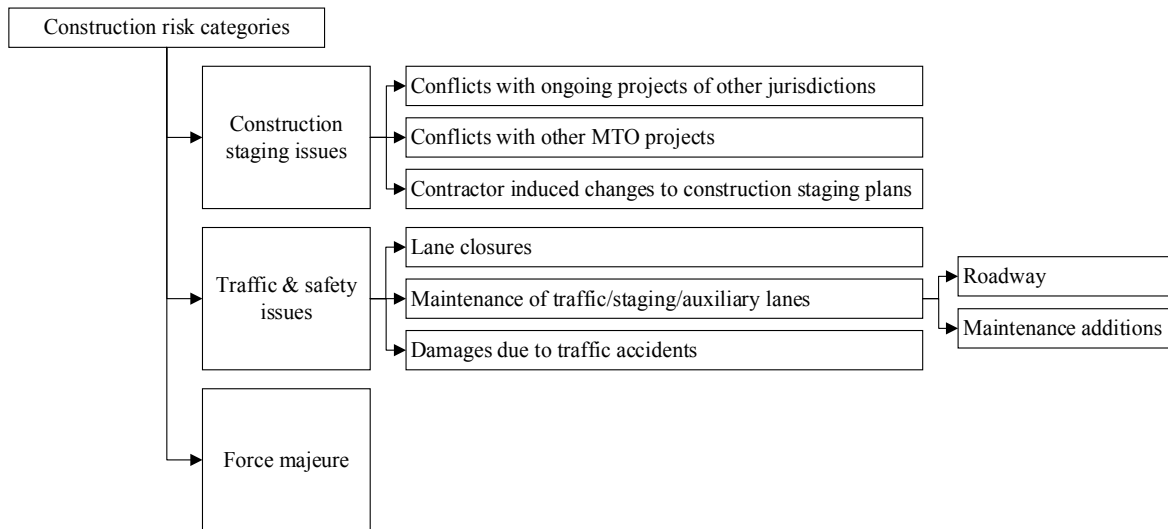


Figure 4.2: Construction Risk Categories

Table 4.2: Description of Construction Risk Categories

Risk	Possible Root Cause	Description/Example
Construction staging issues	Conflicts with on-going projects of other jurisdictions	<ul style="list-style-type: none"> For example, conflicts at the regional level
	Conflicts with other MTO projects	<ul style="list-style-type: none"> For example: If two contracts are given permission to use the same Quarry for aggregate crushing operations but the facility can only produce an output for one project's demand
	Contractor induced changes to construction staging plans	<ul style="list-style-type: none"> MTO designs the staging but the contractor is not bound by it
Traffic and safety issues	Lane closures	
	Maintenance of traffic/staging/auxiliary lanes	<ul style="list-style-type: none"> Maintenance additions Roadway
	Damages due to traffic accidents	
Force majeure	-	<ul style="list-style-type: none"> Adverse weather conditions (wind, temperature, rain, and so forth) Natural disaster (flood, earthquake, landslide, fire, and so on)

4.1.1.3 Risks that Fall into either Design and/or Construction

Figure 4.3 and Table 4.3 present the design and/or construction risk categories and their descriptions.

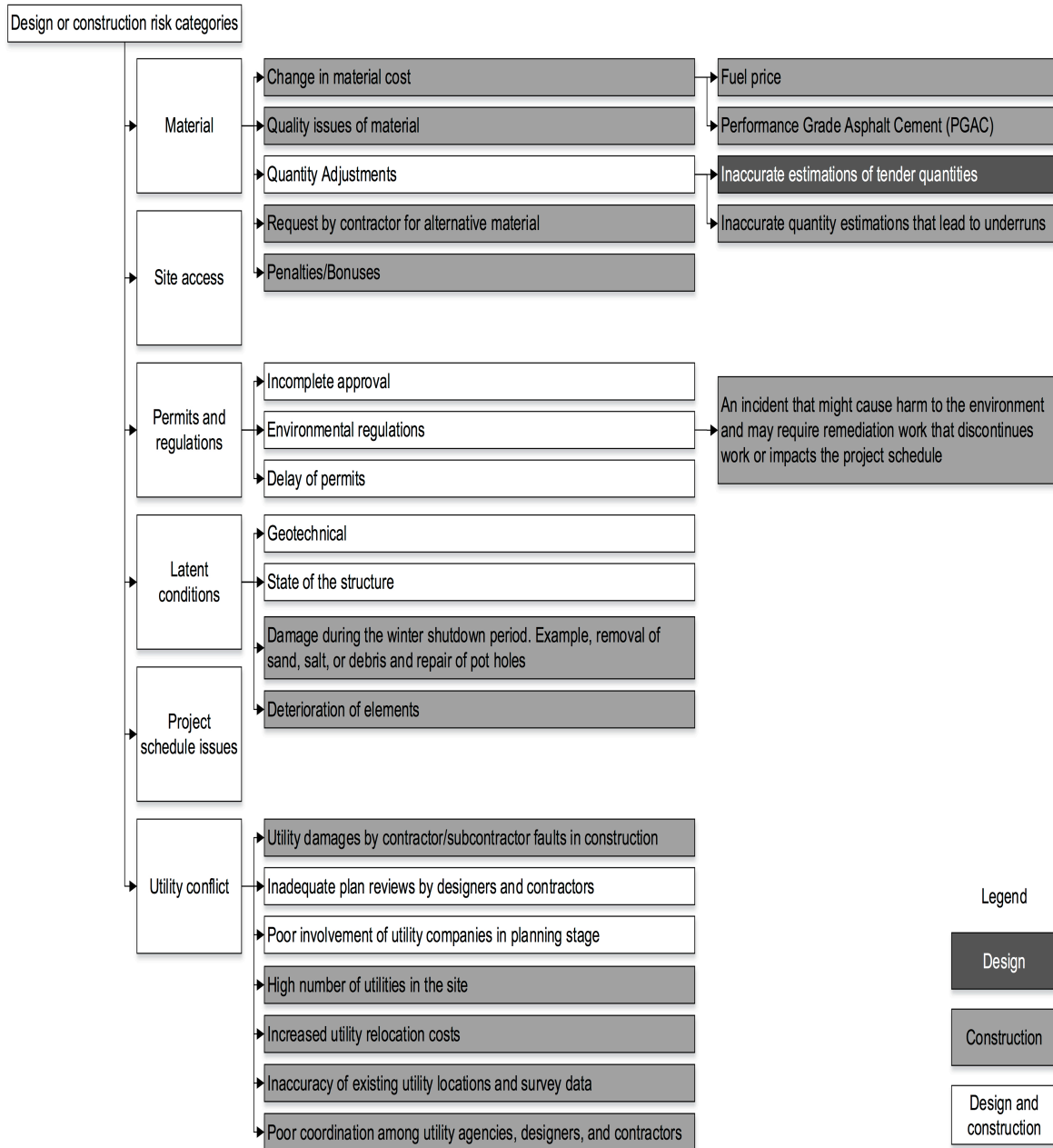


Figure 4.3: Design or Construction Risk Categories

Table 4.3: Description of Design (D) or Construction (C) Risk Categories

Risk	Possible Root Cause	Description/Example
Material (D&C)	Change in material cost (C) (Fuel price and PGAC)	<ul style="list-style-type: none"> • Breakdowns of equipment that may increase costs
	Quality issues of material (C)	<ul style="list-style-type: none"> • Material, such as waterproofing, is not meeting the specifications required after testing
	Quantity adjustments (D&C)	<ul style="list-style-type: none"> • Inaccurate estimations of tender quantities (D) • Inaccurate quantity estimation that lead to under runs (C) • “To better suit field conditions” • Items not used
	Request by contractor for alternative material (C)	<ul style="list-style-type: none"> • Example: use of Glass Fiber Reinforced Polymer (GFRP) instead of stainless steel rebar in barrier wall • Potential cost savings are shared with the contractor
	Penalties / bonuses (C)	<ul style="list-style-type: none"> • Bonuses/Penalties and Incentives/Disincentives • Monetizing the present value of life cycle performance risk
Site access (D&C)	-	<ul style="list-style-type: none"> • Inadequate amount of storage area • Unavailability of storage area
Permits and regulations (D&C)	Incomplete approval (D&C)	<ul style="list-style-type: none"> • Errors in permits
	Delay of permits (D&C)	<ul style="list-style-type: none"> • Caused by changes to regulatory requirements
	Environmental regulations (D&C)	<ul style="list-style-type: none"> • An incident that might cause harm to the environment and may require remediation work that discontinues work or impacts the project schedule • Protection of areas that require it, for example installation of silt fences around a fish habitat
Latent conditions (D&C)	Geotechnical (D&C)	<ul style="list-style-type: none"> • Differing site conditions • Poor geotechnical condition • Incompleteness of design review
	Damage during the winter shutdown period.	<ul style="list-style-type: none"> • Example: removal of sand, salt, or debris and repair of pot holes (C)

Risk	Possible Root Cause	Description/Example
Latent conditions (D&C)	State of the structure (D&C)	<ul style="list-style-type: none"> • Conflicting site conditions • Incompleteness of design review • Changes to the conditions to meet required specifications • Conditions that should have been caught in the first place ex. Medians in poor conditions • Clean up of debris from box girders • Poor performance • Alignment issues between design and field conditions • Extra work due to unexpected condition
	Deterioration of elements (C)	<ul style="list-style-type: none"> • Incompleteness of design review • Repair of potholes • Steel erosion • Repair of washouts • Failure of items during the contract and within the contract limits (ex. Culvert collapse, sink holes) • Complete failure
Project schedule issues (D&C)	-	<ul style="list-style-type: none"> • Delay of project schedule • Inability to perform a task on time
Utility conflict (D&C) (Diab et al., 2012)	Utility damages by contractor/subcontractor faults in construction (C)	
	Inadequate plan reviews by designers and contractors (D&C)	
	Poor involvement of utility companies in planning stage (D&C)	
	High number of utilities in the site (C)	
	Increased utility relocation costs (C)	
	Inaccuracy of existing utility locations and survey data (C)	
	Poor coordination among utility agencies, designers, and contractors (C)	

Table 4.4 presents the instances in which the proposed risk categories have appeared in literature and the risk management processes of several departments of transportation. It's important to note that some of these risk registers shown in Table 4.4 are set up as guidelines and must be expanded by the project team responsible for developing the risk management approach.

Table 4.4: The Appearance of Proposed Risk Categories in Literature

	Wilson 2014	Yoon et al. 2014	Creedy et al. 2010	Diab et al. 2012	Oberlender, 2014	MTO	IO	Caltrans
Owner ordered enhancement (MTO and stakeholders)	✓	✓	✓	✓	✓	✓	✓	✓
Design errors and omissions		✓	✓	✓	✓			✓
Project definition omission	✓	✓	✓	✓	✓			✓
Land acquisition delay	✓			✓	✓	✓		✓
Available land area is insufficient						✓		✓
Specification changes			✓		✓			✓
Conflicts with ongoing projects of other jurisdictions						✓		✓
Conflicts with other MTO projects						✓		✓
Contractor induced changes to construction staging plans								
Lane closures								✓
Maintenance of traffic/staging/auxiliary lanes				✓				
Damages due to traffic accidents								
Force majeure (most likely weather)		✓	✓		✓	✓	✓	
Change in material cost (most commonly Fuel price and PGAC)	✓		✓	✓	✓			✓
Quality issues of material		✓	✓		✓		✓	
Quantity adjustments	✓		✓		✓			✓
Request by contractor for alternative material								
Penalties / bonuses					✓			
Site access		✓			✓			✓
Incomplete approval					✓	✓	✓	✓
Delay of permits	✓	✓		✓	✓	✓	✓	✓
Environmental regulations	✓				✓	✓	✓	✓
Geotechnical		✓	✓	✓	✓	✓	✓	✓
State of the structure		✓	✓		✓	✓	✓	✓
Damage during the winter shutdown period								
Deterioration of elements		✓	✓					✓
Project schedule issues	✓	✓		✓	✓		✓	✓
Utility conflict			✓	✓	✓	✓	✓	✓

4.1.2 Risk Classification

A database of the risks encountered by MTO in each of the projects in the project sample is created through the classification process presented in this section. This involves the extraction of change order information from the documents selected in section 4.1 and then sorting them into the categories presented in section 4.1.1. Figure 4.4 presents an example of the classification process of a risk. Step 1 begins with identifying individual risks from the change orders presented in a project's PCR. In Step 2, further information regarding the risk from the discussion section of the PCR, RFP, or tender documents are identified and added to the risk description. Finally, Step 3 involves matching the risk description with one of the risk categories and sources identified earlier in this section. A total of 1,051 change order events were considered, out of which 986 were classified as risk events.

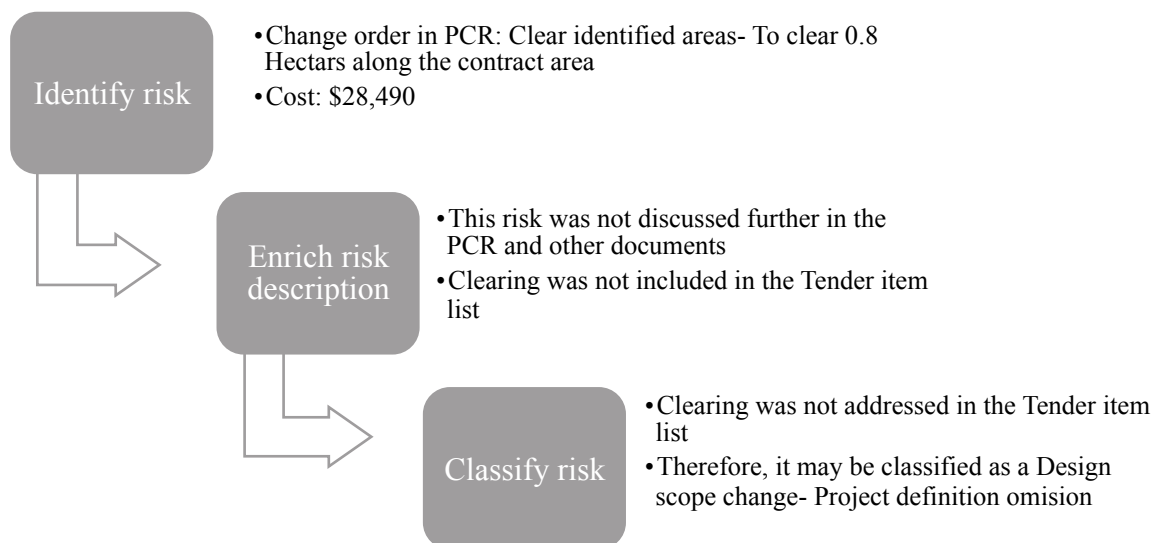


Figure 4.4: Sample Classification Process

The results of applying this process to each project in the MTO project sample are presented in Chapter 5.

A sample of the database of the risks encountered by MTO in each of the projects in the project sample (Appendix A) is presented for Eastern Region Project 1. Table 4.5 shows the first ten change order events encountered on this project and their impact.

Table 4.5: Ten Change Order Events Identified in Eastern Region Project 1

Number	Description	Amount
1	Revised 100F08 and DCZ.	\$0.00
2	Supply and install temporary attenuator foundations for the energy attenuators for the Pre-Stage 1 and Stage 1 work. Upgrade the Energy Attenuator systems specified in items 29 and 30 from a TL-2 to a TL-3.	\$28,279.00
3	Rock excavation along detour route. No provisions were included in the contract.	\$41,047.81
4	Erection of silt fence at culvert. During construction the area was identified as a fisheries habitat	\$3,297.84
5	Construction of a leveling slab at South East pier of Temporary Modular Bridge (TMB)	\$5,706.04
6	Maintenance and patching of existing potholes throughout the construction zone	\$13,401.88
7	Revised location of ditch inlet on West side of Detour	\$0.00
8	Work required due to conflicts with the existing steel beam guide rail (SBGR) and eccentric loaders at the North and South approaches during the construction of the detour	\$10,184.65
9	Additional earth excavation along detour route	\$4,711.37
10	Request to use an alternate grout material for the installation of the rock anchors at the south piers of the TMB	\$0.00

The first change order event presents a revision to the specification (100F08) that dictates the lane closure times. This was classified as not a risk because the change did not have an impact on the project. The second change order event presents a change to a tender item (energy attenuators) that was necessary due to an error and omission in the contract. The contract showed attenuators being installed on granular surfaces without showing the requirement for concrete pads. It also showed attenuators as TL-2 when TL-3 was required, which is a specification that the attenuator has to meet concerning hazard protection at certain speeds. This was classified as a design scope change due to design errors and omissions

because of the omission of the attenuator foundation and the specification error in the project contract. The third change order event presents an addition of rock excavation necessary along a detour route. This was classified as a design scope change due to project definition omission because the contract drawings did not accurately reflect rock located in the detour route and this work was not included in tender item list. The fourth change order event presents the erection of silt fence at culvert that was identified as a fisheries habitat during construction. This was classified as an environmental regulation risk event under permits and regulations because the work is required to meet environmental regulations for fisheries habitat. The fifth change order event presents the construction of a leveling slab at a pier of the Temporary Modular Bridge (TMB). The contract specifies that the contractor shall develop and submit a procedure to ensure that the approaches and the TMB deck is level and adjusted when necessary. This was classified as a quality issue of material under material risk events because of the additional work to ensure proper TMB operation. The sixth change order event presents maintenance and patching of existing potholes throughout the construction zone. This was classified as deterioration of elements under latent conditions. The seventh change order event presents a revised location of ditch inlet on the west side of detour. This was classified as not a risk because the change did not have an impact on the project. The eighth change order event presents work required due to conflicts with the existing [steel beam guide rail \(SBGR\)](#) and eccentric loaders at the North and South approaches during the construction of the detour. This was classified as a construction staging issue. The ninth change order event presents additional earth excavation along detour route. This was classified as state of the structure under latent conditions because the original ground line identified in the contract drawings did not match the field condition. The tenth change order event presents a request to use an alternate grout material for the installation of

the rock anchors at the south piers of the TMB, which was classified as a request by contractor for alternative material under material risk events.

4.2 Risk Analysis

The focus of risk analysis is to determine the likelihood of a risk occurring and the impact that the risk would have, whether in a qualitative or quantitative format. Risk is commonly identified as:

$$Risk = Probability * Consequence$$

Exposure must also be included or considered in the consequence calculation. Probabilities and consequences can be calculated by specifying a unit of exposure such as a mile of construction or a more specific task/project type such as bridge deck rehabilitation or abrasive blast cleaning of reinforcing steel. However, more information regarding the unit of exposure is necessary such as the quantity, schedule, and/or cost variation of work or the type of work that is occurring in each mile of the project and how it is affected by quantity, schedule, and/or cost variations.

Several researchers have looked at conducting the risk analysis without calculating the risk probabilities. Yoon et al. (2014) use the impacts of risk events on project profit to quantify risks. The profit impacts (PI) are adjusted for the variation in bid profits between projects and calculated on an annual basis. Impacts are calculated for each risk and the weighted impact is combined.

4.2.1 Calculating risk impacts and probabilities

Before applying a risk analysis process, such as Monte Carlo simulation and decision trees, the underlying risks impacts and probabilities must be determined, especially in the case of a

quantitative analysis. In this research, the risk impact and probabilities will be determined from the risk database created through the process described in 4.1.2 and its results, which are presented in Chapter 5 and Appendix A.

In the proposed methodology the risk impacts are considered as the value of the risk event as a percentage of the project tender cost. The probabilities are calculated based on the past occurrence of the risk in the project sample. For example, if only one out of four projects incurs a cost overrun due to a particular risk materializing, the probability of occurrence on a future similar project could be estimated as 25%.

4.3 Identifying risk response strategies

The risk categories identified as having the highest likelihood and impact are analyzed further to try and identify which risk mitigation strategies are most fitting. The common risk mitigation strategies are accept, transfer, mitigate/control, exploit, enhance, or avoid (Caltrans, 2012; Oberlender, 2014). A through critical reading and analysis of the contract documents, specifically the request for proposal and the tender document, and literature on the topic of risk response, provided information about the decisions regarding the actions that were taken to pay for or mitigate the impacts of some of the critical risks.

4.4 Limitations

The approach followed produces empirical-based risk assessments that are geographic/economic area and time period specific. It also creates a procedure that MTO can update with newly completed projects to help improve the accuracy of the results over time. However, a few limitations of the research methodology should be noted. This includes the exclusion of other key performance indicators such as schedule and quality.

The scope of the work excluded the performance and time project objectives. The analysis of the data provided from MTO did not include the status of the project after construction and information on any previous rehabilitation work on the project. This omission excludes risks related to the quality of the work completed and risks from poorly written contract clauses on warranty from the risk analysis. The existence of such issues on MTO projects is confirmed by an Office of the Auditor General of Ontario report that raises concerns regarding pavement conditions due to premature cracks observed in completed highways projects (Office of the Auditor General of Ontario, 2016). As mentioned previously, delays were excluded because they are rarely documented in the analyzed projects change orders.

Chapter 5

Results and Discussion

As discussed in Chapters 3 and 4, the proposed risk management approach is applied to a set of 14 highway infrastructure projects provided by the Ontario Ministry of Transportation to identify, analyze, and address the project risks that may impede project success. This chapter presents the results of the research in the form of a summary of identified risks per analyzed project, a summary of identified risks by project type, the results of estimating the probability of risk occurrence and resulting impact ranges for the identified critical risks, a comparison between pre and post construction risk analysis, and a discussion of possible risk mitigation strategies for critical risks. The limitations of the results are also discussed.

5.1 Summary of identified risks per project

The following section presents a brief project description and summary of the risk classification results for each of the 14 highway infrastructure projects provided by the Ontario Ministry of Transportation. The risk classification results are presented as a table that summarizes the total cost and percentage of project cost overrun of the change orders classified under each risk category. While the pie charts report percentages that represent the proportion of total risk expenditure under specific risk categories and are based on the net sum of positive and negative individual change orders, divided by the sum of the absolute values of risk expenditure in each risk category. For example, design scope changes in Eastern region project 1 result in \$401,897.34 of cost overruns (net of positive and negative change orders). The sum of the absolute values of net changes in all risk categories is \$751,057.68. Hence, design scope changes are shown as 53.4% ($\$401,897.34/\$751,057.68$)

in Figure 5.1. The individual risk events identified and classified in each project are presented in Appendix A.

5.1.1 Eastern region project 1

The project involved bridge deck rehabilitation with the use of a temporary modular bridge for traffic management. The cost overrun of the project is 13.0%. Table 5.1 and Figure 5.1 present the risk classification results. Design scope changes during the design stage consisted of:

- An addendum for the separation of the environmental assessment (EA) processes of Petawawa River Bridges and CPR (Petawawa) Overhead Bridge rehabilitations and to account for changes in the extent of work required to perform initial foundations investigations for in-water piers;
- The addition of two culvert replacements; and
- Addition of inspection, design, and preparation of changes to drawings and other contract documents to include an on-site temporary detour route making use of a Temporary Modular Bridge.

Table 5.1: Cost Overrun and Change Order Breakdown of Risks for Eastern Region Project 1

Category	Total Cost	% Of Project Cost Overrun
Design scope changes	\$401,897.34	7.0
Material	\$104,599.85	1.8
Permits and regulations	\$3,297.84	0.1
Project schedule issues	\$10,263.11	0.2
Latent conditions	\$183,814.43	3.2
Construction staging issue	\$10,184.65	0.2
Force majeure	\$37,000.46	0.6
Not a risk	(\$1,650.00)	0.0
Total Change Order Value	\$749,407.68	13%

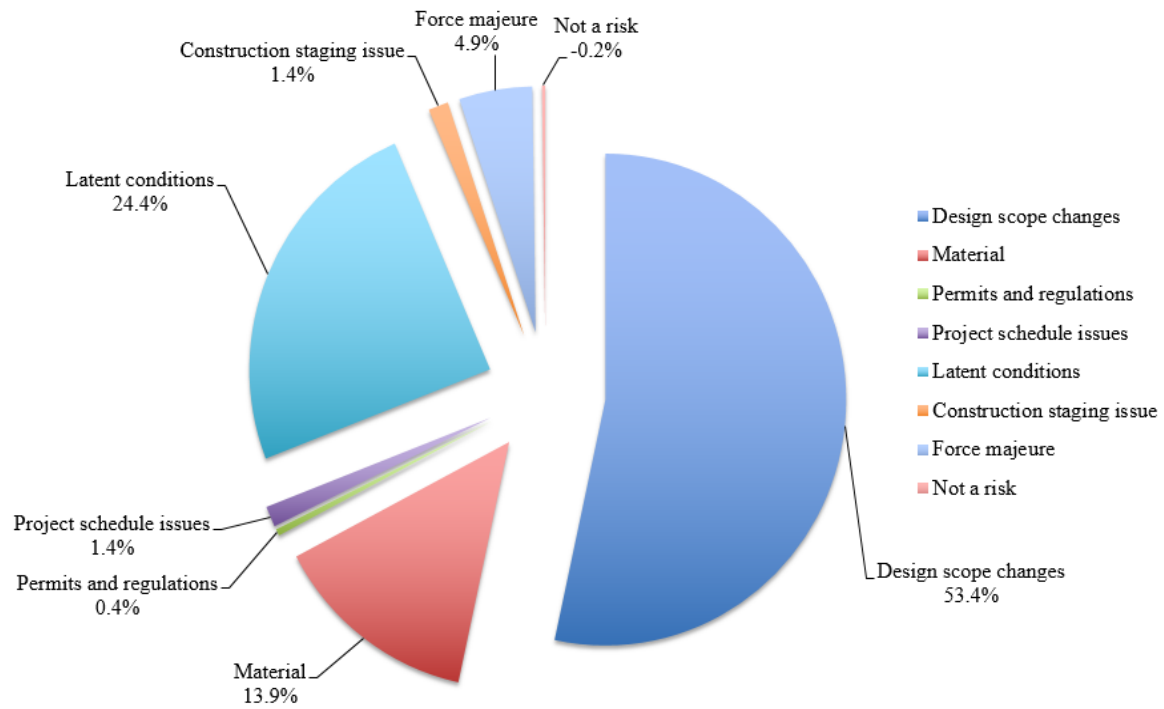


Figure 5.1: Breakdown of Risks for Eastern Region Project 1

The design scope changes observed in this project can be attributed to issues such as inaccurate drawings, items missing from tender item list, additions to the scope of work, and missing payment provisions. Latent condition can be attributed to culvert failure, additional geotechnical work, and additional work to match site conditions to design specifications. Material risk factors are expected in all the projects due to the uncertain final quantity aspect of unit price contracts.

5.1.2 Eastern region project 2

The project involved bridge rehabilitation including girder repair, sidewalk and curb replacement, new steel barrier, deck repair, and culverts rehabilitation and replacement. The cost overrun of the project is 29.2%. Table 5.2 and Figure 5.2 present the risk classification results. Design scope changes during the design stage consisted of missed guide rail evaluation report deliverable, addition of testing of suspected designated substances in ducts

within the sidewalk and curb of the bridge, and design changes to incorporate an open railing design for the bridge.

Table 5.2: Cost Overrun and Change Order Breakdown of Risks for Eastern Region Project 2

Category	Total cost	% Of Project Cost Overrun
Design scope changes	\$236,409.02	4.0
Material	\$110,196.42	1.9
Project schedule issues	\$24,500.00	0.4
Latent conditions	\$360,113.95	6.1
Traffic and safety issues	\$3,842.69	0.1
Force majeure	\$71,500.00	1.2
Not a risk	\$455.00	0.0
Unclassified *	\$911,560.57	15.5

Total Change Order Value \$ 1,718,577.65 29.2%

*A difference of \$911,560.57 between the final contract value and initial tender value reported in the project construction report (PCR) is unaccounted for in the risk analysis. This is excluded from the data of the graph below.

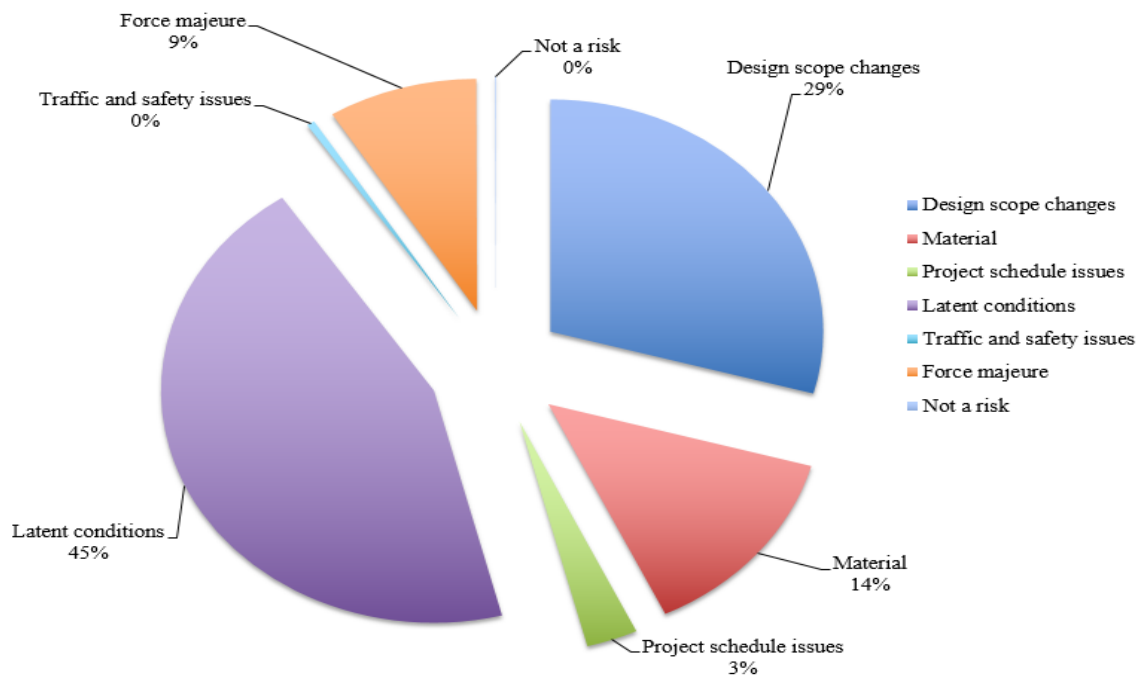


Figure 5.2: Breakdown of Risks for Eastern Region Project 2

The design scope changes observed in this project can be attributed to additions to the scope of work. Latent condition can be attributed to additional geotechnical work and additional work to address deterioration of elements.

5.1.3 Eastern region project 3

The project involved culvert replacements and resurfacing of highway. The cost overrun of the project is 10.7%. Table 5.3 and Figure 5.3 present the risk classification results. No design scope changes occurred during the design stage.

Table 5.3: Cost Overrun and Change Order Breakdown of Risks for Eastern Region Project 3

Category	Total cost	% Of Project Cost Overrun
Design scope changes	\$39,163.35	1.5
Material	\$154,250.60	6.0
Latent conditions	\$40,337.90	1.6
Utility conflicts	\$27,583.00	1.1
Traffic and safety issues	\$13,374.33	0.5
Total Change Order Value	\$274,709.18	10.7%

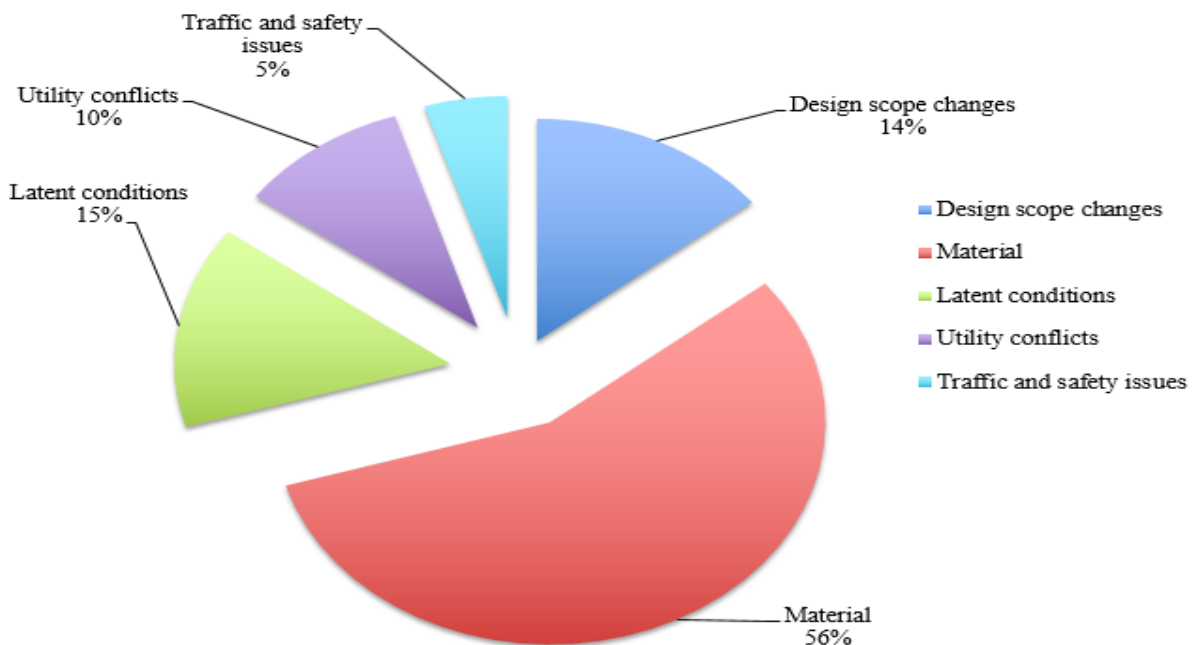


Figure 5.3: Breakdown of Risks for Eastern Region Project 3

The design scope changes observed in this project can be attributed to additions to the scope of work and items missing from contract. Latent condition can be attributed to additional work to address deterioration of elements. Utility conflict can be attributed to additional material quantities required to relocate a curb that is conflicting with utilities.

5.1.4 Eastern region project 4

The project involved road rehabilitation with full structure closure. The cost overrun of the project is 7.5%. Table 5.4 and Figure 5.4 present the risk classification results. No design scope changes occurred during the design stage.

Table 5.4: Cost Overrun and Change Order Breakdown of Risks for Eastern Region Project 4

Category	Total cost	% Of Project Cost Overrun
Design scope changes	\$84,297.83	5.6
Material	(\$41,670.00)	-2.8
Latent conditions	\$70,600.76	4.7
Total Change Order Value	\$113,228.59	7.5%

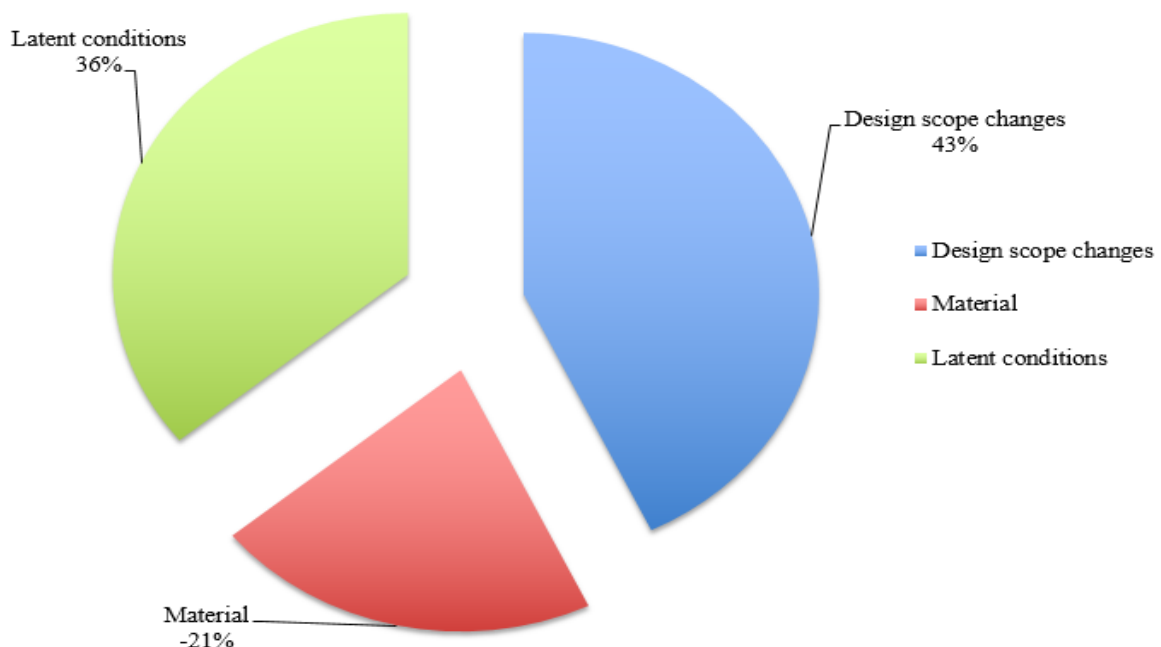


Figure 5.4: Breakdown of Risks for Eastern Region Project 4

The design scope changes observed in this project can be attributed to design changes, incorrect drawings, and items missing from contract. Latent condition can be attributed to additional work to address deterioration of elements.

5.1.5 Eastern region project 5

The project involved milling and replacement of surface course asphalt with reinstatement of granular shoulders, removal of concrete gutter and replacement with fully paved shoulder, and relocation of ramp closure gate. The cost overrun of the project is 43.5%. Table 5.5 and Figure 5.5 present the risk classification results. No design scope changes occurred during the design stage.

Table 5.5: Cost Overrun and Change Order Breakdown of Risks for Eastern Region Project 5

Category	Total cost	% Of Project Cost Overrun
Design scope changes	\$358,453.96	43.8
Material	(\$16,722.18)	-2.0
Latent conditions	\$13,720.14	1.7
Traffic and safety issues	\$641.48	0.1
Total Change Order Value	\$356,093.40	43.5%

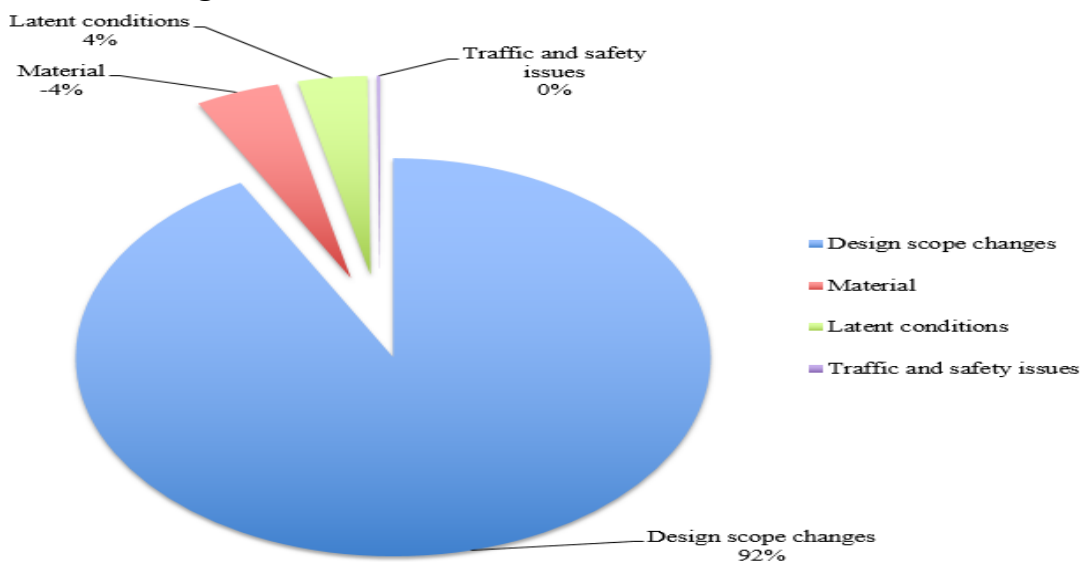


Figure 5.5: Breakdown of Risks for Eastern Region Project 5

The design scope changes observed in this project can be attributed to an inaccurate scope of work.

5.1.6 Northwestern region project 1

The project involved in-place full depth reclamation of asphalt, placement Granular A throughout and paving with hot mix asphalt, and culvert replacement. The cost overrun of the project is 3.1%. Table 5.6 and Figure 5.6 present the risk classification results. No design scope changes occurred during the design stage.

Table 5.6: Cost Overrun and Change Order Breakdown of Risks for Northwestern Region Project 1

Category	Total cost	% Of Project Cost Overrun
Design scope changes	\$40,843.87	0.7
Material	\$128,322.71	2.3
Traffic and safety issues	\$3,567.00	0.1
Not a risk	(\$1,275.00)	0.0
Total Change Order Value	\$171,458.58	3.1%

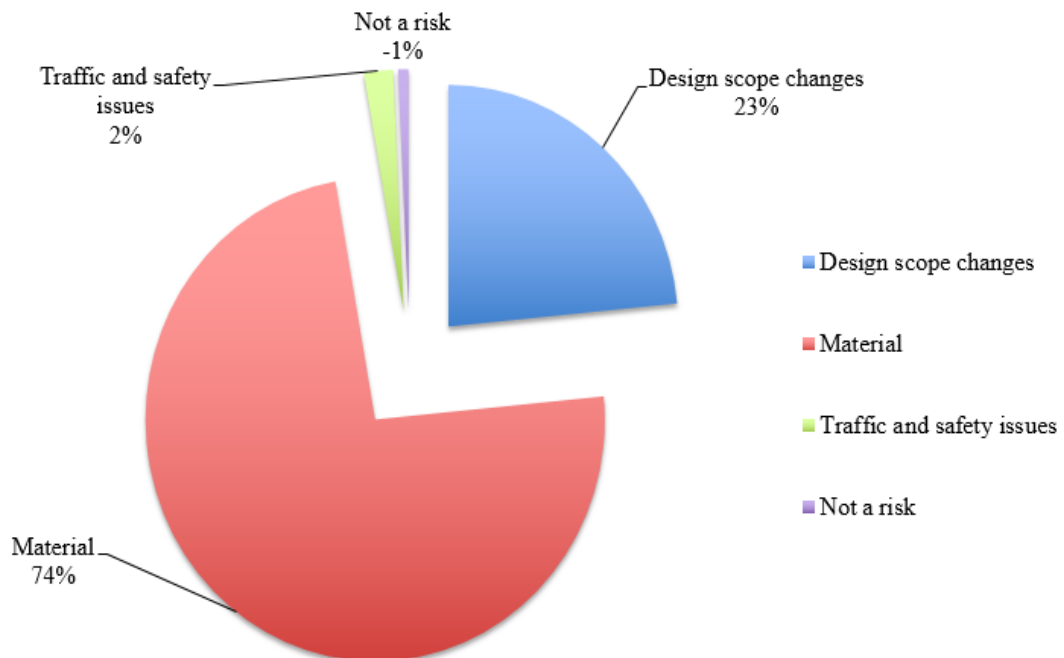


Figure 5.6: Breakdown of Risks for Northwestern Region Project 1

The design scope changes observed in this project can be attributed to additions to the scope of work and design changes.

5.1.7 Northwestern region project 2

The project involved Resurfacing to improve the ride quality and culverts and ditch cleanout. The cost overrun of the project is 2.5%. Table 5.7 and Figure 5.7 present the risk classification results. Design scope changes during the design stage consisted of a pavement thickness investigation to support pavement treatment recommendations.

Table 5.7: Cost Overrun and Change Order Breakdown of Risks for Northwestern Region Project 2

Category	Total cost	% Of Project Cost Overrun
Design scope changes	\$43,182.32	0.7
Material	\$78.18	0.0
Latent conditions	\$60,189.55	1.0
Traffic and safety issues	\$474.03	0.0
Not a risk	(\$2,500.00)	0.0
Unclassified*	\$52,703.70	0.8
Total Change Order Value	\$154,127.78	2.5%

*A difference of \$52,703.70 between the final contract value and initial tender value reported in the PCR is unaccounted for in the risk analysis. This is excluded from the data of the graph below.

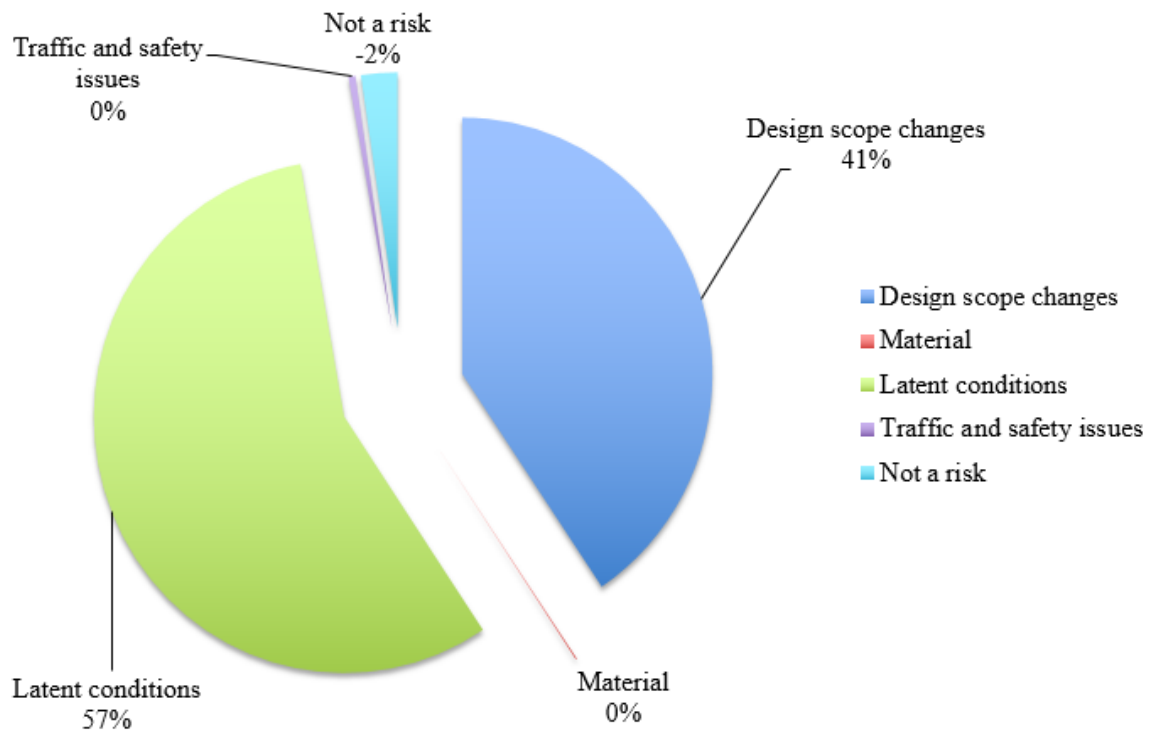


Figure 5.7: Breakdown of Risks for Northwestern Region Project 2

The design scope changes observed in this project can be attributed to items missing from contract and item tender list. Latent condition can be attributed to additional work to address deterioration of elements and additional work to match site conditions to design specifications.

5.1.8 Northwestern region project 3

The project involved grading, drainage, granular base, and hot mix paving on highway. The cost overrun of the project is 3.7%. Table 5.8 and Figure 5.8 present the risk classification results. Design scope changes during the design stage consisted of sampling and testing of 6 culverts for the presence of asbestos.

Table 5.8: Cost Overrun and Change Order Breakdown of Risks for Northwestern Region Project 3

Category	Total cost	% Of Project Cost Overrun
Design scope changes	\$30,377.68	0.3
Material	\$150,842.05	1.7
Project schedule issues	\$16,882.21	0.2
Latent conditions	\$130,022.71	1.5
Traffic and safety issues	\$1,000.55	0.0
Not a risk	(\$17,950.00)	-0.2
Total Change Order Value	\$311,175.20	3.7%

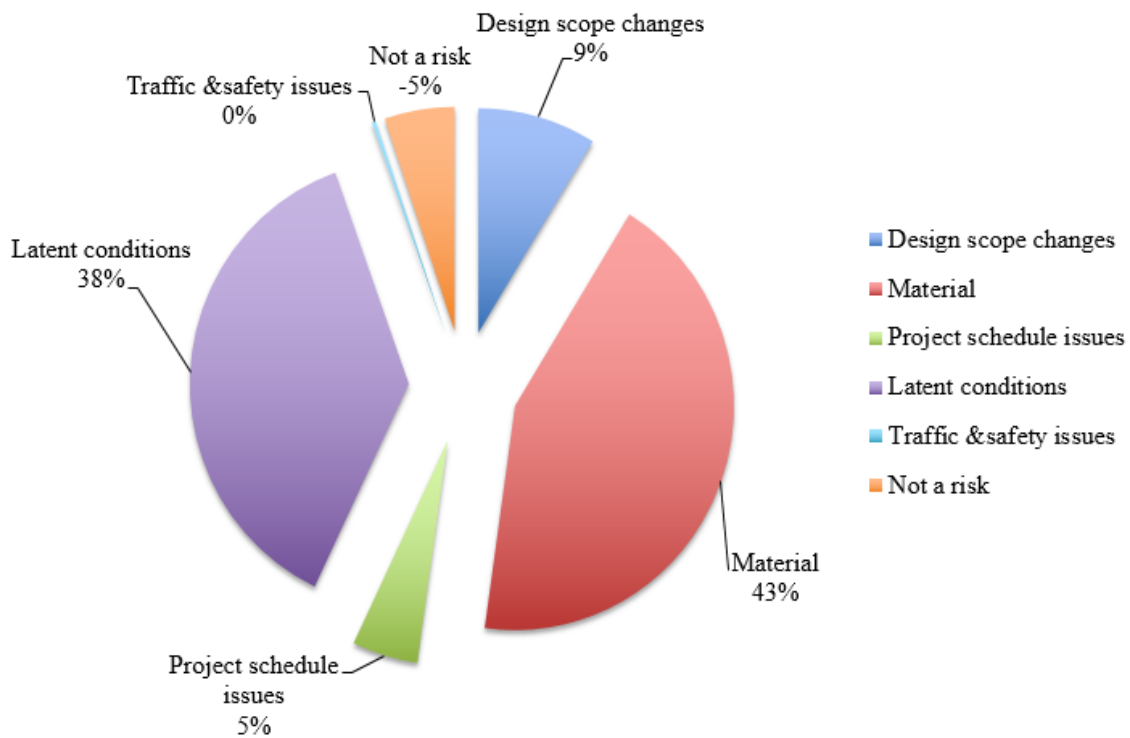


Figure 5.8: Breakdown of Risks for Northwestern Region Project 3

The latent condition observed in this project can be attributed to additional geotechnical work and additional work to address deterioration of elements.

5.1.9 West region project 1

The project involved pavement rehabilitation, lane widening, culverts rehabilitation and replacement, drainage improvement, and minor electrical work. The cost overrun of the

project is 5.0%. Table 5.9 and Figure 5.9 present the risk classification results. Design scope changes during the design stage consisted of:

- Field investigations and detail design for operational improvements to an intersection;
- An independent road safety assessment to evaluate the existing safety concerns;
- Additional Highway Engineering, Bridge Engineering, Foundation Engineering, Drainage & Hydrology and Environmental work at additional culvert locations
- Electrical Engineering is required for a new flasher beacon and for the replacement of one additional traffic counting station;
- Roadside Tree Inventory and Assessment be conducted for trees within the highway's right-of-way;
- Design changes for a retaining structure (RSS wall) to reduce the construction cost of the retaining wall
- Incorporation of an additional structural culvert (designed by Stantec) from outside the project limits (originally part of WP 406-94-00, Hwy 21, St. Joseph to Bayfield)
- Additional utility test pits required at various locations throughout the project.
- Additional environmental work (fisheries and avian) was identified during detailed design as a result of changes to the Endangered Species Act (ESA) legislation, which occurred during the consultant assignment.
- Bridge Engineering required to update the original Gully Creek rehabilitation design, including preparation of a new contract tender for the rehabilitation of the Gully Creek and 'Bayfield South' culverts in order to conform to the new ESA permit conditions.
- Bridge and Highway Engineering is required to provide construction liaison, to review and address stakeholder and contractor issues during construction.

Table 5.9: Cost Overrun and Change Order Breakdown of Risks for West Region Project 1

Category	Total cost	% Of Project Cost Overrun
Design scope changes	\$152,797.64	1.16
Material	\$319,514.78	2.43
Latent conditions	\$178,775.16	1.36
Utility conflict	\$127,996.00	0.97
Construction staging issue	(\$35,841.00)	-0.27
Not a risk	(\$26,826.00)	-0.20
Unresolved change order	(\$57,900.00)	-0.44
Total Change Order Value	\$716,416.58	5%

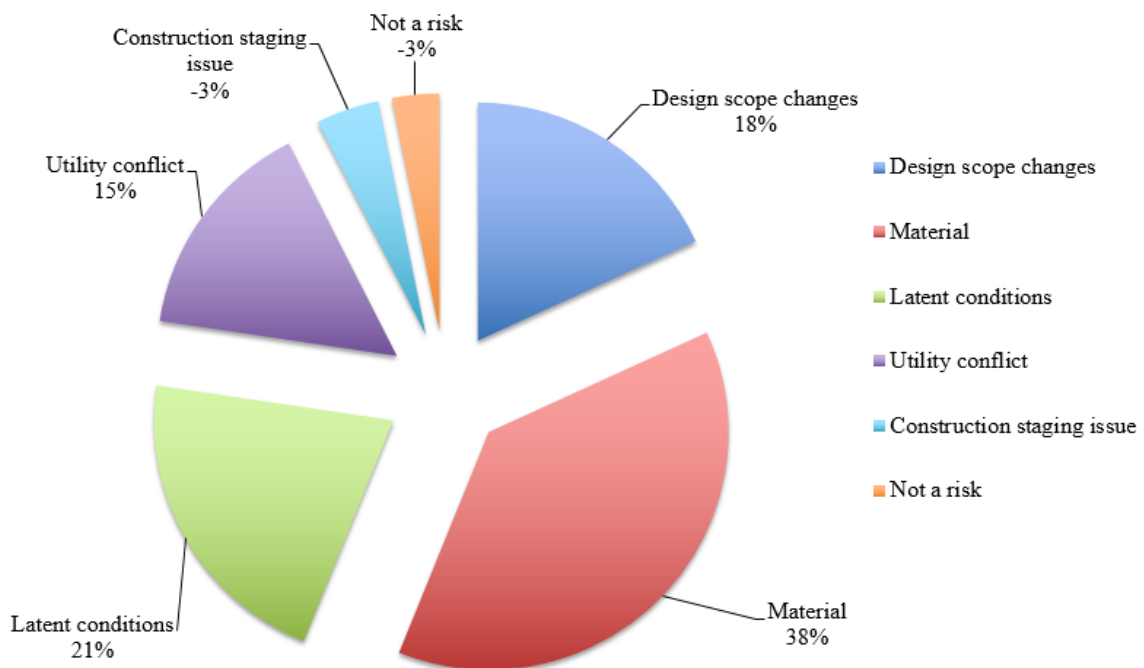


Figure 5.9: Breakdown of Risks for West Region Project 1

The design scope changes observed in this project can be attributed to additions to the scope of work and items missed in contract documents, tender item list, and design. Latent condition can be attributed to work to address deterioration of elements and additional geotechnical work. Utility conflict can be attributed to design conflict with existing utility.

5.1.10 Northeast region project 1

The project involved construction of four lanes on highway, an interchange, four new bridges, an access road, and a ramp at the highway interchange; resurfacing/realigning existing highway including a grade separation; completing construction of approach slabs and waterproofing on five bridges; and rehabilitation of Bridge Crossing. The cost overrun of the project is 4.4%. Table 5.10 and Figure 5.10 present the risk classification results. No design scope changes occurred during the design stage.

Table 5.10: Cost Overrun and Change Order Breakdown of Risks for Northeast Region Project 1

Category	Total cost	% Of Project Cost Overrun
Design scope changes	\$1,232,789.96	2.3
Material	(\$2,585,724.18)	-4.9
Permits and regulations	\$25,343.98	0.0
Latent conditions	\$672,648.01	1.3
Utility conflict	\$32,090.71	0.1
Traffic and safety issues	\$115,920.90	0.2
Not a risk	\$1,263,921.06	2.4
Unclassified*	\$1,561,479.79	3.0
Total Change Order Value	\$2,318,470.23	4.4%

*A difference of \$1,561,479.79 between the final contract value and initial tender value reported in the PCR is unaccounted for in the risk analysis. This is excluded from the data of the graph below.

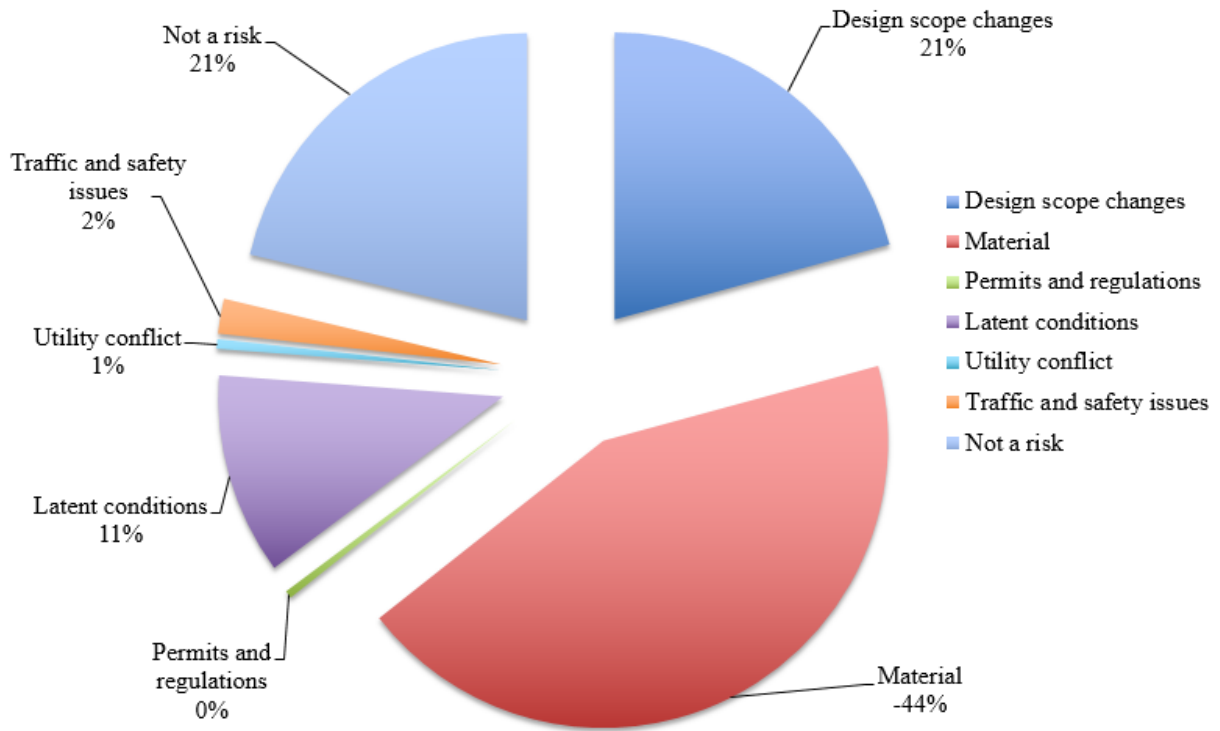


Figure 5.10: Breakdown of Risks for Northeast Region Project 1

The design scope changes observed in this project can be attributed to additions to the scope of work.

5.1.11 Northeast region project 2

The project involved four-lane expansion of a highway, involving grading, drainage, granular base, illumination, hot mix paving, and 15 structures. The cost overrun of the project is 13.5%. Table 5.11 and Figure 5.11 present the risk classification results. No design scope changes occurred during the design stage.

Table 5.11: Cost Overrun and Change Order Breakdown of Risks for Northeast Region Project 2

Category	Total cost	% Of Project Cost Overrun
Design scope changes	\$722,619.60	1.2
Material	\$3,733,843.10	6.4
Permits and regulations	\$964,300.86	1.7
Project schedule issues	\$3,590.87	0.0
Latent conditions	\$1,502,885.83	2.6
Utility conflict	\$6,000.00	0.0
Construction staging issues	\$151,971.25	0.3
Traffic and safety issues	\$75,040.00	0.1
Not a risk	\$0.00	0.0
Unclassified*	\$711,367.23	1.2
Total Change Order Value	\$7,871,618.74	13.50

*A difference of \$605,367.23 between the final contract value and initial tender value reported in the PCR is unaccounted for in the risk analysis. As well as a change order for \$106,000 for unknown contractor claims. This is excluded from the data of the graph below.

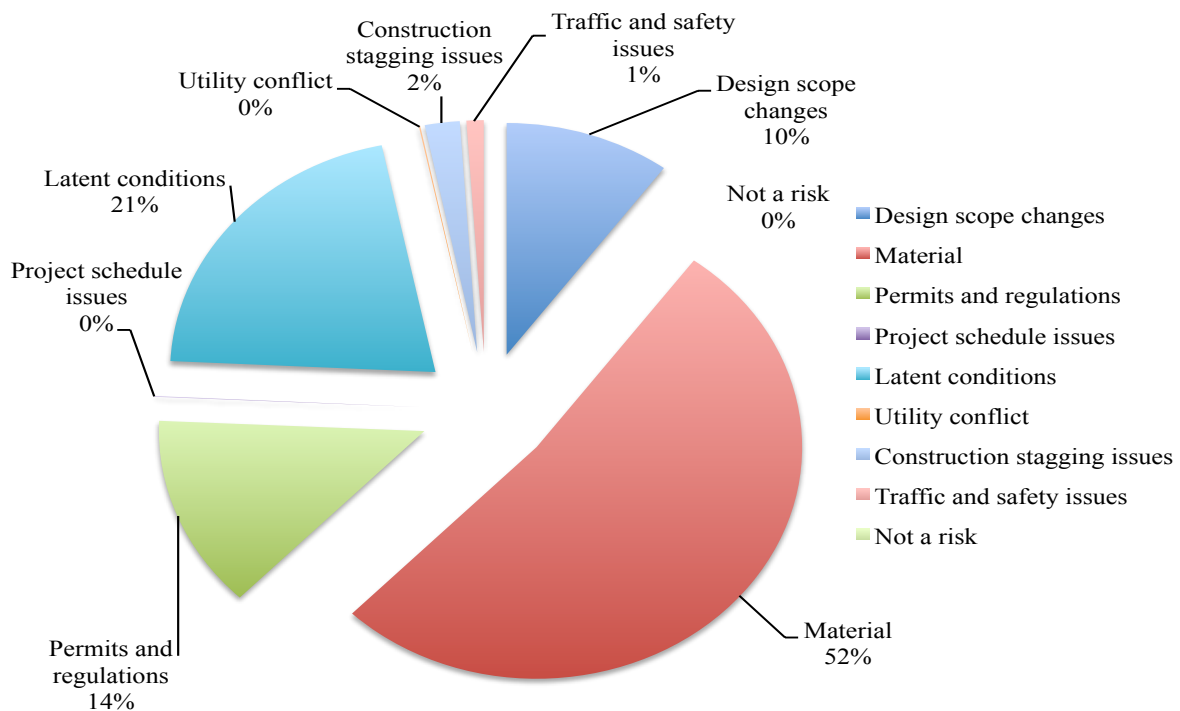


Figure 5.11: Breakdown of Risks for Northeast Region Project 2

The design scope changes observed in this project can be attributed to additions to the scope of work, redesign, and missed quantities. Latent condition can be attributed to geotechnical work. Permits and regulation can be attributed to changes to address environmental regulations.

5.1.12 Northeast region project 3

The project involved four-lane expansion of a highway, involving grading, drainage, granular base, illumination, hot mix paving and 11 structures. The cost overrun of the project is -2.4% excluding unresolved change orders. Table 5.12 and Figure 5.12 present the risk classification results. No design scope changes occurred during the design stage.

Table 5.12: Cost Overrun and Change Order Breakdown of Risks for Northeast Region Project 3

Category	Total cost	% Of Project Cost Overrun
Design scope changes	(\$349,234.69)	-0.6
Material	(\$971,982.58)	-1.8
Latent conditions	\$41,846.61	0.1
Utility conflicts	\$3,335.00	0.0
Construction staging issue	\$43,559.18	0.1
Traffic and safety	\$19,930.00	0.0
Not a risk	(\$85,939.20)	-0.2
Unresolved Change Orders and Claims**	\$22,000,000.00	-
Total Change Order Value	(\$1,298,485.68)	-2.4%

**Not included in graph below

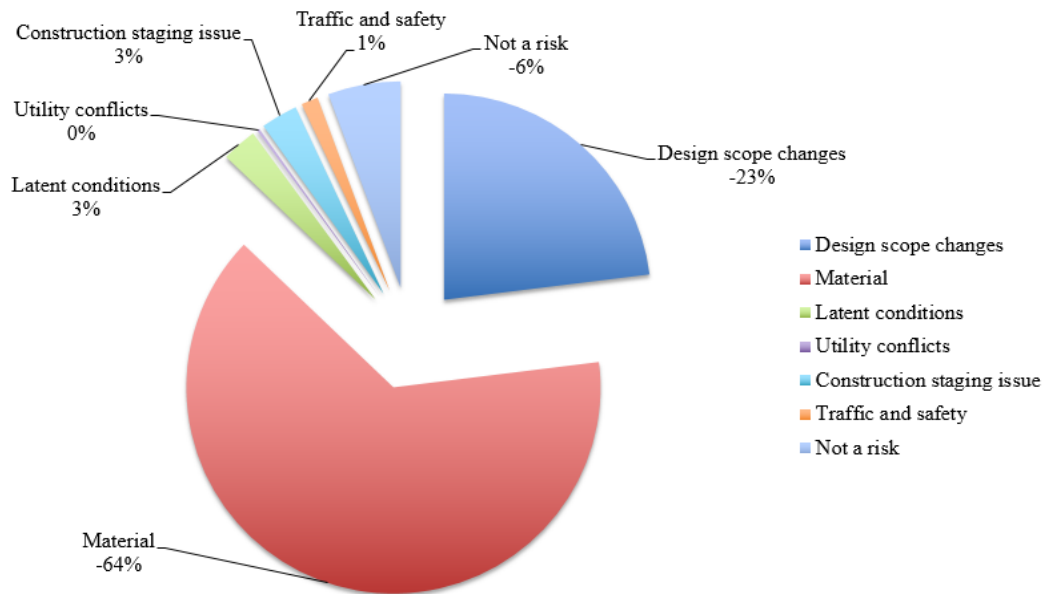


Figure 5.12: Breakdown of Risks for Northeast Region Project 3

The design scope changes observed in this project can be attributed to redesign, missing quantities, changes to wildlife fencing, and design errors.

5.1.13 Northeast region project 4

The project involved construction of new alignment for a highway, involving grading, drainage, and warm mix paving, granular shouldering, removal of existing alignment, and rock protection works for rehabilitating river slopes. The cost overrun of the project is 10.6%.

Table 5.13 and Figure 5.13 present the risk classification results. No design scope changes occurred during the design stage.

Table 5.13: Cost Overrun and Change Order Breakdown of Risks for Northeast Region Project 4

Category	Total cost	% Of Project Cost Overrun
Design scope changes	\$96,370.37	6.6
Material	(\$33,719.39)	-2.3
Permits and regulations	\$4,420.00	0.3
Latent conditions	\$87,775.79	6.0
Not a risk	(\$1,125.00)	-0.1
Total Change Order Value	\$153,721.77	10.6%

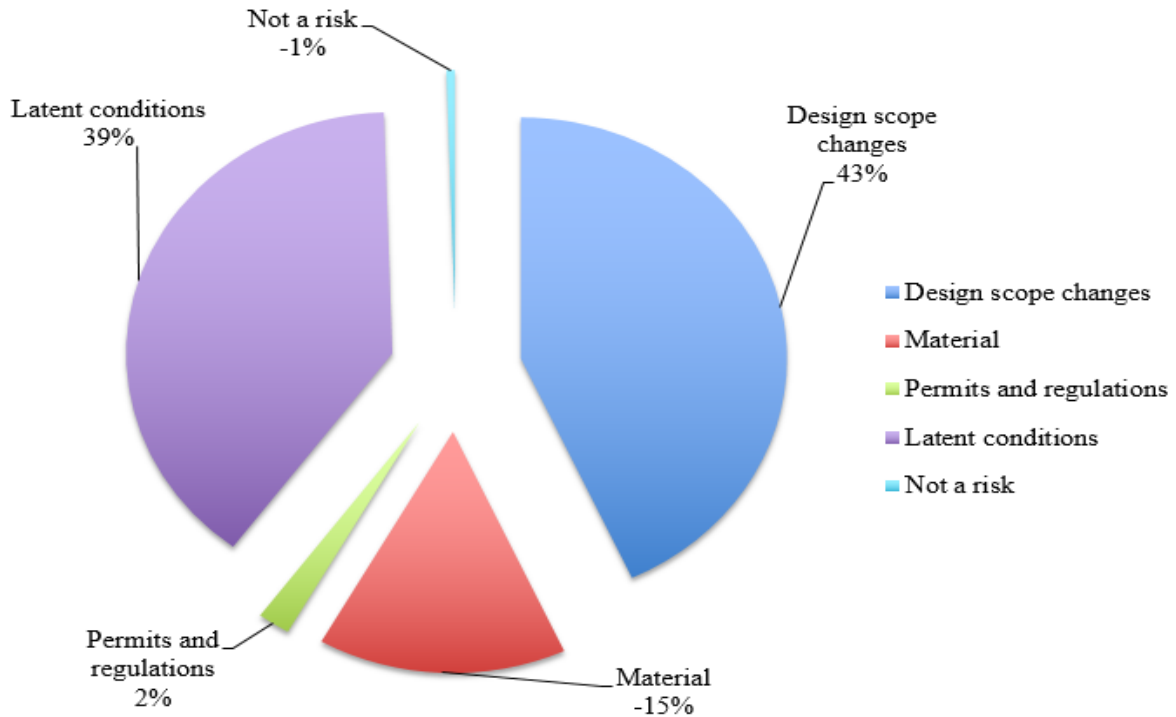


Figure 5.13: Breakdown of Risks for Northeast Region Project 4

The design scope changes observed in this project can be attributed to design errors and missing quantities. Latent condition can be attributed to inaccurate contract drawings.

5.1.14 Northeast region project 5

The project involved work on a highway including improvements to a highway/road intersection and improvements to pavement condition of the road. Improvements of the pavement condition, ride quality, safety and operational characteristics of sections of another highway, bridge rehabilitation, treatment of pavement distress areas, culverts replacement and rehabilitation. The cost overrun of the project is -2.1% excluding unresolved change orders. Table 5.14 and Figure 5.14 present the risk classification results. No design scope changes occurred during the design stage.

Table 5.14: Cost Overrun and Change Order Breakdown of Risks for Northeast Region Project 5

Category	Total cost	% Of Project Cost Overrun
Design scope changes	(\$432.49)	0.0
Material	(\$483,482.47)	-4.9
Project schedule issues	\$514.79	0.0
Latent conditions	\$240,207.96	2.4
Utility conflict	\$1,560.90	0.0
Traffic and safety issues	\$38,295.32	0.4
Unresolved Change Orders and Claims	\$2,053,825.15	-
Unclassified*	(\$5,345.30)	-0.1
Total Change Order Value	(\$208,681.29)	-2.1%

*A difference of -\$5,345.30 between the final contract value and initial tender value reported in the PCR is unaccounted for in the risk analysis. This is excluded from the data of the graph below.

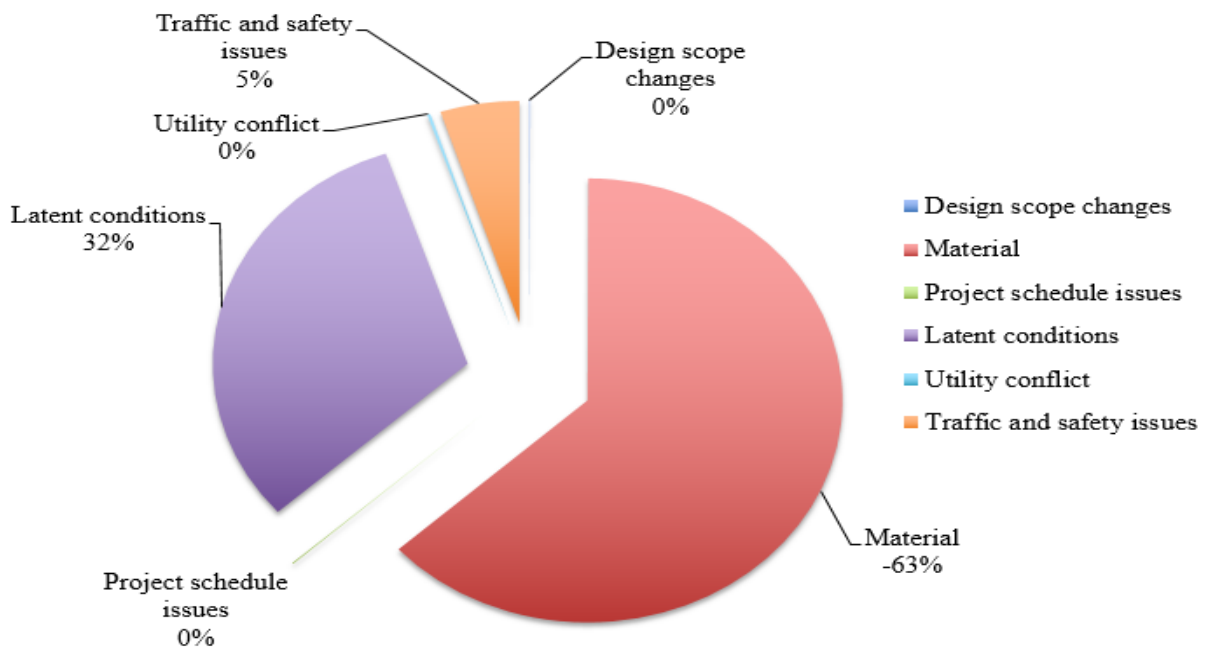


Figure 5.14: Breakdown of Risks for Northeast Region Project 5

The latent conditions observed in this project can be attributed to additional geotechnical work and additional work to address deterioration of elements.

5.2 Summary of identified risks by project type

The risk identification results are split into two main categories: rehabilitation and new construction (Figures 5.15 and 5.16, respectively). Reported percentages represent the proportion of total risk expenditure under specific risk categories and are based on the net sum of positive and negative individual change orders, divided by the sum of the absolute values of risk expenditure in each risk category. For example, design scope changes in rehabilitation projects result in \$1,483,360.89 of cost overruns (net of positive and negative change orders). On the other hand, construction staging issues in rehabilitation projects result in a savings of \$25,656.35 (net of 34 positive and negative change orders). The sum of the absolute values of net changes in all risk categories is \$3,704,370.85. Hence, design scope changes are shown as 40% ($\$1,483,360.89 / \$3,704,370.85$) in Figure 5.15, and construction staging issues are shown as -1% ($-37 \text{ } \$25,656.35 / \$3,704,370.85$). The expenditures occur between the years 2008 and 2015 and were not adjusted for inflation. Design scope changes are only reported for the construction stage. The design scope changes that occur in the design phase are summarized in Appendix B.

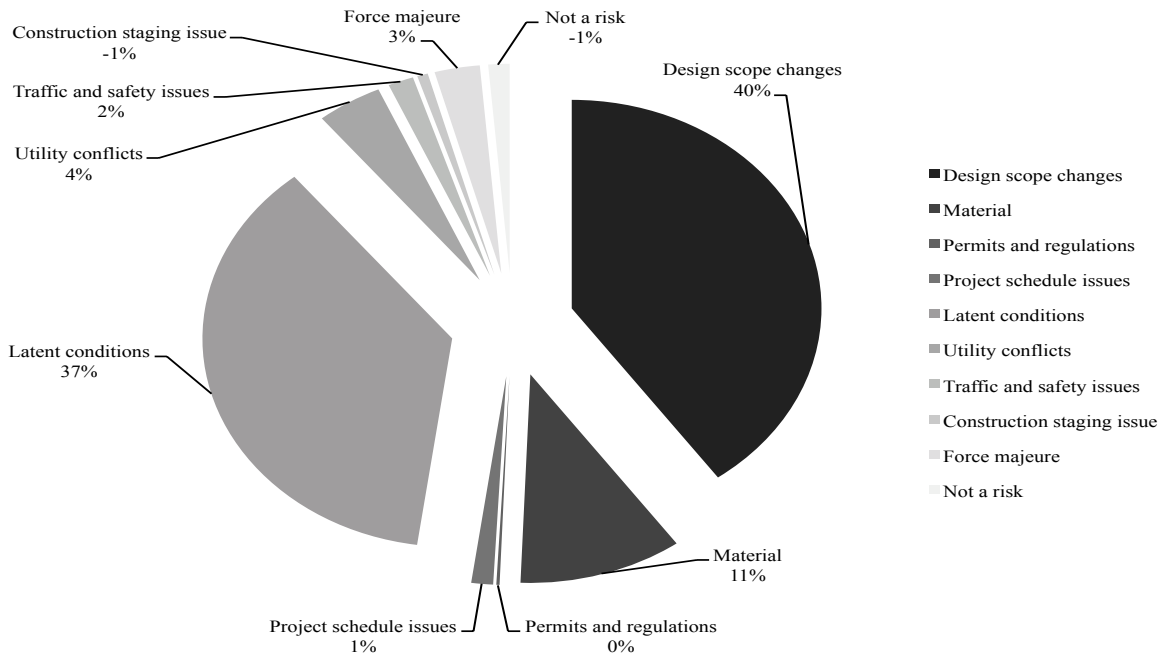


Figure 5.15: Breakdown of Risks for All Rehabilitation Projects

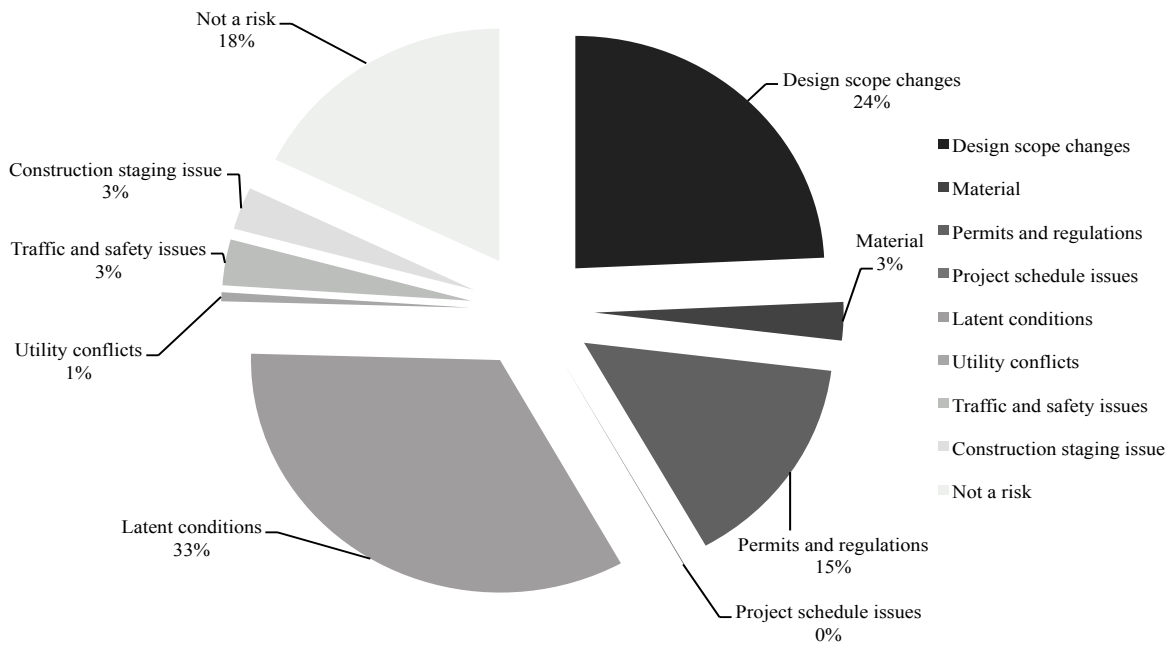


Figure 5.16: Breakdown of Risks for All New Construction Projects

For rehabilitation projects (Figure 5.15), the critical risks are design scope changes (40%), latent conditions (37%), and material (11%). Design scope changes and material risks occur

in all eleven projects while latent conditions appear in ten projects, giving these three risks a high likelihood of occurring in rehabilitation projects. Figures 5.17 to 5.19 provide a more detailed breakdown of these top risks.

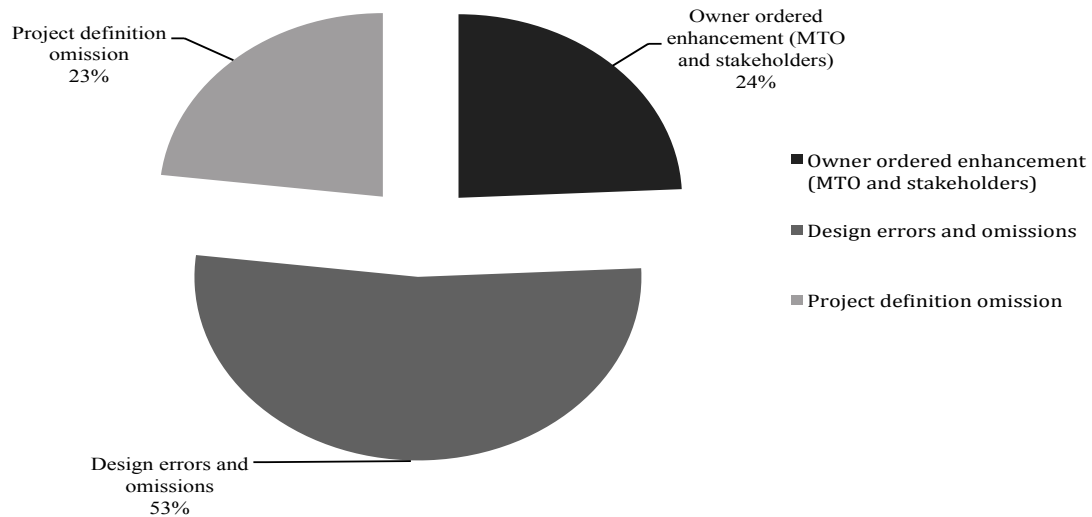


Figure 5.17: Further Breakdown of Design Scope Changes Risk (Rehabilitation Projects)

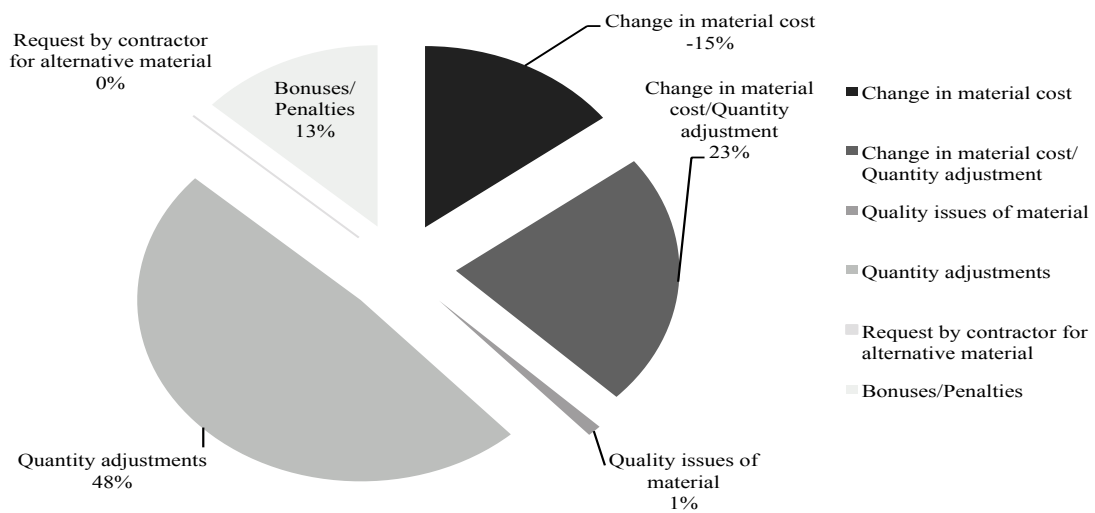


Figure 5.18: Further Breakdown of Material Risk (Rehabilitation Projects)

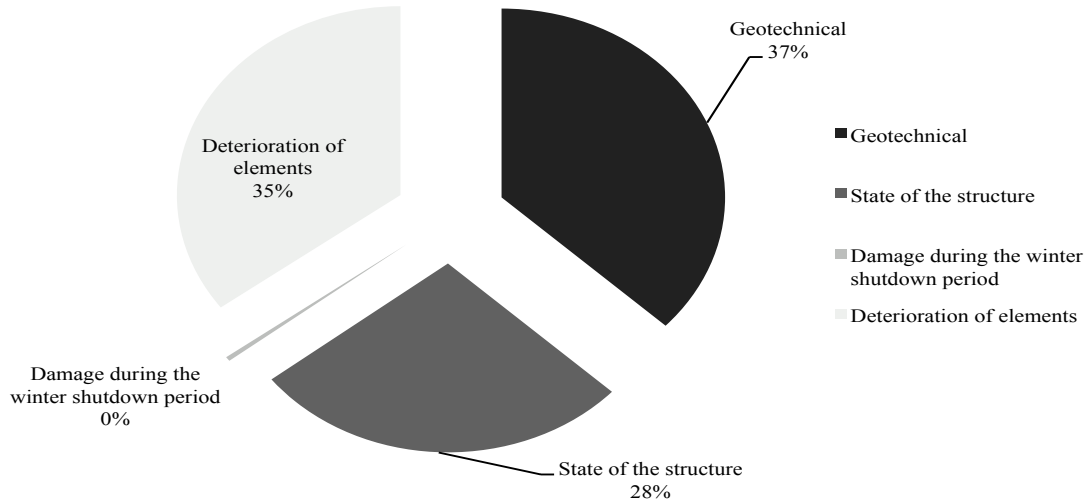


Figure 5.19: Further Breakdown of Latent Conditions Risk (Rehabilitation Projects)

For new construction projects (Figure 5.16), the critical risks are latent conditions (33%), design scope changes (24%), and permits and regulations (15%). Design scope change and latent condition risks appear in all three projects while permits and regulations appear in two projects. The permits and regulations percentage is substantially higher in the new construction projects (15%) when compared to the rehabilitation projects (0%). This difference is due to the occurrence of several change orders on one of the projects that were created to address a change in the Endangered Species Act legislation that occurred after contract award, and other changes added to comply with the Ministry of Natural Resources' recommendations. Figures 5.20 and 5.21 provide a more detailed breakdown of the top risks for new construction projects. For permits and regulations, all of the change orders were

caused by environmental regulations.

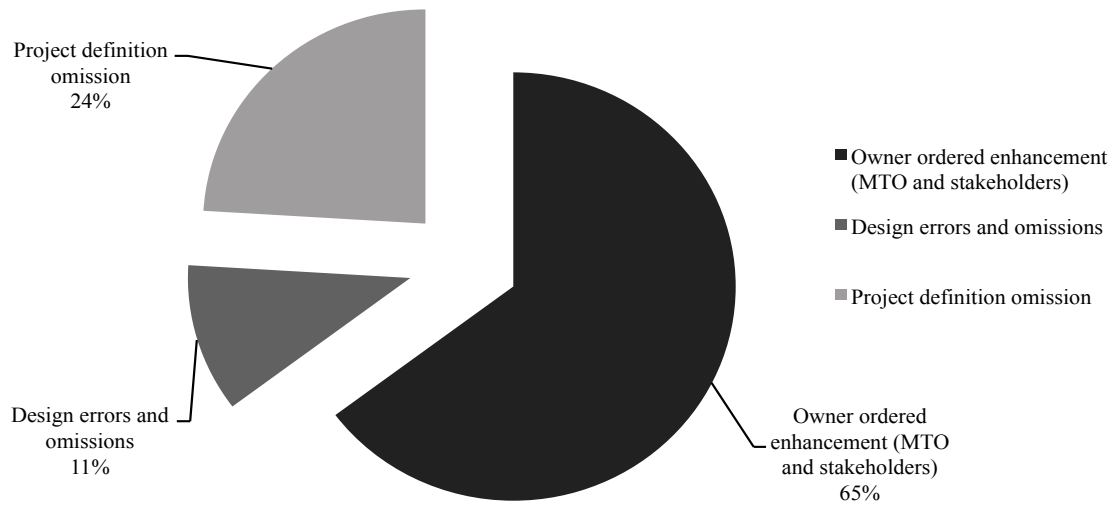


Figure 5.20: Further Breakdown of Design Scope Changes Risk (New Construction Projects)

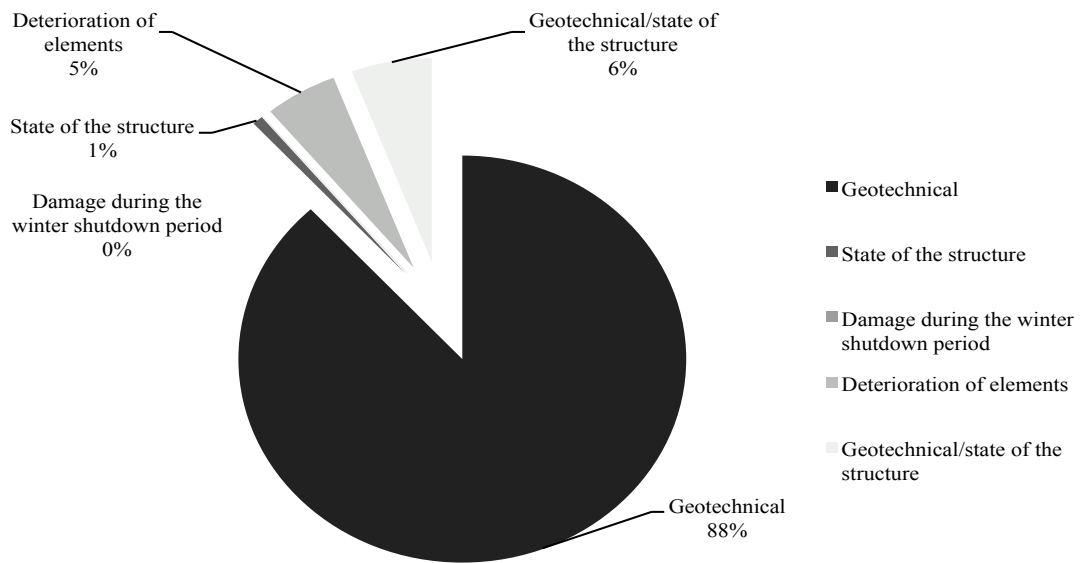


Figure 5.21: Further Breakdown of Latent Conditions Risk (New Construction Projects)

5.3 Estimating the Probability of Risk Occurrence and Resulting Impact Ranges for the Identified Critical Risks

The probability of a risk materializing is calculated based on the past occurrence of the risk in the project sample. For example, if only one out of four projects incurs a cost overrun due to a particular risk materializing, the probability of occurrence would be 25%. The probabilities of occurrence for design scope changes and owner ordered enhancement calculated for all of the projects, regardless of type, are shown in Tables 5.15 and 5.16. The probabilities are calculated based on whether or not the risks occur in the project sample.

Table 5.15: Probability of Occurrence for Design Scope Changes on New Construction and Rehabilitation Projects

Project ID	Is the risk present? (Occurrence)	Cost (\$)
Eastern region project 1	YES	401,897.34
Eastern region project 2	YES	236,409.02
Eastern region project 3	YES	39,163.35
Eastern region project 4	YES	84,297.83
Eastern region project 5	YES	358,453.96
Northwestern region project 1	YES	40,843.87
Northwestern region project 2	YES	43,182.32
Northwestern region project 3	YES	30,377.68
Northeast region project 1	YES	1,232,789.96
Northeast region project 2	YES	722,619.60
Northeast region project 3	YES	(349,234.69)
Northeast region project 4	YES	96,370.37
Northeast region project 5	YES	(432.49)
West region project 1	YES	152,797.64
	Probability	Probability*Impact
	100%	\$220,681.13

Table 5.16: Probability of Occurrence for Owner Ordered Enhancement on New Construction and Rehabilitation Projects

Project ID	Is the risk present? (Occurrence)	Cost (\$)
Eastern region project 1	YES	75,747.97
Eastern region project 2	YES	163,680.00
Eastern region project 3	YES	24,463.37
Eastern region project 4	YES	16,138.20
Eastern region project 5	YES	2,550.00
Northwestern region project 1	YES	39,215.87
Northwestern region project 2	NO	-
Northwestern region project 3	NO	-
Northeast region project 1	YES	1,046,581.92
Northeast region project 2	YES	293,584.40
Northeast region project 3	YES	(300,044.13)
Northeast region project 4	NO	-
Northeast region project 5	NO	-
West region project 1	YES	37,899.00

Probability

71%

Probability*Impact

\$99,986.90

The probability of risk occurrence for the risks with the highest change order percentages are presented in Figure 5.22. These calculations are based on a sample of 11 rehabilitation projects. For the new construction projects, the small sample size results in a probability of risk occurrence of 100% for most of the risks, except for environmental regulations and damage during the winter shutdown, which are 67% and 0%, respectively. Assigning risk based on exposure units (such as sections of road) was an alternative approach, however the data sample was not adequate for this approach.

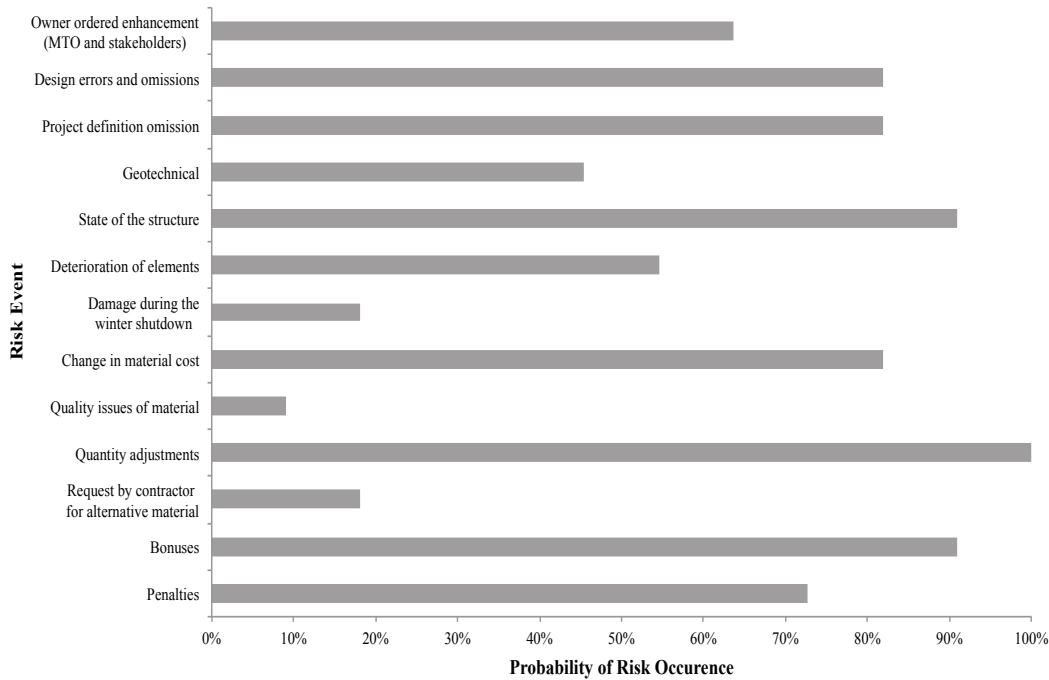


Figure 5.22: Probabilities of risk occurrence of critical risks in rehabilitation projects

The variation in the impact of the risk events with the highest change order percentages is presented in Figures 5.23 and 5.24. The length of the box represents the likely range of variation (interquartile range), the line within the box is the typical value (median), the whiskers represent the maximum and minimum values within the span of 1.5 times the interquartile range, and outliers are beyond 1.5 times the interquartile range. Figures 5.23 and 5.24 exclude the extreme outliers that are located above the third quartile or below the first quartile by more than 3 times the interquartile range. All outliers are not represented in the graph's whiskers but are included in the calculation for the interquartile range. For new construction, owner ordered enhancement, project definition omission, and geotechnical risks have the largest range of variation in impact (as a percentage). For rehabilitation projects, owner ordered enhancement and design errors and omissions risks have the largest range of variation in impact.

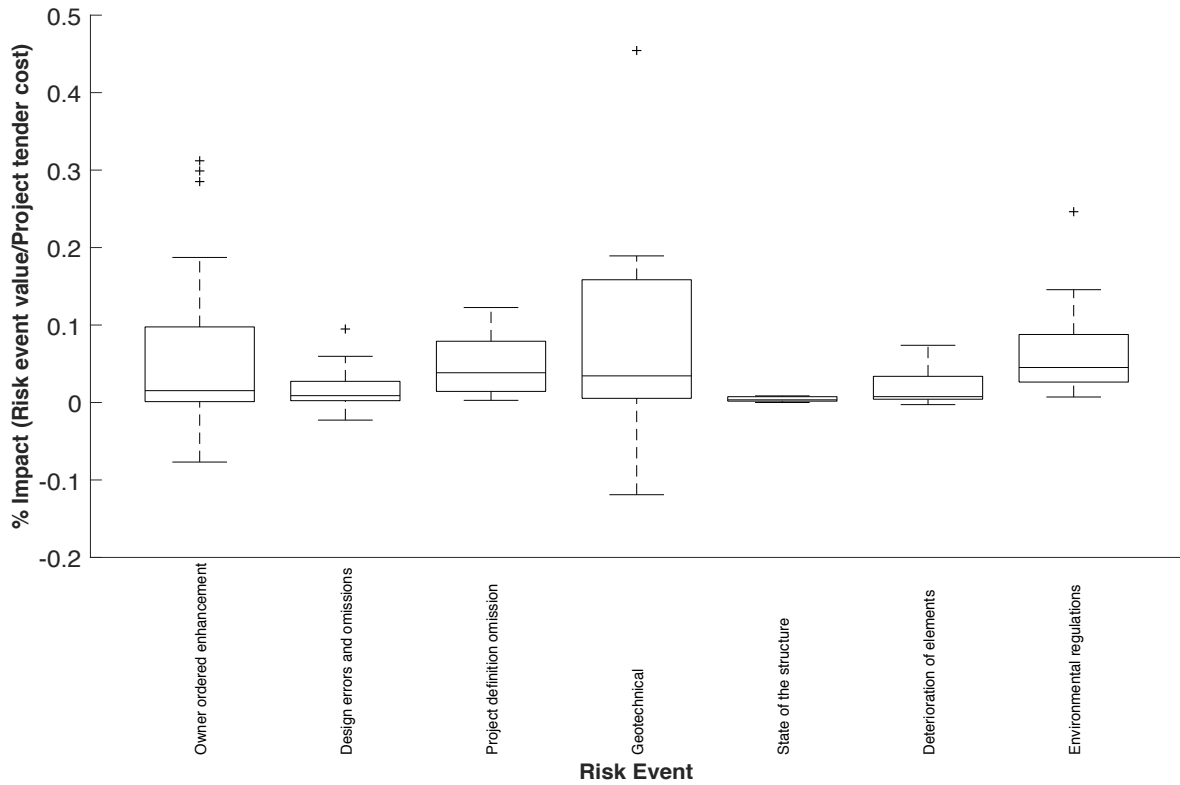


Figure 5.23: Impact Variation for New Construction Projects Top Risk Sources

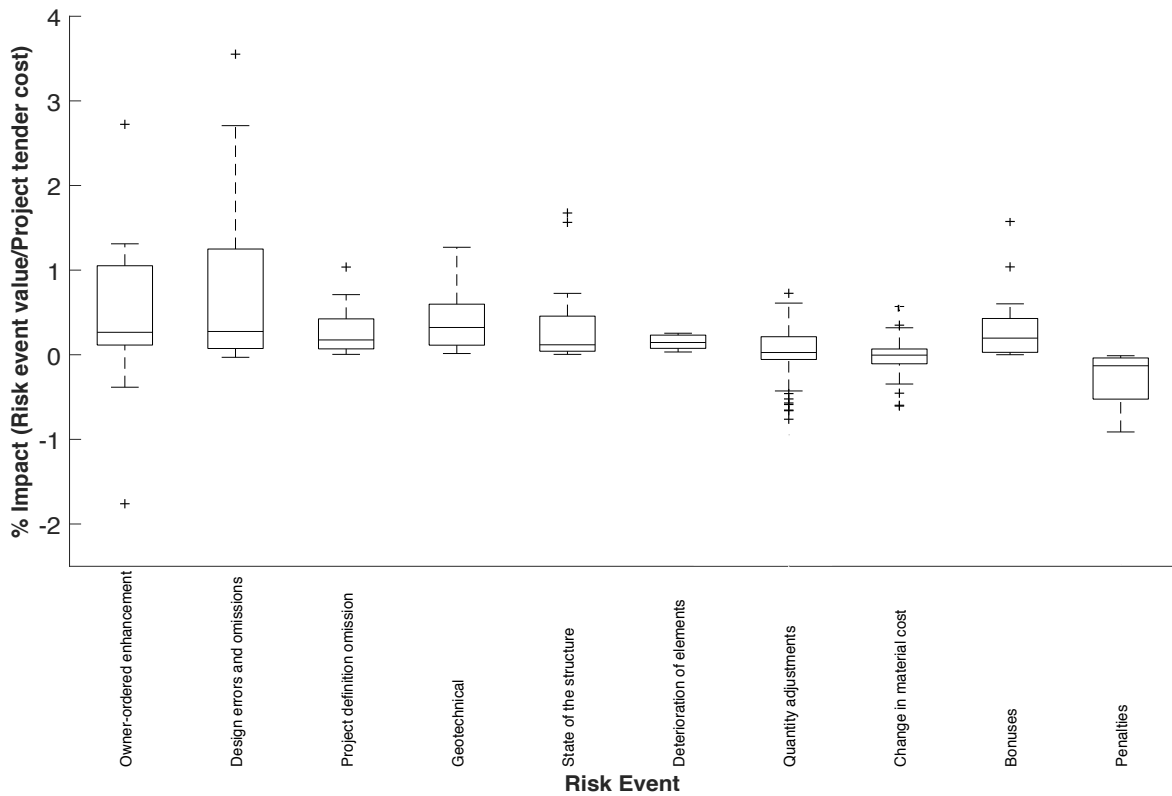


Figure 5.24: Impact Variation for Rehabilitation Projects Top Risk Sources

In Figure 5.24, the risk category damage during the winter shutdown was not included due to a small sample size.

In Infrastructure Ontario's risk assessment process, the resulting cost impact ranges are calculated as a range from (i) unlikely, but low additional cost (10th percentile); (ii) most likely additional cost; and (iii) unlikely, but high additional cost (90th percentile) (Infrastructure Ontario, 2015). If a similar statistical simulation is to be conducted for MTO projects this information can be derived from the data presented in Figures 5.23 and 5.24.

5.4 Comparison between pre and post construction risk analysis

The risk register worksheet in the scope and cost report includes, description of the risk event; risk cost before and after risk response strategy; probability, cost, and schedule impact; cost and schedule criticality; weighted risk cost with and without a risk response; risk response strategy and its cost; risk allowance rational and value; and risk owner.

Table 5.17 presents the risks identified in the risk register worksheet for Eastern Region Project 1 and the reported change orders from the project construction report that correspond with these risks. The risk response strategy selected for these risks is acceptance, therefore, its magnitude of its appearance in the change orders is not affected by any attempts to reduce its probability and/or impact. Difficulty arises when trying to compare the estimated and actual impact of the risks, because they sometimes appear as only a part of a larger change order request which cannot be broken down to represent only the specific risk. This hinders the possibility of a comparison between the expected and actual impact of risks. As discussed in Chapter 3's limitations section, a breakdown of the change orders from the project construction report such as the breakdown presented in the expenditure forecast summary

document provided for the first sample projects is necessary for a quantitative comparison to be possible. In addition, risk register worksheets were only completed for 5 out of the 14 projects. Some of these projects have a justification report which did not require a risk register worksheet.

Table 5.17: A comparison of a risk identified during the design phase and its occurrence during the construction phase (Eastern region project 1)

Detailed description of risk event identified in design phase	Risk breakdown structure	Change order descriptions
Concrete and steel quantity for bridge rehabilitation prone to increase	Construction risk	Costs incurred by the fabricator for increasing the plate sizes and any additional anchors required. This was required following the x-ray of the existing steel showing that the plate sizes needed to be increased to avoid existing steel in the pier caps
		Addition of Item # 076 - Abrasive Blast Cleaning of Structural Steel in Contact with Concrete. No provisions were included in the contract.
		POP Adjustments Item 59 -Abrasive Blast Cleaning of Reinforcing Steel & Item 61 -Dowels into Concrete
Quantities and material costs for temporary modular bridge (TMB) prone to increase	Construction risk	Construction of a leveling slab at SE pier of TMB
		Request to use an alternate grout material for the installation of the rock anchors at the south piers of the TMB
		PQP Adjustment Item 67 - Earth Excavation for Structures (Temporary Bridge tender list items)
		Use of quarry stone for the core material of the NE pier foundation of the TMB
		PQP Adjustment Item 67 - Earth Excavation for Structures & Item 69 - Tremie Concrete (Both are Temporary Bridge tender list items)

One possible workaround is in the inability to conduct a quantitative comparison at the specific risk level that can be explored in future work, is to compare the low (optimistic), reasoned, and high (pessimistic) cost estimates from the scope and cost reports with the tender and final contract values from the project construction reports. The reasoned cost estimate is the low estimate plus the risk allowance. The high cost estimate is the low estimate plus the risk cost without a risk response. This comparison is not possible with the available project documents because some of the provided scope and cost reports are completed at 90% detailed design, which places the cost estimates close to the tender contract values.

5.5 Limitations

The limitations of this research approach's results should be noted, including issues related to using change order data. The change order data used in this analysis creates a limitation on the results because several project changes are sometimes grouped together into a single change order and only the net sum is reported in the project construction reports. This issue occurs frequently enough to create an impact on the results. For example, the material risks for new construction projects have values of -\$2,585,724.18, \$3,733,843.10, and -\$971,982.58, which are reported in this analysis as a total of \$176,136.34 for all projects. Hence, material risk gets reported as only 3% of total change orders (Figure 5.16), even though a large variation has occurred within the individual projects. Also, change orders may be broken down from larger change orders into \$49k units so they do not have to be sent to MTO. The initial data collection process included an expenditure forecast summary document that provided details on each of the items in a change order including their unit

prices which would allow for the change order to be divided further to eliminate the cancellation effect. This would be necessary for future risk assessment efforts.

Chapter 6

Lessons Learned

The average project value for both the rehabilitation and new construction projects analyzed is approximately \$17 million and the average cost overrun is 10.1%. When compared with other studies summarized in Figure 6.1, this analysis suggests MTO is within but on the higher end of the range of cost overruns. MTO's unique assumption of risk might explain this to some extent.

For the analyzed rehabilitation projects, the average final project value is approximately \$6 million and the average cost overrun is 11.5%. When compared with Figure 6.1, this result again suggests the MTO is on the higher end of the range of cost overruns, since projects of a similar size are exhibiting cost overruns of 4%.

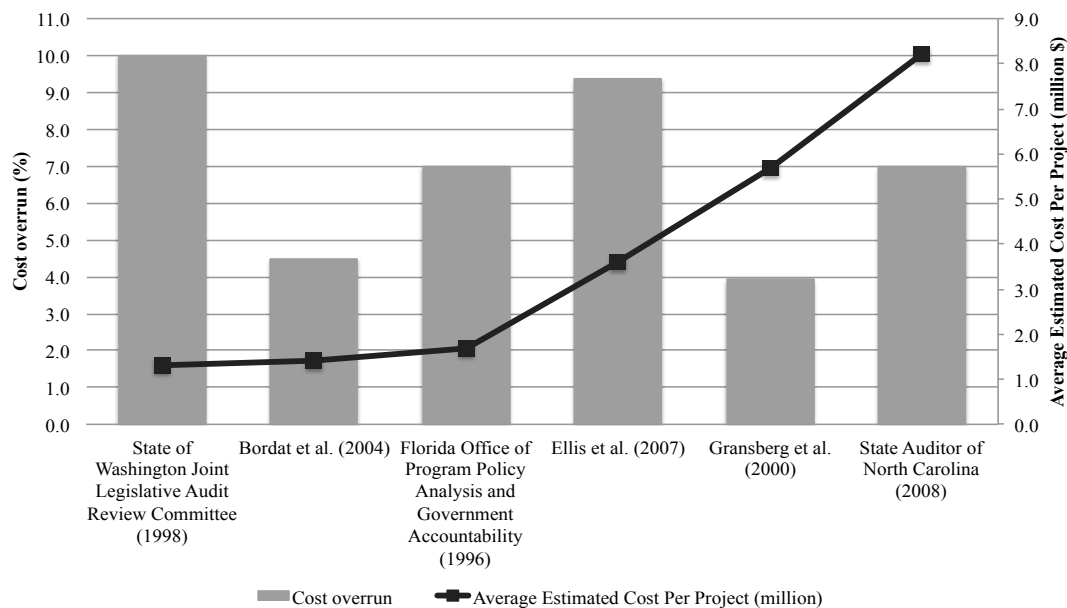


Figure 6.1: Average Cost Overrun Values from Literature On DBB Projects

An example of cost overruns for PPP projects is an average of 3.22% from a sample of 25 projects in the U.S., which had a value range from \$18 million to \$2.1 billion (Ramsey and El Asmar, 2015).

The average estimated cost per project reported in the studies is lower than the value for the MTO projects due to the larger sample size reported in the studies. For example, the Gransberg et al. (2000) study is on 280 projects and the Florida Office of Program Policy Analysis and Government Accountability (1996) study is on 3,969 projects.

The MTO currently absorbs much of the overall project risk, which may lower bid prices (i.e., reduce contractor contingencies). However, a more detailed analysis of specific project risks may reveal areas for improvement. For example, a study by Ilbeigi et al. (2015) study into the bid prices of asphalt cement for U.S. DOTs revealed that the common risk sharing strategy of price adjustment clauses was not a statistically significant variable in a multivariate regression analysis of variables that influence bid prices, which implies that it does not help with reducing submitted bid prices. The MTO currently uses a price adjustment clause for fuel and PGAC, which may drive cost overruns without lowering initial bid prices and thus overall project costs. In other words, and counterintuitively, private entities may seek similar profit margins on risk free projects as on risky projects, contrary to popular perception. Thus, public owner acceptance of risk may lead to ineffective risk management and higher project costs. In this light, project contracts must reflect the economic environment within which the owner, consultant, and general contractor are working. For example, in less competitive markets (e.g., small number of contractors with local control of means of production of aggregate and paving materials) or in the presence of cooperation, price adjustment clauses may be an ineffective risk sharing strategy. Further research is

needed to understand and characterize the economic landscape of the construction industry in Ontario.

The types of risks and root causes experienced by the MTO as identified in this research are comparable to previous studies of other agencies. Siemiatycki (2009) analyzed the results of independent government auditor studies on transportation-project cost overruns and identified the most frequently used explanations for these overruns as scope changes and change orders, poor project reporting and performance tracking, poor project management, project delays leading to cost escalation, incomplete studies before project approval, and unexpected inflation in materials. Similar research, conducted at the University of Kentucky, on 610 Kentucky roadway construction projects from the years 2005 to 2008, determined that the main causes of change orders included contract omissions, contract item overrun, owner-induced enhancement, and fuel and asphalt adjustments. The work items displaying a high frequency of occurrence and high magnitude change for contract omissions are guiderail and barrier and asphalt bases; for contract item overrun the main work items are guiderail and barrier, asphalt bases, earthwork, and erosion control; finally, for owner-induced enhancement the main work items are guiderail and barrier, asphalt bases, and earthwork (Taylor et al. 2012).

6.1 Risk mitigation strategies for critical risks

For rehabilitation projects, the main risks that appear to influence cost overruns are design scope changes, material, and latent conditions. For new construction the main risks are design scope changes, latent conditions, and permits and regulations.

Under design scope changes, there is owner ordered enhancement, design errors and omissions, and project definition omission. Owner ordered enhancement and project

definition omission might be the results of the method used by MTO to fund projects.

Limited yearly funds make it easier to fund a smaller sized project that can be expanded later in the implementation phase, or smaller required works such as culvert repair can be added to a nearby contract during the construction phase.

Under material risks, there is change in material cost, quality issues of material, quantity adjustments, request by contractor for alternative material, and penalties and bonuses.

Quantity adjustment risks are expected with unit price contracts so risk mitigation relies on receiving a satisfactory unit price and making accurate quantity estimates.

Latent conditions require better site and geotechnical investigations. MTO itself has conducted a few studies such as the Rock Claims Initiative- Value Engineering Study (NCE Limited, 2003) to look into ways to decrease costs they face with claims related to rock quantity overruns/underruns.

Permits and regulations are usually external risks that may difficult to address because regulations are not all within the control of MTO. A possible method for addressing such risks is setting up project milestones to elevate their importance.

Chapter 7

Conclusions

7.1 Conclusions

The key findings of this research are as follows:

- For rehabilitation projects, the main risks that appear to influence cost overruns are design scope changes (the risk category includes owner ordered enhancement, design errors and omissions, and project definition omission), material (the risk category includes change in cost, quality issues, quantity adjustments, request by contractor for alternative material, and penalties/bonuses), and latent conditions (the risk category includes geotechnical, state of the structure, damage during winter shutdown period, and deterioration of elements).
- For new construction the main risks are design scope changes, latent conditions, and permits and regulations (the risk category includes incomplete approval, environmental regulations, and delay of permits).
- The risk identification and analysis process could benefit from a standardized change order reporting process. This could help shorten the data processing time. Another option is to have the project team involved with a project to update the risks encountered at financial close.

The following recommendations for future research are proposed based on this thesis:

- Obtaining more projects under each project type (e.g., bridge, roadway reconstruction, pavement resurfacing, and highway lane construction). Also, a larger sample size would allow for a look into more specific risks for example environmental regulation

could be divided further into risks on wildlife, noise complaints, and changes in environmental regulations.

- Conducting a statistical analysis on the risk classification data to identify correlations between specific risk categories and project type.
- Model validation by running a statistical analysis model using the calculated risks probabilities and impacts, such as Monte Carlo simulation, on a new sample of completed projects to see if it represents the cost and schedule overruns that may be faced.
- Examine projects delivered by MTO under the design build project delivery method for a comparison of risk management between the two project delivery methods. Also, an empirical based comparison with the risk management process for Infrastructure Ontario's Alternative Financing and Procurement (AFP) project delivery method.
- Examine cost of road construction in Ontario to help determine if MTO acceptance of all project risk is cost effective.
- Include risks that correspond to meeting other project key performance indicators such as quality and time to achieve risk management under a wider umbrella.

7.2 Contributions

The common occurrence of cost overruns, schedule delays, and quality issues in infrastructure projects, as observed with MTO, highlight the need for risk management. This research presented an empirically based approach to identify, describe, and assess the risk factors that may occur during a project's design and construction stages. Information on the probability of occurrence and impact of such risk factors is necessary when conducting

quantitative risk assessment. However, such data is difficult to obtain from literature and if it is available caution is necessary when applying the data and results of risk research studies to projects occurring in a different country, because construction costs and in turn risk impacts may be geographic and economic area or time period specific. In addition, project characteristics such as size and complexity might also play a role in the risk factors encountered and their characteristics. This makes risk data collected based on an organization's own projects more valuable and accurate.

This research makes two contributions:

1. This research developed empirical methods for risk identification, risk classification, and risk analysis, specifically tailored for MTO's highway program. The methods use data already collected by the MTO (request for proposals, design change orders, tender contracts, and project construction reports), allowing for easy and ongoing updating in the future.
2. This research applied the developed methods to analyze the MTO's risks, based on their unique project delivery approach. Their risks and cost overruns were compared with other transportation agencies to gain insights into their risk management performance.

This research analyzed a small sample of MTO projects. Extending this analysis to a larger number of projects will create more representative probabilities, impacts, and ultimately materialized risk statistics.

References

- Akintoye, A., & MacLeod, M. (1997). Risk Analysis and Management in Construction. 15(1), 31-38.
- Boadi, R. S., Kennedy, A. A., & Couture, J. (2015). Risk-Based Planning in Transportation Asset Management: Critical Pitfalls. *Journal of Transportation Engineering*, 141(2).
- Bordat, C., McCullouch, B. G., Labi, S., & Sinha, K. C. (2004). An analysis of cost overruns and time delays of INDOT projects. Washington, DC.
- Caltrans (2012). Project Risk Management Handbook: A Scalable Approach. California Department of Transportation, United States.
- Chapman, Chris (1997). Project Risk Analysis and Management- PRAM the Generic Process. *International Journal of Project Management*, 15(5), 273-281.
- Creedy, G., Skitmore, M., & Wong, J. (2010). Evaluation of Risk Factors Leading to Cost Overrun in Delivery of Highway Construction Projects. *Journal of Construction Engineering and Management*, 136(5), 528-537.
- Diab, M., Varma, A., & Nassar, K. (2012). Using Risk Assessment to Improve Highway Construction Project Performance. 48th ASC Annual International Conference Proceedings.
- Ellis, R., Pyeon, J. H., Herbsman, Z., Minchin, E., & Molenaer, K. (2007). Evaluation of alternative contracting techniques on FDOT construction projects. Tallahassee, Florida.
- Florida Office of Program Policy Analysis and Government Accountability (1996). Review of the Florida Department of Transportation's performance in controlling cost overruns and delays when building roads and bridges. Tallahassee, FL.
- Flyvbjerg, B., Holm, M. K. S., & Buhl, S. L. (2003). How Common and How Large are Cost Overruns in Transport Infrastructure Projects?. *Transport Reviews*, 23(1), 71-88.
- Haas, C. T. (2013). CIVE 332 Civil Engineering Systems Course Notes.
- Gransberg, D. D., Runde, D. F., & Stergios, J. (2000). The Effect of Innovative Highway Construction Contract Methods. AACE International.

- Ilbeigi, M., Ashuri, B., & Shayegh, S. (2015). Price Adjustment Clauses and Submitted Bid Prices for Major Asphalt Line Items in Highway Projects. *Journal of Construction Engineering and Management*, 142(5).
- Infrastructure Ontario (2015). *Assessing Value for Money: An Updated Guide to Infrastructure Ontario's Methodology*. Ontario, Canada.
- Maria-Sanchez, Pedro, Cather, R., Melendez, L., & Lowrie, R. (2011). *Integrating Risk Management within the Project Delivery Process at Caltrans: A Transportation Project Case Study*.
- Ministry of Transportation. (2012). *Regional Boundaries*. Retrieved from <http://www.mto.gov.on.ca/english/engineering/management/corridor/Provincial-Map.pdf>
- MMM Group Limited (2015). *Value for Money, Civil Infrastructure Projects- DBFM Highway Projects*. Ontario, Canada.
- Mylvaganam, C., & Borins, S. (2004). *If you build it: business, government, and Ontario's electronic toll highway*. Toronto, Canada: Centre for Public Management, University of Toronto.
- Nasir, D., McCabe, B., & Hartono, L. (2003). Evaluating Risk in Construction–Schedule Model (ERIC–S): Construction Schedule Risk Model. *Journal of Construction Engineering and Management*, 129(5).
- NCE Limited (2003). *Rock claims Initiative VE Study*. Ontario, Canada.
- Oberlender, G. (2014). *Project Management for Engineering and Construction*. McGraw-Hill Professional.
- Office of the Auditor General of Ontario (2014). *Chapter 3: Infrastructure Ontario- Alternative Financing and Procurement*. Ontario, Canada.
- Office of the Auditor General of Ontario (2016). *Chapter 3: Ministry of Transportation- Road Infrastructure Construction Contract Awarding and Oversight*. Ontario, Canada.
- PMI. (2013). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Fifth Edition*, Project Management Institute.

- Ramsey, D. W., & El Asmar, M. (2015). Cost and Schedule Performance Benchmarks of U.S. Transportation Public–Private Partnership Projects. *Journal of the Transportation Research Board*, 2504(7), 58-65.
- Shane, J. S., Molenaar, K. R., Anderson, S., & Schexnayder, C. (2009). Construction Project Cost Escalation Factors. *Journal Of Management In Engineering*, 25(4), 221-229.
- Siemiatycki, M. (2009). Academics and Auditors: Comparing Perspectives on Transportation Project Cost Overruns. *Journal of Planning Education and Research*, 29(2), 142-156.
- State Auditor of North Carolina (2008). Performance audit: Department of transportation highway project schedules and costs. Raleigh, NC.
- State of Washington Joint Legislative Audit and Review Committee (1998). Department of transportation highways and rail programs performance audit. Olympia, WA.
- Taylor, T. R. B., Uddin, M., Goodrum, P. M., McCoy, A., & Shan, Y. (2012). Change Orders and Lessons Learned: Knowledge from Statistical Analyses of Engineering Change Orders on Kentucky Highway Projects. *Journal of Construction Engineering and Management*, 138(12), 1360-1369.
- The World Bank, (2014). Public-Private Partnerships Reference Guide
- Van Staveren, M.Th. (2014). Innovative Ways to Implement Risk Management in Infrastructure Projects.
- Williams, T. (1995). A Lassified Bibliography of Recent Research Relating to Project Risk Management. *European Journal of Operational Research*, 85(1), 18-35.
- Wilson, Craig R., Tran, Dan, Molenaar, Keith R. (2015). Program Risk Management Approach to Reducing Cost Uncertainty in Highway Projects.
- Yoon, Y., Tamer, Z., & Hastak, M. (2015). Protocol to Enhance Profitability by Managing Risks in Construction Projects.
- Zou, P. X. W., Zhang, G., & Wang, J. (2006). Identifying Key Risks in Construction Projects: Life Cycle and Stakeholder Perspectives. *Proceedings of the 12th Pacific Rim Real Estate Society Conference*, Auckland, New Zealand.
- Zoysa, Sanjaya De, Russell, Alan D. (2003). Knowledge-Based Risk Identification in Infrastructure Projects. *Canadian Journal of Civil Engineering*, 30(3): 511-522.

Appendix A

Risk Classification Data Results

Eastern Region Project 1

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
1	Revised 100F08 and DCZ.	\$0.00	Lump Sum	Not a risk	-	The 100F08 in the tender included lane closure times on Fridays and Saturdays from 1/2hr after sunrise to 1/2 hr before sunset. This resulted in CO 2012-4014-001 being issued restricting the hours on Fridays to 1/2hr after sunrise to 15:00. The revised 100F08 did not permit lane closures on Saturdays.
2	Supply and install temporary attenuator foundations for the energy attenuators for the Pre-Stage 1 and Stage 1 work. Upgrade the Energy Attenuator systems specified in items 29 and 30 from a TL-2 to a TL-3.	\$28,279.00	Lump Sum	Design scope changes	Design errors and omissions	The contract showed attenuators being installed on granular surfaces without showing the requirement for concrete pads. It also show attenuators as TL-2 when TL-3 was required.
3	Rock excavation along detour route. No provisions were included in the contract.	\$41,047.81	Time and Material	Design scope changes	Project definition omission	Drawings did not accurately reflect rock located in the detour route. Item not included in tender item list.
4	Erection of silt fence at culvert. During construction the area was identified as a fisheries habitat	\$3,297.84	Time and Material	Permits and regulations	Environmental regulations	ENVIRONMENTAL CONSTRAINT - Waterbody/Fisheries Protection During Work in Waterbodies and on Waterbody Banks on pg 28 to 40 of Tender contract. However, the contract does not directly address the protection of fisheries.
5	Construction of a leveling slab at SE pier of TMB	\$5,706.04	Lump Sum	Material	Quality issue of material	From Tender: 1) The requirements of the TMB inspection and maintenance program clause of the modular bridge (superstructure) includes c) Inspect baseplates and substructure periodically and correct any uneven settlement to the satisfaction of the Contract Administrator. 2) The Contractor shall develop and submit a procedure to ensure that the approaches and the TMB deck is level and adjusted when necessary. This shall consist of, at a minimum, inspecting and adjusting the foundations, footings, base plates, etc. A procedure for jacking the TMB to restore to original elevations shall be developed. The Contractor shall notify the Contract Administrator after each inspection. The Contractor shall provide immediate notification to the Contract Administrator of any damage to the bridge or supports. (tender document page 105) 3) The Contractor shall jack the structure as needed to restore the original deck elevations and maintain a smooth ride across the structure. The survey elevations shall be reported in writing to the Contract Administrator (tender document page 107).
6	Maintenance and patching of existing potholes throughout the construction zone	\$13,401.88	Time and Material	Latent conditions	Deterioration of elements	
7	Revised location of ditch inlet on West side of Detour	\$0.00	Lump Sum	Not a risk	-	Item 12 600 mm x 600 mm Manholes Catch Basins and Ditch Inlets
8	Work required due to conflicts with the existing SBGR and eccentric loaders at the North and South approaches during the construction of the detour	\$10,184.65	Lump Sum	Construction staging issue	-	
9	Additional earth excavation along detour route	\$4,711.37	Time and Material	Latent conditions	State of the Structure	Sheet 15 shows an original ground line that was not the same as the actual original ground in the field. Original ground from station 10+400-10+555 was in fact higher than the detour. This resulted in a typical drawing needing to be revised and CO 2012-4014-009 to be issued
10	Request to use an alternate grout material for the installation of the rock anchors at the south piers of the TMB	\$0.00	Lump Sum	Material	Request by contractor for alternative material	Item 75 on pg 108 of tender contract. The contract specifies: The non-shrink grout shall be an approved DSM 9.15.35 (MTO's Designated Sources for Materials) non-shrink grout.
11	PQP Adjustment Item 67 - Earth Excavation for Structures	\$6,721.47	Variation in Tender Quantity	Material	Quantity adjustments	Temporary Bridge tender list items

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
12	PQP Adjustment Item 20 - Rock Protection	\$8,007.85	Variation in Tender Quantity	Material	Quantity adjustments	
13	Use of quarry stone for the core material of the NE pier foundation.	\$30,258.89	Lump Sum	Latent conditions	Geotechnical	Material placed as the core material at the NW pier foundation of the TMB failed to meet the gradation requirements for Option 1 - Granular B Type I or Option 2 - Quarry Stone as specified in the special provision on Page70 of the tender document. As a result, the Ministry requested that the contractor retain the services of a Geotechnical Engineer to provide recommendations on how to proceed. The report from the Geotechnical Engineer stated that the materials factored bearing ULS (Ultimate Limit State) was not adequate. This resulted in a revised corrective action plan which included the widening of the core material platform and the placement of geotextile to prevent any potential loss of fines. Payment at the contract price for the above tender item shall include full compensation for all labour, equipment, and materials required to do the work.
14	Removal and replacement of existing centerline CSP culvert at Station 19+784	\$75,747.97	Lump Sum	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	This culvert was to be replaced under an upcoming contract. P&D requested replacement under this contract to avoid constructor issues.
15	Repair of washouts along detour route	\$8,974.72	Time and Material	Latent conditions	Deterioration of elements	
16	Drainage improvements along detour route	\$14,087.50	Lump Sum	Design scope changes	Design errors and omissions	Proper drainage along the detour route was not provided in the drawings
17	PQP Adjustment Item 67 - Earth Excavation for Structures & Item 69 - Tremie Concrete	\$19,946.22	Variation in Tender Quantity	Material	Quantity adjustments	Both are Temporary Bridge tender list items
18	Due to the water levels in the spring of 2013, the Petawawa River reached levels that could potentially impact the earth borrow placed as per the contract on the North Side of the River. As a result the MTO requested that the contractor place rock protection along the N river embankment	\$11,446.52	Lump Sum	Force majeure	-	
19	Remove and replace the existing CSP located on Murphy Road (located approximately 40m south of Hwy 17 CL)	\$48,300.00	Lump Sum	Latent conditions	Deterioration of elements	During construction, MTO was notified of a potential culvert failure at this location. Following a review, it was verified the culvert was collapsed and required replacement
20	Due to the high water levels in the spring of 2013, the Petawawa River reached levels that could potentially impact the south piers and south embankment along the South piers. As a result MTO requested that the contractor re-shape the south bank along the south piers and install rock protection	\$11,423.90	Lump Sum	Force majeure	-	
21	Following severe thunderstorms and heavy rain, repairs were required to the detour alignment, on the west side of the structure, due to washouts	\$11,104.53	Time and Material	Force majeure	-	
22	Remove existing cable guide rail in areas where the O/G is higher than the detour alignment. Cut the existing slope/shoulder back to maintain at least 0.5m behind the TCB. Place rip-rap and geotextile along the slope where the O/G is higher than the detour alignment. Granular seal existing shoulder	\$23,582.33	Time and Material	Latent conditions	State of the Structure	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
23	Removal of partial paved shoulders of the existing highway at the locations of the detour tie-ins prior to paving of the detour. The asphalt is to be removed to allow for the 90mm tie in of the detour asphalt	\$8,411.45	Lump Sum	Design scope changes	Design errors and omissions	Could this be based on site conditions as well?
24	Revised TCB alignment for winter shutdown	\$39,249.89	Lump Sum	Design scope changes	Design errors and omissions	Alignment of the TCB, as shown in the contract, would be in conflict with the paving of the detour tie-in to the existing Highway.
25	Lump sum negotiated savings for asphalt placed along detour route.	(\$9,800.21)	Lump Sum	Material	Change in material cost	
26	Hot mix patching of potholes at structure approaches	\$7,742.69	Time and Material	Latent conditions	Deterioration of elements	
27	Costs incurred by the fabricator for increasing the plate sizes and any additional anchors required. This was required following the x-ray of the existing steel showing that the plate sizes needed to be increased to avoid existing steel in the pier caps	\$3,990.65	Lump Sum	Latent conditions	State of the structure	
28	Placement of additional 0.5m PPS along detour route (50mm SP 12.5 FC1)	\$1,762.16	Time and Material	Latent conditions	State of the Structure	The width of the asphalt at the detour tie-ins to the existing alignment was at a width of 3.5m. This did not provide a partial paved shoulder in these areas. MTO requested a 0.5m partial paved shoulder to eliminate maintenance concerns throughout construction at these locations.
29	On May 9, 2014, heavy rain caused a washout at the North abutment underneath the Temporary Modular Bridge. The Ministry requested the contractor to place rip rap in this area to avoid any further erosion	\$1,708.55	Time and Material	Force majeure	-	
30	Replacement of Temporary Concrete Barriers that was damaged over the winter shutdown and no longer conform to OPSS 740S03.	\$2,737.23	Lump Sum	Latent conditions	Damage during the winter shutdown	
31	Replacement of Light Duty Silt Fence on both North-West & North-East of the river bank due to the high water levels which unearthed, and moved the silt fence out of position.	\$1,316.96	Time and Material	Force majeure	-	
32	Addition of Item # 076 - Abrasive Blast Cleaning of Structural Steel in Contact with Concrete. No provisions were included in the contract.	\$24,495.00	Negotiated price	Design scope changes	Project definition omission	Item 076- Abrasive Blast Cleaning of Structural Steel in Contact with Concrete was added via CO 2012-4014-032 for blast cleaning the tops of the steel girders prior to deck placement. Item was not included in the tender item list.
33	Remove and replace the existing shoe plates at the abutments (a total of 6 plates) to ensure proper contact between the bearing and the shoe plate	\$27,397.40	Lump Sum	Latent conditions	State of the Structure	
34	POP Adjustments Item 32- Temporary Concrete Barrier Relocation & Item 34- Topsoil (Imported) & Item 35 - Seed and Mulch & Item 59 -Abrasive Blast Cleaning of Reinforcing Steel & Item 61 -Dowels into Concrete	\$14,502.34	Variation in Tender Quantity	Material	Quantity adjustments	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
35	Contractors request for plant added Super P. MTO allowed this request and the contractor agreed to the acceptance requirements for rapid chloride permeability.	\$0.00	Lump Sum	Material	Request by contractor for alternative material	
36	New granular A placed on existing granular as leveling for placement of the new curb and gutter. Placement of the rounding as seen on Sheet 14A in Addendum 2	\$6,930.65	Time and Material	Latent conditions	State of the structure	
37	Compensation for additional jacking of structure. The extra jacking was required as this area was not able to jacked on the original date due to the Ministry's request to replace the shoe plates (CO 033)	\$10,263.11	Lump Sum	Project schedule issues	-	
38	Extension of Time Request# 1	\$0.00	Lump Sum	Project schedule issues	-	
39	Extension of Time Request# 2 and #3	\$0.00	Lump Sum	Project schedule issues	-	
40	Design, installation and maintenance of a physical barrier to protect barrier walls from de-icing chemicals	\$15,896.60	Time and Material	Design scope changes	Design errors and omissions	
41	Removal and replacement of damaged cable guide rail posts on the NW quadrant of the work zone	\$1,987.97	Time and Material	Latent conditions	Deterioration of elements	
42	Placement of SP 19.0 as lower binder at the approaches to match the existing depth of the asphalt. The contractor shall also remove an additional 30 m2 of asphalt (15 m2 at east end and 15 m2 at west end).	\$2,036.49	Time and Material	Latent conditions	State of the structure	
43	PQP Adjustments Item 20 - Rock Protection & Item 21 - Geotextile & Item 28 - Single Rail Steel Beam Guide Rail with Channel	\$35,266.85	Variation in Tender Quantity	Material	Quantity adjustments	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
44	PQP Adjustments Item 56- Concrete Removal - Partial Depth - Type C & Item 60- Concrete Patches, Formed Surfaces	(\$12,144.00)	Variation in Tender Quantity	Material	Quantity adjustments	
45	Extension of Time Request #5	\$0.00	Lump Sum	Project schedule issues	-	
46	Compensation for the construction of the final configuration. The shoulders throughout the detour alignment are to be built to OPSD 912.530 (attached) with a design shoulder width of 3m and a 1m rounding in order to accommodate new SBGR. The 3m shoulder will continue for 150m from the end of the concrete barrier wall. From this point, the shoulder shall be tapered at 40:1 until it matches existing shoulder widths. Shoulders shall be graded to - 6% throughout.	\$59,874.86	Time and Material	Design scope changes	Project definition omission	No payment provisions were included for grading work related to the final condition of the detour route.
47	Removal of existing SBGR, attenuators, CGR, anchor blocks and installation of new SBGR and attenuators	\$83,172.14	Time and Material	Design scope changes	Design errors and omissions	The existing SBGR and cable guiderail on the N side of the highway was in conflict with the detour construction and was required to be removed during construction staging. P&D provided a new SBGR layout for final construction.
48	Removal of rock protection and core material placed on the NW pier out of the Petawawa River. The contract drawings did not clearly show that the material would be required to be placed in the river, and as such, and no provisions were provided in the contract for removals.	11,635.12	Time and Material	Design scope changes	Project definition omission	
49	PQP Adjustments Item 6 -Tack Coat & Item 25 - Pavement Marking Obliterating - By Abrasive Blasting & Item 26 - Pavement Marking & Item 27- Adjust Steel Beam Guide Rail, Wooden Posts	(\$5,391.05)	Variation in Tender Quantity	Material	Quantity adjustments	

Total \$709,273.34

Other payment adjustments

Number	Description	Amount	Method of payment	Category	Subcategory
1	Fuel Price Index Adjustments	\$53.38		Material	Change in material cost
2	Granular A price adjustment (lot 1)	(\$816.40)		Material	Change in material cost
3	Overrun to Item 9- Granular B Type I (Option 2: Quarry Stone)	\$7,340.94		Material	Quantity adjustments
4	Payment Adjustments for changes to the PGAC Index.	\$1,536.30		Material	Change in material cost
5	Credit to compensate for the QA testing of the Superplasticizer.	(\$500.00)		Not a risk	-
6	Contractor is to bear the following costs related to referee testing of concrete aggregates:	(\$1,150.00)		Not a risk	-
	1) Shipping and Handling (concrete sand)= \$300.00				
	2) Shipping and Handling (13.2mm stone)= \$300.00				
	3) Gradation testing (concrete sand)= \$275.00				
	4) Gradation testing (13.2mm stone)= \$275.00				
7	Compensation for over-runs Item 8 - Granular A & Item 10- Granular B Type III	\$16,879.59		Material	Quantity adjustments
8	Overrun to Item 7 - Superpave 12.5 FC1	\$20,468.04		Material	Quantity adjustments
9	OPSS 1350 - Bonus for Air Void System in Hardened Concrete.	\$867.00		Material	Bonuses
10	OPSS 1350- Price Adjustment for Concrete.	\$3,605.00		Material	change in material cost
	40 Mpa =389m3 x \$5/m3= \$1,945.00				
	30 Mpa =332m3 x \$5/m3= \$1,660.00				
11	Payment adjustments for AC content.	(\$8,149.51)		Material	Quantity adjustments

Total \$40,134.34

Eastern Region Project 2

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
1	At Tomlinson's request, the key joint design for the pre-cast concrete culvert at Corben Creek will be modified. The fabricator will now construct this with a flat joint.	\$0.00	No Payment- Change in the Work	Not a risk		
2	Tomlinson requested to use 30 Mpa concrete with 13.2 mm maximum nominal size coarse aggregate instead of Self Consolidating Concrete for the abutment refacing work under Item 123 at no cost to the Ministry.	\$0.00	No Payment- Change in the Work	Material	request by contractor for alternative material	
3	OPSD 923.181 for bi-directional Energy Absorbing Terminals was not included in this contract. Traffic is exposed to the leaving end treatments of Temporary Concrete Barriers at both ends of the Trent Canal bridge. This change is for the installation of a bidirectional end treatment for the protection of public traffic.	\$3,300.00	Negotiated Lump Sum	Design scope changes	Design errors and omissions	
4	Steel bridge girders, above the number stated in the contract, are showing signs of deterioration. This work is to include all materials needed to repair girders 3 and 5 on the south end of the Trent Canal Bridge by welding steel plating to the webs and flange as shown in the attached drawings. The price includes mobilization and demobilization if required.	\$2,970.00	Negotiated Lump Sum	Latent conditions	Deterioration of elements	
5	Adjusting Quantities for Plan Quantity Payment Items	\$7,916.40	PQP Adjustments	Material	Quantity adjustments	
6	Steel bridge girders, above the number stated in the contract, are showing signs of deterioration. This work is to include all materials needed to repair girders 2, 3 and 4 on the north end of the Trent Canal Bridge by welding steel plating to the webs and flange as shown in the attached drawings. The price includes mobilization and demobilization if required.	\$4,455.00	Negotiated Lump Sum	Latent conditions	Deterioration of elements	
7	OPSD 923.181 for bi-directional Energy Absorbing Terminals was not included in this contract. Traffic is exposed to the leaving end treatments of Temporary Concrete Barriers at both ends of Corben Creek Culvert, Mariposa Brook Culvert and the Trent Canal Bridge Stage 2. This change is for the installation of a bi-directional end treatment for the protection of public traffic at each of the above locations.	\$11,235.40	Negotiated Lump Sum	Design scope changes	Design errors and omissions	
8	This change order is to facilitate the installation of new footings adjacent to the existing using existing bedrock as a base.	\$125,000.00	Negotiated Lump Sum	Latent conditions	Geotechnical	
	Corben Creek culvert replacement requires extra concrete and related work to install new footings requiring the use of a trench box. The existing footings are on unstable soil and rock materials that are noted in the contract.					
9	Mariposa Creek culvert soffit, footings and fascia requires extra work due to changes to the scope of the work. Extra reinforcing bar is needed on the fascia, footings and walls. Staging will be required to repair the soffit in a safe manner.	\$6,526.30	Negotiated Lump Sum	Latent conditions	state of the structure	After the construction started, the culvert was de-watered and the footings were exposed - they were found in a very bad condition (severe erosion, undermining, remnants of a timber crib, etc.), so additional reinforcing needed to be installed to stabilise the footings and entire culvert above.

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
10	The footings at South McLaren Creek are severely deteriorated. They will need extensive repairs involving new reinforcement bars, new concrete and new lean concrete base for the new concrete. This work is required to stabilize the existing footings. Sketches and details are provided.	\$319,881.87	Time and Materials	Latent conditions	Deterioration of elements	
11	Credit to MTO for referee testing requested by Tomlinson. The Superpave 19.0 and Superpave 12.5 FCI combined aggregate test results from the Quality Assurance Laboratory were deemed unacceptable by Tomlinson and referee testing was requested. According to OPSS 313 the test results are within the parameters where Tomlinson are assessed some or all of the extra costs. See Instruction Notice #93.	(\$1,125.00)	Negotiated Lump Sum	Not a risk		
12	The existing expansion joint at the north end of the Trent River bridge has loose concrete support. The expansion joint is hammering against the concrete as vehicles travel over it causing a disturbance to local residents. This work is for temporarily securing the steel in the existing joint to the abutment until the eventual replacement in 2014.	\$1,000.00	Negotiated Lump Sum	Latent conditions	State of the structure	
13	The existing finger expansion joints at the Trent Canal Bridge are uneven at both ends of the structure. The Ministry has requested remedial work take place to enable snow ploughing operations to proceed without the risk of catching the plough blades on the uneven finger joints.	\$13,239.11	Time and Materials	Latent conditions	State of the structure	
14	Tomlinson requested to use Trernie 30 Mpa Concrete instead of regular 30 Mpa concrete at no cost to the Ministry. This work will be carried out for the Stage I, Northeast footing at the Corben Creek Culvert. There is no cost to the Ministry for the change in supplied material and no credit due from the contractor for this change in the work. The Ministry found the proposed material change to be acceptable.	\$0.00	No Payment- Change in the Work	Material	request by contractor for alternative material	
15	Adjusting Quantities for Plan Quantity Payment items	\$11,260.90	PQP Adjustments	Material	Quantity adjustments	
16	Due to the placement of scaffolding over the side roads at the north and south end of the Trent Canal Bridge, the height and width of Trent Canal Rd and Coldstream Rd are restricted. Signs indicating the revised height and width at these locations were requested by the Ministry to alert public traffic using these roads. The work includes pick up, installation, maintenance, removal and disposal of the signs. Signs will be 1.22 m by 1.22 m and installed according to the height and offset noted in the Traffic Manual.	\$3,146.38	Negotiated Lump Sum	Traffic and safety issues		
17	Steel bridge girder number 2 at the South end requires repair. This work is to include all materials needed to weld steel plating to the webs and flange as shown. The price includes mobilization and demobilization if required.	\$516.93	Negotiated Lump Sum	Latent conditions	State of the structure	
18	During the Type A deck repairs to the existing concrete in Stage 3, deleterious and missing reinforcing bars areas were encountered. These bars were replaced with 15m bars. A minimum 450 mm overlap to existing bars was required. This work included extra concrete removal to incorporate the overlap to sound existing reinforcing bars. Payment is for the materials, equipment and labour to perform the repairs.	\$3,059.67	Time and Materials	Latent conditions	State of the structure	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
19	Abrasives from winter maintenance collected on the new sidewalk throughout the winter months. This sand needed to be removed before work on the bridge deck in Stage 3 could take place. Normal bridge cleaning had not taken place by the Area Maintenance Contractor. Payment is for removal and disposal of this material per OPSS 180.	\$2,403.11	Negotiated Lump Sum	Latent conditions	Damage during the winter shutdown period. Example, removal of sand, salt or debris	
20	Credit for retesting a second sample of concrete water reducer admixture. A credit is due because the original sample was taken using incorrect methods by Tomlinson's supplier. A new sample was taken and tested at the MTO QA laboratory.	(\$500.00)	Negotiated Lump Sum	Not a risk		
21	Due to the staging at the Trent Canal Bridge, the pavement has been left uneven across the structure. To warn the traveling public of this, the Ministry agreed to place a TC-24, uneven pavement, at either end of structure.	\$696.31	Negotiated Lump Sum	Traffic and safety issues		
22	This Change Order is for resolution of extra costs for Stage I and overwintering at Corben Creek. Weather, existing earth conditions and staging factors impacted the completion of the work in one season. This negotiated lump sum concludes any extra costs associated with Stage I.	\$60,000.00	Negotiated Lump Sum	Force majeure		
23	Compensation to the Contractor for the damages caused by a person cutting wires from the generators/pumps while dewatering at South McLaren Creek Culvert.	\$11,500.00	Negotiated Lump Sum	Force majeure		
24	Adjusting Quantities for Plan Quantity Payment items.	\$16,268.80	PQP Adjustments	Material	Quantity adjustments	
25	In order to pave the final stage of the Trent Canal Bridge and continue with installation of the expansion joints, the Temporary Concrete Barriers will have to be removed and reinstated one additional time not included in the contract quantities. This Change Order is for the additional cost to maintain them off site until the paving is completed. The placement and removal will be by PQP adjustment.	\$15,000.00	Negotiated Lump Sum	Design scope changes	Project definition omission	
26	No item was included in the contract for culvert waterproofing at Mariposa Brook Culvert. This Change Order is for waterproofing the new pre-cast culvert according to the method employed at Corben Creek using identical materials.	\$28,243.62	Negotiated Lump Sum	Design scope changes	Project definition omission	
27	Adjusting Quantities for Plan Quantity Payment item.	\$20,178.00	PQP Adjustments	Material	Quantity adjustments	
28	Extra concrete slabs were installed below the existing grade at Mariposa Brook Culvert. These slabs were installed with the original road at the approaches to the culvert. The lump sum price for Item 182 was for the removal of the existing culvert and footings. Payment is for the extra concrete encountered that was not noted in the contract documents.	\$14,950.00	Negotiated Lump Sum	Design scope changes	Project definition omission	
29	Adjusting Quantities for Plan Quantity Payment item.	\$6,327.20	PQP Adjustments	Material	Quantity adjustments	
30	Tomlinson is to supply 3 loads of Granular 'A' and grade the parking lot below the Trent Canal Bridge.	\$3,300.00	Negotiated Lump Sum	Design scope changes	Owner ordered enhancement (MTO and stakeholder)	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
31	There was a delay in the work of replacing the Mariposa Brook Culvert. The delay was for the issuing of the PH-M-125 Drawings in relation to the contractor's Road Protection design. The delays caused Tomlinson to incur extra costs for dewatering the work site. Costs are for rental pumps, fuel, cloth filters, maintenance and removals of same	\$24,500.00	Negotiated Lump Sum	Project schedule issues		
32	Repairs made to farmer's fence North of Corben Creek and to a piece of curb at Trent Canal Bridge. This work was required to complete the contract.	\$2,080.00	Negotiated Lump Sum	Not a risk		
Large Item Variations		\$109,248.00		Material	Quantity adjustments	
	SP 19.0	\$29,156.40		Latent conditions	State of the structure	Extra depth hot mix binder was placed to match existing
	Concrete removals partial depth - Type A	(\$192,276.00)		Latent conditions	State of the structure	Not required- Trent Canal deck in better shape than anticipated
	Granular A	\$44,181.56		Latent conditions	Geotechnical	Backfill to culverts on Hwy. 7 Extra excavation of unsuitable material
	Concrete removals partial depth - Type B	\$160,380.00		Design scope changes	Owner ordered enhancement (MTO and stakeholder)	Extra removal at Mariposa Creek footings and soffit repairs requested by MTO Structures office

Total \$868,019.96

Other payment adjustments

1	SP19.0 Lot 1	(\$20,108.56)		Material	Penalties
2	SP19.0 Lot 2	(\$2,947.00)		Material	Penalties
3	SP12.5 FCI Lot 1	(\$7,325.55)		Material	Penalties
4	SP 12.5 FCI Lot 2	\$987.68		Material	Bonuses
5	SP12.5 FCI Lot 3	-		-	
6	SP12.5 FCI Lot 4	(\$28,464.05)		Material	Penalties
7	SP12.5 FCI Lot 5	(\$2,247.47)		Material	Penalties
8	SP12.5 FCI Lot 6	(\$897.93)		Material	Penalties

Total (\$61,002.88)

Eastern Region Project 3

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
1	Supply TC 64 Signs in the Contract	\$2,248.76	Time and Materials	Material	Quantity adjustments	Existing tender item
2	Road Maintenance and repairs not included in the contract	\$13,374.33	Time and Materials	Traffic and safety issues	Maintenance additions	
3	Change Construction sequence by proceeding with Stage 2 first \$0.00	\$0.00	Lump Sum	Not a risk		
4	Change Construction sequence, Combined Area 1 and 2 \$0.00	\$0.00	Lump Sum	Not a risk		
5	Changes to the construction sequence. R WT to work in area 4, 5 and 6 at the same time \$0.00	\$0.00	Lump Sum	Not a risk		
6	Change Construction sequence permitting Daytime Paving on Hwy 137 \$0.00	\$0.00	Lump Sum	Not a risk		
7	PQP Adjustments for September to Item 1 Earth excavation, Item 9 300mm diameter pipe culvert, Item 13 Removal of Asphalt pavement partial depth, Item 18 Removal of Pipe Culverts and Item 35 Light duty Silt fence to better suit field conditions	\$3,434.60	Variation in Tender Quantity	Material	Quantity adjustments	
8	Place Frame & Grates and Tops on Manholes	\$24,463.37	Time and Materials	Design scope changes	Owner induced enhancement (MTO and stakeholders)	The contract did not require the replacement of the frames and grates on the existing catch basins; the contractor was instructed to place new frames and grates. However the existing Catch basins were not all catch basins, some of the structures were 4 x 4 manholes. Therefore they were not suitable to replace the frames and grates so the contractor was required to cast new covers in place on some of the structures and then place new grates or manhole covers on top
9	Change Construction sequence, Change from Night work to Day work \$0.00	\$0.00	Lump Sum	Not a risk		
10	Change Construction sequence, Daytime Paving of Ramps RFC 9 \$0.00	\$0.00	Lump Sum	Not a risk		
11	Paving in Median that was not included in original contract item work	\$40,337.90	Time and Materials	Latent conditions	State of the structure	The Asphalt Median located under the Thousand Island Parkway at stations 12+430 to 12+680 was not included in the contract to be removed and replaced. The median was in poor condition and when the contractor removed the curb and gutter the asphalt was pulled apart and had to be replaced. The asphalt at the concrete curb bullnoses needed to be replaced due to their poor condition as well, this asphalt replacement was also not included in the contract.
12	PQP Adjustments for October, Item 7 Concrete Curb and Gutter, Item 8 Concrete Outlets, Item 14 removal of Concrete curb and gutter, Item 18 removal of pipe culverts, Item 21 detector loops, Item 22 traffic counting stations and Item 31 Steel beam Guide Rail to better suit field conditions	\$13,591.05	Variation in Tender Quantity	Material	Quantity adjustments	
13	Extra Work not included in original contract Placing Curb and Gutter, Granular Sealing, Fixing Guide Rail.	\$14,699.98	Time and Materials	Design scope changes	Design errors and omissions	The contract did not have items for the removal of the existing anchor blocks in the "Removal of Cable Guide Rail", item #19. A change order was set up to compensate the contractor for this work.

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
14	PQP Adjustments for October Item 30 temporary pavement markings and Item 34 Seed and Mulch to better suit field conditions	\$27,837.50	Variation in Tender Quantity	Material	Quantity adjustments	
15	PQP Adjustments for November, item 4 SP12.S, Item 5 SP 19.0, Item 3 Tack Coat, Item 20 Rip Rap, Item 28 Pavement Markings, Item 24 PVMS Relocation and Item 29 Pavement Marking Symbols Durable to better suit field conditions	\$18,726.07	Variation in Tender Quantity	Material	Quantity adjustments	
16	PQP Adjustments for November, Item 3 Tack Coat, Item 4 SP 12.5 FC2 and Item 13 Removal of Asphalt Partial Depth to better suit field conditions	\$3,553.60	Variation in Tender Quantity	Material	Quantity adjustments	
17	Final Audit on contract items resulted in PQP Adjustments in December for Item 1, Earth excavation, Item 3 Tack Coat, Item 4 SP12.5FC2 and Item 5 SP 19.0 to better suit field conditions	\$13,582.30	Variation in Tender Quantity	Material	Quantity adjustments	
18	Final Audit on contract items resulted in PQP Adjustments in December for Item 8 Concrete Gutter outlets, Item 9 300mm Pipe Sewer, Item 28 Pavement Marking and Item 30 Temporary Pavement Marking to better suit field conditions	(\$1,965.50)	Variation in Tender Quantity	Material	Quantity adjustments	
19	Final Audit on the Construction Administration System resulted in PQP Adjustments in December for Item 35 Silt Fence. The incorrect value of the item was noted in a previous change order. It was corrected under Change order 19.	(\$470.90)	Variation in Tender Quantity	Material	Quantity adjustments	
20	Final Audit on the Contract resulted in PQP Adjustments in December for Item 4 SP12.5FC2. An increase of 27m2 was required for Progress PaymentNo4	\$407.70	Variation in Tender Quantity	Material	Quantity adjustments	
Large Item Variations (Item 6- Granular A)		\$27,583.00		Utility conflict	Utility location not shown on shown on the contract documents	Additional granular behind new curbs was required due to utility conduit that required relocation of the curb and not included in the tender quantity
Total		\$201,403.76				

Other payment adjustments

1	SP 12.5FC2	\$40,617.72		Material	Bonuses	ERS Bonus
2	SP 19.0	\$26,777.67		Material	Bonuses	ERS Bonus
3	Concrete C & G	\$1,457.50		Material	Bonuses	Compressive Strength Bonus
4	Concrete C & G	\$982.25		Material	Bonuses	Air Void Bonus
5	SP12.5FC2	\$3,470.28		Material	Bonuses	Asphalt Bonus for Segregation

Total		\$73,305.42				
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Eastern Region Project 4

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
1	Additional TCB to secure the South Access	\$2,640.00	PQP Adjustments	Material	Quantity adjustments	
2	Contractor requested a change to Mesh- Zero Value	\$0.00	Lump Sum	Material	Request by contractor for alternative material	
3	Clean up Inside of Debris Box Girders	\$8,376.47	Time and Materials	Latent conditions	State of the structure	
4	Change in the spacing of Vertical Steel	\$1,115.54	Lump Sum	Design Scope Changes	Design errors and omissions	Change was caused by design
5	Response to RFC #001 - Change in re-inforcing position -Zero Value	\$0.00	Lump Sum	Design Scope Changes	Design errors and omissions	Please see attached RFC001. Not enough concrete cover
6	Response to RFC 004- Lap vertical steel in abutment	\$2,535.14	Lump Sum	Design Scope Changes	Design errors and omissions	The abutment height shown on the drawings was incorrect and was not discovered until after the steel was manufactured. The abutment was higher than expected and we had to tie in additional vertical steel causing the lap. Please see attached RFC004
7	Repairs to Centre Column Traffic Control Only (See OPA for item adjustment of \$4,346.90)	\$7,811.16	Lump Sum	Latent conditions	State of the structure	The column was in need of repair unsound concrete was noticed by the field staff and repairs were completed
8	Supply and install two Overhead Signs in Lane One	\$10,662.55	Lump Sum	Design Scope Changes	Project definition omission	
9	Additional re-inforcing in Deck patches for Section Loss and Steel in Abutment Patches	\$2,891.13	Lump Sum	Latent conditions	Deterioration of elements	
10	Cost to cut RCP cores in Overlay, outdated SP in the contract	\$1,650.00	Lump Sum	Material	Change in material cost	
11	PQP Adjustments	(\$8,643.00)	PQP Adjustments	Material	Quantity adjustments	
Total		\$29,038.99				

Other payment adjustments

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
1	Additional Scarifying of the Deck	\$418.75		Material	Quantity adjustments	
2	Item 56- Formed Patches added 9.48m3	\$51,522.00		Latent conditions	State of the structure	Deck condition
3	Item 46- Concrete Removal Type A in Deck	\$7,314.00		Material	Quantity adjustments	
4	Item 55 - Concrete Patches Unformed Surfaces in Deck	\$53,846.40		Design scope changes	Design error and omission	Incorrect value for item
5	Item 4- SPA 12.5 Changed Paving Limits to improve ride	\$16,138.20		Design scope changes	Owner ordered enhancement (MTO and Stakeholder)	
6	Item 5 - Granular A Backfill to Structure	\$20,052.00		Material	Quantity adjustments	
7	Item 26 Topsoil -Additional material at the four corners	\$1,542.80		Material	Quantity adjustments	
8	Item 2 - Earth Borrow item not used	(\$6,956.00)		Material	Quantity adjustments	
9	Items 47, 48, 49, 51, 53 and 57 Underrun on the contract	(\$60,775.45)		Material	Quantity adjustments	
10	Concrete Bonus	\$1,086.90		Material	Bonuses	
Total		\$84,189.60				

Eastern Region Project 5

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
1	Additional Hot Mix Asphalt Resurfacing of Hwy 37	\$355,903.96	Revised Tender Prices and Time and Material	Design scope changes	Design errors and omission	Sheet 5 of the contract quantity breakdown sheets indicated work on Hwy 37 totaling 1248m2, bridge approaches only with unaccurate stationing. Upon initial review of work, it was determined that Hwy 37 will be requiring 14,845m2 of work.
2	Pavement Marking - Symbols at Palace Rd and Hwy 37	\$2,550.00	Lump Sum	Design scope changes	Owner-ordered enhancement	Additional pavement marking symbols were completed at the recommendation of Traffic Office.
3	POP adjustments for Items #12 and 23	(\$5,415.00)	Variation in Tender Quantities	Material	Quantity adjustments	Item #12: Removal of Cable Guide Rail, Item #23: Highway Fence
4	Hwy 401 west bound Hwy 37 on ramp emergency culvert replacement	\$13,720.14	Time and Material	Latent conditions	State of the structure	One culvert was replaced on WB Hwy 37 On-ramp due to poor performance following milling operation.
5	Hwy 401 east bound Palace Rd off ramp emergency ramping	\$641.48	Time and Material	Traffic and safety issues	-	The emergency ramping was to reopen the ramp at the request of the OPP due to emergency detour required. There was a complete shutdown of the 401 eastbound just east of our project limits following our milling operations and prior to paving. Please see attached CO.
6	Deseronto Rd Ramp Gate Negotiated Savings	(\$500.00)	Lump Sum	Material	Change in material cost	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
7	POP adjustments for October PPC#001	(\$20,052.10)	Variation in Tender Quantities	Material	Quantity adjustment	

Total \$346,848.48

Other payment adjustments

1	Segregation Penalty	(\$2,000.00)		Material	Penalties
2	Asphalt Cement Content Adjustment for the Month of October	\$1,922.25		Material	Quantity adjustments
3	Asphalt Cement Content Adjustment for the Month of November	\$1,083.97		Material	Quantity adjustments
4	Hot Mix Asphalt Material Bonus	\$19,222.45		Material	Bonuses
5	Monthly Fuel Price Index Adjustment	(\$2,832.71)		Material	Change in material cost
6	Item #6 Granular A Adjustment	(\$8,151.04)		Material	Quantity adjustments

Total \$9,244.92

Northwestern Region Project 1

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
1	A centerline culvert collapsed just outside of the east contract limits. The contractor was requested by MTO to replace the culvert.	\$65,159.74	Time and material	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	
2	POP adjustments to cancel Item #32 Topsoil From Stockpile and #34 Erosion Control Blanket. A decision was made by MTO to use an alternate method of erosion control	(\$21,395.94)	Variation in Tender Quantity	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	
3	New Item of Granular Sheeting to replace cancelled Items in C.O. #2 and provide a more stable form of erosion control on steep foreslope	\$12,701.34	New item	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	
4	MTO requested a new entrance culvert be installed at a different location from the existing one in Pipeline Road. The new location would enable slope flattening material to be placed further into the radius of the entrance and the cable guiderail could then be eliminated.	\$9,492.07	Time and material	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	
5	Various areas on the contract were identified that would benefit from erosion control. The stockpiled <100mm stone from Firesteel #42 was used at areas outline in IN #10	\$56,518.67	New item	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	
6	Design changes implemented by the MTO resulted in the cancellation of the following items: item #13-Concrete Curb and Gutter item #15-Adjust Catch Basin item #18-Clean Out Catch Basins (2 of 4 cleanouts cancelled) item #19-Removal of Concrete Curb and Gutter item#39-Clean out Culverts (2 cleanouts cancelled)	(\$98,202.84)	Variation in Tender Quantity	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	
7	Maintenance of roadway as per GC 7.08.05	\$3,567.00	Time and material	Traffic and safety issues	Maintenance additions	The Owner shall bear the cost of maintaining, in a satisfactory condition for public traffic, a Roadway through the Working Area. The Contractor shall bring any defects to the attention of the Contract Administrator as soon as they are identified. Such defects include potholes, distortions, pavement edge loss, washouts, drop-offs, and soft or wet areas. Compensation for all labour, Equipment, and Materials to address such defects shall be at the Contract prices appropriate to the work and, where there are no such prices, at negotiated prices. Notwithstanding the foregoing, the cost of providing an operated grader, required to maintain the surface of such Roadways, shall be deemed to be included in the prices bid for the various tender items and no additional payment shall be made.
8	Concrete barriers remaining after 3 entrances were permanently closed required removal and were hauled to Firesteel Pit #42	\$1,628.00	Lump Sum	Design scope changes	Project definition omission	
9	Extra effort and cost required for contractor to access the Granular A that was stockpiled at the Firesteel Pit #42 under a separate contract	\$15,000.00	Lump Sum	Material	Change in material cost	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
10	PQP adjustment to the following Items:	\$4,133.42	Variation in Tender Quantity	Material	Quantity adjustments	
	Item #1- Earth Excavation					
	Item #2- Rock Excavation					
	Item #3- Rock Face					
	Item #4- Rock Supply (not required)					
	Item #12- In-Place Processing (area missed by designers in q-sheets)					
	Item #16- 500mm Culvert (existing entrance culvert collapsed)					
	Item #17- 600mm Culvert (extra 4 meters installed to improve entrance width and turning radius)					
	Item #20- Removal of Pipes and Culverts (increased due to removal of collapsed entrance culvert)					
	Item #21- Removal of Cable Guide Rail (slope flattening eliminated the need for the guide rail at that location)					
	Item #22- Removal of Anchor Blocks (guide rail and anchor blocks no longer required due to removal of hazard)					
Item #30- Adjust Guide Rail (guide rail eliminated had been slated for adjustment but no longer required)						
Item #33-Seed and Mulch (areas covered with <100mm stone did not require seed and mulch for erosion protection)						
Item #39- Cleanout Pipe Culverts (culvert could not be located due to infilling)						
11	MTO requested placing of 19.0mm stone over RAP at two slope flattening areas to provide proper slope transition	\$5,360.16	Time and material	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	
12	MTO requested the placement of <100mm stone on areas deemed prone to erosion	\$9,582.67	Time and material	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	
13	PQP adjustment to the following Items:	(\$57,416.19)	Variation in Tender Quantity	Material	Quantity adjustments	
	Item #6-Drill and Blast Rock in Ditches (actual quantity different from plan quantity)					
	Item #7- Granular Sealing (CSA requested areas deemed unnecessary not to be sprayed)					
	Item #24- Pavement Marking (areas beyond contract limits required one coat of paint, a separate area only required one coat as it had already received one the previous year)					
	Item #28- Ground Mounted Signs (an island was removed so the "No Parking" sign for it was no longer required)					
Item #35- Silt Fence (adjustment to length made in the field so lesser quantity is required)						
14	PQP adjustment to Item #33-Seed and Mulch	(\$480.00)	Variation in Tender Quantity	Material	Quantity adjustments	

Total		\$5,648.10				
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Other Payment Adjustments

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
OPA #--001	Fuel Price Adjustment	(\$33,830.96)	-	Material	change in material cost	
OPA #--005	Asphalt Cement Content	(\$36,467.96)	-	Material	Quantity adjustments	
OPA #--007	Asphalt Cement Index	(\$7,527.42)	-	Material	change in material cost	
OPA #--008	Adjustment for Non PQP measured items	\$69,503.57	-	Material	Quantity adjustments	

Total		(\$8,322.77)				
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Bonuses/Penalties and Incentives/Disincentives

Lot 1	19.0 Superpave (Reason or Reference: ERS Bonus (OPSS 313))	\$7,579.26	-	Material	Bonuses/Penalties	
Lot 2	19.0 Superpave (Reason or Reference: ERS Bonus (OPSS 313))	\$14,822.73	-	Material	Bonuses/Penalties	
Lot 2	19.0 Superpave (Reason or Reference: Referee Costs as per SP100S61)	(\$425.00)	-	Not a risk		
Lot 3	19.0 Superpave (Reason or Reference: ERS Bonus (OPSS 313))	\$18,708.30	-	Material	Bonuses/Penalties	
Lot 3	19.0 Superpave (Reason or Reference: Referee Costs as per SP100S61)	(\$425.00)	-	Not a risk		
Lot 4	19.0 Superpave (Reason or Reference: ERS Bonus (OPSS 313))	\$8,139.97	-	Material	Bonuses/Penalties	
Lot 1	12.5 Superpave (Reason or Reference: ERS Bonus (OPSS 313))	\$18,889.80	-	Material	Bonuses/Penalties	
Lot 2	12.5 Superpave (Reason or Reference: ERS Bonus (OPSS 313))	\$23,313.99	-	Material	Bonuses/Penalties	
Lot 2	12.5 Superpave (Reason or Reference: Referee Costs as per SP100S61)	(\$425.00)	-	Not a risk		
Lot 3	12.5 Superpave (Reason or Reference: ERS Bonus (OPSS 313))	\$33,554.25	-	Material	Bonuses/Penalties	
Lot 4	12.5 Superpave (Reason or Reference: ERS Bonus (OPSS 313))	\$16,323.72	-	Material	Bonuses/Penalties	
-	Incentive/Disincentive Provisions (Reason or Reference: SP Pg. 24-25 of Tender)	\$7,500.00	-	Material	Bonuses/Penalties	
-	Segregation (Reason or Reference: OPSS 313.10.01.04)	(\$645.45)	-	Material	Bonuses/Penalties	
-	Smoothness (Reason or Reference: NSSP 103F31M)	\$27,221.68	-	Material	Bonuses/Penalties	

Total		\$174,133.25				
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Number	Description	Amount	Method of payment	Category	Subcategory	Notes
1	PQP adjustments for Items 20, 32, and 34	(\$1,580.87)	Variation of tender costs	Material	Quantity adjustments	
	Item 20 - Removal of Anchor Blocks					
	Item 32 - Small Signs - Ground Mounted - New					
	Item 34 - Small Signs - Removal					
2	Erect 3 MCIS (Major Contract Identification Signs) French signs- To install 3 additional French MCIS not identified in the tender	\$1,054.80	Lump sum payment	Design scope changes	Project definition omission	
3	Clear identified areas- To clear 0.8 Hectares along contract 2011-6027 right of way	\$28,490.00	Lump sum payment	Design scope changes	Project definition omission	Clearing is not included in the TENDER ITEM LIST
4	Curb, Gutter, and catch basins - To remove bad curbs, replace and raise selected manholes and replace damaged grates	\$44,440.50	Lump sum payment	Latent conditions	State of the structure	
5	NSSP 331F01 - To replace NSSP 331F01, July 2010 version with NSSP 331F01 May 12, 2011 version	\$0.00	Lump sum payment	Not a risk	-	Change in item specific special provision for Item 12 (pg 16 of tender contract)
6	Maintenance - To repair areas requiring maintenance during the contract not attributed to the contractor or sub contractor	\$474.03	Time and Materials	Traffic and safety issues	Maintenance additions	
7	Install 2nd set of stakes - To install 2nd set of stakes for the opposite side of the highway	\$2,768.08	Time and Materials	Material	Quantity adjustments	
8	NSSP 103F01 - To replace NSSP 103F01, April 6, 2011 version with NSSP 103F01 March, 2011 version	\$0.00	Lump sum payment	Not a risk	-	Change in GENERAL SPECIAL PROVISIONS not found in the tender contract
9	Remove existing entrance pipe - To remove existing rusted plugged entrance pipe and replace shipping extra	\$10,063.29	Variation of Tender Quantities / Variation in Tender Cost	Latent conditions	State of the structure	
10	June PQP Adjustments - PQP Adjustments to Items 16, 21	\$4,424.74	Variation in Tender Quantities	Material	Quantity adjustments	
	Item 16 - Removal of Asphalt pavement					
	Item 21 - Gravel Sheeting					
11	Vacuum Catch Basins - To vacuum existing catch basins on Highway 17 in Ignace	\$3,685.76	Revision in Tender Price or Negotiated Price	Latent conditions	State of the structure	
12	Ignace Mall Entrance - To remove asphalt, add Granular A re-grade compact and repave to a depth of 60 mm	\$4,251.59	Variation in Tender Quantities	Design scope changes	Project definition omission	
13	Asphalt Behind Curbs - to saw cut, edge, remove and replace asphalt to 60mm depth	\$9,106.65	By Revision in Tender Price or Negotiated Price	Design scope changes	Project definition omission	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
14	14.5m of Curb - To remove granite curb at the entrance to Ignace plaza	\$279.28	Time and Materials	Design scope changes	Project definition omission	
15	Sink Hole - To mill 50mm and 4m long at a sub grade failure in Unsurveyed Territory, repair and repave	\$2,000.00	Time and Materials	Latent conditions	Deterioration of elements	
16	August PQP Adjustments - PQP Adjustments for Items 8,16,22, 29 and 32	(\$3,522.18)	Variation of tender costs	Material	Quantity adjustments	
	Item 8 - Tack Coat					
	Item 16 - Removal of Asphalt pavement					
	Item 22 - Pavement Marking					
	Item 29 - Seed and Mulch					
Item 32 - Small Signs - Ground Mounted - New						
17	September PQP Adjustments - PQP Adjustments for Items 1, 2, 3, 11, 16, 17 and 21	(\$10,669.24)	Variation of tender costs	Material	Quantity adjustments	
	Item 1 - Earth Excavation, Grading					
	Item 2 - Rock Excavation, Grading					
	Item 3 - Rock Face					
	Item 11 - In-Place Full Depth Reclamation of Bituminous Pavement and Underlying Granular					
	Item 16 - Removal of Asphalt pavement					
	Item 17 - Removal of Asphalt pavement, Partial Depth					
Item 21 - Gravel Sheeting						

Total		\$95,266.43				
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Other payment adjustments

1	Incentive for Open Grade	\$18,000.00		Material	Bonuses	
2	Disincentive for milled asphalt surface: Milled surface allowed open for 10 calendar days as outlined in special provision on Pg. 92, actually open 16 calendar days	(\$6,000.00)		Material	Penalties	For each section where the 10 calendar days for the completion are exceeded, as specified, the ministry will deduct from contract payment \$500.00 per calendar day for each day in excess of the 10 days.
3	Disincentive for open grade	(\$5,500.00)		Material	Penalties	
4	Referee Testing Fees	(\$2,500.00)		Not a risk	-	
5	Smoothness (payment adjustment)	(\$50,563.70)		Material	Penalties	
6	Fuel price adjustment	(\$16,298.26)		Material	Change in material cost	
7	PGAC Index and %AC	\$101,012.72		Material	Change in material cost/Quantity adjustment	
8	Item 10- Granular A from stock pile	(\$31,993.11)		Material	Quantity adjustment	Total quantity not required in work

Total		\$6,157.65				
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Northwestern Region Project 3

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
1	This Change Order has been set up for placing of Geogrid at asphalt distortion area Sta. 15+915 to 15+980. To facilitate the placement of geogrid, excavation of granular material was required at this location.	\$4,027.80	Extra Work- Time and Material	Design scope changes	Design errors and omissions	Geogrid was missed for asphalt distortion area in contract drawings. The contractor completed the repairs at this area in accordance to contract drawings without the placement of Geogrid. Later on, the contract drawing was revised with Geogrid. The Contractor excavated the area again to install Geogrid. The quantity of geogrid was given in the quantity sheet.
2	This Change Order has been set up for winter sand cleaning at truck climbing lane from Sta 14+900 to 17+00 Township of Phillips. Winter sand cleaning from the existng pavement was required prior to overlay to expose the pavement edge.	\$1,000.55	Extra Work- Time and Material	Traffic & safety issues	Maintenance	
3	This Change Order has been set up for clearing & grubbing which is required on following locations of alignment shift areas: Sta. 11+295 to 11+375 left side Sta. 11+630 to 11+670 left side	\$943.48	Extra Work- Time and Material	Design scope changes	Project definition omission	No tender item for Clearing and Grubbing
4	PQP Adjustment of tender items # 19, 20, 21, 25 & 42 is required as detailed below:	\$27,991.76	Extra Work- Variation in Tender Quantities	Latent conditions	Deterioration of elements	
	Tender Item # 19: Removal of Asphalt Pavement Tender Quantity: 10,557.0 m2 Addition: 943.0 m2 [To pave side road entrances due to pot holes] Revised Quantity: 11,500.0 m2			Material	Quantity adjustments	Asphalt removal quantity for Arrowhead Road was missed in the quantity sheet
	Tender Item # 20: Removal of Asphalt Pavement, Partial Depth Tender Quantity: 425.0 m2 Addition: 787.0 m2 [Missed paved entrances] Revised Quantity: 1,212.0 m2			Material	Quantity adjustments	
	Tender Item # 21: Removal of Pipes and Culverts Tender Quantity: 465.0 m Deletion: -19.0 m [Culvert # 68 could not be removed] Revised Quantity: 446.0 m			Latent conditions	Geotechnical	
	Tender Item # 25: Geogrid Tender Quantity: 1,298.0 m2 Addition: 421.0 m2 [Soft spots Sta. 11+627 to 11+735] Revised Quantity: 1,719.0 m2			Material	Quantity adjustments	Clean out of an entrance culvert at Sta. 11+380 Rt. given the quantity sheet #43 was not required as this culvert was replaced as shown on Quantity Sheet #45
	Tender Item # 42: Clean out of Culverts Tender Quantity: 31 each Deletion: -2 each [Not required due to field conditions] Revised Quantity: 29 each					

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
5	This Change Order has been set up for the cost of Calcium Chloride, which is required to suppress the dust on haul route from MTO Kakagi Lake K033-023 Pit to Hwy 71 about 2.7 km length. The gravel road is also used by campers during summer season.	\$7,286.40	Extra Work- Time and Material	Design scope changes	Project definition omission	
6	This Change Order has been set up for lowering the invert elevation of culvert #36.	\$3,790.00	Extra Work- Lump Sum	Latent conditions	State of the structure	
	Existing elevations:					
	Upstream elevation: 323.21m					
	Downstream elevation: 322.57m					
As constructed on site:						
Upstream elevation: 322.27m						
Downstream elevation: 322.27m						
7	PQP Adjustment of tender items # 23, 34 & 40 is required as detailed below:	(\$49,490.42)	Extra Work- Variation in Tender Quantities	Material	Quantity adjustments	Quantity did not reflect field conditions. The actual lake edge parallel to the road is shorter in length.
	Tender Item # 23 Removal of Anchor Blocks Tender Quantity: 50 each Addition: 1 each [extra removal required in section 14+350 to 14+693 Lt.] Revised Quantity: 51 each					
	Tender Item # 34: Anchor Blocks Tender Quantity: 50 each Deletion: - 2.0 each [Not required in section 11+316 to 11+549 Rt.] Revised Quantity: 48 each					
	Tender Item # 40: Turbidity Curtains Tender Quantity: 798.0m Deletion: -566.0m [Not required in section 11+078 to 11+856 Rt. due to field conditions] Revised Quantity: 232.0m					
8	This Change Order has been set up to hammer oversize rock boulders to be encountered at stage 2B of alignment shift area. The negotiated price to hammer oversize rock boulders: \$425.00 per hour. Measurements shall be the time in hours when hammering machine is working on the site in effective operation; Rock boulder with a volume of about 1.0 m3 or greater should be considered for hammering purpose; A new item #5007 has been created for Hammering Oversize Rock Boulders.	\$9,350.00	Extra Work- Negotiated Unit Price of Non-Tender Items	Design scope changes	Project definition omission	There was no tender item for removal of oversize rock

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
9	This Change Order has been set up to replace rusted cable on following three cable guide rail locations.	\$5,725.50	Extra Work- Negotiated Unit Price of Non-Tender Items	Latent conditions	State of the structure	
	Phillips Township:					
	Station 16+910 to 16+965 = 55.0m					
	Station 17+513 to 17+640 = 127.0m					
	Station 18+848 to 19+063 = 215.0m					
	Station 18+847 to 19+049 = 202.0m					
	Tweedsmuir Township:					
	Station 11+010 to 11+065 = 55.0m					
	Station 11+277 to 11+357 = 80.0m					
	Station 11+418 to 11+491 = 73.0m					
	Station 11+682 to 11+762 = 80.0m					
	Station 12+595 to 12+642 = 47.0m					
	Station 12+607 to 12+670 = 63.0m					
Total= 1,041m						
The negotiated price to replace rusted cable: \$5.50 per m						
10	This Change Order has been set up for removal and reinstallation of existing Steel Beam Guide Rail on north of Nestor Fall Bridge at the following locations:	\$8,770.00	Extra Work- Lump Sum	Design scope changes	Project definition omission	This issue was not captured in the design. Removal and reinstallation of steel guide rail was missed on north of Nestor Fall bridge which was required due to lowering of the grade
	11+078 to 11+116 Rt. = 38.0m [including eccentric loader]					
	11+078 to 11+120 Lt. = 42.0m [including Energy attenuator]					
	The removal and reinstallation is required due to lowering of the grade. The scope of the work includes the removal of existing steel beam guide rail, steel beam energy attenuator terminal and reinstallation of these components after completion of paving work.					
11	PQP Adjustment of tender items # 31, 32 & 36 is required as detailed below:	\$42,913.20	Extra Work- Variation in Tender Quantities	Material	Quantity adjustments	calculation error
	Tender Item # 31: Cable Guide Rail Tender Quantity: 2,920m Deletion: 92m [Required as per site conditions] Revised Quantity: 2,828m					
	Tender Item # 32: Adjust Cable Guide Rail Tender Quantity: 5,785 m Addition: 536.0 m [Required as per site conditions] Revised Quantity: 6,321.0 m					
	Tender Item # 36: Steel Beam Energy Attenuating Terminal System Tender Quantity: 5 each Addition: 8 each [Required as per site conditions] Revised Quantity: 13 each					
						SBEATs at some approach and leaving ends were missed, which were added upon clarification.

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
12	PQP Adjustment of tender items # 2, 3 & 4 is required as detailed below:	\$13,907.79	Extra Work- Variation in Tender Quantities	Material	Quantity adjustments	
	Tender Item # 2: Earth Excavation, Grading Tender Quantity: 15,886 m ³ Addition: 665 m ³ [as per site conditions] Revised Quantity: 16,551.0 m ³					
	Tender Item # 3: Rock Excavation, Grading Tender Quantity: 3,427.00 m ³ Deletion: -52.65 m ³ [as per site conditions] Revised Quantity: 3,374.35 m ³					
	Tender Item # 4: Rock Face Tender Quantity: 1,265 m ² Addition: 18.52 m ² [as per site conditions] Revised Quantity: 1,283.52 m ²					
13	Hauling Granular 'A' material from Kenora: Due to overrun of Granular A material, the contractor hauled 571.87t additional Granular A from commercial pit at Kenora to site to meet the contract requirements. Negotiated unit price: \$42.50/t This unit price includes hauling Granular A from commercial pit at Kenora and placement in accordance with contract specifications. A new item # 5012 has been created for hauling Granular A from Kenora.	\$24,304.48	Extra Work- Negotiated Unit Price of Non-Tender Items	Material	Quantity adjustments	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
14	PQP Adjustment of tender items # 10, 22, 24, 30, 33, 34, 35 & 43 is required as detailed below:	(\$17,076.74)	Extra Work- Variation in Tender Quantities	Material	Quantity adjustments	
	Tender Item # 10: Tack Coat Tender Quantity: 249,001.0 m2 Addition: 890.0 m2 [Missed Entrances] Revised Quantity: 249,891.0 m2					
	Tender Item # 22: Removal of Cable Guide Rail Tender Quantity: 3,590.0 m Addition: 75.0 m [Required as per site conditions] Revised Quantity: 3,665.0 m					
	Tender Item # 24: Removal of Steel Beam Guide Rail Tender Quantity: 1,301.0 m Addition: 45.0 m [Required as per site conditions] Revised Quantity: 1,364.0 m					
	Tender Item # 30: Pavement Markings - Durable Tender Quantity: 168.0 m Deletion: -54.0 m [Not required as per site conditions] Revised Quantity: 114.0 m					
	Tender Item # 33: Cable Guide Rail Post Replacement Tender Quantity: 20 each Deletion: 9 each [Not required as per site conditions] Revised Quantity: 11 each					
	Tender Item # 34: Anchor Blocks Tender Quantity: 50 each Deletion: -2.0 each [Not required as per site conditions] Revised Quantity: 46 each [Already adjusted -2 in CO # 007]					
	Tender Item # 35: Single Rail Steel Beam Guide Rail Tender Quantity: 2,010.0 m Deletion: 137.0 m [Not required as per site conditions] Revised Quantity: 1,873.0 m					
	Tender Item # 43: 500 mm dia. pipes Tender Quantity: 20.0 m Addition: 6.0 m [Required as per site conditions] Revised Quantity: 27.0 m					
15	This Change Order has been set up for removal of buried asphalt layer. Buried asphalt layer was encountered at alignment shift area [Godson	\$13,600.34	Extra Work- Negotiated Unit Price of Non-Tender Items	Latent conditions	Geotechnical	Buried asphalt layer was not captured in the boreholes detailed on contract drawings and the removal of the buried asphalt layer was not addressed in contract documents
	Sta. 11+145 to 11+370					
	Sta. 11+517 to 11+620					
	Sta. 11+626 to 11+800					
	Negotiated unit price: 3.87/ m2. A new item # 5015 has been created for removal of buried asphalt layer					

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
16	This Change Order has been set up to compensate the Contractor for unabsorbed head office overhead in pursuant to GC. 3.07.03 for extended period of the contract from October 23 to November 04, 2015:	\$16,882.21	Extra Work- Lump Sum	Project schedule issues		Extension of Time was granted as the critical operation of alignment shift area was delayed mainly due to the following reasons:
	The contract completion date as per tender documents: October 23, 2015.					Rock knobs and soft spots were encountered under road bed at alignment shift areas
	Permission to start the work: June 09, 2015					Additional rock scaling was required throughout the project
	Original Contract Value: \$8,417,109.12					
	Fixed completion date of the contract extended to November 04, 2015 [12 days]					
Final Contract Value: \$8,816,729.98						
$HOOH=(Tc(OCv \times 0.05)/T) - 0.05(FCv-Ocv)= \$36,863.25 - \$19,981.04 = \$16,882.21$						

Total	\$113,926.35
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Other payment adjustments

OP--001	Fuel Price Adjustments - July 2015	(\$13.02)	-	Material	Change in material cost	
	Fuel Price Index - Tender Advertisement Month [April - 2015]: 89.00					
	Fuel Price Index - July 2015: 83.0					
	Total Fuel Consumption July 2015: 217.0 liters					
	Fuel Price Adjustment: (\$13.02)					
OP--002	Fuel Price Adjustments - August 2015	(\$695.61)	-	Material	Change in material cost	
	Fuel Price Index - Tender Advertisement Month [April - 2015]: 89.00					
	Fuel Price Index - August 2015: 78.1					
	Total Fuel Consumption August 2015: 6381.70 liters					
	Fuel Price Adjustment: (\$695.61)					
OP--003	Fuel Price Adjustments - September 2015	(\$38,240.51)	-	Material	Change in material cost	
	Fuel Price Index - Tender Advertisement Month [April - 2015]: 89.00					
	Fuel Price Index - September 2015: 78.6					
	Total Fuel Consumption September 2015: 367,697.20 liters					
	Fuel Price Adjustment: (\$38,240.51)					

Number	Description	Amount	Method of payment	Category	Subcategory	Notes				
OP--004	Asphalt Cement Content Payment Adjustment - September 2015	\$48,058.82	-	Material	Change in material cost					
	PGAC Purchase Price: \$875.00									
	AC JMF: 5.2%									
	AC BID: 5.0%									
	HMA Quantity: 27,462.18 t									
	Amount: \$48,058.82									
OP--005	Variation of following measured items has been identified due to field conditions	\$157,356.28	-	Material	Quantity adjustments	Due to existing field conditions, and additional rock scaling locations not identified in the contract (Value: \$121,531.41)				
	Item #1: Rock Excavation, Machine Scaling									
	Tender Quantity: 105.00 hours									
	Actual Quantity: 220.50 hours									
	Change: 115.5 hours									
	Item #6: Rock Supply									
	Tender Quantity: 381.0 m3									
	Actual Quantity: 0.0 m3									
	Change: - 381.0 m3									
	Item #7: Rental of Hydraulic Backhoe-Crawler Mounted, 20,000Kg Minimum Operating Weight									
	Tender Quantity: 286.00 hours									
	Actual Quantity: 316.0 hours									
	Change: 30.0 hours									
Item #8: Drill and Blast Rock in Ditches										
Tender Quantity: 170.0 m										
Actual Quantity: 226.0 m										
Change: 56.0 m										
OP--006	Item #9: Granular Sealing	\$38,313.56	-	Material	Quantity adjustments					
	Tender Quantity: 32,164.0 kg									
	Addition: 5,173.00 kg [Some additional areas were added due to field conditions]									
	Revised Quantity: 37,337.00 kg									
	Item #11: Superpave 12.5									
	Tender Quantity: 31,862.0 t									
	Deletion: 699.40 [Under run due to field conditions]									
	Revised Quantity: 31,162.60 t									
	Item #12: Granular A									
	Tender Quantity: 18,257.0 t									
	Addition: 3,660.80 [Over run due to field conditions]									
	Revised Quantity: 21,917.80 t					Due to steeper crossfall of existing granular shoulders				
	Item #13: Granular B Type III									
Tender Quantity: 6,068.0 t	\$106,906.87	-	Latent conditions	Geotechnical						
Addition: 4,471.22 t [Over run due to field conditions and soft spots encountered at alignment shift areas]										
Revised Quantity: 10,539.22 t										

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
OP--007	Asphalt Cement Content Payment Adjustment - October 2015	\$5,912.99	-	Material	Change in material cost	
	PGAC Purchase Price: \$875.00					
	AC JMF: 5.2%					
	AC BID: 5.0%					
	HMA Quantity: 3,378.85 t					
	Amount: \$5,912.99					
OP--008	Fuel Price Adjustments - October 2015	(\$9,351.83)	-	Material	Change in material cost	
	Fuel Price Index - Tender Advertisement Month [April - 2015]: 89.00					
	Fuel Price Index - October 2015: 78.2					
	Total Fuel Consumption October 2015: 86,591.00 liters					
	Fuel Price Adjustment: (\$9,351.83)					
OP--009	Referee Testing Costs Recoverable from the Contractor:	(\$17,950.00)	-	Not a risk		If the referee test results show that the lot is rejectable or the referee test results show that the referee payment factor for compaction or mix properties is not higher than the payment factor for compaction or mix properties based on the original QA test results by more than 0.025, the Contractor shall be charged the cost of the referee testing.
	Ignition oven calibration: \$1,150.00					
	Lot 1 [sub lots 1 through 10 for mix properties & compaction] = \$7,500.00					
	Lot 2 [sub lots 1 through 10 for mix properties & compaction] = \$7,500.00					
	Lot 3 [sub lots 1 and 4 for mix properties] = \$1,500.00					
	Lot 5 [shipping costs due to second request]= \$300.00					
	Total= \$17,950.00					
OP--010	HMA Material Bonus/Penalties:	(\$93,048.70)	-	Material	Penalties/bonuses	
	Lot # 1 Payment Factor: 0.9066: (\$59,192.25)					
	Lot # 2 Payment Factor: 0.8874: (\$71,360.25)					
	Lot # 3 Payment Factor: 0.9979: (\$1,330.87)					
	Lot # 4 Payment Factor: 1.0261: \$16,540.88					
	Lot # 5 Payment Factor: 1.0574: \$36,377.25					
	Lot # 6 Payment Factor: 0.9827: (\$10,963.88)					
	Lot # 7 Payment Factor: 0.9707: (\$3,119.57)					
	Total= (\$93,048.70)					

Total		\$197,248.85				
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West Region Project 1

Identified Causes of Change Orders	Item Number	COW/OPA No.										Cost
Unexpected Site Conditions:												
Pipe culverts that require replacement due to poor condition	Item 42 - Removal of Pipes and Culverts	CO--001	CO--002	CO--006	CO--014	CO--044	CO--046					2,667.00
	Item 35 - 600 mm Pipe Culvert Extension	CO--001										5,474.00
	Item 25 - 500 mm pipe culvert	CO--003	CO--006	CO--014	CO--018	CO--025	CO--044	CO--048				62,643.00
	Item 26 - 600 mm pipe culvert	CO--007										17,880.00
	Item 83 - clean out concrete culvert	CO--002										4,275.16
Temporary concrete barrier and energy attenuator required for Stage 1 Naftels Creek due	Item 63 - energy attenuator (temporary, narrow)	CO--004										16,456.00
Poor existing soil condition discovered during the	Item 66 - temporary concrete barrier	CO--004										10,800.00
Slope repairs and rip rap placement at Naftels		CO--026	CO--028									31,680.00
The removal of granular material to place		CO--059										14,200.00
		CO--057										12,700.00
Missed Specifications in Contract Documents:												
Item missed in contract documents (clear zone)		CO--001	CO--002	CO--011	CO--012							44,370.00
Item missed in tender quantities (Tack coat)	Item 7 - tack coat - required on the expanded asphalt mix surface.	CO--009	CO--046									46,128.72
Item missed in design (channel required by		CO--058										13,700.00
Underestimated Tender Quantities:												
Underestimated quantities (clearing and grubbing)		CO--035	CO--043									7,140.00
Underestimated quantities (rip rap)	Item 47 - rip rap	CO--008	CO--042	CO--046								41,620.00
Issues Brought Up During Construction:												
Construction required a shift in traffic		CO--019	CO--037	CO--053	CO--054							28,635.00
Design issue due to utility conflict (item 4.5 in		CO--027	CO--034	CO--056								127,996.00
Changes due to construction staging	Item 15 (Full Depth Reclamation With Expanded Asphalt Stabilization) was removed and Item 38 (Removal of Asphalt Pavement) was included instead	CO--010	CO--013									(64,476.00)
Other:												
		CO--015	CO--016									10,699.92
Change orders produced due to pricing				CO--021	CO--036	CO--038	CO--055					(26,826.00)
Additional work requested by MTO		CO--030	CO--031	CO--032	CO--039	CO--041	CO--045	CO--046	CO--047	CO--049	CO--050	37,899.00

Identified Causes of Change Orders	Item Number	COW/OPA No.								Cost
Adjustments in Item Quantity:										
	Item 9 - Hot Mix Asphalt Miscellaneous	CO--017								4,641.00
	Item 12 - Superpave 12.5 FC1 50mm Lift Thickness	CO--051								3,022.38
	Item 17 - Concrete Gutter Outlets	CO--033								1,206.00
	Item 35 - 600 mm pipe culvert extension	CO--005								5,083.00
	Item 38 - removal of asphalt pavement	CO--024	CO--041							5,337.50
	Item 40 - sod	CO--040								(3,664.00)
	Items 42 and 29	CO--024								522.50
	Item 46 - Removal of Steel Beam Guide Rail	CO--033	CO--035							105.00
	Item 59 - pavement marking symbols, durable. Directional arrows for delegation of 2 way traffic	CO--046								680.00
	Item 61 - Single Rail Steel Beam Guide Rail	CO--052								3,936.00
	Item 62 - Single Rail Steel Beam Guide Rail With Channel	CO--033	CO--035							1,695.00
	Item 78 - straw bale flow check dams. Placed at new ditch and Naftels Creek for seeding	CO--046								850.00
	Item 79 - shrubs, 500 mm height	CO--020								2,850.00
	Item 80 - coniferous trees, 1m height	CO--020								756.20
	Item 81 - deciduous trees, 2.0 m height	CO--020	CO--046							2,340.00
	Item 84 - Removal of Concrete	CO--022								9,423.00
	Item 110 - Concrete in culverts	CO--023								(10,264.00)
	Removal of winter sand from intersections not completed by Maintenance	CO--029								3,600.00
Unresolved Change Orders and Claims										
Contractor has contested the penalty imposed for the Expanded Asphalt Mix Lot 2 not meeting the Contract requirements										(57,900.00)
Bonuses:										
Granular A ERS										-
PGAC Content Adjustment										35,712.61
Asphalt Properties ERS										240,490.54
Concrete Strength ERS										3,250.00
Concrete Air Voids ERS										-
Segregation										3,640.00
Penalties:										
Asphalt Smoothness ERS										(18,695.00)
Granular Sealing										(2,557.94)
Rejectable Expanded Asphalt Mix										(57,900.00)
Naftels Creek Repairs Credit										(92,500.00)

Northeast Region Project 1

Number	Description	Amount	Category	Subcategory	Notes
1	(Oct 2008, Pay #001, Inst #21) Monthly 'Tender' Items Adjusts # 2, 3, 27, 37, 39, 48, 52, 57, 62, 66 & 82	\$29,780.68	Material	Quantity adjustments	
	Item #2 - Close Cut Clearing (unit= ha (P))				
	Item #3 - Grubbing (unit= ha (P))				
	Item #27 - Reclaim Asphalt Pavement - Full Depth (unit= m2 (P))				The item unit for Reclaimed Asphalt Pavement "Full Depth" in this Contract was in m2 instead of m3. When measurement is specified in m2 more borehole data depths should be required and a table showing these depths included, this would allow contractors a better estimation of the cost involved when bidding. On this Contract there were areas with a significant depth of asphalt to be removed full depth requiring the milling machine to make more than one pass. The Contractor requested additional payment, as these increased depths were not shown in the contract documents. URS verified depths by average thickness measurements as removed and calculated an addition to the item of 11,613 m2 at a cost of \$32,400.27.
	Item #37 - Removal of Concrete Curb and Gutter (unit= m (P))				
	Item #39 - Removal of Pipe Culverts and Sewers (unit= m (P))				
	Item #48 - Rip Rap (unit= m2 (P))				Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O. 's over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75.
	Item #52 - Pavement Marking Obliterating - By Grinding (unit= m (P))				
	Item #57 - Pavement Marking, Temporary (unit= m (P))				Item #57 Additional freshening up lines for safety concerns throughout contract, total cost \$57,188.88
	Item #62 - Highway Fence (unit= m (P))				
	Item #66 - Ground Mounted Signs (unit= each (P))				
	Item #82 - Straw Bale Flow Checks (unit= each (P))				
	2				(Nov 2008, Pay #002, Inst #29) Monthly 'Tender' Items Adjusts # 2, 4, 5 & 82
Item #2 - Close Cut Clearing (unit= ha (P))					
Item #4 - Earth Excavation (Grading) (unit= m3 (P))					
Item #5 - Rock Excavation (Grading) (unit= m3 (P))					
Item #82 - Straw Bale Flow Checks (unit= each (P))					
3	Nov 2008 Repair Pothole Hwy.11 Existing S. Mag. Deck	\$3,981.73	Latent conditions	deterioration of elements	
4	Nov 2008 Guide Rail Accident Repair 19+750 RT BURKS FALLS	\$13,265.41	Traffic and safety issues	damage due to traffic accident	
5	(Dec 2008, Pay #003, Inst #36) Monthly 'Tender' Items Adjusts # 4 & 5	\$14,161.23	Material	Quantity adjustments	
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))				
	Item #5 - Rock Excavation (Grading) (unit= m3 (P))				

Number	Description	Amount	Category	Subcategory	Notes
6	(Dec 2008, Pay #003, Inst #36) Monthly 'Tender' Items Adjusts # 5, 6 & 7	\$29,957.66	Material	Quantity adjustments	
	Item #5 - Rock Excavation (Grading) (unit= m3 (P))				
	Item #6 - Rock Face (unit= m2 (P))				
	Item #7 - Rock Embankment (unit= m3 (P))				
7	(Dec 2008, Pay #003, Inst #36) Monthly 'Tender' Items Adjusts # 7	\$23,656.64	Material	Quantity adjustments	
	Item #7 - Rock Embankment (unit= m3 (P))				
8	Crack Repairs Magnetawan River North Crossing NBL b49, p116, b51, p307	\$29,943.50	Latent conditions	deterioration of elements	
9	(Feb 2009, Pay #005, Inst #48) Item #167 GFRP "in lieu of Stainless Steel" Change Proposal	(\$78,670.00)	Material	Request by contractor for alternative material	The Contractor submitted a change proposal for the use of GFRP reinforcing bar in lieu of stainless steel reinforcing steel in the barrier walls of 3 structures (Items #167, 190 and 213). This change proposal was accepted by the MTO with a saving to the Ministry of \$96,886.00 after the 50/50 split. CO #012.
	Item #167 - Stainless Steel Reinforcing Bar (unit= lumpsum)				
10	(Feb 2009, Pay #005, Inst #48) Item #190 GFRP "in lieu of Stainless Steel" Change Proposal	(\$56,642.00)	Material	Request by contractor for alternative material	
	Item #190 - Stainless Steel Reinforcing Bar (unit= lumpsum)				
11	(Feb 2009, Pay #005, Inst #48) Item #213 GFRP "in lieu of Stainless Steel" Change Proposal	(\$58,460.00)	Material	Request by contractor for alternative material	
	Item #213 - Stainless Steel Reinforcing Bar (unit= lumpsum)				
12	Item #167, 190, 213 - 50/50 Cost Savings GFRP "in lieu of Stainless Steel"	\$96,886.00	Material	Request by contractor for alternative material	
13	(Jan 09, Pay #004, Inst #40) Monthly 'Tender' Items Adjusts # 4, 5, 7, 233, 234 & 236	\$28,711.53	Material	Quantity adjustments	The Contractor had to drive 69 metres of additional piling at the Municipal Service Road Structure. This was due to the addition of one extra pile in the East Abutment required to satisfy the ultimate capacity. Additional cost to the contract was \$18,147.00
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))				
	Item #5 - Rock Excavation (Grading) (unit= m3 (P))				
	Item #7 - Rock Embankment (unit= m3 (P))				
	Item #233 - H-Piles - HP 310X110 (unit= m)				
	Item #234 - Rock Points (unit= each (P))				
	Item #236 - Mass Concrete (unit= m3 (P))				
14	(Feb 09, Pay #005, Inst #48) Monthly 'Tender' Items Adjusts # 4	\$29,259.51	Material	Quantity adjustments	
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))				
15	(Feb 09, Pay #005, Inst #48) Monthly 'Tender' Items Adjusts # 4	\$29,982.48	Material	Quantity adjustments	
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))				
16	(Feb 09, Pay #005, Inst #48) Monthly 'Tender' Items Adjusts # 4	\$29,957.55	Material	Quantity adjustments	
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))				

Number	Description	Amount	Category	Subcategory	Notes
17	(Feb 09, Pay #005, Inst #48) Monthly 'Tender' Items Adjusts # 4, 5, 6, 7, 66 & 230	\$25,156.51	Material	Quantity adjustments	
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))				
	Item #5 - Rock Excavation (Grading) (unit= m3 (P))				
	Item #6 - Rock Face (unit= m2 (P))				
	Item #7 - Rock Embankment (unit= m3 (P))				
	Item #66 - Ground Mounted Signs (unit= each (P))				
	Item #230 - Earth Excavation for Structure (unit= m3 (P))				
18	Dec-2008 Adjust Re-bar E Abut. MSR due to Design Bearing & Screed Elev Error SH's 335 & 338	\$1,183.04	Design scope changes	Design errors and omissions	
19	April 2009 Washout Repairs Various Locations	\$4,523.25	Latent conditions	Deterioration of elements	
20	(Apr 09, Pay #007, Inst #62) Monthly 'Tender' Items Adjusts # 4, 5, 6, 69, 75 & 81	\$29,976.59	Material	Quantity adjustments	
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))				
	Item #5 - Rock Excavation (Grading) (unit= m3 (P))				
	Item #6 - Rock Face (unit= m2 (P))				
	Item #69 - Cable Guide Rail (unit= m (P))				
	Item #75 - Eccentric Loader (unit= each (P))				
	Item #81 - Light Duty Silt Fence Barriers (unit= m (P))				
21	(Apr 09, Pay #007, Inst #62) Monthly 'Tender' Items Adjusts # 4, 7, 41 & 42	\$28,978.02	Material	Quantity adjustments	
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))				
	Item #7 - Rock Embankment (unit= m3 (P))				
	Item #41 - Removal of Guide Rail End Treatments (unit= each (P))				
	Item #42 - Removal of Cable Guide Rail (unit= m (P))				
22	(May 09, Pay #008, Inst #76) Monthly 'Tender' Items Adjusts # 4, 5, 6 & 7	\$28,595.25	Material	Quantity adjustments	
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))				
	Item #5 - Rock Excavation (Grading) (unit= m3 (P))				
	Item #6 - Rock Face (unit= m2 (P))				
	Item #7 - Rock Embankment (unit= m3 (P))				
23	(May 09, Pay #008, Inst #76) Monthly 'Tender' Items Adjusts # 48, 57, 66, 78 & 83	\$12,403.48	Material	Quantity adjustments	Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O. 's over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75. Item #57 Additional freshening up lines for safety concerns throughout contract, total cost \$57,188.88
	Item #48 - Rip Rap (unit= m2 (P))				
	Item #57 - Pavement Marking, Temporary (unit= m (P))				
	Item #66 - Ground Mounted Signs (unit= each (P))				
	Item #78 - Sodding (unit= m2 (P))				
	Item #83 - Turbidity Curtains (unit= m (P))				

Number	Description	Amount	Category	Subcategory	Notes
24	(Jun 09, Pay #009, Inst #84) 3 Mile Lake Road NBL N Pier Additional Costs	\$45,000.00	Design scope changes	Project definition omission	
25	(Jun 09, Pay #009, Inst #84) 3 Mile Lake Road SBL N Pier Additional Costs	\$45,000.00	Design scope changes	Project definition omission	
26	(Jun 09, Pay #009, Inst #84) Monthly 'Tender' Items Adjusts # 4, 6, 9, 40, 42, 63, 69, 104 & 105	\$27,963.87	Material	Quantity adjustments	
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))				
	Item #6 - Rock Face (unit= m2 (P))				
	Item #9 - Asphalt Spillways (unit= m (P))				
	Item #40 - Removal of Steel Beam Guide Rail (unit=m (P))				
	Item #42 - Removal of Cable Guide Rail(unit= m (P))				
	Item #63 - Brace Panels (unit= each (P))				
	Item #69 - Cable Guide Rail (unit= m (P))				
	Item #104 - Earth Excavation for Structure (unit= m3 (P))				
	Item #105 - Rock Excavation for Structure (unit= m3 (P))				No rock encountered
27	(Jun 09, Pay #009, Inst #84) Monthly 'Tender' Items Adjusts # 5, 7 & 62	\$29,847.88	Material	Quantity adjustments	
	Item #5 - Rock Excavation (Grading) (unit= m3 (P))				
	Item #7 - Rock Embankment (unit= m3 (P))				
	Item #62 - Highway Fence (unit= m (P))				
28	(Jul 09, Pay #10, Inst #99) Monthly 'Tender' Items Adjusts # 4, 5, 7, 48, 63, 77, 79, 84, 105 & 301	(\$1,482.39)	Material	quantity adjustments	
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))				
	Item #5 - Rock Excavation (Grading) (unit= m3 (P))				
	Item #7 - Rock Embankment (unit= m3 (P))				
	Item #48 - Rip Rap (unit= m2 (P))				Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O. 's over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75.
	Item #63 - Brace Panels (unit= each (P))				
	Item #77 - Topsoil from Stockpiles (unit= m3 (P))				
	Item #79 - Seed and Mulch (unit= m2 (P))				
	Item #84 - Permanent Rock Flow Checks (unit= each (P))				
	Item #105 - Rock Excavation for Structure (unit= m3 (P))				No rock encountered
	Item 301 not in tender item list				

Number	Description	Amount	Category	Subcategory	Notes
29	(Aug 09, Pay #011, INC #101) 3 Mile Lake Road H-Piles Under-run Compensation	\$66,239.30	latent conditions	geotechnical	The Three Mile Lake Road structures achieved the ultimate resistance required for the piles at a considerably higher elevation than that shown in the contract documents. Pile items #177 and #200 for the SBL and NBL ended up as major item under-runs. The Contractor requested additional payment for these under-runs to compensate for the loss in the steel price from the date of purchase and stockpiling on site to the date of piling completion. This claim also included the cost of removal from site and for fixed costs and unrecoverable overheads. Change Order #029 was negotiated at a cost of \$66,239.00. The actual cost saving for these two items was \$344,319.60 resulting in a net savings of \$278,080.60.
30	(Aug 09, Pay #11, Inst #101) Monthly "Tender" Items Adjusts # 4, 5, 7, 48, 71, 84, 104, 105, 243 & 299 Item #4 - Earth Excavation (Grading) (unit= m3 (P)) Item #5 - Rock Excavation (Grading) (unit= m3 (P)) Item #7 - Rock Embankment (unit= m3 (P)) Item #48 - Rip Rap (unit= m2 (P)) Item #71 - Single Rail Steel Beam Guide Rail (unit= m (P)) Item #84 - Permanent Rock Flow Checks (unit= each (P)) Item #104 - Earth Excavation for Structure (unit= m3 (P)) Item #105 - Rock Excavation for Structure (unit= m3 (P)) Item #243 -Reinforcing Steel Bar (unit=lumpsum) Item 299 not in tender item list	\$12,027.01	Material	quantity adjustments	Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O. 's over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75. No rock encountered

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
31	(Sep 09, Pay #012, INC #112) 3 Mile Lk Rd "Additional Costs", Culv's # 8, 9 & 10 Design Invert Change BK16, PG 648	\$129,158.98	LS	latent conditions	Geotechnical/state of the structure	Additional subsurface investigations should be undertaken during design in critical areas, such as structures and culvert foundations, particularly if rock or excessive water content could be possibilities, any subsequent delays during construction for redesign can be very costly. Areas in the vicinity of the Three Mile Lake Road structures and Culverts #8, 9 and 10 had many issues. Culvert #24 information showed rock existing and none was found in foundation area.
32	(Sep 09, Pay #012, INC #112) Electrical Repairs Hwy 11 & Sunset Pass b71, p702	\$3,468.63	LS	Latent conditions	Deterioration of elements	
33	(Sep 09, Pay #12, INC #112) Monthly 'Tender' Items Adjusts # 4, 5, 50, 66, 67 & 89	\$19,929.00	Tender Units	Material	quantity adjustments	Item 67 - When flexible delineator posts are to be used on the Contract they should not be used at a transition to two-way traffic for any significant distance down the centreline of the roadway. On this Contract they continued for 250+ metres past the point of lane separation and were continually being knocked out or damaged by traffic and requiring replacement. During the winter months they are knocked out by snow plough operations. The OPP also had an issue with them as they received many public complaints. Following consultation with the MTO Traffic Section and the MTO CSA it was decided to remove the delineators in the centreline location back to the separation point of the lanes. In addition, as requested by MTO, more were ordered for maintenance purposes at a cost of \$4,000.00.
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))					
	Item #5 - Rock Excavation (Grading) (unit= m3 (P))					
	Item #50 - River Stone (unit= m3 (P))					
	Item #66 - Ground Mounted Signs (unit= each (P))					
	Item #67 - Flexible Delineator Posts (unit= each (P))					
Item #89 - Shrubs, 600 mm Height (unit= each (P))						
34	(Sep 09, Pay #12, INC #112) Monthly 'Tender' Items Adjusts # 188 & 189	\$18,140.23	Tender Units	Material	Quantity adjustments	
	Item #188 - Reinforcing Steel Bar (unit=lumpsum)					
	Item #189 - Coated Reinforcing Steel Bar (unit=lumpsum)					
35	(Oct 09, Pay #13, INC #119) Monthly 'Tender' Items Adjusts # 48, 51, 52, 53, 58, 59, 60, 66 & 179	(\$29,749.75)	Tender Units	Material	quantity adjustments	Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O.'s over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75.
	Item #48 - Rip Rap (unit= m2 (P))					
	Item #51 - Pavement Marking Obliterating - By Abrasive Blasting (unit= m (P))					
	Item #52 - Pavement Marking Obliterating - By Grinding (unit= m (P))					
	Item #53 - Pavement Marking Obliterating - By Black Line Mask (unit= m (P))					
	Item #58 - Pavement Marking Symbols, Temporary (unit= each (P))					
	Item #59 - Pavement Marking, Temporary - Removable (unit= m (P))					
	Item #60 - Pavement Marking Symbols, Temporary-Removable (unit= each (P))					
	Item #66 - Ground Mounted Signs (unit= each (P))					
	Item #179 - Retapping Piles (unit= lumpsum)					

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
36	(Dec 09, Pay #15, INC #131) Maintain Generators at Temporary Hydro Connections	\$28,278.25	LS	Utility conflict	-	The planned electrical supply for Detour #6 showed power coming from an existing line carried too higher voltage and another source was required. An alternative supply from a different location was proposed by URS and redesigned by MMM, requiring Hydro One to place additional poles and a new line for this supply. This work was not completed on time for the opening of the detour. Furthermore, there was other supply issues throughout the Contract, (T5, T6, T7, T8, T9 & Supply D) also required temporary power to be supplied by a generator on site. CO 036 & 081 were setup at an additional cost of \$32,090.71
37	(Nov 09, Pay #14, INC #125) Supply and Maintain TCS4's For Detour 2, During Stage 1C	\$10,005.00	LS	Traffic and safety issues	-	There were safety concerns with traffic flow in the vicinity of Detour #6, Stage 1C. TC 54's were added to aid traffic flow at a cost of \$10,005 (CO #037).
38	(Dec 09, Pay #15, INC #131) Retaining walls Mag. River South Crossing SBL	\$7,075.00	LS	Material	quantity adjustments	
39	(April 10, Pay #19, Inst #150) Monthly 'Tender' Items Adjusts # 8 Rock Supply	(\$242,926.25)	M3	Material	quantity adjustments	not required
40	(Nov 09, Pay #14, Inst #125) Monthly 'Tender' Items Adjusts # 5, 6, 13, 30, 39, 51, 52, 53, 57, 59, 66, 67, 73, 84, 121, 130 & 131 Item #5 - Rock Excavation (Grading) (unit= m3 (P)) Item #6 - Rock Face (unit= m2 (P)) Item #13 - Hot Mix Asphalt Miscellaneous (unit= m2 (P)) Item #30 - 600 mm Pipe Culvert (unit= m (P)) Item #39 - Removal of Pipe Culverts and Sewers (unit= m (P)) Item #51 - Pavement Marking Obliterating - By Abrasive Blasting (unit= m (P)) Item #52 - Pavement Marking Obliterating - By Grinding (unit= m (P)) Item #53 - Pavement Marking Obliterating - By Black Line Mask (unit= m (P)) Item #57 - Pavement Marking, Temporary (unit= m (P)) Item #59 - Pavement Marking, Temporary - Removable (unit= m (P)) Item #66 - Ground Mounted Signs (unit= each (P)) Item #67 - Flexible Delineator Posts (unit= each (P)) Item #73 - Temporary Concrete Barrier (unit= m (P)) Item #84 - Permanent Rock Flow Checks (unit= each (P)) Item #121 - Steel Messenger Cables, Aerial (Temporary) (unit= m (P)) Item #130 - Wood Poles, Direct Buried in Earth (Temporary) (unit= each (P)) Item #131 - Wood Poles, Direct Buried in Rock (Temporary) (unit= each (P))	(\$2,007.41)	Tender Units	Material	quantity adjustments	Item #57 Additional freshening up lines for safety concerns throughout contract, total cost \$57,188.88 Item 67 - When flexible delineator posts are to be used on the Contract they should not be used at a transition to two-way traffic for any significant distance down the centreline of the roadway. On this Contract they continued for 250+ metres past the point of lane separation and were continually being knocked out or damaged by traffic and requiring replacement. During the winter months they are knocked out by snow plough operations. The OPP also had an issue with them as they received many public complaints. Following consultation with the MTO Traffic Section and the MTO CSA it was decided to remove the delineators in the centreline location back to the separation point of the lanes. In addition, as requested by MTO, more were ordered for maintenance purposes at a cost of \$4,000.00.

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
41	(Dec 09, Pay #15, Inst #131) Monthly 'Tender' Items Adjusts # 4, 29, 48, 66, 69, 70 & 121	\$7,131.11	Tender Units	Material	quantity adjustments	Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O.'s over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75.
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))					
	Item #29 - 500 mm Pipe Culvert (unit= m (P))					
	Item #48 - Rip Rap (unit= m2 (P))					
	Item #66 - Ground Mounted Signs (unit= each (P))					
	Item #69 - Cable Guide Rail (unit= m (P))					
	Item #70 - Anchor Blocks (unit= each (P))					
Item #121 - Steel Messenger Cables, Aerial (Temporary) (unit= m (P))						
42	(Jan '10, Pay #016, INC 134) Settlement Repair 10+255 Detour D-7	\$26,287.25	LS	Latent conditions	Geotechnical	URS and the MTO had safety concerns with heaving in the Detour #7 area during the winter of 2009 & 2010. The area was padded with asphalt and additional signage placed at a cost of \$26,287.25 (CO #042).
43	(Jan '10, Pay #016, INC 134) Overhead Sign 24+400 NBL Correction Two-way Traffic Overlay	\$941.73	LS	Material	quality issues of material	
44	(Jan 10, Pay #16, Inst #134) Monthly 'Tender' Items Adjusts # 4, 23, 57 & 120	\$11,704.07	Tender Units	Material	quantity adjustments	Item #57 Additional freshening up lines for safety concerns throughout contract, total cost \$57,188.88
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))					
	Item #23 - Concrete Curb and Gutter (unit= m (P))					
	Item #57 - Pavement Marking, Temporary (unit= m (P))					
	Item #120 - Low Voltage Cables, Aerial on Messenger Cable (Temporary) (unit= m (P))					
45	(Feb 10, Pay #17, Inst #136) Monthly 'Tender' Items Adjusts # 4, 5 & 7	(\$4,947.16)	Tender Units	Material	Quantity adjustments	
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))					
	Item #5 - Rock Excavation (Grading) (unit= m3 (P))					
	Item #7 - Rock Embankment (unit= m3 (P))					
46	(April 10, Pay #19, INC #150) Passing Lane Closure, TC54's 22+300 - 23+300 SBL	\$3,500.00	LS	Traffic and safety issues	-	MTO requested TC 54's be placed from Station 22+300 to 23+300 SBL to close the passing lane to traffic due to the evidence of severe frost heaving. The cost was \$3,500 (CO #046).
47	(Mar 10, Pay #18, INC #146) Monthly 'Tender' Items Adjusts # 63, 66, 67 & 71	\$3,954.01	Tender Units	Material	quantity adjustments	Item 67 - When flexible delineator posts are to be used on the Contract they should not be used at a transition to two-way traffic for any significant distance down the centreline of the roadway. On this Contract they continued for 250+ metres past the point of lane separation and were continually being knocked out or damaged by traffic and requiring replacement. During the winter months they are knocked out by snow plough operations. The OPP also had an issue with them as they received many public complaints. Following consultation with the MTO Traffic Section and the MTO CSA it was decided to remove the delineators in the centreline location back to the separation point of the lanes. In addition, as requested by MTO, more were ordered for maintenance purposes at a cost of \$4,000.00.
	Item #63 - Brace Panels (unit= each (P))					
	Item #66 - Ground Mounted Signs (unit= each (P))					
	Item #67 - Flexible Delineator Posts (unit= each (P))					
	Item #71 - Single Rail Steel Beam Guide Rail (unit= m (P))					

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
48	(April 10, Pay #19, INC #150) Feb 22-10 Accident repair, station 18+475 - 18+545 Rt.	\$7,781.27	LS	Traffic and safety issues	Damages due to traffic accidents	
49	(April 10, Pay #19, INC #150) Monthly 'Tender' Items Adjusts # 48 Item #48 - Rip Rap (unit= m2 (P))	\$99,939.90	Tender Units	Latent conditions	Geotechnical	Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O. 's over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75. Due to saturated slopes in various locations of the contract, rip rap and rock protection was placed for slope stabilization. Additional costs \$140,500.75 (CO#049).
50	(Apr 10, Pay #19, INC #150) Repair washout S-E/W Ramp Deer Lk. Rd.	\$1,922.23	LS	Latent conditions	Deterioration of elements	
51	(Apr 10, pay #19, INC #150) Monthly 'Tender' Items Adjusts #4 Item #4 - Earth Excavation (Grading) (unit= m3 (P))	\$18,996.66	Tender Units	Material	Quantity adjustments	
52	(Apr 10, Pay #19, INC #150) Monthly 'Tender' Items Adjusts # 5, 6, 7, 37, 62, 63, 66 & 158 Item #5 - Rock Excavation (Grading) (unit= m3 (P)) Item #6 - Rock Face (unit= m2 (P)) Item #7 - Rock Embankment (unit= m3 (P)) Item #37 - Removal of Concrete Curb and Gutter (unit= m (P)) Item #62 - Highway Fence (unit= m (P)) Item #63 - Brace Panels (unit= each (P)) Item #66 - Ground Mounted Signs (unit= each (P)) Item #158 - CSP For Integral Abutment (unit= lumpsum)	(\$271.05)	Tender Units	Material	Quantity adjustments	
53	(Apr 10, Pay #19, INC #150) Monthly Tender Items Adjusts # 28 Item #28 - Pipe Subdrains (unit= m (P))	(\$7,930.92)	Tender Units	Material	Quantity adjustments	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
54	(Apr 10, Pay #19, INC #150) Monthly Tender Items Adjusts # 57 Item #57 - Pavement Marking, Temporary (unit= m (P))	\$18,237.80	Tender Units	Traffic and safety issues	-	Item #57 Additional freshening up lines for safety concerns throughout contract, total cost \$57,188.88
55	(Apr 10, Pay #19, INC #150) Monthly Tender Items Adjusts # 71 Item #71 - Single Rail Steel Beam Guide Rail (unit= m (P))	\$27,252.48	Tender Units	Material	Quantity adjustments	
56	(Apr 10, Pay #19, INC #150) Monthly Tender Items Adjusts # 75 Item #75 - Eccentric Loader (unit= each (P))	\$3,172.06	Tender Units	Material	Quantity adjustments	
57	(Apr 10, Pay #19, INC #150) Monthly Tender Items Adjusts # 212 Item #212 - Coated Reinforcing Steel Bar (unit= lumpsum)	\$8,739.76	Tender Units	Material	Quantity adjustments	
58	(June 10, Pay #21, INC #177) Finish and Cure Concrete Overlay, Katrine Rehab, Bk.95, Pg. 655	\$19,800.00	LS	Design scope changes	Design errors and omissions	
59	(May 10, Pay #20, INC #168) Monthly Tender Items Adjusts # 8 Rock Supply	(\$43,750.00)	Tender Units	Material	quantity adjustments	not required
60	(May 10, Pay #20, INC #168) Monthly Tender Items Adjusts # 4, 28, 48, 63, 78, 79, 80, 150, 160, 250 & 255 Item #4 - Earth Excavation (Grading) (unit= m3 (P)) Item #28 - Pipe Subdrains (unit= m (P)) Item #48 - Rip Rap (unit= m2 (P)) Item #63 - Brace Panels (unit= each (P)) Item #78 - Sodding (unit= m2 (P)) Item #79 - Seed and Mulch (unit= m2 (P)) Item #80 - Seed and Erosion Control Blanket (unit= m2 (P)) Item #150 - Removal of Bridge Structure (unit= lumpsum) Item #160 - Concrete in Footings (unit= m3 (P)) Item #250 - Concrete in Substructure (unit= lumpsum) Item #255 - Dowels into Concrete (unit= each (P))	\$19,858.88	Tender Units	Material	quantity adjustments	Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O. 's over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75.
61	(May 10, Pay #20, INC #168) Monthly Tender Items Adjusts # 49, 71, 157 & 165 Item #49 - Rock Protection (unit= m3 (P)) Item #71 - Single Rail Steel Beam Guide Rail (unit= m (P)) Item #157 - Retapping Piles (unit= lumpsum) Item #165 - Reinforcing Steel Bar (unit= lumpsum)	(\$15,498.54)	Tender Units	Material	Quantity adjustments	
62	(May 10, Pay #20, INC #168) Monthly Tender Items Adjusts # 109 Item #109 - Unshrinkable Fill (unit= m3 (P))	(\$47,646.72)	Tender Units	Material	Quantity adjustments	
63	Item #563: D-7 Settlement Repair including Salvage & Re-use of existing Granular 'A' & 'B' for backfill. (June 10, PAY #21, INC #177) Monthly Tender Items Adjustments # 4, 17, 18 & 48. Salvage and Re-use Gran A & B = \$46,440.00. Items # 4 Earth = \$176,720.46 & # 48 Rip Rap = \$16,783.80 (Paid and adjusted under original tender PQP items). *NOTE: Items # 17 Gran 'A' = \$28,647.72 & # 18 Gran 'B' = \$131,233.57 (Paid and adjusted under original tender "NON" PQP items. See OPA's # 2 & # 5 June 10). Total cost C.O. #063 including OPA's = \$399,825.55	\$239,944.26	Tender Units	latent conditions	geotechnical	Issues arose during the use of Detour #7. The area heaved excessively over the winter and padding was required to correct for safety concerns. There was also an issue with the culvert placement within this Detour. The design did not allow enough cover over the culvert and field adjustments were required. The area was further reviewed with MTO Geotech. and the decision was made to sub excavate the area, after detour removal for construction of the southbound lanes, to remove wet soil conditions and fill with granular "B" to alleviate potential issues with heaving in the future. The ditch was also deepened and rip-rapped to improve drainage. The repair area was extended to cover from Sta. 15+825 to 16+300. CO. #063 was set up for this work at a cost of \$399,825.55.
64	(July 10, Pay #22, INC #185) Concrete Refacing, Rehab Adjust #269	\$75,225.00	M3	Design scope changes	Design errors and omissions	Design did not allow enough for overlay & curb refacing/sidewalk

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
65	(June 10, Pay #21, INC #177) Monthly Tender Items Adjusts # 27, 28, 44, 57, 63, 72, 157, 255 & 256	\$14,601.38	Tender Units	Material	quantity adjustments	The item unit for Reclaimed Asphalt Pavement "Full Depth" in this Contract was in m2 instead of m3. When measurement is specified in m2 more borehole data depths should be required and a table showing these depths included, this would allow contractors a better estimation of the cost involved when bidding. On this Contract there were areas with a significant depth of asphalt to be removed full depth requiring the milling machine to make more than one pass. The Contractor requested additional payment, as these increased depths were not shown in the contract documents. URS verified depths by average thickness measurements as removed and calculated an addition to the item of 11,613 m2 at a cost of \$32,400.27.
	Item #27 - Reclaim Asphalt Pavement - Full Depth (unit= m2 (P))					
	Item #28 - Pipe Subdrains (unit= m (P))					
	Item #44 - Removal of Steel Beam Guide Rail (unit= m (P))					
	Item #57 - Pavement Marking, Temporary (unit= m (P))					
	Item #63 - Brace Panels (unit= each (P))					
	Item #72 - Single Rail Steel Beam Guide Rail with Channel (unit= m (P))					
	Item #157 - Retapping Piles (unit= lumpsum)					
	Item #255 - Dowels Into Concrete (unit= each (P))					
	Item #256 - Reinforcing Steel Bar (unit= lumpsum)					
66	(June 10, Pay #21, INC #177) Monthly Tender Items Adjusts # 48, 51 & 160	\$28,892.52	Tender Units	Material	quantity adjustments	Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O. 's over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75.
	Item #48 - Rip Rap (unit= m2 (P))					
	Item #51 - Pavement Marking Obliterating - By Abrasive Blasting (unit= m (P))					
	Item #160 - Concrete in Footings (unit= m3 (P))					
67	(July 10, Pay #22, INC #185) Monthly Tender Items Adjusts # 4, 5, 6, 12, 13, 27, 28 & 66	\$29,934.76	Tender Units	Material	quantity adjustments	The item unit for Reclaimed Asphalt Pavement "Full Depth" in this Contract was in m2 instead of m3. When measurement is specified in m2 more borehole data depths should be required and a table showing these depths included, this would allow contractors a better estimation of the cost involved when bidding. On this Contract there were areas with a significant depth of asphalt to be removed full depth requiring the milling machine to make more than one pass. The Contractor requested additional payment, as these increased depths were not shown in the contract documents. URS verified depths by average thickness measurements as removed and calculated an addition to the item of 11,613 m2 at a cost of \$32,400.27.
	Item #4 - Earth Excavation (Grading) (unit= m3 (P))					
	Item #5 - Rock Excavation (Grading) (unit= m3 (P))					
	Item #6 - Rock Face (unit= m2 (P))					
	Item #12 - Tack Coat (unit= m2 (P))					
	Item #13 - Hot Mix Asphalt Miscellaneous (unit= m2 (P))					
	Item #27 - Reclaim Asphalt Pavement - Full Depth (unit= m2 (P))					
	Item #28 - Pipe Subdrains (unit= m (P))					
Item #66 - Ground Mounted Signs (unit= each (P))						
68	(Aug 10, Pay #23, INC #190) GFRP in 3 MLR Struct. SBL	\$26,574.90	LS	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	MTO structural section requested additional GFRP placement in the Three Mile Lake. Rd. SBL & S. Magnetawan R. structure barrier walls and a change to a PL2 from a PL3 configuration resulted in additional costs under C.O. 068 and 069 of \$26,574.90 and \$16,351.50 respectively

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
69	(Aug 10, Pay #23, INC #190) GFRP in S. x-ing Struct. and dowels.	\$16,351.50	LS	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	MTO structural section requested additional GFRP placement in the Three Mile Lake. Rd. SBL & S. Magnetawan R. structure barrier walls and a change to a PL2 from a PL3 configuration resulted in additional costs under C.O. 068 and 069 of \$26,574.90 and \$16,351.50 respectively
70	(Aug 10, Pay #23, INC #190) Monthly Tender Items Adjusts # 23, 28, 29, 31, 39, 48, 51, 54, 63, 78, 79, 80, & 84 Item #23 - Concrete Curb and Gutter (unit= m (P)) Item #28 - Pipe Subdrains (unit= m (P)) Item #29 - 500 mm Pipe Culvert (unit= m (P)) Item #31 - 700 mm Pipe Culvert (unit= m (P)) Item #39 - Removal of Pipe Culverts and Sewers (unit= m (P)) Item #48 - Rip Rap (unit= m2 (P)) Item #51 - Pavement Marking Obliterating - By Abrasive Blasting (unit= m (P)) Item #54 - Pavement Marking (unit= m (P)) Item #63 - Brace Panels (unit= each (P)) Item #78 - Sodding (unit= m2 (P)) Item #79 - Seed and Mulch (unit= m2 (P)) Item #80 - Seed and Erosion Control Blanket (unit= m2 (P)) Item #84 - Permanent Rock Flow Checks (unit= each (P))	\$15,024.59	Tender Units	Material	quantity adjustments	Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O. 's over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75.
71	(Aug 10, Pay #23, INC #190) Monthly Tender Units Adjusts # 166, 211, 212 & 255 Item #166 - Coated Reinforcing Steel Bar (unit= lumpsum) Item #211 - Reinforcing Steel Bar (unit= lumpsum) Item #212 - Coated Reinforcing Steel Bar (unit= lumpsum) Item #255 - Dowels Into Concrete (unit= each (P))	\$23,690.28	Tender Units	Material	Quantity adjustments	
72	(Sept 10, Pay #24, INC #192) Pavement Distress Treatment, 22+185 - 22+210 SBL	\$157,861.54	New Unit Price	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	The MTO requested additional work to be completed in the southbound lanes (previous Contract), from station 22+185 to 22+865 to repair distressed pavement areas, (frost heaves). This work included sub excavation, backfilling with granular adjusting ditches to promote positive drainage, and repaving. C.O. 72 to 75 were set up for this work at a final cost of \$904,770.18.
73	(Sept 10, Pay #24, INC #192) Pavement Distress Treatment, 22+504 - 22+561 EW-S Ramp	\$58,955.87	New Unit Price	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	
74	(Sept 10, Pay #24, INC #192) Pavement Distress Treatment, 22+340 - 22+370 SBL	\$164,781.99	New Unit Price	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	
75	(Sept 10, Pay #24, INC #192) Pavement Distress Treatment, 22+580 - 22+840 SBL	\$523,170.78	New Unit Price	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	
76	(Sept 10, Pay #24, INC #192) Katrina Rd. Sinkhole Repair 9+275	\$39,000.00	LS	latent conditions	Deterioration of elements	There were two instances of sinkholes forming that required extra work on sections of old Hwy. 11, changed to Katrina Road (Service Road). The first was in the slope outside of the guide rail at Station 12+050 RT (existing culvert crossing) that required filling the sink hole with rock. The second was in the NB lane at Station 9+275 at a culvert crossing, just south of the Katrina Rehab. The work required removal of the old existing culvert and backfilling, including the reinstatement of fresh laid asphalt. This work was completed under C.O. # 076 at a cost of \$39,000. Where existing culverts in old roadbeds are to be left in place and road use continued, a thorough investigation should take place to verify culvert suitability for future use. There are many old culverts in this Service Road that could require replacement in the near future.

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
77	(Sept 10, Pay #24, INC #192) Adjusts # 120, 165, 166, 254 & 257	\$24,578.30	Tender Units	Material	Quantity adjustments	
	Item #120 - Low Voltage Cables, Aerial on Messenger Cable (Temporary) (unit= m (P))					
	Item #165 - Reinforcing Steel Bar (unit= lumpsum)					
	Item #166 - Coated Reinforcing Steel Bar (unit= lumpsum)					
	Item #254 - Unshrinkable Fill (unit= m3 (P))					
Item #257 - Coated Reinforcing Steel Bar (unit= lumpsum)						
78	(Nov 10, Pay #26, INC #203) Additional SBGR, & Eccentric Loader 14+622 - 15+630 SBL	\$98,885.34	LS	Design scope changes	Owner ordered enhancement (MTO and stakeholders)	The MTO requested the addition of SBGR placement in the SBL's Rt. from Station 14+622 to 15+630, including the provision of an Eccentric Loader for safety reasons. C.O. #078 was set up for this work at a cost of \$98,885.34.
79	(Oct 10, Pay #25, INC #197) Monthly Tender Units Adjusts # 12, 25, 27, 48, 62, 63, 121, 130 & 134	\$21,926.81	Tender Units	Material	Quantity adjustments	<p>The item unit for Reclaimed Asphalt Pavement "Full Depth" in this Contract was in m2 instead of m3. When measurement is specified in m2 more borehole data depths should be required and a table showing these depths included, this would allow contractors a better estimation of the cost involved when bidding. On this Contract there were areas with a significant depth of asphalt to be removed full depth requiring the milling machine to make more than one pass. The Contractor requested additional payment, as these increased depths were not shown in the contract documents. URS verified depths by average thickness measurements as removed and calculated an addition to the item of 11,613 m2 at a cost of \$32,400.27.</p> <p>Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O. 's over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75.</p>
	Item #12 - Tack Coat (unit= m2 (P))					
	Item #25 - Rumble Strips - Asphalt (unit= m (P))					
	Item #27 - Reclaim Asphalt Pavement - Full Depth (unit= m2 (P))					
	Item #48 - Rip Rap (unit= m2 (P))					
	Item #62 - Highway Fence (unit= m (P))					
	Item #63 - Brace Panels (unit= each (P))					
	Item #121 - Steel Messenger Cables, Aerial (Temporary) (unit= m (P))					
	Item #130 - Wood Poles, Direct Buried in Earth (Temporary) (unit= each (P))					
	Item #134 - Guy Anchors (Temporary) (unit= each (P))					
80	(Nov 10, Pay #26, INC #203) Accident Repair, 15+400 SBL Lt	\$1,942.54	LS	Traffic and safety issues	Damages due to traffic accidents	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
81	(Nov 10, Pay #26, INC #203) Temp. Power Supply for Lighting, Supplies "E" & "G", Hydro cost Supply "E"	\$3,812.46	LS	Utility conflict	-	The planned electrical supply for Detour #6 showed power coming from an existing line carried too higher voltage and another source was required. An alternative supply from a different location was proposed by URS and redesigned by MMM, requiring Hydro One to place additional poles and a new line for this supply. This work was not completed on time for the opening of the detour. Furthermore, there was other supply issues throughout the Contract, (T5, T6, T7, T8, T9 & Supply D) also required temporary power to be supplied by a generator on site. CO 036 & 081 were setup at an additional cost of \$32,090.71

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
82	(Nov 10, Pay #26, INC #203) Monthly Tender Units Adjusts # 25, 47, 48, 51, 54, 62, 66, 67, 71, 72, 48, 79, 80, 84, 126, 150, 156, 160 & 243	\$29,376.86	Tender Units	Material	Quantity adjustments	
	Item #25 - Rumble Strips - Asphalt (unit= m (P))					
	Item #47 - Removal of Building (unit= lumpsum)					Item #47 for the removal and demolition of structures/buildings and site decommissioning was covered under an SP and included work at the former Searle's Restaurant and Gas Bar. The SP listed the work to be completed including restrictions and requirements for construction at these sites. There were no significant problems. however, some additional contaminated soils required removal after sampling and testing for adherence to environmental guidelines that added an additional \$25,343.98 to the item. (complete cost already covered by change order 83)
	Item #48 - Rip Rap (unit= m2 (P))					Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O. 's over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75.
	Item #51 - Pavement Marking Obliterating - By Abrasive Blasting (unit= m (P))					
	Item #54 - Pavement Marking (unit= m (P))					
	Item #62 - Highway Fence (unit= m (P))					
	Item #66 - Ground Mounted Signs (unit= each (P))					
Item #67 - Flexible Delineator Posts (unit= each (P))	Item 67 - When flexible delineator posts are to be used on the Contract they should not be used at a transition to two-way traffic for any significant distance down the centreline of the roadway. On this Contract they continued for 250+ metres past the point of lane separation and were continually being knocked out or damaged by traffic and requiring replacemnt. During the winter months they are knocked out by snow plough operations. The OPP also had an issue with them as they received many public complaints. Following consultation with the MTO Traffic Section and the MTO CSA it was decided to remove the delineators in the centreline location back to the separation point of the lanes. In addition, as requested by MTO, more were ordered for maintenance purposes at a cost of \$4,000.00.					

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
82	Item #71 - Single Rail Steel Beam Guide Rail (unit= m (P))	\$29,376.86	Tender Units	Material	Quantity adjustments	
	Item #72 - Single Rail Steel Beam Guide Rail with Channel (unit= m (P))					
	Item #79 - Seed and Mulch (unit= m2 (P))					
	Item #80 - Seed and Erosion Control Blanket (unit= m2 (P))					
	Item #84 - Permanent Rock Flow Checks (unit= each (P))					
	Item #126 - Removal of Electrical Equipment (unit= lumpsum)					
	Item #150 - Removal of Bridge Structure (unit= lumpsum)					
	Item #156 - Rock Points (unit= each (P))					
	Item #160 - Concrete in Footings (unit= m3 (P))					
	Item #243 -Reinforcing Steel Bar (unit=lumpsum)					
83	(Nov 10, Pay #26, INC #203) Monthly Tender Units Adjusts # 47	\$25,343.98	Tender Units	permits and regulations	environmental regulations	Item #47 for the removal and demolition of structures/buildings and site decommissioning was covered under an SP and included work at the former Searle's Restaurant and Gas Bar. The SP listed the work to be completed including restrictions and requirements for construction at these sites. There were no significant problems. however, some additional contaminated soils required removal after sampling and testing for adherence to environmental guidelines that added an additional \$25,343.98 to the item.
	Item #47 - Removal of Building (unit=lumpsum)					
84	(Nov 10, Pay #26, INC #203) Monthly Tender Units Adjusts # 5, 25, 48, 51, 54, 62, 66, 67, 71, 72, 78, 79, 80, 84, 150, 156, 160 & 243	\$25,583.03	Tender Units	Material	Quantity adjustments	
	Item #5 - Rock Excavation (Grading) (unit= m3 (P))					
	Item #25 - Rumble Strips - Asphalt (unit= m (P))					
	Item #48 - Rip Rap (unit= m2 (P))					
	Item #51 - Pavement Marking Obliterating - By Abrasive Blasting (unit= m (P))					
	Item #54 - Pavement Marking (unit= m (P))					
	Item #62 - Highway Fence (unit= m (P))					
	Item #66 - Ground Mounted Signs (unit= each (P))					
	Item #67 - Flexible Delineator Posts (unit= each (P))					
	Item #71 - Single Rail Steel Beam Guide Rail (unit= m (P))					
	Item #72 - Single Rail Steel Beam Guide Rail with Channel (unit= m (P))					
	Item #78 - Sodding (unit= m2 (P))					
	Item #79 - Seed and Mulch (unit= m2 (P))					
	Item #80 - Seed and Erosion Control Blanket (unit= m2 (P))					
	Item #84 - Permanent Rock Flow Checks (unit= each (P))					
Item #150 - Removal of Bridge Structure (unit= lumpsum)						
Item #156 - Rock Points (unit= each (P))						
						Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O. 's over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75.
						Item 67 - When flexible delineator posts are to be used on the Contract they should not be used at a transition to two-way traffic for any significant distance down the centreline of the roadway. On this Contract they continued for 250+ metres past the point of lane separation and were continually being knocked out or damaged by traffic and requiring replacement. During the winter months they are knocked out by snow plough operations. The OPP also had an issue with them as they received many public complaints. Following consultation with the MTO Traffic Section and the MTO CSA it was decided to remove the delineators in the centreline location back to the separation point of the lanes. In addition, as requested by MTO, more were ordered for maintenance purposes at a cost of \$4,000.00.

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
84	Item #160 - Concrete in Footings (unit= m3 (P)) Item #243 - Reinforcing Steel Bar (unit=lumpsum)	\$25,583.03	Tender Units	Material	Quantity adjustments	
85	(Final Payment #27, INC #207) Final Tender Unit Adjusts # 71. Item #71 - Single Rail Steel Beam Guide Rail (unit= m (P))	\$9,565.44	M	Material	Quantity adjustments	

Total	\$2,347,680.08
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Quantity adjustment edits						
1	Item #27 - Reclaim Asphalt Pavement - Full Depth (unit= m2 (P)). The item unit for Reclaimed Asphalt Pavement "Full Depth" in this Contract was in m2 instead of m3. When measurement is specified in m2 more borehole data depths should be required and a table showing these depths included, this would allow contractors a better estimation of the cost involved when bidding. On this Contract there were areas with a significant depth of asphalt to be removed full depth requiring the milling machine to make more than one pass. The Contractor requested additional payment, as these increased depths were not shown in the contract documents. URS verified depths by average thickness measurements as removed and calculated an addition to the item of 11,613 m2 at a cost of \$32,400.27.	\$32,400.27		Latent conditions	Geotechnical	
2	Item #48 - Rip Rap (unit= m2 (P)). Change Order #049 was setup under item #48, Rip Rap for an additional 5,525 m2 required at various locations throughout the contract to be placed in saturated silt ditches and on unstable slopes. Total additional cost for this C.O. was \$99,939.90. Additional monthly C.O. 's over the course of the Contract were also required to correct unstable slopes and ditches at a cost of \$40,560.75.	\$40,560.75		Latent conditions	Geotechnical	
3	Item #57 Additional freshening up lines for safety concerns throughout contract, total cost \$57,188.88	\$57,188.88		Traffic and safety issues		
4	The Contractor had to drive 69 metres of additional piling at the Municipal Service Road Structure. This was due to the addition of one extra pile in the East Abutment required to satisfy the ultimate capacity. Additional cost to the contract was \$18,147.00	\$18,147.00		Latent conditions	Geotechnical	
5	Item #105 - Rock Excavation for Structure (unit= m3 (P)). No rock encountered	(\$62,869.04)		Latent conditions	Geotechnical	
6	Item 67 - When flexible delineator posts are to be used on the Contract they should not be used at a transition to two-way traffic for any significant distance down the centreline of the roadway. On this Contract they continued for 250+ metres past the point of lane separation and were continually being knocked out or damaged by traffic and requiring replacement. During the winter months they are knocked out by snow plough operations. The OPP also had an issue with them as they received many public complaints. Following consultation with the MTO Traffic Section and the MTO CSA it was decided to remove the delineators in the centreline location back to the separation point of the lanes. In addition, as requested by MTO, more were ordered for maintenance purposes at a cost of \$4,000.00.	\$4,000.00		Traffic and safety issues		

Other payment adjustments (Bonuses/Penalties and Incentives/Disincentives)

700A	OPA #8 SP 19.0 Aggregate Density Correction	\$2,597.91	Aug 09 Lot #1, INC #101	Not a risk	
700B	OPA #8 SP 19.0 Aggregate Density Correction	\$166.02	Aug 09 Lot #2, INC #101		
700C	OPA #8 SP 19.0 Aggregate Density Correction	\$45.62	Aug 09 Lot #3, INC #101		
700D	OPA #8 SP 19.0 Aggregate Density Correction	\$26,797.60	Aug 09 Lot #4, INC #119		
700E	OPA #8 SP 19.0 Aggregate Density Correction	\$38,015.20	Oct 09 Lot #5, INC #119		
700F	OPA #8 SP 19.0 Aggregate Density Correction	\$106,567.20	Oct 09 Lot #6, INC #119		
700G	OPA #8 SP 19.0 Aggregate Density Correction	\$14,712.29	Nov 09 Lot #7, INC #131		
700H	OPA #8 SP 19.0 Aggregate Density Correction	\$5,608.80	June 10 Lot #8 INC #177		
700I	OPA #8 SP 19.0 Aggregate Density Correction	\$2,492.80	July 10 Lot 9, INC #185		
700J	OPA #8 SP 19.0 Aggregate Density Correction	\$1,246.40	Sept 10 Lot 10, INC 192		
700K	OPA #8 SP 19.0 Aggregate Density Correction	\$37,392.00	Oct 10 Lot 11, INC #197		
700L	OPA #8 SP 19.0 Aggregate Density Correction	\$39,067.16	Nov 10 Lot 12, INC #197		
700M	OPA #8 SP 19.0 Aggregate Density Correction	(\$274,709.00)	Correction. Does not apply to this item as per OPSS 313.10.01.05, 700A to 700L		
701A	OPA #9 Sp 19.0 Hotmix Bonus	\$16,761.58	Lot #1, INC #101		Material
701B	OPA #9 Sp 19.0 Hotmix Bonus	\$372.16	Lot #2, INC #101	Material	Bonuses
701C	OPA #9 Sp 19.0 Hotmix Bonus	\$304.12	Lot #3, INC #101	Material	Bonuses
701D	OPA #9 Sp 19.0 Hotmix Bonus	\$12,464.00	Lot #4, INC #119	Material	Bonuses
701E	OPA #9 Sp 19.0 Hotmix Bonus	\$35,460.08	Lot #6, INC #125	Material	Bonuses
701F	OPA #9 Sp 19.0 Hotmix Bonus	\$15,543.86	Lot #7, INC #131	Material	Bonuses
701G	OPA #9 Sp 19.0 Hotmix Bonus	\$32,406.40	Lot #8, INC #177	Material	Bonuses
701H	OPA #9 Sp 19.0 Hotmix Bonus	\$40,445.68	Lot #9, INC #185	Material	Bonuses
701I	OPA #9 Sp 19.0 Hotmix Bonus	\$41,754.40	Lot #10, INC #192	Material	Bonuses
701J	OPA #9 Sp 19.0 Hotmix Bonus	\$42,377.60	Lot #11, INC #197	Material	Bonuses
701K	OPA #9 Sp 19.0 Hotmix Bonus	\$42,322.76	Lot #12, INC #197	Material	Bonuses
702	OPA #18 35 Mpa Compressive Strength Bonus	\$5,695.00	Concrete Bonus (1,138.5 m3 X \$5.00), Correct rounding error to 1 cubic metre (1,139 m3 X \$5.00) INST # 101 & 112	Material	Bonuses

703	OPA #19 Grout, Compressive strength Bonus	\$7,537.20	Grout Bonus, INC #112 & #119	Material	Bonuses
704A	OPA #51 QC Compliance Incentive	\$50,000.00	Incentive, INC #203	Material	Bonuses
705A	OPA #21 SP 12.5 Aggregate Density Correction	\$17,750.98	Lot # 1 Oct 2009, INC #119	Not a risk	
705B	OPA #21 SP 12.5 Aggregate Density Correction	\$30,914.30	Lot #2 Oct 2010, INC #197		
705C	OPA #21 SP 12.5 Aggregate Density Correction	\$8,165.41	Lot #3 Oct 2010, INC #197		
705D	OPA #21 SP 12.5 Aggregate Density Correction	(\$56,830.69)	Correction. Does not apply to this item as per OPSS 313.10.01.05, 705A to 705C		
706A	OPA #22 Sp12.5 FC1 Aggregate Density Correction	\$116.08	Lot #1 October 2009, INST #119, 203 & 206, correcting previous spreadsheet formula input errors	Material	change in material price
706B	OPA #22 Sp12.5 FC1 Aggregate Density Correction	(\$2,043.15)	Lot #2 October 2009, INST #119, 203 & 206, correcting previous spreadsheet formula input errors	Material	change in material price
706C	OPA #22 Sp12.5 FC1 Aggregate Density Correction	(\$2,393.90)	Lot #3 November 2009, INC #197, 203 & 206, correcting previous spreadsheet formula input errors	Material	change in material price
706D	OPA #22 Sp12.5 FC1 Aggregate Density Correction	\$2,724.20	Lot #4 October 2010, INC #203 & 206, correcting previous spreadsheet formula input errors	Material	change in material price
706E	OPA #22 Sp12.5 FC1 Aggregate Density Correction	\$5,711.01	Lot #5 October 2010, INC #203 & 206, correcting previous spreadsheet formula input errors	Material	change in material price

706F	OPA #22 Sp12.5 FC1 Aggregate Density Correction	\$3,593.75	Lot #6 November 2010, INC #203 & 206, correcting previous spreadsheet formula input errors	Material	change in material price
707A	OPA #25 SP12.5 FC1 Bonus	\$346.29	Inst #129 Lot #1 142.03t X \$136.21 = \$19,345.91 X (PF 1.0179- 1.0000)	Material	Bonuses
707B	OPA #25 SP12.5 FC1 Bonus	\$24,858.33	Inst #131 Lot #2 5000t X \$136.21 = \$681,050.00 X (PF 1.0365 - 1.0000)	Material	Bonuses
707C	OPA #25 SP12.5 FC1 Bonus	\$17,954.28	Inst #131 Lot #3 3515.02t X \$136.21 = \$ 478,780.87 X (PF 1.375 - 1.0000)	Material	Bonuses
708A	OPA #25 SP12.5 FC1 Bonus	\$9,234.17	INC #125 Lot #1 = \$2,748.06t X \$134.41 = \$369,366.75 X (1.0250-1.0)	Material	Bonuses
708B	OPA #25 SP12.5 FC1 Bonus	\$38,978.90	INC #197 Lot #2 = 5000t X \$134.41 = \$672,050.00 X (1.0580-1.0)	Material	Bonuses
708C	OPA #25 SP12.5 FC1 Bonus	\$5,458.73	INC #197 Lot #3 = 1125t X \$134.41 = \$151,211.25 X (1.0361-1.0)	Material	Bonuses
709A	OPA #41 HST Adjustment	\$363,491.63	INC #190 July 2010 Payment #22 Invoice	Not a risk	
709B	OPA #41 HST Adjustment	\$264,933.59	INC #190 Aug 2010 Payment #23 Invoice		
709C	OPA #41 HST Adjustment	\$335,127.87	INC #192 Sep 2010 Payment #24 Invoice		
709D	OPA #41 HST Adjustment	\$324,604.31	INC #197 Oct 2010 Payment #25 Invoice		
709E	OPA #41 HST Adjustment	\$94,160.41	INC #203 Nov 2010 Payment #26 Invoice		
710A	OPA #45 30 Mpa Compressive Strength Bonus	\$16,164.00	INC #203 30 Mpa 700&800 series Concrete (5,388 m3 X \$3.00)	Material	Bonuses
710B	OPA #45 30 Mpa Compressive Strength Bonus	\$380.00	INC #203 30 Mpa 900 series Concrete (76 m3 X \$5.00)	Material	Bonuses
711A	OPA #46 Air Voids in Concrete Bonus	\$6,397.48	OPSS 1350.08.02.01	Material	Bonuses
712A	OPA #47 Payment Adjustment for Segregated HMA	\$2,839.32	INC #203 Pay. Adjust. Seg. HMA as per OPSS 313.10.01.04	Material	change in material price

713	OPA #52 Asphalt Smoothness Adjustment	\$67,314.98	INC #203 Pay. Adjust For HMA Smoothness as per SP103F31	Material	Bonuses
750A	OPA #1 Item #750: Fuel Price Index Adjustment	(\$28,822.53)	October 2008 Quantities, INST #021	Material	change in material price
750B	OPA #1 Item #750: Fuel Price Index Adjustment	(\$104,969.91)	November 2008 Quantities, INST #029	Material	change in material price
750B	OPA #1 Item #750: Fuel Price Index Adjustment	\$25,655.40	November 2008 Payment #2, INST #036	Material	change in material price
750C	OPA #1 Item #750: Fuel Price Index Adjustment	(\$107,874.63)	December 2008 Quantities, INST #036	Material	change in material price
750D	OPA #1 Item #750: Fuel Price Index Adjustment	(\$119,967.97)	January 2009 Quantities, INST #040	Material	change in material price
750E	OPA #1 Item #750: Fuel Price Index Adjustment	(\$135,536.88)	February 2009 Quantities, INST #048	Material	change in material price
750F	OPA #1 Item #750: Fuel Price Index Adjustment	(\$140,006.48)	March 2009 Quantities, INST #062	Material	change in material price
750G	OPA #1 Item #750: Fuel Price Index Adjustment	(\$141,808.47)	April 2009 Quantities, INST #062	Material	change in material price
750H	OPA #1 Item #750: Fuel Price Index Adjustment	(\$94,473.84)	May 2009 Quantities, INST #076	Material	change in material price
750I	OPA #1 Item #750: Fuel Price Index Adjustment	(\$127,751.36)	June 2009 Quantities, INST #084	Material	change in material price
750J	OPA #1 Item #750: Fuel Price Index Adjustment	(\$97,940.01)	July 2009 Quantities, INST #099	Material	change in material price
750K	OPA #1 Item #750: Fuel Price Index Adjustment	(\$142,210.76)	Aug 2009 Quantities, INST #101	Material	change in material price
750L	OPA #1 Item #750: Fuel Price Index Adjustment	(\$159,865.67)	Sept 2009 Quantities, INST #112	Material	change in material price
750M	OPA #1 Item #750: Fuel Price Index Adjustment	(\$210,200.11)	Oct-2009 Quantities, INST #119	Material	change in material price
750N	OPA #1 Item #750: Fuel Price Index Adjustment	(\$63,854.93)	Nov-2009 Quantities, INST #125	Material	change in material price
750O	OPA #1 Item #750: Fuel Price Index Adjustment	(\$56,549.70)	Dec 2009 Quantities, INST #131	Material	change in material price
750P	OPA #1 Item #750: Fuel Price Index Adjustment	(\$41,729.54)	Jan 2010 Quantities, INST #134	Material	change in material price
750Q	OPA #1 Item #750: Fuel Price Index Adjustment	(\$29,435.54)	Feb 2010 Quantities, INST #136	Material	change in material price
750R	OPA #1 Item #750: Fuel Price Index Adjustment	(\$6,939.89)	March 2010 Quantities, INST #150	Material	change in material price
750S	OPA #1 Item #750: Fuel Price Index Adjustment	(\$12,632.51)	April 2010 Quantities, INST #150	Material	change in material price
750T	OPA #1 Item #750: Fuel Price Index Adjustment	(\$64,801.51)	May 2010 Quantities, INST #168	Material	change in material price

750U	OPA #1 Item #750: Fuel Price Index Adjustment	(\$164,800.65)	June 2010 Quantities, INST #177	Material	change in material price
750V	OPA #1 Item #750: Fuel Price Index Adjustment	(\$111,807.78)	July 2010 Quantities, INST #185	Material	change in material price
750W	OPA #1 Item #750: Fuel Price Index Adjustment	(\$106,356.12)	Aug 2010 Quantities, INST #190	Material	change in material price
750X	OPA #1 Item #750: Fuel Price Index Adjustment	(\$123,069.65)	Sep 2010 Quantities, INST #192	Material	change in material price
750Y	OPA #1 Item #750: Fuel Price Index Adjustment	(\$84,473.07)	Oct 2010 Quantities, INST #197	Material	change in material price
750Z	OPA #1 Item #750: Fuel Price Index Adjustment	(\$4,127.75)	Nov 2010 Quantities, INST #203	Material	change in material price
751A	OPA #4 Gran "A" Gradation/Testing Penalty	(\$7,812.00)	INC #084 Grad. Penalty for Lot #1, 5000t x 14% Adjust. x \$11.16/t	Material	Penalties
751B	OPA #4 Gran "A" Gradation/Testing Penalty	(\$1,000.00)	INC #084 Testing (SP110s13) for Lot# 1, 4 Sublots x \$250 ea	Material	Penalties
751C	OPA #4 Gran "A" Gradation/Testing Penalty	(\$1,000.00)	INC #084 Testing (SP110s13) for Lot# 2, 4 Sublots x \$250 ea	Material	Penalties
751D	OPA #4 Gran "A" Gradation/Testing Penalty	(\$1,000.00)	INC #084 Testing (SP110s13) for Lot# 3, 4 Sublots x \$250 ea	Material	Penalties
751E	OPA #4 Gran "A" Gradation/Testing Penalty	(\$1,000.00)	INC #084 Referee Testing (SP110s13) for Lot# 1, 4 Sublots x \$250 ea	Material	Penalties
751F	OPA #4 Gran "A" Gradation/Testing Penalty	(\$213.03)	INC #099 Cost of Shipping Lot# 1 Referee Samples	Material	Penalties
751G	OPA #4 Gran "A" Gradation/Testing Penalty	(\$1,562.40)	INC #101 Grad. Penalty for Lot #4, 5000t x 2.8% Adjust. x \$11.16/t	Material	Penalties
751H	OPA #4 Gran "A" Gradation/Testing Penalty	(\$1,000.00)	INC #101 Testing (SP110s13) for Lot# 4, 4 Sublots x \$250 ea	Material	Penalties
751I	OPA #4 Gran "A" Gradation/Testing Penalty	(\$1,000.00)	INC #101 Testing (SP110s13) for Lot# 5, 4 Sublots x \$250 ea	Material	Penalties
751J	OPA #4 Gran "A" Gradation/Testing Penalty	(\$1,000.00)	INC #101 Testing (SP110s13) for Lot# 6, 4 Sublots x \$250 ea	Material	Penalties

751K	OPA #4 Gran "A" Gradation/Testing Penalty	(\$20,757.60)	INC #119 Grad. Penalty for Lot #7, 7500t x 24.8% Adjust. x \$11.16/t	Material	Penalties
751L	OPA #4 Gran "A" Gradation/Testing Penalty	(\$1,000.00)	INC #119 Testing (SP110s13) for Lot# 8, 4 Sublots x \$250 ea	Material	Penalties
751M	OPA #4 Gran "A" Gradation/Testing Penalty	(\$23,212.80)	INC #197 Grad. Penalty for Lot #12, 10,000t x 20.8% Adjust. x \$11.16/t	Material	Penalties
751N	OPA #4 Gran "A" Gradation/Testing Penalty	(\$1,000.00)	INC #197 Testing (SP110s13) for Lot# 12, 4 Sublots x \$250 ea	Material	Penalties
751O	OPA #4 Gran "A" Gradation/Testing Penalty	(\$1,000.00)	INC #203 Testing (SP110s13) for Lot# 13, 4 Sublots x \$250 ea	Material	Penalties
751P	OPA #4 Gran "A" Gradation/Testing Penalty	(\$6,777.68)	INC #203 Lot# 13 Option 2 for CO#75	Material	Penalties
752A	OPA #6 PGAC Hotmix Content Adjustment	(\$8,070.76)	INST #101 SP 19.0 August 2009 Paving	Material	change in material price
752B	OPA #6 PGAC Hotmix Content Adjustment	(\$34,890.79)	INST #119 SP 19, 12.5, 12.5FC1 Oct 2009 Paving	Material	change in material price
752C	OPA #6 PGAC Hotmix Content Adjustment	(\$12,564.32)	INST #125 SP 19, 12.5, 12.5 FC1 Nov 2009 Paving	Material	change in material price
752D	OPA #6 PGAC Hotmix Content Adjustment	(\$555.11)	INST #131 SP 19, 12.5, 12.5 FC1 Dec 2009 Paving	Material	change in material price
752E	OPA #6 PGAC Hotmix Content Adjustment	(\$21,196.47)	INST #177 SP 19, 12.5, 12.5 FC1 June-2010 Paving	Material	change in material price
752F	OPA #6 PGAC Hotmix Content Adjustment	(\$6,054.20)	INST #185 Adjust for June 2010 Pay #21 Qty's Missed for 752E	Material	change in material price
752G	OPA #6 PGAC Hotmix Content Adjustment	(\$10,306.48)	INST #185 SP 19, 12.5, 12.5 FC1 July-2010 Paving	Material	change in material price
752H	OPA #6 PGAC Hotmix Content Adjustment	(\$18,822.30)	INST #192 SP 19, 12.5, 12.5 FC1 Sept-2010 Paving	Material	change in material price
752I	OPA #6 PGAC Hotmix Content Adjustment	(\$35,093.81)	INST #197 SP 19, 12.5, 12.5 FC1 Oct-2010 Paving	Material	change in material price
752J	OPA #6 PGAC Hotmix Content Adjustment	(\$6,388.89)	INST #203 SP12.5FC1 Nov 2010 Frost Heave Paving	Material	change in material price

753A	OPA #7 PGAC Index Price Adjustment	(\$50,972.00)	INST #101 SP 19.0 Aug 2009 Paving	Material	change in material price
753A	OPA #7 PGAC Index Price Adjustment	(\$12,397.90)	INST # 112 Correction spreadsheet input errors August 2009 Payment	Material	change in material price
753B	OPA #7 PGAC Index Price Adjustment	(\$219,317.69)	INST #119 Paving SP 19, 12.5, 12.5 FC1 Oct 2009	Material	change in material price
753C	OPA #7 PGAC Index Price Adjustment	(\$61,808.26)	INST #125 Paving SP 19, 12.5, 12.5 FC1 Nov 2009	Material	change in material price
753D	OPA #7 PGAC Index Price Adjustment	(\$5,530.88)	INST #131 Paving SP 19, 12.5, 12.5 FC1 Dec 2009	Material	change in material price
753E	OPA #7 PGAC Index Price Adjustment	(\$50,204.91)	INST #177 SP 19, 12.5, 12.5 FC1 June 2010 Paving	Material	change in material price
753F	OPA #7 PGAC Index Price Adjustment	(\$18,987.40)	INST #185 Adjust for June 2010 Pay #21 Qty's Missed for 753E	Material	change in material price
753G	OPA #7 PGAC Index Price Adjustment	(\$22,138.85)	INST #185 SP 19, 12.5, 12.5 FC1 July-2010 Paving	Material	change in material price
753H	OPA #7 PGAC Index Price Adjustment	(\$104,845.23)	INST #192 SP 19, 12.5, 12.5 FC1 Sept-2010 Paving	Material	change in material price
753I	OPA #7 PGAC Index Price Adjustment	(\$88,055.73)	INST #197 SP 19, 12.5, 12.5 FC1 Oct-2010 Paving	Material	change in material price
754A	OPA #23 SP 19.0 Hotmix Properties Penalty	(\$124.64)	INST #119 Oct'09 Lot #5: 1.0t X \$124.64 = \$124.64 (PF 0.9998-1.0)	Material	Penalties
755A	OPA #26 SP12.5 FC1 Aggregate Density Correction	(\$2,393.90)	INST #125 Nov'09 Lot #3: 3,515.02t X \$136.21/t X PF(0.995-1.0)	Not a risk	
755B	OPA #26 SP12.5 FC1 Aggregate Density Correction SP12.5 FC1 Aggregate Density Correction	\$2,393.90	INST #203 Nov'09 Lot #3: ERS Input Error Should be 706C		
756A	OPA #27 SP 12.5 FC1 Penalty	(\$19,954.77)	INST #125 Nov'09 Lot #2: 5,000t X \$136.21/t X PF (0.9707-1.0)	Not a risk	
756B	OPA #27 SP 12.5 FC1 Penalty	\$19,954.77	INST #131 Nov'09 Lot #2: ERS Input Error Should be 707B "Bonus"		

756C	OPA #27 SP 12.5 FC1 Penalty	(\$1,250.00)	Nov '10 Lot #4: Ref Testing 10 lots X \$125/lot = - \$1,250	Material	Penalties
756D	OPA #27 SP 12.5 FC1 Penalty	(\$1,375.00)	Nov '10 Lot #5: Ref Testing 11 lots X \$125/lot = - \$1,375	Material	Penalties
756E	OPA #27 SP 12.5 FC1 Penalty	(\$27,091.13)	Nov '10 Lot #6: 2,047.72t X \$135.00 X (0.9020-1.000)	Material	Penalties
756F	OPA #27 SP 12.5 FC1 Penalty	(\$1,000.00)	Nov '10 Lot #6: Testing 4 sublots X \$120.00 ea/per	Material	Penalties
757A	OPA #40 Embedded PST Adjustment	(\$21,933.51)	INST #190 July 2010 Payment #22 Invoice	Not a risk	
757B	OPA #40 Embedded PST Adjustment	(\$10,772.82)	INST #190 Aug 2010 Payment #23 Invoice		
757C	OPA #40 Embedded PST Adjustment	(\$45,570.88)	INST #192 Sept 2010 Payment #24 Invoice		
757D	OPA #40 Embedded PST Adjustment	(\$39,367.29)	INST #197 Oct 2010 Payment #25 Invoice		
757E	OPA #40 Embedded PST Adjustment	\$747.75	INST #203 Nov 2010 Payment #26 Invoice. "Plus" due to asphalt quantity corrections.		
758A	OPA #42 Low Compressive Strength Test X625 & X627	(\$1,500.00)	INST #192 Sep 2010 Payment #24	Not a risk	
759A	OPA #48 Surface Course Profile Indices Adj. SP103F31	(\$3,000.00)	INST #203 NOV 2010 Payment #26	Material	Penalties
800	OPA #20 Stage 1-C Incentive Bonus	\$8,000.00	Stage 1-C Incentive Bonus Page 29 Tender Documents	Material	Bonuses

Total		(\$1,535,729.75)			
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Change Proposals

No.	Nature of work	Proposed cost	Rejected or accepted	Reason for decision
1	Change stainless steel rebar in barrier walls to GFRP	\$231,660.00	Accepted	New product with possible future in Ministry designs and of financial benefit to the Ministry.

Total	\$231,660.00
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Northeast Region Project 2

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
1	The Contractor was required to install and remove three (3) Federal Funding signs.	\$1,626.75	Extra Work- By revision in tender prices, or by negotiated price for a new Item	Design scope changes	Project definition omission	No requirement for Major Contract Identification Signs
2	The Contractor was required to install 1.8 m x 12 m Precast Concrete Box Culverts in lieu of 1,800 mm Pipe Culverts at Culvert Nos. 33, 34, 38 and 39 to meet DFO requirements.	\$143,772.20	Extra Work- By revision in tender prices, or by negotiated price for a new item	Permits and regulations	Environmental regulations	In order to conform to DFO requirements for Fish Habitat Area F3, the Contractor was required to supply and install 1.8 m x 1.2 m concrete box culverts for Culvert Nos. 33, 34, 38 and 39 in lieu of the specified 1,800 mm circular pipe culverts for this area. Change Order No. 2 was issued to pay for the extra 130 m of 1.8 m x 1 m box culvert which included the credit of the 130 m of 1,800 mm pipe that was no longer required. (DFO=Department of Fisheries and Oceans).
3	PQP adjustment for additional grubbing areas missed in quantity sheets.	\$34,798.00	Additional Work- By Variation in Tender Quantities	Design scope changes	Design errors and omissions	
4	PQP adjustment for pavement markings that were missed in quantity sheets.	\$1,391.50	Additional Work- By Variation in Tender Quantities	Design scope changes	Design errors and omissions	
5	PQP adjustment for rock excavation for trenches and associated structures at Sta. 17+580 for Culvert No. 23.	\$25,830.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
6	PQP adjustment for rock embankment and geotextile at Sta. 18+156 for Culvert No. 24.	\$995.80	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
7	PQP adjustment for Pavement Marking Symbols at Construction Access Nos. 2 & 3 that were missed in quantity sheets.	\$540.00	Extra Work- By Variation in Tender Quantities	Design scope changes	Design errors and omissions	
8	This Change Order was issued to compensate the Contractor for acceleration costs associated with the stop work order between Swamps 505 and 506 (Sheppard Lake) that occurred between January 8, 2010 and January 29, 2010. The agreed upon cost for compensation included mobilization, demobilization and operation of an additional crusher and scale to crush extra filter blanket in order to ensure that the excavation and backfill of granular filter blanket at Swamps 505 & 506 are completed before the watercourse/fisheries protection timing constraint detailed in the contract documents.	\$85,000.00	Extra Work- By revision in tender prices, or by negotiated price for a new item	Permits and regulations	Environmental regulations	The Contract Documents did not detail an excavation methodology for the excavation of Sheppard Lake. The Ministry instructed the Contractor to not commence work between Swamps 505 and 506 on January 8, 2010 due to direction from the MNR given the possibility of Blanding's Turtles hibernating at this location (reference Change Order No. 08)(MNR=Ministry of natural resources).
9	This Change Order was issued in addition to Change Order No. 8 to compensate the Contractor for a premium cost for processing additional Granular Filter Blanket required at Swamps 505 & 506.	\$454,400.00	Extra Work- By revision in tender prices, or by negotiated price for a new item	Permits and regulations	Environmental regulations	Connected to change order 8
10	This Change Order was issued as a PQP adjustment for additional Earth Excavation at Culvert Nos. 4, 33, 34 & 38 in order to remove unsuitable material.	\$1,290.00	Extra Work- By Variation in Tender Quantities	Latent conditions	Geotechnical	
11	This Change Order was issued as a PQP adjustment for Cable Guide Rail and Anchor Blocks.	\$9,894.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
12	This Change Order was issued as a PQP adjustment for Rock Excavation for Trenches and Associated Structures for Culvert No. 3 at Sta. 15+500.	\$735.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
13	This Change Order was issued as a PQP adjustment for Pavement Marking Obliterating - by Abrasive Blasting from Sta. 19+025 - 19+228 CL of existing Hwy 69.	(\$3,530.80)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
14	This Change Order was issued as a PQP adjustment for an additional Straw Bale Flow Check to be placed at Sta. 21+205 near Culvert No. 38, and an additional Temporary Rock Flow Check to be placed at Sta. 20+890 near Culvert No. 33.	\$1,015.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
15	This Change Order was issued for the supply, installation, maintenance and removal of an additional 15m 300mm CSP Culvert at Swamp 508 due to the existing water level.	\$2,000.00	Extra Work- Lump Sum	Latent conditions	State of the structure	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
16	This Change Order was issued as a PQP adjustment for the final quantity of Granular Filter Blanket that was placed in Swamps 505, 506, 507, 508 & 509.	\$825,893.50	Extra Work- By Variation in Tender Quantities	Latent conditions	Geotechnical	Peat removal /swamp excavation for wick drains substantially over-ran which accounted for overrunning Item No. 35 Granular Drainage Blanket (reference Change Order No. 016 - \$825,893.50).
17	This Change Order was issued for the placement of concrete instead of a steel plate connection on the exiting timber Culvert No. 67 extension.	\$1,800.00	Extra Work- Lump Sum	Design scope changes	Owner ordered enhancement	
18	This Change Order was issued as a PQP adjustment for Earth Excavation and Rock Excavation at Sta. 19+900 - 20+240 NBL (RT) to drain water from Swamp 508 for the installation of wick drains.	\$10,168.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	It should be noted that a "crust" consisting of stiff to very stiff silt/clay near ground surface and a silt layer consisting of compact to very dense silt (i.e. Silt Interlayer) within the silty clay deposit were encountered in some boreholes in Swamps 507 and 508 and are expected to pose increased resistance to wick drain installation. In order to install the wick drains through the compact to very dense silt layer (i.e. Silt Interlayer) present within the silty clay deposit in Swamps 507 and 508, the Contractor shall be prepared to use suitable vibratory equipment and/or pre-augering.
19	This Change Order was issued as a PQP adjustment for Earth Excavation and Rock Excavation from Sta. 16+200 - 17+250 SBL & NBL to reflect actual quantities generated by HDS.	\$39,160.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
20	This Change Order was issued as a PQP adjustment for Earth Excavation at Swamps 505, 506, 507 & 508 to reflect actual quantities generated by HDS.	\$292,984.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
21	This Change Order was issued to enlarge turtle nests at Swamps 505, 506 & 507.	\$13,074.32	Extra Work- By Variation in Tender Quantities and Lump Sum	Permits and regulations	Environmental regulations	
22	This Change Order was issued as a PQP adjustment for placement of Rock Protection in lieu of Erosion Control Blanket from Sta. 20+965 - 21+180.	\$5,909.50	Extra Work- By Variation in Tender Quantities	Design scope changes	Owner ordered enhancement	
23	This Change Order was issued to have temporary Culvert No. 59 and subsequent Sheppard Lake South Turtle Culverts (NBL and SBL) be relocated from Sta. 18+800 to 18+920.	\$5,000.00	Extra Work- Lump Sum	Permits and regulations	Environmental regulations	Temporary Culvert No. 59 was requested, by MNR, to be relocated after initial installation.
24	This Change Order was issued to compensate the Contractor for the redesign required at the NBL and SBL Wildlife Underpass Structures. The redesign was required due to the final profile of the rock foundation after blasting and rock excavation.	\$77,059.00	Extra Work- By Variation in Tender Quantities and by revision in tender price	Design scope changes	Design errors and omissions	After substantial over-blasting at the Wildlife Underpass structures, a redesign was required to construct the abutment benches. The Contractor successfully argued that the owner was accountable for half the cost of over-blasting. Aecon asserted that in combination with the natural seams in the rock (they felt were unique to Northern Ontario) that the blasting specification for these structures was unachievable and vaguely written (Addendum No. 1)
25	This Change Order was issued as a PQP adjustment for Temporary Concrete Barriers to be placed from Sta. 14+625 - 15+160 SBL RT to provide safety to the travelling public on the SBL during the removal of the rock stockpiles and as a physical barrier between both Contractors.	\$56,175.00	Extra Work- By Variation in Tender Quantities	Traffic and safety issues		Item No. 77 Temporary Concrete Barrier (TCB) over-ran (\$103,935.00) primarily due to the fact that the 720 m of TCB identified to be available from a previous contract was not available (reference tender page 228).
26	This Change Order was issued for a premium cost for the Contractor to use Wanup Quarry (AP 402031) instead of Rock Bay Quarry (AP 402032) for crushing their asphalt aggregates. Another Contractor was utilizing the Rock Bay Quarry at the time as access to their contract and the Contractor was unable to use the Rock Bay Quarry for their crushing operation.	\$140,000.00	Extra Work- Lump Sum	Construction staging issues	Conflict with other MTO projects	
27	This Change Order was issued as a PQP adjustment for Silt Fence. The MNR, MTO and MTO's Planning and Design Section requested that additional Silt Fence be placed at various locations throughout the Contract to act as temporary reptile fencing.	\$6,732.00	Extra Work- By Variation in Tender Quantities	Design scope changes	Owner ordered enhancement	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
28	This C.O. was issued for additional "Reptile Fence mesh at the bottom" of Wildlife Fencing at various locations. This extra work was requested by MNR, and MTO's Planning and Design Section.	\$43,065.90	Extra Work- By revision in tender prices, or by negotiated price for a new item	Permits and regulations	Environmental regulations	Significant additional Reptile Fencing was requested, by MNR, after award. The original Item No. 64 Wildlife Fence had a small portion of Reptile fence blended into it. A new Item was initiated to pay for additional Reptile Fence (reference Change Order No. 28 - 1,962 m).
29	This Change Order was issued to compensate the Contractor for the redesign of the SBL Joint Use Culvert. The redesign was required due to the low elevation of the rock.	\$103,275.92	Extra Work- By revision in tender prices, or by negotiated price for a new item and by variation in tender quantities	Latent conditions	Geotechnical	
30	This Change Order was issued for the placement of Snow Fence from Sta. 15+155 - 15+460 to act as a physical barrier between two Contractors (Bot Construction and Aecon Construction) who were working within 300m of each other.	\$11,971.25	Extra Work- By revision in tender prices, or by negotiated price for a new item	Construction staging issues	Conflict with other MTO projects	
31	This Change Order was issued for the construction of eight (8) toe walls that were required at the NBL and SBL Wildlife Underpass Structures as a result of the redesign.	\$90,659.00	Extra Work- By revision in tender prices, or by negotiated price for a new item and by variation in tender quantities	Design scope changes	Design errors and omissions	Linked to change order 24
32	This Change Order was issued for dewatering at the NBL Joint Use Culvert. There was no dewatering item included for the NBL Joint Use Culvert.	\$35,387.44	Extra Work- Time and Material	Design scope changes	Project definition omission	
33	This Change Order was issued as a PQP adjustment for additional Rock Protection along the entire perimeter of the meandering stream and its slopes due to the existing soil conditions.	\$19,764.00	Extra Work- By Variation in Tender Quantities	Latent conditions	Geotechnical	
34	This Change Order was issued for the preparation of a level rock pad in the MNR rock stockpile area for their crushing operations. Snow Fence and one temporary gate and two brace panels were also installed for the entrance.	\$39,736.29	Extra Work- Time and Material	Material	Change in material cost	
35	This Change Order was issued for the supply, installation and maintenance of snow fence along the western boundary of the Bunwash pit (AP 402004) as mitigation measures that were required under the Endangered Species Act Agreement.	\$32,729.55	Extra Work- By revision in tender prices, or by negotiated price for a new item	Permits and regulations	Environmental regulations	
36	This Change Order was issued as a PQP adjustment for additional Brace Panels, Wildlife Fencing and Swing Gates that were deleted from Contract No. 2007-5189 and added to Contract No. 2009-5131.	\$22,095.00	Extra Work- By Variation in Tender Quantities	Design scope changes	Owner ordered enhancement	
37	This Change Order was issued to compensate the Contractor for re-drilling the North-East West ramp due to an incorrect alignment being issued originally.	\$3,657.38	Extra Work- Lump Sum	Design scope changes	Design errors and omissions	
38	This Change Order was issued for the relocation of an existing Hydro Pole and Supply Cabinet located at Sta. 11+841 o/s 32 RT. The pole was in conflict with the placement of Rock Embankment.	\$6,000.00	Extra Work- Lump Sum	Utility conflict		Existing Utility Poles conflicted with grading operations. Four poles, each in different locations, required relocation during construction.
39	This Change Order was issued as a PQP adjustment for additional Straw Bale Flow Checks between Sta. 21+215 and 21+810.	\$1,020.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
40	This \$0.00 Change Order was issued for the Contractors proposal to replace the Granular "B" surcharges with Granular "A".	\$0.00	Extra Work- By revision in tender prices, or by negotiated price for a new item	Material	Request by contractor for alternative material	
41	This Change Order was issued to compensate the Contractor's staff for attending the mandatory Species at Risk basic training on June 11th, June 18th and the relocation training on June 24th, 2010.	\$36,176.06	Extra Work- Lump Sum	Permits and regulations	Environmental regulations	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
42	This Change Order was issued for the multicoloured animal graphics on each of the Decorative precast Concrete Panels.	\$19,055.50	Extra Work- Lump Sum	Design scope changes	Owner ordered enhancement	Not mentioned in tender contract
43	This Change Order was issued to compensate the Contractor for revising four Wick Drain Layout Reports. The Wick Drain spacing was increased from 1.5 m to 3.62 m.	\$9,660.00	Extra Work- Lump Sum	Design scope changes	Design errors and omissions	
44	This Change Order was issued to compensate the Contractor's Subcontractor (Sturgeon Falls Brush) for standby time. The Sub-Contractor was prevented from conducting clearing operations for a private entrance at Rock Lake by the property owner.	\$3,590.87	Extra Work- Lump Sum	Project schedule issue		
45	This Change Order was issued for the cost savings associated with Change Proposal No. 2. The Change Proposal was based on the elimination of 71,000 t of surplus Granular 'B' Type II by replacing several Granular 'B' Type II surcharges with Granular 'A' surcharges.	(\$674,500.00)	Extra Work- By Variation in Tender Quantities	Material	Request by contractor for alternative material	
46	This Change Order was issued in addition to Change Order No. 45 and was prepared to compensate the Contractor for the costs sharing associated with Change Proposal No. 2.	\$337,250.00	Extra Work- Lump Sum	Material	Request by contractor for alternative material	Linked to change order 45
47	This Change Order was issued as a result of temporary Culvert No. 59 being relocated from Sta. 18+800 -18+920. It was recommended that (4) additional Nail Pines and (4) additional Settlement Rods be installed at Sta 18+920 to monitor settlement in order to assess timing for surcharge removal.	\$4,140.00	Extra Work- Lump Sum	Permits and regulations	Environmental regulations	Temporary Culvert No. 59 was requested, by MNR, to be relocated after initial installation. Linked to change order number 23
48	This Change Order was issued for the placement of Gravel Sheeting on SSM slopes at various locations throughout the Contract to prevent erosion.	\$166,466.56	Extra Work- By revision in tender prices, or by negotiated price for a new item	Design scope changes	Owner ordered enhancement	The use of SSM embankments in the Township of Burwash presented extreme erosion issues in the form of scouring, sedimentation, and turbidity to the adjacent drainage courses. As a result, gravel sheeting was placed to stabilize the inside slopes, in addition to extra temporary erosion control measures. This extra was paid under Change Order No. 48 (SSM=select subgrade material)
49	This Change Order was issued to compensate the Contractor for the modifications made by the Designer to the Hwy 647 West Abutment. The modifications were required to compensate for the low rock elevation.	\$6,628.70	Extra Work- By revision in tender prices, or by negotiated price for a new item	Latent conditions	Geotechnical	
50	This Change Order was issued to compensate the Contractor for additional concrete that was required at the NBL Joint Use Culvert for the inconsistent elevation of rock.	\$13,310.00	Extra Work- By Variation in Tender Quantities	Latent conditions	Geotechnical	
51	This Change Order was issued for line drilling required for extra depth shatter in order to provide adequate drainage from Sta. 15+725 - 15+860 NBL RT, 15+750 - 15+830 NBL LT & 16+050 - 16+180 SBL RT.	\$88,894.00	Extra Work- By revision in tender prices, or by negotiated price for a new item	Latent conditions	Geotechnical	Shatter is the fracturing of solid rock within the road section by the use of explosives, to form a suitable foundation to receive the granular base course, and also to provide drainage of the roadbed.
52	This Change Order was issued as a PQP adjustment to reduce the Granular 'B' Type II quantity. It was determined that sufficient Granular 'B' Type II had been processed and surplus was not required.	(\$427,500.00)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
53	This Change Order was issued to compensate the Contractor for the shortage of the Granular 'A' stockpile from Contract 2008-5129.	\$29,973.98	Extra Work- Lump Sum	Material	Quantity adjustments	
54	This Change Order was issued as a PQP adjustment for Relocation of the Tri-Chord Overhead sign to Sta. 11+630 NBL to accommodate switching traffic under Stage 2.	\$42,900.00	Extra Work- By Variation in Tender Quantities	Design scope changes	Project definition omission	Relocation of Tri-chord Overhead sign to accommodate switching traffic for Stage 2 at Station 11+630 in the NBL was not included in the Contract and was paid under Change Order No. 54.
55	This Change Order was issued as a PQP adjustment for Earth Excavation to reflect updated quantities generated by HDS.	\$80,008.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
56	This Change Order was issued as a PQP adjustment for Earth Excavation to reflect updated quantities generated by HDS.	\$210,528.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
57	This Change Order was issued as a PQP adjustment for Rock Excavation to reflect updated quantities generated by HDS.	(\$103,915.00)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
58	This Change Order was issued as a PQP adjustment for Rock Face to reflect updated quantities generated by HDS.	(\$3,675.00)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
59	This Change order was issued as a PQP adjustment for Rock Embankment to reflect updated quantities generated by HDS.	(\$13,992.00)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
60	This Change Order was issued to compensate the Contractor for lost production at Sheppard Lake due to double handling materials during the Blanding's Turtle investigations.	\$4,654.38	Extra Work- Lump Sum	Permits and regulations	Environmental regulations	
61	This Change Order was issued to compensate the Contractor for Claim Nos. 2 & 3.	\$106,000.00	Extra Work- Lump Sum			
62	This Change Order was issued as a PQP adjustment for Earth Excavation to reflect updated quantities generated by HDS.	\$108,408.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
63	This Change order was issued as a PQP adjustment for Rock Embankment to reflect updated quantities generated by HDS.	\$58,792.90	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
64	This Change Order was issued for the cost savings associated with Change Proposal No. 3 Rev. 2. In consultation with Northeastern Regional Geotechnical Section, the Contractor's Change Proposal to substitute 1.0m of Select Subgrade Material and 0.35m of Gramlar 'B' Type II and an additional 0.35m of sub excavation with Rock Embankment was accepted.	(\$42,274.49)	Extra Work- By revision in tender prices, or by negotiated price for a new item and by variation in tender quantities	Material	Request by contractor for alternative material	
65	This Change Order was issued in addition to Change Order No. 64 and compensated the Contractor for 50% of the net construction cost savings resulting from Change Proposal No. 3.	\$21,137.25	Extra Work- Lump Sum	Material	Request by contractor for alternative material	
66	This Change Order was issued to the Contractor for the supply, fabricate and install two trial Reptile Escape Ramps that were requested by the Ministry.	\$2,459.68	Extra Work- By revision in tender prices, or by negotiated price for a new item	Design scope changes	Owner ordered enhancement	
67	This Change Order was issued as a PQP adjustment for additional Single Rail Steel Beam Guide Rail and Steel Beam Energy Attenuating Terminal as a result of the relocation of the Tri-Chord overhead sign to Sta. 11+630 NBL.	\$34,791.00	Extra Work- By Variation in Tender Quantities	Design scope changes	Project definition omission	Linked to change order 54
68	This Change Order was issued as a PQP adjustment for Bridge Deck Waterproofing at the NBL and SBL Joint Use Culvert. Test results found the material to be outside specification. It was agreed with MTO that the material could be left in place with a 100% payment reduction.	(\$10,000.00)	Extra Work- By Variation in Tender Quantities	Material	Quality issue of material	
69	This Change Order was issued as a PQP adjustment for Wildlife Fencing, Brace Panels and Swing Gates. This additional work was required as a result of a site visit/review with AECOM, MNR and MTO.	\$59,445.00	Extra Work- By Variation in Tender Quantities	Permits and regulations	Environmental regulation	
70	This Change Order is issued for the construction of curbs at the NBL approach slabs for the Lowering Structures. They were not identified in Contract No. 2009-5131 or 2007-5189.	\$3,501.34	Extra Work- Lump Sum	Design scope changes	Project definition omission	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
71	This Change Order was issued as a PQP adjustment for Earth Excavation and Rock Excavation for Trenches and Associated Structures at Culverts Nos. 15, 16, 18 & 54 to remove unsuitable material.	(\$1,647.59)	Extra Work- By Variation in Tender Quantities	Latent conditions	Geotechnical	
72	This Change Order was issued as a PQP adjustment for additional Wildlife Fence & Brace Panels to be placed south of the Nelson Road Interchange from Sta. 14+150 - 14+469 SBL LT.	\$20,896.00	Extra Work- By Variation in Tender Quantities	Permits and regulations	Environmental regulations	
73	This Change Order was issued for the placement of additional earth material & Seed and Mulch in the median on Contract No. 2007-5189 from Sta. 13+840 - 15+430.	\$48,750.00	Extra Work- By Variation in Tender Quantities and Lump Sum	Design scope changes	Owner ordered enhancement	
74	This Change Order was issued to compensate the Contractor for the replacement of dowels at the SBL Wildlife Underpass Deck due to conflicting drawings on Sheet Nos. 375 & 378a.	\$13,973.87	Extra Work- Lump Sum	Design scope changes	Design errors and omissions	
75	This Change Order was issued for the redesign of the electrical work at the NB Tie-In/Transition requested by the Ministry.	(\$44,883.20)	Extra Work- By revision in tender prices, or by negotiated price for a new item and by variation in tender quantities	Design scope changes	Owner ordered enhancement	
76	This Change Order was issued as a PQP adjustment for Granular 'B' Type II in order to eliminate any surplus material and avoid unnecessary crushing.	(\$254,885.00)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments?	
77	This Change Order was issued as a PQP adjustment for additional Wildlife Fencing and Brace Panels that were required each Swing Gate. These quantities were missed in the quantity sheets.	\$28,707.00	Additional Work- By Variation in Tender Quantities	Design scope changes	Design errors and omissions	
78	This Change Order was issued as a PQP adjustment for Removal of Steel Beam Guide Rail and Rock Excavation for Trenches and Associated Structures.	\$1,872.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
79	This Change Order was issued to compensate the Contractor for gates, ditching and berming required at AP 402-031 and AP 402-016. This extra work was requested by MTO geotechnical section.	\$7,658.47	Additional Work- Lump Sum	Design scope changes	Owner ordered enhancement	
80	This Change Order was issued as a PQP adjustment for Rock Excavation for Electrical Installations, Sectional Steel Poles, Base Mounted and Concrete Footings in Rock. MTO Planning and Design stated that monitoring posts at the Wildlife Underpass and Joint Use Culverts will not be required.	(\$20,659.20)	Extra Work- By Variation in Tender Quantities	Design scope changes	Owner ordered enhancement	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
81	This Change Order was issued to compensate the Contractor for dewatering, additional earth excavation, drilling and concrete due to the lower rock elevation. This Change Order is in addition to Change Order No. 54 regarding the relocation of the Tri-Chord Sign at Sta. 11+630 NBL.	\$22,406.76	Extra Work- Time and Material	Design scope changes	Project definition omission	
82	This Change Order was issued as a PQP adjustment for additional Earth Excavation at Culvert Nos. 48, 50, 52 and 45 to remove unsuitable material.	\$2,140.00	Extra Work- By Variation in Tender Quantities	Latent conditions	Geotechnical	
83	This Change Order was issued after an agreement between the MTO, AECOM and the Contractor during Progress Meeting No. 19, to reduce the wick drain item by 16,666.66m primarily based on the lack of preaugering and failure adhere to amendments and instructions as well as errors during the installation of Wick Drains.	(\$94,217.34)	Extra Work- By Variation in Tender Quantities	Design scope changes	Design errors and omissions	The Special Provision for wick drains and the design calculations were faulted as the wick drain quantity was calculated at 1 wick drain per 2.25 square metres where the drawings identified 1 wick drain per 1.95 square metres. Ultimately, 1 wick drain per 2.62 square metres was installed to avoid a significant over-run.
84	This Change Order was issued as a PQP adjustment for Pipe Subdrains that were detailed in the drawings but missed in the quantity sheets.	\$10,920.00	Extra Work- By Variation in Tender Quantities	Design scope changes	Design errors and omissions	
85	This Change Order was issued to compensate the Contractor for constructing a concrete slab to secure danger rock at the Wildlife Underpass SBL after Mechanical scaling was unsuccessful in pulling down the hazard rock at this location.	\$4,975.80	Extra Work- Lump Sum	Latent conditions	State of the structure	
86	This Change Order was issued for the substitution of approximately 27,000 tonnes of excess Granular 'B' Type II from surcharges for Granular 'A' from Sta. 21+320 - 22+376 (Servos Twp.) and Sta. 10+000 - 12+326 (Burwash Twp.). There was no additional cost of cost savings associated with this Change.	\$0.00	Extra Work- Lump Sum	Material	Quantity adjustments	
87	This Change Order was issued for the substitution of approximately 6,500.00 tonnes of Select Subgrade material with excess Granular 'B' Type II from surcharges from Sta. 21+230 - 21+320 SBL.	(\$27,950.00)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
88	This Change Order was issued as a PQP adjustment for additional Steel Beam Guide Rail and Steel Beam Energy Attenuating Terminals required for the protection of the traveling public on the NBL.	\$10,525.00	Extra Work- By Variation in Tender Quantities	Traffic and safety issues		

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
89	This Change Order was issued as a PQP adjustment for additional Earth Excavation, Cutting Existing Pavement and Removal of Asphalt Pavement at various locations.	\$14,849.80	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
90	This Change Order was issued to compensate the Contractor for Daily Work Records submitted July 13 & 14, 2010 regarding a soft spot encountered from Sta. 19+675 - 19+690 NBL.	\$3,473.66	Extra Work- Time and Material	Latent conditions	Geotechnical	
91	This Change Order was issued for the Contractor's proposal to relocate the diversion channel during the construction of the Rock Bay Culvert with no cost savings and no additional costs to the owner. It was agreed that payment for the work would be made at the tender item prices for the work at the rock bay culvert.	\$0.00	Extra Work- By Variation in Tender Quantities	Not a risk		
92	This Change Order was issued as a PQP adjustment for Rock Excavation for Trenches and Associated Structures, Earth Excavation for Structures, Rock Excavation for Structures and Rock Excavation for Electrical Installations to reflect updated quantities generated by HDS.	(\$81,891.66)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
93	This Change Order was issued as a PQP adjustment for Removal of Guide Rail End Treatments, Single Rail Steel Beam Guide Rail and Steel Beam Attenuating Terminal at various locations.	\$8,978.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
94	This Change Order was issued to compensate the Contractor for the removal of scab from upper chase to the left barrier wall and right barrier wall at the NBL Lowering Structures prior to waterproofing and paving operations. The Lowering Structures were constructed by another Contractor.	\$1,000.00	Extra Work- Lump Sum	Latent conditions	State of the structure	
95	This Change Order was issued as a PQP adjustment for Form and Fill Grooves at NBL Lowering Structures and Hwy 637 Interchange in order to conform to OPSD 3370.101.	\$2,812.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
96	This Change Order was issued as a PQP Adjustment for placement of Rock Protection in the median at Christine's Turtle Culvert, Joint Use Culvert and South Sheppard Lake Turtle Culvert to prevent erosion.	\$19,532.20	Extra Work- By Variation in Tender Quantities	Permits and regulations	Environmental regulations	
97	This Change Order was issued as a PQP adjustment for Delineator Posts required at the Hwy 69 entrance at Sta. 15+650 LT. The posts were detailed in the drawings however not included in the quantity sheets.	\$3,159.00	Extra Work- By Variation in Tender Quantities	Design scope changes	Design errors and omissions	
98	This Change Order was issued as a PQP adjustment / Lump Sum to construct the NB Tie-In / Transfer from Sta. 12+610 - 12+840 as a result of revised templates and drawings issued by the designer.	\$68,021.90	Extra Work- By Variation in Tender Quantities / Lump Sum	Design scope changes	Owner ordered enhancement	
99	This Change Order was issued as a PQP adjustment for the removal of additional Granular B Type II from Stockpile surcharge materials.	\$189,800.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	Plan quantity adjustment of stockpiled item to be reused as Granular B material elsewhere in the contract.
100	This Change Order was issued as a PQP adjustment issued for the cost savings associated with the Contractors accepted Electrical Change Proposal No. 4. Change Proposal is based on the elimination of UPC No. 9 and replacement with overhead wires at the NBL Tie-In / Transfer.	(\$4,425.98)	Extra Work- By Variation in Tender Quantities	Material	Request by contractor for alternative material	
101	This Change Order is in addition to Change Order No. 100 and is prepared to compensate the Contractor for 50% of the net construction cost savings resulting from the accepted Electrical Change proposal No. 4.	\$2,212.99	Extra Work- Lump Sum	Material	Request by contractor for alternative material	
102	This Change Order was issued as a PQP adjustment for additional Brace Panels, Wildlife Fencing and Reptile Fencing after a field review was carried out prior to opening Stage 2B traffic on Hwy 69.	\$24,701.60	Extra Work- By Variation in Tender Quantities	Permits and regulations	Environmental regulation	
103	This Change Order was issued as a PQP adjustment to Pavement Marking Obliterating, by Abrasive and Water Blasting and Pavement Marking items as part of the staging requirements to successfully switch traffic on the south service road and Murdock River Road.	\$6,317.10	Extra Work- By Variation in Tender Quantities	Design scope changes	Design errors and omissions	Pavement Marking Obliterating by water blasting (Item No. 57) incurred a significant over-run due primarily to the missed NBL quantities to remove the double solid centre line (design accounted for single) and the solid left edge line from Stage 2b to final configuration (reference Change Order No. 103 + Change Order No. 106 = 26,596 m).

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
104	This Change Order is being issued for additional Reptile Fencing to be installed to fill in gaps between all swamps. James Baxter-Gilbert from Laurentian University recommended the additional reptile fencing be installed based on his monitoring movements of a Blanding's turtle.	\$17,713.65	Extra Work- By revision in tender prices, or by negotiated price for a new item and by variation in tender quantities	Permits and regulations	Environmental regulation	
105	This Change Order was issued as a PQP adjustment for Temporary Flexible Delineator Posts, and Temporary Flexible Delineator Posts Relocation. The Contractor was required to remove the 36 existing damaged posts, supply of 21 new posts and installation of 36 posts (21 new posts & 15 posts supplied by MTO)	\$2,455.00	Extra Work- By revision in tender prices, or by negotiated price for a new item and by variation in tender quantities	Latent conditions	Deterioration of elements	The Contractor was required to install additional flexible delineator posts at the south end transition from 4-lane to 2-lane / SBL to avoid confusion to the traveling public. The distance between the temporary concrete barriers and white line to the right lane was greater than 3.0 m. To remedy this safety concern, flexible delineator posts were placed on both the left and right sides at the south end transition.
106	This Change Order was issued as a PQP adjustment for Pavement Marking Obliterating - By Water Blasting as a result of missing quantities during the final staging of Hwy 69.	\$55,370.40	Extra Work- By Variation in Tender Quantities	Design scope changes	Design errors and omissions	Pavement Marking Obliterating by water blasting (Item No. 57) incurred a significant over-run due primarily to the missed NBL quantities to remove the double solid centre line (design accounted for single) and the solid left edge line from Stage 2b to final configuration (reference Change Order No. 103 + Change Order No. 106 = 26,596 m).
107	This Change Order was issued as a PQP adjustment for Form and Fill Grooves at SBL Lovering Creek & Lovering Lake Road in order to conform to OPSD 3370.101.	\$6,275.20	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
108	This Change Order was issued to compensate the Contractor for miscellaneous work at various locations. Miscellaneous work included removal of silt fence and turbidity curtain on Contract 2007-5189, removal of existing joint filler at SBL Loring Structures and removal of diesel soaked asphalt from accident on SBL Loring Lake Road Structure.	\$4,546.00	Extra Work- Time and Material	Latent conditions	State of the structure	
109	This Change Order was issued to compensate the Contractor for the removal of 23 Steel Beam Energy Attenuating Terminals that were installed for Stage 2A two-way traffic. These are to be replaced with a leaving end treatment as per MTOD 912.534.	\$11,500.00	Extra Work- Lump Sum	Design scope changes	Project definition omission	The Contractor is advised that all reference to MTOD 912.534 in the contract documents shall be revised to OPSD 912.235.OPSD 912.235 is: Guide Rail System, Steel Beam, Leaving End Treatment, Installation
110	This Change Order was issued as a PQP adjustment as a result of an error in the quantity sheets for Removal and Salvage of Temporary Concrete Barriers. It was agreed that the Temporary Concrete Barriers would be removed and disposed off site for a revised unit price.	\$47,250.00	Extra Work- By revision in tender prices, or by negotiated price for a new item	Design scope changes	Project definition omission	The tendered quantity was 10 m. In the course of completing the final staging, it was identified that there were 1,900 m of temporary concrete barrier that needed removal from the site. Change Order No. 110 was issued to pay for this extra after a new price was negotiated for the excessive over-run.
111	This Change Order was issued to compensate the Contractor for the installation of additional temporary flexible guide posts to be installed at the NB Tie-In / Transfer to avoid confusion to the traveling public.	\$6,840.00	Extra Work- By revision in tender prices, or by negotiated price for a new item	Traffic and safety issues		
112	This Change Order was issued as a PQP adjustment for Earth Excavation, Rock Excavation, Rock Face & Rock Embankment to reflect updated quantities generated from HDS.	\$9,288.80	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
113	This Change Order was issued as a PQP adjustment for Ground Wires and Ground Electrodes at CP 1. These quantities were not included in the quantity sheets and it is a requirement as per the electrical code that CP's are properly grounded.	\$950.00	Extra Work- By Variation in Tender Quantities	Design scope changes	Design errors and omissions	
114	This Change Order was issued as a PQP adjustment for Pipe Subdrains and 800mm Pipe Culverts. The Pipe Subdrain quantities were not included in the quantity sheets and the 800mm Pipe Culverts that were to be placed under the wildlife fencing were deleted from the Contract.	(\$13,273.00)	Extra Work- By Variation in Tender Quantities	Design scope changes	Design errors and omissions	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
115	This Change Order was issued as a PQP adjustment for additional concrete required to Plug Culvert No. 68.	\$7,760.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
116	This Change Order was issued as a PQP adjustment concrete in steel column breakaway sign support footings.	(\$13,900.00)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
117	This Change Order was issued for the installation of reflectors on existing steel beam guide rail.	\$1,500.00	Extra Work- Lump Sum	Traffic and safety issues		
118	This Change order was issued as a PQP adjustment for Rock Excavation, Rock Supply, Tack Coat, 800mm Pipe Culvert, Pavement Marking Obliterating - By Water Blasting and Temporary Pavement Marking.	(\$9,053.51)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
119	This Change order was issued as a PQP adjustment for Light Duty Silt Fence Barriers, Straw Bale Flow Checks, Silt Fence Flow Checks and Temporary Rock Flow Checks.	(\$29,713.00)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
120	This Change order was issued as a PQP adjustment for Topsoil and Seed and Erosion Control Blanket.	(\$50,384.70)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
121	This Change order was issued as a PQP adjustment for Earth Excavation, Rock Face, Rip Rap & Ground Mounted Signs.	(\$28,670.00)	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
122	This Change order was issued as a PQP adjustment for Removal of Guide Rail End Treatments, Removal of Anchor Blocks, Removal of Steel Beam Guide Rail, Geotextile, Cable Guide Rail and Anchor Blocks.	\$27,219.50	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
123	This Change order was issued as a PQP adjustment for Steel Beam Guide Rail and Steel Beam Energy Attenuating Terminals.	\$29,997.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
124	This Change order was issued as a PQP adjustment for Single Rail Steel Beam Guide Rail with Channel, Lapping Of Steel Beam Guide Rail, Steel Poles, Base Mounted, Loop Detectors and Reptile Fencing.	\$29,142.85	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
125	This Change order was issued as a PQP adjustment for Asphalt Removal and Temporary Energy Attenuators.	\$34,230.32	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
126	This Change order was issued as a PQP adjustment for Brace panels, Gates and Wildlife Fencing.	\$52,519.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	
127	This Change order was issued as a PQP adjustment for Temporary Concrete Barriers and Temporary Concrete Barrier Relocation.	\$62,714.00	Extra Work- By Variation in Tender Quantities	Material	Quantity adjustments	Item No. 77 Temporary Concrete Barrier (TCB) over-ran (\$103,935.00) primarily due to the fact that the 720 m of TCB identified to be available from a previous contract was not available (reference tender page 228).
128	This Change Order was issued for the purchase of nine Steel Poles, Base Mounted that were delivered to MTO.	\$10,178.19	Extra Work- Lump Sum	Design scope changes	Owner ordered enhancement	
Large Item variation		\$459,336.50		Material	Quantity adjustments	

Total **\$3,074,568.11**

Unresolved Change Orders and Claims

Issue Resolution No.	Cost	Status	Description and Reason for Issue Resolution	Category	Subcategory	Notes
1	\$424,886.84	Submitted to Head Office	Wick Drain - Request for compensation due to change of soil density conditions at Swamps 507 & 508.	Latent condition	Geotechnical	There was difficulty in achieving the desired tip elevation of the wick drains at Swamp 508 between Stations 10+375 and 10+425 in the median and SBL areas. Claim No. 1 has been forwarded to Head Office level.
5	\$1,134,322.31	Submitted to Head Office	Request for Cost Recovery for the Crusher Breakdowns and Delays at Quarries 7 and 8 located on Contract 2007-5189.	Material	Change in material cost	

Total **\$1,559,209.15**

Bonuses / Penalties and Incentives / Disincentives

OPA No.	Description of Item	Cost	Reason	Category	Subcategory
16	SP 25.0 Rap Lot 1 ERS	\$20,500.00	OPSS 313	Material	Bonus
18	SP 25.0 Rap Lot 2 ERS	\$10,134.26	OPSS 313	Material	Bonus
23	Concrete Air Void System Lot 1 Sublot 1-31	\$639.60	OPSS 1350	Material	Bonus
26	Granular A Lot 704	(\$3,750.00)	Tender Document, Pages 90 & 91	Material	Penalties
27	Early Lane Closure Penalty	(\$4,100.00)	Tender Document, Pages 60 & 61	Material	Penalties
28	Early Lane Closure Penalty	(\$5,000.00)	Tender Document, Pages 60 & 61	Material	Penalties
31	SP 12.5 FC1 Lot 1 ERS	\$32,576.93	OPSS 313	Material	Bonus
32	SP 12.5 Rap Lot 1 ERS	\$26,189.75	OPSS 313	Material	Bonus
35	Concrete Air Void System Lot 1 Sublot 31-44	\$1,987.75	OPSS 1350	Material	Bonus
38	Select Subgrade Material, Lot 8 Referee Payment Adjustment	(\$7,085.00)	Tender Document, Pages 90 & 91	Material	Penalties
40	Select Subgrade Material, Lot 13	(\$322.50)	Tender Document, Pages 90 & 91	Material	Penalties
43	Concrete Air Void System Lot 1 Sublot 45	\$255.00	OPSS 1350	Material	Bonus
45	SP 12.5 FC1 Aggregate Density Lot 1	\$30,540.87	OPSS 313	Material	Bonus
46	Granular A Lot 704 Payment Adjustment	(\$2,000.00)	Tender Document, Pages 90 & 91	Material	Penalties
48	SP 12.5 Rap Lot 1 & SP 25.0 Lot 2 ERS Correction	(\$44.16)	OPSS 313	Material	Penalties
50	SP 12.5 FC1 Lot 2 ERS	(\$165.76)	OPSS 313	Material	Penalties
51	SP 12.5 FC1 Lot 3 ERS	(\$11.32)	OPSS 313	Material	Penalties
52	SP 25.0 Rap Lot 5 ERS	\$25,420.00	OPSS 313	Material	Bonus
53	SP 25.0 Rap Lot 3 ERS	\$21,935.00	OPSS 313	Material	Bonus
56	SP 12.5 FC1 Lot 6 ERS	\$35,880.00	OPSS 313	Material	Bonus
59	SP 25.0 Rap Lot 4 ERS	\$25,830.00	OPSS 313	Material	Bonus
60	SP 12.5 FC1 Lot 7 ERS	\$229.51	OPSS 313	Material	Bonus
64	SP 12.5 FC1 Lot 5 ERS	\$34,060.00	OPSS 313	Material	Bonus
65	SP 12.5 FC1 Lot 8 ERS	\$316.24	OPSS 313	Material	Bonus
68	SP 12.5 FC1 Lot 4 ERS	(\$3,373.55)	OPSS 313	Material	Penalties
69	SP 12.5 FC1 Lot 9 ERS	\$31,980.00	OPSS 313	Material	Bonus
70	SP 25.0 Rap Lot 6 ERS	\$2,208.00	OPSS 313	Material	Bonus
71	SP 25.0 Rap Lot 7 ERS	\$27,675.00	OPSS 313	Material	Bonus
72	SP 25.0 Rap Lot 8 ERS	\$27,675.00	OPSS 313	Material	Bonus
81	SP 12.5 FC1 Aggregate Density Lot 2 - 14	\$211,541.14	OPSS 313	Material	Bonus
82	SP 25.0 Rap Lot 10 ERS	\$17,867.79	OPSS 313	Material	Bonus
83	SP 12.5 Rap Lot 2 ERS	\$12,689.03	OPSS 313	Material	Bonus
84	SP 12.5 Rap Lot 3 ERS	\$25,200.00	OPSS 313	Material	Bonus
85	SP 12.5 Rap Lot 4 ERS	\$26,381.29	OPSS 313	Material	Bonus
86	SP 12.5 Rap Lot 5 ERS	\$520.13	OPSS 313	Material	Bonus
87	Concrete Air Void System Lot 1 Sublot 46 - 53	\$288.00	OPSS 1350	Material	Bonus
88	SP 12.5 FC1 Lot 12 ERS	\$44,249.22	OPSS 313	Material	Bonus
90	Concrete Strength 2009-5131-30-01	\$6,716.00	OPSS 1350	Material	Bonus
91	Concrete Strength 2009-5131-30-02	\$700.00	OPSS 1350	Material	Bonus
101	Quality Control Compliance Incentive	\$40,000.00	SP199553	Material	Bonuses
102	Smoothness Payment Adjustment	\$89,561.45	SP103F31	Material	Bonuses
103	PGAC Content Payment Adjustment	(\$113,506.75)	OPSS 313	Material	Quantity adjustments
104	SP 25.0 Rap Lot 6 ERS Revision	\$21,695.00	OPSS 313	Material	Bonuses
105	Compensation for Granular A Surplus	\$83,345.25	SP199538	Material	Quantity adjustments

Total \$797,428.17

Change Proposals (all included in change orders)

No.	Nature of Work	Proposed Cost	Total Calculated Benefit	Rejected / Accepted	Reason for Decision
1	Replace Granular 'B' Type II material for surcharges with Granular 'A'	\$1,012,728.10	\$506,364.05	Rejected	Aecon's scheduling and construction staging.
2	Elimination of the surplus stockpile of Granular 'B' Type II for surcharges with the use of Granular 'A' for surcharges	\$674,500.00	\$337,250.00	Accepted	Cost savings and eliminate surplus material.
3	Substitution of 1.0m thickness of Select Subgrade Material, 0.35m thickness of Granular 'B' with Rock Embankment from Sta. 20+900 to 21+230 SBL	\$42,274.49	\$21,137.25	Accepted	Cost savings and better end product.
4	Elimination of UPC No. 9	\$4,425.98	\$2,212.99	Accepted	Cost savings and eliminate the installation of UPC No. 9 in live traffic.

Total	\$1,733,928.57	\$866,964.29			
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Diesel Fuel Price Adjustment

OPA No.	Description of Item	Adjustment	-	Category	Subcategory
2	October 2009	\$3,333.90		Material	Change in material cost
3	November 2009	\$29,305.33		Material	Change in material cost
4	December 2009	\$22,381.86		Material	Change in material cost
5	January 2010	\$32,584.24		Material	Change in material cost
6	February 2010	\$43,647.91		Material	Change in material cost
7	March 2010	\$46,704.17		Material	Change in material cost
8	April 2010	\$50,646.13		Material	Change in material cost
9	May 2010	\$27,801.88		Material	Change in material cost
10	June 2010	\$23,106.51		Material	Change in material cost
11	July 2010	\$1,606.53		Material	Change in material cost
12	August 2010	\$8,002.95		Material	Change in material cost
13	September 2010	\$9,598.46		Material	Change in material cost
14	October 2010	\$11,328.34		Material	Change in material cost
17	November 2010	\$13,879.24		Material	Change in material cost
20	December 2010	\$7,356.70		Material	Change in material cost
21	January 2011	\$14,608.89		Material	Change in material cost
22	February 2011	\$27,628.71		Material	Change in material cost
24	March 2011	\$22,245.93		Material	Change in material cost
25	April 2011	\$19,960.37		Material	Change in material cost
33	May 2011	\$6,682.58		Material	Change in material cost
34	June 2011	\$26,140.31		Material	Change in material cost
37	July 2011	\$14,388.22		Material	Change in material cost
39	August 2011	\$28,016.51		Material	Change in material cost
41	September 2011	\$18,401.56		Material	Change in material cost
42	October 2011	\$16,159.88		Material	Change in material cost
44	November 2011	\$21,672.21		Material	Change in material cost
47	December 2011	\$4,615.41		Material	Change in material cost
49	February 2012	\$261.22		Material	Change in material cost
54	April 2012	\$7,144.01		Material	Change in material cost
66	May 2012	\$52,573.15		Material	Change in material cost
67	Surcharge Removal (2011-April 2012)	\$52,854.41		Material	Change in material cost
76	June 2012	\$27,071.87		Material	Change in material cost
77	Surcharge Removal (May 2012-June 2012)	\$4,911.32		Material	Change in material cost
89	July 2012	\$61,094.91		Material	Change in material cost
92	Surcharge Removal (July 2012)	\$2,391.76		Material	Change in material cost
94	August 2012	\$28,623.40		Material	Change in material cost
106	September 2012	\$16,987.11		Material	Change in material cost

Total	\$805,717.89				
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Asphalt Cement Index

OPA No.	Description of Item	Adjustment	-	Category	Subcategory
1	October 2009 (SP 12.5 & SP 19.0)	(\$2,284.68)		Material	Change in material cost
2	November 2010 (SP 25.0)	\$20,500.00		Material	Change in material cost
3	Revision to OPA No. 1 & 15	(\$3,644.51)		Material	Change in material cost
4	May 2011 (SP 12.5 FC1)	\$10,150.71		Material	Change in material cost
5	May 2011 (SP 12.5)	\$14,015.96		Material	Change in material cost
6	June 2011 (SP 12.5 FC1)	\$6,355.92		Material	Change in material cost
7	April 2012 (SP 25.0)	\$15,996.30		Material	Change in material cost
8	May 2012 (SP 25.0)	\$113,147.36		Material	Change in material cost
9	May 2012 (SP 12.5)	\$17,523.26		Material	Change in material cost
10	May 2012 (SP 12.5 FC1)	\$100,994.68		Material	Change in material cost
11	June 2012 (SP 25.0)	\$45,715.12		Material	Change in material cost
12	June 2012 (SP 12.5)	\$1,361.17		Material	Change in material cost
13	June 2012 (SP 12.5 FC1)	\$22,463.10		Material	Change in material cost
14	July 2012 (SP 25.0)	\$49,878.40		Material	Change in material cost
15	July 2012 (SP 12.5)	\$48,482.19		Material	Change in material cost
16	July 2012 (SP 12.5 FC1)	\$102,345.45		Material	Change in material cost
17	August 2012 (SP 12.5)	\$6,991.26		Material	Change in material cost

Total		\$569,991.69			
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Northeast Region Project 3

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
1	131m of Temporary Concrete Barriers was not required.	(\$11,790.00)	PQP Quantity Adjustments	Material	Request by contractor for alternative material	
2	Extra Light Duty Silt Fence Barrier was required at 15+200 - 15+300 Rt.	\$13,300.00	PQP Quantity Adjustments	Material	Quantity adjustments	Used for Protection of Species at Risk until Permanent Wildlife Fencing is installed by contract completion. All equipment, labour and materials shall be deemed to be included in the contract bid price for various tender items. No additional payment under item "Light Duty Silt Fence Barriers" will be made.
3	Repairs required to cable guide rail on existing Hwy 69, 19+800.	\$2,370.73	Extra Work - Lump Sum	Latent conditions	Deterioration of elements	
4	Change the Murdock Structure girders from Option 'A' (Precast Members) to Option 'B' (Welded Steel Girders)	\$0.00	Murdock Structure Girder Option		Not a risk	
5	Contractor proposed to utilize used not new Temporary Concrete Barrier left in place at stage completion.	(\$38,130.00)	Cost Savings - Lump Sum	Material	Request by contractor for alternative material	
6	Rock Excavation, Rock Embankment and Earth Excavation updated design quantities.	\$3,679.00	PQP Quantity Adjustments	Material	Quantity adjustments	
7	Culverts to be installed through the Wildlife Fencing at various locations cancelled to prevent wildlife from gaining access to the ROW.	(\$12,100.00)	PQP Quantity Adjustments	Design scope changes	Owner ordered enhancement	
8	Rock Supply, Rock Excavation, Rock Embankment, Rock Face and Earth Excavation updated design quantities.	(\$29,117.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
9	To compensate the Contractor for the restocking of culverts from Change Order No. 7.	\$3,153.26	Extra Work - Lump Sum	Design scope changes	Owner ordered enhancement	Connected to change order No. 7
10	To split the cost saving of Change Order No. 1 with the Contractor	\$5,895.00	Extra Work - Lump Sum	Material	Request by contractor for alternative material	Connected to change order No. 1
11	Earth Excavation updated design quantities.	(\$80,664.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
12	Rock Excavation updated design quantities.	\$99,207.00	PQP Quantity Adjustments	Material	Quantity adjustments	
13	Rock Face updated design quantities.	\$1,497.20	PQP Quantity Adjustments	Material	Quantity adjustments	
14	Rock Embankment updated design quantities.	(\$53,494.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
15	Extra Rock Excavation for Trenches and Associated Structures and Stone Substrate for Precast Concrete Box Culverts at 10+140 SBL	\$3,800.00	PQP Quantity Adjustments	Material	Quantity adjustments	
16	Compensation for extra work involved with handling and sorting excavated muck materials.	\$4,065.63	Extra Work - Time & Material Lump Sum	Material	Change in material cost	
17	Adjustment to switch stage 2 Item No. 74 Temporary Concrete Barrier Relocation with Item No. 73 Temporary Concrete Barrier.	(\$4,440.00)	PQP Quantity Adjustments	Material	Change in material cost	
18	Change Proposal to construct the rock drainage layers in lieu of Granular 'B' Type II.	(\$27,500.00)	Cost Savings - Lump Sum	Material	Request by contractor for alternative material	Improved constructibility
19	To split the cost saving of Change Order No. 18 with the Contractor.	\$13,750.00	Extra Work - Lump Sum	Material	Request by contractor for alternative material	Connected to change order No. 18
20	As measured quantities for Item No. 49 Rock Excavation for Trenches and Associated Structures.	\$14,500.00	PQP Quantity Adjustments	Material	Quantity adjustments	
21	PQP adjustments for Item No. 46 - Rip Rap and Item No. 77 - Seed and Mulch.	\$1,800.50	PQP Quantity Adjustments	Material	Quantity adjustments	
22	For the supply and installation of Freyssinet Anchors at the Crooked Lake Underpass.	\$3,223.22	Extra Work - Lump Sum	Design scope changes	Design errors and omissions	Request for Clarification No. 26 identified that the longitudinal tendon anchors were too large given the precast slab thickness. Crooked Lake Road Underpass revised drawing 319-2 approved the use of Freyssinet or VSL tendons and removed the need for Cona Multi and VSA.
23	PQP adjustment for Item No. 55 - Pavement Markings, re-application to stage 1.	\$3,131.00	PQP Quantity Adjustments	Material	Quantity adjustments	A few missed sections around interchange / north transfer (approximately 50% over-run)
24	Rock Excavation and Rock Face updated design quantities.	\$6,974.43	PQP Quantity Adjustments	Material	Quantity adjustments	
25	Based on DWR, to compensate the Contractor for extra work at Construction Access No. 6.	\$8,223.98	Extra Work - Lump Sum	Construction staging issues		
26	Based on DWR, to compensate the Contractor for removal of an obstruction from the existing culvert at 10+120 Cox existing Hwy 69.	\$1,005.65	Extra Work - Lump Sum	Latent conditions	State of the structure	
27	To compensate the Contractor for the RFC No. 40 regarding Letter No. 67 Traffic Staging 14+885 Delamere to 15+363 Cox.	\$35,335.20	PQP Quantity Adjustments	Construction staging issues	Contractor induced changes to construction staging plans	
28	PQP adjustment for the placement of Temporary Concrete Barriers in lieu of Energy Attenuators.	(\$22,590.00)	PQP Quantity Adjustments	Material	Change in material cost	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
29	PQP adjustment for Item No. 79 - Light Duty Silt Fence.	\$9,000.00	PQP Quantity Adjustments	Material	Quantity adjustments	Used for Protection of Species at Risk until Permanent Wildlife Fencing is installed by contract completion. All equipment, labour and materials shall be deemed to be included in the contract bid price for various tender items. No additional payment under item "Light Duty Silt Fence Barriers" will be made.
30	Rock Face, Rock Excavation, Rock Embankment and Earth Excavation updated design quantities.	\$49,069.00	PQP Quantity Adjustments	Material	Quantity adjustments	
31	PQP adjustments to Rock Excavation and Earth Excavation as per Addendum No. 1 - deleted snowmobile trail accommodation.	(\$17,524.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
32	PQP adjustments to Straw Bale Flow Checks and Rock Flow Checks, as measured in the field.	\$8,500.00	PQP Quantity Adjustments	Material	Quantity adjustments	
33	Rock Face, Rock Excavation, Rock Embankment and Earth Excavation updated design quantities.	\$9,891.00	PQP Quantity Adjustments	Material	Quantity adjustments	
34	To compensate the Contractor for the negotiated quantities of Granular 'A' and Earth Excavation for Structure at the Crooked Lake Underpass.	\$7,550.00	PQP Quantity Adjustments	Material	Quantity adjustments	
35	As per INC 266 and RFC 47, the Contractor is compensated for work left in place after construction. NBL and SBL Pier 2 locations.	\$67,169.00	Extra Work - Lump Sum	Design scope changes	Project definition omission	
36	PQP adjustments to Rock excavation for Trenches and Associated Structures, to reflect measured quantities in the field.	\$2,730.00	PQP Quantity Adjustments	Material	Quantity adjustments	
37	To compensate the Contractor for extra work required with the re-design of the Murdock Structure P3 SBL footing.	\$10,340.00	PQP Quantity Adjustments	Design scope changes	Design errors and omissions	
38	PQP adjustments to Light Duty Silt Fence, to be included at F30A.	\$0.00	PQP Quantity Adjustments	Material	Quantity adjustments	Used for Protection of Species at Risk until Permanent Wildlife Fencing is installed by contract completion. All equipment, labour and materials shall be deemed to be included in the contract bid price for various tender items. No additional payment under item "Light Duty Silt Fence Barriers" will be made.
39	PQP adjustments to Earth Excavation and Stone Substrate, for the construction of a channel at the east side of Culvert No. 37.	\$5,264.00	PQP Quantity Adjustments	Material	Quantity adjustments	
40	PQP adjustments for Earth Excavation for Structure and Rock Excavation for Structure (Mechanical), at the Murdock Structures.	\$33,555.00	PQP Quantity Adjustments	Material	Quantity adjustments	
41	Earth Excavation updated design quantities.	(\$71,640.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
42	Rock Excavation updated design quantities.	\$48,483.00	PQP Quantity Adjustments	Material	Quantity adjustments	
43	Rock Face updated design quantities.	\$12,224.60	PQP Quantity Adjustments	Material	Quantity adjustments	
44	Rock Embankment updated design quantities.	(\$18,816.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
45	PQP adjustments for Reptile Fence, to provide proper end treatment into existing rock face and fill in gap to make the fence continuous.	\$3,549.00	PQP Quantity Adjustments	Design scope changes	Design errors and omissions	
46	As per AECOM's analysis, 35,000 tonnes of Granular 'B' Type II to be cancelled.	(\$365,600.00)	PQP Quantity Adjustments	Design scope changes	Owner ordered enhancement	Pg. 16 of PCR
47	As per Addendum No. 3, Granular 'B' Type II Surcharge is deleted and Culvert No. 100 not required.	(\$20,996.00)	PQP Quantity Adjustments	Design scope changes	Owner ordered enhancement	Pg. 16 of PCR
48	PQP adjustments to Pavement Markings to re-apply white edge line and to apply a double solid line to reduce speeding and passing.	\$26,090.00	PQP Quantity Adjustments	Traffic and safety issues	Maintenance of traffic/staging/auxiliary lanes	
49	To delete the duplication of Culvert No. 37 and 38 under Item No. 33 - Precast Concrete Box Culvert, and Lump Sum payment of \$104,210.37 to compensate the contractor for materials, fabrication and delivery.	(\$231,789.63)	PQP Quantity Adjustments and Extra Work Lump Sum	Design scope changes	Design errors and omissions	Culverts No. 37 and No. 38 were duplicated in Items No. 33 and No. 92. Through discussion with the Ministry's Contracts Office and the Designer, it was concluded that Item No.33, sub-codes 33-3 and 33-4 would be deleted. Because this duplication was missed prior to the Contractor ordering both items, the Ministry agreed to purchase the pre-cast culvert box sections at the invoiced material cost from Anchor Concrete Products Limited (ACPL) plus pay an additional 10% mark-up for delivery to North Bay, Ontario. During negotiations, ACPL was able to sell 13 of the 48 pre-cast culvert box sections, reducing the material invoice cost to \$104,210.37. Change Order No.2012-5101-049 accounted for a \$336,000.00 credit to Item No.33 and a \$104,210.37 debit for supply and delivery of the 35 pre-cast box culvert sections
50	To compensate the Contractor for addressing the erosion issues associated with the drainage of Culverts No. 46 and 47.	\$22,060.00	PQP Quantity Adjustments	Latent conditions	Deterioration of elements	
51	Change Proposal to eliminate underground electrical works at the NBL Transfer and to be replaced with overhead wires.	(\$3,765.30)	CP Cost Savings - PQP Quantity Adjustments	Material	Request by contractor for alternative material	Temporary illumination (overhead versus underground)
52	In conjunction with Change Order No. 51, the Contractor is entitled to cost sharing.	\$1,882.15	Cost Savings Sharing Lump Sum	Material	Request by contractor for alternative material	Connected to change order No. 51
53	PQP adjustment to 1000mm Pipe Culvert, to install 5m pipe extension to improve flow.	\$2,500.00	PQP Quantity Adjustments	Design scope changes	Owner ordered enhancement	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
54	PQP adjustment to Tremie Concrete, as a result of dimensions detailed in the cofferdam working drawings and designers recommended Tremie concrete thickness of 1.2m.	\$21,600.00	PQP Quantity Adjustments	Design scope changes	Owner ordered enhancement	
55	PQP adjustment to Reptile Fencing, to provide continuous run of fencing at 13+500 - 13+900 Lt Delamere.	\$5,265.00	PQP Quantity Adjustments	Design scope changes	Design errors and omissions	
56	PQP adjustments to H-Piles and Mass Concrete, to reflect actual quantities.	\$66,147.40	PQP Quantity Adjustments	Material	Quantity adjustments	
57	Earth Excavation updated design quantities.	(\$107,368.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
58	Rock Excavation updated design quantities.	\$172,404.00	PQP Quantity Adjustments	Material	Quantity adjustments	
59	Rock Embankment updated design quantities.	\$24,768.00	PQP Quantity Adjustments	Material	Quantity adjustments	
60	To settle negotiations over compensation for remedial work required due to out of tolerance H-piles as per NCR 24 and 25.	\$30,000.00	Extra Work - Lump Sum	Material	Quality issue	
61	A revision to the tender price for Rock Embankment as negotiated to account for a design change by the owner.	\$77,660.00	Extra Work - design change premium	Design scope changes	Owner ordered enhancement	
62	Replaced By Change Order No. 63	\$0.00	Replaced By Change Order No. 63	Not a risk		
63	Murdock Structure steel girder restraint system shall be installed to provide stability prior to deck placement.	\$0.00	Extra Work	Design scope changes	Owner ordered enhancement	
64	PQP adjustment for Rock Excavation for Trenches and Associated Structures, due to existing rock conditions.	\$8,350.00	PQP Quantity Adjustments	Latent conditions	Geotechnical	
65	PQP adjustments to Temporary Concrete Barrier and Temporary Concrete Barrier Relocation, Barriers at 15+830- 16+090 Lt Cox no longer required.	(\$16,800.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
66	Rock Embankment and Earth Excavation updated design quantities.	\$16,050.00	PQP Quantity Adjustments	Material	Quantity adjustments	
67	PQP adjustment to cancel 18 Rock Flow Check Dams, as rock grading and ditching has been completed without the need of Flow Checks.	(\$18,000.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
68	PQP adjustment to Wildlife Fencing - Ungulate, to tie-in and close off fencing to rock cuts and rock embankments.	\$1,443.00	PQP Quantity Adjustments	Design scope changes	Design errors and omissions	Pg 19 of PCR
69	This Change Order was issued for the work associated with repairing/patching pot holes on the existing Highway 69.	\$7,857.93	Extra Work - Time and Material	Latent conditions	Deterioration of elements	
70	PQP adjustment to Single Rail Steel Beam Guide Rail, eliminating 13+865 - 13+935 Lt.	(\$4,690.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
71	PQP adjustments to Rock Excavation, for as measured quantities at Culvert No. 46 and 47.	\$1,080.00	PQP Quantity Adjustments	Material	Quantity adjustments	
72	The supply and installation of WaboSeal to fill the void between the barrier wall on the deck and the barrier wall on the wing wall for the Murdock River Bridges.	\$0.00	Extra Work - Lump Sum	Design scope changes	Owner ordered enhancement	
73	Replaced by Change Order No. 106 and 109	\$0.00	NA	Not a risk		
74	Cancelled	\$0.00	NA	Not a risk		
75	PQP adjustment to Rock Excavation for Structure, to reflect as measured quantities at Culvert No. 49.	(\$14,170.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
76	PQP adjustment to Rock Excavation for Structure, to reflect as measured quantities at Culvert No. 51.	\$28,600.00	PQP Quantity Adjustments	Material	Quantity adjustments	
77	Rock Embankment and Rock Excavation updated design quantities.	\$13,677.00	PQP Quantity Adjustments	Material	Quantity adjustments	
78	PQP adjustments to Steel Beam Energy Attenuating Terminal and Steel Beam Guide Rail, due to accident at 10+080 - 10+120 SBL Lt Cox requiring repairs.	\$3,822.00	PQP Quantity Adjustments	Traffic and safety issues	Damages due to traffic accidents	
79	PQP adjustments to Earth Excavation for Structure and Rock Excavation for Trenches and Associated Structures, to reflect as measured quantities at Culvert C-1.	\$2,590.00	PQP Quantity Adjustments	Material	Quantity adjustments	
80	PQP adjustment to Wildlife Fencing - Reptiles, to prevent reptiles from entering the roadway at Culvert No. 50 and 51.	\$936.00	PQP Quantity Adjustments	Design scope changes	Design errors and omissions	
81	Rock Excavation updated design quantities.	(\$16,074.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
82	This Change Order was issued to have the contractor install Wabo Inverseal at the Murdock River NBL and SBL Structures.	\$10,523.61	Extra Work - Lump Sum	Design scope changes	Owner ordered enhancement	
83	PQP adjustments to Temporary Concrete Barrier, as required during Stage III configuration.	\$4,500.00	PQP Quantity Adjustments	Material	Quantity adjustments	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
84	PQP adjustments to Temporary Concrete Barrier Relocation and Shoulder Rumble Strips - Asphalt, as required during Stage III configuration.	\$3,600.00	PQP Quantity Adjustments	Material	Quantity adjustments	
85	PQP adjustment to Removal of Asphalt Pavement, due to missing quantities in the Quantity Sheets.	\$11,340.00	PQP Quantity Adjustments	Design scope changes	Project definition omission	
86	Area Maintenance Contractor invoice for snow removal and salting on new section of 4-lane highway prior to stage opening.	\$1,178.00	Extra Work - Lump Sum	Traffic and safety issues	Maintenance additions	
87	PQP adjustment to Earth Excavation for Structure, as measured for Concrete Box culvert at 13+206 Cox.	\$1,644.00	PQP Quantity Adjustments	Material	Quantity adjustments	
88	Replaced By Change Order No. 108	\$0.00	NA	Not a risk		
89	PQP adjustment to Wildlife Fencing Ungulates, to add fencing between the NBL and SBL Murdock Structure abutments, North and South sides.	\$2,925.00	PQP Quantity Adjustments	Design scope changes	Design errors and omissions	Pg 19 of PCR
90	PQP adjustment to Turbidity Curtain, extra 8m was required to connect the curtain to the shore at Ink Lake.	\$3,600.00	PQP Quantity Adjustments	Latent conditions	State of the structure	
91	The Contract revised Swing Gate post connections for the agreed upon credit of \$750/gate.	(\$7,500.00)	PQP Unit price Adjustments	Material	Change in material cost	
92	PQP adjustment to Turbidity Curtain, extra 15m was required to connect the curtain to the shore at Ink Lake.	\$0.00	PQP Quantity Adjustments	Latent conditions	State of the structure	
93	Tri-Chord Sign not required. PQP adjustment to Concrete in Ground Mounted Sign Support Footings and agreed upon Lump Sum price for the supply of Footing Anchors.	(\$26,048.00)	PQP Quantity Adjustments and Lump Sum	Material	Quantity adjustments	
94	Tri-Chord Sign not required. Agreed upon 50% of Relocation of Overhead Sign Support Structure, to deliver to the adjoining contract.	(\$18,000.00)	PQP Quantity Adjustments	Design scope changes	Owner ordered enhancement	
95	PQP adjustment to install extra hand hole at the NEW Ramp due to hydro pole conflicts.	\$535.00	PQP Quantity Adjustments	Utility conflict		
96	PQP adjustment to Single Rail Steel Beam Guide Rail and Steel Beam Energy Attenuating Terminal System to provide protection around pier rock at Crooked Lake Road Structure.	\$7,769.00	PQP Quantity Adjustments	Design scope changes	Project definition omission	
97	PQP adjustment to Wildlife Fence - Reptiles and Wildlife Fence - Ungulates, to close off wildlife access in various areas.	\$12,753.00	PQP Quantity Adjustments	Design scope changes	Design errors and omissions	
98	PQP adjustment to Wildlife Fence - Reptiles and Wildlife Fence - Ungulates, to close off wildlife access in various areas and provide 2 man gates at Murdock Structure median and 1 man gate at MTO Pit entrance.	\$6,455.25	PQP Quantity Adjustments and Lump Sum	Design scope changes	Design errors and omissions	
99	PQP adjustment to Removal of Steel Beam Guide Rail and Single Rail Steel Beam Guide Rail due to vehicle accident damage at 11+430 SBL Servos.	\$840.00	PQP Quantity Adjustments	Traffic and safety issues	Damages due to traffic accidents	
100	PQP adjustments to Shoulder Rumble Strips Asphalt and Single Rail Steel Beam Guide Rail to tie-in shoulder rumble strips to the previous contract to the north, and provide SBGR protection at Culvert No. 46.	\$2,477.00	PQP Quantity Adjustments	Design scope changes	Project definition omission	

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
101	PQP adjustment to 500mm Pipe Culvert, due to a bell and hydro conflict at Crooked Lake Road private entrance.	\$2,800.00	PQP Quantity Adjustments	Utility conflict		
102	PQP adjustment to Rock Excavation for Electrical Installation, due to no rock at the designed locations.	(\$1,892.70)	PQP Quantity Adjustments	Latent conditions	Geotechnical	
103	PQP adjustment to Steel Beam Energy Attenuating Terminal and Single Rail Steel Beam Guide Rail, to protect the public from ends of Culvert No. 41.	\$8,110.00	PQP Quantity Adjustments	Design scope changes	Project definition omission	
104	PQP adjustment to Shoulder Rumble Strips Asphalt to tie-in to both ends of previous contracts.	\$1,215.00	PQP Quantity Adjustments	Design scope changes	Owner ordered enhancement	Pg 20 of PCR
105	PQP adjustment to Temporary Flexible Guide Posts Relocation, due to damaged posts, only salvaged posts were to be utilized.	(\$1,505.00)	PQP Quantity Adjustments	Latent conditions	Deterioration of elements	
106	PQP adjustment to Earth Excavation as per updated HDS design	\$117,904.00	PQP Quantity Adjustments	Design scope changes	Design errors and omissions	
107	PQP adjustment to Rock Excavation as per updated HDS design	(\$85,671.00)	PQP Quantity Adjustments	Design scope changes	Design errors and omissions	
108	PQP adjustment to Rock Face as per updated HDS design	\$1,774.60	PQP Quantity Adjustments	Design scope changes	Design errors and omissions	
109	PQP adjustment to Rock Embankment as per updated HDS design	\$4,837.00	PQP Quantity Adjustments	Design scope changes	Design errors and omissions	Missing HDS for north end grading
110	PQP adjustment to Small Signs — Ground Mounted — New, Relocation, Removal, and Delineator Posts	\$5,400.00	PQP Quantity Adjustments	Material	Quantity adjustments	
111	Final Adjustments to PQP Items	(\$25,316.75)	PQP Quantity Adjustments	Material	Quantity adjustments	
112	Final Adjustments to PQP Items	(\$36,677.50)	PQP Quantity Adjustments	Material	Quantity adjustments	
113	Final Adjustments to PQP Items	(\$26,644.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
114	Final Adjustments to PQP Items	(\$26,513.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
115	Final Adjustments to PQP Items	(\$25,440.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
116	Final Adjustments to PQP Items	(\$103,000.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
117	Final Adjustments to PQP Items	(\$30,564.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
118	Final Adjustments to PQP Items	(\$32,875.00)	PQP Quantity Adjustments	Material	Quantity adjustments	
			Unclassified =			

Total	(\$395,505.54)
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Other Payment Adjustments

OPA No.	Description	Amount	Category	Subcategory
1	Diesel Fuel Price Adjustment, September 2012 Fuel Index	(\$507.79)	Material	Change in material cost
2	Diesel Fuel Price Adjustment, October 2012 Fuel Index	(\$1,247.68)	Material	Change in material cost
3	Traffic Management Incident No. 1, OPSS 1077	(\$5,000.00)	Traffic and safety	
4	Diesel Fuel Price Adjustment, Sep & Oct 2012 Fuel Index Correction	\$45.82	Material	Change in material cost
5	Diesel Fuel Price Adjustment, November 2012 Fuel Index	(\$8,365.88)	Material	Change in material cost
6	Diesel Fuel Price Adjustment, December 2012 Fuel Index	(\$2,126.58)	Material	Change in material cost
7	PGAC Index - October 2012, OPSS 310	(\$766.16)	Material	Change in material cost
8	PGAC Index - November 2012, OPSS 310	(\$989.64)	Material	Change in material cost
9	Diesel Fuel Price Adjustment, January 2013 Fuel Index	\$1,110.85	Material	Change in material cost
10	Diesel Fuel Price Adjustment, February 2013 Fuel Index	\$13,044.85	Material	Change in material cost
11	Diesel Fuel Price Adjustment, March 2013 Fuel Index	\$4,905.30	Material	Change in material cost
12	Diesel Fuel Price Adjustment, April 2013 Fuel Index	(\$12,791.49)	Material	Change in material cost
13	Diesel Fuel Price Adjustment, May 2013 Fuel Index	(\$21,369.63)	Material	Change in material cost
14	Diesel Fuel Price Adjustment, June 2013 Fuel Index	(\$27,501.11)	Material	Change in material cost
15	PGAC Index - May 2013, OPSS 310	(\$90.52)	Material	Change in material cost
16	Diesel Fuel Price Adjustment, July 2013 Fuel Index	(\$13,015.67)	Material	Change in material cost
17	Diesel Fuel Price Adjustment, August 2013 Fuel Index	(\$3,332.02)	Material	Change in material cost
18	Railway Flagging, Tender Documents Page 41	(\$84,294.20)		Not a risk
19	Diesel Fuel Price Adjustment, September 2013 Fuel Index	(\$2,558.01)	Material	Change in material cost
20	Diesel Fuel Price Adjustment, October 2013 Fuel Index	(\$8,220.74)	Material	Change in material cost
21	Traffic Management Incident No. 2, OPSS 1077	(\$2,500.00)	Traffic and safety	
22	Traffic Management Incident No. 3, OPSS 1077	(\$2,500.00)	Traffic and safety	
23	Traffic Management Incident No. 4, OPSS 1077	(\$2,000.00)	Traffic and safety	
24	Diesel Fuel Price Adjustment, November 2013 Fuel Index	\$2,422.44	Material	Change in material cost
25	Diesel Fuel Price Adjustment, December 2013 Fuel Index	\$6,353.13	Material	Change in material cost
26	Diesel Fuel Price Adjustment, January 2014 Fuel Index	\$7,748.41	Material	Change in material cost
27	Diesel Fuel Price Adjustment, February 2014 Fuel Index	\$15,269.98	Material	Change in material cost
28	Diesel Fuel Price Adjustment, March 2014 Fuel Index	\$7,757.65	Material	Change in material cost
29	Diesel Fuel Price Adjustment, April 2014 Fuel Index	\$5,560.28	Material	Change in material cost
30	SP 25.0 Lot 1 ERS, OPSS 313	\$22,072.50	Material	Bonuses
31	Diesel Fuel Price Adjustment, May 2014 Fuel Index	\$29,529.44	Material	Change in material cost
32	QA Grade Check Penalty, SP314S03	(\$15,750.00)	Material	Penalties
33	Diesel Fuel Price Adjustment, June 2014 Fuel Index	\$4,507.99	Material	Change in material cost
34	SP 12.5 FC 1 Lot 1 ERS, OPSS 313	\$27,820.00	Material	Bonuses
35	Diesel Fuel Price Adjustment, July 2014 Fuel Index	(\$3,740.07)	Material	Change in material cost
36	SP 25.0 Lot 2 ERS OPSS 313	\$27,135.00	Material	Bonuses
37	SP 25.0 Lot 3 ERS OPSS 313	\$25,920.00	Material	Bonuses
38	SP 12.5 FC 1 Lot 1 ERS Correction, OPSS 313	\$5,564.00	Material	Bonuses
39	SP 25.0 Lot 4 ERS, OPSS 313	\$11,319.75	Material	Bonuses

OPA No.	Description	Amount	Category	Subcategory
40	Diesel Fuel Price Adjustment, August 2014 Fuel Index	(\$1,936.44)	Material	Change in material cost
41	SP 25.0 Lot 5 ERS, OPSS 313	(\$23,652.00)	Material	Penalties
42	SP 12.5 FC 1 Lot 2 ERS, OPSS 313	\$12,896.00	Material	Bonuses
43	AVS Lot 16 A & B Referee Testing, OPSS 1350	(\$950.00)		Not a risk
44	Diesel Fuel Price Adjustment, September 2014 Fuel Index	(\$12,159.09)	Material	Change in material cost
45	AVS Lots 1-26, OPSS 1350	(\$17,725.30)	Material	Penalty
46	Coarse Aggregate Referee Testing, OPSS 1002	(\$565.00)		Not a risk
47	Diesel Fuel Price Adjustment, June, July, August 2014 Fuel Index Correction	(\$818.61)	Material	Change in material cost
48	SP 12.5 FC 1 Lot 3 ERS, OPSS 313	\$36,400.00	Material	Bonuses
49	SP 12.5 FC 1 Lot 4 & SP 25.0 Lot 6 ERS, OPSS 313	(\$8,450.25)	Material	Penalties
50	SP 12.5 FC 1 Lot 5 ERS, OPSS 313	(\$2,632.59)	Material	Penalties
51	Asphalt damage credit, OPSS 313	(\$1,500.00)	Material	Penalties
52	PGAC Index - 2014, OPSS 310	\$62,294.37	Material	Change in material cost
53	Diesel Fuel Price Adjustment, October 2014 Fuel Index	(\$4,249.52)	Material	Change in material cost
54	Diesel Fuel Price Adjustment, November 2014 Fuel Index	(\$4,039.43)	Material	Change in material cost
55	Rapid Chloride Permeability - Deck Panels, SP110S11	(\$3,648.44)	Material	Penalties
56	Diesel Fuel Price Adjustment, December 2014 Fuel Index	(\$7,980.64)	Material	Change in material cost
57	SP 12.5 FC 1 Lot 1 - 5 Aggregate Density, OPSS 313	\$86,058.76	Material	Bonuses
58	Diesel Fuel Price Adjustment, January 2015 Fuel Index	(\$7,310.03)	Material	Change in material cost
59	QA Grade Check Penalty, SP314S03	\$0.00	Material	Penalty
60	Diesel Fuel Price Adjustment, February 2015 Fuel Index	(\$1,315.43)	Material	Change in material cost
61	Diesel Fuel Price Adjustment, April 2015 Fuel Index	(\$10,463.75)	Material	Change in material cost
62	QA Grade Check Penalty, SP314S03	(\$14,250.00)	Material	Penalty
63	Diesel Fuel Price Adjustment, May 2015 Fuel Index	(\$5,188.40)	Material	Change in material cost
64	SP 25.0 Lot 7 ERS, OPSS 313	\$19,237.50	Material	Bonuses
65	Diesel Fuel Price Adjustment, June 2015 Fuel Index	(\$12,430.59)	Material	Change in material cost
66	Granular 'A' Referee Testing, OPSS 1010	(\$130.00)		Not a risk
67	SP 25.0 Lot 9 ERS, OPSS 313	\$16,584.75	Material	Bonuses
68	SP 12.5 FC 1 Lot 7 ERS, OPSS 313	\$28,600.00	Material	Bonuses
69	SP 12.5 FC 1 Lot 8 ERS, OPSS 313	(\$5,564.00)	Material	Penalties
70	Diesel Fuel Price Adjustment, July 2015 Fuel Index	(\$37,848.71)	Material	Change in material cost
71	Concrete Strength Lot 1-51, OPSS 1350	\$19,125.00	Material	Bonuses
72	SP 12.5 FC 1 Lot 9 ERS, OPSS 313	(\$3,666.00)	Material	Penalties
73	SP 12.5 FC 1 Lot 10 ERS, OPSS 313	\$16,100.00	Material	Bonuses
74	SP 12.5 FC 1 Lot 11 ERS, OPSS 313	\$58.95	Material	Bonuses
75	Diesel Fuel Price Adjustment, August 2015 Fuel Index	(\$20,706.71)	Material	Change in material cost
76	SP 12.5 FC 1 Aggregate Density Lot 6 - Lot 9, OPSS 313	\$55,770.00	Material	Bonuses
77	SP 25.0 Lot 7 ERS, OPSS 313	\$19,237.30	Material	Bonuses
78	Asphalt Repairs, OPSS 313	(\$1,500.00)	Material	Penalty
79	PGAC Index - 2015, OPSS 313	(\$13,448.06)	Material	Change in material cost
80	Segregation Bonus, OPSS 313	\$6,455.15	Material	Bonuses
81	Adjustment to 2014 AC Index	(\$38,039.70)	Material	Change in material cost
82	Adjustments to all Non-PQP Items	(\$1,019,049.43)	Material	Quantity adjustments

Total

(\$902,980.14)

Unresolved Change Orders and Claims

-	Description and Status of Issue	Contractor Estimate	Rejected / Accepted	-
-	Claim #1 Design Error (Shatter) (HEAD OFFICE LEVEL)	unknown	Unresolved Change Orders and Claims	
-	Claim #3 Extra Rock (request Change order) (HEAD OFFICE LEVEL)	unknown	Unresolved Change Orders and Claims	

Total		\$22,000,000.00		
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Northeast Region Project 4

Number	Description	Amount	Method of payment	Category	Subcategory
1	<p>This Change Order is required to show the changes to the original Contract Tender Pg. 51 Item #2 Grubbing Special Provision. Whereas the tender indicates that included in the price of the Grubbing item is the cost to haul and stockpile the grubbing material to MTO Source #AP404035. MTO Geotechnical Section has advised that there was error in contract documents, to stockpile grubbing materials in the identified source. The Contractor was given a choice to place materials within a designated cleared area in the ROW or they can temporarily stockpile materials to be removed and hauled to a new area upon completion. Therefore this change order shall be for any costs associated with this change to Contract Documents by utilizing Option #1 additional hauling if there is sufficient room to stockpile on ROW, or option #2 close cut clear additional area to accommodate the materials.</p> <p>This change order is also to request from Pedersen Construction costs to perform either option. The change order shall cover all direct and indirect costs to perform the work to all applicable Ministry of Transportation standards and specifications</p>	\$6,000.00	Negotiated Lump Sum	Design scope changes	Project definition omission
2	<p>This change order is required to compensate Pedersen construction to install a gate supplied by the owner for the Aggregate Source #404098 located in the Township of James, Lot 8, Conc. 6 in the District of New Liskeard. The Contractor has began screening granular materials SSM and Granular B Type I, to be utilized on the project, however this source did not have an existing gate at the entrance therefore to eliminate unauthorized entry to the Source, a gate must be installed. This change order shall cover all direct and indirect costs to pickup from Owner a supplied gate and install in an approved area within the limits of boundaries in the source.</p>	\$1,950.00	Negotiated Lump Sum	Latent conditions	State of the structure
3	<p>This change order is required to compensate Pedersen Construction for the demobilizing and mobilizing costs for their equipment, as the Ministry was unable to Commission the New Highway due to non-availability of Senior Management Staff.</p>	\$4,420.00	Negotiated Lump Sum	Permits and regulations	Delay of permits
Total		\$12,370.00			

Price Adjustments (Bonuses / Penalties)

Item No.	Description of Item	Cost	Reason		
OP--001	Fuel Price Adjustment for the Month of August 2012 and September 2012	\$1,967.26		Material	change in material cost
OP--002	Fuel price Adjustment for the Month of October 2012.	\$4,619.44		Material	change in material cost
OP--005	Fuel Price Adjustment for the Month of November 2012.	\$1,673.47		Material	change in material cost
OP--006	Fuel Price Adjustment for the Month of June 2013.	\$731.85		Material	change in material cost
OP--007	Granular A	\$23,533.68	This OPA is required to show the difference in quantities for the Granular A Item #5, design used a factor of 2.4 for density of this material. Actual density taken from Proctor information is 2.2 therefore the difference in quantities from tender to actual used. Further Design did not allow for loss of granular materials placed on top of granular sub-base @500 t/km and also 10% loss for allowing traffic over granular surface.	Design scope changes	Design errors and omissions
OP--008	Topsoil, imported	\$21,258.72	This OPA is required to show the difference in quantities for the Topsoil Item #22. Page 52 of contract document states "The disposal shall be covered with topsoil, seeded and mulched in accordance with appropriate tender item as outlined elsewhere in the contract". The quantity sheets do not show any quantity for this work.	Design scope changes	Design errors and omissions
OP--009	Seed and Mulch	\$6,348.40	This OPA is required to show the difference in quantities for the Seed and Mulch Item #23. Page 52 of contract document states "The disposal areas shall be covered with topsoil, seeded and mulched in accordance with appropriate tender item as outlined elsewhere in the contract". The quantity sheets do not show any quantity for this work.	Design scope changes	Design errors and omissions
OP--012	Superpave 12.5 WMA	(\$11,042.64)	Item #4 Superpave 12.5 WMA actual quantity was less than the design quantity	Material	Quantity adjustments
OP--013	Fuel Price Adjustment for the Month of August 2013.	\$3,420.30		Material	change in material cost

Total		\$52,510.48			
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Incentives / Disincentives

Item No.	Description of Item	Cost	Reason		
OP--010	Paving ERS Penalty	(\$35,089.07)	Pay factor = 0.8873	Material	Penalties
OP--011	Referee testing charges for Lot- 1 Asphalt	(\$1,125.00)	Lot-1 tests failed for both QA and Referee		Not a risk

Total (\$36,214.07)

Overruns / Underruns

Item No.	Description of Item	\$	Reason		
6	Granular B, Type I	\$39,229.57	The design considered 2.0 t/m3 for the conversion; The control strip test showed that the unit weight closer 2.1 t/m3	Design scope changes	Design errors and omissions
7	Select Sub-grade Material (compacted)	\$85,825.79	The over run is due to in-accurate ground information given the contract drawings.	Latent conditions	State of the structure

Total

Number	Description	Amount	Method of payment	Category	Subcategory	Notes
1	Cost of control strip and proctor test on pulverized material. The contractor claimed that they are not capable of testing compaction on pulverized material due to technical reasons. The contractor stated they were not responsible for the cost of the control strip or proctor. Review of the Contract did result in some ambiguity related to the responsibility to test compaction of pulverized material. As the Contractor had already carried out the work to construct the control strip this CO was issued as compensation.	\$1,569.51	T & M	Design scope changes	Project definition omission	Review of the Contract Documents details that there may be some ambiguity related to the requirement to test compaction of pulverized material. OPSS 501 includes provisions for QC compaction testing as either method A or Method B. Method B entails nuclear gauge testing with lot, subplot and quality index requirements. Method A simply states the Contractor is responsible for establishing QC procedures. The specification details that Method A shall be used when Method B is not specified in the Contract Documents, it would appear that Method B is not specified in the Contract Documents for the compaction testing of pulverized surfaces. Confirmation of compaction requirements for pulverized material should be reviewed by MTO to ensure appropriate language is detailed in the specifications.
2	Cost of cleaning out silt and other debris from Culvert #11. The pipe liner item does include cleaning/flushing prior to installing liner however significantly more material was present in the culvert than expected. The cause of this silt accumulation is runoff from a nearby farm. The designed noted minimal silt was evident during the design stage.	\$22,866.14	LS	Latent conditions	State of the structure	
3	Pole relocation at Radley Hill Road.	\$1,560.90	LS	Utility conflict	Inaccuracy of existing utility locations and survey data	A hydro pole at Highway 11 and Radley Hill Road was incorrectly aligned (exp site visit on August 21, 2015), therefore the contractor was paid under CO #003 to relocate the pole out of the ditch line. The pole was relocated on September 11, 2014.
4	Unsuitable native material encountered at Sutton Creek Culvert was not suitable as backfill and was replaced with Granular B Type II.	\$12,670.00	PQP & Negotiated Price for New Item	Latent conditions	Geotechnical	
5	Replace four sections of 100D 1800mm concrete pipe, culvert #5. The presence of cobbles and boulders were not identified in the contract documents and during the installation of the culvert there was damage to the newly installed culvert sections. The increase in boring pressures led to the damage of the pipes.	\$40,700.00	LS	Latent conditions	Geotechnical	
6	Item 123: Extension of culvert # 2	\$915.00	PQP	Material	Quantity adjustments	
7	Eliminate Item #159: Supply Control Cabinet.	(\$5,300.21)	PQP	Material	Quantity adjustments	
8	Remove and Replace SBGR due to Traffic Accident at Jelly Hill Road.	\$8,425.20	PQP	Traffic and safety issues	Damages due to traffic accidents	
9	Replace Old Conduit for Flashing Beacon on Hwy 11 and Radley Hill Rd.	\$15,360.00	PQP & LS	Latent conditions	Deterioration of elements	
10	Repair two sections of Concrete Pipe Culvert #5.	\$6,500.00	LS	Latent conditions	Geotechnical	
11	Placement of Concrete in the Bottom of Culvert #6.	\$24,467.40	LS	Latent conditions	State of the structure	
12	Monitor Settlement Culvert #10.	\$1,415.88	T & M	Latent conditions	Geotechnical	
13	Install Tarp on the Northwest side slope station 12+530 Culvert #10 to protect slope from sloughing in before erosion protection measures could be implemented.	\$441.34	T & M	Latent conditions	State of the structure	
14	Two additional OPP assisted lane closures during the jacking of the Moose Creek Bridge.	\$514.79	T & M	Project schedule issues	-	There were 2 OPP assisted lane closures in the Tender. There was a need for 2 additional OPP assisted lane closures for the jacking and lowering of the structure. The contractor raised up the East end of the structure, locked the jacks in place and completed the work. The OPP returned to site for the removal of the jacks from the East side of the structure. The Contractor required 2 additional OPP closures for the work done at the West end of the structure.
15	Item #30 Removal of Pipes and Culverts adjustment.	(\$382.50)	PQP	Material	Quantity adjustments	
16	Eliminate Item #33 Removal of Anchor Blocks.	(\$1,716.00)	PQP	Material	Quantity adjustments	
17	Chip the mass concrete block that was encountered at all four corners to 75mm below the base of the semi-integral abutments.	\$5,344.70	PQP	Latent conditions	Geotechnical	

Number	Description	Amount	Method of payment	Category	Subcategory
18	Rehabilitation of Settlement of existing road bed at Culvert #10, Scope of work included: Extend the rock protection treatment identified on Sheet 25 to the crest of the foreslope. NW Ditch Outlet - Ditch to be excavated deeper and wider then lined with rock protection.	\$31,680.00	LS	Latent conditions	Geotechnical
19	Negotiated settlement for Claim No. 3 Culvert #5 delay costs.	\$53,762.50	LS	Latent conditions	Geotechnical
20	Repairs at Jelly Hill Road for damaged guiderail due to third party traffic accident.	\$29,870.12	T & M	Traffic and safety issues	Damages due to traffic accidents
21	Construction of a Radius on the West Side of Mr. Trudel's Entrance.	\$968.00	LS	Design scope changes	Design errors and omissions
22	500mm Pipe Culvert Item #13 SC 11 - 19+371 Rt Entrance culvert to remain in place as this culvert was replaced two years ago under the maintenance contract.	(\$2,970.00)	PQP	Design scope changes	Design errors and omissions
23	Deletion of pipe subdrain - Item 073	(\$1,056.00)	PQP	Material	Quantity adjustments
24	Repair SE & SW slopes and ditches on Hwy 11. Compact shoulders and apply granular sealing	\$25,000.00	LS	Latent conditions	Deterioration of elements
25	PQP adjustments to Items 5, 40, 53, 82, 97, 137	(\$9,263.40)	PQP	Material	Quantity adjustments

Total **\$263,343.37**

Other Payment Adjustments

OPA No.	Description	Amount	-	Category	Subcategory
1	Fuel Consumption Index PPC #1	(\$2,032.81)		Material	Change in material cost
2	SP 19.0mm Lot #1 - Hot Mix Pay Factor Calculation Based on QA for Acceptance.	\$6,880.00		Material	Change in material cost
3	SP 19.0mm Lot #2 - Hot Mix Pay Factor Calculation Based on QA for Acceptance.	\$688.00		Material	Change in material cost
4	Fuel Consumption Index PPC #2.	(\$11,730.57)		Material	Change in material cost
5	Fuel Consumption Index PPC #3.	(\$18,246.24)		Material	Change in material cost
6	SP 19.0mm Lot #3&4 - Hot Mix Pay Factor Calculation Based on QA for Acceptance.	\$34,348.00		Material	Change in material cost
7	Item #101 - Measured 1m Extra Due to Cleaning up Ends of the Excavation at Sutton Creek Culvert.	\$26.50		Material	Quantity adjustments
8	Fuel Consumption Index PPC #4.	(\$11,580.82)		Material	Change in material cost
9	SP 12.5mm Lot 1 to 4 - Hot Mix Pay Factor Calculation Based on QA for Acceptance.	\$58,725.00		Material	Change in material cost
10	SP 19.0mm Lot #201 - Hot Mix Pay Factor Calculation Based on QA for Acceptance.	\$579.00		Material	Change in material cost
11	Fuel Consumption Index PPC #5.	(\$9,266.35)		Material	Change in material cost
12	SP 12.5mm Lot 301 - Hot Mix Pay Factor Calculation Based on QA for Acceptance.	(\$4,373.00)		Material	Change in material cost
13	Fuel Consumption Index PPC #6.	(\$431.13)		Material	Change in material cost
14	Fuel Consumption Index PPC #7.	(\$679.03)		Material	Change in material cost
15	Post Pipe Inspection Penalty Item #21 - 1500mm Pipe Culvert	(\$4,042.00)		Material	Penalties

OPA No.	Description	Amount	-	Category	Subcategory
16	Fuel Consumption Index PPC #11.	(\$13.64)		Material	Change in material cost
17	Fuel Consumption Index PPC #12.	(\$1.88)		Material	Change in material cost
18	Fuel Price Adjustment for July 2015	(\$2,379.97)		Material	Change in material cost
19	Fuel Price Adjustment for August 2015	(\$52.22)		Material	Change in material cost
20	Fuel Price Adjustment retroactive to November 2014	(\$4,065.62)		Material	Change in material cost
21	Bonus for AVS testing of 30mpa concrete	\$168.00		Material	Bonuses
22	SP 12.5 Penalty for Lot 117-1 Remainder of Hwy 11 and 65	(\$3,620.03)		Material	Penalties
23	Lot 1 Moose Creek Bridge Stage 1 SP 12.5 Binder Course Bonus	\$118.80		Material	Bonuses
24	Lot 2 Moose Creek Bridge Stage 2 SP 12.5 Binder Course Bonus	\$62.67		Material	Bonuses
25	Lot 3 Moose Creek Bridge SP12.5 Surface Course Bonus	\$40.39		Material	Bonuses
26	Non PQP item adjustments	(\$416,812.97)		Material	Quantity adjustments
27	Non PQP item adjustments	(\$38,166.00)		Material	Quantity adjustments
28	Fuel Price Adjustment - September 2015	(\$863.87)		Material	Change in material cost
29	Smoothness bonus	\$54,547.76		Material	Bonuses
30	Smoothness penalty	(\$30,000.00)		Material	Penalties
31	Asphalt thickness penalties	(\$89,672.03)		Material	Penalties
32	Major Item Underrun - Granular A. Compensation for under run as per the GCs.	\$25,167.22		Material	Quantity adjustments
33	Non PQP item adjustment	(\$0.52)		Material	Quantity adjustments

Total (\$466,679.36) (The sum does not add up)

Unresolved Change Orders and Claims

-	Description and Status of Issue	Contractor Estimate	CA Estimate	-	-
-	Claim # 001 - Compensation for material at culverts. See section 4.1	\$245,524.87	\$0.00	Unresolved Change Orders and Claims	-
-	Claim # 002 - Asphalt thickness review. The contractor stated that there were not enough ways to determine the thickness on the binder course. The contractor was only allowed to core from the surface course. The CSA noted that the specification has changed to allow the contractor to core in to other lifts. The claim was denied at the regional level.	\$49,219.63	\$0.00	Unresolved Change Orders and Claims	-
-	Claim # 003 - TBM retrieval at culvert #10. CSA said that the Contractor tried to resolve the problem to get the TBM unstuck. The MTO/CA told the contractor that it was their problem. The first quote to remove the TBM was \$320,000. By the end of January 2015, the estimated cost was 1.8million. The ACE said that the BH showed that there could have been cobbles and boulders and showed the water level was high. The main factor for the claim being denied was because there was no shoring in place as per the spec. There was a vertical face that sloughed in.	\$1,759,080.65	\$0.00	Unresolved Change Orders and Claims	-

Total \$2,053,825.15 \$830,454.72

Appendix B

Summary of Design Scope Changes

Table A-15: Description of Design Scope Changes Reported at the Design Stage in the Project Sample

Design Scope Change
Change to environmental assessment process
Adding culvert replacement
Change in scope of investigation, design, drawings, and other contract documents to include an on-site temporary detour route
Adding the deliverable of guide rail evaluation report to justify guide rail replacement
Design changes to include an open rail system to maintain view on bridge
Testing for verification of pavement thickness to support geotechnical and pavement design recommendations
Hydraulic analysis of culverts
Environmental sampling for testing of asbestos in culverts

Appendix C

Sample Tender Contract Summary

Table A-16: Description of Contract Clauses Found in the Tender Contracts of the MTO Projects

Specification	Responsibility	Description	Consequence
Preparation for Seasonal shutdown	Contractor	Prior to “seasonal shutdown”, the Contractor shall complete all partial depth pavement removal and paving operations on all lanes, shoulders, structures and ramps. The Contractor shall schedule his operations such that the minimum acceptable pavement structure for “seasonal shutdown” will be either the existing full depth pavement structure or the new proposed pavement structure up to and including the upper binder course. The Contractor shall schedule and carry out his operations in accordance with these requirements, using any required acceleration.	Compensation for all such work shall be deemed to be included in the Contract price for the appropriate tender items and no additional payment shall be made. In addition, All hot mix paving work performed by the Contractor to meet seasonal shutdown requirements, that do not meet the full requirements, shall be considered temporary paving and all costs associated with the placement and subsequent removal of the temporary pavement shall be at the Contractor’s expense.
Obtaining permits to Areas Outside of the Highway Right-of Way	Contractor	The Contractor must apply for and obtain all necessary clearances and approvals from all Provincial Ministries, Conservation Authorities, federal agencies and municipal authorities for activities including, but not limited to, permission to store or place surplus materials in areas outside of the highway right-of-way. The Ministry makes no assurances that areas not identified as environmentally sensitive, will automatically be granted approval for disposal sites.	Applications and fees will be the responsibility of the Contractor, at no additional cost to the contract. Should disposal in areas adjacent to the right-of-way be denied for any reason, the Ministry will not be held responsible for any additional associated costs incurred by the Contractor caused by such denial whether direct or indirect.
Taking of Water for Consumptive Use	Contractor	All costs associated with the taking of water; and the recording, summary and submission for the consumptive use of water shall be deemed to be included with those tender items requiring the use of water	no additional payment shall be made.

Specification	Responsibility	Description	Consequence	
Location and Storage of Materials and Equipment	Contractor	Material and Equipment shall not be stored within 4 m of the traveled portion of any roadway.	The Contractor shall, at his own expense, remove any vehicle, equipment or material which, in the opinion of the Contract Administrator, constitutes a traffic hazard or obstruction to maintenance operations.	
Lane Closures	Contractor	On each occasion when the Contractor closes lanes to traffic earlier than the specified times	The Contract Administrator will assess the Contractor an initial penalty of \$ 500.00 and a further penalty of \$ 50.00 per minute will be assessed against the Contractor for every minute outside the permitted closure window that the traffic lanes are not open to traffic.	
Lane Closures	Contractor	On each occasion when the Contractor fails to reopen the traffic lanes by the specified time	The Contract Administrator will assess the Contractor an initial penalty of \$ 500.00. The contractor has 15 minutes to reopen the lane otherwise a further penalty of \$ 50.00 will be assessed against the Contractor and then a penalty of \$ 50.00 per minute will be assessed against the Contractor for every minute that the traffic lanes are not open to traffic.	
Lane Closures	Owner	If an authorized third party stipulates that additional OPP-assisted lane closures or speed control activities are required	The Owner will compensate the Contractor for the cost of the OPP services as a Change in the Work	
Placing Hot Mix Asphalt before winter shutdown	Contractor	If the Contractor does not comply with the restrictions on placing earth, rock or granular materials over frozen ground, ice or snow before the winter shutdown	The Contractor shall be responsible for the costs of removal and replacement of the pavement, granular and subgrade materials, subdrains, pavement markings, temporary traffic barriers, signs and other associated work and the provision of traffic control where removal and replacement is deemed necessary by the Contract Administrator.	In addition, the Contractor shall be responsible for the costs incurred by the Owner in maintaining the roadway in a condition satisfactory for the travelling public during winter shutdown, excluding the costs of applying de-icing salts, abrasives and snow-ploughing operations. And payment at the contract prices for the work will be withheld until any necessary removal and replacement of the roadway has been completed after it has thawed in the spring.
Placing Hot Mix Asphalt before winter shutdown	Contractor	If the Contractor paves over a frozen roadbed or in violation of the temperature restrictions for paving before the winter shutdown	The Contractor shall be responsible for the costs of removal and replacement of the hot mix pavement, granular base and shouldering materials, pavement markings, temporary traffic barriers and the provision of traffic control.	
Surface Smoothness of Asphaltic Concrete	Contractor	In case of any incident of localized roughness	The contractor shall repair or receive a payment adjustment for the work and shall be responsible for the cost of QA inertial profiler acceptance re-testing. All repairs shall be made entirely at the Contractor's expense.	
Testing of Performance Graded Asphalt Cement (PGAC)	Contractor/ Owner	Referee testing	Referee testing costs shall be borne by the Contractor, unless the referee testing confirms total conformance of the PGAC sample to the Contract Documents when the QA testing did not, in which case the costs shall be borne by the Owner.	
Earth Excavation Grading Check	Contractor	If the finished grade or cross-section is found to be outside the specification limits allowed in this contract, the Contractor shall be required to bring the earth or Rock grade surface to grade within the specified tolerances.	The Contractor shall be charged \$250 per station for finished grade outside of specification limits for each QA grade check. All grading carried out by the Contractor as a result of QA grade checks to ensure minimum tolerances will be completed at no additional charge to the Owner.	

Specification	Responsibility	Description	Consequence
Backfill for Over-excavation	Contractor	backfill for any over-excavation in excess of the specified tolerances	No payment shall be made
Granular Sealing requirement	Contractor	Any lot of sealer which does not meet all contract requirements will be subject to a price adjustment. Except when the lot sample has been delivered within the maximum number of business days after sampling as specified elsewhere in the contract and testing is not started within 14 calendar days of sampling.	Subject to price adjustment
Temporary Hot Mix Pavement Quality Assurance	Contractor	The Contractor shall repair all defects in the materials and workmanship of the temporary hot mix pavement to ensure a safe and smooth riding surface.	No payment will be made for the labour, equipment, and materials required to repair potholes and associated work including, but not limited to, traffic control, pavement markings and shoulder materials. Timing of pothole repairs shall be according to the Owner's maintenance standard current at the time of repair.
Temporary Hot Mix Pavement Quality Assurance	Contractor	If lane closure is required for repairs	The Contractor will be charged \$500.00 each time that a lane(s) constructed with temporary hot mix pavement is closed to traffic by the Contractor.
Temporary Hot Mix Pavement Repair Delay	Contractor	There is a penalty to the contractor if a delay in the start of repairs occurs beyond the 24 hours after the time that the Contractor is given written notification by the Contract Administrator that a deficiency has been observed in the Temporary Hot Mix Pavement. Or each time that uncompleted repair work stops and the time that it resumes.	The penalty is \$30 per hour for each hour
Temporary Hot Mix Pavement Repair	Contractor	If the Owner makes the repairs	Repair delay charges and lane rental charges will be assessed against the Contractor in accordance with the contract requirements as if the Contractor had made the repairs
Temporary Hot Mix Pavement	Contractor	If the Owner incurs additional contract administration costs because of repairs by either the Contractor or the Owner	The Owner will deduct the additional costs from the payment due to the Contractor.
Referee Testing for Thickness of Superpave 12.5FC 1 - 50 mm lift thickness	Contractor/ Owner	If the referee test result is 5.0 mm or more greater than the original QA test result, the Owner will bear the cost of the thickness measurement referee testing. If the referee test result is not 5.0 mm or more greater than the original QA test result for the subplot retested, the Contractor will be charged the cost of the referee testing.	The referee testing results will determine who bears the cost of the testing

Specification	Responsibility	Description	Consequence
Retained Soil System (RSS)	Contractor	The Contractor shall submit a warranty to the Owner to address all deficiencies identified by the Owner related to the performance of the RSS for a period of 36 months from the date of certification of completion of the Contract.	No payment shall be made for corrective work, including investigation of deficiencies, design of repairs, site access, traffic staging and removal of existing work, except where the corrective work is required as a result other than an act or fault of the Contractor.
Installation the Temporary Advance Information Signs	Contractor	On each occasion when the Contractor fails to install the Temporary Advance Information Signs in accordance with the contract requirements, or fails to remove the signs within two hours of re-opening of the affected roadway.	The Ministry will assess a penalty of \$2,000.00. A further penalty of \$2,000.00 per calendar day, or part thereof, with no maximum penalty, shall be assessed until such time as the Temporary Advance Information Sign is removed.
Dowels in Concrete	Contractor	The Contractor's installation and removal operations shall not cause spalling, cracking, or other damage to the surrounding concrete. Any damage caused by the Contractor's operation shall be repaired in a manner acceptable to the Contract Administrator.	-
Pull Testing of Dowels in Concrete	Contractor	Any installed dowels that fail the pull test shall be removed and replaced by the Contractor. In lieu of removal, dowels can be cut off flush with the concrete surface.	Work must be done at no additional cost to the owner and the cost of additional pull testing shall be at the Contractor's expense and shall be a lump sum of \$1,000 per mobilization to the contract with an additional cost of \$50 per dowel.
Temporary Flow Passage System Capacity	Contractor	The Contractor shall note that there is a risk that the capacity of the temporary flow system may be exceeded during construction in the event that there is a storm event with flows that exceed the flows upon which the design of the temporary flow system is based, and that this will result in flooding of the work zone which may result in additional work and delays.	May result in additional work and delays

Specification	Responsibility	Description	Consequence
Portable Temporary Traffic Signals Supplied by Owner	Contractor	The Contractor shall have the technical representative at the site providing assistance during the initial set-up of the unit. The representative shall remain on site until the unit is operating to the satisfaction of the Contract Administrator. Once a portable temporary traffic signal is put into operation the Contractor assumes all responsibility for the operation and maintenance of the portable temporary traffic signals.	For the installation, no extra payment will be made for any additional manufacturer/supplier site visits. In addition and no additional payments will be made for any maintenance or other costs associated with the operation, maintenance, repair, or replacement of the portable temporary traffic signals.
Time for Completion	Contractor	If the working days limit is not sufficient to permit completion of the Work by the Contractor working a normal number of hours each Day or week on a single daylight/night shift basis, it is expected that additional and/or augmented daylight and night shifts will be required throughout the life of the Contract to the extent deemed necessary by the Contractor to ensure that the Work will be completed within the time limit specified	Any additional costs occasioned by compliance with these provisions will be considered to be included in the prices bid for the various items of work and no additional compensation will be allowed therefore.
Liquidated Damages	Contractor	In case all the Work called for under the Contract is not finished or completed within the number of Working Days	The Contractor will pay to the Owner the sum of \$1,500.00 as liquidated damages for each and every calendar day's delay in completing the Work in excess of the number of Working Days prescribed.