Project Name:	Clevor - Oracle + witness deceased (LOSS)	**Start Date:**	2020-01-01
Project Number:	2001	**Completion Date:**	2021-05-21

Project Details:

Scientific or Technological Objectives:

This project example is based on the Tax Court of Canada judgment for CLEVOR TECHNOLOGIES INC. AND HER MAJESTY THE QUEEN (2019 TCC 166).

the appeal pertains to the Minister's denial of the Appellant's claim for scientific research and experimental development (SR&ED) expenditures of $72,046, which if recognized would entitle the Appellant to refundable investment tax credits under the Act in the amount of $24,991.

[2] The Appellant was unrepresented by counsel. Its only witness was its president, Sheila Maithel. Her evidence established that the Appellant is a Saskatchewan corporation engaged in the business of software development for operational management. Prior to 2013 it had developed a sophisticated project management software application termed the "Clevor Schedule Optimizer" (CSO). The function of the CSO software was that, upon having data inputted respecting variables relevant to execution of a particular project (such as a construction or mining project), the software could relatively promptly determine the timing and sequencing of steps for optimally efficient (i.e., earliest) completion of that project.

[5] The Appellant sought SR&ED benefits from two activities it engaged in in 2013 in conjunction with its commercially successful software, CSO.

[6] The first such project stemmed from the fact that CSO was designed to interface with third party software that provided the "front end" to the customer in the linked operation of the two applications. Ms. Maithal referred to CSO as being the "brains" in such integrated applications, with CSO operating in integrated fashion with such front end applications such as MS Project and Oracle's Primavera P6.

[8] The second activity, reported as an actual SR&ED "project", was the Appellant's 2013 work in seeking to improve CSO by incorporating therein the "best lateness and overhead calculation" to enhance CSO's ability to calculate optimal timelines for the concurrent running of projects.

Field of Science/Technology:

Computer sciences (1.02.01)

Project Details:

Intended Results:	Develop new processes
Work locations:	Commercial Facility
Key Employees:	
Evidence types:	

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[3] Ms. Maithal does not have formal computer or software development training and had not been employed by the Appellant at any relevant time. Throughout 2013 and prior, her father Ravi Maithel, since deceased, was president of the Appellant. I understand that he had a background in computers. Ms. Maithal herself, while an astute and erudite witness, had no personal or direct knowledge of the Appellant's activities in 2013 relevant to this appeal.

[3] ... Her evidence essentially was derived from the content of two letters her late father had written in 2015 in exchanging correspondence with Canada Revenue Agency (CRA) SR&ED auditors - addressing at the audit stage the Appellant's SR&ED claims at issue herein. It was left unexplained why the Appellant did not call to testify any current or former employees of the Appellant who had had any significant involvement in the Appellant's activities in 2013 underlying this SR&ED claim

[4] Testifying for the Respondent was Dr. Mayank Pandey, a CRA employed research and technology advisor (RTA). He has a PhD in engineering management. He was the RTA who advised CRA respecting the subject SR&ED claims. He was accepted as an expert witness without objection from the Appellant. His expert report was filed as Ex. R-1. It pertains to the "second activity", referenced in paragraph 8 below.

[5] The Appellant sought SR&ED benefits from two activities it engaged in in 2013 in conjunction with its commercially successful software, CSO.

[7] ... in or about early 2013 Oracle updated its "application programming interface" (API) code for its new version of Primavera being Primavera P7. This change blocked CSO from integrating with Primavera P7, pending adaptations of CSO's code. While Oracle had published, for reference by software companies with products integrating with Primavera, an explanation of its API changes, that published explanation apparently was insufficiently comprehensive to permit the Appellant to readily ascertain required code changes for CSO.

The most significant underlying key variables are:

applying metaheuristics (unresolved), adding constraints (unresolved), UNDERSTAND 3RD PARTY API's - INELIGIBLE (unresolved)

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Internet searches	10 Articles	Here is an example of a search for prior art pplying+metaheuristics)+(adding+constraints)+machine+learning
Suppliers	1 products	Insufficient documentation of Primavera & Oracle API updates for latest release

Activity #1-1: updates for Oracle (Fiscal Year 2020)

Methods of experimentation:

[13] Regarding the first of these two 2013 initiatives, being the API work, the Appellant in its written submissions asserted that, "this lack of documentation [for the new P7's API code] created scientific or technological uncertainties" saying further that this, "could not be overcome by using standard programming practice/brute force in solving the problem…"

[14] The Appellant submitted also that, the hypothesis generated was that the changes made to the API that affect [the Appellant's] integration could be determined if developers systematically tried various combinations of XML items [an aspect of API code] and added/removed different item fields to eliminate the errors, and warnings, generated when a partial XML file was used to update a project in Primavera 6. The knowledge gained from this systematic investigation improves our understanding of the new schema file and help[s] [the Appellant's] future integration work.

[15] The Respondent (CRA) submits that, "learning about third party products such as Primavera does not constitute a technological advancement." I disagree with this statement only insofar as it does not acknowledge that conceivably technological advancement might be found in the development, through scientific methodology and not standard processes or routine engineering, of some new process for ascertaining the unpublished content of the new P7 API code.

Results:

Conclusion:

The judge commented:

[16] Here, the Appellant's "hypothesis" as above cited is to, "systematically [try] various combinations of XML [an aspect of API code] and [add/remove] different item fields to eliminate the errors, and warnings, generated when a partial XML file [is] used to update a project in Primavera 6." But that does not seem a scientific proposition to be tested by scientific experimentation. Rather, it describes a methodology for seeking to ascertain the nature of the XML element of Primavera P7's API coding, i.e. seeking to acquire knowledge, already possessed by Oracle, of the latter's P7 API code. This proposed procedure, couched as an "hypothesis" - the systematic trying of various combinations of API coding factors - is redolent of a trial and error approach.

[17] In my view, trial and error procedure is routine engineering. In Northwest, "routine engineering" was said to mean, as stated above, "techniques, procedures that are generally available to competent professionals in the field." Certainly trial and

error is a known technique, available to competent professionals in the field. Moreover, there is no reasonable indication that the Appellant's proposed trial and error procedure would be only a minor aspect of, in the greater context, a genuine scientific methodology.

[18] Thus, I do not find here evidence sufficient to permit the conclusion that in dealing with the API issue, SR&ED was engaged in.

Activity #1-2: lateness & overhead calculation factors (Fiscal Year 2020)

Methods of experimentation:

[19] The second activity that the Appellant put forward for SR&ED consideration was the Appellant's 2013 work seeking to incorporate the "best lateness and overhead calculation" to enhance CSO's ability to calculate optimal timelines for concurrently run projects. As explained in the Appellant's written submissions, in 2013, we saw that at times in the optimized schedule that [CSO produced], some projects were significantly delayed while other projects were on time, and at times a given project's total duration was often unnecessarily expanded. Our initial analysis showed that this was due to lateness cost rate setting and lack of project duration control. The investigation into possible solutions to overcome [an] undesirable optimized schedule resulted [sic] based on project lateness and overhead looked at implementing various types of cost calculations to the calculation engine or implementing overhead analysis costing.

[20] The Appellant in its written submissions stated that it had proposed five courses of conduct, described by the Appellant in its submissions as "hypotheses". They were,
1. Lateness - use a lateness cost interest to the lateness cost calculation;
2. Lateness - use a compound lateness cost interest to the lateness cost calculation;
3. Minimize fragmentation - use a standardized project overhead cost;
4. Minimize fragmentation - implement a critical path analysis to find the reason from duration point of view;
5. Minimize fragmentation - implement bottleneck resource analysis to find the reason from resource point of view.

[21] The Appellant further submitted that the first three of these five "potential solutions" were tested using multiple datasets for different test cases including, "composite resource only" dataset, "discrete resource only" dataset and "mixed resources" dataset, plus three dataset sizes - large (greater than 5,000 activities), small (less than 1,000 activities) and medium. The Appellant submitted that it concluded from these tests that incorporation of a compound lateness cost and standard overhead cost produced optimal scheduling results best emulating a human decision.

Results:

22] The Respondent's written submissions, reflective of Dr. Pandey's expert report and opinion evidence, was that here there was no technological uncertainty - as the Appellant had used an established methodology termed "metaheuristics" to resolve the lateness and overhead costs matter. Dr. Pandey in his expert report (Ex. R-1) states that, [a] known way to solve [scheduling problems including involving the addition of each new variable] is to use metaheuristics, which in essence search the solution space based on some algorithms and converge to a solution. There are multiple known ways of using metaheuristics to solve schedule optimization problems. [The Appellant] had already been using such metaheuristics in the existing application for solving schedule/cost optimization problems.

[23] Further,[Dr. Zhou of the Appellant at a meeting dated October 29, 2014 with Canada Revenue Agency officials and others]...explained that new constraints were required to be added in the existing problem to overcome the deficiencies in the existing organizer. However, adding new constraints itself does not represent any scientific or technological uncertainties. It is known that any new constraints to an existing optimizing problem may necessitate adding new heuristics (set of rules) to the existing setup (rule-base) so that the solution space, bounded by constraints, could be explored by a metaheuristics and a final solution could be obtained. The solutions can be further refined using various numerical techniques via iterative simulation.

[24] And finally, the information and supporting evidence provided do not establish that [the Appellant] encountered any scientific or technological uncertainties in either modeling the problem, using the existing metaheuristics in solving the problem at hand or devising/adding new heuristics. At the outset of the claimed work, [the Appellant] was using [a] metaheuristics based solution approach...and they had a stable schedule engine to generate a schedule satisfying all defined constraints and scheduling rules....While the new constraints (adding the lateness cost and overhead cost in a multi-project optimization scenario) added further complexity to the scheduling problem, the facts presented for review do not show that these two constraints/requirements created any [scientific or technological uncertainty] for [the Appellant]. The company had the necessary expertise in applying metaheuristics and adding constraints in schedule/cost optimization problems in a multi-project scenario. Furthermore, the formation and supporting evidence provided for review do not establish that any scientific or technological uncertainties were encountered/addressed at the system level with respect to how the addition of the new constraints would have created uncertainties on the existing technologies/components. As such, while the work was complex and time consuming, requiring algorithm refining, coding and testing to obtain an acceptable solution, the work did not involve experimentation or analyses to resolve scientific or technological unknowns per subsection 248(1) of the Act... [emphasis added]

Conclusion:

The judge stated:

> [25] I accept the expert evidence of the Respondent as expressed above. The Appellant through its sole witness, a non-expert and untrained in computer science, did not present evidence at all sufficient to persuade me that the Respondent's evidence was in error. And I note again that the Appellant called no witnesses with any direct knowledge of the work of the Appellant had done in 2013 (nor explained why it did or could not do so). Nor did the Appellant seek to qualify an expert to testify in response to Dr. Pandey's evidence. Thus, as with the API activity, for this second activity concerning lateness and overhead factors, I deny the claimed SR&ED tax credits.

Project Name:	Kam Press Metal - custom structure (LOSS W COSTS)	**Start Date:**	2020-01-31
Project Number:	2002	**Completion Date:**	2020-02-29

Project Details:

Scientific or Technological Objectives:

This project is based on the Tax Court of Canada judgment for KAM-PRESS METAL PRODUCTS LTD.v. HER MAJESTY THE QUEEN (CITATION: 2019 TCC 246).

[4] Three witnesses testified for the Appellant: Mr. Michael Bobee (“MB”), the founder and the president and general manager of the Appellant; Mr. Chad Bobee (“CB”), the sales and engineering manager of the Appellant and the son of MB; and Mr. Michael Witen, an independent SR&ED consultant to the Appellant prior to and during the taxation years in issue. [5] MB provided a brief overview of the history and business of the Appellant.

The Appellant was established in 1973 by MB and has carried on the business of custom manufacturing since its inception. The Appellant works primarily with metal but occasionally works with other materials as the need arises. One product custom-manufactured by the Appellant is referred to as a memorial niche, which is used to display funeral urns. The memorial niches custom-manufactured by the Appellant are typically made of metal with a glass front.

[6] Prior to the commencement of the Project, the Appellant was approached by a distributor of its custom-manufactured products who wanted to discuss the manufacture of a memorial niche for a church in Alberta. The architect for the church envisioned a memorial niche with a complex design involving both curved and straight sections that would give the effect that the urns were floating in space.
The latter aesthetic required the memorial niche to be as transparent as possible with lighting that supported the desired effect.

Field of Science/Technology:

Mechanical engineering (2.03.01)

Project Details:

Intended Results:	Develop new materials, devices, or products
Work locations:	Commercial Facility
Key Employees:	
Evidence types:	

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[9] The Appellant considered three possible designs. The first design used the traditional materials of metal and glass to construct the memorial niche columns. This design proved too difficult and costly to manufacture.
[10] The second design replaced the metal with tempered glass. This design resulted in a memorial niche column that was heavy and expensive and the components of which would be difficult to ship without breakage and to assemble without weakening the structural integrity of the niche.
[11] The third and final design envisioned a memorial niche constructed of acrylic. The Appellant reviewed various samples of acrylic and concluded that it needed to use high-grade high-strength extruded acrylic. The Appellant acquired the acrylic from a third-party manufacturer of acrylic.

AUTHOR'S NOTE: THE APPELLANT DID NOT PROVIDE EVIDENCE OF RESEARCH ON "READILY AVAILABLE" TECHNIQUES.

The most significant underlying key variables are:

PROBLEM: marketing vs. technology issues? (unresolved)

Technology or Knowledge Base Level:

Activity #1-1: development (Fiscal Year 2020)

Project Name:	Kam Press Metal - custom structure (LOSS W COSTS)	**Start Date:**	2020-01-31
Project Number:	2002	**Completion Date:**	2020-02-29

Methods of experimentation:

Method	Experimentation Performed
Analysis / simulation:	25 alternatives
Trials:	15 runs / samples
Physical prototypes:	2 samples

[13] One issue was the creation of columns of niches that could be combined into the desired arc of columns. The Appellant used 3D computer-aided design software to model the columns. The result of the modelling was then tested using a mock-up built on the factory floor. An important aspect of the design was that the tolerances had to be tight so that the niche columns would line up properly when
combined in an arc.
[14] A second issue was the design of a base for the columns that would support the columns while replicating the arc of the columns. Again, the Appellant used 3D computer-aided design software to identify configurations for the base. The first design was discarded because of its cost. The second design was adopted and several base plates were manufactured and tested using different means to connect
the base plates. The Appellant encountered issues securing the niche column into the baseplate, which it overcame by designing a custom mount attached to the baseplate.
[15] A third issue was the design and manufacture of a traditional extruded and anodized aluminum front beam system for the niche columns. The beams had to interconnect and provide a housing for parts such as the LED light valance. The Appellant encountered issues with regard to such things as the correct position of mounting holes in the acrylic, the manner of cutting horizontal top beams for arced
columns so that they could be joined, and the means of securing corner joint and Tjoint rosette cover plates. The Appellant was able to resolve these issues by trying different spacing for the mounting holes, using a straight cut for all horizontal top beams and trying different means of securing the cover plates.
[16] A fourth issue was the reflectivity of the acrylic panels used in the columns. The Appellant tried different sanding techniques to dull the surface of the acrylic. After that failed to achieve the desired result, the Appellant purchased prefinished panels that addressed the issue.
[17] A fifth issue was the design of a jig to hold the acrylic pieces together during assembly of the columns. After considering and rejecting a two-jig system (one for arced columns and one for non-arced columns), the Appellant designed and constructed a single versatile jig for all columns. The jig was designed to be very robust so that there would be no shifting or flexing during the gluing process and
so that the appropriate pressure would be applied to the joints during the gluing process. The Appellant tested different configurations and structural components before achieving the desired level of rigidity and pressure.
[18] A sixth issue was the cutting of the acrylic sheets and the gluing together of the acrylic shapes in a way that was structurally sound and satisfied the aesthetic requirements of the architect (i.e., maximum transparency). Initial trials using laser-cut acrylic shapes proved unsuccessful because the cut surfaces were not flat, so the Appellant moved to machine-cut acrylic shapes instead. The Appellant encountered difficulty gluing the shapes together in a structurally sound way while maintaining the desired aesthetic. After attempting solutions such as routed grooves in the backplate to allow for proper seating and gluing of the shelves and dividers for assembly with the outer acrylic column pieces, the Appellant determined that it could not solve the assembly issues and outsourced the assembly
of the columns to an acrylic item manufacturing

Results:

THE JUDGE COMMENTED:
[24] Neither party presented an expert witness. In my view, the evidence of an expert witness is not necessarily required to resolve the question of whether an activity is SR&ED.

Conclusion:

THE JUDGE RULED (LOSS + COSTS):
[25] In this case, I do not require the technical assistance of an expert witness to conclude that the activities of the Appellant in furtherance of the Project are not SR&ED. The Appellant was faced with several technical difficulties in the design and construction of the acrylic memorial niche columns, some of which it was able to solve through computer-aided design exercises and trial and error.
[26] The resolution of those issues that were resolved involved the application of standard procedures or routine engineering such as variations in the design of components, in the approaches to the assembly of components and in the materials used to construct components. In my view, the Appellant did not resolve or attempt to resolve any technological uncertainty.
[27] The issues identified and addressed by the Appellant were routine technical issues associated with the design and construction of an existing product using different materials. As stated by Judge Bowman in Northwest Hydraulic, the fact that there may have been some doubt as to the way in which the technical issues would be resolved does not amount to the existence of technological uncertainty.
[28] The Appellant attempted, but was not able, to resolve the problem of how to assemble the niche columns and it

subcontracted that work to an acrylic item manufacturing company. In the absence of evidence to the contrary, I can only infer from this that that company had the experience and expertise to perform the required assembly, which suggests to me that the issues faced by the Appellant in designing and constructing the acrylic memorial niches resulted from a lack of experience and expertise in working with acrylic and not from any technological uncertainty associated with the design and construction of the memorial niches.

[29] I also find that the approach of the Appellant to resolving the issues raised by the Project was one of trial and error. Adopting the words of Judge Bowman, I conclude that the Appellant has not demonstrated that the procedures adopted for the Project accord with established and objective principles of scientific method, characterized by trained and systematic observation, measurement and experiment, and the formulation, testing and modification of hypotheses. This is reflected in the-fact-that-there-is-a-complete-absence-of-documentation-save-for-the-after-the-fact-summaries-prepared-by-the-Appellant's-
SR&ED consultant.

[30] For the foregoing reasons, the appeals are dismissed, with costs to the Respondent in accordance with the Tariff.

AUTHOR'S NOTE: IT IS UNCOMMON FOR THE JUDGES TO CHARGE COSTS TO THE LOSERS OF SR&ED RELATED CASES UNLESS THEY BELIEVED THE CASE WAS FRIVOLOUS.

Significant variables addressed: PROBLEM: marketing vs. technology issues?

Project Name:	CRL Engineering - distributed computing (WIN)	**Start Date:**	2020-02-10
Project Number:	2003	**Completion Date:**	2020-08-31

Project Details:

Scientific or Technological Objectives:

This project is based on the Tax Court of Canada judgment for CRL Engineering Ltd. v. The Queen (2019 TCC 65).

[13] The Appellant is an engineering firm specialized in developing public transit related technology. It was incorporated in September 2009.

[14] Dr. Raman Paranjape, the Appellant's Chief Executive Officer, testified at the hearing. He holds a Ph.D. in engineering and is a professor of Electric Systems Engineering at the University of Regina. The Appellant's Chief Operating Officer, Craig M. Gelowitz, also holds a Ph.D. in engineering. He was present throughout the hearing but did not testify.

[15] The Appellant commenced its SRED activities as early as 2010 and it was ongoing during the subject taxation years. The Appellant described it as "A Real Time Vehicle Arrival Prediction Model for Transitlive" (the "Project"). It was intended to develop the Appellant's web based system using algorithms and a global positioning system ("GPS") data to provide accurate real time for public transit buses.

Field of Science/Technology:

Computer sciences (1.02.01)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Research Facility
Key Employees:	Dr. Raman Paranjape (Electrical Engineering - PhD (1985) / CEO)
Evidence types:	Records of resources allocated to the project, time sheets; Samples, prototypes, scrap or other artefacts; Design, system architecture and source code

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[16] The Appellant argued that the Project involved "developing a physically distributed, multi-computing platform using general purpose computing systems to create, communicate, integrate, analyse and report real-time, dynamic data to users of the transit systems and administrators" and that the technological uncertainty was whether "autonomous computational systems based on general-purpose computing units could be effectively deployed in order to provide accurate and real-time status information to both users and administrators in real-world transit systems". It was argued that the use of "general purpose computing systems" for that purpose is what "creates real scientific uncertainty."

[17] The Respondent (CRA) argues that there was no scientific uncertainty and that the Project involved the use of existing technology, notably Global Positioning Systems or "GPS", and routine engineering or, as described in paragraph (f) of the definition "routine testing of materials, devices, products or processes".

[21] The Appellant described what it called its "over-arching hypothesis" as whether "autonomous distributed computing systems based on general purposes computing units [can] be effectively deployed in order to provide accurate real-time status information to both users and administrators in a real world transit system". The Respondent argues that the Project involved a series of unrelated and un-connected tasks and that there was no real hypothesis.

[22] While the hypothesis appears to be phrased more as a question than an assumption, I find that the Appellant had a "logical plan devised to observe and resolve the hypothetical problem" and that, as such, this criterion is satisfied.

Technology or Knowledge Base Level:

Activity #1-1: Development (Fiscal Year 2020)

Methods of experimentation:

[23] The Appellant indicates that it installed and monitored “a set of computing units on transit vehicles (…) to examine how the system could function” and included various iterations of a code to test some aspect of the operating system that was “regularly updated to evaluate sequentially and progressively more complex options (...) and to examine alternatives”. The Appellant argues that the activities constituted a “progressive and systematic investigation” including adjustments to the sub hypothesis, followed by new testing and documentation.

Results:

Were detailed records kept as the work progressed? THE JUDGE COMMENTED:

[30] The Appellant’s witness explained that “system snapshots were captured on a weekly basis and maintained in a document repository” that were accessible and regularly reviewed. It also maintained a “wiki” that was used to “log data, methods, issues and results”. The documentary evidence, notably Exhibits A 1 and A 3, supported Dr. Paranjape’s oral testimony on this issue.

[31] On balance, I find that the Appellant has satisfied this criterion.

Conclusion:

[26] The Appellant argued that its activities were “focused on understanding the nature and characteristics of physically distributed general purpose multi-computing systems in a hostile and challenging environment”. Its results were reported in a scholarly journal (Exhibit A-2) though the Appellant conceded that its research activities were ongoing. It argued that its research provided a “launching pad for new achievements in distributed computing”.

AS A RESULT THE JUDGE RULED:

[32] On the basis of the documentary and testimonial evidence adduced at the hearing, the Court finds that the Appellant has satisfied the five-factor test described in the case law and that it was engaged in SRED activities during the subject taxation years.

Documentation:

- Offline Documents: weekly system snapshots

Project Name:	Exxon - drilling evidence for SRED (LOSS)	**Start Date:**	2020-03-01
Project Number:	2004	**Completion Date:**	2020-10-29

Project Details:

Scientific or Technological Objectives:

This project is based on the Tax Court of Canada judgment for EXXONMOBIL CANADA LTD. & EXXONMOBIL CANADA HIBERNIA COMPANY LTD. v. HER MAJESTY THE QUEEN (2019 TCC 108).

One of the issues in this case involved 2) the reassessment of EMCHCL to deny EMCHCL's claim that its share of the expenditure incurred in 2005 to drill well B16-54 qualified as an expenditure for "scientific research and experimental development" as defined in subsection 248(1) of the ITA (the "SR&ED Claim").

[57] During 2005, well B16-54 was drilled to a depth of 4,600 metres, at which point the drill bit "torqued off" the bottom of the well and was lost. The principal issue is whether EMCHCL's share of the cost of drilling the B16-54 well in 2005 qualifies as a scientific research and experimental development expenditure. The PSAF states that the cost of drilling well B16-54 in 2005 was $40,964,305 and that EMCHCL's share of that cost was $2,048,215.

Field of Science/Technology:

Environmental and geological engineering (2.07.01)

Project Details:

Intended Results: Improve existing processes
Work locations: Lab
Key Employees:
Evidence types:

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[60] The Appellant (EXXON) submits that the drilling of the B16-54 well was SR&ED because it provided experimental validation of the predictions made using the new/improved RCA methodology developed by Upstream Research Company.

[61] The Respondent (CRA) submits that the drilling of well B16-54 was to delineate the oilfield in the Hibernia southern extension and to satisfy the requirements of EL1093 and that paragraph (h) of the definition of SR&ED excludes drilling for petroleum, which is consistent with the fact that the cost of oil wells is addressed in the definitions of "Canadian exploration expense" ("CEE") and "Canadian development expense" ("CDE") in subsections 66.1(6) and 66.2(5) respectively of the ITA.

Technology or Knowledge Base Level:

Activity #1-1: Activity 1 (Fiscal Year 2019)

This Activity is addressed in Fiscal Year 2019.

Activity #1-1: development (Fiscal Year 2020)

Methods of experimentation:

[62] To support its position, the Appellant submitted the expert reports of Doctor Fairchild and to support her position the Respondent submitted the expert reports of Professor Gringarten.

REGARDING THIS EVIDENCE THE JUDGE COMMENTED:

While these reports provide some interesting technical background, they provide limited assistance with respect to the issue of whether the drilling of well B16-54 constitutes SR&ED.

[64] Having said this, I find that two observations by Professor Gringarten provide useful background to the issue under appeal:

. . . In any case, the validation of a reservoir model cannot rely on a single well but comes from the accumulation of proofs from a series of wells. [46]

. . .

All wells are drilled based on reservoir characterization and reservoir connectivity studies and in turn all wells, from wildcat to appraisal to delineation to development, contribute knowledge that is used to improve the reservoir model and reduce uncertainty. [47]

[65] The primary objectives, incentives and issues in respect of the B16-54 well are described in the presentation to management dated June 16, 2005 as follows:

PRIMARY OBJECTIVES

- Define OWC in Hibernia South by penetrating primary reservoir targets of Layers 2 and 3 between 4500-4800 m (14764-15748 ft) TVDss - tests deepest possible contact.

- De-risk sufficient volumes to determine economic viability of platform facility upgrades and/or an 11 well subsea water injection development.

- Obtain core and fluid samples to characterize reservoir properties with depth to optimize future developments.

INCENTIVES

- The incremental risked STOOIP capture of NFW MM1 is 170 MB in up to 6 fault blocks.

- The risked unit development cost of the Hibernia South development is C$4-5/B.

- Fulfills EL 1093 commitment of C$8 M.

ISSUES

- Depth of OWC in Hibernia South is currently unknown but NFW MM1 will test interval of 4500-4800 m (14764-15748ft) TVDss. RCA and data from MM NFW derisks Hibernia South explicitly.

- Magnitude of potential reservoir quality (permeability and porosity) degradation with depth will be better understood through log and core acquisition. [48]

[66] The e-mail from Mark P. Evans found at Tab 47 of the JBD confirms the reasons for the drilling of the B16-54 well, which was to facilitate and accelerate the development of the Hibernia southern extension, in furtherance of which EL1093 had been obtained on January 15, 2005 (i.e., before the new/improved RCA methodology had been developed).

Results:

THE JUDGE STATED:

[67] The fact that the limited data provided by the B16-54 well, or more accurately sidetrack W, supported the prediction made using the new/improved RCA methodology is not proof that the well was a component of the SR&ED performed to create/improve that methodology. The fact that the path of well B16-54 was chosen to obtain the greatest amount of data at the least cost is also not proof that the well was a component of the SR&ED performed to create/improve the RCA methodology. Both facts are also consistent with the drilling of well B16-54 to facilitate and accelerate the development of the Hibernia southern extension, as stated in the documents at Tabs 42 and 47 of the JBD.

Conclusion:

JUDGE'S RULING & RATIONALE: LOSS

[68] The new/improved RCA methodology predicted the existence of significant amounts of oil in the Hibernia southern extension. Any well drilled in the southern extension subsequent to this prediction could potentially contribute data relevant to assessing the veracity of the prediction. However, common sense and commercial reality dictate that the primary purpose of any such well (even the first one) is not to validate the RCA methodology but rather to obtain data regarding oil in the southern extension. In this case, I find as a fact that well B16-54 was drilled to obtain data regarding oil in the southern extension and to satisfy the requirements of EL1093. The validation of the RCA methodology was incidental to these objectives. This conclusion is consistent with the fact that there was no evidence to tie well B16-54 to the formulation, testing and modification of the RCA methodology.

[69] The drilling of a conventional well, based on the predicted location of oil, to establish whether and to what extent oil is present may be distinguished from the construction of a pilot plant to test a new or improved process or technology. The latter contributes to the resolution of technological uncertainty associated with the construction of a full scale plant while the former incidentally provides data that either agrees with or disagrees with the outcome predicted by the model.

AUTHOR'S COMMENT:

THIS CASE PROVIDES AN EXAMPLE OF THE MINIMUM REQUIRED DEGREE OF DOCUMENTATION REQUIRED. IN THIS CASE THE CLAIMANT DID NOT BENCHMARK VS. EXISTING MODELS. TO SIMILAR WORK IN THE LANDMARK CASES OF NORTHWEST HYDRAULIC CONSULTANTS & RAINBOW PIPELINE WHERE THE CLAIMANTS WERE SUCCESSFUL IN DEMONSTRATING ACCEPTED TECHNOLOGICAL LIMITS & RELATED ADVANCEMENTS IN THEIR FIELDS OF ENGINEERING.

HAD THE CLIENT BEEN ABLE TO PRODUCE RELATED EVIDENCE OF TECHNOLOGICAL ADVANCEMENT THE FACT THAT THE DATA COULD ALSO HAVE COMMERCIAL VALUE/USE SHOULD NOT HAVE NEGATED THE ELIGIBILITY.

Project Name:	Beton Mobile - 14 concrete projects (6 WIN)	**Start Date:**	2020-03-31
Project Number:	2010	**Completion Date:**	2020-07-31

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Durability (x)	(not set)	(not set)	No
air (x)	(not set)	(not set)	No
slump (x)	(not set)	(not set)	No
temperature (x)	(not set)	(not set)	No
density / compression) (x)	(not set)	(not set)	No

The case examined 14 specific projects over a period of 3 taxation years. Ultimately 6 of these projects were found to be eligible

[71] Exhibit AI-1, which is a table detailing the expenses incurred in respect of each project.

[415] [THE JUDGE] I conclude that the activities carried out by BMQ in the context of projects B 10 18, B 11 04, B 11 07, B 12 01, B 12 03 and B 12 07 are SR&ED activities.

7) Project B-10-18: Develop a light self-compacting mortar for mobile concrete mixer
9) Project B-11-04: Analysis of the influence of binders and additives on the performance of self-placing concrete
10) Project B-11-07: Developing an ultra-fast setting mortar for installation in a marine environment
11) Project B-12-01: Development of fast-setting latex-free concrete
13) Project B-12-03: Development of quick-setting latex concrete screed
14) Project B-12-07: Development of repair product for roller compacted concrete

[6] Mr. Jacques Bertrand testified at the hearing. He is an engineer and also one of the founders of BMQ; he was president of BMQ at the relevant times. Gérard Dubé, engineer at BMQ, also testified at the hearing.

[7] The Canada Revenue Agency ("CRA") research and technology advisers ("CRT") , namely Mr. Cédric Durban, who examined the projects for the 2010 taxation year, and Mr. Karim Mimoune, who reviewed projects for the 2011 and 2012 taxation years, also testified. Mr. Durban obtained a doctorate in mechanical engineering in 1997. Mr. Durban began his career as a private consultant in SR&ED; in 2009, he joined the CRA and was working as a CRT with the CRA at the time of the audit. Mr. Mimoune holds a doctorate in mechanical engineering and has worked as CRT at the ARC since 2002.

A. EVIDENCE - CONTEXT OF PROJECTS
1) Business operated by BMQ
[10] Mr. Bertrand is an engineer by training and has been practicing this profession since 1967. He has worked for many years in the field of civil engineering for large projects such as James Bay and Churchill Falls, in which concrete was widely used. He also worked on the construction of the Montreal metro.

[11] Mr. Bertrand and two partners founded BMQ in 1979. Mr. Bertrand testified that at the time, there was a lack of companies capable of meeting the demand for smaller projects, or for more specific projects or for repairs.

[12] BMQ operates as a concrete supplier in the field of prepared and specialized concrete. This company is a leader in this field. Its clients are entrepreneurs who work for public or private construction sites. Most of BMQ's turnover comes from contracts in the public sector. Usually, before the awarding of a contract to BMQ, and particularly when a contract is awarded in the public sector, the concrete mixture to be supplied by BMQ to the contractor is pre-approved by the client and by the contractor, since concrete must meet minimum industry standards.

[13] BMQ supplies fresh concrete using mobile concrete mixers and not “drum concrete mixers”or conventional concrete mixers, which allows it to offer its customers innovative solutions and products to meet the various needs of these in the context of the realization and repair of concrete structures.

Field of Science/Technology:

Civil Engineering (2.01.01)

Project Details:

Intended Results:
Work locations:
Key Employees:
Evidence types:

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

2) Concrete
[16] Concrete is made up of several inputs: cement, sand, stone and drinking water. Various adjuvants can be added, such as entrained air, superplasticizers, colloidal agents and latex. These additives are added to give concrete certain characteristics, such as better resistance or better durability.

[17] BMQ has the recipes for around 300 concrete mixes and develops 15 to 20 per year. According to Mr. Bertrand, the possible combinations of the various inputs are extremely numerous since there are six or seven cements, 100 types of stones, a very large number of types of sand, and 500 to 1000 different additives. The dosage of each of these inputs can also be subject to variations.

[18] A concrete mixture must meet certain standards to be used on public worksites. For example, standard 3101 of the Specifications and General Specifications of the Ministère des Transports du Québec ("MTQ") must be reached. According to Mr. Bertrand, even when inputs have been known for a long time, the needs of the industry change and BMQ seeks to make new mixtures accordingly. In addition, minimum standards are evolving. Standard 3101 is reviewed annually and CSA (Canadian Standards Association) standards are reviewed every five years. For example, Mr. Bertrand explained that the compressive strength standards went from 35 megapascals to 50 megapascals between the 60s and today. In addition, BMQ does not necessarily limit itself to meeting the standards and may seek to improve products even when they already meet the minimum standards. Each concrete mixture must reach certain thresholds, and around twenty tests must be carried out in the laboratory for the mixture to be approved for use on a public site. These tests are aimed, for example, at checking the compressive strength, the chipping resistance and the permeability to chlorine ions.

[19] In addition, other tests are carried out directly on a site before pouring concrete. These tests are carried out while the concrete is still in the plastic state, that is to say while it is still in liquid form. This is an air test, a slump test and a temperature test, which take about ten minutes to do, and a compression / density test, i.e. taking samples in cylinders, which takes about fifteen minutes to do.

3) Research
[20] Mr. Bertrand testified that BMQ has been doing research and development since the end of the 1980s, either to create new products or to improve existing ones. New products are developed either at the request of customers or because industry standards have changed. Sometimes a project can be launched directly by the company, because it always seeks to remain competitive. Both Mr. Bertrand and Mr. Dubé and also Mr. Fournier (the master mechanic of BMQ) can decide to start a project.

[21] With regard to the approach followed by BMQ in the context of the various projects, Mr. Bertrand explained that the company works regularly with the MTQ and various universities. The starting point for a project is usually bibliographic research and discussions with colleagues, industry and university professors. However, the results of studies carried out in places like the United States are not necessarily directly transferable to Quebec, where winter must be taken into account to determine if a concrete is durable; Also, it must be taken into account that the concrete mixture is prepared in a mobile concrete mixer. Then, the hypotheses are fixed: for Mr. Bertrand, the hypotheses are the characteristics sought in a mixture, or, according to Mr. Dubé,

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Internet searches	20 sites / articles	

Patent searches	2 patents
Competitive products or processes	3 products
Similar prior in-house technologies	1 products / processes
Suppliers	3 products
Queries to experts	4 responses

Activity #1-1: Activity 1 (Fiscal Year 2020)

Methods of experimentation:

The case involved examination of 14 separate projects. 6 were deemed eligible & 8 ineligible.

We will examine the successful projects independently in projects 2011-2017.

OVERVIEW OF RESEARCH METHODOLOGY

[22] Subsequently, BMQ begins to test and continues the project if it looks promising after the first tests. BMQ has a laboratory with equipment - such as a balance, sagging cones, an air meter, cylinders, a washing tub, a cold room and a small mixer - to do certain tests. In the laboratory, the concrete is prepared as in a conventional concrete mixer. If a mixture is satisfactory, it must then be checked whether the results are similar when the mixture is produced in the mobile concrete mixer and whether the mixture meets the standards. BMQ uses its own concrete mixers to do this. Durability tests, like those of compressive strength, are carried out by independent laboratories.

[23] The direction research will take will then depend on the characteristics sought. For example, a specific adjuvant can be considered at the start of a project to achieve a certain standard. Mr. Dubé explained that, despite his expertise, he does not always find the solution to a problem on the first try. In addition, BMQ must redo the standard tests (air, slump, temperature and density / compression) to check if the standards are always met each time an element is modified in a mixture.

[24] Two stages must be successfully completed for a mixture to be satisfactory for BMQ. First, the standard air, slump, temperature, and density / compression (cylinder) tests are done in the laboratory; if the results are acceptable, this will be followed by chlorine ion permeability tests, chipping tests and freeze-thaw tests. If at the first stage the results are not satisfactory, BMQ will try to determine the causes and reformulate the mixture to then repeat the tests.

[25] The second step consists in calibrating the mobile concrete mixer and pouring the mixture to carry out the same tests again to ensure that the mixing in the mobile concrete mixer has not affected the characteristics of the mixture. According to Mr. Dubé, three people are required to carry out a test: a mobile concrete mixer operator, a technician qualified for taking samples and himself. Mr. Dubé testified that it took approximately two to three hours to calibrate the mobile concrete mixer.

[26] The analysis of the results is largely carried out by Mr. Bertrand and Mr. Dubé. A meeting with the employees involved in a project, including the technicians who operate the mobile concrete mixer and take samples, is convened when test results are received by the company, because these employees can have an idea about the causes of the failure of a test and must be made aware of the progress of a project.

[27] A project ends either when the objective is reached, or if the objective is not reached and no solution is envisaged to overcome the difficulties.

Results:

i) For the taxation year ending January 31, 2010: $ 3,521 for salaries, $ 427 for materials and $ 360 for costs of subcontractors;

ii) For the taxation year ending January 31, 2011: $ 37,668 for salaries, $ 2,520 for materials and $ 3,425 for costs of subcontractors;

iii) For the taxation year ending January 31, 2012: $ 44,192 for salaries, $ 4,433 for materials and $ 9,204 for subcontractor costs.

DOCUMENTATION:
[28] No report is written at the end of each project. However, Mr. Dubé completes Form T661 Request for Scientific Research and Experimental Development Expenses (“Form T661”) and submits it to the CRA. This form contains a description of the progress that BMQ has attempted to achieve, the obstacles that had to be overcome and the steps taken to implement a project.

[29] Mr. Bertrand explained that, during the years in dispute, he was personally involved in research activities with regard to the conception, design and development of research plans and that he attended conferences related to projects. He also personally participated in field tests, in laboratory at BMQ, as well as in universities.

[30] With regard to expenses, Mr. Dubé testified that, generally, the date, time and a brief description of the tests carried out within the framework of a project are noted in a notebook. Mr. Dubé admits that the notes kept will not necessarily be understandable for another civil engineer, but he is able to understand them and consult his computer files to determine what was done in a project.

[31] Each month, documents relating to a project, such as handwritten notes and emails, are given by the employees to Mr. Dubé, who compiles the hours of work spent on each project in BMQ's computer system. Only employees paid according to hours worked fill out time sheets, which excludes Mr. Bertrand, Mr. Dubé and Mr. Fournier. To calculate the hours spent working on a research project, Mr. Bertrand indicates the time he has spent on a project and gives it to Mr. Dubé, who compiles the hours. Mr. Dubé testified at the hearing that he rounded up the hours indicated on the time sheets.

TIMING OF EVENTS:

DATES OF THE HEARING: April 8, 9, 10, 11 and 12 and May 29, 30 and 31, 2019

REASONS FOR JUDGMENT BY: The Honorable Justice Dominique Lafleur

DATE OF JUDGMENT: December 11, 2019

Conclusion:

Project Name:	10-18: Develop a light self-compacting mortar for mobile concrete mixer	**Start Date:**	2020-03-01
Project Number:	2011	**Completion Date:**	2021-06-30

Project Details:

Scientific or Technological Objectives:

[213] This project is an attempt by BMQ to develop a light self-compacting mortar for mobile concrete mixers. This product was already existing for conventional concrete mixers. However, given the greater flexibility of the mobile concrete mixer, a BMQ client requested that the company develop such a product for mobile concrete mixer. BMQ therefore had to develop a mortar that could be poured between existing storm sewer pipes and new pipes, without deforming them.

[214] Mortar differs from concrete in that it does not contain stones. The term "self-compacting" implies great fluidity - that is, the ability to spread by the sole effect of gravity - while the term "light" means low density, i.e. a high air content in The mixture. The air content sought for the mixture in the context of this project was 20%, but it was also necessary that the resistance of the mortar to compression be at least 20 megapascals.

Field of Science/Technology:

Project Details:

Intended Results:
Work locations:
Key Employees:
Evidence types:

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[220] In the event that the activities carried out by BMQ in the context of this project are qualified as SR&ED activities, the parties' disagreement would only remain with regard to the salaries for which the deduction is claimed by BMQ, which total 1,710 $ and relate essentially to the 34 hours devoted to bibliographic research to find foaming products and equipment as well as to certain discussions between Mr. Bertrand and Mr. Dubé for the development of mixtures, which took place between November 7 and 20 November 2009. The Respondent agrees that amounts totaling $ 2,202 for salaries, $ 427 for materials and $ 360 for costs of subcontractors would be deductible expenses under section 37 and eligible for the calculation of the ITC.

7.2 The parties' submissions
[221] According to the appellant, the existing products and equipment were not designed for the mobile concrete mixer. The uncertainty consisted in the absence of existing data on the ability of the mobile concrete mixer to produce the mortar in question and in the absence of foaming equipment that would be suitable for the mobile concrete mixer. The work enabled BMQ to acquire new knowledge on the limits regarding the capacity of foaming additives and a mobile concrete mixer to produce mixtures with high air content. The project also made it possible to determine that the source of these limits was the mixing process of the mobile concrete mixer. These activities therefore constitute SR&ED activities since they can be qualified as experimental development work undertaken in the interest of technological progress.

[222] According to the respondent, the activities carried out by BMQ cannot be qualified as SR&ED since the whole does not seem complicated. In fact, in less than three weeks, the equipment was designed and the mixture was produced. According to Mr. Durban, BMQ has not deviated from standard methods by using a foaming adjuvant and an air entraining adjuvant whose characteristics precisely consist in generating air in a mixture. Adding air with this equipment designed to add air also had a predictable result, which was to increase the air content.

THE JUDGE RULED
[224] The evidence showed, on a balance of probabilities, that technological uncertainty was present in the case of this project. BMQ was unable to predict whether the generally available experience or knowledge or current practices would meet the criteria required by its client. The objectives set by the client were achievable by using a conventional concrete mixer, but it was impossible for BMQ to predict whether they would be achieved by means of the mobile concrete mixer. Uncertainty existed with respect to the manufacture of a very light mortar product with 20% air that can be installed in storm sewer lines without distorting the old lines. The evidence showed that no data existed regarding the ability of the mobile concrete mixer to produce such mortar.

Technology or Knowledge Base Level:

Activity #1-1: Activity 1 (Fiscal Year 2020)

Methods of experimentation:

[216] BMQ tested several mixtures by trying to successively modify the adjuvants (air entrainer and foaming agent existing on the market) and the cement content of a standard mortar mixture. Air content, temperature, spreading and compressive strength tests were performed on the mixtures as part of this project. Test results demonstrated an air content ranging from 12% to 15%; these results were therefore below the criteria required by the client.

[217] Faced with these unsuccessful tests, BMQ employees worked on the design of equipment to further foam the mixture by injecting compressed air. They were inspired by equipment designed for conventional concrete mixers but which could not be installed on a mobile concrete mixer. BMQ has repeated the tests, but without more success.

Results:

[218] The project was unsuccessful since BMQ failed to obtain an air content of 20% for the mixture. In fact, despite the adjustments to the mixture and the use of the equipment designed by the two BMQ employees, it was not possible to increase the air content of the mixture.

[219] To date, the product that BMQ has attempted to design still does not exist. This project has not been resumed since that time.

Conclusion:

THE JUDGE CONCLUDED

[225] BMQ also sought technological progress, although it was unable to meet the criteria required by its client. Indeed, progress would have consisted in the incorporation in a mixture of mortar produced by means of a mobile concrete mixer of a characteristic, that is the air content of 20%, difficult, if not impossible, until then, to reach in current practice. The fact that this project did not provide the desired product does not exclude the activities from the definition of SR&ED activities. As indicated by Mr. Dubé, BMQ has acquired certain knowledge regarding the limit of the mixing energy of the mobile concrete mixer and the effects of the limited mixing time of the latter on concrete / mortar mixtures.

[226] According to the respondent, given that BMQ employees took only a few hours to adapt equipment designed for conventional concrete mixers to the mobile concrete mixer, this could not be so complicated, and that this indicates that the activities cannot be qualified. SR&ED activities. I do not see how the criterion of difficulty or ease in doing something can be relevant for the purposes of qualifying an SR&ED activity. The evidence showed that the two BMQ employees designed equipment for the mobile concrete mixer based on equipment designed for conventional concrete mixers. These employees could not adapt the equipment designed for the conventional concrete mixer directly to the mobile concrete mixer; thus, I conclude that these activities are not part of current practice.

[227] The evidence also showed that Mr. Dubé systematically studied the problem raised by the low percentage of air in the mixtures tested and did some experimentation to determine the causes of these results. Tests have been performed by an independent laboratory. The assumption was made that the addition of a foaming aid and an air entraining aid and the injection of air would increase the air content of the mortar mixture. I consider that the scientific method was followed by BMQ. Although there was no detailed contemporary account of the tests, the documentation produced at the hearing and the testimonial evidence, particularly the testimony of Mr. Dubé, made it possible to detail the activities undertaken within the framework of this project .

[228] For these reasons, the activities carried out by BMQ in the context of this project constitute SR&ED activities.

Project Name:	11-04: Analysis of the influence of binders and additives on the performance of self-placing concret	**Start Date:**	2020-03-02
Project Number:	2012	**Completion Date:**	2020-12-31

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
achieve 10 Megapascals (hours)	48	24	Yes
achieve 50 Megapascals (days)	28	7	Yes

9.1 Description of the project
[261] This project was set up by BMQ following a request made by Hydro Québec. Hydro Québec needed concrete with certain characteristics in order to be used for repairing the slideways of the floodgates at the Paugan hydroelectric power station. It was important that the valves did not move while the concrete was being poured; thus, the concrete had to dry very quickly without deforming the slides. This concrete also had to meet very precise standards of compressive strength, that is to say a resistance of 10 megapascals 24 hours after installation and 50 megapascals seven days after installation. According to Mr. Dubé, this type of concrete did not exist at the time; what existed was concrete that reached 10 megapascals 48 hours after installation and 50 megapascals 28 days after installation.

Field of Science/Technology:

Project Details:

Intended Results:
Work locations:
Key Employees:
Evidence types:

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[268] According to the appellant, this project meets the definition of SR&ED activities since it involved the creation of a product that did not previously exist and that must have exceptional characteristics. The success of the formulation of a mixture achieving the targeted objectives therefore constitutes technological progress. Consequently, these activities constitute SR&ED activities since they can be qualified as experimental development work undertaken in the interest of technological progress.

[269] According to the respondent, the activities cannot be classified as SR&ED. According to Mr. Mimoune, it is known that the addition of accelerator admixture is used to obtain better resistances more quickly. In addition, no systematic research was carried out within the framework of this project, since BMQ used a method based on trial and error and the available knowledge.

The most significant underlying key variables are:

binders, self compacting concrete effects, mixing energy of mobile mixer, adjuvants

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Internet searches	5 Articles	
Competitive products or processes	6 products	
Suppliers	5 products	Worked with cement supplier Holsten to co-develop customized tertiary cement for use

Activity #1-1: Activity 1 (Fiscal Year 2020)

Project Name:	11-04: Analysis of the influence of binders and additives on the performance of self-placing concret	**Start Date:**	2020-03-02
Project Number:	2012	**Completion Date:**	2020-12-31

Methods of experimentation:

Method	**Experimentation Performed**
Analysis / simulation:	42 alternatives
Trials:	15 runs / samples

[262] Mr. Dubé began by doing visual tests on the setting time of a standard BMQ concrete mixture made from ternary cement. He then tried to increase the amount of setting accelerator aid in the mixture. This modification allowed a faster setting, but was not sufficient to reach high compressive strengths after a short time. To improve the results, BMQ's supplier, the cement manufacturer Holcim, has changed the formulation of its ternary cement several times.

[263] Mr. Dubé also tested mixtures containing “HE” cement and general-purpose cement to compare their resistance at a young age to that of the mixture used in the first tests. He then tried to increase the dosage of cement in the mixture to increase the compressive strength.

[264] Mr. Dubé ended up changing course and opted for a binary cement which had not been used for ten years, instead of the ternary cement initially used. Mr. Dubé also replaced the superplasticizer admixture contained in the mixture with another that he knew was less effective, but which would delay setting less, thus increasing the resistance of concrete at an early age.

[265] According to the timesheets produced in evidence, tests with the mobile concrete mixer and with a pump and large-scale tests were also carried out to validate the mixture. The trials were spread over ten months.

Results:

achieve 10 Megapascals: 24 hours (100% of goal)

achieve 50 Megapascals: 10 days (85% of goal) -- Only achieved 43 MP at 7 days

[266] The results of the tests carried out were not entirely in line with what was sought by Hydro-Québec since the mixture only reached 43 megapascals of resistance instead of 50 after seven days of setting time. However, the mixture was still accepted and used by Hydro Québec.

[267] In the event that the activities carried out by BMQ in the context of this project are qualified as SR&ED activities, the parties' disagreement would only remain with regard to expenses for wages totaling $ 17,146 including the deduction is claimed by BMQ. The respondent agrees that amounts of $ 26,743 for salaries, $ 2,126 for materials and $ 3,425 for costs of subcontractors would be expenses deductible under section 37 and eligible for the calculation of the ITC.

9.3 Discussion

a) Qualification of the project

[270] In the case of this project, BMQ has succeeded in demonstrating that, on a balance of probabilities, the technological uncertainties linked to Hydro-Québec's requests could not be eliminated by usual procedures or current technical studies. Indeed, the evidence has shown that this type of concrete does not exist. Industries using the conventional concrete mixer did not manufacture such a type of concrete. The evidence has shown that BMQ was the first player in the concrete industry to create such a mixture. The objective was to obtain a mixture offering a compressive strength greater than 10 megapascals after 24 hours, while retaining the other properties of self-compacting concrete. Technological uncertainty concerned the creation of such concrete, which had never been created before.

Conclusion:

a) Qualification of the project

[270] In the case of this project, BMQ has succeeded in demonstrating that, on a balance of probabilities, the technological uncertainties linked to Hydro-Québec's requests could not be eliminated by usual procedures or current technical studies. Indeed, the evidence has shown that this type of concrete does not exist. Industries using the conventional concrete mixer did not manufacture such a type of concrete. The evidence has shown that BMQ was the first player in the concrete industry to create such a mixture. The objective was to obtain a mixture offering a compressive strength greater than 10 megapascals after 24 hours, while retaining the other properties of self-compacting concrete. Technological uncertainty concerned the creation of such concrete, which had never been created before.

[271] Also, in response to the examination report (exhibit I - 3, tab 10, p. 6), Mr. Bertrand said: “We are well aware that the binders and adjuvants that integrate the formulations have been the subject studies of their characteristics and their possible effect (s). However, what is not documented and has not been the subject of specific studies is the combination of all these components in the context of self-compacting concrete and mobile concrete mixer with its mixing energy. Hence the presence of technological uncertainties related to the integration and combination of these elements. "

[272] I also note that there is technological progress as required for activities to be qualified as SR&ED. In fact, BMQ incorporated into a product - self-compacting concrete - a characteristic, namely rapid setting, which was not easily accessible in current practice, thus improving the product in question. We can also assume that, if there had been certainty of obtaining the characteristics requested by Hydro - Québec, BMQ would not have been the only company to supply such a product. In this project, BMQ acquired new knowledge on the effects of ternary cement and HE cement on the compressive strength of concrete at a young age.

[273] I do not believe that BMQ simply qualified products as part of this project, as concluded by Mr. Mimoune. On the contrary, BMQ has created a quick setting self-compacting concrete, a concrete that did not exist before. Mr. Dubé could not know that he would achieve the required characteristics since he could not trust any current technical study in this regard.

[274] The evidence demonstrated that the scientific method was followed by BMQ. Numerous tests have been done by independent laboratories, and numerous laboratory reports have been produced in evidence. Assumptions have also been made. Even though BMQ did not draw up a detailed account contemporaneously with the tests, the documentation produced at the hearing and the testimonial evidence, particularly the testimony of Mr. Dubé, demonstrated the progress of the activities.

[275] Thus, for these reasons, the activities carried out by BMQ in the context of this project constitute SR&ED activities

Significant variables addressed: adjuvants, binders, mixing energy of mobile mixer, self compacting concrete effects

Project Name:	11-07: Developing an ultra-fast setting mortar for installation in a marine environment	**Start Date:**	2020-03-04
Project Number:	2013	**Completion Date:**	2021-04-01

Project Details:

Scientific or Technological Objectives:

10.1 Description of the project
[286] This project started when BMQ received a request from a client for a cement mixture based on ultra-rapid cement to be used to seal rock underwater and used as a bridge pillar. A mortar mixture intended to be installed underwater has the characteristic of containing an anti-leaching additive so that it holds in place without diluting. The client demanded that the setting of the mortar be very rapid in order to be able to start work the day after the laying of the mortar, while a waiting period of 21 days after laying is normally necessary.

[287] The component of activities preceding September 8, 2010 is no longer the subject of a claim for deduction for expenses relating to SR&ED activities. The aim of these activities was to improve the air content of certain mixtures, without affecting the properties of the mixture. However, at the hearing, BMQ agreed that the claim for SR&ED expense deduction would only apply to activities that began on September 8, 2010 with the formulation of a new quick-setting anti-leaching mortar mixture, which ended on October 27, 2010.

[288] In order for the mortar to set quickly, BMQ had to add an accelerating adjuvant to its mixture. According to the timesheets produced in evidence, the superplasticizer adjuvant was also modified to improve the air content of the mixture. This formulation was tested at BMQ in order to check if the mortar could be poured using a mobile concrete mixer and would spread well in the cavities of the rock. Samples taken during this test showed that the addition of the superplasticizer adjuvant negatively affected the compressive strength of the mixture at an early age.

[289] Several reformulations took place following the test in order to optimize the air content as well as the resistance of the mixture to compression. BMQ succeeded in creating the desired mixture and the client was able to carry out their project with the mortar recipe created by BMQ.

[290] In the event that the activities carried out by BMQ in the context of this project are qualified as SR&ED activities, the parties' disagreement would only remain with regard to salary expenditures totaling $ 1,390, including the deduction is claimed by BMQ and subcontractor costs totaling $ 1,917. The respondent agrees that amounts of $ 1,920 for salaries and $ 394 for materials would be expenses deductible under section 37 and eligible for the calculation of the ITC.

Field of Science/Technology:

Project Details:

Intended Results:
Work locations:
Key Employees:
Evidence types:

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[291] According to the appellant, the project enabled BMQ to create a new product, which did not previously exist. This product being non-existent, there was no data on this subject. In his analysis, Mr. Mimoune failed to consider the need to place the mortar underwater. These activities therefore consist of SR&ED activities since they constitute experimental development work undertaken in the interest of technological progress.

[292] According to the respondent, the activities cannot be classified as SR&ED since this project does not reveal any technological uncertainty. According to Mr. Mimoune, the work was carried out using basic knowledge in the field. Thus, if a setting accelerator is used (as for quick-setting mortars), it is clear that the air content of the mixture will be lower and that it will therefore be necessary to compensate with an adjuvant which promotes the creation of air bubbles . Also, large-scale tests were carried out the week following the development of the mixture, which demonstrates the absence of technological uncertainty.

[295] However, the evidence also showed that BMQ knew that the addition of an accelerator would have a negative impact on the air content of a mixture. This is what emerges from the introduction to the project, which can be found on form T661: "The objectives of this project are to optimize and obtain robustness in the air content of concrete mixtures fast. The presence of setting accelerator in an air-entrained concrete formulation significantly influences the air content as well as the network of air bubbles. "Also, according to this form, in order to optimize certain mixtures, certain adjuvants had to be replaced by other adjuvants; this replacement of superplasticizing adjuvants by other superplasticizing adjuvants included certain factors of uncertainty which led to certain dosages having to be re-evaluated. Likewise, Mr. Bertrand indicated that BMQ had used quick-setting cement since 2001 and that it had been used in the United States since the 1990s.

[296] But although BMQ used current technological knowledge or current practices to create the new product in this project, BMQ could not predict whether the objectives could be achieved, or at least BMQ could be fairly convinced of achieving them. , but without knowing with certainty which solution would be applicable. The uncertainty concerned the creation of a product allowing installation underwater and containing an anti-leaching adjuvant so that the product held in place without diluting, and which would be taken very quickly. This project is not a product development since the evidence has shown that such a product does not exist, and it is not about data collection since only activities that started on September 8, 2010.

Technology or Knowledge Base Level:

Activity #1-1: Activity 1 (Fiscal Year 2020)

Methods of experimentation:

[293] In the case of this project, BMQ succeeded in demonstrating that, on the balance of probabilities, there was a technological uncertainty raised by the requests of its client.

[294] In the present case, the evidence demonstrated that this project resulted in the creation of a new product (907 mix), namely the quick-setting anti-leaching mortar; this product did not exist on the market before.

[297] Also, scientific progress in this case consists in advancing BMQ's knowledge of the various dosages and properties of the inputs used. In particular, BMQ learned that the new superplasticizer adjuvant affected the early compressive strength of its mixture and BMQ eliminated some dosing possibilities for the adjuvants tested to arrive at a solution.

[298] The fact that only one week has passed between the formulation of the mixture and the start of the tests does not in any way demonstrate the absence of technological uncertainty.

Results:

[300] As in the case of the other projects, BMQ's tests can partially be reconstructed using its documentation, but a report compiling the tests and making it possible to follow BMQ's thinking throughout the project did not been done. However, even if BMQ did not prepare a detailed account contemporaneously with the tests, the documentation produced at the hearing and the testimonial evidence, particularly the testimony of Mr. Bertrand, demonstrated the progress of the activities.

[306] The total expenses deductible under section 37 and eligible for the calculation of the ITC for salaries is therefore $ 2,979

Conclusion:

[299] BMQ demonstrated that, as part of this project, it had hypothesized that the air content of its mixture would be improved by modifying the superplasticizer adjuvant and that resistance at a young age would generally be improved by other modifications in the dosage of adjuvants. With regard to the use of the scientific method, I conclude that, since tests have been carried out scientifically and that the modifications made to adjust the dosages have been in reaction to the results obtained, the scientific method has been followed.

[300] As in the case of the other projects, BMQ's tests can partially be reconstructed using its documentation, but a report compiling the tests and making it possible to follow BMQ's thinking throughout the project did not been done. However, even if BMQ did not prepare a detailed account contemporaneously with the tests, the documentation produced at the hearing and the testimonial evidence, particularly the testimony of Mr. Bertrand, demonstrated the progress of the activities.

[301] Thus, for these reasons, the activities carried out by BMQ in the context of this project constitute SR&ED activities.

Project Name:	12-01: Development of fast-setting latex-free concrete	**Start Date:**	2020-03-13
Project Number:	2014	**Completion Date:**	2020-09-30

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Chip resistance (x)	(not set)	(not set)	No
flexural strength (x)	(not set)	(not set)	No
methods to replace latex (% content)	(not set)	(not set)	No

[309] This project started after BMQ received a request from Transport Canada for the supply of concrete to be used for the repair of taxiways at Montréal-Trudeau Airport.

[310] These repairs required the use of quick-setting concrete in order for the traffic lanes to be operational as quickly as possible. Likewise, the latex had to be removed from the mixture used by BMQ. The modified mixture should allow rapid achievement of good compressive strengths, but it should also be durable and meet industry standards. Concrete used for aircraft taxiways must also meet certain flexural strength standards.

Field of Science/Technology:

Project Details:

Intended Results:
Work locations:
Key Employees:
Evidence types:

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[311] A few years earlier, BMQ had attempted to develop a latex-free quick-setting concrete mixture without, however, having been able to reach the standards of chipping resistance while obtaining good compressive strength quickly enough. According to Mr. Bertrand, the difficulty lay in the need to find adjuvants compatible with quick-setting cement (CSA cement) and having effects allowing them to be used to replace latex.

[312] Despite previous failures, BMQ found superplasticizing admixtures that could potentially improve the performance of quick-setting concrete without latex. The project started with discussions that led to the formulation of two mixtures, which were tested in the laboratory, in particular to determine their resistance to compression at a young age.

[318] According to the appellant, the project conforms to the definition of SR&ED activities since it enabled BMQ to study the possibility of using adjuvants in liquid form in a mobile concrete mixer, when these are solid inputs which are normally used in the mobile concrete mixer. Furthermore, it considers that the modification of a mixture based on the analysis of results obtained does not constitute trial and error. These activities therefore constitute SR&ED activities since they can be qualified as experimental development work undertaken in the interest of technological progress.

[319] According to the respondent, the purpose of this project was to carry out an emergency repair with a mixture that had been approved before being installed. It is therefore a commercial project and not an SR&ED activity. The majority of the steps taken as part of this project were discussions with BMQ experts and partners, which shows that the information was accessible. Mr. Mimoune's report also points out that this approach is an ordinary method and that the tests carried out by BMQ constitute trial and error based on available knowledge and experience of BMQ. The difficulties encountered are normal and can be resolved by current practice in the field.

The most significant underlying key variables are:

adjuvants compatible with quick-setting cement, liquid vs powdered adjuvants, limits of mobile mixer

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Internet searches	4 Articles	
Similar prior in-house technologies	2 products / processes	failed products from prior SR&ED

Activity #1-1: Activity 1 (Fiscal Year 2020)

Methods of experimentation:

Method	Experimentation Performed
Analysis / simulation:	2 alternatives
Trials:	7 runs / samples

[313] Mr. Bertrand explained that BMQ did its first tests with a mixture containing powdered adjuvants and subsequently tried mixtures in which adjuvants had been incorporated in liquid form. According to Mr. Bertrand, liquid admixtures are more practical and safe for employees than powder admixtures. The first test with a powdered adjuvant provided a useful reference for the use of adjuvants in liquid form. Also, according to BMQ, the adjuvant identified as being capable of improving performance only existed in solid form in Canada and was not compatible with the use of the mobile concrete mixer, given the particular mixing conditions of the latter, where the attempt to develop a mixture with liquid adjuvants (letter dated November 12, 2013, exhibit I 3, tab 10).

[314] Mr. Bertrand also explained that a test board was made at BMQ before a first large-scale test was carried out at one of his customers. A second large-scale test was then undertaken at the airport.

[315] The list of materials on the timesheets indicates that BMQ has tested two mixtures. The first mixture was tested three times and the second mixture was tested four times.

Results:

[322] With respect to the use of the scientific method, I conclude that, since tests have been carried out scientifically and that the modifications to adjust the dosages have been made in response to the results obtained, the scientific method has been followed. The trial and error method, contrary to what the respondent claims, was not used in this project.

[323] As in the case of the other projects, BMQ's tests can be partially reconstructed with its documentation, but a report compiling the tests and making it possible to follow BMQ's thinking throughout the project was not made. However, even if BMQ did not prepare a detailed account contemporaneously with the tests, the documentation produced at the hearing and the testimonial evidence, particularly the testimony of Mr. Bertrand, demonstrated the progress of the activities.

[330] Also, I consider that, given Mr. Dubé's testimony that he rounded up the hours, it is more likely that the number of hours was actually overestimated. I conclude that it would be reasonable to reduce the deduction claimed for salary expenses by 10%. Salary expenses, the deduction of which is claimed by BMQ, should therefore be reduced by $ 2,108. The total expenditure for salaries that are deductible under section 37 and eligible for the calculation of the ITC is therefore $ 18,968.

[331] Finally, with regard to the amount accepted as expenditure for the costs of subcontractors, this amount corresponds to all of the expenditure incurred within the framework of this project, with the exception of an amount of 3,116 $ relating to tests carried out on May 18 by the Qualitas laboratory. Since BMQ did not produce in evidence any invoice relating to these costs, the position taken by the respondent is justified. This amount cannot be deducted according to article 37 or be considered for the calculation of the ITC.

[332] Also, given the concession made by the respondent, expenses totaling $ 1,964 for materials and $ 3,128 for subcontractor costs are deductible expenses under section 37 and eligible for the calculation of the ITC .

Conclusion:

[316] On form T661, BMQ explains that in its last tests, the chipping resistance and the air bubble network were still insufficient, although the other standards were met. BMQ therefore believes that it has acquired new knowledge on the effects of certain additives in a quick-setting cement-based concrete mixture. BMQ is still trying to understand the interaction of adjuvants in order to define their compatibility with quick-setting cement, and the evidence has shown that the

documentation on the subject is almost non-existent (Exhibit I - 3, tab 23). BMQ explained that in 2015 the behavior of the test board at Montréal-Trudeau airport was still under observation.

a) Qualification of the project

[320] The evidence showed, on a balance of probabilities, that technological uncertainty was present in the case of this project since BMQ could not have predicted whether Transport Canada's objectives could be achieved using the usual procedure or current technical studies. BMQ's objective in this project was to develop a new product: a quick-setting concrete without latex that would be as durable and efficient as quick-setting concrete with latex. The aim was to find an adjuvant that reacts with CSA cement instead of latex. BMQ is still trying to understand the interaction of adjuvants in order to define their compatibility with quick-setting cement, and the documentation on the subject is almost non-existent (Exhibit I - 3, tab 23).

[321] The technological progress made by BMQ in the context of this project consists in acquiring new knowledge on the performance of certain superplasticizing adjuvants in its mixtures. BMQ has hypothesized that certain superplasticizing additives can give a concrete mixture the same property as latex.

[325] Thus, for these reasons, the activities carried out by BMQ in the context of this project constitute SR&ED activities.

Significant variables addressed: adjuvants compatible with quick-setting cement, limits of mobile mixer, liquid vs powdered adjuvants

Project Name:	12-03: Development of quick-setting latex concrete screed	**Start Date:**	2020-03-19
Project Number:	2015	**Completion Date:**	2020-12-31

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Durability (x)	(not set)	(not set)	No
Chlorine permeability (x)	(not set)	(not set)	No
adherance to existing surfaces (x)	(not set)	(not set)	No

[356] The project started when the MTQ became interested in the possibility of using quick-setting latex concrete as a running surface while this product is normally used as a repair product. The MTQ wanted to study the question of whether the running surfaces composed of surface asphalt and conventional concrete underlayment on the Pierre Laporte bridge, which must be repaired every three to five years, could be replaced by quick-setting latex concrete given the greater durability of this concrete. This type of concrete also reduces penetration with chlorine ions because it is more waterproof than conventional concrete, which should contribute to the sustainable development of concrete structures. This meant that the concrete adhered well to the concrete structure already in place despite the vibrations and movements of the bridge. The MTQ saw certain advantages, notably the longer durability of this concrete compared to conventional concrete and its better permeability to chlorine ions.

Field of Science/Technology:

Project Details:

Intended Results:
Work locations:
Key Employees:
Evidence types:

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[357] The mixture used in this project was developed in a project for the 2011 taxation year (project B-11-06). This was a project to develop a quick-setting latex concrete with rolling surface durability, which project was considered partially eligible during the CRA audit. According to Mr. Bertrand, BMQ knew this type of product; however, BMQ did not know how this concrete would react as a running slab. The MTQ was very interested in the product and wanted to make "a prototype" of it .

[358] Mr. Bertrand explained that a study on the installation of latex concrete slabs on existing concrete structures had given positive results in the United States, but no information was available for a mixture comprising setting cement fast. Also, according to an American researcher contacted by Mr. Bertrand, latex concrete had never been installed on a suspension bridge

[369] The appellant argued that this project was a continuation of project B - 11-06, which was considered to be partially admissible during the audit. The activities undertaken by BMQ as part of this project are SR&ED activities since BMQ sought to develop a new way of using latex concrete. These activities therefore represent SR&ED activities since they constitute experimental development work undertaken in the interest of technological progress.

[370] According to the respondent, the activities cannot be classified as SR&ED activities given the absence of technological uncertainty in the context of this project. According to Mr. Mimoune, the project ultimately only led to the diagnosis of a problem that arose in the context of an ordinary installation operation undertaken following discussions and consultations. According to him, the project is not a continuation of project B - 11-06 since the difficulties encountered were not due to the mixture supplied, but to the manner of preparing the surface on which it was going to be poured, which is a technical problem common practice. In addition, according to the respondent, the mixture had already been tested.

The most significant underlying key variables are:

surface preparation for adhesion, curing method to avoid cracks, air entraining admixture effects, effects of setting retarder

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Internet searches	1 Articles	information not available for a mixture comprising setting cement fast.
Similar prior in-house technologies	1 products / processes	quick-setting latex concrete technologies
Queries to experts	1 responses	US expert confirmed no known use

Activity #1-1: Activity 1 (Fiscal Year 2020)

Methods of experimentation:

Method	Experimentation Performed
Physical prototypes:	2 samples

[359] On June 17, 2011, BMQ therefore undertook to carry out a first test board (convenience test) under the bridge where the samples were taken. According to Form T661, the poured mixture contained a setting retarder to allow more time for placement and finishing. An air entraining admixture was also added to meet the MTQ air content standards. This test made it possible to test a method of placing concrete. Since it was a quick setting concrete, some results in compressive strength could be obtained quickly.

[360] The next day, a test on the bridge itself took place over twenty meters. Samples were taken again. The results were satisfactory except for the air bubble network of the concrete, which affected the tightness of the concrete as well as its permeability to chlorine ions.

[361] Following the adjustment of the air entraining admixture in the mixture to improve the air bubble network, a test was done on the Dubuc bridge in Saguenay on August 28, 2011. BMQ had doubts about the surface preparation, which was not adequate and was likely to interfere with the tests. However, the MTQ has agreed to carry out the tests in order to verify the grip under extreme conditions. The slab cracked after a few days. BMQ believed that there had been problems with the curing of the concrete and the preparation of the surface on which it had been poured. The samples taken also showed that the network of air bubbles in the concrete remained unsatisfactory.

[362] The air entraining adjuvant was therefore adjusted a second time to correct the network of air bubbles before a new test was undertaken on another section of the Dubuc bridge.

REGARDING THE RESEARCH PROCESS THE JUDGE COMMENTED:

[376] With regard to the use of the scientific method, I conclude that, since tests have been carried out scientifically and the modifications made to adjust the dosages have been done in reaction to the results obtained, the method scientist was followed. The trial and error method, contrary to what the respondent claims, was not used in this project. Assumptions have also been made and verified.

[377] As in the case of the other projects, BMQ's tests can be partially reconstructed using its documentation, but a report compiling the tests and making it possible to follow BMQ's thinking throughout the project did not been done. However, even if BMQ did not prepare a detailed account contemporaneously with the tests, the documentation produced at the hearing and the testimonial evidence, particularly the testimony of Mr. Bertrand, demonstrated the progress of the activities.

Results:

[363] The two planks on the Dubuc bridge showed significant cracks, although the network of bubbles finally met the standards. BMQ has checked the evaporation rate of its mixture to exclude this variable. The MTQ then proceeded to core the test boards, and the tests carried out on the cores confirmed that there was a problem of adhesion of the concrete to the surface in place. Mr. Dubé testified that he observed the poor results in the first phase of the tests on the Dubuc bridge and suspected a grip problem, but still proceeded to the second test.

[364] Analysis of the results led to the conclusion that the surface had been poorly prepared before the concrete was poured. The two planks had to be demolished.

[365] The test board installed on the Pierre Laporte bridge was also removed a few months after its installation due to the poor adhesion to the existing surface. According to Mr. Bertrand, the thermal constraints of the bridge generated this problem.

[366] Since the large-scale trials were unsuccessful, the project to design a running surface on bridges that would be made with quick-setting latex concrete has been abandoned by BMQ for the moment.

[374] On the Pierre Laporte bridge, after removing the concrete screed, BMQ found that the grip was not good and concluded that it was due to the thermal stresses of the bridge. As for the tests on the Dubuc bridge, given the poor surface preparation, the concrete did not adhere properly. As mentioned above, the MTQ wanted to test the concrete under extreme conditions.

COSTS:
[385] Thus, the salary expenses for which the deduction is claimed by BMQ should be reduced by a total amount of $ 3,575, representing the salaries for ineligible activities ($ 1,964) and the 10% reduction in expenses ($ 1,611). The total deductible salary expenses under section 37 and eligible for the calculation of the ITC is therefore $ 14,496.

[386] Given the concession made by the respondent, the amounts totaling $ 1,975 for materials and $ 4,159 for subcontractor costs are deductible expenses under section 37 and eligible for the calculation of the ITC.

Conclusion:

a) Qualification of the project
[371] The work consisted in carrying out large-scale tests of a product previously developed by BMQ. The aim was to test the behavior of quick-setting latex concrete as a rolling surface material, and not as a repair material. Indeed, quick-setting latex concrete was a known material used in the industry as a repair material.

[372] Also, the evidence showed that BMQ did not provide concrete to make repairs to the bridges, but to test them.

[373] Mr. Bertrand testified that he knew the characteristics of fast-setting latex concrete for having performed laboratory analyzes on this concrete, but this material had never been tested for use as a running surface. Thus, the objective of this project was to advance technology relating to quick-setting latex concrete. In fact, according to Mr. Bertrand's testimony, this concrete had never been used as a running surface on a suspension bridge. The American expert consulted by Mr. Bertrand confirmed that, to his knowledge, latex concrete had never been installed on a suspension bridge. Based on the evidence, I conclude that the characteristics of the project were not technologically fixed. This project therefore goes beyond current practice,

[375] According to the respondent, since the product created within the framework of project B - 11-06 had already been tested on other sites, it is not clear that technological uncertainty existed in this case. I do not share this opinion. The evidence demonstrated that there was technological uncertainty due to the fact that quick-setting latex concrete had never been used as a rolling surface material and uncertainty as to how the surface should be prepared in order to promote concrete adhesion, as well as the concrete curing method to avoid cracking. The solutions could not therefore be based solely on current practice.

[378] Thus, for these reasons, the activities carried out by BMQ in the context of this project constitute SR&ED activities.

Significant variables addressed: air entraining admixture effects, curing method to avoid cracks, effects of setting retarder, surface preparation for adhesion

Project Name:	12-07: Development of repair product for roller compacted concrete	**Start Date:**	2020-03-24
Project Number:	2016	**Completion Date:**	2020-12-31

Project Details:

Scientific or Technological Objectives:

[387] This project is a continuation of the BMQ parking lot covering project. Roller compacted concrete or BCR is a product that has experienced misfires following its arrival on the market some fifteen years ago. A BCR repair product was available but it was very expensive. According to Mr. Bertrand, BMQ decided to develop a repair product for this type of concrete that could be used for repairs in thin layers as well as in depth.

Field of Science/Technology:

Civil Engineering (2.01.01)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Research Facility
Key Employees:	Jacques Bertrand (Civil - PEng. (1970) / President)
Evidence types:	

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[396] According to the appellant, technological uncertainty existed because the only data available on this type of concrete came from California, where the climatic conditions are different and that the mixtures developed had to be compatible with the mobile concrete mixer. Mr. Mimoune misunderstood the project since he does not distinguish BCR as such from repair products for this concrete. The project made it possible to develop promising new products, which we continued to monitor in the years following the year in dispute. These activities therefore constitute SR&ED activities since they can be qualified as experimental development work undertaken in the interest of technological progress.

[397] According to the respondent, the activities cannot be qualified as SR&ED. According to Mr. Mimoune, the mixes had been developed in collaboration with the company that created the cements introduced in the tested mixes, namely CTS Cement. BMQ has neither modified the mixes nor developed new techniques for placing concrete. Repair products were available, and although they had to be adapted for use in the mobile concrete mixer, this is a normal obstacle in the industry. BMQ did not use the scientific method, according to him, since the procedures consisted mainly of consulting experts. Also, the respondent argued that discussions led directly to large-scale tests and that the scientific method was therefore not followed by BMQ. In addition,

Technology or Knowledge Base Level:

Activity #1-1: Activity 1 (Fiscal Year 2020)

Methods of experimentation:

[388] According to Mr. Bertrand, it is difficult to validate the durability of such a product without putting it to the test under real conditions, which include, for example, the passage of heavy vehicles, because laboratory tests are not enough not always to obtain a faithful representation of a product.

[389] BMQ therefore undertook to test repair products on its own slab made of BCR located in its parking lot. Two strips were dug in the BCR slab of the BMQ parking lot to test the products, that is to say that two small sections of the parking slab were demolished (two feet wide, twenty feet long and different depths, 25 and 125 millimeters respectively). One was demolished by scarification and the other using a jackhammer. Both are located in a part of the BMQ parking lot where heavy trucks regularly pass by to refuel.

[390] More specifically, three mixes of repair concrete were placed on the edges. According to Mr. Bertrand, the mixtures

tested were not "tablet" mixtures . The mixtures were all made of quick setting cement, but had variations in the type of cement and the admixtures used.

[391] The first mixture put in place was a mixture developed by BMQ in the 2000s. It was to serve as a point of comparison for the other two mixes. The second mixture was a self-consolidating concrete containing a type of cement that BMQ had only used for two years, as well as a superplasticizer and a colloidal adjuvant which gave the mixture its self-compacting property. Finally, the third mixture was experimental in nature and had the particularity of containing powdered acrylic latex. This mixture had been tested in the United States and used for the repair of concrete structures in this country. However, the expert consulted by Mr. Bertrand had confirmed that he did not believe that this concrete would perform well in the planned repairs.

[392] The cements used in the second and third mix came from the same supplier, CTS Cement, with whom BMQ planned the implementation of this project.

[393] Samples were taken during the installation of the repair products to check the adhesion by oblique shearing, the network of air bubbles, as well as the resistance to compression. According to Mr. Bertrand, two of the three mixtures can be used to make repairs to the BCR; however, the test mixture from the United States can only be used indoors since it did not meet the standards for durability testing.

[394] BMQ continued to observe the progress of the repairs carried out over the following years. Three years after the end of the tax year in dispute, BMQ has made tensile strength tests on cores taken from the selvedges to verify the adhesion of the mixtures to the concrete slab on which they were laid. . The testing of other repair products combined with different demolition techniques of the BCR slab was also done in the taxation years after the 2012 taxation year.

Results:

COSTS

[412] Thus, the salary expenses for which the deduction is claimed by BMQ should be reduced by a total amount of $ 2,715, representing the salaries for ineligible activities ($ 1,524) and the 10% reduction in expenses ($ 1,191). The total deductible salary expenses under section 37 and eligible for the calculation of the ITC is therefore $ 10,728.

[413] According to the documentary evidence filed at the hearing, the expenses for the materials totaled $ 494, representing the cost of the various mixtures tested within the framework of this project. However, according to Exhibit AR-1, the appellant has waived the right to claim the deduction of costs relating to mobile concrete mixers (that is, the 32 hours during which they were used). Given the concessions made by the parties, the total expenditure for the materials that are deductible under section 37 and eligible for the calculation of the ITC is therefore $ 494.

[414] Expenses related to subcontractors retained to perform laboratory tests are considered expenses for SR&ED activities, being expenses incurred in support of the project and directly related to the SR&ED work. However, the expenses incurred for the excavation of the slab of BCR should not be included as deductible expenses under section 37 and eligible for the calculation of the ITC, these being instead replaced by the replacement amount, since I consider that these expenses do not represent expenses directly related to the SR&ED work. Thus, taking into account the concessions made by the appellant and the exhibits produced, the expense of $ 1,917 for the subcontractors is deductible under section 37 and admissible for the calculation of the ITC

Conclusion:

a) Qualification of the project

[398] In the present case, the evidence demonstrated that relatively new cements were introduced into the mixtures tested and that the performance of the mixtures as BCR repair products was unknown in current industry techniques or practices. A mixture had actually been created by BMQ in 2009 and used to carry out repairs on the Champlain Bridge; another mixture, containing an acrylic latex, was an experimental concrete that had been tested in the United States and used in the repair of certain works in the United States; and another mixture had been used by BMQ since the early 2000s.

I consider that BMQ's objective in this project was to advance the procedures for repairing BCR slabs. The evidence showed that the characteristics of the repair concrete were not fixed at the outset; the objective was precisely to develop a concrete that can be used for repairs in thin layers as well as in depth. We therefore met the criterion of technological progress.

[399] In the present case, BMQ convinced me of the existence of a technological uncertainty in this project, which could not be dissipated by technical studies or usual procedures, since BMQ demonstrated that the probability of reaching the objectives sought were not known or determined in advance according to the technological knowledge usually available. Indeed, no large-scale test had been done to test the new BCR repair materials. BMQ could not therefore rely on technical studies or current practices to dispel this technological uncertainty. More specifically, one of the mixtures had never been tested or used in Quebec.

[400] Also, BMQ used the scientific method in the context of this project, having compared the results of the various mixtures placed under similar conditions; it also posed hypotheses.

DOCUMENTATION

[401] As in the case of the other projects, BMQ's tests can be partially reconstructed using its documentation, but a report compiling the tests and making it possible to follow BMQ's thinking throughout the project did not been done. However, even if BMQ did not prepare a detailed account contemporaneously with the tests, the documentation produced at the hearing and the testimonial evidence, particularly the testimony of Mr. Bertrand, demonstrated the progress of the activities.

RULING

[402] Thus, for these reasons, the activities carried out by BMQ in the context of this project constitute SR&ED activities.

Project Name:	Beton Mobile - (8 LOSSES)	**Start Date:**	2020-03-01
Project Number:	2020	**Completion Date:**	2020-09-30

Project Details:

Scientific or Technological Objectives:

Ineligible projects

Field of Science/Technology:

Project Details:

Intended Results:
Work locations:
Key Employees:
Evidence types:

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

Technology or Knowledge Base Level:

Activity #1-1: Activity 1 (Fiscal Year 2020)

Methods of experimentation:

Results:

THE JUDGE CONCLUDED:

[157] Overall, the activities carried out by BMQ in the context of projects B 10 05, B 10 07 and B 10 08 are the result of a change of supplier of ternary cement. Even if I examine the three projects as a whole, the presence of uncertainty going beyond what is resolvable by current technical studies or usual procedures has not been demonstrated by BMQ on a balance of probabilities. Indeed, I conclude that this is an update or product development carried out through standardized tests and field trials.

Also, the progress described by BMQ, namely the modification of the ternary cement supplied by Holcim, has not been demonstrated convincingly enough to determine whether it is an advancement made by BMQ or by Holcim.

[169] As mentioned in the analysis of project B 10 05, the appellant considers that the characterization activities of a new generation superplasticizer adjuvant must be examined in conjunction with projects B 10 05, B 10 07 and B 10 08. These activities constitute, according to her, SR&ED activities since they constitute experimental development work undertaken in the interest of technological progress.

[170] According to the respondent, the activities carried out by BMQ within the framework of this project are only intended to characterize products and do not demonstrate any uncertainty or any technological progress. The work undertaken by BMQ in the context of this project is standard formulation work and work to assess the performance of existing commercial products, and there has been no obstacle or technological progress in the case of this work. Thus, the activities cannot be qualified as SR&ED activities.

Conclusion:

Project Name:	B-10-12: Development of cavernous concrete with a high vacuum content.	**Start Date:**	2020-05-01
Project Number:	2021	**Completion Date:**	2020-08-31

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Vacuum content (void %) (%)	30	35	Yes
reduce water run off to city (%)	(not set)	(not set)	No

[178] The activities of this project took place in conjunction with the activities of two other projects, namely project B 10 11 (draining concrete), partially accepted as part of the audit, and project B 10 10 (roller compacted concrete or BCR), rejected at the verification stage. The appellant discontinued appeal regarding this project during the hearing.

[179] The City of Laval, where the BMQ premises are located, has been asking for several years that the company's parking lot be paved. Also, according to the city's requests, the discharge of rainwater into the sewers should be limited.

[180] BMQ therefore undertook to pave part of its land located at the front of its business with two types of concrete, namely BCR and draining concrete, below which BMQ had installed a layer of cavernous concrete comprising a vacuum content of 35%. The cavernous concrete also contains a water drainage system designed by BMQ, a network of perforated drains to collect rainwater. The cavernous concrete underlay installed over the entire surface of the parking lot thus acts as a water retention basin.

Field of Science/Technology:

Civil Engineering (2.01.01)

Project Details:

Intended Results:	Improve existing processes
Work locations:	Lab
Key Employees:	Jacques Bertrand (Civil - PEng. (1970) / President)
Evidence types:	

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

APPELLANT ARGUED:

[187] According to the appellant, the project made it possible to develop cavernous concrete with a vacuum content of 35%, which did not previously exist. This product was created with the aim of retaining water instead of simply letting it flow as it usually did. This project is an integral part of the draining concrete project.

[188] The appellant referred to a report prepared by a doctoral candidate at the University of Waterloo (Vimy Henderson), who undertook the project on draining concrete (Exhibit I 1, tab 8). According to this report, maintaining a vacuum content of 35% in cavernous concrete was essential to this project.

[189] For the appellant, the activities constitute SR&ED activities since they constitute experimental development work undertaken in the interest of technological progress, as well as applied research work undertaken in the interest of advancement science.

CRA ARGUED:

[190] According to the respondent, cavernous concrete is not concrete that can be installed using a mobile concrete mixer. BMQ therefore had no interest in developing such a product.

The vacuum percentage of 35% instead of 30% would have been chosen simply to be able to install a thinner layer and thus reduce costs. In addition, there is no real progress or advancement just because of the increase in the percentage of vacuum content in an existing product.

Also, it is not reasonable to consider the entire BMQ parking lot as a test bed. Only a small part of the cavernous concrete was instrumented, that is to say that installed under the draining concrete, which covers only a small part of the parking lot (15% to 20% of the area). According to Mr. Durban, the purpose of the instrumentation installed in the context of the draining concrete project was to verify the efficiency and behavior of the draining concrete and not that of the cavernous concrete.Instrumentation of cavernous concrete was only necessary to ensure that the passage of water through the draining concrete was properly measured.

Finally, the absence of technological uncertainty is also demonstrated by the fact that the city of Laval accepted the plans provided by an engineer who indicated before the work was even carried out, that the work would meet the water retention requirements of the city, and this engineer also confirmed the conformity of the works after the repair of the parking lot. Thus, the activities cannot be qualified as SR&ED activities.

Instrumentation for cavernous concrete was only necessary to ensure that the passage of water through the draining concrete was properly measured.

The most significant underlying key variables are:

how to achieve vacuum content 35% (unresolved), integration with draining concrete (unresolved)

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Internet searches	1 Articles	[188] The appellant referred to a report prepared by a doctoral candidate at the University of Waterloo (Vimy Henderson), who undertook the project on draining concrete (Exhibit I 1, tab 8). According to this report, maintaining a vacuum content of 35% in cavernous concrete was essential to this project.

Activity #1-1: Activity 1 (Fiscal Year 2020)

Methods of experimentation:

Method	Experimentation Performed
Trials:	1 runs / samples
Physical prototypes:	1 samples

[181] Cavernous concrete is a concrete also called “popcorn concrete” because of its very porous appearance. The higher the void percentage of the cavernous concrete, the more it is able to retain a large amount of water. According to Mr. Bertrand, cavernous concrete is a product that existed in the literature, but it was not covered by any standard. However, the void percentage of such concrete was limited and was between 12% and 30%. BMQ has chosen to use cavernous concrete with a void percentage of 35% in order to be able to install a thinner and therefore more economical layer, and in order to be able to retain an equivalent amount of water.

[184] In the context of project B 10 11 (draining concrete), the University of Waterloo installed probes that measured the moisture in the draining concrete; these probes were installed in surface concrete (draining concrete), in cavernous concrete under draining concrete and in loose soil under cavernous concrete. The probes made it possible to measure the percolation of water in these three layers. According to Mr. Bertrand, the surface area of the parking lot used for the purpose of the draining concrete experiment was approximately 3,000 to 4,000 square feet (out of approximately 20,000 square feet).

[185] The excavation of BMQ's land prior to the installation of the concrete was done by subcontractors. BMQ supplied the cavernous concrete, but the concrete and the drainage system were installed by a subcontractor, Demix Construction. This work took place in two phases so as not to hamper BMQ's activities. The first phase took place on July 22 and 23, 2009 and the second phase on August 13, 2009.

Results:

- Vacuum content (void %): 35 % (100% of goal)

[187] According to the appellant, the project made it possible to develop cavernous concrete with a vacuum content of 35%, which did not previously exist. This product was created with the aim of retaining water instead of simply letting it flow as it usually did. This project is an integral part of the draining concrete project.

Conclusion:

RULING & RATIONALE: THE JUDGE CONCLUDED;

[191] BMQ did not convince me that, on a balance of probabilities, there was technological or scientific uncertainty in the case of this project, since the existing scientific or technological knowledge enabled BMQ to achieve the objectives of the project. Similarly, BMQ did not convince me that there had been scientific or technological progress.

[192] The absence of technological or scientific uncertainty is demonstrated by the fact that the parking plan proposed by BMQ was approved by an engineer and by the city of Laval even before the work was undertaken and without any other steps being taken by BMQ. Thus, BMQ had to be convinced that the objectives would be achieved and that the cavernous concrete solution was viable. Also, I conclude that the probability that the objectives sought by BMQ would be achieved was foreseeable in this case, given current industry practices.

[193] In addition, I conclude that the creation of cavernous concrete with a vacuum content of 35% was the result of common industry practices. Mr. Bertrand testified that tests had been carried out to create cavernous concrete at 35%. However, the documentary evidence produced at the hearing does not refer to any test or analysis. Also, on the T661 form it is a question of 30% cavernous concrete. Questioned on this subject at the hearing, Mr. Bertrand indicated that the project had evolved over time. However, this answer is not very plausible since the T661 form is filed with the CRA after the work is completed. In addition, in the report prepared by the doctoral candidate at the University of Waterloo (Vimy Henderson), who undertook the project on draining concrete (Exhibit I 1, tab 8), it is stated that, usually, cavernous concrete has a porosity of 30 to 40%. The evidence did not demonstrate that there was an improvement in the characteristics of the cavernous concrete in this project. Indeed, this product already existed in the industry.

[194] In their arguments, the appellant referred to the report prepared by Vimy Henderson, according to which maintaining a void of 35% in cavernous concrete was essential to this project, to argue that the activities constituted SR&ED activities. However, the passage in question from the report seems to me to speak rather of the fact that the data on the draining concrete could have been distorted by a malfunction of the cavernous concrete and therefore does not support the appellant's argument.

[195] According to BMQ, the progress or advancement in the context of this project consisted in understanding the performance of cavernous concrete when accompanied by other concretes and used in different configurations. On form T661, mention is made of the improvement in the rate of infiltration of rainwater into the original soil, the reduction in the maximum rate and the volume of rainwater sent to the municipal network or, by runoff, to rivers, the installation of a foundation by "paver" so as to allow the installation of cavernous concrete containing 30% vacuum, and the installation of draining concrete, also by "paver". However, the instrumentation installed by the University of Waterloo was intended to measure the permeability of the draining concrete and this instrumentation was only installed in the part of the parking lot whose surface was made of draining concrete, i.e. from 15% to 20% of total area. BMQ did not convince me that it was able to increase its knowledge of cavernous concrete as part of this project.

[196] BMQ also had to be convinced that the objectives would be achieved since the cavernous concrete was installed underlayment of the draining concrete and the BCR, without the possibility of having access to it.

[197] I am not convinced that the scientific method was followed within the framework of this project. Indeed, a large-scale test was carried out directly without any prior test of the smallest size having been made. Observations were made using the instrumentation installed by the University of Waterloo, but only on the part of the parking lot covered by the draining concrete. For the rest, the observations seem above all to have been made visually. Similarly, the documentation produced by BMQ mainly concerns the approval of the work by the city and the stages of concrete installation. BMQ has agreed to withdraw its claim for deduction for all expenses relating to the hours devoted to the analysis of results, which suggests that the analysis of the performance of the drainage system was primarily visual.

[198] Thus, for these reasons, the activities carried out by BMQ cannot be qualified as SR&ED activities since, in particular, the criteria of technological or scientific uncertainty and technological or scientific progress have not been met.

[199] The appellant's argument that I should consider this project as part of the draining concrete project does not change my conclusion. BMQ has failed to demonstrate on a balance of probabilities how the combination of draining concrete and cavernous concrete created technological or scientific uncertainty and how technological or scientific progress would have been made in this regard. Indeed, the new knowledge described in the Vimy Henderson report relates almost exclusively to draining concrete.

Project Name:	B-11-01: Study of permeability to chloride ions and durability with various pozzolanic additions and	**Start Date:**	2020-01-01
Project Number:	2022	**Completion Date:**	2020-05-31

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
chlorine penetration (coulombs)	3500	2500	Yes
compression resistance (x)	(not set)	(not set)	No
spalling (x)	(not set)	(not set)	No
freeze thaw stability (x)	(not set)	(not set)	No
air bubble distribution (x)	(not set)	(not set)	No

[233] In 2009-2010, the MTQ and the Canadian Standards Association (“CSA”) added a new requirement to the standards applicable to concrete , namely a permeability threshold for chlorine ions (maximum conductivity from 1000 coulombs to 56 days). This standard has been implemented since the chlorine ions passing through the concrete can cause the steel reinforcements of the concrete structures to rust, which we seek to avoid. Mr. Bertrand testified that in order to meet concrete standards, twenty-two tests must be performed, to which is now added the new test for permeability to chlorine ions.

[234] A grace period of a few months was granted to the companies to allow them time to do the tests necessary to demonstrate that their concrete mixes complied with the new standard.

[235] According to Mr. Bertrand, the new standard caught everyone in the industry off guard. BMQ did not measure the penetration rate of chlorine ions in its mixtures before the standards were changed, since this was not required. However, a standardized test existed in the industry to do this.

resistance to compression, spalling and the freeze / thaw cycle and to check the stability of the distribution of the network of air bubbles had to be carried out.

Field of Science/Technology:

Civil Engineering (2.01.01)

Project Details:

Intended Results: Improve existing processes
Work locations: Lab
Key Employees: Jacques Bertrand (Civil - PEng. (1970) / President)
Evidence types:

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

[236] This project began on February 8, 2010 and ended on December 21, 2010. BMQ therefore undertook to verify whether its concrete mixes met the new standard. The objective of the project was to reformulate and optimize the concrete mixes according to the new standard. Mixtures with five different types of cement have been tested. According to Mr. Bertrand, the information available on each type of cement - for example, their technical data sheets - did not allow the permeability to chlorine ions to be determined in advance. For example, GU concrete (common concrete) had a chlorine ion permeability of 3500 coulombs, which exceeded the new standard.

[237] BMQ's assumptions included whether the different cements met the standard, whether BMQ blends were able to meet the standard, and, if the new standard was not met, what changes were to be made be made to the mixtures. According to Mr. Bertrand, the uncertainty was that BMQ did not know if the concrete mixes would comply with the new standard.

CRA ARGUED:
[243] According to the respondent [CRA], the activities carried out by BMQ in the context of this project are only an attempt to validate existing products with regard to applicable industry standards, and therefore, these activities cannot be qualified as activities of SR&ED. According to Mr. Mimoune, existing mixtures containing known ingredients were tested. The

techniques used by BMQ to adapt the mixes also fall under standard engineering techniques. The scientific method would also not have been respected since there are no links between the mixtures tested, that is to say that they do not fit into a logical sequence and that we have simply abandoned some when they did not meet the standard, instead of trying to understand the causes of failure.

The most significant underlying key variables are:

adding pozzolan (unresolved), modify mixing method (unresolved), effects of latex (unresolved)

Technology or Knowledge Base Level:

Benchmarking methods & sources for citings:

Benchmark Method/Source	Measurement	Explanatory notes
Internet searches	1 Articles	Only quoted new government standards

Activity #1-1: Activity 1 (Fiscal Year 2020)

Methods of experimentation:

Method	Experimentation Performed
Trials:	15 runs / samples

[238] BMQ carried out tests on fifteen mixtures. Five mixtures were subjected to more than one test. According to Mr. Bertrand, when a mixture did not meet expectations, it was either left out or reformulated. In addition, when a mixture was modified to reach the new standard, it then became necessary to check whether the other standards were still respected. Thus, tests to check the resistance to compression, spalling and the freeze / thaw cycle and to check the stability of the distribution of the network of air bubbles had to be carried out.

[239] After a first series of tests which led to the conclusion that no mixture complied with the new standard, BMQ modified the quantity of cement and modified the mixing sequence and the method of introducing the adjuvants; this second series of tests was successful for certain mixtures. Subsequently, BMQ decided to substitute pozzolanic mineral additions for a certain amount of cement in order to improve the compression results.

THE JUDGE NOTED:

[244] BMQ made an inventory of its products, checked which ones met the standards, changed the mixing sequence and how to introduce the adjuvants, balanced the content of cement and minerals like pozzolan in order to reformulate products and, after receiving the results of laboratory tests , selected the mixtures which complied with the standards. BMQ did not investigate the reasons why some of these mixtures did not meet the standards.

[247] BMQ first tried to characterize its various existing mixtures of concrete made with different types of cement. The timesheets produced in evidence describe validation activities of mixtures in relation to the various tests making it possible to determine whether the concretes met the standards. The timesheets do not show any time spent reformulating mixtures, but there are many hours spent discussing and analyzing results, as well as hours validating mixtures. I also note that the mixtures have been tested directly, without having been reformulated in any way. This therefore demonstrates that the activities consisted of normal data collection carried out within the framework of the BMQ business in order to validate the mixtures against the standards, so that these were not SR&ED activities.

[248] BMQ also carried out tests to verify the effect of pozzolan on cements as well as the effect of modifying the mixing method. According to Mr. Mimoune, pozzolan is a known material and its effects on porosity have also been well known and documented in the scientific literature for many years. In the response to the examination report, BMQ admitted that adding pozzolan and modifying the mixing method are techniques known in the industry, specifying however, the use of a mobile concrete mixer makes the results unpredictable.

Results:

- chlorine penetration: 2800 coulombs (70% of goal) -- Average on 15 mixtures. 6 of 15 met the 2,500 goal.

[239] For six mixtures, these modifications made it possible to comply with the new standard and all the applicable standards.

[240] Mr. Bertrand also indicated that the addition of latex to a mixture containing a general purpose cement had increased the permeability to chlorine ions.

Conclusion:

RULING & RATIONALE: THE JUDGE CONCLUDED;

[248] BMQ however did not convince me that the use of a mobile concrete mixer brings a degree of scientific uncertainty that would justify that the activities be qualified as SR&ED activities.

[249] Although I accept that the standard for permeability to chlorine ions has been received with surprise by people in the industry, I do not see how the MTQ could have set up such a standard knowing that the companies subject to this standard could not meet it. This therefore also demonstrates an absence of scientific or technological uncertainty in this regard.

[250] Also, BMQ has not convinced me that it followed the scientific method for this project. Indeed, although tests have been made scientifically by an independent laboratory, a certain amount of trial and error is noticeable given the passage from one mixture to another without a specially detailed analysis of the reasons why a mixture respects the standards or does not meet them.

[251] Finally, with regard to the existence of a detailed report, the tests carried out by BMQ can be partially reconstructed using the documentation produced at the hearing and the testimony of representatives of BMQ.

[252] Thus, for these reasons, the activities carried out by BMQ in the context of this project cannot be qualified as SR&ED activities since they consist of normal product characterization tests that have not created scientific uncertainty.

Project Name:	B-12-02 Improvement of quick setting self-compacting concrete	**Start Date:**	2020-05-01
Project Number:	2023	**Completion Date:**	2020-09-30

Project Details:

Scientific or Technological Objectives:

Measurement	Current Performance	Objective	Has results?
Cause of aggregate segregation (yes =1 or no = 0)	0	1	No

[333] According to Mr. Dubé, a contractor working for Hydro Québec used the mixture developed within the framework of project B 11 04 to make repairs to the Manouane C Dam. However, the inputs contained in the mixture segregated.
[334] According to BMQ, project B 12 02 is a continuation of project B 11 04. BMQ retested its mixture, which showed that the test results remained satisfactory and did not match the problems encountered by its client.
[335] Mr. Dubé tried to increase the dose of the colloidal agent in the mixture, thereby increasing the viscosity of the mixture so that the various inputs remain in suspension and do not separate. This addition, however, made the mixture too fluid. The mixture was therefore reformulated and other tests carried out, with varying degrees of success.

Field of Science/Technology:

Civil Engineering (2.01.01)

Project Details:

Intended Results:
Work locations: field
Key Employees: Jacques Bertrand (Civil - PEng. (1970) / President)
Evidence types:

Scientific or Technological Advancement:

Uncertainty #1: Technological uncertainty

APPELLANT ARGUED:

[339] According to the appellant, the activities undertaken by BMQ in the context of this project constitute SR&ED activities, since these aim to determine the factors that may affect a mixture on the job site, which met standards when it was tested in laboratory. New knowledge on the impact of water on concrete was acquired during this project. The activities therefore constitute SR&ED activities since they can be qualified as experimental development work undertaken in the interest of technological progress.

CRA ARGUED:
[340] According to the respondent, the activities cannot be classified as SR&ED. According to Mr. Mimoune, the mixture used was already known to BMQ, although adjustments regarding the dosage of the inputs were made. The steps taken by BMQ were aimed at solving a technical problem, which was done by the trial-and-error method since BMQ used public data and the experience of its staff and collaborators to solve the problem. problem. In addition, the problems encountered in the development of the mixture are normal difficulties whose solutions are part of current practice. In this case, BMQ designed existing technologies, which was feasible with a certain effort and reasonable skills.

The most significant underlying key variables are:

WATER CONTENT & CONTAMINANTS (unresolved), effects of colloidal agents (unresolved), effects of plasticizers (unresolved), setting agents (unresolved)

Technology or Knowledge Base Level:

Activity #1-1: Activity 1 (Fiscal Year 2020)

Project Name:	B-12-02 Improvement of quick setting self-compacting concrete	**Start Date:**	2020-05-01
Project Number:	2023	**Completion Date:**	2020-09-30

Methods of experimentation:

Method	Experimentation Performed
Analysis / simulation:	4 alternatives
Trials:	4 runs / samples

[335] Mr. Dubé tried to increase the dose of the colloidal agent in the mixture, thereby increasing the viscosity of the mixture so that the various inputs remain in suspension and do not separate. This addition, however, made the mixture too fluid. The mixture was therefore reformulated and other tests carried out, with varying degrees of success.
[336] After analyzing various factors that could cause a mixture to segregate, such as the weather or the presence of vibrations, Mr. Dubé concluded that the only factor of variation was the local water used to prepare the mixture. In principle, concrete is made with potable water; the literature indicates that water should not have an impact on a mixture, unless organic matter is present there. However, after having repeated the tests with a sample of the site water, Mr. Dubé discovered that the water used on the site in question was problematic, even if this water was potable. Mr. Dubé is however unable to specify the element present in the water that could have had this effect.
[337] According to Mr. Dubé's testimony, water was therefore delivered to the site to allow the work to be completed. From now on, when a project is done in a remote region, BMQ requests that the water to be used in the mixture be sent to it beforehand so that it can carry out tests to ensure that the mixture will not be affected.

Results:

[336] After analyzing various factors that could cause a mixture to segregate, such as the weather or the presence of vibrations, Mr. Dubé concluded that the only factor of variation was the local water used to prepare the mixture. In principle, concrete is made with potable water; the literature indicates that water should not have an impact on a mixture, unless organic matter is present there. However, after having repeated the tests with a sample of the site water, Mr. Dubé discovered that the water used on the site in question was problematic, even if this water was potable. Mr. Dubé is however unable to specify the element present in the water that could have had this effect.

Conclusion:

RULING & RATIONALE: THE JUDGE CONCLUDED;

[341] The evidence did not convince me, on a balance of probabilities, that there was a technological uncertainty that could not be resolved by current technical or practical studies and that the process led to technological progress.

[342] BMQ used current technological knowledge to improve the product developed within the framework of the B 11 04 project, which does not necessarily demonstrate technological uncertainty. There would have been technological uncertainty if BMQ had convinced me that the probability of achieving the objectives or the way to achieve them could not be known or determined in advance based on the experience or technological knowledge usually available. BMQ was faced with uncertainty as to the causes of the unsatisfactory results of a mixture whose performance had been previously tested. In my opinion, the addition of a colloidal agent to decrease the segregation of a mixture and the analysis of weather and vibrations are common techniques in the industry.

[343] Also, the documentary evidence does not support the explanation of the project given by Mr. Dubé at the hearing. In his testimony, Mr. Dubé indicated that progress in this project consists in the fact that BMQ has acquired the knowledge that water, even drinking water, can affect the results of a mixture. However, the only mention of water on Form T661 is that indicating that the water had been analyzed since the only variable under construction in relation to laboratory tests is the water-binder ratio. Form T661 indicates that technological progress lies in the acquisition of knowledge related to the effect of certain adjuvants, namely the colloidal agent VMA 362, the plasticizer Glenium 7500 and the setting accelerator Pozzutec 20+, in the formulation of the mixture and in the acquisition of knowledge on the impact of these elements on the fluidity. There is no mention of water as an element that could have an impact on the mixture. Similarly, in the letter from BMQ dated November 12, 2013 addressed to the CRA (exhibit I 3, tab 10), BMQ indicated that the technological advancement of this project consists in understanding the causes of the instability mixing and developing a solution with regard to formulation or mixing; technological uncertainty was due to the question of what would be the synergy of the adjuvants used (colloidal agent, plasticizer and setting accelerator) in reaction with the cement. According to this letter, tests have shown that the effect produced by an adjuvant could affect the effect that one sought to obtain by means of another adjuvant present in the formulation. Nowhere in this letter is there any mention of the effect of water on the mixture.

[344] I conclude that Mr. Dubé's testimony is not consistent with the content of the T661 form and what BMQ claims in the letter of November 12, 2013. Similarly, the timesheets produced in evidence indicate that the water used in this project has been tested and found to comply. There is no mention of the tests carried out with different water that Mr. Dubé talked about.

[345] Several laboratory tests were carried out, but, overall, BMQ proceeded by the trial-and-error method to determine the cause of the problems with its mixture and not by applying the scientific method, even if several hypotheses were put forward by BMQ, although they were not explicitly stated at the hearing.

[346] Finally, as in the case of the other projects, the BMQ tests can be partially reconstructed using its documentation, but a report compiling the tests and making it possible to follow BMQ's thinking throughout the project. has not been prepared. In addition, as mentioned above, Mr. Dubé's testimony is not in accordance with Form T661 and the letter from BMQ dated November 12, 2013.

[347] Thus, for these reasons, the activities carried out by BMQ in the context of this project cannot be qualified as SR&ED activities since, in particular, the criteria of technological uncertainty and technological progress were not met.