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|---|---|---|---|
| **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)

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**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.

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[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.

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