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.

COMMERCIAL CO

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.

COMMERCIAL CO