# ACI Sherbrooke

*Section étudiante / Student chapter*

## Presentation of Sherbrooke student chapter

**By: ESSELAMI Redha, Ph.D. Candidate, President of Sherbrooke student chapter**

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**ACI Student Forum, ACI Fall Convention, October 14-18, 2018, Las Vegas**

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# Introduction


ACI Sherbrooke is a student chapter of the American Concrete Institute (ACI) at the University of Sherbrooke.

**Objectives of the Student chapter**

1. **To encourage exchanges between students and professionals**
2. **To participate in promoting the Université de Sherbrooke**
3. **To promote the visibility of the research in the field of concrete structures and cementitious materials**

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# Introduction

## Industrial and academic Sponsors

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ACI Sherbrooke is a student chapter of the American Concrete Institute (ACI) at the University of Sherbrooke.

**Objectives of the Student chapter**

I. **To participate in various student competitions organized by the ACI in North America**

II. **Promoting ACI Sherbrooke student chapter activities**

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# Introduction

## Academic Sponsors

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ACI Sherbrooke is a student chapter of the American Concrete Institute (ACI) at the University of Sherbrooke.

**Objectives of the Student chapter**

I. **To participate in various student competitions organized by the ACI in North America**

II. **Promoting ACI Sherbrooke student chapter activities**

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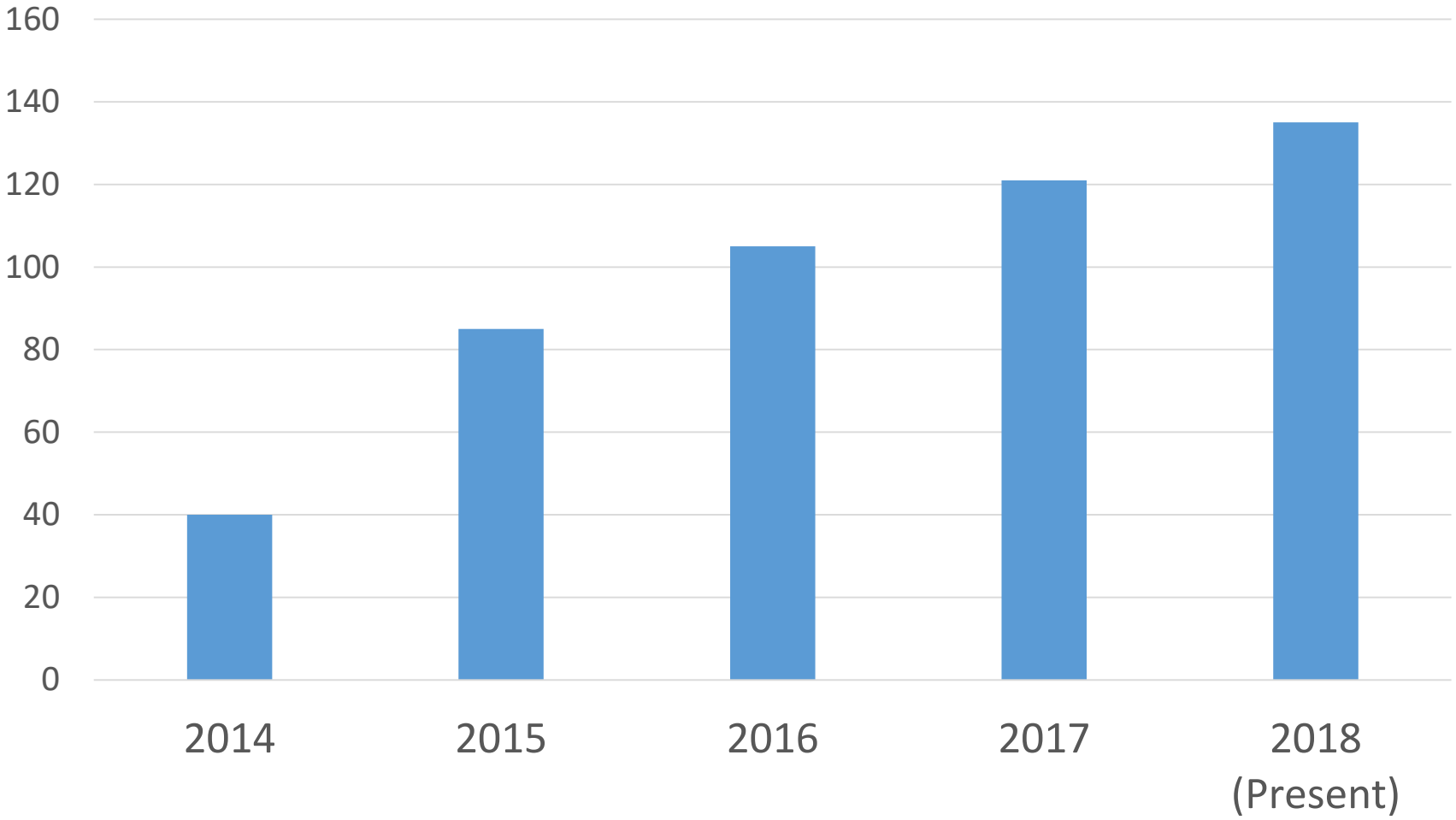
# Membership




**This non-profit student section has 135 graduate and undergraduate members.**

## In full growth

**43% Bachelor students**
**21% M.Sc. Students**
**25% Ph.D. Students**
**11% others**

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# Executive members


The executive board is composed of:

- President,
- Treasurer,
- Secretary,
- Communication VP,
- Competitions VP,
- Undergrad activities VP,
- Representative of research group.

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# Activities



## Technical and educational presentations

Invited speakers from different communities: Other universities, industry, consultants, designing.

## Technical visits

Construction sites, industrial concrete projects, and cement and concrete plants.

## Competitions

Student competitions for graduate and undergrad students such as: Eco concrete, quad chart, and photography.

## ACI Conventions

Organizing trips for students to participate in ACI competitions and talk about their research projects

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# Lectures and networking events


Since 2014, the ACI Sherbrooke student chapter has offered to its members:

- 33 presentations
- 10 technical visits
- 5 ACI conventions
  - Washington, F2014
  - Philadelphia, F2016
  - Detroit, W2017
  - Anaheim, F2017
  - Las Vegas, F2018

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# Local Pervious concrete competition


Preparing students for the international competition by enhancing their knowledge about the most important elements of the competition.

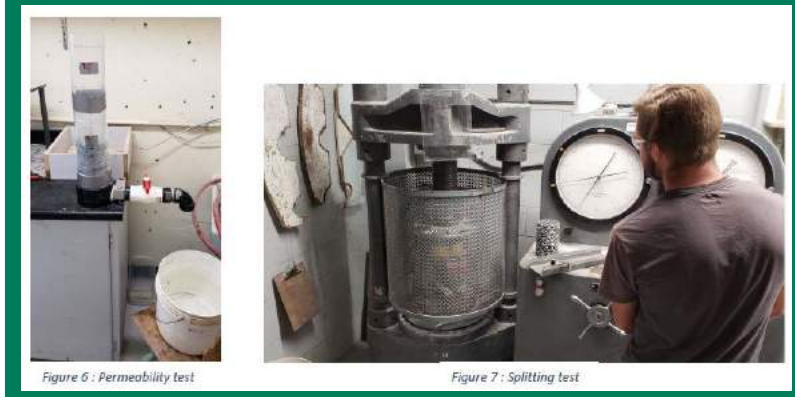

Figure 6 : Permeability test

Figure 7 : Splitting test

The competition winners were announced during the wine and cheese conference.

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# EcoConcrete Student Competition (1st ed. at Anaheim 2017)

**Developed by Sherbrooke Student chapter**

**A two-year project and collaboration of 19 students**

## Outline

- To promote the idea of environmental performance in concrete mix design as an important aspect of sustainability.
- To develop an innovative concrete mixture, with the lowest environmental impacts while maintaining maximum mechanical and durability performance.
- To seek out and use local sources of concrete materials (SCMs, ASCMs, recycled aggregates, etc.)

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# EcoConcrete Student Competition (1st ed. at Anaheim 2017)

## CalculationTools 2.01

- To promote the idea of environmental performance in concrete mix design as an important aspect of sustainability.

*Lastest version:*

## EcoConcrete Student Competition

### Summary

*Developped by ACI Sherbrooke Student Chapter*

**Table 1 : Base- and Alternative-Case Scenarios charcateristics**

| Mix characteristics | Unit | Base-Case Scenario | Alternative-Case Scenario | Note |
|---|---|---|---|---|
| Density | kg/m³ | 2470 | 2470 | |
| Total binder content (b | kg/m³ | 400 | 400 | $b_{BCS} = b_{ACS}$ |
| Water-to-binder ratio (w/b) | | 0.43 | 0.43 | $w/b_{BCS} = w/b_{ACS} = 0.43$ |
| Cement substitution rat | % | 0% | 40% | Maximum 40% |

**Table 2 : Details of the potential environmental impact scores and variation**

| Impacts categories | Units | Base-Case Scenario | Alternative-Case Scenario | Potential environmental impact reduction |
|---|---|---|---|---|
| Global warming | kg $CO_{2\,eq}$ | 366.973 | 262.496 | 28.5% |
| Carcinogenic | CTUh | 5.18E-06 | 4.55E-06 | 12.2% |
| Ozone depletion | kg CFC-11 eq | 1.55E-05 | 1.16E-05 | 25.4% |
| Ecotoxicity | CTUe | 596.460 | 528.068 | 11.5% |
| Fossil fuel depletion | MJ | 142.815 | 102.095 | 28.5% |

**Figure 1: Your improvements in a glance**

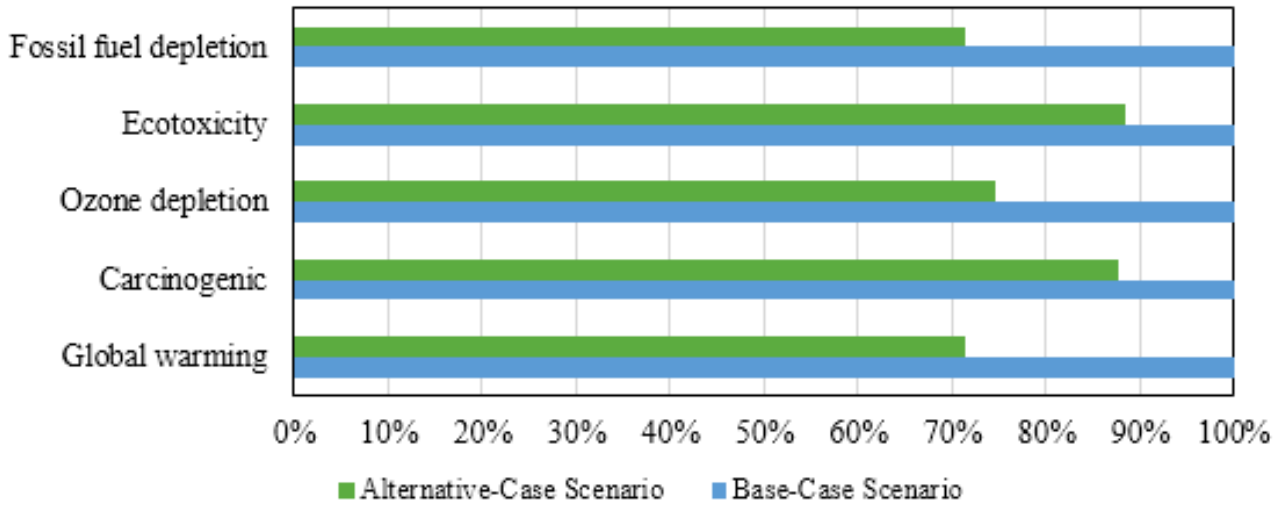


**Table 3 : Sensivity analysis and estimation of your final score**

| Performances | Units | Weigthing | Results |
|---|---|---|---|
| Written report | % | 0.25 | 100.0% |
| Poster presentation | % | 0.20 | 80.0% |
| Compressive strength | MPa | 0.10 | 50.0 |
| Electrical resistivity | kΩ*cm | 0.20 | 254.0 |
| Environmental impact reduction | % | 0.25 | 21.2% |

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# ACI Conventions

## ANAHEIM A2017


## ANAHEIM
## Autumn 2017

- ACI Sherbrooke student chapter delegation consisted of 06 students.
- 05 students participated in eco-concrete competition.
- 01 student presented his research studies.

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## MIXTURE FORMULATION

### Base-Case Scenario

| | | |
|---|---|---|
| Type 1 GU Portland Cement: | 400 | kg/m³ |
| Sand (natural): | 740 | kg/m³ |
| 5-10 mm Aggregate: | 1010 | kg/m³ |
| Water: | 172 | kg/m³ |

**E/C = 0.43**

### Alternative-Case Scenario

| | | |
|---|---|---|
| Type 1 GU Portland Cement: | 240 | kg/m³ |
| Coal fly ash: | 120 | kg/m³ |
| Metakaolin: | 8 | kg/m³ |
| Glass powder: | 32 | kg/m³ |
| Sand (natural): | 740 | kg/m³ |
| 5-10 mm Aggregate: | 1010 | kg/m³ |
| Water: | 172 | kg/m³ |
| Sika viscocrete 2110: | 0.8 | kg/m³ |
| Sika De-Air: | 0.8 | kg/m³ |

**E/C = 0.43**

## NPUTS FOR THE LIFE CYCLE ASSESMENT

### GLASSPOWDER PRODUCTION ENERGY (PER KG)

| Process | Quantity of energy | Unit |
|---|---|---|
| leating: naturel gas high ressure (CA-QC) | 8,11E-06 | m³ |
| rinding: electricity, nedium voltage (CA-QC) | 0,068 | kWh |
| licronization: electricity, nedium voltage (CA-QC) | 0,2262 | kWh |

## ADMIXTURES

A lot of studies show that the environmental impacts of the admixtures are really low. Since they are used in really small proportions in the concrete mixtures, it's beneficial to use them because of all the benefits they can bring on the aspects of durability and mechanical performances.

### MECHANICAL AND PHYSICAL PROPERTIES

| Properties | Value | Age |
|---|---|---|
| Compressive strength | 38.6 MPa | 21 days |
| Estimated electric resistivity | 26.2 kΩ.cm | 21 days |

### TRANSPORTATION (KM)

| Material | Road | Rail | Waterway | Manufacturing location |
|---|---|---|---|---|
| Cement | 155 | 0 | 0 | Lafarge St-Constant, QC Canada |
| Sand | 8,7 | 0 | 0 | Beton Provincial Sherbrooke, QC Canada |
| Gravel | 8,7 | 0 | 0 | Beton Provincial Sherbrooke, QC Canada |
| Glass powder | 222 | 0 | 0 | VERROX (by Tricentris) Lachute, QC Canada |
| Fly ash | 155 | 0 | 0 | Lafarge St-Constant, QC Canada |
| Metakaolin | 155 | 0 | 570 | BASF Canada Mississauga, ON Canada |

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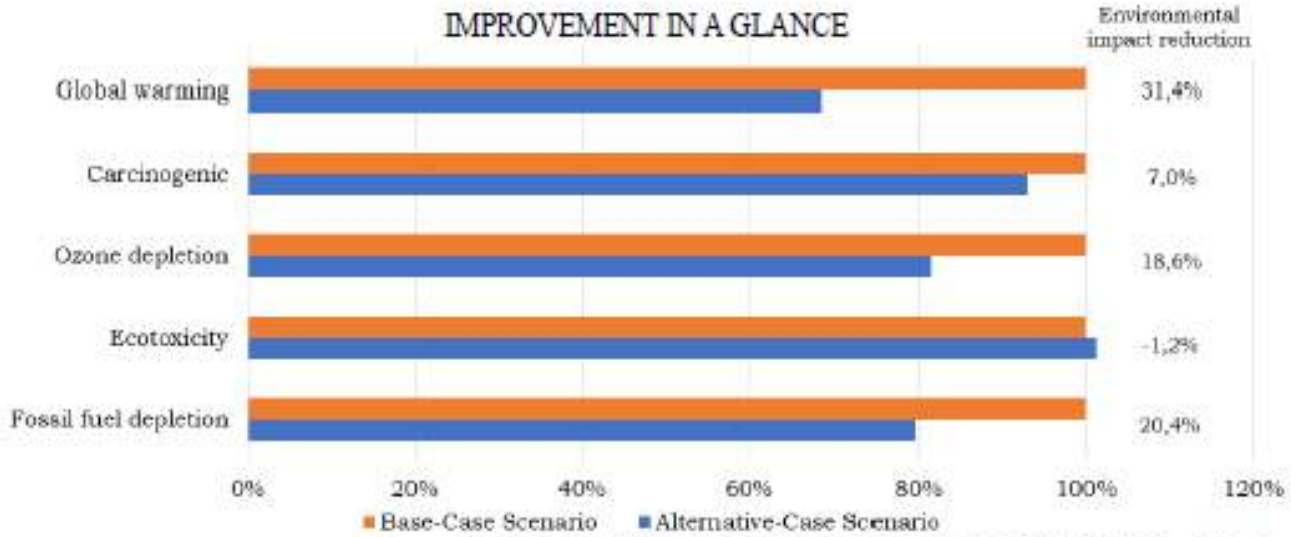
## Base-Case Scenario environmental impact

| Product | Global warming kg $CO_2$ eq | Carcino-genic CTUh | Ozone Depletion Kg CFC-$11_{eq}$ | Ecotoxicity CTEh | Fossil fuel depletion MJ |
|---|---|---|---|---|---|
| Type 1 (GU) Portland cement | 98,3% | 85,4% | 93,9% | 82,4% | 93,8% |
| | 371,572 | 4,55E-06 | 1,70E-05 | 566,52 | 156,875 |
| 0-5 mm sand | 0,3% | 0,6% | 1,5% | 1,4% | 1,4% |
| | 1,114 | 3,28E-08 | 2,70E-07 | 9,724 | 2,414 |
| 5-10 mm aggregate | 1,4% | 13,6% | 4,8% | 11,8% | 4,7% |
| | 5,177 | 7,25E-07 | 8,64E-07 | 80,84 | 7,921 |
| Tap water | 0,0% | 0,4% | 0,0% | 4,5% | 0,0% |
| | 0,029 | 2,32E-08 | 3,51E-09 | 30,788 | 0,028 |
| **Total** | **377,892** | **5,33E-06** | **1,81E-05** | **687,872** | **167,238** |




**AVERAGE ENVIRONNEMENTAL IMPACT REDUCTION : 15.2%**

As shown in the two figure above, some of the alternative materials have negative impact on the environment compared to the portland cement. However, those materials provide to the concrete a greater compressive strength and a better durability. Therefore, in combination with other materials which have less impact on environment, it is possible to design a concrete that is less damageable to the environment, that has an increased compressive strength and that is more durable.

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# ACI Conventions

## PHILADELPHIA A2016

**Philadelphia**
**Autumn 2016**

- ACI Sherbrooke student chapter delegation consisted of 13 students.
- 6 students presented their research studies (5 oral and 1 poster).

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# Denver
# Automne 2015



## Denver
## Automne 2015

Eight undergraduate students and ACI Sherbrooke members competed in the student competition;

**Pervious concrete cylinder competition**

The delegation finished 13th out of a total of 49 participating teams.

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# Student competitions


## Philadelphia
## Automne 2016

For undergraduate students who competed in the student competition;

**Mortar workability**

The delegation finished 10th out of a total of 48 participating teams.

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# Student competitions

## Kansas City Winter 2015 and Detroit Winter 2017

At the ACI convention undergraduate students and members of Sherbrooke chapter participated in the student competition,

## FRP Composite Competition

One of the teams from the Université de Sherbrooke delegation finished 6th out of a total of 11 teams.

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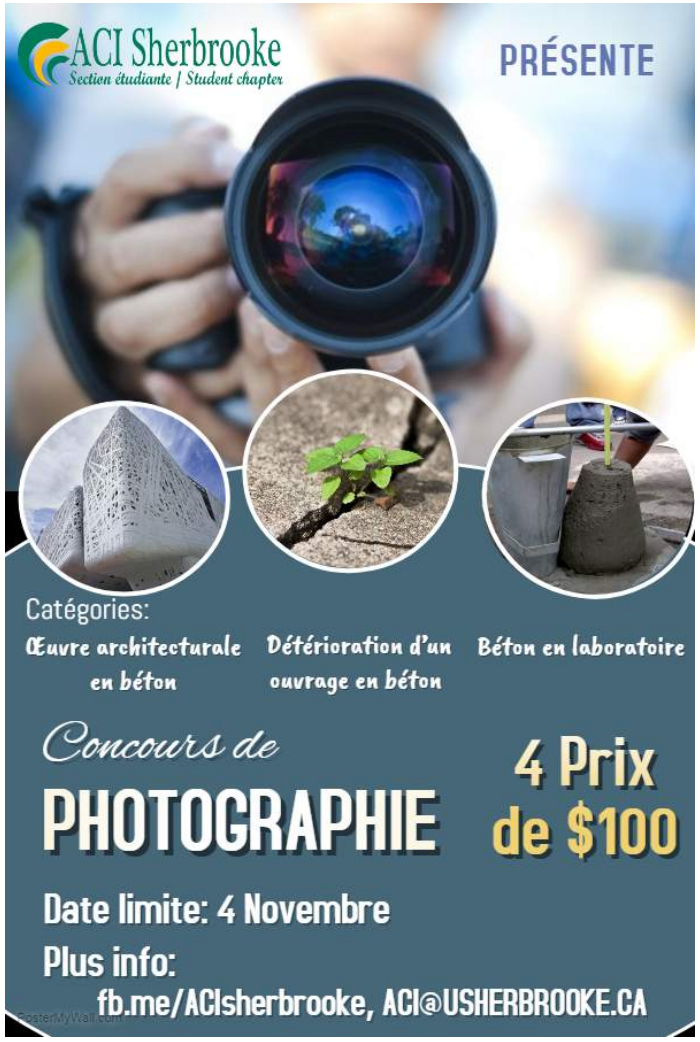
# Photo Contest, First Version




To promote civil engineering work in concrete and stimulate the creativity of students at the University de Sherbrooke.

## Categories:

- Architectural Concrete
- Concrete Deterioration
- Concrete in laboratory

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# Glass concrete Plates!


In the aim to thank the companies who hired students for their internship, the university decided to offer a gift which represent the university of Sherbrooke. We contribute in this project by producing a glass concrete plates made with nano-cellulose fibers. All the team participated in this project and the results were just amazing.


**The ACI Sherbrooke Student chapter thanks you for your attention.**

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