

The following lists the criteria and point range to be used in judging the GNCTR teams wishing to compete for the CIRCA Award. Note that all entrants must submit their mix designs as well as the results of the required tests. *Entrants are required to present results in the measures/terms indicated for each criterion and summarize results in a separate table (see form on page 3).* Completed Results Report Forms should be submitted to CIRCA Judges on site at the Technical Exhibit.

From a technical perspective, best Fly Ash concrete will be defined by scoring entrants against each other as well as against generally accepted concrete practices on the following criteria:

Criteria and Scoring

1) Highest Fly Ash Percentage – 125 points maximum

The higher the percentage of fly ash used, as a proportion of the total cementing materials, the lower the environmental footprint of the concrete produced. This assumes that fly ash is commercially available, at reasonable cost, in the geographic area in which the concrete is being produced. Minimum Fly Ash Content has to be 20% of total cementitious materials in the mix. If fly ash is absolutely not available in your region, contact CIRCA (see Technical Support, below) to access the product needed.

2) Ultimate Strength at 28 days – 75 points maximum

Ultimate strength is the most used measure of the soundness and quality of the concrete. Further, it can be said that the higher the strength, the smaller the concrete mass in the overall design. 56-day, as opposed to 28-day strength, is typically chosen by the engineering community for higher performance concretes especially those incorporating large volumes of Fly Ash. In recognition of the time constraints presented by the GNCTR, accelerated curing is encouraged at temperatures not to exceed 60 deg-C. This allows the long-term benefit of using fly ash to be realized within a shorter period. Specimens for strength testing can be cured in water at temperatures up to 60 deg-C after the initial day curing in the moulds/forms at lab temperature.

3) Low W/CM ratio – 50 points maximum

The lower the water to cementing materials ratio, the better the durability of the concrete, all other things being equal. Another important consideration here is achieving the appropriate plastic properties to meet the method of placing or molding.

4) Cement Efficiency at 28 days – 50 points maximum

The best Economy, as well as low environmental impact and durability, is an important goal of good engineering. Cement efficiency, as measured by MPa's of compressive strength at 56 (or in this case, 28) days per kg of cementing materials, is a common way of measuring the efficiency of the cementing materials and the mixture design in concrete. As the cementing

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materials are typically the highest cost item in concrete, cement efficiency can also be used as a measure of economy (strength/c+fa).

5) Economy – 100 points maximum

The cost per cubic meter of a concrete mix translates directly to the overall cost of a project. A goal of good engineering needs to consider the overall cost benefit of a given solution and thus the overall cost of all building materials should be minimized while maintaining other engineering goals. The lowest overall mix cost per cubic meter is the goal of this criterion. For the purpose of costing the mix the following raw material costs should be used: Type GU cement = \$175 / tonne, Type HE cement = \$200 /tonne, Fly Ash = \$100 / tonne, Slag = \$160/ tonne, Silica Fume = \$600 / tonne, High Range Water Reducer = \$5.00 / litre, Non-chloride Accelerator = \$5.00 / litre, Air Entraining Agent = \$5.00 / litre.

RESULTS MUST BE REPORTED IN THE UNITS SPECIFIED FOR EACH DATA ELEMENT LISTED IN THE RESULTS REPORT FORM, ATTACHED.

SUBMISSIONS MUST INCLUDE A COPY OF YOUR TEAM’S TECHNICAL REPORT.

Technical Support

CIRCA recognizes that all competitors may not have the capacity to do prescribed testing or ready access to fly ash. In these cases, **contact CIRCA directly to access required technical support or product at anne_weir@sympatico.ca or tel.: (514) 482-1220.**

General technical support can be obtained through the following CIRCA members:

Mr. Brad Pope	Manager Lehigh Cement	(604) 952-5621	bpope@lehighcement.com
Mr. Paul Masson	Regional Technical Director Lafarge Canada Inc.	(403) 225-5424	paul.masson@lafarge-na.com
Mr. James MacLean	Senior Mechanical Engineer exp	(506) 461-0366	james.macleam@exp.com

CIRCA resources are available at no cost on the CIRCA website: www.circainfo.ca/resources.htm

Technical Fact Sheets, Videos and a **Web-based learning module** on *“Traditional and Non-traditional Uses of Coal Combustion Products (CCPs)”* describe the performance and sustainability benefits of Coal Ash in concrete applications. The learning module, produced in collaboration with the University of New Brunswick (Dept. of Civil Engineering), introduces the nature, origins and applications of Fly Ash and other Coal Combustion Products.

While not rewarded here, it must be stated that the most important goal of any engineering design is the preservation of human life and well-being. CIRCA encourages all participants to have fun, be creative and most of all BE SAFE!



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RESULTS REPORT FORM

SCHOOL: _____

TEAM NAME: _____

TEAM CONTACT: _____

CELL PHONE: _____

E-MAIL ADDRESS: _____

SCORING CRITERIA:

- 1) Highest Fly Ash Percentage – 125 points maximum
- 2) Ultimate Strength at 28 days – 75 points maximum
- 3) Low W/CM ratio – 50 points maximum
- 4) Cement Efficiency at 28 days – 50 points maximum
- 5) Economy – 100 points maximum

REPORT RESULTS IN SPECIFIED UNITS FOR EACH DATA ELEMENT:

Mix Design	Required Data	Units
Cement – Type GU		kg/m ³
Cement – Type GUL		kg/m ³
Cement – Type HE		kg/m ³
Fly Ash		kg/m ³
Silica Fume		kg/m ³
Slag		kg/m ³
HR Water Reducer		litre/m ³
NC Accelerator		litre/m ³
Air Entraining Agent		litre/m ³
Other		
Other		
Other		
Water		litre/m ³
Performance		
Strength @ 7 Days		MPa
Strength @ 28 Days		MPa

TO BE PRESENTED BY YOUR TEAM’S MIX DESIGN SPECIALIST, WITH A COPY OF YOUR TEAM’S TECHNICAL REPORT TO A CIRCA JUDGE AT THE TECHNICAL EXHIBIT.

DATA REPORTED WILL REMAIN CONFIDENTIAL TO CIRCA