LAFARGE

A MEMBER OF HOLCIM

Sustainability

We are committed to living up to the responsibilities that come with being the global leader in building materials and solutions. We spearhead the transition towards low-carbon construction and are the leader in promoting a circular economy, from alternative fuels to concrete recycling

ECOPact
The Green Concrete

Reducing water usage

Reducing waste in operations

Creating social value

Reducing CO2 emissions

BUILDING FOR net zero PEOPLE & PLANET

As global leader, we aim to demonstrate, with our actions, how we are a responsible and ethical company, with sustainability as a core value

LAFARGE A MEMBER OF HOLCIM

Circularity in construction: How can we overcome the hurdles?

Extraction

- Fuel
- Dewatering

Transportation

- Type of transport
- Ratio of fuel consumption vs. material moved
- Proximity to market

Manufacturing

- Fuel, energy
- Chemical processes
- Raw materials (recycled or % substitute)

Construction

- Fuel
- Raw materials (recycled or % substitute)

Demolition

- Fuel
- Upcycling materials, re-incorporate back into the system

Key Catalysts:

- Planning and design: Introduce sustainability and circularity from the project's conceptualization
- Political will: A critical and powerful change agent
- Standards and regulations: Modernization and awareness to incorporate "what's possible'

Building Materials: Setting the Context

5 Important Things to Know…	
1	Canada generates approximately 34M tonnes of waste and is one of the biggest per capita generators of waste on earth, with 25M tonnes sent for disposal in landfills
2	Lafarge estimates that the GTA generates approx. 5M tonnes of asphalt and concrete demolition rubble every year. This would equate roughly to 10% of the annual GTA aggregates demand.
3	Concrete, second only to water, is the most consumed substance in the world. Concrete is used twice as much in construction as all other building materials combined.
4	700,000 km / year of new roads are built worldwide. One km of a four-lane highway requires 40-50k tonnes of material for construction.
5	Over 550kg of CO_2 are emitted per tonnes of cement produced; according to the Cement Association of Canada, 13M tonnes of cement was produced in 2014 (over 7 million tonnes of CO_2 emissions!)

Material innovations can drastically reduce the environmental impact that results from building our cities, while also supporting our journey to net zero.

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Recycled Aggregate Solutions

The future is… Aggneo

Consistency in quality & performance

Aggneo is Lafarge's 100% recycled quality aggregate
Lafarge's established operating procedures and chain of custody for materials provides controlled quality, consistency, and performance
Over 10 years experience in producing recycled aggregates

Recycled & Sustainable

Lifecycle CO_2 lower than natural aggregate considering production (removing overburden, blasting, etc).
Natural aggregate emits about 15 kg of CO_2 per ton and 7 kg of CO_2 per ton for recycled aggregates.
Closer to market reduces CO_2 emissions. 1L of diesel generates ~2.7kg of CO_2 emissions. For every 100km avoided, this avoids over 105kg of CO_2 emissions. It adds up!
Recycled aggregates avoids depletion of natural resources.
Diversion of waste from landfills

Versatile & Flexible

Aggneo is currently used across Eastern Canada for road construction (base and sub-base), parking lots, parkways, pipe bedding and trench backfill on municipal water servicing projects.
Lafarge invests in continuous research and testing to expand acceptable applications based on performance

People & Services

Our team supports your efforts in increasing sustainability and circularity in the built environment
Lafarge is a leader in quality control, innovation and research; our best in class technical support ensures product compliance and consistency
Encourages a circular economy in the built environment

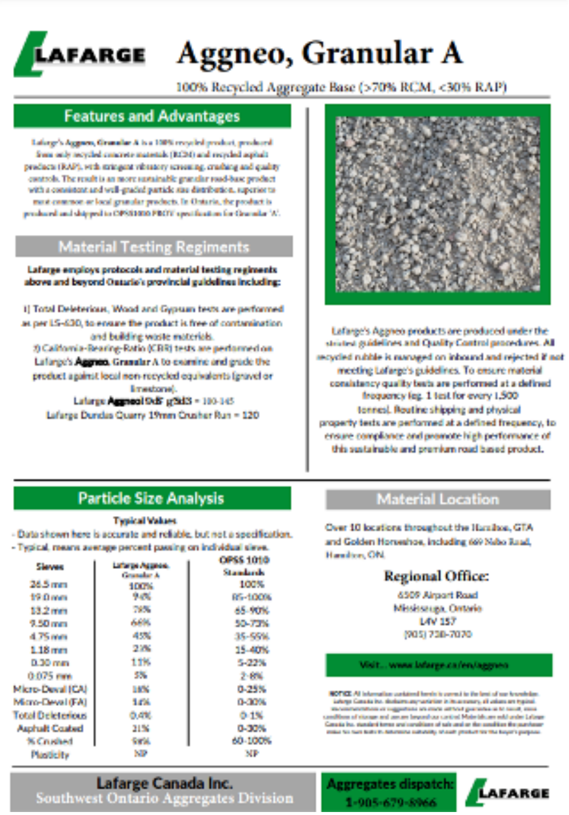
Recycled Aggregate: Fast Facts

The future is… Aggneo

- The Ontario Ministry of Transportation (MTO) is the largest single consumer of aggregates in the province of Ontario with average annual consumption of 10.9 million tonnes (2001-2011) (1)
- Between 2005-2008, approx. 20% of the aggregates used by MTO in provincial highway road construction were recycled materials
- Only about 7% of aggregate used in Ontario is recycled material, in comparison to up to 20% in European Countries (2)
- The City of Toronto is a municipal leader in the use of recycled aggregates, with applications ranging from base and subbase for pavements, hot mix asphalt, and backfill materials (TS1010). Recycled aggregate has also recently been approved for pipe bedding and trench backfill on municipal water servicing projects.
- Increasing the use of recycled aggregates would avoid millions of tonnes of natural resource extraction of a **depleting resource**.
- Recycled aggregates is a **true circular economy solution**, diverting waste from landfill, giving new life to aggregates, and reducing CO2 emissions.
- Increasing recycled aggregates would remove trucks from the road that generate CO2 emissions. 1L of diesel generates ~2.7kg of CO2 emissions. For every 100km avoided, this avoids over 105kg of CO2 emissions.
- Wear and tear on municipal roads would also be avoided with the closer proximity to market and reduced transportation.

(1) Quality Metrics for Recycled Aggregates in Municipal Roads, 2014 Paper prepared for presentation at the Green Technologies – Innovation to Implementation and Evaluation Session of the 2014 Conference of the Transportation Association of Canada Montreal, Quebec
(2) Environmental Commissioner of Ontario (2017). 2017 Environmental 118. Government of Ontario (2019). Ontario Regulation 406/19 On-site Protection Report: Good Choices, Bad Choices: Environmental Rights and Excess Soil Management.

Specifications & Operating Procedures



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Aggneo, Granular A

100% Recycled Aggregate Base (>70% RCM, <30% RAP)

Features and Advantages

Lafarge's Aggneo, Granular A is a 100% recycled product, produced from only recycled concrete materials (RCM) and recycled asphalt products (RAP), with stringent vibratory screening, crushing and quality controls. The result is an more sustainable granular road-base product with a consistent and well-graded particle size distribution, superior to most common or local granular products. In Ontario, the product is produced and shipped to OPSS1010 PROV specification for Granular 'A'.

Material Testing Regiments

Lafarge employs protocols and material testing regiments above and beyond Ontario's provincial guidelines including:

1) Total Deleterious, Wood and Gypsum tests are performed as per LS-630, to ensure the product is free of contamination and building waste materials.
2) California-Bearing-Ratio (CBR) tests are performed on Lafarge's **Aggneo**, Granular A to examine and grade the product against local non-recycled equivalents (gravel or limestone).
Lafarge **Aggneo** 19mm = 100-145
Lafarge Dundas Quarry 19mm Crusher Run = 120

Lafarge's Aggneo products are produced under the strictest guidelines and Quality Control procedures. All recycled rubble is managed on inbound and rejected if not meeting Lafarge's guidelines. To ensure material consistency quality tests are performed at a defined frequency (eg. 1 test for every 1,500 tonnes). Routine shipping and physical property tests are performed at a defined frequency, to ensure compliance and promote high performance of this sustainable and premium road based product.

Particle Size Analysis

Typical Values

- Data shown here is accurate and reliable, but not a specification.
- Typical, means average percent passing on individual sieve.

Sieves	Lafarge Aggneo, Granular A	OPSS 1010 Standards
26.5 mm	100%	100%
19.0 mm	94%	85-100%
13.2 mm	78%	65-90%
9.50 mm	66%	50-73%
4.75 mm	45%	35-55%
1.18 mm	23%	15-40%
0.30 mm	11%	5-22%
0.075 mm	5%	2-8%
Micro-Deval (CA)	18%	0-25%
Micro-Deval (FA)	14%	0-30%
Total Deleterious	0.4%	0-1%
Asphalt Coated	21%	0-30%
% Crushed	98%	60-100%
Plasticity	NP	NP

Material Location

Over 10 locations throughout the Hamilton, GTA and Golden Horseshoe, including 669 Nebo Road, Hamilton, ON.

Regional Office:

6509 Airport Road
Mississauga, Ontario
L4V 1S7
(905) 738-7070

Visit... www.lafarge.ca/en/aggneo

Lafarge Canada Inc.
Southwest Ontario Aggregates Division

Aggregates dispatch:
1-905-679-8966

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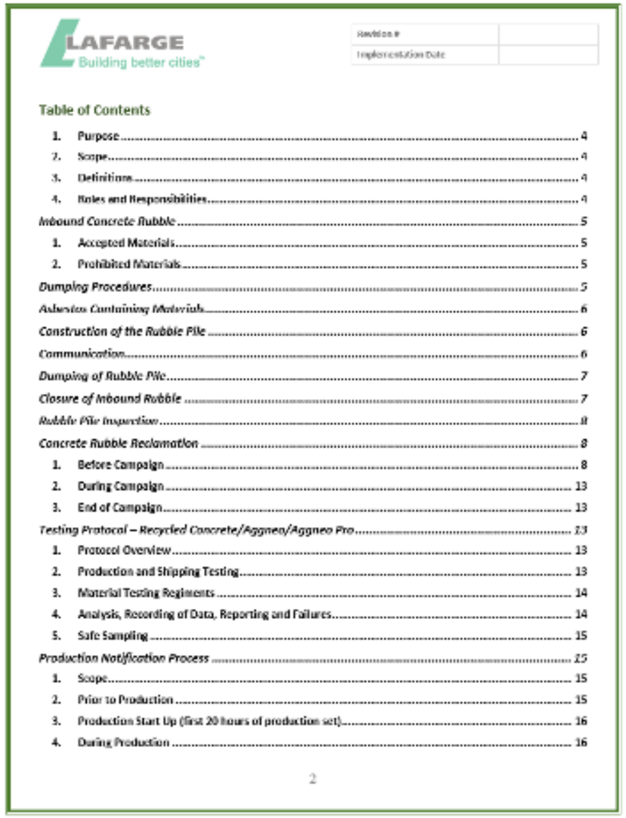

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Building better cities™

Revision #	
Implementation Date	

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Lafarge is a leader in rigorous production and quality control procedures for recycled aggregates.

Challenges and Solutions

Challenges

Perception

- Lack of knowledge and experience with using recycled aggregates
- Previous experiences with non-performing product (performance issues listed below)

Performance and Standards

- Inconsistent standards and specifications across regions including accepted applications
- Lack of standards and specifications within the industry including operating and production procedures and chain of custody; not all producers are equal
- Environmental diligence

Economics

- Recycled facilities (depots, quarries) must be close to the job
- Delivered prices of recycled materials need to have cost “advantage” over primary
- Public procurement must play a role to boost demand

Solutions

Perception

- Workshops, discussions, and events; partnerships with industry groups (i.e. Circular Economy Leadership Canada)
- Research and development; collaboration with Universities to test and document lifecycle performance and encourage expanded use
- Partnerships with local municipalities to increase use

Performance and Standards

- Research and development; collaboration with Universities; additional testing and field trials
- “Recycled Aggregates Action Plan” request for working group co-chaired by industry and municipalities and led by provincial government

Economics

- Lafarge expanding footprint and seeking additional sources of clean concrete and construction demolition rubble for crushing
- Workshops and collaboration with industry influencers to understand and improve the dynamics and to determine how procurement can be leveraged to maximize circularity

Case Study: GHG Emissions

Case study: Lafarge Canada aggregates reduces GHG emissions on Amazon project

SEPTEMBER 2020, EDMONTON, AB: During Lafarge Canada's collaboration with the University of Alberta's PhD Sustainability Scholar program, PhD Student Md Mustafizur Rahman conducted a study to assess the lifecycle and CO2 of recycled aggregates versus natural aggregates in Edmonton, AB. He developed a Greenhouse Gas (GHG) calculator which accounted for the life cycle analysis for aggregates from production site to customer, including GHG generated associated with stripping, mining, de-watering (pumping water), crushing and screening, reclamation, and transportation.

Dr. Rahman's study also completed the same analysis for recycled aggregates, which lack many manufacturing steps when compared to regular aggregates. One of our sources of recycled aggregates is the rubble from demolition of concrete structures and construction - another step in keeping non-recyclable waste out of our landfills.

In Edmonton, Lafarge stores recycled aggregates at our urban depots, so the transportation distances to the end user are even further reduced compared to facilities outside of the city limits. These factors alone significantly reduce the GHG emissions associated with transportation of aggregates to project sites, and Dr. Rahman's calculator determines by just how much.

A detailed review of the GHG impact of supplying aggregates to the new Amazon warehouse in the Edmonton area considered haul distances and stripping depths. Lafarge Canada's Northern Alberta team supplied recycled aggregates for the 1,000,000 ft2 facility - a total of 49,000 tonnes - from our Petroway depot. The recycled aggregate was also selected for its superior performance characteristics in this particular application.

The Sustainability Scholar calculations indicate that we reduced the amount of CO2 by 65% using recycled aggregates versus supplying new aggregate for this application. **This is the equivalent of keeping 148 cars off the road for one year!**

https://www.lafarge.ca/en/case-study-lafarge-canada-aggregates-reduces-ghg-emissions-amazon-project