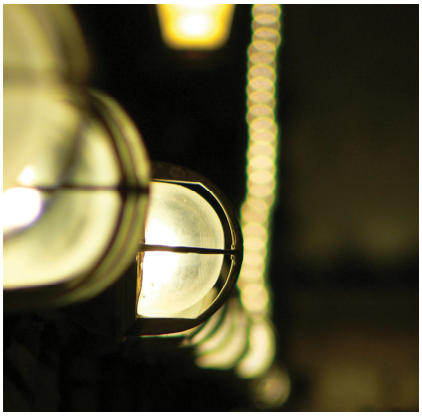
University of Saskatchewan


# Smart Purchases Big Impact

## Sustainable Purchasing Guide

## Road Materials

*Sustainability... your university, your world*



# Road Materials

## Introduction

This section provides information on currently available options for ***road materials*** that can help to move the University of Saskatchewan toward its sustainability goals. Living within the boundaries of our sustainability goals requires us to apply two main strategies:

***Dematerialization*** requires that we reduce the amount of materials as much as possible; and that we continually move toward the use of 100% recycled content.

***Substitution*** requires that we find less harmful materials to replace those that currently damage and are not recyclable.

***Sustainable purchasing*** is about including social, environmental, financial and performance factors in a systematic way. It involves thinking about the reasons for using the product (the service) and assessing how these services could be best met. If a product is needed, sustainable purchasing involves considering how products are made, what they are made of, where they come from and how they will be used and disposed.

Finally, remember that this is an evolving document – it will change with new information as our understanding of sustainability impacts and potential solutions improves.


### Purchasing Services

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**Smart Purchases Big Impact**

Wherever possible **CHOOSE** products that employ a combination of characteristics listed in the left hand column, and **AVOID** products that demonstrate characteristic in the right-hand column.

| CHOOSE | AVOID |
|---|---|
| • Reduce road building<br>• Recycled content<br>• Supplementary cementing material<br>• Permeable pavement | • Virgin Materials |

## Option: Reduce Road Building

**Strategy: Dematerialization (SO 1, 2, 3, 4)**

The most sustainable approach to road surfacing is to minimize its use and to avoid the excess use of roads. One strategy to shorten road length is to design more compact and pedestrian developments. A second strategy is to design narrower roadways, particularly in areas where traffic flow is minimal. Reducing our reliance on roadways reduces the resources consumed in road usage and discourages vehicle traffic.

## Option: Use Recycled Materials

**Strategy: Dematerialization (SO 1, 2, 3, 4)**

Using recycled material content in roadways is one way to reduce the associated material impacts. At least three such dematerialization strategies can be considered. First, crushing and reusing old roadway materials reduces the demand for virgin materials and diverts waste materials from the landfill. Secondly, a portion of the cement content can be replaced with fly ash, a by-product of coal generated as our electricity generation. Using this approach helps to avoid some of the impacts associated with the production of cement. Finally, in some areas old tires, roofing shingles or other materials and are being used as the bedding material for roadways.

## Option: Use Supplementary Cementing Materials

**Strategy: Substitution (SO 1, 2, 3, 4)**

Supplementary cementing materials (SCM) can be used to partially replace cement in concrete. Typical examples include fly ash, ground granulated blast furnace slag, rice husk ash, and silica fume. Fly ash, a by-product from coal-fired power plants, is one of the most commonly used SCMs. If this waste is not utilized it typically ends up in landfill so there is a further benefit in deferring the waste.

## Option: Use Permeable Pavement

**Strategy: Substitution (SO 3, 4)**

Permeable paving and road surface materials allow storm water to percolate into the soil and recharge groundwater resources. One type of permeable pavement option that works well in parking lots is a grass gravel pave system. These systems use gravel in the laneways between parking stalls and special grass for the parking stalls. This process reduces waste, prevents damage and creates green-space.

# Arriving
## at the currently preferred options

### 1. Identify the service

Road surface materials provide a surface for motor vehicles to travel upon. Roads are ever-present in developed societies and provide a network for transportation of people and animals, food, materials, emergency vehicles, and many other purposes.

### 2. Assess the need

Supporting the needs of the University of Saskatchewan requires access, as well as the ability to transport people and goods. Currently, this is primarily achieved through road transportation. While roads (and thus road surface materials) are required into the foreseeable future, some less intensive alternative transportation methods should be explored and implemented as appropriate.

### 3. Identify the contents

For the purposes of this assessment both concrete and asphalt roadways are considered.

***Concrete*** is the most commonly used construction material in the world. It is a mixture of two components: aggregates and paste. The paste is usually composed of Portland cement and water, which binds together the fine and coarse aggregates. A typical mix is about 10-15% cement, 60-75% sand/aggregate, 10-20% water and 5-8% air. When freshly mixed, it is malleable, allowing it to be poured into place and finished. Then, through a chemical reaction called hydration, the mixture hardens and gains strength to form the concrete we see in roads, buildings, sidewalks, bridges and other structures.

***Cement*** is the principle component of concrete and is produced by intergrinding clinker and gypsum into a fine grey powder. Clinker is a granular product produced by intergrinding raw materials such as limestone, shale, clay and sand in predetermined proportions, and heating the ground materials at very high temperatures (>1500 °C) in rotating kilns. Gypsum (a mineral) is added to regulate the setting time of the cement after the clinker is cooled, prior to conversion into cement.

***Asphalt*** is a dark brown to black cement-like material in which the predominating constituents are bitumens, which occur in nature or are obtained in petroleum processing. Asphalt is a constituent in varying proportions of most crude petroleum and used is used for paving, as well as roofing, industrial and other special purposes.

***Aggregates*** are hard, graduated fragments of inert mineral materials, including sand, gravel, crushed stone, slag, rock dust, or powder. Recycled aggregate is produced by crushing concrete, and sometimes asphalt, to reclaim the aggregate according to strict manufacturing standards.

### 4. Identify sustainability impacts

*i. ...systematically increasing concentrations of substances from the earth's crust?*

- ***Producing one tonne of cement*** results in the emission (and accumulation) of approximately one tonne of carbon dioxide (CO2), created by fuel combustion and the calcination of raw materials (CO2 production is inherent to the basic process of calcinating limestone). Cement manufacturing is a substantial source of greenhouse gas emissions.
- The ***extraction and transportation*** of road surface materials requires heavy transport vehicles and construction equipment. If the ***energy*** for these vehicles is derived from the combustion of fossil fuels, it leads to an increase in concentration of substances from the earth crust in nature, (e.g. CO2, CO and SOx). Increasing concentrations of these substances in nature can contribute to a number of negative effects such climate change and acid rain, as well as the associated negative human health impacts.
- ***Bitumens in asphalt*** are obtained from petroleum processing.

*ii. ...systematically increasing concentrations of substances produced by society?*

- The ***combustion of fossil fuels*** for energy produces a number of chemical compounds (e.g. nitrogen oxides) that build up in the atmosphere.

*iii. ...systematically degrading nature by physical means?*

- ***Road salt run-off can damage plants and pollute water bodies***. Excess salts limit plant uptake of nutrients and water, and salt build up can result in plant death. Spring melting can carry de-icers used on roads through municipal storm water collection systems into local surface water bodies, thereby contaminating freshwater resources and potentially harming aquatic species. Aquatic ecosystems can also be damaged, as the phosphates in de-icers promote algal growth potentially resulting in ***eutrophication*** of impacted water bodies.

*continued on page 3 . . .*

## 4. Identify sustainability impacts (con't)

- Road salts for de-icing purposes are often ***mined or extracted*** from deep pools, and proper steps must be taken to reduce the ecological footprint of the mining process and to remediate the impacted site after its use.

*iv. . . .systematically undermining people's ability to meet their basic human needs?*

- A number of the compounds produced by the combustion of fossil fuels (e.g. nitrogen oxides, carbon monoxide, sulfur oxides, particulate matter) have a negative effect on ***human health***.

## 5. Envision sustainable road surface materials

In principle, the sustainable management of road surface materials would feature:

- No materials that are derived from the earth's crust (e.g. petrochemicals and metals), unless those ingredients are 100% captured and reused in technical cycles.
- No components that are persistent in nature, unless those substances are 100% captured and reused.
- A production process that:
    - Does not contribute to the increased concentrations of substances from the earth's crust or the buildup of persistent compounds in nature,
    - Uses only sustainable renewable energy or energy produced in a carbon-neutral manner
    - Does not rely on practices that systematically physically degrade land and ecosystems
    - Does not rely on practices that undermine people's capacity to meet their basic needs.
    - Protects the health of workers, users and others.

## 6. Identify and prioritize alternatives

Step 6 helps identify the product or service that offers the best pathway toward meeting all four of our Sustainability Objectives by using the following three criteria for assessment:

a) Does the product or service move us in the right direction with regards to our four Sustainability Objectives?

b) Does the product or service create a

c) Is the decision financially viable?

# Resources
## and Additional Information

1. UK Highway Agency
   http://www.highways.gov.uk/aboutus/33752.aspx
2. EcoSmart Concrete
   http://www.ecosmart.ca
3. Permeable Pavement
   http://www.crd.bc.ca/watersheds/lid/permeable.htm

WHISTLER

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