

# Concrete Sourcing and Use

## Aim of the Credit

To reward projects that reduce environmental impacts from concrete.

## Credit Criteria

1	<b>Reduced Use of Portland Cement</b>	<p>Up to 2 points are available where the Portland cement content in all concrete used in the project has been reduced by replacing it with supplementary cementitious materials.</p> <p><b>1 point</b> is awarded where the Portland cement content is reduced by 30%, measured by mass across all concrete used in the project compared to the reference case;</p> <p>Or</p> <p><b>2 points</b> are awarded where the Portland cement content is reduced by 40%, measured by mass across all concrete used in the project compared to the reference case.</p>
2	<b>Reduced Use of Water</b>	<p><b>0.5 point</b> is available where the mix water for all concrete used in the project contains at least 50% captured or reclaimed water (measured across all concrete mixes in the project)</p>
3	<b>Reduced Use of Aggregates</b>	<p><b>0.5 point</b> is available where either:</p> <p>At least 40% of coarse aggregate in the concrete is crushed slag aggregate or another alternative materials (measured by mass across all concrete mixes in the project), provided that use of such materials does not increase the use of Portland cement by over five kilograms per cubic meter of concrete;</p> <p>Or</p> <p>At least 25% of fine aggregate (sand) inputs in the concrete are manufactured sand or other alternative materials (measured by mass across all concrete mixes in the project), provided that use of such materials does not increase the use of Portland cement by over five kilograms per cubic meter of concrete.</p>

If the cost of placed concrete (all costs) represents less than 1% of the project's contract value this credit is 'Not Applicable' and is excluded from the points available used to calculate the Materials Category Score.

This credit addresses all concrete used in the project including structural and non-structural uses. Concrete masonry is excluded.

Pre-existing concrete that is retained in a refurbished project, re-used concrete elements and recycled materials used in concrete masonry or other masonry, are addressed in 'Building Re-use' and 'Recycled and Re-used Products and materials' and are therefore not considered in this credit.

## Compliance Requirements

### 1 - Reduced Use of Portland Cement

#### Calculating the Reference Case

A reference case is used as a basis for calculating the percentage reduction of Portland cement in the building. The reference case represents the amount of Portland cement (in kilograms) that would have been used in the project if no supplementary cementitious materials were used.

The reference case should be established through the following steps (an example is provided in table 2):

Establish the concrete mixes used in the project, their volume and strength grade.

Based on table 1 calculate the total amount of Portland cement in each mix, in kilograms, assuming no supplementary cementitious materials are used.

Add all totals of Portland cement in all mixes, this figure is the reference case for the project.

It is noted that not all concrete mixes used in a project may have exactly the concrete strength grades shown in Table 1. The project concrete designer or the supplier's concrete technologist will need to use figures in table 1 to calculate the amount of Portland cement in such mixes. This is to be done as a linear interpolation of the two closest performing concrete mix reference cases.

Concrete Strength Grade	Portland cement content to be used in establishing the reference case
MPa	kg/m <sup>3</sup>
20	280
25	310
32	360
40	440
50	550
65	550
80	610
100	660

Table 1: Portland cement content concrete strength grades as defined in AS1379 – The Specification and Supply of Concrete and standard cement contents for each strength grade.

At grades higher than 65MPa, the strength becomes determined by water content and other factors, not just cement content, hence the reference case for 50MPa and 65MPa is the same.

The reference case and the proposed design must have the same structural and functional requirements in the same location and season.

### Portland Cement use Documentation Example

Table 2 shows a worked example of how the percentage of total Portland cement reduction shall be presented as a function of reference case and the actual case. Six different mixes are used in the example and the reference case Portland cement content and the actual Portland cement content is calculated for each mix. The total Portland cement content in the reference case and the actual case are then compared to establish the overall percentage reduction in Portland cement, in this case 38.3%.

Mix Label	MPa	Volume (m3)	Reference Case Portland Cement Content (kg/m3)	Total Portland Cement Content in the Reference Case (kg)	Actual Portland Cement Content (kg/m3)	Actual Total Portland Cement Content (kg)
Mix 1	20	300	280	84000	128	38400
Mix 2	32	800	360	288000	166	132800
Mix 3	32	4400	360	1584000	238	1047200
Mix 4	40	290	440	127600	247	71630
Mix 5	50	90	550	49500	295	26550
Mix 6	65	100	550	55000	333	33300
Overall Total Portland Cement (kg)				2188100		1349880

Table 2: An example of how the percentage of total Portland cement reduction shall be presented as a function of reference case and the actual case.

Overall percentage of replacement  $(1359480/2188100) \times 100 = 38.3\%$

Portland cement content in this example was reduced by 38.3% and is awarded with one point.

## 2 - Reduced Use of Water

Captured or reclaimed water is defined as rainwater captured on either the concrete supplier's manufacturing site, or another site, or recycled/recovered from a previous use such as blackwater or greywater from any locations.

### 3 - Reduced Use of Aggregates

Acceptable types of alternative coarse and fine aggregate are listed in Cement Concrete and Aggregate Australia publications Use of Recycled Aggregates in Construction and Guide to the Specification and Use of Manufactured Sand in Concrete.

#### Water and Aggregate Schedule Example

Table 3 shows an example of how use of alternative aggregate and captured water are documented. Values to be provided from the concrete supplier and verified on the basis of supplier batching or production records.

The purpose of this example only includes documentation of fine aggregate, documentation of coarse aggregate should be performed in a similar manner.

Mix Label	Mix Volume (m3)	Water				Fine Aggregate			
		Total (L /m3)	Total Water Content	Reclaimed or Captured Component (L/m3)	Total Reclaimed or Captured Water	Total (kg/m3)	Total Fine Aggregate in Mix	Alternative Fine Aggregate Component (kg/m3)	Total Alternative Fine Aggregate
Mix 1	300	142	42600	142	42600	867	260100	335	100500
Mix 2	800	141	112800	141	112800	802	641600	270	216000
Mix 3	4400	138	607200	70	308000	834	3669600	245	1078000
Mix 4	290	146	42340	70	20300	670	194300	90	26100
Mix 5	90	159	14310	0	0	553	49770	0	0
Mix 6	100	125	42600	0	42600	677	260100	0	100500
Totals		-	819250	-	483700	-	4815370	-	1420600
Overall percentage of replacement		$(483700/819250) \times 100 = 59.04\%$				$(1420600/4815370) \times 100 = 29.05\%$			

Use of captured and reclaimed water in this example exceeds 50%, use of alternative fine aggregate in this example exceeds 25%, as such one point may be awarded in this example

#### Portland Cement

Portland cement is the combined Portland cement clinker and calcium gypsum which is used in the manufacture/production of various cement types. Portland cement is defined in Australian Standard AS3972 – 2010 General purpose and blended cements section 3.2.

#### Supplementary Cementitious Materials

Supplementary cementitious materials include flyash, ground granulated blast furnace slag, and amorphous silica. They are defined in Australian Standard 3582 - Supplementary cementitious materials for use with Portland and blended cements.

Mineral additions include flyash, ground granulated blast furnace slag or limestone and are defined in AS 3972-2010 General purpose and blended cements.

## Innovation Challenge

### Sustainable Sourcing of Concrete Aggregates

The GBCA invites project teams submit an innovation challenge for the sustainable sourcing or concrete aggregates.

## Documentation Requirements

### ‘Design Review’ Submission (Optional)

Project teams are to submit information/documentation marked with an asterisk\* for ‘design review’

### As Built Submission

All project teams are to submit the following documentation:

#### Submission Template\*

- Description of the uses of concrete in the building\*
- Summary of the concrete mixes used in the building and the volume used\*
- Summary of the amounts of recycled aggregates and recycled water included in the concrete mix\*

Project teams are required to provide documentation supporting credit compliance. The following documents may be used to demonstrate compliance:

- **Structural Specifications**
- **Structural Drawings**
- **Structural engineer’s report** including
  - Summary calculation of the Portland cement content in the project based on the reference case and the actual case as well as showing the percentage reduction of Portland cement.
  - Identifying all water or coarse or fine aggregate uses in the project and demonstrating how the Credit Criteria is met.
- **Concrete suppliers submission** detailing target mix designs for each product supplied to the project identifying strength grade of the concrete, any special properties associated with each product, quantities and types of Cement, supplementary cementitious materials, water, coarse aggregates and fine aggregates.
- **Confirmation from the architect, quantity surveyor or head contractor** that: no new concrete is specified in the project; or comparing the cost of concrete specified in the project against the project’s total contract value.

Please provide feedback on the technical content of this credit:

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