Date issued: 16 May 2012

Stakeholder Feedback Report

Revised Concrete Credit

May 2012

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Introduction

The Green Building Council of Australia (GBCA) has developed the Revised Concrete Credit to replace the current Concrete Credit in Green Star rating tools.

A draft of the Revised Concrete Credit was developed by the GBCA in conjunction with the Concrete Expert Reference Panel in 2010. Stakeholders were invited to provide feedback on these drafts through a formal process; details of which can be viewed at www.gbca.org.au. This Stakeholder Feedback Report provides a summary of the 12 written submissions received and the responses from the GBCA. It also lists changes made to the Revised Concrete Credit to accommodate this feedback. Stakeholder feedback is provided in *italics.*

The GBCA would like to thank all stakeholders for taking the time to assist in the development of the Revised Concrete credit. Further feedback is welcomed as the credit is implemented and used.

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Use of Supplementary Cementitious Materials

1. Comment: *The inclusion of a reference mix design and cement content is a positive step and clarifies the reference case. I am unable to comment on the actual values used – I assume these have been derived from typical concrete batch designs from around Australia?*

GBCA Response: The reference establishes the maximum amount of Portland cement and was established on the basis of typical concrete batch designs in Australia. These were provided by the concrete industry through the Concrete Expert Reference Panel.

2. Comment: *The current Concrete Credit recognizes that it is harder to use cement replacement in concrete mixes for precast and post tensioned concrete due to the early strength requirements of these mixes. The proposed credit does not.*

With the proposed changes it will be very hard to achieve the points for cement replacement in structures made from precast or post-tensioned structures. The credit will therefore discourage the use of these forms of construction. This is disappointing because both forms of construction have their merits in achieving Sustainable design.

I believe the proposed credit should be reconsidered to ensure it does not disadvantage post-tensioned concrete, and in fact consideration could be given to encouraging it. The Concrete Credit should facilitate the dematierialization of structure in a building, rather than indirectly promoting the opposite.

I also believe there are merits in promoting precast concrete as a form of construction with Sustainable outcomes, but they are less compelling than the case for post tensioning. The existing credit nonetheless offers a more reasonable approach to encouraging sustainable construction using precast concrete.

I have reviewed a range of post tensioned mixes that I have used on previous projects.

I have S32 mixes for concrete that range from 150 kg/m3 (super green mix) to 370 kg/m3. Most are around 280kg/m3. Interestingly this is well below your reference case for normal 32 MPa. This then poses the question, are your reference case concretes really raising the bar?

I only have a couple of examples 40 MPa post tensioned mixes, they are 280kg/m3, 350 kg/m3 and 400 kg/m3.

The concrete mixes I have looked at are in many cases designed to achieve the Green Star Concrete Credit, so perhaps are no use in helping you develop a reference case that may apply to post tensioned concrete. In all cases fly ash is added.

I think that you should consider making it a condition of submission to that all projects have to submit the concrete mix design. Then, over a period of years, you will have your own library of concrete mix designs, and you can use this to inform the decision about benchmarks.

AND

The current GBCA Green Star – Office V3 2008 Mat-5 Concrete stipulates, 2 credit points are available where the project has reduced the absolute quantity of Portland cement with industrial waste products across all concrete mixes in insitu concrete to 60%, precast 40% and pre stressed/post tensioned concrete 30% - for 1 point insitu concrete to 30%, precast 20% and pre stressed/post tensioned concrete to 15% . The proposed Green Star Mat-4 Concrete draft now states 2 points available where the Portland cement content, measured by mass across all concrete in a project is reduced by 40%, and for 1 point by 30%, compared to the reference case.

As a passing comment, depending on the Bill of Quantities of concrete for a project and the amount of Post Tensioned and High Strength concrete applicable, the construction schedule maybe under slightly more pressure than at current where 15% or 30% replacement for a 1 or 2 point credit is sought. However, that being said the general benchmark we use to calculate the cement contents for the V3 tool is Vic Roads where for example, 32MPa and 40MPa concrete mixes would use a total of 330kg and 400kg of cement per cubic meter respectively. The new draft allows the reference case for the cement content for 32MPa and 40MPa concrete to be less than or equal to 360kg and 440kg per cubic meter for 32MPa and 40MPa respectively (reference case totals for all concrete strength grades on page 2 of draft), which may well provide room to offset the impact when calculating overall cement reduction totals for a project.

GBCA Response: We recognise the need to include the range of mixes used in a project and accommodate a variety of design and construction technologies. Under the requirements of the first criterion of the credit, reduction in cement content is measured across all concrete uses in the project and on the basis of cement content for various mixes. The benchmarks prescribed in this criterion have been chosen on the basis of concrete Expert Reference Panel recommendation that these should accommodate the various design and construction technologies and accommodate the constraints you are referring to.

The use of a reference case to help measure the cement content of concrete mixes is a fundamental part of the Concrete Credit review outcomes. The advantage of the reference case over the approach taken in the previous Concrete Credit are that this standardises the measurement of cement reduction and therefore ensures the credit accurately measures the achievement of the credit criteria and best practice Portland cement reduction. Following the implementation of the credit the Green Building Council of Australia will monitor the use of the reference case, making adjustments and issuing clarifications if required.

As suggested, under the revised credit projects are required to submit concrete mix designs, this will enable the Green Building Council of Australia to collate information for future use.

3. Comment: *The changed focus of the criteria to reduce Portland cement compared to the reference case may lead to less than optimal outcomes for durability, that is where SCM are not used, but Portland cement content is only reduced or replaced by other non-reactive or inert fillers.*

The previous criteria required the incorporation of a minimum percentage of SCM's. Upon reading the criteria literally … two points are only available where Portland cement HAS BEEN replaced with SCM's… may require some further clarification by GBCA.

GBCA Response: While we understand your concern, the Australian standards relevant to concrete (*AS 3600 concrete structures*) restrict the use of inert fillers to 5% of the cementitious material, removing the perceived risk that inert fillers will be used in large quantities. Much like the previous concrete credit, the revised Concrete Credit also requires a minimum amount of supplementary cementitious materials is used.

Use of non-potable water

4. Comment: *The common use of the term non-potable water contradicts the definition proposed in the credit. The credit has nothing to do with if the water is potable or not – as this is a measure of water quality, only potable water (i.e. good quality water) should ever be used in a structural concrete. This water may be reused or recycled water and is not necessarily scheme or bore water. I would suggest the term 'recycled, reused or captured water' is more suitable for use in the credit. I would suggest the last sentence be changed to "It does not include water taken directly from rivers, lakes or groundwater (bore water)." With the reference to "unless it has previously been used" being removed as it is unclear as to what extent the water must be used prior being considered in this credit.*

GBCA Response: We agree with this feedback and the suggested changes have been made.

Use of Alternative Fuels

5. Comment: *The use of alternative fuels (AFR) in cement production is well advanced in many countries but AFR programs in Australia have been hampered by high transport costs, relatively cheap sources of coal and environmental concerns. The Cement Industry Federation (CIF) reported 6% use in 2001, far short of worldwide AFR rates reported by Holcim (12.1% in 2009), Heidelberg Cement (17.5% in 2008) and 54.4% reported for Germany in 2008. The third point of the Green Star Concrete Credit has always been difficult to achieve, and this is where we have seen significant innovation and technical excellence in concrete mix design and placement techniques. Having such a low requirement for AFR use will make this point automatic in most cases and reduce the need for concrete producers to consider using recycled and slag aggregates and manufactured sands.*

AND

Comment: In 2004 the cement industry reported an aggregated 6% AFR, being far short of worldwide AFR rates and world best practice of 60%. The industry under business as usual conditions (meaning no significant technology change) projected in 2006 that AFR use would increase to 23% by 2012. It's now 2011. We do note however that AFR utilisation across Australia is extremely variable and subject to the vagaries of state environmental policy decisions.

Given that in 2004 the industry (aggregated) was using 6% AFR, and the Concrete Credit requires only 4% AFR, this would suggest that cement manufactures will have little difficulty in meeting this requirement. Having such a low requirement for AFR will likely make this point automatic in most cases and reduce the need for concrete producers to consider using recovered materials such as ISS's. No explanation is provided in the review as to why this threshold has been set below 2004 publically reported industry performance. The 'Concrete Credit' criteria could lead to reduced take up and interest in the use of alternative coarse and fine aggregates such as blast furnace slag aggregates. There is limited guidance or justification given in the background and outcomes paper.

AND

Comment: One example of Australian alternative fuels innovation that is possible is found at Geocycle Australia, a subsidiary company of Cement Australia. With project funding from the Australian Government through the Asia-Pacific Partnership on Clean Development and Climate, Geocycle Australia is working to utilise the thicker heavier sludge currently being sent to landfill as a fuel for cement kilns which can reduce the need to burn coal for thermal energy.

Also, with project funding from the Australian Government through the Asia-Pacific Partnership on Clean Development and Climate, the Boral Cement Waurn Ponds Works is undertaking demonstration trials of technology to remove mercury from cement kiln emissions. If successful, this technology will allow for the use of mercury contaminated sewage sludge, located at Melbourne Water's nearby Werribee water treatment works, as an alternative fuel.

However, the use of alternative fuels using these types of new innovation cannot necessarily be replicated in all States due to disparate State regulatory barriers that do not take into account sustainability benefits. This is an important issue that needs to be addressed urgently by Federal and State Governments, and advocated by supporting bodies with sustainability programs.

Comment: In support of the 4% fuel substitution level prescribed by the credit, we have the following comments.

There must not be any confusion between the 4% fuel substitution described in the Credit and the aggregated figure of 6% for the industry reported by the Cement Industry Action Agenda in 2006. It should be noted that the requirements of the proposed Credit is for the individual manufacturer to have at least 4% of the annual kiln fuel inputs to clinker substituted by alternate fuels. The statistical cohorts for these measures are quite different and hence comparison of these two figures is quite spurious. In the Australian context, both the low number of cement manufacturing sites and an especially high level of fuel substitution at one particular facility, a statistical aberration is induced, further demonstrating the need to carefully consider the basis for both measures of cement fuel substitution.

Reference to the Cement Technology Roadmap 2009 (IEA/WBSCD – CSI, Geneva, 2009), shows a similar situation exists in Europe. While the overall fuel substitution in Europe is given as 20%, "large differences in alternative fuel use occur, for example 98% in the Netherlands but nearer 0% in Spain. ….. Individual country cases should be considered in more detail"

*In 2006, the aggregated industry figure was 6.5% (*Fast Facts 2009.pdf*, Cement Industry Federation, Canberra, March 2010), while the reported industry result for 2009 in the same report was 7.2%. This is a minimal increase over three years and is also below that projected in the CIAA of 2006. This minimal progress is a product of both the variability in fuel substitution level at various manufacturing sites and the attitudes of state environmental regulators. There are further dynamics in the changing nature of the economics and availability of suitable substituting materials which has precluded the attainment of the projected level of substitution.*

In the Cement Technology Roadmap 2009, referenced above, the baseline alternative fuel level is determined at 3% for 2006, on an industry basis. This is further used in the calculation of the possible future improvement, however the International Energy Agency determined the industry baseline in 2050 at 4% substitution. Should there be changes in fuel availability, utilisation technologies or government policy, then this figure may be increased. However, it demonstrates the practical limitations to further improvement in alternate fuel use without the participation of the cement industry, its suppliers, government and research institutions.

Finally, it should be understood that the Concrete Credit applies on a nation-wide basis. The national availability of slag or remanufactured aggregates is restricted on a geographic basis. The inclusion of the cement kiln fuel substitution measure represents an alternate pathway for a concrete supplier to meet the requirements, should a combination of non-potable water and non-natural fine or slag aggregates not be available.

GBCA Response: While the GBCA appreciates the time stakeholders have taken to provide arguments for and against the benchmark for fuel substitution prescribed in the credit, we recognise some states have legislative barriers to alternative fuel use. A measure for reduced environmental impact, such as the use of alternative fuels, cannot be promoted by a Green Star credit where there are substantial legislative barriers to its implementation. The credit criteria related to use of alternative fuels does not form part of the Revised Concrete Credit.

Use of Alternative Aggregate

6. Comment: *The production of concrete aggregates although contributing minimally to greenhouse gas production compared to the production of cement would rate highly in the sustainability of the concrete industry and the depletion of the earth's natural resources.*

Some concrete producers, mainly in Victoria, have invested in concrete reclaimers to recycle waste concrete which separate and reuse the sand and stone that would normally be discarded. However by the draft awarding in effect half a point to aggregate replacement it would seem unlikely to stimulate concrete producers across the country to invest in capital such as concrete reclaimers. In a study commissioned by Grocon and conducted by RMIT on the Comparative Life Cycle Assessment of Concrete Blends, the study found 'the supply of blast furnace slag in Australia is currently constrained by the volume of material being produced at the blast furnaces; that this material is being imported is a reflection of this constraint'.

AND

The current Mat-5 V3 Concrete, awards an additional point where at least 1 point is achieved through cement reduction in conjunction with 20% of all aggregate used for structural purposes is replaced with recycled (Class 1 RCA HB155-2002) or slag aggregate. The Mat-4 Concrete draft now awards 1 point where the mix water for all concrete used in the project contains at least 50% captured or reclaimed water in conjunction with either 40% (100% increase) of coarse aggregate in the concrete is crushed slag or alternative materials (measured across all mixes) or 25% of fine aggregate (sand) inputs are manufactured sand or other alternative materials (measured across all mixes). Concrete

producers have been capturing, reclaiming and recycling water in concrete plants and producing and utilising manufactured sand (Crusher dust/pre consumer) in their concrete mixes for decades, and it is interesting that both these are now available for credit. It is in the producers interest to reuse these products because it costs them money not to do so – ie paying for fresh water and storage/disposal for the waste crusher dust. The production of concrete aggregates, although contributing minimally to greenhouse gas production compared to the production of cement, would rate highly in the sustainability of the concrete industry and the depletion of the earth's natural resources.

GBCA Response: The most important environmental impact arising from the use of concrete is greenhouse gas emissions, the use of natural resource is however also an important issue. The current credit acknowledges this by requiring one or two points for cement replacement is achieved before points can be claimed for use of non-virgin aggregate. The revised concrete credit further acknowledges this by requiring the use of captured or reclaimed water as well as the use of non-virgin aggregate. The increased benchmark for use of non-virgin aggregate represent the fact that 20% replacement is widely achieved, 40% was chosen as this is described by experts as a level which is achievable without creating undesired outcome such as a substantial increase in Portland cement use to compensate for poor quality aggregate.

The criterion for alternative aggregates does not require that a particular aggregate type be used. While there may be supply shortages of slag aggregate, slag aggregate is not the only aggregate type that can be used to comply with this criterion. The alternative aggregate criterion rewards the use of various alternative aggregate types, including recycled concrete aggregate and reclaimed aggregate.

7. Comment: *It is important to encourage demolition and recycling contractors to move toward producing well graded quality recycled demolition aggregates.*

GBCA Response: The GBCA agrees that it is important to encourage demolition and recycling contractors to move towards well graded quality recycled aggregate. The credit criteria is designed to create demand for recycled aggregate, which should incentivise suppliers to invest in providing better products to the marketplace.

8. Comment: The requirement that one credit point be awarded only where the use of such materials does not increase the use of Portland cement in concrete by over 5kg per m3 is confusing. Any advice as to the rational technical literature and or published papers, which support this requirement that the use of alternative materials 'increases' Portland cement contents would be helpful. If there are no such published references supporting these assertions, the requirements should be removed.

GBCA Response: The reason for including this comment in the credit was to avoid increase in Portland cement demand in concrete. SAA HB 155 *Guide to use of recycled concrete and masonry materials* recognises that recycled concrete aggregates may impact on the concrete strength at higher replacements (refer to section 2.7.4.2). Not all recycled aggregates are the same and their performance affects concrete strength. As such, the required mix of cement content to achieve a targeted strength as required by AS1379 *Specification and supply of concrete* changes. This comment is a reminder to users of the credit that there is no point in using a particular replacement of a specific source of alternative aggregate if using these leads to increased Portland cement content.

9. Comment: We are very supportive of the proposed revised 'concrete credit' as it provides strong incentives to reduce emissions and increase sustainability demand. However, in order to maximise the benefits gained from the proposed concrete credit it is important that the following factors are also addressed:

- *Further standards development to allow greater use of SCMs, whether through existing standards or through the development of additional cement standards.*
- *Increasing market acceptance of SCMs.*
- *Elimination of unnecessary regulatory barriers to alternative fuel use*
- *Further investment in research, development and deployment of energy efficiency measures and*
- *Further investigation of opportunities to utilise waste heat.*

GBCA Response: While the GBCA cannot directly influence building code or Australian Standards requirements relating to concrete, the credit criteria is intended to create demand which should, among other outcomes, create incentives for revisions of standards. Market acceptance of supplementary cementitious materials has grown in the past decade, and it can be argued the previous Concrete Credit in the Green Star rating tools contributed to this. One of the aims of the Revised Concrete Credit is to further drive the acceptance of increased supplementary cementitious materials use in Australia. Investment in research opportunities may be yet another positive outcome of the Revised Concrete Credit.

General Comments

10. Comment: The Concrete Credit states that points are awarded on the basis of reduction in Portland cement content rather than the quantity of SCM used, but using a proven concrete design solution that can significantly reduce total cement usage, has no clear treatment in the credit.

Concrete masonry products do not correspond to the credit in many places. The concrete grades in Table 1 of the credit do not match concrete masonry products and the documentation requirements in the As Built Rating for alternative aggregate refers only to waste aggregate or manufactured sand, excluding the lower quality materials that can be used in concrete masonry products.

We also recognise that further credits are potentially available in other areas, such as maintainability and internal wall materials. However, sometimes even these are not allowed. For example, the dematerialisation credit applies for floors and ceilings but not walls or pavements.

We believe that there needs to be consideration for concrete masonry products in the Green Star credit system, either in the Materials - Concrete Credit or in another section, as the points earned under the current and revised concrete credit fail to fully realise the potential benefits, in terms of the environment and Life Cycle Assessment, that these often forgotten concrete products can provide.

GBCA Response: Concrete masonry is not addressed by the concrete credit. The compliance requirements of the credit have been revised to clarify this. The use of recycled materials in masonry, is rewarded under the Mat-3 'Re-used and Recycled Products and Materials' credit.

11. Comment: The credit does not seem to apply well to projects in Western Australia. There is no slag aggregate in WA, No blast furnace slag in WA as a separate ingredient in concrete batching, as stated in GBCA notes. Also in WA a very small proportion of placed concrete contains fly ash, slag or silica fume – not 90% as stated in the GBCA notes.

Blast furnace slag in WA cement comes from Japan and has a significant carbon footprint

First 3 of above are true for east coast but do not apply in WA, therefore making it either impossible to achieve in WA or material being trucked across the continent with the resulting environmental and economic cost.

AND

Comment: The replacement of 30% and 40% of Portland cement places certain states at a disadvantage. In South Australia there is no slag (GGBS) available and thus it will be extremely difficult if not impossible to obtain two points. In the Northern Territory and Tasmania there is neither slag nor fly ash readily available, thus obtaining the two points available for replacing Portland cement will be extremely difficult if not impossible to obtain.

AND

Comment: I see merit in promoting the use of waste materials such as slag aggregates and manufactured sand where concrete construction is to take place in markets where these materials are available. However, these materials are not freely available in all locations in Australia, as the associated industry producing the waste products is not in all locations.

Is it reasonable that buildings located near a blast furnace producing slag suitable for making aggregate material be given access to a credit that will not be possible in other locations? I note that the credit will work well in the Sydney market.

Surely we do not want to promote large volumes of this material being transported large distances just so a Green Star credit can be obtained? Sustainability is about making use of local materials and avoiding excessive transportation. Can this credit be adjusted to make it specific to relevant locations without penalising other locations?

GBCA Response: While using locally available supplementary cementitious materials will maximise the greenhouse gas savings arising from their use, supply shortages of supplementary cementitious materials should not pose a barrier to importation of supplementary cementitious materials from other states or off-shore sources.

An example of the calculations demonstrating the greenhouse gas emission benefits of supplementary cementitious materials in all locations is included in section 6 of the 'Background and Outcomes' document. In the example, the

transportation of supplementary cementitious materials from other states and from off shore results in an overall reduction in greenhouse gas emissions against standard practice.

The GBCA recognises that this is not true for the alternative aggregate criterion. Hence this criterion provides a number of methods of demonstrating compliance. The transportation of slag aggregate where this is not available is not required. Instead, the credit criteria can be achieved by using recycled concrete aggregate, reclaimed aggregate, spent foundry sand, or another manufactured sand type, as an alternative aggregate.

12. Comment: *We believe that holistic assessment of the environmental performance of a building, incorporating the resource acquisition, construction, operation, maintenance and end-of-life phases is vital in developing a true assessment of its performance. We also believe that it is important to recognise the interplay between design and materials such as concrete, that can minimise operational and maintenance impacts and maximise the durability and potential for reuse of structures.*

GBCA Response: The GBCA agrees with the need for a holistic assessment of environmental performance buildings and recognises the limitations of the current material category credits which use a prescriptive approach to rewarding environmental gains. Future work by the GBCA will seek to include the development of lifecycle assessment based Green Star credits. This is likely to provide a more holistic approach to determining the impacts of materials in the building's life cycle.

13. Comment: *In the document 'Background and outcomes of the Green star concrete credit review' under the 'Expert panel conclusions' one of the point is that further environmental impact reductions can be achieved through other Green Star credits such as the Dematerialisation credit. According to the Version 3 Green Star Office Design technical manual, the Dematerialisation credit only applies to reductions in the mass of structural steel and does not reference any reductions in concrete volume. This is illogical and should be adjusted as any reduction in the volume of concrete used in a building should be rewarding in a similar manner to how reductions in steel are addressed.*

GBCA Response: The note in the Background and Outcomes of the Concrete Credit Review document referred to is a recommendation from the Expert Reference Panel, suggesting that the dematerialisation credit should be changed to include concrete.

Unfortunately, the difficulty of establishing a reference case against which the reduced use of concrete can be measured and benchmarked has meant we are currently unable to change the dematerialisation credit to specifically address concrete. We welcome proposals from Green Star project teams as to how this can be documented through the Credit Interpretation Request Process or the innovation category credits.

14. Comment: *As use of alternative fuels is fundamentally a sustainability benefit rather than greenhouse gas reduction, was the use of industrial by-products in cement kiln raw feed also considered by the expert reference panel? Steel mill scale, copper slag, blast furnace slag, steel furnace slag and cement fibreboard off-cuts plus many others have been successfully utilised as raw materials for cement manufacture in Australia. When pre-calcinated materials are used, there is an additional reduction in greenhouse gas. Depending upon cement type and limestone chemistry, kiln feed can contain from 2-3% up to 20%*

GBCA Response: Many potential initiatives were reviewed and discussed by the concrete Expert Reference Panel, including alternatives to cement kiln feed. Practical limitations on the overall number of criteria meant the GBCA had to rationalise the criteria included. The criteria in the credit were chosen because they, above others, achieve the greatest reductions of the most significant environmental impacts arising from concrete use in buildings. As a result, these were seen as more relevant to the aim of the credit. Information on this can be found in section four of the 'Background and Outcomes' document. Based on the feedback provided on the draft Concrete Credit (outlined in the comments above), the alternative fuels has been removed from the finalised credit.

15. Comment: *Can the third point be claimed if no SCM use points had been obtained, if so this should be clearly stated.*

GBCA Response: The GBCA appreciates this feedback. The criteria of the credit are independent of each other either or both can be claimed. This has been clarified in the finalised credit.

16. Comment: I am particularly concerned if we are not able to provide a framework that encourages the reclaiming of "waste" concrete (ie that which returns to the plant not used from site).

GBCA Response: On a industry wide level there may well be high amount of wasted concrete which can and should be salvaged and reused. When considering the overall environmental impact of concrete in a particular building, which is the focus of Green Star, the non re-use of returned concrete, whilst unfortunate, does not rate as a major impact. Re-use of returned concrete is also not a direct performance attribute of the building assessed for a Green Star rating.

General Comments which do not require response

Comment: Compared to previous material credits for concrete, I believe this a good step forward. The recent update of steel credit has made that credit more achievable, and I believe this draft concrete credit is also more achievable, while still maintaining the sustainability intent of the previous credit.

Comment: The revised Concrete Credit has gone some way to recognising the wide range of environmental improvement initiatives that the concrete industry has implemented in recent years in the cement manufacturing, aggregate production and concrete manufacture and concrete construction technology areas. However, the concrete credit points will still be difficult for many parts of the industry to achieve.

Concrete by its nature, must be produced very close to the point of its consumption. That means that in a country as large as Australia over 1500 concrete batching plants are required to service the needs of Australia's communities. The availability of suitable supplementary cementitious materials for concrete manufacture remains variable. This will challenge the ability of many manufacturers to source sufficient quantities locally. Equally, in cement manufacture, there are significant regulatory barriers to the increased use of alternate fuels in a number of jurisdictions that are difficult to overcome. As a result, it is likely that not all cement manufacturers will consistently be able to comply with the alternate fuels component of the credit. The same concerns apply to the availability of alternate aggregates and recycled water.

Nonetheless, we recognise that the GBCA's objective is to set challenging targets for the industry to encourage improvements in environmental performance.

We are encouraged that the structure of the Green Star Concrete Credit allows some latitude to concrete suppliers to employ a range of environmental performance initiatives to achieve at least some of the credit points available. As such we are supportive of the proposed revision to the Concrete Credit and will promote its uptake with our Members.

Comment: In light of the emission contributions the value of the credit [3 points], in terms of driving new market behaviours, can not be understated for current and emerging non-traditional materials. The past industry claims of 'unintended consequences' arising from the Credits simple approach, in our view, are unjustified. Moreover, these consequences are more a reflection of historical market practices and resistance to change and innovation by participants in the supply chain.

To these ends, we support the expert panels findings on associated emission for transportation= of SCM to markets/regions where SCM are not readably available are insignificant and have been appropriately addressed in the review. However other aspects such as construction cycle times driven by contractor practices may require further education before the complete benefits of the concrete credit can be realised such as environmental or durability benefits arising from SCM's and aggregate substitution.

Comment: I did not find previous versions of the concrete credit to be overly complicated or difficult to understand. Although I do agree interpretation of some sections in isolation could produce undesirable outcomes, especially in respect to maintaining building cycle times. I have encouraged everyone who had trouble understanding the intentions of the Green Star rating tool to attend a GBCA course before making further judgment.

Comment: The use of GGBFS in concrete has two environmental advantages; greenhouse gas reduction and waste minimisation/resource preservation. The majority of GBFS processed in Australia is sourced overseas for economic reasons, primarily due to differences in domestic vs. international shipping costs and other countries higher landfill levies. This reduces the overall environmental benefit to Australia and additional shipping increases GGBFS green house gas emissions by 50-100 CO2eq kg/t by most calculations and 110-120 CO2eq /t using references cited in GBCA documents. ASMS are capable of producing 1Mtpa of GBFS in Port Kembla and an additional 0.5Mtpa of blast furnace slag is air-cooled rather than granulated at Whyalla, SA. While use of imported GBFS is clearly a better environmental option than Portland cement production, GBFS produced in Australia is measurably better than either.

Comment: The CIF strongly supports the proposed concrete credit as it relates to the integrated cement industry, despite the challenges it may face in meeting the proposed criteria. Gains in reducing greenhouse gas emissions in the cement industry will be largely dependent upon Federal and State environment and regulatory bodies having the ability to consider the sustainability benefits, especially in terms of alternative fuel use and increasing SCMs as extenders in cement.

Comment: Based on an estimate of 24 million cubic meters of concrete being manufactured in 2010 this equates to an average of 65 kg of ISS [ground granulated blast furnace slag and blast furnace slag aggregates] are used in a typical 1 m3 of concrete. Based on an analysis of Concrete Credit Table 2 – there is Considerable scope to increase SCM and aggregate uptake based on the allowable replacement percentages.

Comment: As determined by the expert panel, greenhouse gas emission and resources use are the two most significant lifecycle environmental impacts. In terms of the conclusions we support:

- *the encouraged and continued use of SCM and recovered aggregates*
- *the use of benchmarks for mix designs*
- *the use of locally available SCM and aggregates where available and appropriate*
- *that claimed transport impacts using SCM (O'Moore and O'Brien) are unjustified*
- *resources conservation where appropriate, but question the merits of potable water and alternative fuels being awarded with one point*

Comment: The credit use continues to challenge industry paradigms. The expert panel may need to consider the important role of Australian Standards such as AS3600, 3792 and 1379 being enablers in changing these past practices and how these standards may impede the uptake of the Concrete Credit. In particular, construction cycle times driven by contractor practices.