Date:	July 12, 2007
Subject:	New Sri Lanka cement standards - revision

Standards;

1 Draft Sri Lanka standard for OPC – SLS 107

2 Draft Sri Lanka standard for blended cements – SLS 1247

3 Draft Sri Lanka standard for Portland limestone cement – SLS 1253

1.0 General comments

Some definitions are not the same for the three documents – they should be harmonized:

1.1 Minor additional constituents:

The best solution should be to adopt the definition used in the draft standard for blended cements (item 5.2, p. 10). The one used in the OPC standard excludes CKD, for example, and the one in the limestone cement standard excludes any inorganic mineral materials which are not derived from cement production, such as fly ash, slag, rice husk ash, etc.

1.2 Gypsum:

The definitions used in the standards for blended and limestone cements are better than the one used in the OPC one, which excludes industrial/artificial gypsum and has additional requirements that only complicate the text.

Regarding the table presented

on p. 14 (Figure 2) **“Recommended applications for blended hydraulic cement”,**

on Page 11 (Fgure 2 “ Recommended applications of Portland Limestone Cement

We do not see the necessity of such a guideline” in a standard document. If the technical committee wants to publish a user guide, it should be done as an independent document, as done, for example, in USA, by the ACI (American Concrete Institute), which every year publishes the ACI Building Code. Also an aspect to be seriously considered is that this kind of “instruction” in a cement bag could even cause liability problems (to the cement producer or even to the Sri Lanka Standards Institution) in case the cement is not properly used at the job site and failure occurs and expected performance is not achieved. Considered that the user of bag cement may not be technically very well educated, this is a point to take into account.

Additionally the classification/recommendations made are very subjective and some of them lack technical background (see below).

2. SPECIFIC COMMENTS

2.1 Draft Sri Lanka standard for blended cements

Definition of reactive calcium oxide (CaO) (item 3.6) says: *"that fraction..... can form calcium silicate hydrates or calcium aluminate hydrates".* Portlandite is not mentioned: it is also a product from CaO reaction and should be added. The new sentence could be: *"that fraction..... can form calcium silicate hydrates, calcium aluminate hydrates or calcium hydroxide".* This is not a critical issue, but if one wants to talk about it, it should be correctly done.

Regarding the table presented on p. 14 (Figure 2) ***"Recommended applications for blended hydraulic cement"***, as mentioned before, we would strongly advise to take them out of the standard and of the cement bag, but if not possible…

- for high strength concrete is said that blended cements *"may be used under technical guidance".* There are many high performance/strength concrete works done with composite cements and there is not technical reason to consider that they are less suitable than OPC for such kind of application.

- Furthermore, due to pozzolanic effect of the mineral component (Fly ash/ slag) the strength gaining will continue even after 28days that would end up with higher final strength compared to OPC.

- We have been supplying our fly ash blended cement to many projects and the trial mix designs done by us shows that this cement is suitable for all Concrete Grades. We are attaching herewith the results of the mix designs for this cement we market and as one can see the required strength is readily achievable

- For normal concrete blended cements are only "recommended" – considering the benefits they bring in terms of durability, they should be "strongly recommended". The same for cement based products (should at least be recommended instead of "may be used under technical guidance).

Refer

Annex 1 – Concrete Trial mix done by holcim lanka

- We also attaching herewith the mix designs of our customers using this cement for high Strength concrete and they are quite happy with the product.

Annex – 2A- Concrete mix design report of ELS construction Ltd.

Annex – 2B - Sun Ready mix, using 25%Fly ash blended cement

2.2 Draft Sri Lanka standard for Portland limestone cement

Composition of Portland limestone cement (Table 1, p. 6): **the maximum amount of limestone could be increased to 20%.** The argument used to restrict the amount of limestone to 15% is presented in the Appendix A, 4th paragraph: *"Even for limestone contents up to 20 per cent, BS 8500: part 2 imposes certain restriction. In line with this thinking, this Sri Lanka Standard limits that limestone content to a maximum of 15 per cent".*

The point is that the cited BS was **withdrawn** and replaced in November 2006 by a new document where most of the restrictions to limestone cement have been abolished: **now the use of limestone cement with upto 20% of limestone is allowed in all exposure classes where OPC or other composite cements are allowed. The remaining restrictions to CEM II L (up to 20% limestone) are the same applied to OPC (very aggressive environments).**

For Example,

In BS 8500- 1:2002 (Obsolete version), Table A 15 It was specified that Portland Cement may be used only in DC classes, DC – 2, DC - 2z, DC – 3z or DC – 4z where the sulphate classification designed sulphate class for the site does not exceed DS – 1.

However, in BS 8500 – 1 : 2006 (latest version), Table A 11 specify the same limiting values for both OPC (CEM I) and PLC (CEM II- A L/LL) .

Moreover in BS 8500 – 1:2006 , Table A 4 and A 5 specifies durability recommendations for reinforced or pre stressed element with an intended working life of at least 100 Years. Under this PLC can be used for same exposure conditions and applications where OPC is recommended.

Refer,

Annexure 3A - BS 8500 -1:2006,

Annexure 3B – BS 8500 – 2: 2006

Therefore there is no basis technical or otherwise for limiting the limestone content to 15%.

Further more clinker reduction will decrease Co2 emission to the atmosphere in large volumes. As cement manufactures are major contributors for green gas emission thus responsible for global warming.

172 countries have signed Kyoto protocol to reduce Co2 emission where Sri Lanka too is a member country. Hence it is a national commitment to reduce Co2 emission and is a responsibility of all government Institutes and public to strongly support the efforts. It is also noted that all major cement manufactures have set their own targets to reduce global average net specific carbon Dioxide emission.

Reference:

Annexure 4A –Holcim Limited – Resources

Annexure 4B – List of Kyoto protocol signatories

Regarding the table presented on p. 11 (Figure 2) “Recommended applications of Portland Limestone Cement.

- There is no technical reason to not recommend the use of PLC in high strength concrete: **any cement can be used to produce high strength concrete if the mix design is adequate**. An OPC and PLC with same strength class, used in two concretes prepared with same mix design would results in concrete with similar strength. Same for precast concrete, cement based products, etc.

- With reference to table A 14 of BS 8500 – 1:2006, CEM I and CEM II A are equally recommended. As an example concrete designated as RC 40/50 can be produced by using PLC (CEM II A) .

Therefore there is no basis (technical or otherwise) to say PLC is not recommended for high strength concrete.

Attach herewith the mix designs of high Strength concrete used by our customers using Holcim brand PLC Product.

Reference:

Annexure 5A – Mix design Data sheets of Kandy Redymix (Sanken Lanka)

Annexure 5B – Mix design data sheets of Sathuta Builders

- The only restriction that makes sense in the table is to the use of limestone cement in concrete exposed to severe to very severe conditions; **for such environment neither OPC is appropriated.**

- In view of the technical data above stated that PLC can be used in high strength concrete with the right mix design, the proposed statement in Figure 2 that PLC is not recommended for high strength concrete is factually incorrect. Such statement, if included in the labeling as suggested by the proposed standards, can amount to **“misleading conduct”** which is **expressly prohibited** under the Consumer laws of the country, and can render the manufacturer liable for an offence. **The proposed statement is therefore illegal.**

- In so far as the labeling in concerned, as far as we are aware the Sri Lanka Standards Institution Act does not empower the SLSI to prescribe the mode in which labeling is done on a product such as Recommended Applications etc. It only empowers the SLSI to prescribe the certification mark which shall be displayed on the covering or packing of a product. **The certification mark that has been declared and published in the gazette in respect of Portland Limestone Cement in terms of section 17 of the Act only carries the SLS mark with the standard No.1253 printed underneath the SLS mark. Therefore the only requirement for labeling should be that mark is printed on labeling in dimensions prescribed by SLSI. Other specifications such as Recommended Applications can be part of the standard but not part of the certification mark.**

- Further, Holcim is currently the only manufacturer and seller of PLC in Sri Lanka. In the context of the technical data provided by us that PLC is suitable for high strength concrete, the proposed statement in the labeling that PLC is not recommended for high strength concrete, being a factually incorrect and misleading statement, is **discriminatory of us and is in violation of our fundamental right to engage in a lawful trade**. So is the restriction of acceptable limestone content to 15%. That is because the users of cement would be misled by such statement not to use our PLC for high strength concrete.

- Holcim is a BOI approved investment. The recommended applications for PLC which excludes 'high strength concrete' will only affect Holcim because currently Holcim is the only manufacturer of PLC in Sri Lanka. Restriction of limestone content to 15% too would affect only Holcim. The said restrictions, having no factual or technical basis, would discriminate PLC manufactured by Holcim and effectively deprive PLC of its marketability. **This will place our competitors who are unable to manufacture PLC at an unfair advantage over Holcim**. Holderfin B.V, our main shareholder which is a company incorporated in the Netherlands, has invested monies in this company relying on the protections afforded under the Investment Protection Treaty signed between GOSL and the Kingdom of the Netherlands. The treaty has received the approval of the Parliament of Sri Lanka. Article 157 of the constitution of Sri Lanka prohibits administrative actions that violate treaty obligations of the State. On this ground too the matters objected to above would be illegal. We therefore strongly object to the proposed labeling as well as restricting the limestone content to 15% without any basis whatsoever.

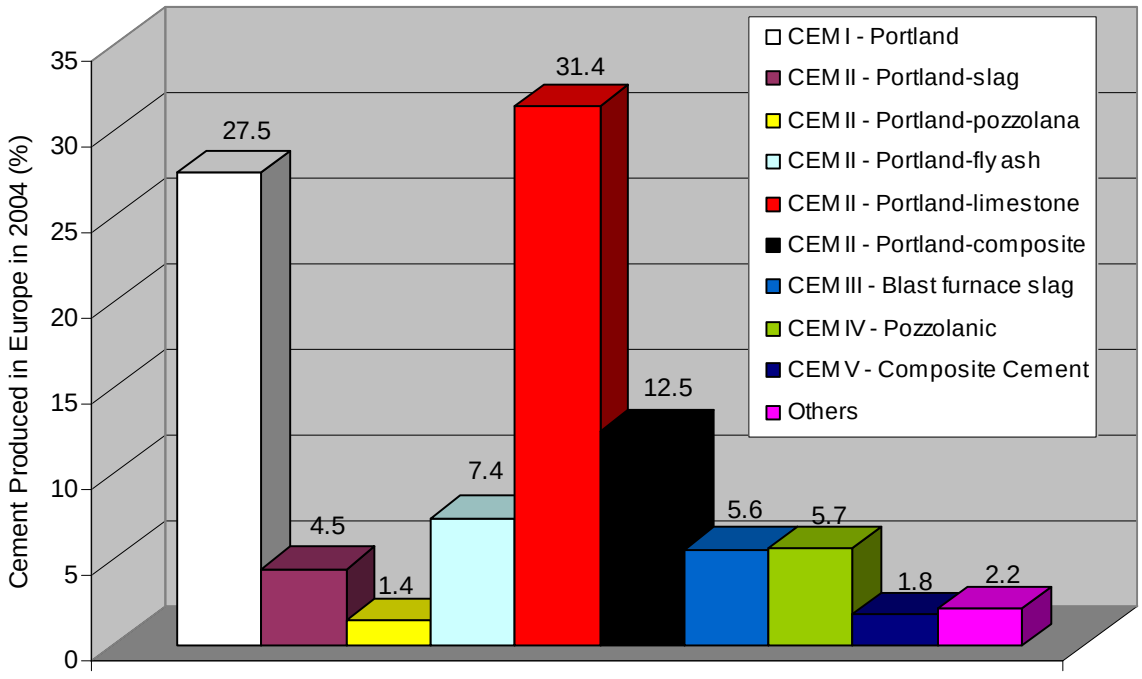
Appendix A

This appendix should be removed from the standard! Any guidance on use of any cement should be subject of a special document, independent from the standard. One of the reasons for this is that normally a standard is difficult to change; sometimes it may take more than 20 years. The level of knowledge on PLC for example, has increased substantially recently and based on the amount of studies in course, one can foresee that it will continue to increase even at higher rate. So, in other words, any guideline given now, may be not valid in few years and if it is part of the standard it will be difficult to modify it.

Specifically with respect to the document presented in the appendix A, it is simply not acceptable! There are many conceptual mistakes, it is based on very few technical/scientific publications, and the newest reference is an article from 2003 – most of them are from the 80's and 90's – clearing showing that this guidance does not reflect the state-of-the-art on PLC performance. The BS 8500 – 2002, which is taken as basis for the limitation of limestone content on PLC to 15%, for example, was withdrawn last year and replaced by a new BS 8500, where most of the restrictions to use of PLC were removed.

Some examples of inaccurate statements:

PLC is not a cement used worldwide (1st paragraph): the text makes reference to Moir (2003) (attached). Moir's article gives no ground for such affirmation. On the contrary: it shows that PLC has been used in Europe since 1970 and according to Cembureau was the major cement type produce in Europe in 2004 (see graph below). PLC is also produced in other regions/countries, as New Zealand (15% of limestone), Argentina (20% limestone), South Africa (20% and 35% of limestone), Mexico (35% of limestone), only to mention some of them.



4th paragraph: has to be revised: as mentioned the BS 8500 (2002) was withdrawn!

5th paragraph, 4th line: *"Secondly, hydration rate is increased……. nucleation sites for $Ca(OH)_2$ crystallization".* Although this sentence does not have a negative impact with respect to PLC acceptance it is not totally correct and should be modified. The fine limestone also provides nucleation sites for C-S-H and carboaluminates.

7th paragraph: *"PLC should be stored under very dry conditions, since it can react rapidly…… due to its higher fineness".* In a PLC produced by inter grinding (the usual case), the finer portion of a PLC is mainly composed of limestone, due to the differences in grindibility between limestone (softer) and clinker (harder). Considering that the finer fraction contains basically limestone and that limestone does not react with water, this statement makes no sense. Of course all cements should be stored under dry conditions: storage conditions are not more critical for PLC.

It is our experience; that we have no complaints due to hardening of Portland Limestone Cement since the introduction of this cement type in 2003.

12th paragraph (p. 15): *"While good early most curing is essential for blended cements……. the long term strength of PLC may be superior even with poor curing conditions…."* May even be true but should never be said in a document that intends to be a guideline for cement users. Curing should be always done – poor curing should never be "excused"!

13th paragraph: *"PLC has less cementitious (there is a typing mistake in the text!) matter in comparison to OPC. So the performance of PLC containing greater than 5% of limestone is akin to an OPC with less cementitious material".* The last part of the sentence is not clear: may be it was meant to say akin to an OPC because has less cementitious material. Anyway, even with this amendment, it would be wrong as the performance of a PLC with more than 5% of limestone can be comparable or better than the performance of an OPC: the performance depends on clinker performance, fineness, water demand, etc…..There are many examples in the literature that could prove it.

16th paragraph (p. 16): *"Rate of deterioration is similar to OPC under sulfate attack when ettringite rather than thaumasite is formed. In both these instances, rate of deterioration is governed by clinker C_3A content".* The interaction between sulfate and cement can lead to deterioration, but this is not always the case: thaumasite and ettringite may form without any deleterious consequence. When the cement paste is attacked by sulfate ettringite, gypsum or thaumasite may form. However the processes that lead to one or other mineral are distinct and are also distinct the damages that they cause to the cement paste: ettringite and gypsum promote, basically, expansion and cracks, whereas thaumasite, mainly promotes disintegration of the cement paste, with mass and strength losses. So, the type and rate of deterioration can not be compared. It is said that the rate of deterioration is governed by the C_3A content of the clinker: this is only true for ettringite formation (or what is called "normal sulfate attack). For thaumasite form of sulfate attack (TSA) the role of C_3A is controversial: some researches show that higher C_3A helps to prevent TSA, while others suggest the opposite.

The last sentence *"BS 8500 imposes restrictions……"* is not valid anymore (there is not such restriction in the new BS 8500).

Thaumasite form of sulfate attack is very complex, still not very well understood and can not be discussed in a simplistic way as done in the appendix A.

2.3 Draft Sri Lanka standard for OPC

Requirements (item 4.2.2.1, p. 5): Water is mentioned as a component of OPC. It can only be a mistake!!!! On the other hand, industrial gypsum is excluded – it should be added.

Fineness: minimum Blaine 225m^2/kg (by the way, in the PLC standard the Blaine units are cm^2/g, for the sake of rigor, they should be the same).

LSF: also not an EN 197 requirement. we do not understand the reason for this, especially considering that LOI is limited.

Insoluble residue (IR): there are two values for IR – one for OPC without minor constituents and another for OPC with minor constituents. This may cause confusion. It would be better to have only one value (the one for OPC with minor constituents, which is more realistic as, probably, all OPC will have 5% of additions). Same comment also valid for LOI (item 4.4.5, p. 7).

Sulfate: there are 2 limits for SO_3, depending on the C_3A of the clinker. It would be better to adopt one value (EN 197 prescribes $SO_3 \leq 3.5\%$, independent of C_3A content).

Label (Figure 1, p. 9): the same comments made previously are also valid here.