Introduction:

1. The ICR Team has reviewed technical and design documentation (refer document list at the end of this Annex 5) – with the intent to raise awareness of technical issues relating to Pillar 1 infrastructure for stakeholders to consider. These comments may have particular relevance for future partnership infrastructure 'programs'. In particular, it is hoped that the comments and recommendations contained below will contribute to greater quality and sustainability.
2. It is important to note that the comments and recommendations here-in are based upon brief review of the documents supplied, and supplemented/reinforced by visual inspection of the few site examples (which are not statistically relevant). In essence, this Annex represents a preliminary desk top review.[1]
3. The IRC Team takes no responsibility for, nor accepts liability to, any third party who may rely, or act upon the contents of this Annex. The ICR Team reiterates that the intent of this Annex is to raise awareness for the need for continuous, incremental improvement for all stakeholders – i.e. to bring issues to attention for further investigation.
4. It is noted that comment by the ICR Team referring to the MoNE Specifications is beyond the scope of this ICR.

Construction Design Consultants (or the equivalent)

5. It is recommended that construction QA systems include audit trail verified inspection approvals at critical stages prior to proceeding – i.e. the incorporation of 'Inspection – Test – Plans' (ITP) until approval is received e.g. structural reinforcing steel, inspections whilst concrete pour etc – the CDCs need to be held more accountable and the system amended to provide better assurance of this.
6. It is recommended that CDC payments should tied to performance – e.g. progress payments upon confirmed QA accepted stages – however a cost benefit analysis will be required to ascertain value for large scale project in remote locations of Indonesia.
7. Construction and as-built drawings to incorporate QA signoff legends by CDCs that:
   A – certify structural design as meeting Indonesian standards, codes and regulations and that have been modified as is necessary to suit the applicable site and geotechnical conditions, and,
   B – certify that construction has been undertaken reasonably in accordance with the design and is compliant with the procedure set out in any relevant ITP.

Architectural Design – Comments and Considerations:

8. It is recommended that review of the architectural design be undertaken to:
   - reduce risk of using hazardous materials (e.g. nominate materials on drawings that cannot be used for certain applications) – and not rely upon the KM's detailed knowledge of the specifications;
   - increase classroom ventilation (see discussion below);
   - reduce radiant heat transfer to internal areas (see discussion below);
   - rationalise PWD ablutions in a practical and appropriate manner, for example; the inclusion of two PWD toilet facilities per school is not appropriate (see discussion below);
   - address slip and trip hazards (see discussion below);
   - consider rain water harvesting from building roofs (see discussion below), and;
   - consider incorporating solar lighting and power in remote locations.
9. It is assessed that one PWD toilet per school is sufficient and meets code and standard requirements – it was observed that providing two or more constricts ablution facilities overall. Consider the use of western style pedestal toilets following careful consideration of the increased maintenance implications. It is noted that anecdotal evidence suggests that pedestal style toilets are typically preferred by end-users – note that this approach would need to include the bidet/wash hose. It is also noted that the GoI strategic intent includes the notion that the school environment is a 'leading – learning environment of

[1] Note that no structural assessments have been viewed or undertaken.

modern ideas' – which should also include the school's physical environment and facilities and appropriate consideration during the design phase is necessary.

10. Apart for WATSAN, windows and doors will be the most demanding maintenance item on these standard school buildings. With respect to windows, it is the ICR Team's opinion that increased light and ventilation will add to the quality of student classroom experience, teaching and staff facilities. Further, if requirements for PWD students are fully followed it is almost certain that a need for increased natural light in classrooms will be necessary. The ICR Team recommends increased window size[2] and ventilation, and suggests that the use of nylon mechanism (long life, no corrosion and minimal maintenance), high quality louvers should be considered. It is also worth considering extending the height of window frames to the soffit of the RC ring beam – subject to structural bracing restraint limitations. This will give opportunity for increased ventilation and light and reduce masonry mass. Finally the use of louvers will minimize any hazard to students/teachers walking along the external pathways – the extent that the current awning windows are opened is compromised by this issue.

11. It was noted during site visits that radiant heat from the external (metal) roof cladding was uncomfortably high. In addition to increasing ventilation – and noting that no ceiling fans are provided within any of these classrooms or staff rooms – it is felt that incorporation of sisolation and/or ceiling insulation[3] should be considered. This is mandatory in Australian construction (as dictated by national building regulations), and as part of green house reduction initiatives. These issues do need to be considered for programs such as AIBEP wherein very considerable amounts of Australian tax payer dollars are expended. Note also that roof leaks appear to be relatively common (presumed to be the result of inexpert installations by the KP) – and the inclusion of sisolation will also address roof leakage to some degree.

12. With few exceptions, external walkways (under verandas, roof overhangs, breezeways etc) have high gloss ceramic floor tiles installed. There are no issues with the use of these tiles within classrooms and staff rooms however when used in 'wet' areas these tiles are health hazard. 'Wet' areas also includes external areas that are frequently wet (from rain, ablution taps etc) – and this includes most of the walkways. It is strongly recommended that non slip tiles be specified within the specification and on the drawings and be an approval – 'go/no go' - point within ITPs.

13. The stabilised sub floor back fill with a concrete screed and tile membrane over represents perhaps the most cost effective floor solution and fit for purpose approach. However, it is noted that no damp proof barrier is included in the design. This is a major concern on sites that have poor storm water runoff and/or are subject to flooding. Backfill soil also appears to have low levels of control and although the QA sheets. This will inevitably lead to settlement of the floor itself and contribute to 'drummy' (loose) tiles and associated high maintenance need.

14. Site conditions including structural landscaping and stormwater drainage (except for immediately around the buildings) is typically the 'responsibility of the community and/or District. The District is relied upon to provide assistance in site preparation. This does appear to be a serious flaw in the funding/construction model as schools become operational when hazards may still exist and therefore may represent OH&S concerns. It is suggested that the budget be extended to allow for addressing site features that may constitute OH&S hazards.

15. Water supply is seen to be problematic. Common practice is to provide water on school sites using bore holes. The fact that septic tanks with soak-a-ways/transpiration beds are almost universally used for sewage treatment immediately implies potential health risk. It can also be said, with some degree of confidence, that harvesting of rainwater has no adverse cultural objection/implication.[4] On at least half of the school sites visited there was some issue with water supply – most common was shortage of water supply to ablution blocks and no potable water on site. The issue of no potable water on site is strongly

2 It is suggested that the window ledge be 900mm above the floor and that the window header be located immediately under the reinforced concrete ring/lintel beam.

3 Ensuring that any insulation has no aluminium or other foil membrane and that an electrical test approval certificate has been obtained

4 This question was asked at all sites, in most construction related discussions with stakeholders and no comments supporting cultural objections were raised.

debated as many noted that providing public potable water supply is unsustainable although this conflicts somewhat with MDG goals.

16. It appears that harvesting of rainwater is not often incorporated simply because it is not common practice! A simple analysis undertaken by MCPM comparing the life cost of water harvesting with that of bore well showed that the capital cost for 5000 litres capacity of rainwater with pump and piping was approximately 25% more than the cost for a less than 15m deep bore well, 1000 litre storage with pump and piping. Rainwater harvesting con be installed without the need for pumping – a bore well cannot. Rainwater is usually potable – shallow bore wells (e.g. less than 15m) are likely to not be potable. Deeper bores – and a significant percentage of school sites do/have required bore hold deeper than 15 m - makes selection based on initial capital cost less justifiable. Certainly if whole of life costing is taken into account it is very likely that rainwater harvesting will be seen to be more sustainable and, typically, provide more water of superior quality. The ICR Team recommends that rainwater collection and storage be incorporated into future standard school designs.

17. Other miscellaneous architectural considerations are as follows:
    - use industrial quality fittings, e.g. floor traps, fittings – perhaps the Program could supply as a separate supply only contract assuring quality;
    - use spring loaded, self closing taps thru out – this should be mandatory as water conservation is an important issue – perhaps the Program could supply as a separate supply only contract assuring quality;
    - quality hardware – currently variable and not well specified – perhaps the Program could supply as a separate supply only contract assuring quality;
    - external electrical reticulation around the sites appears typically below standard – professional input and site QA steps are required – consult PLN (the national electrical authority) – to address global issues of non conformance;
    - mandatory – progress payment associated – approvals of electrical and plumbing installations are necessary. This would entail utilising only approved suppliers and ensuring that certificates for these two critical issues are received;
    - consider deleting the raised teacher platform in classrooms – this appears to add no value, increases cost and creates trip hazards within the classroom, and;
    - consider limited incorporation of some ceiling fans.

Engineering Design – Comments and Considerations:

Review of the standard engineering design is required to:

- address (in a professional and responsible manner) specific locality site considerations (refer to the discussion below);
- increase disaster resistant structural design (refer to the discussion below);
- eliminate complicated/problematic details (e.g. concrete walkway/veranda roof beams) – refer to the discussion below;
- increase construction safety factors (e.g. 17.5 MPa should be specified 20-25MPa);
- clarify important details (e.g. column ring beam connections, roof to ring beam tie downs) should be drafted at larger, clearer scales;
- re-assess certain aspects of structural design (refer to the discussion below), and;
- Wall and retaining walls do not meet seismic design criteria and should be re-assessed.

18. As noted above and within the body of the report, critical details that are essential to the structural integrity of the building, and in particular the assurance of the safety of the occupants, need to be thoroughly detailed at a larger scale previously as to ensure clear and un-ambiguous parameters for the (typically) unskilled community construction team.

19. It is noted that under the building codes, soil tests and/or geotechnical analysis/reports are not mandatory for single story buildings in Indonesia. It is acknowledged that the standard footing design as detailed is a proven cost effective solution - however this standard solution will not perform well on

reactive soils, or sites that have poor/uneven compaction. Long term performance of school buildings is highly dependent upon the footing system adopted. There is evidence that the standard footing solution has been inappropriately used on sites and/or that, often, CDCs did not have the experience, influence or professional integrity to amend or address. The risk that these sites will be high maintenance, poor sustainability (or worse) and problematic in the future is very high. (There are notable exceptions to this wherein the CDC has made excellent assessment of the abnormal site conditions and has incorporated a suitable structural solution). The QA system needs to incorporate a third party check on this key structural issue.

20. It is assessed that structural connections (e.g. truss connections) as detailed may not meet either Indonesian or Australian Codes or Standards. Particularly if the less than Class 1 timber is used as appears to be often the case. Further, the rafter and truss members appear to be under-sized when class 2 or less, or 'self classified' timber is utilised. The assurance of the quality of timber is questionable and would in practice be quite difficult to assure given the reliance upon classification by sight and experience virtually all through the supply chain.

21. Roof bracing is not adequate as detailed. It is recommended that bracing in the horizontal plane – at ceiling level – be adopted. Roof tie down details to the upper structural plane i.e. the purlins; chords etc are not adequate as detailed or not detailed at all.

22. Concrete strength is specified as 15 MPa or 17.5 MPa which is considered inadequate. Safety factors incorporated into the design do not fully account for the community construction model variability of material quality, construction methodologies employed, worker skill levels and construction knowledge in general, site conditions, proximity to high risk environments such as salt, swamp etc. It is suggested that the hand mixed concrete (based upon volume proportions) needs to be at least 20MPa and – and given the extreme variability of the factors noted above – it is recommended that the mix proportions as detailed be closer to 25MPa.

23. Concrete cover to steel reinforcing is also judged to be inadequate. Apart from concrete strength, cover to reinforcing is a vital aspect of serviceability and durability. Concrete cover under the community based construction model is regarded as insufficient factoring in all the risks and considerations associated (however recognising that exposed members are typically well treated with render, tiling paint etc). Concrete cover should be increased – to 25mm nominal minimum and in highly aggressive sites (e.g. within 1 Km of the sea) cover will typically be required to be greater again – on a case by case assessment.

24. For the reasons noted above, and also for pure adequacy of structural capacity, it is felt that the typical reinforced concrete frame columns and ring beams are also dimensionally inadequate. It is recommended that these issues be structurally analysed which it is felt will result in approximately 25% larger member sizing.

25. Mechanical anchors should not be used in seismic construction. For construction within earthquake areas it is recommended that threaded M12 (e.g. 12 mm all thread – and preferable HD galvanised) with cogs be utilised and installed at time of the concrete pour. This applies to all structural bolted connections (to reinforced concrete). Where insitu anchors are not possible and/or not done chemical anchors should be utilised for critical structural connections (e.g. roof trusses to concrete frame connections)

Documents referred to:

1. As Built Drawing Gedung SD-SMP SATAP Tipe C-2, SMPN 3 SATAP BONOTONOMPO SELATAN (SATAP 0669), SD Inp. Salajo), PT. DACREA Design & Engineering Consultant 2009, 2009;
2. Asset Maintenance Manual 2010 (in Bahasa);
3. Cardno ACIL - CDC Contract – Typical example of 2008 Consultant services contract;
4. CDC_FM Report SATAP 0488 – example of typical FM reports;
5. Construction Quality Rating Definitions – English;
6. Implementation Completion Report (Scl-43080) On A Loan In The Amount Of Us$103.5 Million To The Republic Of Indonesia For A West Java Basic Education Project – World Bank – June 2005;
7. Implementation Guideline for the Construction of New Junior Secondary School (MoNE), AIBEP, MoNE, Directorate General of Primary and Secondary Education Management, , Directorate General of Junior Secondary School Improvement, MCPM, 12 December 2008;
8. Implementation Guideline for the Construction of One – Roof Schools (MoNE), AIBEP, MoNE, Directorate General of Primary and Secondary Education Management, , Directorate of PSMP, MCPM, 12 December 2008;
9. Technical Guideline for the Construction of One – Roof Madrasah, Book II-D/E/F/G, AIBEP, MoRA, Directorate General of Islamic Education, Directorate of Madrasah Education, MCPM, 12 December 2008;
10. Technical Guideline for the Construction of One – Roof Madrasah, Book I, AIBEP, MoRA, Directorate General of Islamic Education, Directorate of Madrasah Education, MCPM, 12 December 2008;
11. Technical Guideline for the Construction of One – Roof Madrasah, Book II-B/C, AIBEP, MoRA, Directorate General of Islamic Education, Directorate of Madrasah Education, MCPM, 12 December 2008;
12. Technical Guideline for the Construction of One – Roof Madrasah, Book II-A, AIBEP, MoRA, Directorate General of Islamic Education, Directorate of Madrasah Education, MCPM, 12 December 2008, and;
13. Technical Guidelines for the Construction of New Junior Secondary School (MoNE), Book II, AIBEP, MoNE, Directorate General of Primary and Secondary Education Management, , Directorate General of Junior Secondary School Improvement, MCPM, 12 December 2008.