Technical Evaluation of Infrastructure, 2015

National Program for Village Development (PNDS)

Final Report

Findings and Recommendations

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Technical Evaluation of Infrastructure, PNDS, 2015

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Executive Summary

The Programa Nasionál Dezenvolvimentu Suku (PNDS – National Program for Village Development) is Timor-Leste's first nation-wide community development program, launched in 2012. The Pilot Phase of the project took place in 30 villages in 13 Sub-Districts of five Districts, and the project has expanded in three subsequent phases to all 442 villages of Timor-Leste.

This technical evaluation was undertaken to review and assess the quality of a random sample of infrastructures that have been completed, as well as some that are currently under construction. The random sampling was based on sub-projects from the Pilot Phase, Phase 1 and Phase 2, across three Sectors – Water & Sanitation – Sector 2; Roads, Bridge & Flood Control – Sector 5; and Other – Sector 7. **A total of 53 sub-projects were evaluated during this exercise**.

The technical evaluation was conducted by Neil Neate, P.Eng. and Octaviera Herawati, Civil Engineer, both of whom have extensive experience with Community Driven Development projects with particular involvement with PNPM in Indonesia. Their technical reviews were largely based on information contained in the Community Project Proposals but also included a general overview of all technical aspects of the PNDS project.

The field teams used inspection checklists that were based upon those used recently in the 2012 PNPM Technical Evaluation in Indonesia. The PNPM study involved the collection of field data from 1,765 sub-projects in 13 provinces over approximately eight months. The scope and breadth of that evaluation required that the field instruments be condensed in order that the task be completed on time. For Timor-Leste it was desirable that this PNDS evaluation be more comprehensive in order that recommendations can be made on specific technical matters to help guide the program forward in these early formative years. The field instruments were greatly expanded and enhanced from those used in Indonesia, along with the development of specific analytical tools focused on PNDS program issues.

The technical field instruments separated sub-projects into components or aspects, each of which was rated by the field team members. Components of a building, for example, are Foundation, Walls, Columns, etc., while aspects of these are Reinforcement, Dimensions, etc. The ratings used by the evaluators were 'Meets Specification', 'Slightly Below Specification' and 'Below Specification'. The specifications consulted by the evaluators are those found in the Community Project Proposals.

- **Considering the aggregated total of all sub-projects evaluated, it was found that 83% of the technical components of the structures have been constructed in accordance with the plans and specifications as set out in the Community Project Proposals.** Bridge sub-projects were found on the higher side of this – 97% of technical components were found meeting specification (4 sub-projects were evaluated). Road and drainage sub-projects were noted to be failing in many more respects, with only 52% of technical components observed to be meeting the PNDS specifications (5 sub-projects evaluated). Buildings and water supply sub-project components were found to meet specification 84% and 81% respectively.

The technical evaluation teams also rated other criteria. Members of the sub-project implementation committee were questioned regarding their community's involvement with the construction of the sub-project; the ongoing functionality of the infrastructure; and an assessment of the utilization of the new or rehabilitated works. The sub-projects were also examined and rated in regards to how well the designs and construction efforts met the program's environmental safeguards.

Community involvement during the implementation of the sub-projects and functionality/utilization of them were both found to be satisfactory for a program of this nature in its early years.

- **Community involvement was found to be 51% Average and 43% High**, strong results which point to successful community socialization processes by PNDS and eager rural populations willing and able to participate.

- **A total of 71% of sub-projects were judged of average or high functionality and utilization**. This can be considered a 'passing grade', especially in the knowledge that PNDS is a young and growing program. Understanding the various circumstances and reasons for the lower ratings is important in these early cycles of PNDS. A careful study of those sub-projects rated as Low functionality and utilization will help point to opportunities of increasing functionality and utilization of future sub-projects in this critical aspect of rural infrastructure.
- **94% of the sub-projects evaluated were rated as being Average in terms of their environmental impact with the remaining 6% rated as Good**. PNDS staff should take pride in this result and continue to reduce sub-projects' impact upon the environment.

The remoteness of villages was found to have no strong linkages to the quality of specific types of sub-projects. That said, when considering PNDS' entire portfolio of villages and sub-projects, it was found that the less remote villages technical quality rating of 88% did fall to 83% in remote villages and 76% in very remote villages.

Technical facilitation by PNDS staff was also examined by the evaluation teams. It was found, considering an aggregate of all the sub-projects evaluated, that **Technical Facilitators visited village sub-project sites during Phase 2 an average of at least once per week.**

The technical evaluators observed numerous technical and construction methodologies and practices that have not been adequately addressed in plans and specifications contained in the Community Project Proposals. **These design problems and faulty construction practices have been identified by the evaluators as Key Issues, some of which need to be addressed before the next construction cycle begins**. PNDS is currently addressing this problem with the development of its Technical Construction Standards, draft copies of which are being reviewed by sector agencies. It is anticipated that the final issuance of these documents will be in late 2015 after approval by the Inter-Ministerial Working Group.

This report provides a summary of the major problems and challenges associated with the PNDS construction program, along with recommendations for corrective measures and proper construction methodologies. The findings and recommendations from this report will provide additional direction in the finalization of the Technical Construction Standards.

Final Report – Findings and Recommendations

1 Background

The Programa Nasionál Dezenvolvimentu Suku (PNDS – National Program for Village Development) is Timor-Leste's second nation-wide community development program, launched in 2012.

The Pilot Phase of the program took place in 30 villages in 13 Sub-Districts of five Districts: Liquisa, Aileu, Ermera, Dili and Manatuto. There were 75 sub-projects in these 30 villages, the last of which was completed by May 2014.

The program began full implementation in October 2013. It was decided at that time that a phased approach would be used to roll the program out to all of the nation's villages.

Phase 1 took place in all 13 Districts of Timor-Leste, funding 337 sub-projects for implementation in the PNDS program cycle of 2013/2014. Activities took place in 3 Sub-Districts that had hosted the Pilot program and 19 new Sub-Districts, in a total of 149 villages.

Phase 2 continued the expansion of PNDS, adding 1 further Pilot Sub-District and 14 new Sub-Districts, and operating in a total of 240 villages, supporting the construction of 221 sub-projects. The planning and design steps of Phase 3 are underway, with prioritized projects in most cases approved and ready for funding, with the program expanding into all remaining Sub-Districts (or returning to Pilot Sub-Districts) and now fully encompassing the nation's 442 villages.

The program menu features infrastructure from six Sectors: Sector 1 – Health; Sector 2 – Water and Sanitation; Sector 3 – Education, Culture and Sport; Sector 4 – Agriculture, Food Security, Livelihoods; Sector 5 – Roads, Bridge and Flood Control; and Sector 7 – Other.

2 Technical Evaluation Scope

The main objectives of the technical evaluation were as follows:

- To undertake a review and assessment of the quality of infrastructures based on Community Project Proposals
- Examine utilization and functionality
- Evaluation of infrastructure designs and sub-project budgets
- Review of technical facilitation

The technical evaluation mission also explored other areas where technical aspects of the PNDS Program Cycle are present, including community involvement, environmental safeguards, technical training, design accuracy, and construction methodologies. Commentary and discussion is offered in dedicated sections below for most of these additional areas of interest.

Recommendations of the Technical Evaluation are presented throughout the text of this report, and gathered together in Annex 1 for convenience.

3 Technical Evaluation Members and Field Teams

The technical evaluation was conducted by Neil Neate, P.Eng. and assisted by Octaviera Herawati, Civil Engineer. Two technical evaluation field teams were led by them, and included members of the PNDS National Program Secretariat and District/Sub-District PNDS staff for logistical/safety support. The team led by Neil Neate went to Bobonaro and Emera Districts; the other team evaluated sub-projects in Aileu, Manatuto and Baucau Districts.

Neil Neate has worked with international rural development projects for over thirty years. He has provided consulting engineering advice, mentorship, technical evaluation, monitoring, and project management services to projects in Indonesia, Thailand, Lao PDR, Cambodia, Madagascar, Belize and elsewhere. In 2012 Neil led a team of seven Indonesian engineers and an architect in a technical evaluation of 1,765 sub-projects from PNPM Rural's infrastructure works built between 2008 and 2012. This technical evaluation of PNDS has drawn from resources developed for that PNPM evaluation, adapting the field tools to suit the PNDS Sectors and further developing data analysis tools to produce specific results for current conditions in Timor-Leste.

Octaviera Herawati has been working with the community-driven development (CDD) program called National Program for Community Empowerment (PNPM *Mandiri* Rural) in Indonesia for over thirteen years. She has engineering knowledge and expertise which has been proven through her editorship of a series of six *Good and Bad* illustrated manuals for the development of rural infrastructure (one set of these manuals has been provided to each District Engineer). She was one of the seven engineers in a technical evaluation of PNPM Rural's infrastructure conducted in 2012 (responsible for both fieldwork and office data analysis); and has led a technical evaluation team for PNPM Rural Post-Disaster in 2014. She has provided technical advice to the PNPM Rural program and has also been involved in project management, monitoring and evaluation.

4 Site Selection Procedure and Sampling Methodology

For budget, logistics, safety and security considerations the survey focus is on the Pilot, Phase 1 and Phase 2 projects across 3 Sectors in 5 Districts (Aileu, Baucau, Bobonaro, Ermera and Manatuto), resulting in a total population of 303 projects. Using an online sample size calculator a sample of 52 was derived for 90% confidence interval, 10% margin of error and 50% response rate. (A final total of 53 sub-projects were visited and evaluated.)

To ensure a representative and unbiased sample is chosen and also to improve the accuracy of the results at the District and Sector level a stratified random sampling methodology was used.

- Stratify the sample across the stratification sectors

The population of projects was divided into categories using District and Sector (stratification sectors). The following table provides the population and sample counts by these categories. The population counts in each category were used to stratify the sample across all the stratification sectors.

Table 1 – Sample and Population size by stratification category

District	Sector			TOTAL
	Road, bridge & flood control	Social solidarity	Water & sanitation	
Aileu	2 (13)	3 (14)	2 (13)	6 (402)
Baucau	2 (9)	6 (30)	4 (19)	12 (58)
Bononara	2 (15)	4 (13)	2 (32)	8 (60)
Ermera	1 (6)	9 (48)	7 (38)	17 (92)
Manatuto	3 (19)	2 (14)	3 (20)	8 (53)
TOTAL	10 (62)	24 (119)	18 (122)	52 (303)

Note: Population counts in brackets

- Select a random sample from each stratification sector

To identify the random sample in each of the 15 categories, a randomization procedure in excel was used. The process included:

a) Generating random numbers for the projects in each category
b) Using the random numbers to sort the projects in each category in ascending order
c) Selecting the random sample in each category by choosing the first project, the last project and then every fifth project until the sample size was achieved.

5 Technical Evaluation Methodologies

5.1 PNDS Sectors vs. Sub-Project Types

As described above, the PNDS sub-projects selected for this evaluation were randomly selected based on Sector. The Sectors used within PNDS are as follows:

Table 2 – PNDS Sectors

Sector Number	Sector Descriptor
1	Health
2	Water and Sanitation
3	Education, Culture and Sport
4	Agriculture, Food Security and Livelihoods
5	Roads, Bridge and Flood Control
6	Social Solidarity
7	Other Sector

The types of activities that can be supported within these Sectors are those public goods based on criteria described in the Integrated District Development Planning (PDID) law and further elaborated in the Program Operations Manual, Section 2.1.1 Allowable Activity Types (Menu).

During preparations for this technical evaluation it was noted that some types of rural infrastructure are represented in more than one sector. For example, building construction is noted in health clinics in Sector 1, toilet buildings in Sector 2, schools in Sector 3, markets in Sector 4, etc.), creating reporting and coding difficulties for the technical evaluation data as it is collected, digitized and analyzed.

Sub-projects were therefore divided into six sub-project 'types', allowing each sub-project evaluated to be assigned a sub-project type code. The sub-project types identified for the PNDS menu are as follows:

Table 3 – PNDS Technical Evaluation 2015 Sub-project types

Type	Sub-Project Type Descriptor	Number of Sub-projects Evaluated	Sectors Represented Within This Sample
1	Building	29	2, 3 and 7
2	Bridge	4	5
3	Water Supply	15	2
4	Road, Drainage, Retaining Wall	5	4 and 5
5	Irrigation	0	4
6	Electricity	0	7

The sub-project sampling stratification methodology, based on Sector, remains random and valid. The analysis within this report is, however, largely based upon the above sub-project types, and the findings for each specific sub-project type apply across all sectors in which such infrastructure is found. For example, the technical evaluation's conclusions regarding reinforced concrete practices will apply equally to buildings found in most Sectors, to concrete bridges in Sector 2, to concrete reservoirs in Sector 3, to concrete road structures, drainage channels and retaining walls in Sector 4, etc. Similarly, a single retaining wall sub-project was evaluated during this audit, listed on the menu as under Sector 4, but such wall installations took place at numerous other sites as part of sub-projects in other Sectors (on building and bridge sites, for example). Thus this evaluation's findings for this sub-project type should be viewed and applied with equal interest across the PNDS sectors featuring such infrastructure.

5.2 Technical Inspection Checklists

The technical evaluation (TE) teams used unique Technical Inspection Checklists (TIC) for each sub-project type, based on a field tool that was originally developed for the PNPM 2012 evaluation but adapted and expanded to suit PNDS conditions. A prototype Water Supply checklist was field tested at the first sub-project evaluated, a water system in Tocoluli, Sub-District Railaco, Emera District, before the complete set of TIC were developed. The TIC are attached to this report in Annex 2 - Technical Inspection Checklists.

The field checklists divided the sub-project type structures into a number of technical components, each to be rated separately. The components for the sub-project type Building, for example, started at the base: Foundation, Ground Beam, Wall, Column, etc., proceeding up to the Roof Structure. Where a particular component had several distinct aspects that could be evaluated separately, the component was subdivided, for example: Ring Beam - Reinforcement and Ring Beam - Dimension.

A discussion of each of the components or aspects evaluated on the checklists is presented in Annex 3 - Description of Inspection Details. TIC were not developed for Sub-project Types 5 and 6 since the random site selection procedure did not choose any sub-projects of these type during the sampling exercise.

5.3 Technical Rating System

Each component or aspect of the sub-project was rated as being one of five choices: Meets Spec. (Specification); Slightly Below Spec.; Below Spec.; Not Inspected; and Not Applicable.

These ratings are defined for this technical evaluation as follows:

- **Meets Specification** – The sub-project component or aspect meets the plans, specifications, or criteria as set out in the Community Project Proposal.
- **Slightly Below Specification** – The sub-project displays certain characteristics that could be improved upon within its design/construction/

operations/maintenance or environmental conditions to meet the plans, specifications or criteria presented in the Community Project Proposal.

- **Below Specification –** The sub-project was either (i) not constructed according to the approved plans or specifications in the Community Project Proposal, or (ii) presents a clear and present danger to the life or safety of users.
- **Not Inspected –** It may occasionally be impossible for the TE team to inspect a certain aspect of a sub-project. For example, many completed buildings feature ceilings with limited or no access to the attic. TE teams may not be able to inspect a building's roof structure in these instances. The TE team will question the village and Sub-District personnel in this instance to verify sub-project details as much as possible.
- **Not Applicable –** Some components or aspects will not be applicable to sub-projects. For example, the component Ceiling is included in the Building Checklist, but many building sub-projects do not include such installations.

5.4 Quality Ratings and Other Criteria

The second page of the TIC offers the evaluator an opportunity to rate the sub-project's construction quality as well as in several more general and less-technical areas. These "Overall Project Assessment" categories are as follows:

- Sub-project Construction Quality (rated Good, Average or Poor), with opportunity to write a comment
- Community Involvement (Good, Average, Poor), with opportunity to write a comment
- Functionality and Utilization (High, Average, Low, None), with opportunity to write a comment
- Environmental Considerations (Good, Average, Poor), with opportunity to write a comment
- Frequency of Technical Facilitation and Supervision (frequency was provided in a number of ways; it was simply noted down)

These quality ratings are defined and further discussed below in Section 7, in separate sections for each. Analysis of the sub-project quality ratings gathered in this part of the TIC is presented along with some commentary. A listing of the 53 sub-projects evaluated and their Government of Australia Aid Program quality ratings is provided in Section 6 below, along with a complete summary of the technical evaluation's individual quality ratings in Annex 4.

The second page of the TIC also provides space for the evaluator to write a brief sub-project description and add comments regarding particular issues that were noted during the evaluation. Brief Quality Reports for each sub-project visited have been created to contain this information and are included with this report in Annex 5.

5.5 Field Checklist Data Input

The data from the Technical Inspection Checklist were input to digital spreadsheets in the office after the fieldwork was complete. The digital spreadsheets are patterned after the TIC and are called Sub-project Inspection Data Input Forms (SIDIF). These forms allow input of the field data in a format very similar to that in which it was gathered, thereby reducing input errors. The digital spreadsheets allow the field data to be systematically filed, grouped and analyzed using computer sorting techniques. The data within the sub-project spreadsheets can, for example, be sorted by Phase, by location or by the rating evaluations under Construction Quality or Community Involvement. Sorting procedures can be used to reveal trends or too highlight problem areas.

Spreadsheets for each sub-project evaluated were created and saved to computer files using standard naming formats. The naming formats are based upon the PNDS MIS administrative numbers for each sub-project (Project Phase-District-Subdistrict-Village) along with added codes for Sub-project Type to enable this evaluation's sorting and correlation activities to take place.

The file naming system used for this technical evaluation is as follows, substituting numbers for each square-bracket item:

[Phase]-[District]-[Sub-District]-[Village]-[Sub-project Number]-[Sub-project Type], where Pilot Phase is 0, etc.; GoTL administrative numbers for District, Sub-District, Village; Sub-project Number is the last digit of the PNDS MIS code indicating the number of individual sub-projects within a village during each Phase; and Sub-project Type is 1 for Building, 2 for Bridge, 3 Water for Supply and 4 for Road, Drainage, Retaining Wall.

5.6 Key Issues – Data Recording and Digital Input

It was recognized after the field testing of the checklist in Emera District that certain aspects of sub-projects that ostensibly would "Meet Spec." – i.e. fulfill the requirements as set out in Community Project Proposal – may actually fall below generally accepted engineering standards for such construction or installations. It was felt that another area of the checklist should contain a listing of some of the common Key Issues that are often observed to be problematic during the planning or construction of rural infrastructure projects. In situations where the plans or specifications in the Community Project Proposal were deemed to be lacking or containing insufficient detail, the TE team could highlight the problem area as a Key Issue.

Unique lists of Key Issues were created for each of the sub-project types.
For example, the Building spreadsheet contains Key Issues pertaining to Steel Reinforcing and Concrete, while the Water Supply spreadsheet features such typical problem areas as Pipe Network and Watershed Protection. Evaluators made note of

such problems at each sub-project site on the TIC, notwithstanding the fact that the Community Project Proposal's plans and specifications might have been silent toward such considerations.

The notes from the TIC were recorded on the SIDIF lists of Key Issues, resulting in a concise digital summary of problem areas observed at sub-projects that otherwise might have many of their technical components rated as "Meets Spec." due to deficiencies in the design and drawing of the sub-project.

An analysis of the aggregate assembly of these Key Issues will provide valuable information for improvements to the PNDS design program and future Community Project Proposals, as well as providing valuable input to PNDS as it finalizes the Technical Construction Standards. Section 8, below, offers some commentary regarding these Key Issues, while Annex 6 - Key Issues Summary, contains additional detailed reporting in regards to these findings.

Recommendation 1: Annex 6 - Key Issues Summary should be considered during the finalization of the PNDS Technical Construction Standards.

6 Sub-projects Evaluated

NO.	DISTRICT	ADMINISTRATIVE POST	VILLAGE	STATUS	SUB-PROJECT	GOVERNMENT OF AUSTRALIA AID PROGRAM QUALITY RATING*
1	Baucau	Baucau Vila	Bucoli	Remote	Construction of Aldeia community centre	5
2	Baucau	Baucau Vila	Triloca	Remote	Rehabilitation of water supply system	4
3	Baucau	Baucau Vila	Triloca	Remote	Construction of Aldeia community centre	5
4	Baucau	Baucau Vila	Samalari	Remote	Construction of new road	2
5	Baucau	Baucau Vila	Samalari	Remote	Construction of Aldeia community centre	5
6	Baucau	Baucau Vila	Seical	Remote	Construction of community center	3
7	Baucau	Baucau Vila	Buruma	Not remote	Rehabilitation of water supply system	4
8	Baucau	Baucau Vila	Caibada	Not remote	Construction of public sanitation facilities (MCK)	5
9	Baucau	Baucau Vila	Caibada	Not remote	Construction of Aldeia community centre	4
10	Baucau	Baucau Vila	Bahu	Not remote	Construction of water supply system	5

11	Baucau	Baucau Vila	Buibau	Not remote	Construction of Aldeia community centre	4
12	Baucau	Baucau Vila	Trilolo	Not remote	Construction of Aldeia community centre	4
13	Aileu	Laulara	Talitu	Remote	Construction of retaining wall	4
14	Aileu	Remexio	Faisoi	Remote	Rehabilitation of water supply system	5
15	Aileu	Aileu Vila	Lausi	Remote	Rehabilitation of water supply system	5
16	Aileu	Aileu Vila	Lausi	Remote	Construction of Aldeia community centre	5
17	Aileu	Aileu Vila	Bandudato	Not remote	Construction of water supply system	5
18	Aileu	Aileu Vila	Seloi Malere	Remote	Construction of small bridge	5
19	Aileu	Aileu Vila	Seloi Craic	Remote	Construction of Aldeia community centre	5
20	Bobonaro	Balibo	Leolima	Remote	Rehabilitation of road drainage	5
21	Bobonaro	Balibo	Leolima	Remote	Construction of Suco community centre	3
22	Bobonaro	Cailaco	Dau Odo	Remote	Construction of water supply system	5
23	Bobonaro	Cailaco	Raiheu	Remote	Construction of Aldeia community centre	5
24	Bobonaro	Bobonaro	Malilat	Very Remote	Rehabilitation of road drainage	4

25	Bobonaro	Bobonaro	Malilat	Very Remote	Construction of Aldeia community centre	5
26	Bobonaro	Bobonaro	Lourba	Remote	Rehabilitation of Suco community centre	5
27	Bobonaro	Bobonaro	Tebabui	Very Remote	Construction of public sanitation facilities (MCK)	5
28	Ermera	Ermera	Talimoro	Not remote	Construction of public sanitation facilities (MCK)	5
29	Ermera	Ermera	Talimoro	Not remote	Construction of Aldeia community centre	4
30	Ermera	Ermera	Poetete	Remote	Construction of Aldeia community centre	4
31	Ermera	Ermera	Ponilala	Remote	Construction of Aldeia community centre	4
32	Ermera	Ermera	Estado	Remote	Construction of Aldeia community centre	5
33	Ermera	Ermera	Raimerhei	Remote	Construction of Aldeia community centre	5
34	Ermera	Ermera	Humboe	Not remote	Construction of Aldeia community centre	5
35	Ermera	Railaco	Railaco Leten	Remote	Construction of water supply system	5
36	Ermera	Railaco	Railaco Leten	Remote	Construction of Aldeia community centre	6

37	Ermera	Railaco	Tocoluli	Not remote	Rehabilitation of water supply system	5
38	Ermera	Hatolia	Leimea Sorimbalu	Very Remote	Construction of water supply system	4
39	Ermera	Hatolia	Leimea Sorimbalu	Very Remote	Construction of public sanitation facilities (MCK)	4
40	Ermera	Hatolia	Hatolia	Very Remote	Construction of small bridge	5
41	Ermera	Hatolia	Urahou	Remote	Construction of public sanitation facilities (MCK)	5
42	Ermera	Hatolia	Urahou	Remote	Construction of Aldeia community centre	4
43	Ermera	Hatolia	Fatubessi	Remote	Rehabilitation of water supply system	5
44	Ermera	Letefoho	Hatugau	Very Remote	Construction of Aldeia community centre	4
45	Manatuto	Manatuto	Ma'abat	Not remote	Rehabilitation of small bridge	5
46	Manatuto	Barique_Natarbora	Barique	Extremely remote	Construction of water supply system	4
47	Manatuto	Barique_Natarbora	Uma Boco	Extremely remote	Construction of small bridge	5
48	Manatuto	Natarbora	Manehat	Extremely remote	Rehabilitation of Water Supply	4
49	Manatuto	Natarbora	Manehat	Extremely remote	Rehabilitation of school	5
50	Manatuto	Natarbora	Abot Oan	Extremely remote	Construction of small bridge	5
51	Manatuto	Soibada	Daulorok	Extremely remote	Construction of water supply system	5
52	Manatuto	Laclo	Uma Caduac	Not remote	Construction of water supply system	5

53	Manatuto	Laclo	Uma Naroc	Not remote	Rehabilitation of Guest House	4

- Note: Government of Australia Aid Program Quality Rating Criteria Table

Satisfactory		Less Than Satisfactory	
6	Very high quality; needs ongoing management and monitoring only	3	Less than adequate quality; needs work to improve in core areas
5	Good quality; needs minor work to improve in some areas	2	Poor quality; needs major work to improve
4	Adequate quality; needs some work to improve	1	Very poor quality; needs major overhaul

Further discussion of this table is provided in Section 7.4, p.23 below

7 Technical Findings

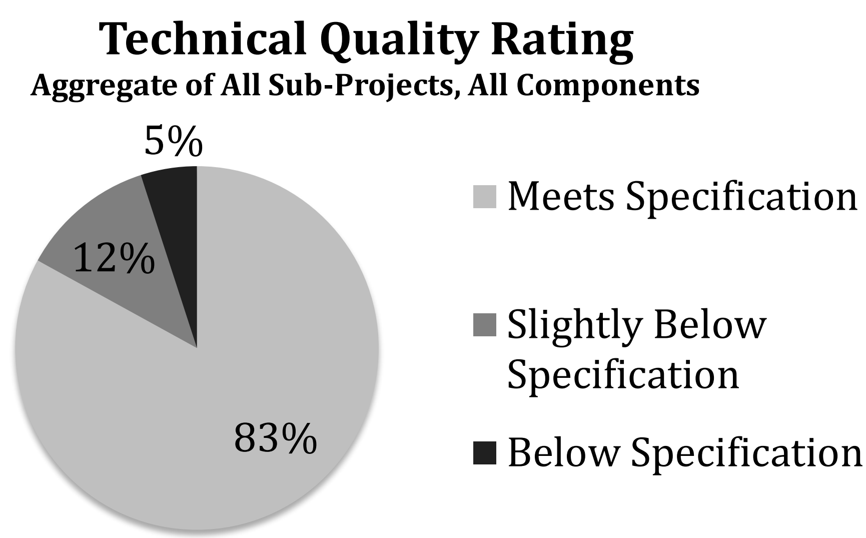
7.1 Community Project Proposal and Technical Specifications

The first page of the Technical Inspection Checklists (TIC) breaks each sub-project type into components to be rated, as described above in section 5.2. An analysis of these ratings shows that, when considering an aggregate of all sub-project components,

83 % of the sub-projects have been constructed in accordance with the plans and specifications contained in the Community Project Proposals.

The chart below presents this finding using an aggregate of all of the technical components of the sub-projects evaluated.

Chart 1: Technical Quality Rating of Sub-Project Construction



The following table presents separate totals for each of the sub-project types evaluated. It should be noted that there were only four bridges and five road/drainage/retaining wall sub-projects inspected during this technical evaluation so that extrapolation of these technical findings over PNDS' entire portfolio of such sub-project types may be tenuous. No irrigation or electricity sub-projects were evaluated during this investigation.

Table 4: Summary of Component Technical Ratings by Sub-project Type

	Meets Spec.	Slightly Below Spec.	Below Spec.	Sectors
Building (29 sub-projects)	84%	10%	6%	2 and 7
Bridge (4 sub-projects)	97%	3%	0%	5
Water Supply (15 sub-projects)	81%	18%	1%	2
Road, Drainage, Retaining Wall (5)	52%	21%	28%	4 and 5
Average over 53 sub-projects	83%	12%	5%	

The aggregated totals for Building, Bridge and Water Supply are reasonable for this early stage of the PNDS project. The total for Road, Drainage, Retaining Wall is less satisfactory, but is influenced by the small sample size and the fact that two of the sub-projects evaluated in this category were experiencing difficulties during construction. The Key Issues section of this report (Section 8 and Annex 6) will examine this sub-project type more intently to understand problem areas and make recommendations to improve sub-projects of this type.

The results presented in Table 4 can also be reported by Sector, as below.

Table 5: Summary of Component Technical Ratings by Sector

	Meets Specification	Slightly Below Spec.	Below Spec.
Sector 2 Water and Sanitation (20 sub-projects)	83%	16%	1%
Sector 4 Agriculture, Food Security, Livelihoods (1 sub-project)	33%	67%	0%
Sector 5 Roads Bridge and Flood Control (8 sub-projects)	82%	5%	13%
Sector 7 Other (24 sub-projects)	84%	11%	6%
Average over 53 sub-projects	83%	12%	5%

It should again be emphasized that the chart and table above represent the technical evaluation of each sub-project using the plans and specifications as set out in the sub-project's Community Project Proposal. The TE team found numerous deficiencies with the plans and specifications but did not rate the sub-projects based on these failings. Deficiencies noted in the Community Project Proposals will be discussed in more detail below in Section 8 – Key Issues of this report.

7.2 Remoteness

The PNDS MIS classifies each village with a degree of remoteness, which is linked to the Suku Grant allocation level. The degrees are as follows:

Not Remote	< 10 km from District Capital
Remote	10 – 30 km
Very Remote	30 – 55 km
Extremely Remote	> 55 km

Spreadsheets were sorted to determine if a village's degree of remoteness played a significant part in the technical quality rating of a sub-project's components. A hypothesis might be that the technical quality of a sub-project will go down as the degree of remoteness goes up, due to a number of possible factors: increased difficulty for technical facilitators to visit the site; reduced number of skilled labourers being available; increased difficulty in securing proper construction materials; etc.

In the table below, the aggregate percentage of "Meets Spec." component ratings for each individual sub-project type are shown for each degree of remoteness, along with the aggregate sum of all sub-projects evaluated.

So, for example, 84% of the Building components in Not Remote villages were evaluated as "Meets Spec."; it is similarly 84% for those sub-projects in Remote villages. In Very Remote villages, however, this percentage goes down to 78% of technical components were evaluated as "Meets Spec." (as one might expect). Incongruently, though, the aggregate figure goes back up to 100% in Extremely Remote sub-project sites. This might be explained by the fact that the TE teams visited only 6 villages classified as Extremely Remote.

Table 6: Aggregate of "Meets Spec." components for Sub-project Types vs. Remoteness

	Not Remote	Remote	Very Remote	Extremely Remote
Building (29 sub-projects)	84%	84%	78%	100%
Bridge (4 sub-projects)	100%	100%	92%	100%
Water Supply (15 sub-projects)	76%	90%	60%	73%
Road, Drainage, Retaining Wall (5 sub-projects)	-	33%	33%	100%
All Sub-projects	88%	83%	76%	88%

An examination of the other sub-project types does not show any strong indication that the *Remoteness Hypothesis* (of greater difficulties to produce adequate results as remoteness goes up) proves to be the case in this Technical Evaluation's sampling. The bottom line, however, represents an aggregate of all sub-projects evaluated; it does display results somewhat in line with remoteness expectations. It is noted that the numbers of Extremely Remote sub-projects evaluated were relatively small (6) and heavy on Water Supply (3 of 6). Water supply sub-projects were generally rated higher in their quality regardless of location.

7.3 Phase

Spreadsheets were sorted to determine if there are any apparent trends in technical quality based upon when the sub-project was constructed. The main difference that might influence technical aspects of sub-projects according to phase is the frequency and quality of technical facilitation and supervision (assuming that quality of material supply and local skilled labour remain the same). The influence of technical facilitation is examined more closely below in Section 7.11, Frequency of Technical Facilitation.

The following table demonstrates that for the sub-projects evaluated, the technical quality (i.e. "Meets Spec." or not) has not fluctuated in any distinct trend with the Project Phase in which the sub-project was constructed.

Table 7: Aggregate of "Meets Spec." components for Sub-project Types by Phase

	Pilot	Phase 1	Phase 2
Building	87%	85%	83%
Bridge	100%	100%	-
Water Supply	73%	86%	86%
Road, etc.	33%	94%	25%
All Sub-projects	82%	85%	81%

For example, while 'Building' sub-projects seem to have gone down slightly in overall technical quality (trending slightly down from 87% of components meeting specification in the Pilot Phase to 83% in Phase 2), one also can note that Water Supply sub-projects trended 'up', from 73% to 86%. Looking at all sub-project ratings aggregated together, the trend is basically flat: 82% in the Pilot Phase, up to 85% in Phase1 and back down to 81% in Phase 2. It is difficult to draw any firm conclusion from these evaluation results. All of these technical quality ratings of 'meeting specification', it must be noted, are in reference to those specifications and plans contained in each individual Community Project Proposal.

7.4 Construction Quality Ratings

The second page of the Technical Inspection Checklists features a section where the evaluator, having evaluated the Community Project Proposal and each of the components of the infrastructure itself, can review the sub-project as a whole entity, disregarding slight imperfections or deficiencies in some components and aspects of the construction. The ratings are Good, Average and Poor.

Most of the infrastructure examined during this evaluation was considered to be Average or Good in its construction quality.

Table 8: Aggregate of Construction Quality ratings, Average or Good

	Pilot	Phase 1	Phase 2	Program to Date
Building	100%	90%	92%	93%
Bridge	100%	100%	-	100%
Water Supply	100%	100%	100%	100%
Road, etc.	100%	100%	50%	80%

It cannot be disregarded that the final finishing of the sub-project, be it a building's plaster and paint or a water system's proper grading around reservoirs and tapstands, does influence an evaluator's final appraisal of a sub-project. A rating of Good might often be based upon such 'finishing touches' on sub-projects – **slightly more than 40% of all sub-projects evaluated were rated Good in their construction quality**. An example of this influence might be seen in the sub-project type Road, above. Pilot Road sub-projects were all rated Average or Good (Table 8), while it can be seen in Table 7 that only 33% of the Pilot Road technical components examined happened to "Meet Spec." The evaluators may have been influenced by other (sometimes social) factors to give a higher rating when viewing the sub-project as a whole entity.

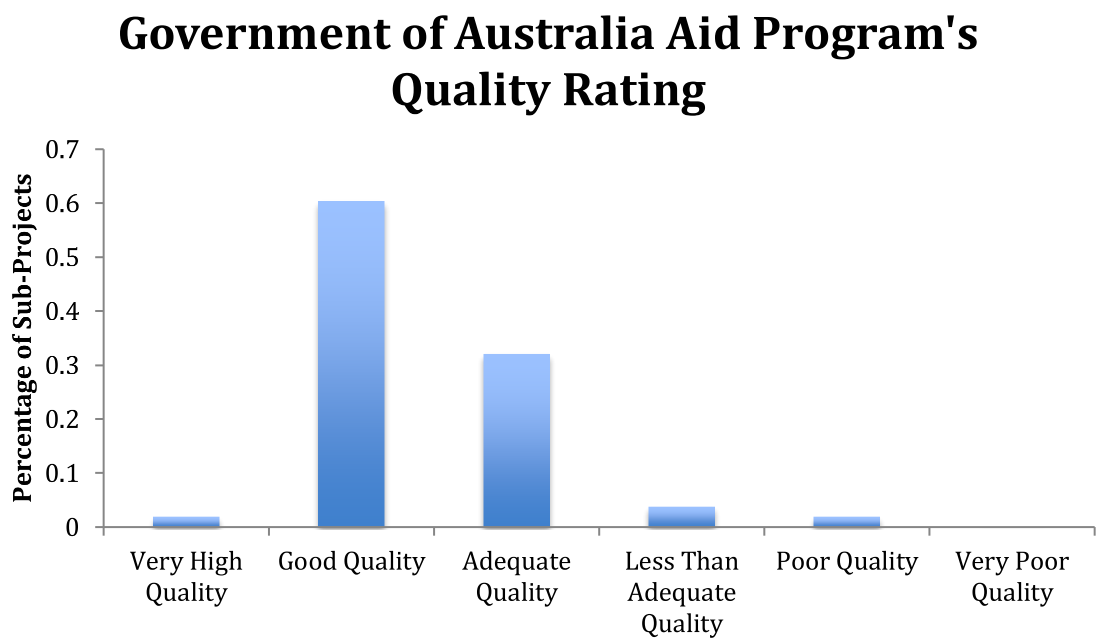
During the input of data to digital spreadsheets, the evaluators reviewed and made careful note of all circumstances relating to each individual sub-project. A final Sub-project Quality Rating, based on the Government of Australia Aid Program's (previously AusAID's) Quality Criteria and Rating System, was entered into the SIDIF and Brief Quality Report (which are contained in Annex 5). The Government of Australia Aid Program's rating system is shown in the following table:

Table 9: Government of Australia Aid Program Quality Criteria

Satisfactory		Less Than Satisfactory	
6	Very high quality; needs ongoing management and monitoring only	3	Less than adequate quality; needs work to improve in core areas
5	Good quality; needs minor work to improve in some areas	2	Poor quality; needs major work to improve
4	Adequate quality; needs some work to improve	1	Very poor quality; needs major overhaul

The chart on the following page shows the relative percentages of sub-projects rated using the Government of Australia Aid Program Quality Criteria.

Chart 2: Sub-project Quality Rating



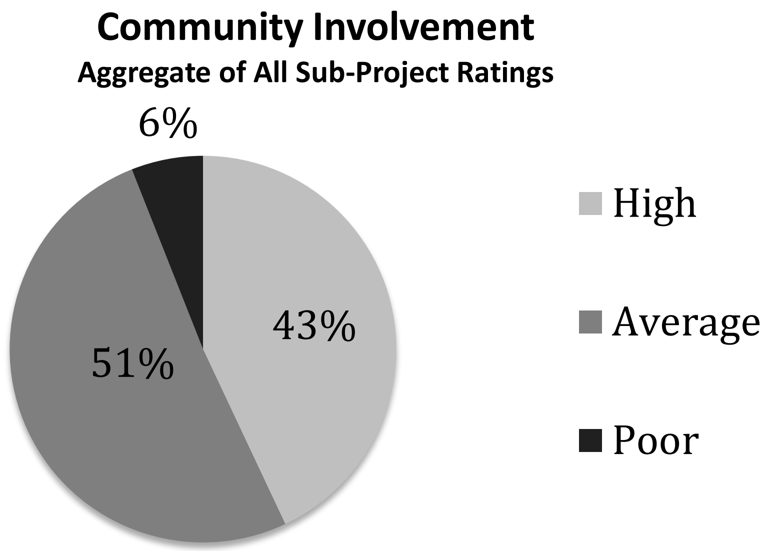
Higher ratings might also be deemed suitable when combined with solid community participation during construction or visibly high use of the infrastructure during the site visit; all of these social aspects of sub-projects can combine to move a technically 'so-so' sub-project higher in its overall quality rating.

7.5 Community Involvement

The TIC contained an entry field inviting an inspector to question members of the building committee and others regarding the community's engagement with the sub-project during the PNDS Program Cycle. The community's input to the process could be judged as High, Average or Poor.

An aggregate of the ratings indicates that 94% of the sub-projects evaluated enjoyed an average or higher amount of community interest and involvement.

Chart 3: Community Involvement



It should be recognized that this assessment can be quite subjective. Much depends upon the persons being questioned, their experiences during the sub-project's construction (good, bad, indifferent?), their personality and their relationships with others connected to the sub-project. Evaluators will most often use Average for obvious reasons. A rating of High community involvement would many times be due to interesting and sincere storytelling by one or more building committee members in regards to local efforts expended during sub-project construction. Likewise, a rating of Poor community involvement would normally be backed up by and based on a visible lack of interest or display of poor workmanship in the sub-project.

It is interesting to note that, while average community involvement was indeed entered for a majority of the sub-projects, a rating of High was not far behind. The efforts of PNDS social facilitators should be praised.

7.6 Functionality and Utilization

The following chart shows that:

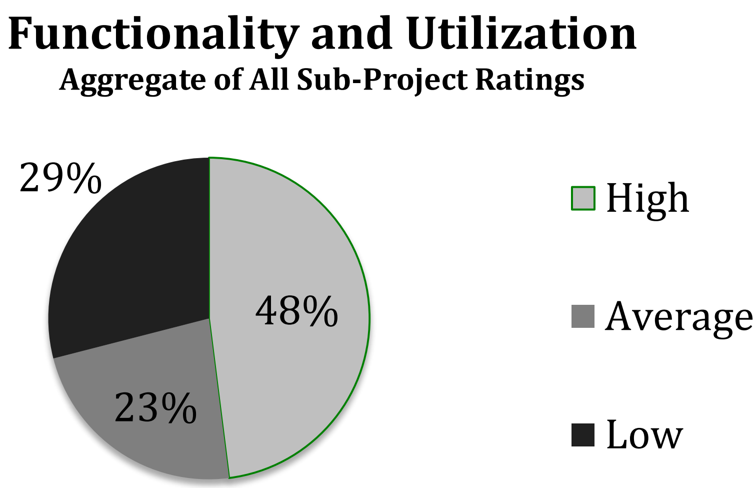
71% of sub-projects have been judged to be of Average or High functionality and utilization.

These two aspects are combined because, while they are measures of different things, they are also quite strongly linked.

Functionality is a relatively easy thing to assess – if the infrastructure is still operating as originally planned or intended then a rating of 'Average' would be considered. A High rating for this aspect of the assessment might be represented by a sub-project where the recipient community or users have independently added to or improved a sub-project to increase its usefulness. Actions of this nature would be a very large vote of confidence in the original PNDS works as the instigator of further self-directed community development activities.

Utilization was rated on two levels by the inspectors. The first is straight-forward: is an appropriate portion of the recipient community's population using the facility or infrastructure as intended? If so, then a rating of 'Average' would be considered.

Chart 4: Functionality and Utilization, All sub-projects



The second level of a sub-project's utilization, however, requires more contextual and personal information to be gathered at the site and assessed. The TE team members made observations and asked questions regarding the community's interest in the infrastructure and enthusiasm for its impact on their activities and daily lives. Statements of support for the addition of the infrastructure into the community's social fabric as well as support for PNDS community planning and construction mechanisms were interpreted as moving this criterion toward the High rating. The final rating is an aggregate of the two findings where one or the other would support a rating of High.

Examples of sub-projects that were rated High are as follows:

- A community center in Railaco Leten, Emera District where a local retired school teacher is providing lessons to primary school children on a daily basis, using the open area in the center as his classroom, with a blackboard leaning against one wall. His teaching materials are carefully stored in one of the two rooms.
- A water system in Manlala, Manatuto District was the first public infrastructure of this kind since the Portuguese colonial era. The villagers' enthusiasm for the construction of the sub-project was such that when weather conditions did not permit a supplier to deliver the materials they organized transportation and

fetched the construction supplies themselves – a three-hour journey in good weather. The new water system relieves the population from a >2 km hike over hilly terrain to get water from a mountain spring.

- A community center in Bucoli, Baucau District was built to replace an older one which still stands opposite. The new center is needed to accommodate the many people who wish to attend village meetings; the population of Bucoli is approaching 3000 people. The new center has been constructed larger than as shown in the Project Proposal since the village wishes to be certain that it will be big enough. The village building committee will continue to work on it, regardless of budget shortfalls, until it is finished.

A disturbingly high percentage of Low functionality and/or utilization has been recorded, 29%, which translates to 13 sub-projects that were considered by the TE teams to be insufficiently providing the recipient communities with the potential benefits of such infrastructure. An examination of the data shows that 7 such sub-projects judged to be Low in terms of functionality and utilization are community centers. A further 3 are MCK facilities and the remaining 3 are road or drainage sub-projects. The latter sub-projects will be discussed in more detail below in the Key Issues section of this report.

Community centers have recently become a contentious issue within the PNDS menu of approved infrastructure. We understand that the selection of this type of infrastructure was restricted for Phase 3 of the program and, more recently, entirely removed from the sanctioned menu. TE team members questioned village or aldeia representatives at sub-project sites in regards to the buildings' use by recipient communities and the frequency was recorded in TIC notations. Most of the community centers that were rated Low are being used once or twice per month. Many of these buildings are on land donated to the community by the village or aldeia chief, with the structures frequently standing close by their personal residences. It seemed apparent at some of these sites that an under-used community center was, perhaps, a 'status' symbol mainly promoted and driven by traditional village or aldeia hierarchy.

MCK facilities that were rated Low are those buildings (3 of 5 inspected), constructed within or near a central community precinct, that typically remain locked up unless there is a meeting being held at the adjacent community center. It is apparent that these toilet facilities are used very infrequently, if ever. Only one of the installations featured any provision for laundry facilities, and in this instance the immense reinforced concrete vats are so large that they are not feasible to fill with water (not to mention that the village's water system is broken and nonfunctional).

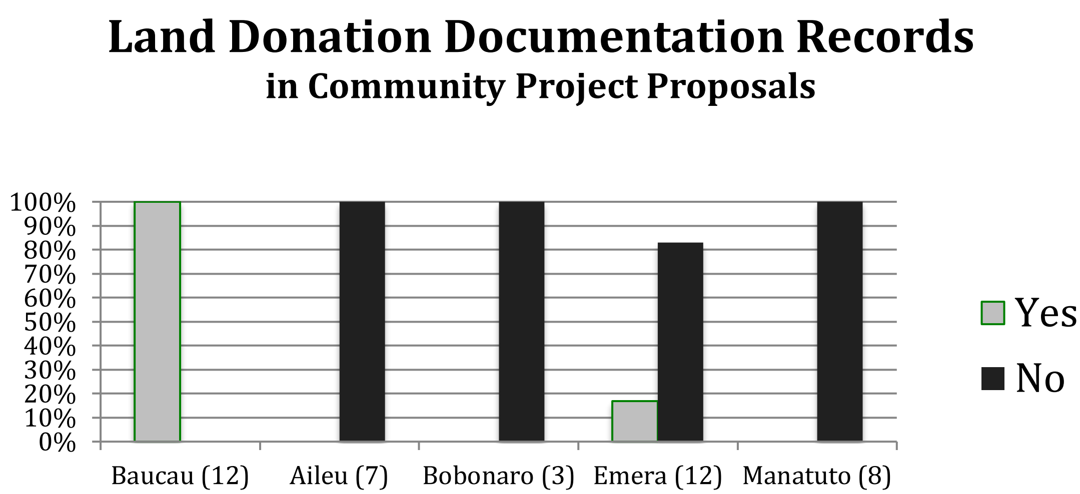
7.7 Land Donation Certificate

Many PNDS sub-projects are wholly or partially constructed on private land that has been donated for that use. Examples include buildings that are often constructed in a central part of a village where existing community lands are not large enough to accommodate the structure or grounds. Many times water systems will have reservoirs sitting within agricultural plots and pipes crossing private property.

Road sub-projects sometimes require a strip of land to be dedicated as public for widening purposes.

It is a requirement of PNDS that the lands are donated to the community for these communal uses. A form known as TF 7.2.2 is created as part of the land donation process, along with a requirement that the landowner writes a personal letter affirming their intentions. We understand that a copy of this documentation is filed in five locations: with the landowner; the aldeia chief; the village chief; the District office of PNDS; and with GoTL National Directorate for Land and Property.

Chart 5: Land Donation Documentation Records – District (number of sub-projects)



Note: District Name (number of sub-projects requiring documentation)

Several of the Community Project Proposals that the TE team viewed contain a copy of TF 7.2.2 and sometimes a copy of the donation letter. These documents are an important aspect of new pieces of community infrastructure and copies should be contained in all Community Project Proposals.

We inspected one community center in Emera, in the village of Railaco Leten, the land for which had been donated by an elderly gentleman who attended our Technical Evaluation visit. This center is amongst the most well used of the community buildings that we evaluated during this mission, and the donor is very pleased to have been able to provide the land for it. No records of land donation documentation exists for this transaction, we were informed; the donation took place during the Pilot Phase of PNDS and such procedures were not yet fully in place, apparently. It would be unfortunate if this oversight causes any land-ownership problems upon the donor's death, we noted to the sub-district personnel accompanying us, encouraging them to look into the situation and rectify it.

Recommendation 2: Copies of donation letter and TF 7.2.2 should be included in all Community Project Proposals.

Recommendation 3: TF 7.2.2 and a letter confirming the donation of the land in Railaco Leten should be completed and filed appropriately.

7.8 Environmental Considerations

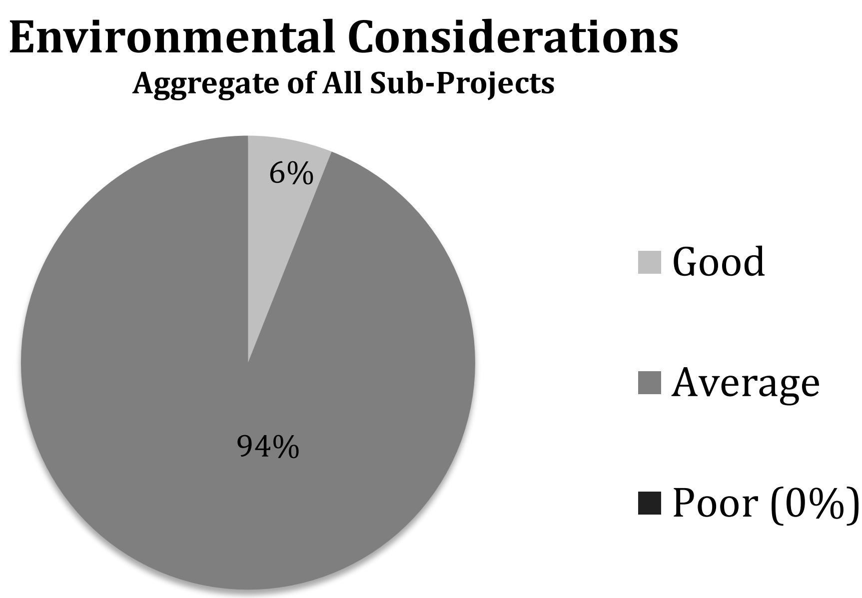
The Technical Inspection Checklists for each sub-project type featured an area on the second page where the quality of the infrastructure and its placement within the recipient village could be assessed in regards to environmental considerations. The POM cites the adherence to proper environmental safeguards as being one of PNDS' Guiding Principles and includes environmentally damaging activities on the Negative List. Cycle Step 6 stipulates that engineers and planners prepare and verify a proposed sub-project with due regard to environmental risks associated with it.

The results of this evaluation show that:

94% of the sub-projects are rated as Average and 6% as Good.

These results show that PNDS staff and trained community workers have spent a sufficient amount of time and effort to ensure that sub-projects do not adversely affect the environment. The chart below shows these ratings pictorially.

Chart 5: Environmental Considerations, All Sub-projects



The sub-projects rated as Good (there are 3 of them) were examined to understand what aspects of the constructions spurred such results. PNDS may wish to study these particular sub-projects in order to add or refine environmental training modules. The individual sub-projects and the TE rationale is as follows:

- Water supply system in Fatu Besi, Emera District: this large, well-maintained system utilizes excess water in agricultural activities, plus the EOM is justifiably concerned about stream bank erosion near the catchment reservoir, drawing our attention to the situation and talking of planning a future sub-project to deal with this potential problem. This water system is being run by intelligent, thinking, diligent people;
- Bridge in Seloi Malere, Aileu District: the well-designed upstream erosion protection and excellent installation of gabion baskets deserved this high rating; and
- Community center in Lausi, Aileu District: a rehabilitation of an existing building in the Pilot Phase is a good example of how something old can be made new again, conserving resources and thereby helping the environment.

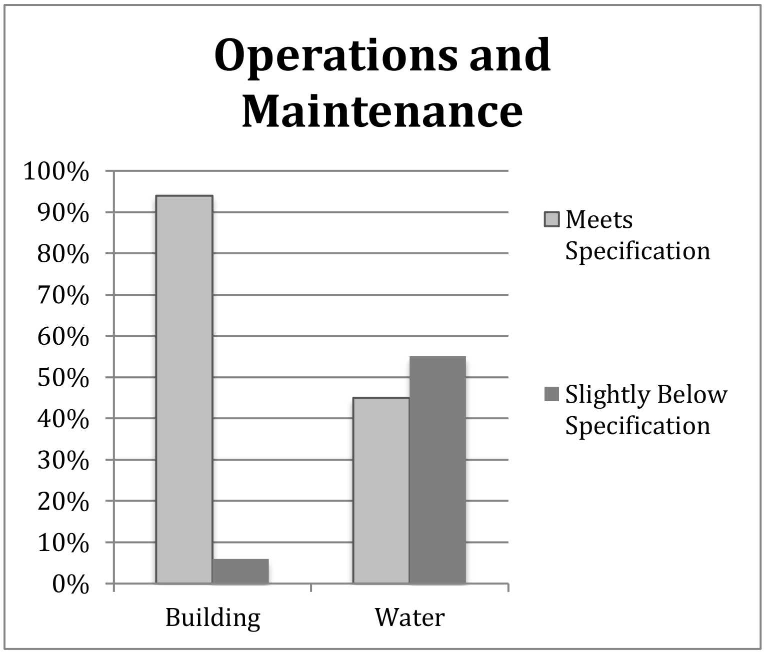
7.9 Operations and Maintenance

Maintenance of sub-projects was an aspect that was rated for all infrastructures evaluated. TE team members questioned villagers about these activities in regards to several lines of inquiry: what kinds of maintenance activities do they undertake? How frequent were cleaning/maintenance activities scheduled? Was a maintenance fee collected from the users?

Building maintenance committees seemed to function in an adequate manner. Community centers were for the most part clean and tidy, although we did hear that many of them are used very infrequently so that maintenance efforts are accordingly slight. The MCK facilities inspected were also very clean, some appearing to never having been used. Considering the fact that their doors are locked most of the time, this is not surprising.

Water systems should have a community level water user group organized after the construction period called a GMF (Grupu Maneja Fasilidade). The village EOM should help to facilitate this if there is not one set up. Some of these EOM teams did not seem to be very active – we inspected many reservoirs that had not been cleaned in over a year. Most systems are not yet collecting any user fees from the villagers. We heard from several EOM that the setting and collection of fees to pay for system maintenance was being discussed at aldeia meetings, but that no firm plans to institute a user fee had been made. It was not clear whether a GMF had been established to oversee the facilities.

Chart 6: Operations and Maintenance, Building and Water Supply



None of the bridge, road or drainage infrastructure that the TE teams visited have been the subject of any major maintenance activities and EOM, if they exist, are not active and no village household user fees are being collected.

Recommendation 4: Some water supply sub-project GMF seem to experience difficulties in the first years after completion of a new system. PNDS, together with the sector ministry, should extend socialization and technical activities to villages for several years following completion of a new system. An occasional visit from an engineer to inspect the ongoing performance of a new system is educational for both the village GMF and PNDS.

7.10 As-Built Drawings and Completion Reports

The POM states in Project Cycle Step 11 that the PNDS APTF and the EIP are to "ensure 'as-builts' (engineering designs adjusted to show any agreed deviations from the original design…) are provided to KPA and explained to the EOM".

The TE teams were not provided with copies of any Completion Reports or as-builts for the sub-projects that we visited. Most of the sub-projects evaluated during this mission featured changes to the original design, most often different dimensions. Many of the alterations, however, involved deletion of some component in favour of the installation of another. Maintaining records of these changes is important from several viewpoints. Certainly the financial implications of a change must be accounted, certified and accepted by the community and its KPA. As-built drawing records of changes are also important from a planning perspective. Accurate as-builts filed with the Sub-district will allow future sub-project planners and designers to learn from recent experiences and improve future designs.

An example of this is the water supply system installed during the Pilot Phase, in Railaco Leten, Emera District. The design for this system included two small catchment dams on the side of a hill above the village, gathering small flows from groundwater springs. The Community Project Proposal contained a hand-drawn plan depicting a coconut fiber/sand/gravel filter installed at each of the two catchment dams. The inlet pipe was to be wrapped in coconut fiber, covered with a layer of filtration sand, and finally topped with a layer of gravel to keep the material in place. Groundwater was to seep through and be cleansed by this filter before entering a pipe and being conveyed to the system reservoirs and distribution network.

The filtration system plugged up within two weeks of installation, we understand, and was removed before the Final Accountability Meeting. The intake pipe is presently open to the environment with no protection. It is evident that much water-borne forest debris is swept into the system reservoirs and distribution network. The situation is exacerbated by the EOM group being unable to remove the cap of the collection reservoir cleanout, lacking the necessary large diameter pipe wrench. It is unknown if records of this design failure were transmitted to the Sub-district. Future designers can benefit from learning of such field problems.

Recommendation 5: The as-built created as part of Program Cycle Step 11 should be included in the Completion Report and kept on file in the village and the District.

7.11 Frequency of Technical Facilitation and Supervision

The frequency of technical facilitation and supervision visits to sub-project sites was examined to see whether there are any apparent trends that can be noted. In order to do this, it is important to understand the background and circumstances of the technical facilitation program of PNDS.

The Pilot Phase of the project used the services of consultants hired from the private sector. These individuals received three weeks of induction to introduce them to the PNDS project cycle and procedures as outlined in the Program Operations Manual (POM). The consultants were based in the Sub-Districts and travelled from there to the project sites. During this phase, there were 6 Administrative Post Technical Facilitators and 6 District Engineers.

Administrative Post Social and Technical Facilitators were hired by the project in 2013. Approximately 200 of the technical recruits were given 8 months training at the Tibar Training Center (CNEFP) in basic construction skills, including design procedures, bill of quantities calculations, site supervision and field practices for the following sub-project types: simple buildings, water supply, small bridge/culvert, drainage, road, sanitation, irrigation and installation of solar panels.

In Phase 1, the project retained 121 of these personnel as Administrative Post Technical Facilitators (APTF), along with 14 as District Municipal Engineers. A further 12 engineers were retained from amongst the consultants of the Pilot Phase of the project. Therefore, technical personnel in 13 Districts and 149 villages comprised:

Administrative Post Technical Facilitator: 121 personnel
Municipal Engineer: 26 personnel

The expansion of Phase 2 was undertaken using technical facilitators from some Phase 1 Districts, moving APTF to the new Administrative Posts and returning to some Pilot Phase Administrative Posts. The project expanded to 240 villages in this phase. The number of technical personnel within the project did not increase.

Phase 3 is being undertaken in a similar manner: Phase 2 APTF will move into new Phase 3 Administrative Posts and return to Pilot Phase Administrative Posts. This phase will see the PNDS operating in all 442 villages of Timor-Leste. The number of technical personnel will remain the same. Following is a table showing the average number of technical staff per village during each PNDS phase to this point.

Table 10: Technical Staffing Ratio

	Pilot Phase	Phase 1	Phase 2	Phase 3
Number of Villages	30	149	240	442
Number of Technical Facilitators	6	121	121	121
Staffing Ratio (Village/Staff)	5	1.23	1.98	3.65

PNDS technical facilitators and District Engineers visit sub-project sites during the planning and construction period to provide technical assistance to village building committees, to inspect the ongoing works, to provide advice and to monitor progress. The POM states that these visits should be "regular" and, in Program Cycle Step 9, indicates that "PNDS Sub-District [Administrative Post] Facilitators [should] conduct supervision visits in each [village] at least once per month, though usually once per fortnight. "

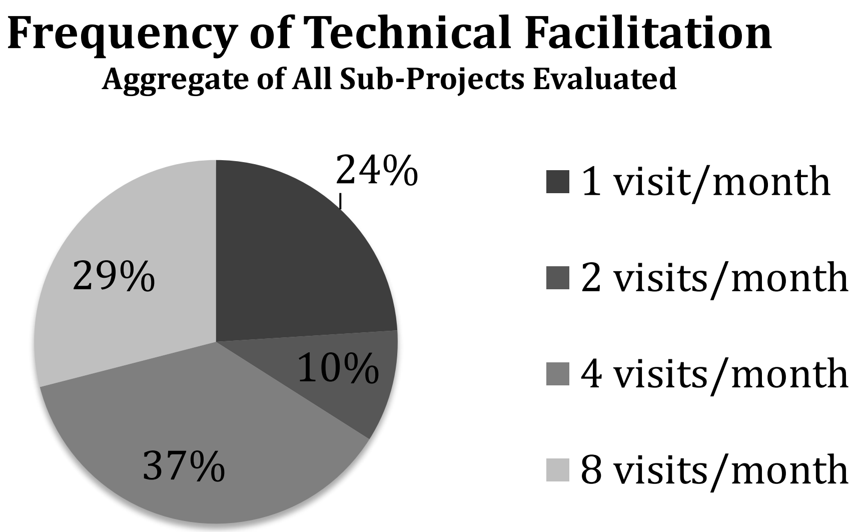
The technical evaluation questioned members of the sub-project building committee at each site regarding the frequency of PNDS technical facilitation visits, making note on the sub-project TIC and then transferring the data into the SIDIF. All frequency results were found to lie within the following choices:

- 8 times/month (twice a week)
- 4 times/month (once a week)
- 2 times/month (once every two weeks)
- 1 time/month

The frequency of technical facilitation recorded at sub-project sites has been analyzed. For all sub-projects evaluated the aggregated results indicate that:

Most sub-projects (66%) are being visited by technical facilitators at a frequency of once/week or greater.

Chart 7: Frequency of Technical Facilitation, All Sub-projects



The frequency of technical facilitation visits was obtained through speaking with members of the village sub-project implementation committee. This data was analyzed in regards to the Phase in which the sub-projects had taken place. This produced the following table:

Table 11: Technical Facilitation Frequency by Phase

	8 times/month	4 times/month	2 times/month	1 time/month
Pilot Phase	15%	46%	8%	31%
Phase 1	32%	18%	18%	32%
Phase 2	38%	56%	0%	6%

This data indicates that the frequency of technical facilitation has increased from Phase 1 to Phase 2. The Pilot Phase results may be incorrect or an aberration based on faulty memories of events in the past. The Phase 2 results are reporting on more immediate experiences and are perhaps more reliable. Referencing the average number of villages per technical staff member in Table 8, we see that the ratio has increased from Phases 1 to 2, from 1.23 village/staff to 1.98 (or greater, since some staff moved to work in Phase 3 locations). If the frequencies noted by this evaluation's data are correct, then PNDS staff must be either moving more efficiently between sub-project sites or spending less time at each site (the latter might affect sub-project quality).

This frequency data was analyzed with respect to the technical quality of sub-projects. A logical theory might be that those sub-projects receiving more frequent visits from technical facilitators might experience heightened levels of quality in aspects of their construction. Comparing the results from the table above, however, with Section 7.3, Table 6, Aggregate of "Meets Spec." Components for Sub-project Types by Phase, it is noted that overall technical quality went slightly down from Phase 1 to Phase 2 (85% Meets Spec. to 81%) while technical facilitation went up in the 4 times/month or greater category, from 50% to 94%. These results could be closely examined for other factors that may affect the results, for example, the remoteness of sub-project sites or how long facilitators actually spend at sub-project sites.

Recommendation 6: The average frequency of technical facilitation should be maintained or increased if possible. This might be achieved by careful scheduling of monitoring visits – working smarter, not harder. Particular attention should be made to those sites that are early in the reinforced concrete phase, to ensure correct methodologies are being used from the start. Monthly work plans should make note of these sub-project sites and monitored by senior technical staff.

7.12 Construction Budgets

Sub-project construction budgets were gathered at each of the evaluation sites from two sources: the Community Project Proposal (CPP) documents and from the sub-project sign board where it still existed (signboards were still intact at 30 of 53 sites). The two figures were compared.

Twenty-seven (27) signboards displayed identical figures (or within $10) with the CPP. One signboard differed by being $50 lower than the budget calculated in the CPP.

Two sub-projects signboards differed substantially from the CPP, both quoting higher budgets than as calculated within the paper documentation. Both of these sub-projects are for water supply in Emera (Fatu Besi, CPP $19,750/signboard $20,900 and Railaco Leten $5,679/$8,057). The reasons for these discrepancies are unclear.

No further analysis of this budgetary information has been done at this time. Additional information regarding the size and complexity of the sub-projects would need to be recorded for outliers to be identified within the sample, as well as an understanding of the annual price surveys that take place within each District.

7.13 Social Issues and Gender Bias

The technical evaluation team would have been complemented by a representative from the Social Sector accompanying the field team to visit sub-projects. It has been observed elsewhere, in technical evaluations of other similar CDD projects, that having the social component of the sub-project subtly examined at the same time as the technical side can oftentimes reveal interesting and valuable insights. We have found that the primary focus of the visit is generally perceived in the village to be the technical audit. Engineers inspecting the ongoing or completed works draw much attention from the local hierarchy. Social sector evaluators can often circulate throughout the gathering, speaking with sub-project representatives but also spending some quality time with other residents and onlookers. Village women, children and elders who might not otherwise be presented by village committees can be questioned regarding aspects of the sub-project implementation.

Two villages displayed apparent gender bias during sub-project implementation. One instance was recorded at a community center in Malilat, Bobonaro District where a small group of women complained to the technical evaluator that they and other women in the village had been excluded from participation in construction activities. The aldeia chief had apparently indicated to them that their unskilled services were not wanted at the site. The women told us that they found this objectionable since, in their opinion, there were equally unskilled men being employed at the construction site. Besides, some of them pointed out, it was only excavation and concrete mixing that they had petitioned to undertake. We asked the aldeia chief the reason for this exclusion of women from the work parties and received a non-committal reply. It was pointed out to the aldeia chief that PNDS requirements stipulate that both genders should be involved in all sub-project phases. The chief indicated that the construction foreman at the time had been of the opinion that the women were not strong enough for the tasks at hand.

The second instance of gender bias occurred in regards to an MCK sub-project in Caibada, Baucau District that was examined by the TE team. The MCK has been located in a 'men-only' area of the village, where men usually take a bath and do washing activities. Therefore, women are not comfortable in using this facility, because the men will get angry if the women are entering and using the facility in their area. The MCK has been locked, with the reason being that it has not been handed-over yet and has to wait until the Final Accountability Meeting for all 3 sub-projects in this village is held.

In regards to this issue within this village, we understand there was a tendency for the women to be excluded from the planning process including when the community was choosing the location. Even though women attended the meeting, their voices were ignored.

Recommendation 7: PNDS technical staff should remain vigilant regarding circumstances involving unfair gender practices during sub-project implementation activities. Technical staff may wish to alert PNDS social staff to look further into questionable practices, while also making suggestions to village implementation committees about the inclusion of one or more women on each work team to undertake lighter tasks as available.

7.14 Universal Accessibility

The POM was searched for references to 'accessibility' with one citation found, in Step 8 of the Program Cycle: "The Detailed Engineering Design is finalized and verified by the PNDS District Engineer, in consultation with relevant EVAS colleagues, to ensure technical feasibility, accessibility and environmental safeguards are adhered to." Further in this step it is noted that "the PNDS District Coordinator verifies compliance with social safeguards, including gender equality, disability access…"

Fully 66% of sub-project buildings evaluated did not feature proper ramps for handicapped and disabled citizens.

Many of the ramps that were installed are too steep to be easily used by the handicapped. Plans and specifications in Community Project Proposals frequently did not feature handicap ramps and those that did show such accessibility features often did not see them installed.

One community center, though, in Estado, Emera District was the reverse of this situation. The plans showed no ramp: there were two tall flights of concrete steps depicted on both sides of the central open area of the bright and airy building. The TE team member noticed, however, a ramp on the rear of the building, constructed with an eye toward lessening the grade by lengthening it up against the side of the structure. The ramp was pointed out to the head of the building committee, and he was asked if the ramp had been added to the plans to accommodate someone living in the village. "No," he replied, "We thought that someone in the future might be confined to a wheelchair and we'd need a ramp then, for sure!" Questioned further, it was noted that, indeed, there is a handicapped individual living in the village, but that with help this person manages to climb the front steps of the center. This is a village that is thinking ahead to its future needs.

Recommendation 8: Ramps for the disabled are an important feature to guarantee Universal Accessibility. Ramps should not be constructed steeper than 16% (wheelchair accessible with helper) and with a rough/non-slip surface. The ramp should be equipped with a proper handrail.

8 Key Issues – Common Design/Construction Problems Noted

Section 7 of this report deals with technical evaluation of the sample sub-projects in relation to the plans and specifications as set out in the approved Community Project Proposals. There were, however, deficiencies noted at the infrastructure sites pertaining to both the plans and specifications and the construction methodologies being used. A careful itemizing of these deficiencies at each site and the development of a summary in this report will be useful as PNDS is finalizing its Technical Construction Standards and presenting these materials to its technical staff.

The SIDIF data input spreadsheet provided a listing of Key Issues unique to each sub-project type, as described above in Section 6.2. There is some commonality amongst the sub-project types in these Key Issues. For example, all sub-projects were noted to be lacking in aspects of design, along with problems in regards to steel reinforcement and concrete practices. An overview of the observed design/ construction problems and issues for these two Key Issue areas will be discussed below and recommendations offered for each as appropriate.

8.1 Design

The following table contains a summary of the main design problems that were noted in Community Project Proposals. The percentage reflects the number of sub-projects that were deemed to be insufficient in these regards.

Table 12: Key Issues – Design (all Sub-project Types unless noted otherwise)

Design Issues	
Lack of construction details on drawings	79%
Inaccurate drawings of connection details (Building and Bridge)	45%
Improper steel reinforcement design (Bldg, Bridge and Water Supply)	42%
Constructed dimensions differ from plan	30%
No elevations on plan (Water Supply)	87%
Drainage design and considerations (Road, Drainage, Retaining Wall)	60%

The drawings and plans contained in the Community Project Proposals were, in many cases, poorly executed and lacking sufficient detail to provide certainty to the construction process. There was great variety within the drawings from District to District and, indeed, within Districts. It was apparent that few if any national design or construction standards were being used by the sub-project design teams. Occasional high-quality AutoCAD drawings for a sub-project in one village center would be juxtaposed with hand-drawn sketches in the documentation for the next hamlet.

We understand that the Technical Construction Standards are presently in draft form. Consultations with sector Ministries has been taking place in the development of these documents, and their issuance is anticipated to be in late 2015 after approval by the Inter-Ministerial Working Group.

Recommendation 9: All reasonable efforts to hasten the issuance of the Technical Construction Standards (TCS), including the design and technical specifications, should be made.

Recommendation 10: Draft versions of the TCS should be circulated to Districts so that Phase 3 sub-project design work can be checked against the proposed new standards.

Recommendation 11: Certain types of sub-project require specialized technical skills, knowledge and experience that all designers or District Engineers will not possess. PNDS should identify those individuals in their engineering group whose aptitude or interest is with these special sectors: water supply; major road repair/drainage; and irrigation. Sub-project designs within these sectors should be checked and signed-off by these specialists. Spot-checking inspections during construction by these specialists should also be done on a random basis. If necessary, PNDS should invest to train their engineers in the specific skills of the above sectors.

Recommendation 12: Liaison with the sector Ministries and their field personnel should be encouraged, particularly during the design step of the Program Cycle. Sector agencies will be able identify those areas where their efforts can help or build upon those of PNDS. Instances of PNDS and the sector Ministry working at cross-purposes will be eliminated if regular update and liaison meetings take place, not only at National level but especially in each District, with proper communications by both groups to keep the National level informed.

8.2 Steel Reinforcement and Concrete

The fabrication, bending, tying and placement of steel reinforcement within concrete forms is found in elements of all four sub-project types inspected during this technical evaluation. Most of the infrastructure examined during the field visits had been completed, with the result that few inspections of the quality of steel reinforcement placement or concrete practices could be performed. One site in Emera and several sites in Baucau, however, were still in construction, allowing the evaluators a glimpse into construction practices which, elsewhere, were complete and covered by plaster.

These few sites gave an indication that poor steel reinforcement methodologies are being used at the majority of PNDS construction sites. The following table shows the results of technical inspections in regards to the items noted. The percentage reflects the number of sub-projects that were deemed to be insufficient in these regards.

Table 13: Key Issues – Steel Reinforcement and Concrete (all Sub-project Types unless noted otherwise.)

	Steel Reinforcement and Concrete Issues	
1	Missing/short development length in reinforcing (Building and Road)	100%
2	Missing anchors, foundation to ground beam/column to wall (Building)	100%
3	Improperly bent reinforcing cage tie bars (Building)	100%
4	Exposed/shallow reinforcing steel (Building and Road)	56%
5	Honeycombing in concrete	56%
6	Poorly mixed concrete (Building, Water Supply and Road)	29%
7	Undersized concrete column/beam (Building)	75%

Note: Items 1 to 6 reflect only sub-projects still in various stages of early construction (1 Road and 7 Building sites). Item 7 includes buildings that are complete with beam or column concrete visible.

Discussion of the items within this table is best done in an itemized manner:

Item 1: The installation of proper development length for steel reinforcement at connections between foundation, columns and beams in a structure is of fundamental importance to a building's ability to withstand seismic events. Steel bars must overlap one another a length equal to 40D (40 * Diameter, for example, if the diameter of steel bar is 10 mm, then the overlapped connection should be 400 mm in length) to avoid the bars being pulled out of the concrete.

Item 1 represents a community center and a road culvert that we witnessed being constructed. The steel reinforcement was not overlapping adequately from columns to beams in the building and from the culvert's sidewalls to its roof (nor was the bar correctly installed in other aspects of the design). No other physical examples of inadequate development length were observed during our fieldwork (we'd need to see reinforcement standing in formwork awaiting a concrete pour), but suspicions are high that such poor practices are common (this is based upon our recent experiences with the Australia-Indonesia Education Partnership school building program where poor practices such as this were the norm in rural areas across Indonesia).

Recommendation 13: APTF should be reminded of the importance of ensuring proper development length of 40D in steel connections (40 * Diameter, for example, if the diameter of steel bar is 10 mm, then the overlapped connection should be 400 mm in length). District engineers should prioritize their own inspection tours to coincide with this phase of construction at building, bridge, culvert and concrete reservoir sites. Training materials should be reviewed to ensure this topic is adequately covered. Skilled labourers should attend short training courses that focus of proper reinforced concrete methodologies.

Item 2: Proper anchors are not shown on any drawings that were inspected by the TE team. Anchors from the foundation to the ground beam (sloof) are required to keep the entire building from slipping off its foundations during an earthquake. Anchors from column to brick or block walls are also required for stability of these walls during seismic events.

Recommendation 14: Standard drawings for buildings should be amended to include proper anchors from foundation to ground beam and from columns to wall sections.

<u>Item 3</u>: Several buildings that were still in construction in Baucau uniformly showed that poor attention has been given to training labourers in proper reinforcing steel cage fabrication. Tie bars are used to form a cage of the vertical column and horizontal beam steel. The tie bars hold the steel a proper distance apart and are secured with wire at each intersection. The ends of tie bars must be bent into the center of the cage in order that the concrete effectively holds them. Tie bars that are not bent in this fashion will tend to spring out in a seismic event, causing the outer surface of the column's concrete and plaster to shatter and spray fragments. Total failure of the columns and beams may follow from very large earthquakes.

Recommendation 15: APTF should be reminded of the importance of ensuring that proper reinforcement cage fabrication (stirrup/*beigel*) practices are followed. The ends of the stirrup should be bent into the center of the column/beam to ensure that the steel is adequately held by concrete. Training modules should be reviewed to ensure this topic is adequately covered.

<u>Item 4</u>: The preparation of concrete formwork and layout of reinforcing steel within those forms is frequently done in an improper manner. Most Phase 2 sub-project sites that were visited in the latter stages of construction exhibited indications of improperly installed reinforcement. Completed columns and beams showed steel at their surface (lacking proper cover of 2 – 3 centimeters), indicating that labourers had not placed spacer blocks between the steel and the formwork before pouring concrete. This steel, even if covered in plaster, will corrode and cause spalling of the plaster and concrete.

Recommendation 16: APTF should be reminded of the importance of ensuring that proper reinforcing steel placement within formwork be maintained. The use of concrete spacers is strongly recommended within all reinforced concrete formwork. Skilled labourers who are expected to direct this work should be provided with training. Training modules should be reviewed to ensure this topic is adequately covered.

<u>Item 5</u>: Honeycombed concrete was observed at many sub-project sites that had not yet been completed. Honeycombing is often covered by plaster, so its presence at other sites is considered likely, based on the percentage observed in latter-stage Phase 2 sub-projects. Honeycombing is a result of poor concrete mixing and/or inadequate vibration. It is noted that columns are frequently riddled with honeycombs. Labourers attempt to pour overly lengthy sections, fail to rod the

concrete sufficiently, or experience leaky formwork where poor quality concrete slurries escape.

Item 6: Most concrete is mixed by hand for PNDS sub-projects. Since most of the sub-projects evaluated had been completed it was impossible to assess the quality of concrete used. Several sites in Baucau were in latter stages of construction, however, and observations there showed evidence of poorly mixed concrete (one culvert and four community centers). Two water reservoirs in Ermera shows signs of efflorescence along cold joints, an indication of improperly mixed concrete and poor vibration.

Recommendation 17: APTF should be reminded of the importance of ensuring that proper concrete mixing, concrete placement and concrete vibration practices are followed at construction sites. Skilled labourers who are expected to direct this work should be provided with training. Training modules should be reviewed to ensure this topic is adequately covered.

Item 7: It was difficult to check the size of concrete beams and columns in completed sub-projects due to the application of plaster. At those sites in latter stages of construction, however, measurements showed that most columns and beams are undersized. Labourers will frequently regard the plan dimension as the final product, i.e. concrete plus two layers of plaster. This results in undersized concrete columns and beams with reinforcing steel at the surface – the result when the inner reinforcing cage has been fabricated for the final (plastered) dimension.

Recommendation 18: The proposed Standard Drawings for construction of concrete buildings should be reviewed to ensure clarity that the outside dimensions of columns and beams does not include the thickness of plaster.

8.3 Other Key Issues

A full summary of other Key Issues identified during this technical evaluation are identified and discussed in Annex 6. Recommendations as appropriate are offered there, copied also in Annex 1.

9 Conclusions and Recommended Follow-Up Actions

This Final Report of the 2015 Technical Evaluation of Infrastructure for the National Program of Village Development has found that the completion of sub-project works in the Districts evaluated to be largely in conformance with the Community Project Proposals and the specifications as set out by PNDS for the community-built infrastructure. Having noted this, however, the lack of adequate details within the plans and insufficient training programs and engineering resources for technical facilitators, skilled labour and others within the program has led to some systemic problems being observed within the completed and ongoing infrastructure works.

Problems and key construction issues were separately highlighted by the technical evaluation teams, with approximate percentages of sub-projects so affected being calculated and presented in this report. These findings can be used to check and make final improvements to the PNDS Technical Construction Standards, which will be issued shortly.

In addition to this, separate ratings were made of the maintenance, functionality, utilization, quality, environmental safeguards and the appropriateness of the design of the sub-projects evaluated. A study of these aggregated ratings also shows that the program is largely meeting its goals. Recommendations for improvements to the program within each of these parameters have also been offered in this report.

The amount of data that was gathered during this technical evaluation is large and this report with its analysis has examined only a fraction of the possible comparisons that might be made. Studies and investigations looking for trends in the data can be done comparing the different parameters with one another. Functionality and Utilization, for example, can be examined with respect to the Remoteness of sub-projects or the degree of Facilitation. Community Involvement can be compared to sub-project type (or Sector) to see if communities are more or less involved with different types of infrastructure.

Some of the results of this technical evaluation have been uncertain and possibly inconclusive. This may have been as a result of the small sample size. A future technical audit should seek a larger sampling of sub-projects, with representative numbers in all Sectors. Special studies that restrict their sampling to road, drainage, irrigation or electricity would also be valuable. If such studies were undertaken soon, correlations with the technical evaluations could be rapidly drawn.