

The Nepal Village Health Improvement Program

Report on Sanitation Studio and Earthquake Reconstruction February 2016

Bhattedande, Jalapadevi & Thangpal Dhap, NEPAL





In honor of Paul Pholeros, whose guidance has ensured the poor receive the very best solutions with the support of thoughtful, skilled students, trades and professionals.



Day 1 Briefing at Kathmandu Airport Hotel, all three teams briefed by Bishnu Shrestha

On the first day of the studio commencement, Paul Pholeros AM passed away (Feb 1st) in Sydney. It was agreed by participants at the initial briefing meeting in Kathmandu to continue the studios and reconstruction efforts in his honour. Paul's wife and Nepal Village Health Improvement Program (NVHIP) co-founder Dr Sandra Meihubers who was planning to run dental camps as part of the Teeth and Toilets (TT) program with Rotary Australia World Community Service (RAWCS) in tandem with the studio, postponed this part of the program.

The Sanitation Studio (SS) 2016 is the 4th consecutive studio held in Nepal. Over the duration of studio, students from Australian universities volunteered their time and skills to develop tools that could be left behind to with the local Nepali teams to help expand and improve the program outcomes. Healthabitat (HH) led the studios in partnership with University of Newcastle (UoN), International Association of Plumbing and Mechanical Officials (IAPMO), WorldSkills (WS) and local Nepali teams. The focus of each studio was to have students work in interdisciplinary teams, to produce tangible tools tried and tested on the ground in consultation with the community who would be benefiting from it. This year was the most ambitious of studios, running across three locations with each project at different stages of development.

This report was compiled with the collective effort of reports from Program manager Bishnu Shrestha; Catherine Forbes (architect); Swathi Saralaya (IAPMO); previous SS participants and architecture students Owen Kelly, Harry Catterns, Jasper Ludwig; Australian plumber and Community Plumbing participant Rob Mauracher and UoN student presentations.

Photography acknowledgments:

Bishnu Shrestha,
Catherine Forbes,
Swathi Saralaya,
Owen Kelly,
Harry Catterns.

SUMMARY

Outline of Program

Three teams across three locations in Nepal. The 10-day workshop included multiple design, construction and health activities summarized across the three sites as follows:

Project #1: Shree Thangpal Dhap Higher Secondary School

Removing waste safely: Toilet block design for school

Location: Melamchi valley, very remote, limited road access.

Previous works completed: None by HH. International NGO has designed and built a toilet block on school site post-earthquake.

Team:

Led by: John Roberts (UoN staff and Architect), Harry Catterns & Jasper Ludewig (Design tutors and previous SS participants)

Student participants: Morgan Petherbridge (UoN Construction Management student), Mia Bacigalupo (UoN Architecture student), Sophie Robinson (UoN Architecture student), Janai Lemar (UoN Architecture student), Mel Kensey (UoN Architecture student, previous SS participant)

Summary of activities:

- Site analysis and documentation
- Assessment of NGO built toilet block
- Briefings with school principal, committee and students
- Site and project planning
- Design and site set out in consultation with committee
- Design precedent: Jalapadevi Girls Toilet block (new construction) and boys toilet block (retrofit and extension) analyzing construction technique, quality control, material and skills availability.
- Final agreed design documented and approved by school principal.



Project #2: Shree Jalapadevi Secondary Higher School, Melamchi

Removing waste safely: Stage 2 Plumbing works

Location: Melamchi valley, remote, road access.

Previous works completed: Girls toilet block and waste management (septic) completed (SS2015). Boys toilet block retrofit, waste management and final teeth brushing station under construction during visit.

Team:

Led by: Swathi Saralaya (IAPMO, CPC), Bishnu Shrestha (BS NEP)

Participants: Adam Koenigs (Plumber WorldSkills USA), Rob Mauracher (Plumber WorldSkills AUS),

Local team: Lok Tamang, Dorje Tamang (plumbers).

Summary of activities:

Plumbing works to boys' toilet:

- 5 x toilets (staff and students)
- 1 x shower room
- Hand washing area (four tap points)
- Tooth brushing instruction area (four tap points)
- Wastewater treatment and disposal system (septic tank and soakage trenches)
- Septic tank capacity recalculated and some repair works (report that septic was dug out and deepened unconfirmed by plumber)

Plumbing works to girls' toilet block:

- Existing taps were replaced as springs were too powerful and difficult to operate by young children. High pressure from tap also resulted in excessive use of water



Project #3: Bhattadande Village, Kavre

Safety: Earthquake reconstruction

Location: Kathmandu Valley, rural with road access to top of village.

Previous works completed: 58 toilets and waste systems completed (20 biogas and 38 septic), immediate earthquake relief efforts including temporary kitchen shelters, personal health kits & funds to families for food.

Team:

Led by: Catherine Forbes (Architect), Owen Kelly (Design tutor and previous SS participant)

Student participants: Brendan Peacock (Construction Management UoN), John Brennan (Construction Management UoN), Anderson Camargo (Environmental Engineering UNSW)

Local team: Sima Chhetri (Architect working in Kathmandu), Prem Lama, Nepal Village construction team.

Summary of activities

Work done and tools developed during studio:

- Applied testing of HH developed:
 - » Construction manual
 - » Materials and cost calculator
 - » Earthquake simulation and band construction model
- Reworked Construction manual including lessons from traditional construction techniques that performed through earthquakes
- Illustrated construction management checklist
- Footings dug and first course laid to “prototype” house
- Original approved houses (two families) footings were incorrect and unable to be restored, therefore HH building contribution to those houses was withdrawn.





Future schedule of works:

Loss of leadership in program co-founders Paul Pholeros (HH) and Sandra Meihubers (TT, RAWCS) during this trip has resulted in a retrospective reporting by Heleana Genaus (HH) via the collation of individual reports, phone calls, meetings and presentations by most attendees and contributors.

A follow up visit by HHOS Program Manager David Donald and HH National Manager & HHOS Director Karin Richards in April 2016 to further investigate:

- The outcome of the works completed to date
- The current capacity of local teams to expand the work
- Develop recommendations for the continued scope of works
- Develop recommendations for the schedule of works.

Program Milestones:

- Inclusion of the Sanitation Studio as a formal elective subject within the University of Newcastle, granting students credit for their participation
- Extensive capacity of local teams across various sites in post-earthquake Nepal,
- Extensive use of interdisciplinary skills to the benefit of program advancement and health gain
- • Continuation of games and skills developed during the Community Plumbing Challenge (CPC) in Nashik, India November 2015
- In the unexpected loss of leadership, the Sanitation Studios were led by previous participants to the Studios and CPC to great success resulting in real, actionable outcomes, positive contributions on the ground with village groups and sound reports.

Acknowledgments:

Program supports:

University of Newcastle
 Rotary Australia World Community Service (RAWCS)
 International Association of Plumbing and Mechanical Officials (IAPMO)
 WorldSkills (WS)
 Partridge Structural (Harry Partridge, Engineer)
 Emergency Architects (Catherine Forbes)
 Healthabitat (HH) & Healthabitat O/S (HHOS)

Local Support:

Bhattedande village development committee
 Shree Jalapadevi Higher Secondary School
 Shree Thangpal Dhap Higher Secondary School



Project #1: REMOVING WASTE SAFELY – TOILET BLOCK DESIGN



Shree Thangpal Dhap Higher Secondary School, Melamchi Valley

The design studio was run by John Roberts (lecturer UoN) with Harry Catterns and Jasper Ludwig, who are previous student participants of a Sanitation Studio and work with HH .

Context:

Thangpal Dhap was heavily effected by the earthquakes in April 2015, the school site's seven buildings all experienced complete collapse or structural damage. Currently operating with temporary school buildings, the school educates approx. 300 students from a range of ages from 4 to 18yrs of age. Many students travel by foot for many hours to the school.

One of the building sites also acts as a hostel for students who travel far to complete their final semester/term of school.

The existing school toilet block and staff toilet blocks were destroyed in the earthquakes. Some aid had been completed by an international NGO after the 2015 earthquakes in the form of a toilet block with the following:

- Four Asian pan toilets provided (2 girls and 2 boys)
- Septic tank under building

Reports from the SS students of the existing sanitary facilities specify:

- Used by 300 students, 20 staff

- Also used by nearby village
- Septic tank installation was incorrect and failing (overflowing)
- Poor construction
- Makeshift shower and hand washing located in the middle of the play area accessed by tapping existing underground main water supply.

Water supply

- Local spring from mountain – direct source not discovered

Studio activities:

- Briefings from the school staff, management committee and students
- Site and project planning
- Site peg out of preliminary ideas and walk through
- Design development and presentation to school staff and students
- Waste removal and treatment system sizing and location
- Precedent study on construction and detail design from previous school site at Shree Jalapadevi Secondary Higher School
- Reusing design tools developed during 2015 SS
- Developing measurements of design success or failure.





Team welcomed by school staff



Existing toilet block and proposed site



Existing hand-washing



Existing basin



Existing toilet



Existing urinal



Team briefing by school staff with Bishnu Shrestha (right)



School briefing



Measure up



Women only: Female students briefing teams on privacy, feminine hygiene and design



Measure up



Teachers consider the peg out for new toilet sites.



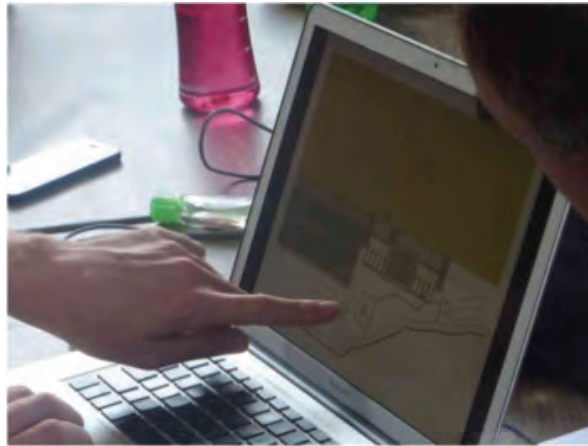
Final design session: plumbers, architecture and construction management students collaborating on the final proposal.



Consultation with students on design.



Final presentations by students and Bishnu Shrestha to the school teachers and management.



Bishnu Shrestha presents students work to the school teachers and management.

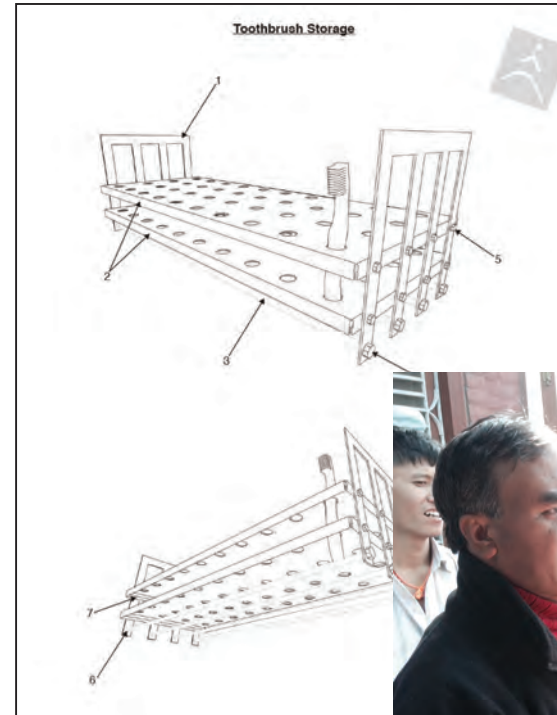
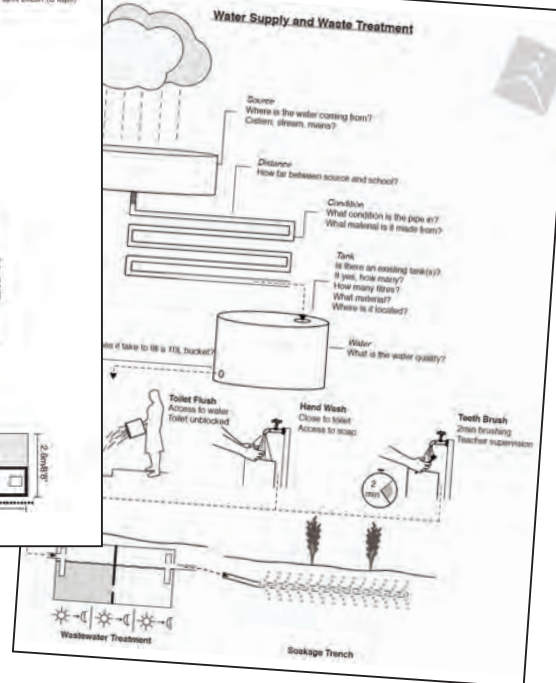
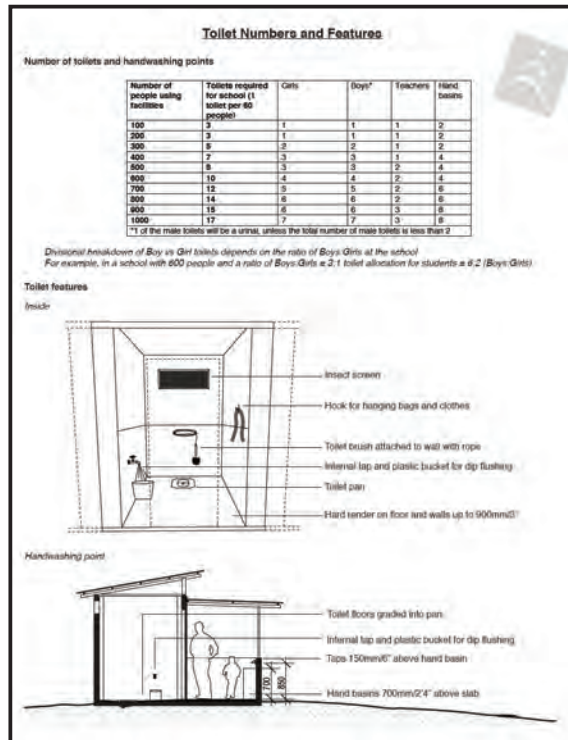


PRECEDENT - TOOLS USED FROM 2015 SS

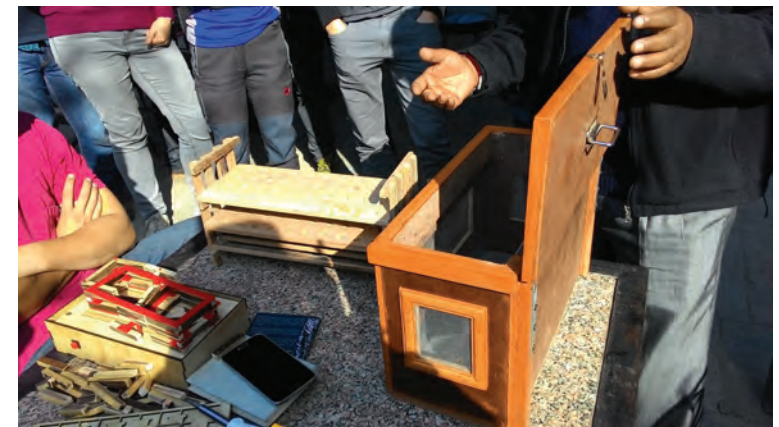
Key design elements borrowed from Jalapadevi school precedent:

Design and construction manual developed for sizing the full system for toilet blocks in schools was applied to the design of the toilet blocks. The outcome resulted:

- The school requested 10 toilets in total, the numbers require for the population totaled in 6 toilets. The design team and school staff agreed to compromise on 8 in total. 4 girls and 4 boys shared amongst teachers and staff.



Teeth brushing storage designed for Jalapadevi now built and in use.





Side view of boys toilet block

Viewed from end of school building. Image shows hard render waterproofing, hand washing bay, four toilet cubicles, view of end wall to girls toilet block beyond.



View of front of toilets from school yard.

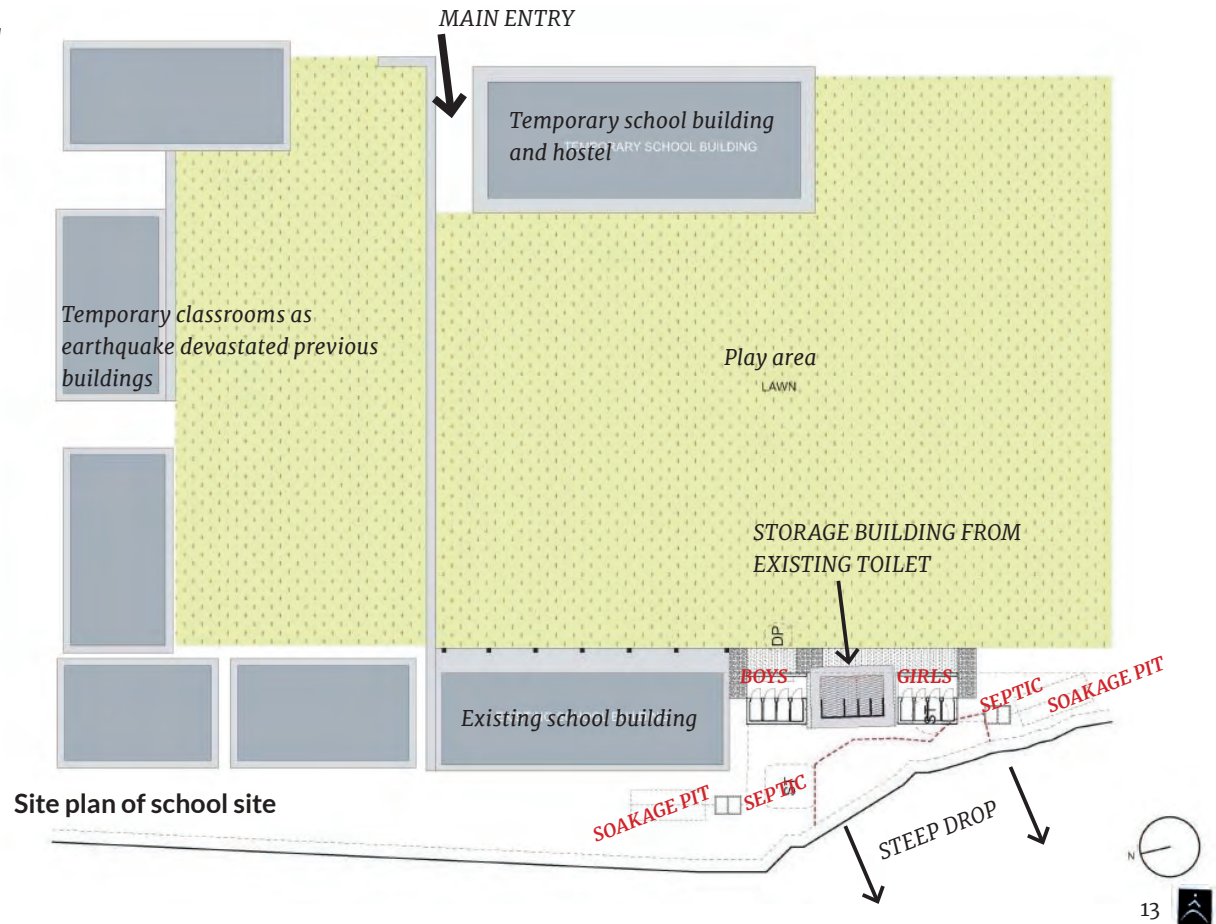
From left:

- Girls toilet block designed to have more privacy with end wall (facing existing toilet block in the middle),
- Existing toilet block converted to storage use with septic tank underground filled out to be made redundant
- Boys toilet block.
- Existing school building

PROPOSED DESIGNS

Key design elements borrowed from Jalapadevi school precedent:

- Double brick construction
- Hard set render for waterproofing and washing down floors and walls
- Shared hand washing bay of rendered masonry
- Steel framed roof structure with iron sheet roofing
- Insect mesh to openings in roof
- Natural light through translucent/transparent roof sheets
- All materials, skill and labour specified is locally available
- Tap for dip flushing and floor cleaning to each toilet
- Asian pan and outward swinging doors to each toilet
- New stone path area in front of toilet blocks and thresholds for reducing mud being carried in on shoes and into blocks
- Septic tank and soakage trench located away from school play areas and designed with plumber onsite.



Site plan of school site

Project #2: REMOVING WASTE SAFELY – STAGE 2 PLUMBING WORKS

Shree Jalapadevi Secondary Higher School, Melamchi

Jalapadevi is the first school HH has worked with to provide a full sanitation program prior to working with the main village nearby. The aim was to:

- Provide improved sanitation facilities to the 400+ students and staff who access the school daily,
- Introduce a teeth brushing program as part of the school education

During the 2014 SS, UoN, USyd and Griffith University students together with IAPMO managers Swathi Saralaya and Grant Stewart worked with the school staff to design facilities and planning tools that could be transferred to other school sites. The final design outcome included:

- A new Girls toilet block with 5 toilets and hand washing basin;
- Retrofit of existing toilet block to a Boys toilet with four pans, a new urinal and two staff toilets (one later changed to a shower room);
- Separate teeth brushing bay managed by staff
- Infrastructure works included sourcing water supply,
- Removing waste works included septic tanks and soakage trenches sizes to each block.
- Design of a toothbrush storage box for the school

After the April Earthquakes, the school and Melamchi region were closer to the epicentre and therefore experienced complete devastation. HH agreed to continue with the sanitation program. Construction commenced to the Girls block after the wet season (Sept 2015) and completed by Dec 2015.



Retrofit of the boys block was underway during this trip. A team of two local plumbers and two international WS plumbers was led by Bishnu and Swathi.

Stage 2 activities:

Plumbing works started in the boy's toilet area with the combined efforts of Adam Koenings (WS USA), Rob Mauracher (WS AUS), Swathi Saralaya (IAPMO) – all part of Community Plumbing Challenge, Nashik 2015 and local plumbers Lok Tamang and Dorje Tamang.

Works included:

- All plumbing works to the boys toilet building including taps, supply, drainage and soak trench installation.
- Brickwork to the septic tank chambers had been installed and some improvements were made to the septic prior to render finishing.
- Hand washing cricket – Game developed during the 2015 CPC in Nashik India was played again to educate on hand washing





Team welcomed by school students and staff



Team working on rainwater drainage trench behind toilet block



Boys toilet block and septic tank under construction (right) and village beyond



Sifting gravel



Excavation work for septic and soakage trench



Local plumber Lok working on shower



School principle (right) and local plumber Lok (left) setting out soakage trench off septic tank



Teams working together with local trades to install drainage



Toilet pan set out



Soakage trench pipe work



Teeth brushing area plumbing work



School students help sort gravel



Boys toilet block under construction





Taps and drain installed to hand-washing sink



Structure for sink trough built around plumbing



Taps and drain installed to toothbrushing sink



Water meter installed to toothbrushing sink



Water supply: Gravity fed from top of school to toilets.



Ground preparation for drainage from toothbrushing sink



Dirty hands: student grab pencils out of buckets of dirt



Dirty hands: UV light reveals germs and dirt on hands



Thorough hand-washing demonstrated to school



Clean hands

Hand-wash cricket!

Students learn about the importance of hand-washing through a game of cricket developed by participants of the CPC in Nashik India 2015.



Project #3: SAFETY – EARTHQUAKE RECONSTRUCTION

Bhattadande Village, Kavre

HH has worked with Bhattadande village since 2007 to build individual toilets with either biogas or septic waste water systems for families. A team of local trades and labour within Bhattadande have continued to work on other projects in nearby villages.

After the earthquakes, HH and RAWCS combined efforts and funding to supply immediate relief for food, personal household kits and temporary communal kitchen shelters, followed by a commitment to help rebuild their homes to improve safety during future earthquakes.

The seismic model was developed in accordance with the Nepal National Building Code and in consultations with Harry Partridge (engineer), Catherine Forbes (architect) and Paul Pholeros (architect). The model developed was to rebuild using the stone stock piled by the village from their own collapsed houses with local construction techniques with the inclusion of seismic intervention banding. The seismic intervention was intended to be hidden/within finished building and to use local materials and skills.

HH offered to fund the seismic interventions to any family willing to rebuild with this model. A series of communication models were created to help illustrate the method which included:

- Exploded 3D render of the parts
- Physical model that simulates earthquake ground movement and the difference between rebuilding with and without seismic reinforcement
- Materials and cost calculator for use the field to generate agreements with village home owners

Two families agreed to have their houses rebuilt using HH developed seismic reinforcement model, their sites and houses drawn up, entered into the calculator and signed prior to works commencing. The SS team were to test the communication techniques listed above onsite, develop a project management checklist and work with local team to commence building on the first two houses.

Studio Activities:

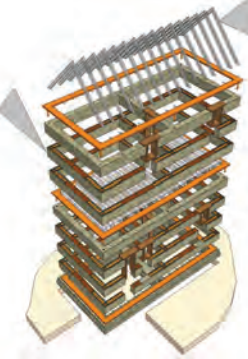
- Applied testing of HH developed:
 - » Construction manual
 - » Materials and cost calculator
 - » Earthquake simulation and band construction model
- Reworked Construction manual including lessons from traditional construction techniques that performed through earthquakes
- Illustrated construction management checklist
- Footings dug and first course laid to “prototype” house



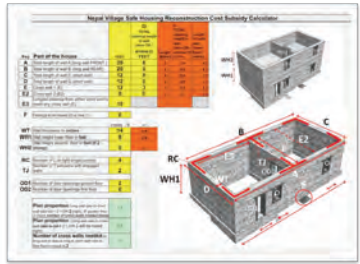
HH TOOLS TESTED

The Nepal Village Health Improvement Program

Construction Manual
for strengthening village houses



Construction Manual Edition 3 27/10/15



2' (60mm) foundation

2' 6" (750mm)

2' (60mm)

Make 1" (25mm) concrete lumps every 1' (300 mm) to top of band to lock next course of stone to band.

PARTRIDGE

CONSTRUCTION MANUAL
excerpts

Nepal Village Housing Reconstruction Cost Subsidy Calculator

Family Name: **Bahin 54** family

Key	Part of the house	FEET	O	Q	Length of wall in feet	Length of wall in metres
A	Total length of wall A (long wall FRONT)	35	9	31	2.7	7.8
B	Total length of wall B (long wall REAR)	35	0	31	8.8	16.7
C	Total length of wall C (short wall)	18	4	5	1.2	4.3
D	Total length of wall D (short wall)	18	1	5	0.3	0.8
E	Cross wall 1 (E)	18	3	5	9.9	29.8
E2	Cross wall 2 (E2)	18	3	5	0.914	4.4
E3	Longest distance from either short wall to meet any cross wall (E)	15		5		
F	Footings to be reused (F) or new (F)	1				
WT	Wall thickness in inches	16	8.4			
WH1	Wall height lower floor in feet	8	3.4			
WH2	Wall height second floor in feet (if 2 storey)	0	0.0			
RC	Number of L or right angle corners	4				
TJ	Number of T junctions with engaged walls	4				
OD1	Number of door openings ground floor	2				
OD2	Number of door openings first floor	0				

Plan proportion Long wall side to short wall side not > 2:1 OR 2 right. If greater than 2 (once number of cross walls needed below)

Plan proportion Long wall side to cross wall side is not > 2:1 (OR 2 will be noted right)

Number of cross walls needed on long wall to reduce long to short wall ratio to less than or equal to 2

Bar and wire placed every 2' (600mm) up the wall

Every 800 courses 10mm deformed bar and 3.8mm wire ties	Number of corners	Number of 2700 long U bars per corner	Number of 2700 U shaped bar ties per corner	Number of bars total	Bar length (m)	Per Course
Right angle corner bar reinforcement	4	4	4	12	2.7	32.4
T junction corner bar reinforcement	4	4	4	12	2.7	32.4
Wire tie every 800 courses						32.4
Number of 800 courses lower floor to be reinforced (BAR)						32.4
Number of 800 courses lower floor to be reinforced (WIRE)						32.4
Number of 800 courses upper floor to be reinforced (BAR)						32.4
Number of 800 courses upper floor to be reinforced (WIRE)						32.4

Reinforcing (BAR) 241
Reinforcing (WIRE) 157

Cost Calculator
excerpt

Before and after "quake": screenshots from video

Unreinforced

Reinforced

Battery powered

Pieces stored in template

EARTHQUAKE SIMULATION MODEL

Before and after "quake": screenshots from video

Unreinforced

Reinforced

Battery powered

Pieces stored in template

EARTHQUAKE SIMULATION MODEL



Seismic band formwork and reinforcement steel assembled onsite with local team to test construction method



Local team set up an onsite jig for bending steel used for reinforcement in the seismic bands



Measuring and siting existing footings.



Undertaking pencil test to determine stability of foundations



Testing clay content of soil for use in mortar



Sima explaining construction as Owen demonstrates model to Ram and stone masons



Assembling the model onsite



Sima explaining construction to masons using drawings prepared for construction manual

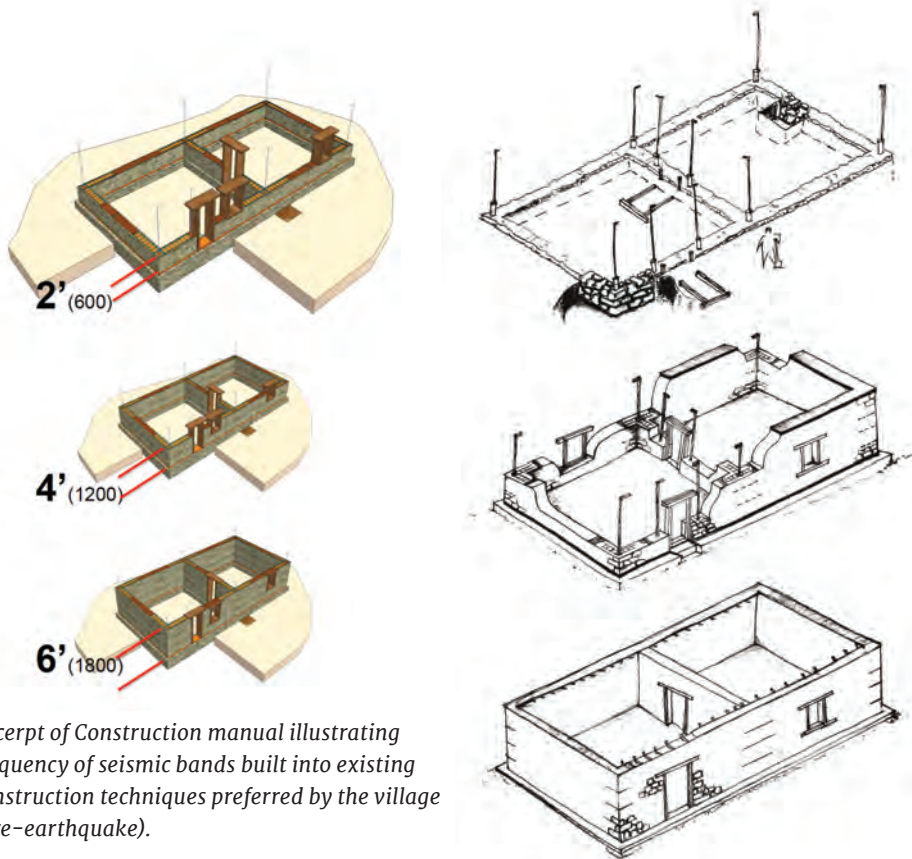


Laying first course in footings to prototype house

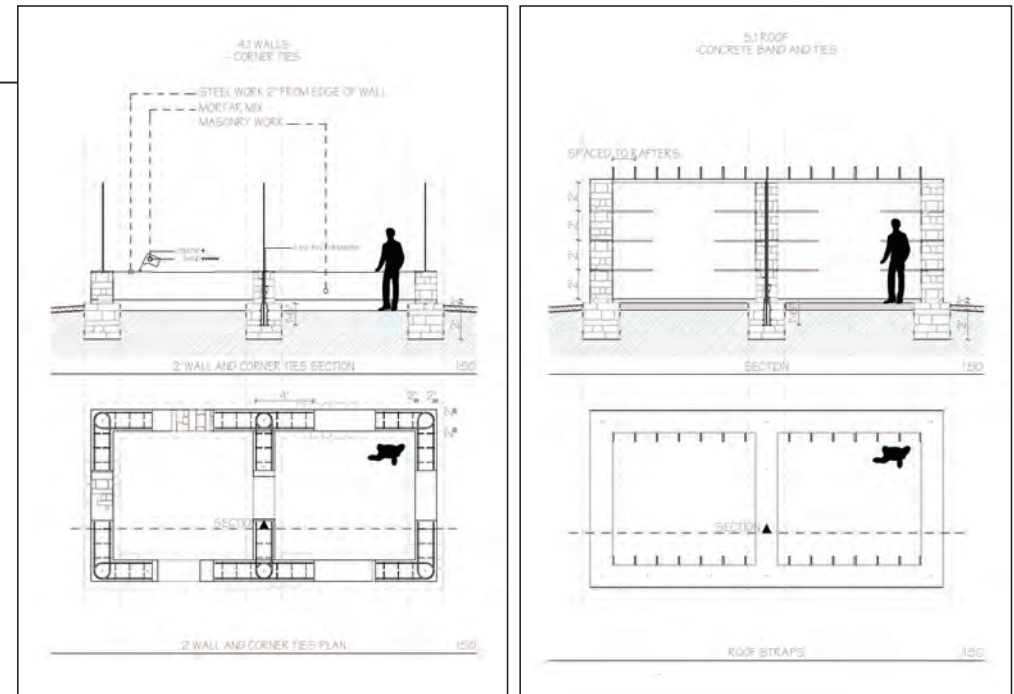


Discussing next steps with Prem (village leader) prior to departure

PROPOSED TOOLS



Excerpt of Construction manual illustrating frequency of seismic bands built into existing construction techniques preferred by the village (pre-earthquake).



Team developed a construction and project management manual in consultation with local builders that includes:

- HH developed seismic band reinforcement
- Traditional construction techniques
- Local materials and communication requirements
- Footings and site conditions.

Thank you to all who participated in the work.

Stay connected to the program's progress at:

www.healthabitat.com

