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As ‘development’ has touched the far-flung Himalayan regions known for their scenic beauty and fragile ecology in recent decades, new houses have become increasingly unsafe, uncomfortable, unsustainable and distant from local culture. Shelter after disaster has been the worst performer, with tin sheds being the default ‘design’.

In this unfortunate architectural landscape of diminishing local wisdom and a tidal influx of alien materials and half understood technologies, the ASF field workshops have in recent years shown how safety, sustainability and heritage can be cornerstones of good local design.

Evolving the thought process from a simple approach of building safe intermediate shelter after disaster in Chamoli, to a comprehensive set of guidelines for safe and sustainable reconstruction in Ranikhet, to finally a live project on safe, sustainable and culturally appropriate reconstruction in Leh, the workshops have demonstrated true learning in action. The Western Himalayan context has provided a great landscape to work in and demonstrate the value of the lessons found.

The Leh workshop documented herein took the workshop series to its intended destination of one complete cycle. Of course, learning in action doesn’t end here and must continue, but at a higher level. Establishing such approaches as demand driven and enterprise based models remains a challenge and a domain to be explored. Eventually these models will have to be seen in an ecosystem framework that changes norms and practice rather than continuing as demonstration projects.

The process of action and learning will surely continue!
INTRODUCTION
The ‘Learning in Leh’ workshop took place between the 19th of July and the 2nd of August 2011. The two-week workshop was based at the Leh Government Girls Higher Secondary School in the Indian Himalayan region of Ladakh. Workshop participants included architects, architecture students and building surveyors from the UK and internationally.

The workshop was organised by Architecture Sans Frontières-UK and supported by SEEDS India. A collaborative approach was key to the workshop and a number of local organisations were also involved.

This was the third in an ongoing series of workshops in the Indian Himalayas organised by ASF-UK. Previous workshops in 2008 and 2010 focused on intermediate shelter provision, and safe and sustainable construction practices for the Himalayan region of Uttarakhand. This workshop continued to address themes of safety and sustainability, whilst also introducing issues surrounding schools and learning environments.

Disastrous flooding in Ladakh in 2010 highlighted a need to raise awareness of the importance of safe, climate responsive and environmentally sustainable building practices in the region.

The Leh workshop was initiated by two participants from the 2010 workshop, one of whom had personally witnessed flood devastation in Ladakh and had subsequently worked with SEEDS India to develop a shelter strategy for the region.

Leh Government Girls School suffered damage in the floods and, one year on, was still without adequate sanitation following damage to a toilet block. Facilities at the school were basic, with school buildings providing challenging or, at worst, entirely inadequate conditions in which to learn.

The workshop was part of a broader initiative to reduce vulnerability and improve the quality of education available for girls at the school. During the summer of 2011, UK-based NGO Multistory conducted teacher training exercises as well as disaster awareness and risk reduction courses.

The workshop achieved lasting outcomes including the construction of a seating and display area during the workshop, and the construction of a replacement toilet block soon after the workshop. The built projects are intended as prototypes for study and improvement, and this document as a record of the workshop process and outcome.
geographical and cultural context

Location and topography
Ladakh is a sparsely populated high altitude region in the Indian Himalayas. The main population centre of Leh is located in a valley, at approximately 3520 metres above sea level.

The area is remote, with other large population centres being at least two days away by road over some of the world’s highest mountain passes. From November to May, roads are closed by snow and access to the region is possible only by air.

Climate
The region has an extreme and harsh climate. It is very cold for much of the year with approximately six months of below freezing temperatures. Temperatures in winter can fall as low as minus thirty degrees centigrade.

The region is also very dry. Ladakh typically receives very little rainfall and is classed as a desert region. As a result, there is little or no vegetation without man-made intervention, and hardly any vegetation in areas away from the Indus river.

The region receives large amounts of sunshine, typically over 300 days per year.

History & culture
For much of its history, Ladakh remained largely isolated from the outside world, developing a rich and unique culture based on the Buddhist religion.

Despite the limited local resources, harsh climatic conditions, and a relatively isolated location, Ladakh’s population achieved much more than mere subsistence. An environmentally responsive way of life with economical use of available resources allowed the population to prosper.

Modern Pressures
The isolation of the region was to an extent reversed with the construction of a road to Leh in the 1970s as well as an airport. Whilst this brought prosperity to some, it has also brought about rapid changes over a very short period of time which have exerted great pressures on the people and the environment of Ladakh.

Adaptations to traditional ways of life in the region are necessary in order to respond to changing needs and expectations. A number of NGOs are working in the region to facilitate appropriate adjustments between vernacular traditions and modernisation, whilst affirming the importance of the highly developed indigenous culture, traditions and architectural heritage of Ladakh.
vulnerability and risk

Disaster risk

The Himalayan region is one of the most disaster prone and ecologically vulnerable ecosystems in the world. The region is in seismic zone IV, indicating a high risk of earthquakes and is prone to cloudbursts, flash floods, avalanches, landslides and other natural disasters.

Ladakh is particularly vulnerable to flooding. On 6th August 2010, flash floods killed more than 200 people and left 1000 families homeless in the Leh region. Many of the hydro-meterological disasters in the Himalayan regions have been demonstrating an increasing trend in the past decades, and are reportedly set to get worse due to the impacts of climate change (source: Mountain Forum Himalayas, 2010).

Vulnerability

The local vernacular in Ladakh developed from the most readily available materials, predominantly mud and stone. Traditional methods of construction incorporated centuries worth of accumulated knowledge. Traditional buildings were generally both safe and sustainable, and highly attuned to the local environment and culture.

Over recent decades, many of the traditional building practices in Leh have been abandoned in favour of more ‘modern’ materials and typologies. Un-engineered concrete, corrugated iron sheeting and other ‘foreign’ materials and components have been becoming increasingly popular. These materials must travel very long distances over high mountain roads in order to reach Ladakh and do not contribute to the local economy or local skill base. Much construction work is now carried out by migrant labour and local construction knowledge and markets have been eroded.

Materials and construction practices, used without proper knowledge or training, and have increased vulnerability to natural disasters. Newer buildings were 4 times more likely to suffer damage in the 2010 flood than those over 50 years old. There was no major damage to heritage sites, which are of traditional mud construction and up to 1000 years old (source: The Indian National Trust For Art and Cultural Heritage).

In addition, these materials and ‘modern’ typologies are often unsuitable for the climate and environment of Ladakh, resulting in reduced comfort levels in buildings, and increased reliance on fossil fuels for heating.

Unfamiliar imported components have resulted in a dependence on the original manufacturer for installation, maintenance and modification, making them difficult or impossible to maintain in Ladakh.

Following the 2010 flood disaster, there is an urgent need to reassess current buildings and building practices in the light of possible future disasters, as well as potential improvements in environmental sustainability.
A lightweight prefabricated post flood shelter near Leh which is too cold for winter use

17th century mud construction, Leh Palace

Devastation in Choglumsar after 2010 floods

Collapsed concrete building in Leh after 2010 floods
The school provides education for 300 girls. The school is near the centre of Leh town and shares its site and some of its facilities with a middle school.

The school buildings provide challenging or, at worst, entirely inadequate conditions in which to learn. Buildings are constructed from imported materials, and typologies are generally unsuited to the climate and environment of Ladakh. The buildings are too cold for much of the year and completely unusable in the cold winter months.

Some parts of the school are derelict, whilst most other spaces are dilapidated, dark, and overcrowded.

One of the toilet blocks at the school partially collapsed during the 2010 floods, exacerbating an already severe lack of basic sanitation and hygiene facilities at the school.

Buildings fail to provide:
- Thermal comfort
- Disaster resilience
- Adequate day lighting
- Adequate space
- Culturally appropriate spaces

Buildings fail to utilise:
- Local resources
- Natural resources
- Green technologies
- Low embodied energy

Location plan
Small
Layout confines teachers to the front of the class limiting engagement with pupils.

Cold
- Overhang and small windows restrict daylight and solar gain.
- Rooms open directly to outside allowing heat to escape.
- Lightweight CGI sheet roof loses heat.

Dilapidated
Unfamiliar materials make the building difficult and expensive to maintain.

Unsafe
Not designed to withstand earthquakes.

Dark
Overhang and small windows restrict daylight.
Learning in Leh Workshop | India 2011

- Cold
- Dilapidated
- Bare
- Crowded
workshop rationale

A need to promote safe and sustainable building practices in Ladakh

The 2010 flood disaster highlighted a need to raise awareness of the importance of safe, climate responsive and environmentally sustainable building practices in the region.

Materials
There is a need to promote the use of locally available construction materials, and particularly in the use of natural materials such as mud.

Typologies and technologies
Adaptations to traditional construction practices are necessary in order to meet modern needs and expectations. There is a need to promote the importance of disaster resilient, climatically appropriate and culturally appropriate construction, and appropriate use of green technologies.

Knowledge and skills
Knowledge of appropriate construction has been declining in the local community and there is a need to improve and support local skills capacities.

A need to improve facilities at Leh Girls’ School

Educational attainment at government schools in Leh district is low. In 2008, 72% of high school students at government schools in Leh failed their final year matriculation exam (source: SECMOL).

A need to improve learning environments
Buildings at the school currently provide inadequate conditions in which to learn. Improvements to school facilities are a necessary part of improving overall educational attainment at the school.

A need to provide adequate sanitation facilities
There is a severe lack of basic sanitation and hygiene facilities at the school and improvements are urgently needed for health and safety reasons. There is also a strong correlation between adequate toilet facilities at school and academic performance of adolescent girls. Recent research estimates that 23% of girls in India drop out of school altogether once they reach puberty due to lack of adequate school based sanitation facilities and privacy. Many more will miss out on several days of school each month (source: Plan India).
workshop methodology

Week 1: Research

The first week of the workshop was research based and included:

Context research
- talks and discussion sessions hosted by locally-based NGOs on local issues and local approaches to construction
- tours of traditional vernacular buildings and heritage sites in Leh Old Town
- an intensive study and survey of a traditional vernacular building in Leh Old Town in collaboration with The Tibet Heritage Fund (THF)
- field trips to study a variety of contemporary approaches to construction

School research
- interviews and interactive exercises with the pupils and staff at the school in order to understand their needs
- field trips to study learning environments and the culture of learning in the region

Resource research
- identification and mapping of locally available construction materials, resources and skills
- information gathering on costs of purchasing and procuring materials locally

Week 2: Prototypes & Proposals

The second week focused on the development of prototypes and proposals for the school at a number of different scales:

Short term proposal (1 week)
Participants designed a small seating area and sunshade for the school playground. They procured the necessary materials for construction, and worked with masons and labourers to build the bench within a small budget and a short timescale. This proposal helped to develop and test materials and construction techniques for the benefit of the medium and long term proposals for the school.

Medium term proposal (1 -2 months)
Participants designed a toilet block to replace the block damaged during the 2010 floods. They also developed a strategy for further improvements to sanitation provision at the school. The toilet block was constructed immediately after the workshop.

Long term proposal (1-2 years)
Participants developed schematic proposals for the overall improvement of the school site focusing on safety, sustainability, and the quality of the learning environment.
2. LOCAL RESEARCH
LOCAL RESEARCH
Talks, tours and field trips

The research activities during the first week of the workshop included:

Talks
Introduction to Ladakh & film screening (ISEC)
Ladakh’s traditional vernacular architecture (INTACH)
The 2010 floods and INTACH’s post flood findings (INTACH)
Leh Old Town & conservation projects (THF)
Approaches to school design (Gerard da Cunha, architect)
Post flood construction projects in Ladakh (SEEDS-India)

Tours: Architecture & Conservation
Lamo Centre, Leh Old Town (LAMO)
Leh Old Town & TFH restoration projects, Leh Old Town (TFH)
Tibetan Museum construction site, Leh Old Town (THF)
Thikse Monastery, Thikse

Tours: Post Flood Construction
SEEDS Shelter, Shey (SEEDS)
Prefabricated Shelter, Choglumsar (local resident)

Detailed case studies

Survey of vernacular architecture
The workshop group conducted a survey and study of a traditional domestic property in the old town in collaboration with the Tibet Heritage Fund.

Study of SECMOL Learning Campus
The workshop group toured and studied the SECMOL campus which provides residential education for 40 students who have failed the conventional educational system.

The school is largely self sufficient in food and energy and uses passive solar design to heat the buildings. The campus is designed, built and managed by a local non-governmental organisation which aims to reform the educational system of Ladakh. SECMOL continually experiments with low-tech sustainable technology, low cost construction techniques and local materials.

Study of Druk White Lotus School
The workshop group toured and studied the Druk White Lotus School campus which provides both day and residential education for 750 children from nursery level to age 18 from local villages and nomadic families.

The campus was designed by a team of architects, environmental and structural engineers from Arup Associates in the UK. The campus is managed by a local non profit organisation and supported by international charitable foundations. The design combines sophisticated earthquake engineering and passive solar design with traditional construction techniques and materials.
LEH

PHEY

Scale

0  5  10km

CHOGLOMSAR

SHEY

THIKSE

LAMO Centre
Leh Old Town & THF restoration projects
Central Asian Museum
Survey of domestic vernacular architecture

SECMOL Learning Campus

Government Shelters

Druk White Lotus School
SEEDS Shelters

Monastery

Leh Old Town & THF restoration projects
Central Asian Museum
Survey of domestic vernacular architecture

SECMOL Learning Campus

Government Shelters

Druk White Lotus School
SEEDS Shelters

Monastery
construction & materials

Traditional Vernacular

Upper walls
mud brick with clay mortar and clay/dung render

Foundation and lower walls:
stone masonry

Ground floor
earth

Roof and upper floors
earth, willow sticks, poplar beams, grass and clay
Contemporary adaptations

**Rammed earth walls**
Provide thermal mass which can help keep buildings warm when combined with passive solar design
Example: SECMOL Campus

**Insulated cavity wall**
Double skin wall construction with waste wood shavings, waste paper, waste plastic, or straw in cavity
Example: SECMOL Campus, Druk School, SEEDS shelters

**Rammed earth walls**
Provide thermal mass which can help keep buildings warm when combined with passive solar design
Example: SECMOL Campus, Druk School, SEEDS shelters

**Mud vault roof**
Reduces the need for timber which is a scarce resource in Ladakh
Example: SECMOL Campus

**Salvaged materials**
Oil drums used as walls
Example: SECMOL Campus

- Local resources
- Low embodied energy
- Easily replicable
- Natural/Renewable/Biodegradable
- Local livelihoods
Thermal mass
Thick mud walls and roof help keep the building warm at night in winter, and cool in the summer.

Small openings
kept small and low to minimise the effects of cold winter winds

Stables
for animals at ground floor level. The body heat of animals warms the rooms above.

Buffer zones
between interior and exterior spaces to minimise heat loss.
Contemporary adaptations

Glazed south/east elevations
for passive solar gain
Example: Druk School, SECMOL Campus

South facing sunspaces
Plastic sheeting traps heat from the sun in winter. It is rolled away in summer.
Example: SECMOL Campus

South facing ‘Trombe’ walls
for passively heating night use spaces
Example: Druk School, SECMOL Campus, SEEDS-India shelters

✅ Climatically appropriate  ✅ Easily replicable  ✅ Economical  ✅ Low tech
safety

Traditional Vernacular

Tapering walls help increase stability

Stone masonry for foundations and the base of walls helps protect against flooding.

Small openings help maintain stability

Tapering walls help increase stability

Timber banding helps to tie the walls together. An internal timber frame is used in some buildings.

Stone masonry for foundations and the base of walls helps protect against flooding.
Contemporary adaptations

Roof
An internal timber structure with cross bracing. This is independent of the walls and can support the heavy roof in the event of damage to walls.
Example: Druk School

Walls
Durable granite outer walls to withstand flood waters as well as a perimeter wall around the site to divert flood waters.
Example: Druk School
green technology

Energy generation

**solar panels**
Photo voltaic panels for powering lighting and computers.
Example: SECMOL campus, Druk School

**solar water heater**
Passive solar heating of water for washing.
Example: SECMOL campus

**solar cooker**
A parabolic reflector made of mirrors which focuses the rays of the sun to passively heat a kettle or pot for cooking.
Example: SECMOL campus, LEDEG centre
Sanitation and waste

passive solar latrine

In the desert environment of Ladakh, where water is scarce and there is no waterbourne sewage system, dry composting toilets provide a more appropriate solution than flushing latrines.

The traditional dry composting latrine design can be improved by adding a passive solar flue. The sun heats the dark metal surface of the flue causing hot air to rise inside the flue drawing up flies, smells, and moisture from the pit to the outside.

Example: Druk School

‘The design of the toilet system at Druk is simple and effective and significantly improves the traditional Ladakhi toilet.’
 – Tom Marshall, workshop participant

✔ Economical ✔ Low embodied energy ✔ Easily replicable ✔ Culturally appropriate
learning environments

Spatial qualities

**Space**
Generous, multi-use spaces allow teachers to move around the space for individual learning and allow pupils to work alone or in groups. Example: Druk School & SECMOL Campus

**Light**
Shallow plans with large window openings provide good day lighting. Example: Druk School & SECMOL Campus
Fittings and Furniture

Carpets and soft furnishings allow pupils to sit on the floor. Example: Druk School, SECMOL Campus

Storage units and multiuse furniture on casters to allow for easy repositioning. Example: Druk School

Pinboards and display areas for peer learning. Example: Druk School, SECMOL Campus

- Easily replicable
- Culturally appropriate
local resources

Leh Town

“The local area is full of resources and exciting materials for immediate use and shows plenty of options for future work and design.”
– Nousheen Rehman, workshop participant

A range of non-local materials are also available in the Moti market including timber from Kashmir, metal, rope, tarpaulin, plywood, ceramics, glass, glue and paints.
regional resources
Leh Region

“We discovered non-Ladakhi labourers as whole families hand-manufacturing mud-brick after mud-brick, ready to sell and deliver. To test the quality we placed a brick on top of two more – an inch on either side and jumped on it. We also dropped it from 1m onto soft-ish ground. The brick was solid! The labourers were confident and one man began throwing the brick in the air just to show off a little.”

- Mena Shah, workshop participant

Traditional materials
Salvaged materials
Skills

1. Mud blocks, grass
2. Scrap yard for recycled bottles, tins and other metals
3. Clay and sand
4. Granite
5. Slate
6. Poplar, willow
7. Carpenters, metal workers, workshops

A range of imported materials including concrete blocks, cement, sand, timber, steel, aluminium, carpentry, sanitaryware, hardware, plywood, tiles and glass are also available for sale.
Scrap metal, tyres and glass
Granite quarry
Mud brick manufacturing
PROTOTYPES + PROPOSALS
The brief for the second week was developed from observations and assessments of the school’s needs made during the first week.

The brief enabled design and testing at three scales: detail design, building design and schematic design.

**short-term proposal (1 week)**

**seat and sun shade**

- Design and construct a small seating area for the school playground
- Use principally local or salvaged materials
- Source and procure materials and labour locally within a limited budget and a short time-scale (4 days)
- Design should be easy to build with construction techniques that can foster local community involvement
- Develop and test materials and construction techniques within the design for the benefit of the medium and long term proposals for the school.
medium-term (1-2 months) toilet block

- Design a three cubicle toilet block to replace the block which collapsed during the floods of August 2010.
- Use principally locally available materials and climatically appropriate sustainable technologies
- Address safety issues in new design both in terms of hygiene and resilience to natural disaster (particularly flooding, following 2010 disaster).
- Develop a strategy for the layout and orientation of the entire toilet area so that further appropriate improvements to sanitation provision can be made.

long-term (1-2 years) buildings and site

- Develop schematic proposals for the overall improvement of the buildings and site
- Develop proposals for improving learning environments.
- Develop proposals for use of the school as an emergency centre in the event of a natural disaster.
- Given the limited resources available to the school, proposals should be low-cost and low-tech whilst aiming to deliver significant improvements.
design process

**Participatory tools**
In order to understand the school’s needs and aspirations, workshop participants used a variety of techniques including observation, mapping, interviews, mapping games, drawing elicitation and 3D model elicitation exercises. Workshop participants devised activities that would be engaging in order to encourage the active participation of staff and pupils. Groups were kept small to help the children feel comfortable explaining their thoughts.

**Sketching, drawing and model making**
Workshop participants worked together in groups to make proposals through sketching and model making. Designs evolved in tandem with construction and material testing in a cyclic process of experimentation.
1.1 experimentation and prototyping
Workshop participants procured materials from salvage yards, quarries, brick yards and local markets to test appropriate materials and technologies in 1:1 scale mock-ups. This included experimentation with glass bottles in wall construction in a workshop with architect Gerard da Cunha, and testing the use of black paint in raising the temperature inside a metal flue.

Critique and discussion
Participants shared and discussed proposals with students and staff as well as local experts and NGOs during the design process, making modifications to the original proposals as appropriate. Ongoing communication within the group, with the school, and with the local community were important in developing successful proposals that responded to local needs.
short-term proposal
seat and sun shade

The Design: improving the learning environment
The Design: local and salvaged materials

- **Foundation and plinth**: granite with mud and clay mortar
- **Upper wall**: Mud brick with mud and clay mortar, mud and dung render.
- **Canopy**: Willow
- **Frame**: Timber
- **Seat**: Slate
- **Detail**: Glass bottles

**Local materials**
**Salvaged materials**
**Construction phase 1**
A mason and labourer built the granite foundations and walls up to seat level with direction and assistance from workshop participants.

**Construction phase 2**
The workshop participants constructed the mud brick and glass bottle walls, assembled the post and beams for the canopy, laid the slate surface of the seat, rendered the walls and painted the display boards.
medium-term proposal

**toilet block**

**Existing toilet area**
An unplanned layout restricts access for pit emptying. As a result, some latrines are impossible to empty and overflowing. There are no hand washing facilities.

**Proposed toilet area**
Phased proposal for new toilet blocks with simplified layout and new hand washing facilities. Blocks arranged to minimise overshadowing and allow passive solar ventilation of pits.

**Site plan**
Plan (Phase 1)
Dry composting toilet
A dry composting toilet is the most suitable solution for Ladakh as water supplies are limited and there is no waterborne sewage system.

Passive solar ventilation
Simple metal flues on the south side of the block assist ventilation to the pit, helping to reduce smells.
Salvaged glass bottles bring light into the interior

Upper Walls:
Mud brick with mud mortar, slate coping

Roof: Soil, clay, grass, poplar and willow

Lower walls:
Granite with mud mortar

Floor structure
Poplar beams (salvaged), willow

Partitions: timber and CGI sheet

Materials
Local and salvaged materials

Traditional materials
Salvaged materials
Construction work started on the toilet block soon after the workshop.

The construction project was managed by a member of the ASF-UK team. SEEDS India provided structural and technical advice as well as financial and logistical assistance during the construction of the toilet block.
long-term proposal
buildings and site

Spatial environment

**Improve day lighting**
- Add or enlarge windows where practicable (oriented to the south or east).
- Remove/reduce shading and overhangs.
- Add blinds to help control glare in summer.
- Improve views by creating child-height windows.
- Paint walls and ceiling a light colour.

**Maximise space**
- Position furniture on casters to allow multiple positioning and flexible use of space.
- Multi-use spaces help support more creative, child-centred, and activity based approaches to teaching.

**Extend space**
- Add sun spaces that can be used as extensions to the classrooms for use on sunny days.
- Eases overcrowding and enables teachers to move around the classroom for individual teaching.
Fittings and furniture

Soft furnishings
to allow for sitting on the floor

Storage units and multiuse furniture
Furniture on casters to allow multiple positioning and flexible use of space.

Pinboards and display areas
for peer learning
Thermal comfort

Observations
- Poor orientation (main facade rotated away from south)
- Overshadowed (tight spacing of blocks restricts potential for solar gain)

Strategies
- Remove/replace prefabricated huts
- Reduce heat loss
- Improve direct solar gain, day lighting and reduce heat loss
**Reduce heat loss**

- **Add buffer zones**
  between inside and outside

- **Protect north elevation**
  Reduce number and size of openings on north elevations.

- **Protect windows**
  Add night shutters or thermal blinds to reduce heat loss at night. Add secondary glazing.

- **Add Insulation**
  Add insulation to walls, floors and ceilings using locally available materials (e.g. straw, waste wood shavings, used paper or empty plastic bottles)

**Improve direct solar gain**

- **Add glazing on south/east elevations**
  Add or enlarge windows oriented to the south or east where practicable.

- **Add sun spaces**
  Timber frame with polythene sheeting helps collect the sun’s radiation, passively heating the space.

- **Remove solid overhangs**
  Remove/reduce shading and overhangs to allow sun to heat internal spaces

- **Increase thermal mass**
  Increase areas of exposed thermal mass where practicable so that heat from the sun can be stored and released by the building fabric.
**Solar energy**
Ladakh’s plentiful sunshine provides excellent opportunities for collecting solar energy for cooking, water heating and electricity generation.

- **Solar water heaters** for toilet blocks
- **Solar cookers** for the canteen
- **Photovoltaics** for classrooms and library

![Diagram of a floor plan showing the placement of solar water heaters, solar cookers, and photovoltaics](image-url)
Waste & Environment
‘Lost’ spaces between buildings, currently used for rubbish tipping, can be used for productive and educational planting.

Educational Gardens
productive growing with rainwater harvesting

Reuse/recycle point
Educational refuse sorting

Drain cover
to reduce smells from the open drain. Potential redirection of water for irrigation.
Extending use: out of hours and school vacations

There is potential for use of the school campus by the wider community.
Extending use: an emergency centre

There is potential for use of the school campus as an emergency centre in the event of a natural disaster.
Learning outcomes

“I would love to continue my architecture studies in international development or shelter after disaster. From this course I know I will always want to try to design with, not for my ‘clients’.”
- Workshop participant

Participants worked within a real context, tackling real problems and testing solutions in a hands-on way. They learned through research, design and construction at a variety of different scales. The key learning outcomes, which are listed below, can be more widely emulated in other contexts.

Participatory approach
Workshop participants worked with the school and with local organisations to identify and understand local issues, and arrived at solutions through a variety of participatory design workshops. Participants found that working closely with the school and local partners was invaluable in helping them produce proposals that were appropriate and responded to local needs.

Sustainable approach
In a region with scarce resources and an extreme climate, the careful selection of appropriate materials, construction techniques and technologies was a necessity. Key to this was research into the local building traditions so that new innovations could be introduced without losing knowledge that had been built up over generations. This approach helped participants produce proposals that would be environmentally, economically and culturally sustainable.

Adapting working practices to local conditions
Working on the ground in an unfamiliar context, participants faced a variety of new challenges in the design and construction phases of the workshop. Designs had to be constantly modified as participants encountered restraints ranging from material and tool availability to skills and cultural differences. Participants found they had to accept a degree of ‘loose fit’ between idea and execution, and develop an accommodating and open approach to design.

Outcomes for the school

School facilities
The workshop achieved lasting outcomes for the school. The short term project (a seat and sun shelter) was completed during the workshop, and the medium term project (a toilet block) was built immediately after the workshop.

The construction of the toilet block addressed the school’s immediate needs for hygienic sanitation provision following the destruction of a toilet block during the 2010 floods. Further improvements to sanitation and to the general school environment are urgently required as a next step for improving both well-being and learning at the school. The workshop has drawn attention to needs, has generated energy for change and has shown a strategy for simple, cost effective and sustainable improvements.
Teaching, management structures and curriculum
Teaching, management structures and curriculum will also need to be addressed if learning and educational attainment are to be substantially improved at the school. It was important therefore that the workshop formed part of a broader initiative to improve the quality of education available for girls at the school. UK-based NGO Multistory, also supported by SEEDS-India, conducted teacher training exercises as well as disaster awareness and risk reduction strategies at the school soon after the workshop. These are likely to be continued through further engagement in the coming years.

The 2011 projects at the school are the beginning of a process which we hope will make a real long-term difference to the Government Girls School in Leh.

Broader perspective

“It’s great to see mud being used in a contemporary design. It shows that mud can be a modern construction material.”
- Local NGO

The built projects at the school are intended as a demonstration of the potential of local materials and sustainable design. They are intended as prototypes for study and improvement, with a relevance for the school but also more broadly in Ladakh.

During the workshop, participants engaged with a broad range of local organisations and conducted presentation and discussion sessions with these organisations and within the school to raise awareness of the importance of safe, sustainable and culturally appropriate construction practices.

There is much important work still to do in Ladakh, and in the wider Indian Himalayan region. Ladakh needs to improve skills and knowledge for construction, build pride in its traditions, and develop better planning and building guidelines, as well as developing a disaster management strategy.

Appropriate new techniques and technologies can, over time, be refined and adopted into building traditions. The research and projects documented here are intended to contribute to the important process of changing the practice of construction in Ladakh.
APPENDIX
consultation

Balloon tours

Pupils were invited to give a tour of their school placing red balloons to mark the places in the school that they liked, and blue balloons to identify the places they didn’t like.

This revealed some of the children’s key concerns about their school:
- Hygiene and sanitation
- Rubbish heaps
- Open drains
- The need for thermal comfort (warmth in winter and shade in summer)

Key
- ‘Good’ balloons marking places the children liked
- ‘Bad’ balloons marking places the children didn’t like
A note left by a pupil on a ‘bad’ balloon in the toilet area
ASF-UK would like to thank

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Team in Leh: Katherine Johnson, Lucy Schofield, Lucy Thomas and Sarah Ernst

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Sketches and photographs were provided by workshop participants and facilitators.

**Further information**
Workshop project blog
www.learninginleh.wordpress.com

Toilet Construction project blog
www.buildinginleh.wordpress.com

Druk White Lotus School
www.dwls.org

GERES (Groupe Energies Renouvelables, Environnement et Solidarity)
www.geres.eu

Intach (Indian National Trust For Art and Cultural Heritage)
www.intach.org

ISEC (The International Society for Ecology and Culture)
www.localfutures.org

LEDeG (Ladakh Ecological Development Group)
www.ledeg.org

LAMO (The Ladakh Arts and Media Organisation)
www.lamo.org.in

Multistory
www.multistory.org.uk

SECMOL (The Students’ Educational and Cultural Movement of Ladakh)
www.secmol.org

SEEDS India (The Sustainable Environment and Ecological Development Society)
www.seedsindia.org

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Architecture Sans Frontières – UK (ASF-UK) aims to make community and international development issues integral to the practice and teaching of architecture. We strive to make architecture relevant to the world’s majority – people who are marginalised or living in poverty.

Through exhibitions and events, live projects, international workshops and UK workshops ASF-UK explores and engages in complex cross cutting themes of development with ‘participation’ as the primary methodology to achieving a more equitable and fair existence for everybody.

We have established two programmatic approaches for our work: ‘change by design’ and ‘resilience by design’. The ‘Learning in Leh’ workshop falls within our resilience by design programme.