REVIEWS OF THE PROJECT

This context makes life very difficult, particularly for the weakest inhabitants of these villages in the desert: children. Their parents can’t no more convey their typical Bedouin nomadic culture, but at the same time they have no places to give their children an education. Education is the only instrument to redeem their condition and thus becomes a matter of fundamental importance.

ARCO designs Abu Hindi primary school project for an international cooperation project led by Veneto di Terra NISO, an organization working in Palestine for children’s fundamental rights to education and health care. The social and territorial context of ARCO architectural project is Abu Hindi Bedouins community, composed by around 2700 members, sited East of Jerusalem in the West Bank, close to the Israeli colonies of Male Adumim e Cedar. Here Bedouins live in very critical environmental conditions, due to the air and ground pollution and to the serious water scarcity of the area. The refurbishment project had to face restrictions imposed by the Israeli military authority, which state the maintenance of the existing situation and the impossibility of volumetric reshaping for the existing school building. This one was a building made of metal shell walls, totally unfitting any acoustic and thermal insulation requirements usually needed for educational activities.

SOCIAL AND POLITICAL BACKGROUND

After Oslo Accords in 1999 Palestine has been classified and organized into three areas, according to the degree of control from the Israeli authority: A area, B area and C area. In A area and B area Palestinians can build under certain conditions. C area is under the total control of Israeli authority, except for the civilian Palestinian people, and include areas of Israeli settlements, areas of security control and areas scarcely inhabited by Palestinian people. Usually places less densely inhabited are characterized by Bedouins presence, who live in small villages far away from the urban areas. Bedouins used to move across the desert for centuries and now are forced to live in a very limited area, between Jerusalem and Jericho. They live in small villages, still sited in the desert, which is more and more inhabited by new Israeli colonies - usually they all live in the C area. Living in the C area, Bedouins are substantially deprived of any social facility and protection from the intrusive Israeli control. They have almost no public transport at all and at the same time they live far away from hospitals, places of work and market, schools. Bedouins economy is very poor and based on sheep-farming, little legumes cultivation, a poor trade of agriculture and farming products, temporary day-by-day jobs. Usually village areas have no electricity, water and sewage systems, and are placed along roadways or near dumping grounds, as those ones are often the only free areas to settle down. People live in huts made by metal sheets, as this is the easiest and cheapest material to reclaim from dumping grounds around urban areas, and use often old carpets to cover internal surfaces of walls and ground.

Often Bedouins steal electricity and water from their Israeli neighbours as this is the only way to have some necessary facilities to survive, or receive some water supplies from UNRWA and other international organizations. All this situation make Bedouins living in a perpetual subsistence level, without any hope of change and possibility to determine their future. Moreover, the difficulty of displacements of people and goods, the isolation of Bedouins between them and towards the external world, the absence of places or buildings of collective use, make the cultural identity of this people more and more fragile.
SUSTAINABLE REFURBISHMENT OF A PRIMARY SCHOOL
REALIZATION / THE RENEWED SCHOOL

ENVIRONMENTAL QUALITY AND RESOURCE EFFICIENCY – “PLANET”
Restoration activity is a highly efficient use of land, especially of basic importance in a country with land scarcity such as Palestine. We use low-tech materials, easily available and recyclable, with minimum environmental impact; passive mechanisms for thermal energy balance, offered by the bamboo shading panels; ventilated air cavity of the external walls; transpiring walls made of straw and mud; ventilated roof. The project updates the library introduces the rainwater collection and herbal purification system, this helps to use in the best possible way the resource of water, which is an environmental factor of vital importance in the desert.

ECONOMIC PERFORMANCE AND COMPATIBILITY – “PROSPERITY”
The financing of this project comes from voluntary funding raised by Arab Arina NGO. All money has been spent in Abu Hind with the only supervision of NGO team, bringing improvement of their professionalism and possibility of new higher qualified jobs, thus producing a tangible long-term benefit for local communities. All materials and elements are provided by local savings or artisans, thus boosting local economy and opening new market areas in the building sector for unusual and very cheap low-tech materials, such as straw and bamboo. Low cost and easy availability on site of building materials make local communities independent from any scarcity, commercial embargo or invasion.

CONTEXTUAL AND AESTHETIC IMPACT – “PROFICIENCY”
The restoration of the building brings a great positive impact on the children perception of their everyday school-life. The physical context of the building being the desert, the architecture of the school shows its main effects in relation to the surrounding desert landscape and all the details scale. Simple low-cost materials are used to reach high performance and architectural quality.

The colour and texture of bamboo panes, naturally changing with sunshine and time passing, is in harmony with desert landscape slow evolva.

The creation of window tapes on top of external perimeter walls, together with classrooms internal white plastering, creates a warm and beautiful natural light inside the building, at the same time the perimeter void strip of window tapes gives a textade view to the roof surface that covers and completes the building shape.

Inside the classrooms, the rhythm of pie wooden frames and the alternation of white surfaces of lime plastering and light brown surfaces of bamboo panes gives a character of simple harmony.

The mobile bamboo panels of the façade create a new fluidity of external space uses around the existing building and give children and teachers the possibility of changing their new school to fit their different needs.
SUSTAINABLE REFURBISHMENT OF A PRIMARY SCHOOL
NEAR AL AZRAN, PALESTINE
HA11 DYECV

REALIZATION / THE BUILDING SITE

BUILDING PHASES
The building site operations took place during
the summer vacation period, from July to mid
September 2010, when teachers and pupils left
the classrooms free.
It is possible to identify seven steps of
realization:
1. survey on the existing building and dismantling
   of the existing roof, windows, doors and internal
   walls;
2. construction and assembly of the new roof
   beams and internal carpentry;
3. realization of the new roof and assembly of
   the wooden frame for “pale” wall;
4. realization of external “pale” wall;
5. realization of internal stabilised soil bricks
   panels;
6. positioning of internal end external bamboo
   panels;
7. realization of new wooden pavement, internal
   plastering, lighting.

NUMBERS
Bamboo / 500 m²
Straw / 3000 kg
Lime plastering / 325 m²
Soil / 20 m³
Sandwich panels / 314 m²
Wooden pavement / 180 m²
Steel structure / 5x5 – 610 m lineal
Stabilised straw and mud bricks / 120 m³ per
15600 kg
Bedouin workers / 8 per day
Building site days / around 60

INNOVATION AND TRANSFERABILITY – “Progress”
Innovation and transferability are relative concepts, as they are related to the context in which they are.
This project innovates the local inhabitants attitude towards building activity in Palestine, introducing the practice of sustainable
refurbishment of existing buildings.
The approach is transformed into an innovative use of low cost and local materials.
The traditional Mediterranean building technique of pale is innovated and adapted to the existing situation, using the external
metal sheet as a quickwork and siding on the interior side of the wall bamboo panels and lime plastering.
This simple solution is highly transferable in many situations to improve existing buildings in poor countries.
The monitoring of the actual school building situation – after more than a year of life – shows the good resistance of materials, thus giving a proof
of the high transferability of the building technique with good results in other situations.
At the same time this project brings innovation in designing activity methodology for auto-construction projects.
The first project comes after the verification of the building technique critical points by means of a 1:1 scale realization
workshop, hand made by designers. Moreover, the creation of an illustrated instructions booklet makes dissemination of this
innovation easier and fast.

ETHICAL STANDARDS AND SOCIAL EQUITY – “People”
Alb Haidi primary school project was born from a strict cooperation and exchange of ideas and information about needs and
deeds between the Jerusalem Bedouin Committee Arab, the promoter Verit di Terra NGO and APA team. Moreover the
teachers were involved in the process of participatory feasibility study.
This building refurbishment answers to children need for a safe, clean and performing school and to the need for an identity
collective place of the whole Bedouin community.
The school is the only true, “more permanent - unpresentable” building of the area in the desert.
Thus it becomes a symbol of Bedouins possibility to have social facilitation and education infrastructure even in the C area,
where usually they are prevented by Israeli authority from building nothing but their metal sheet huts.
This school dedicates the essential importance of children’s right to education, in whatever area of the country, with whatever
political conditions.
Children’s education is then an important element of community identity preservation and development.
Local inhabitants are employed as workers in a process of complete and transparent participation. At local traditions – such as
Ramadan period of rest, which arrived during 2010 summer – were respected during the building site activities. September 14th 2010, the school year 2010/2011 was opened with 130 students 6-13 years old coming from the Juhani
Bedouin villages in the Al Azrani area, 14 teachers and 1 headmaster.
THE LIBRARY IN THE DESERT

Abu Hindi school refurbishment is part of a bigger refurbishment intervention which will act on the whole school complex: library, headmaster’s office, teachers’ room, students and teachers hygienic facilities.

The library is the closest building to the renewed school and its refurbishment is deeply connected to the school itself: the same building techniques and design strategies are used and a global system of external spaces design unify the two buildings in a new architectural system.

An external shading roof, made of horizontal bamboo panels, gives measure to external space and makes it usable even during the hottest hours of the day.

A system of rain water collection and herbal purification links the two buildings in a unique watarline which goes to a little underground storage tank to serve the washbasins and give water autonomy to the school complex.

The herbal purification system has a particular importance in this region, being the water extreme scarcity both an environmental and political serious problem.

At the same time, the presence of purifying plants transforms the arid landscape of Bedouins villages and it’s an action of new “green” colonization of the land.

Finally, the diffusion among the Bedouin of rain water collecting technologies is an important action of spreading sustainable culture that can improve environment, and in the long term period can change Palestine landscape into a more green country.

Thanks to the echo of Silver Holcim award for Africa and Middle East, the Italian NGO which started the cooperation project of the school renewal will collect new funds for this second refurbishment intervention.
**SUSTAINABLE REFURBISHMENT OF A PRIMARY SCHOOL**

**PROJECT / DETAILS AND MAINTENANCE**

**EXTERNAL WALL DESIGN: REQUESTS AND RESULTS**

The existing metal sheet presented a heat transmission of 5.8 W/m²·K; classrooms were unbearable spaces before the refurbishment. The intervention had to face the need of keeping enough space inside the classrooms together with the constraint of thickening the wall layers only on the inside face, because of the imposition of keeping the external metal sheet as the final envelope of the school building. Thus, the solution was to apply an external removable shading layer, which could protect metal sheet from solar radiation during the very long hot season, and to create a fixed internal wall with a thickness able to give a good thermal insulation without reducing too much the floor surface of the classrooms. Given the mostly recurrent climatic conditions in the geographical context of Abu Hindi school, the thermal analysis of the external wall was made using both the typical analysis with temperature conditions of 0-20 °C and the context border temperature conditions of 40-50 °C. The result of heat transmission across the wall is around 0.84 W/m²·K. This value is under the maximum heat transmission permitted by Italian law in the hottest areas of Italy until 2008 (0.85 W/m²·K) and is comparable to the actual permitted values (until 2009 0.62 W/m²·K, since 2010 0.56 W/m²·K). The wall internal surface is around 17 °C, when the indoor temperature is 20 °C, thus the gradient is of 3 °C. These values show that the new wall guarantees a high thermal comfort, as there is no generation of convective motions due to temperature gradient.

**REALIZATION UPDATE: WINDOWS SHADINGS SUBSTITUTION**

The windows shadings required to be substituted. After the Silver Holcim Award for Africa and Middle East the NGO which was promoter of the project could collect new funds to realize this little maintenance intervention, which costed around 3500 euros. The new shadings are made with green metal panels, which are perforated to allow natural light transmission even when closed, just as Arabic “masjarbija”.

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1. Photo of the renewed Southern facade.
2. Thermal analysis of the new external wall
3. Photo detail of the new external wall
4. Detail facades of the project update with new window shadings
5. 3D images of the new window shadings installations
6. Photos of the realization update with new window shadings.
DESIGN STRATEGIES

1- **Natural ventilation with a new roof section.** The new sandwich panel roof is tilted and raised, to realize new window tapes of 60 cm high on the North side and 30 cm high on the South side. The angle of the roof helps hot air to exit from the window tapes, thus generating refreshing internal air convection motions. Window tapes at the top of walls and windows in the centre of walls create a natural internal ventilation which improve children and teachers perception of internal temperature.

2- **Thermal and acoustic insulation with a new wall layering.** Internal walls between classrooms are realized with stabilized soil bricks, 15 cm thick. External walls are thermally insulated by adapting the "pliòt" technique: new internal layers are built by laying and stamping layers of humid soil and straw between wooden boards, which are used as quarter-decks. The final result is a wall 34 cm thick, including lime plastering, internal bamboo panels, clay and straw layer, existing external metal sheet, air cavity and a final external shading bamboo panel. The general building thermal insulation is improved by placing a new wooden pavement on a concrete surface, and a new roof made by sandwich panels.

3- **Envelope protection from solar radiation.** In hot and dry places - as the desert - shading design and surfaces colour design are very important elements to improve comfort inside buildings. The new roofs made by white sandwich panels which reflect the highest quantity of solar radiation and absorb the lowest quantity of it, while the external existing envelope of metal sheet walls is shaded by bamboo panels.

4- **Modular elements.** Being the existing school a series of classrooms built one besides the other, the creation of a modular envelope is the solution to give a new unity and character to the school as a unique building. External panels have a span of around 1 m as the internal wooden frames which border the plastering. The rhythm of the wooden frames includes the existing openings of windows and doors in a new sequence of solid and void surfaces, and at the same time it makes the building refurbishment operations clearly readable. Moreover a modular system requires an easier and cheaper maintenance, compared to other building systems, which can be better managed by local users, the Bedouins.

5- **Mobile façade elements.** The external shade of bamboo panels is mobile and can be raised up in horizontal position to work as little "porticoes" and create new shadow areas in the exterior space around the school, useful to read, to play, to sit outside in the shade. The possibility of transforming the façade according to temporary uses is an element of connection between the renewed school building and its users-inhabitants, which contributes to give social identity to the building itself.

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1. Panorama view of the school complex after the refurbishment.
2. Detailed plan 1:50
3. Longitudinal inside view section 1:50
4. Facades of the renewed building 1:50
5. Preliminary sketches.
6. Section with façade mobile bamboo panels 1:20
SUSTAINABLE REFURBISHMENT OF A PRIMARY SCHOOL
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Methodology / Workshop + Instructions Booklet

Constraints and Requests from Users

- Very limited budget: around 40,000 euros;
- Very limited time of realization: around 2 months
during summer holiday school vacation;
- Difficulties of building material transport;
- Impossibility of existing metal sheet removal
  and requirement of leaving it visible for Israeli
  military control;
- Requirement for an "unpermanent" refurbishment
  of the building, with elements easy to be removed
  in a second time;
- Difficulties of communication with local workers
  because of the scarce knowledge of English
  language and our total absence of Arabic
  language knowledge.

Preliminary Actions

1- Survey on disposable and economic building materials in the local context;
2- Research on building techniques from the
   Middle East and Mediterranean areas;
3- Research on contemporary similar examples of
   architecture for emergency situation in developing
   countries;
4- Survey on local artisans and workers able to
   produce materials and realize the school
   refurbishment;
5- Discussion about the project and participated
   decision process through NGO option;
6- Choice to build together with Bedouin
   community in auto-construction activity;
7- Verification of the building technique critical points
   for auto-construction activity.

Instructions Booklet

The instructions booklet is a fundamental
instrument for practicing and spreading the
diffusion of auto-construction activities.
Anyone can use it to understand main steps of
construction as it is conceived with a universal
language, made of photos, drawings and a very
few words in English language - just as an idea
assembly instructions manual.
It overtakes translation problems and it's the first
essential tool to master building techniques for
the non-insiders and for people who are going to
build something for the first time in their life.
In this way, building techniques become part
of the permanent local building culture and can
be used in different situations directly by users-
builders.
This is a key aspect for emergency situation
in developing countries, where local economy is
poor and there is need for low-cost and low-tech
auto-construction techniques.
The instructions booklet can be used even without
designers and low-tech building techniques can
be more easily adapted to different situations,
thanks to their low content of complex details and
high content of common materials and elements.
This latter aspect is deeply bounded to
sustainability culture, which promotes the sharing
of open source knowledge.

\[1, 2, 4-6, 7, 9-10, 11\] Pages of the instructions booklets, used to
explain to local Bedouin workers the building technique.
\[9\] Photos of the auto-construction workshop, with the 1:1 scale
building sample realized by designers.