



Build it here? Build it anywhere!

Autonomous alpine shelter Monte Rosa hut, Switzerland

Regional competition Holcim Awards Bronze 2008 Europe; jury appraisal page 52

Near Zermatt, overlooking the Monte Rosa glacier in the Swiss Alps, a new mountain hut is being built by a partnership led by the ETH Zurich. Its message: sustainable construction is possible in any setting. If a building can be constructed in “splendid isolation”, under extreme climatic conditions and be fully self-sufficient, then the concept can be replicated anywhere.



A tough job, but a spectacular workplace: during a short alpine summer, a small yet skilled team sets about constructing the foundations for a new mountain hut in the moraine beside the Monte Rosa glacier. They are 2883 meters above sea level, and with a view of the world famous Matterhorn. But there is no time to enjoy the scenery – work lasts from sunrise to sunset, without any of the comforts of home. No electricity, no running water, no sewerage. And no road. Each night they find themselves in bunk beds of the century-old mountain hut which their new and sustainable construction will replace.

University and Alpine Club

There are more than 150 such mountain huts scattered throughout the Swiss Alps offering simple accommodation to hikers and climbers. They are under the stewardship of the Swiss Alpine Club (SAC) which has some 120,000 members – moun-

taineering is a popular sport. The Monte Rosa hut can be reached from Zermatt by cog railway, followed by a three hour hike. Built in 1895, over the years it had been extended, but its aging infrastructure was insufficient for the needs of today. The SAC, however, had no funds to commit to a major renovation.

Fortunately, at the right time, along came ETH Zurich's 150th anniversary celebrations. How should the Swiss Federal Institute of

The Alps stretch across a 1200 km arc from Austria and Slovenia in the east to France in the west. 128 of its peaks are over 4,000 meters in height. The most famous is the Matterhorn – close by is the new Monte Rosa mountain hut.

Technology best celebrate its reputation as a renowned university of engineering and architecture? Something lasting, something sustainable. Meinrad Eberle was the professor responsible for the celebration, but his wife came up with the idea: why not design a sustainable mountain hut for the SAC?



Beautiful, but its aging infrastructure is insufficient for the needs of today: the old Monte Rosa mountain hut.



Almost totally self-sufficient

Professor Andrea Deplazes from ETH's Department of Architecture was appointed to develop the concept. Together with a SAC hut expert he looked at which huts needed renovation, which ones had the most interesting challenges. "Some are in amazing locations, at the foot of a high cliff, for example," he describes. "But we

wanted to ensure that it was not only extreme sportspeople who could use the facility." They agreed, therefore, to support Monte Rosa, which could be enjoyed by more hikers.

A specific architectural studio was established, masters students were invited to contribute. In the first semester, ten

Building materials were brought in by helicopter, and needed to be as light-weight as possible.

students contributed their designs. The six most interesting designs were brought forward in the following semester – this time 12 new students contributed their ideas. The didactic concept of changing design teams worked. Two designs made the cut to the next stage – to be further developed by specialists.

After four semesters, there was a result. "It was a castle in the air, just as we had visualized," Andrea Deplazes says. A spectacular castle at that – the students had designed the hut to be almost totally self-sufficient in its remote mountain location. Energy efficiency, of course, is a prime concern. The design enables some 90% of the hut's energy needs to be met by itself – by harnessing the sun's energy as well as the building's thermal mass.



Members of the Studio Monte Rosa team (from left): Marcel Baumgartner, Andrea Deplazes and Kai Hellat.



What is not immediately needed can be stored for future use via battery banks.

Best-case scenario

The concept concentrated on developing solutions within a self-sufficient environment. Its technical autonomy extends beyond its own energy production to water collection and systems for treating solid waste and waste water. An integrated



Melt water is stored in a cavern.

water circulation system sees melt water collected in a cavern, and waste water recycled wherever possible (for example, with the flushing of toilets). “We looked for optimal efficiency at every turn,” Andrea Deplazes explains. “We used climate data, building data, looked at visitor records, considered use cycles. We have modeled an entire system of how the hut will be used and how the design can be most efficient in enabling user needs to be met.”

The architectural form of the hut also reflects this goal. A ball or cylinder design delivers the smallest surface size relative to volume, hence conserving energy. The Monte Rosa project took this exacting principle at its word – developing a ball-shaped but geometrically-segmented form. It looks like a quartz crystal, an impression that is only heightened by its outer metallic skin studded with photovoltaic panels. Into

Important job – the selection of the ideal building site.

this crystal is packed some 3700 cubic meters of space, divided into 50 areas. The design includes a spiral-shaped glass band which follows the sun, bringing passive energy into the cascade staircase which winds its way up the building’s periphery. Full advantage is taken of the spectacular landscape, but an important practical purpose is served as well – air circulation across the hut’s five floors.

Architectural flight-simulator

The students took the opportunity to think about so many alternatives, so many “what ifs”, that the project developed into a type of architectural flight-simulator. “There were diverse challenges for which we needed to find solutions,” Andrea Deplazes says. “Universities mainly operate in the theoretical space. We needed to ensure that



“We needed to ensure that the design we came up with would actually be built, not end up in a drawer.” Andrea Deplazes

the design we came up with would actually be built, not end up in a drawer.” Extreme care was taken, therefore, and many other specialists were brought into the equation.



The “light-weight” wooden structure is made of computer-aided prefabricated elements.

“It was an interdisciplinary approach – a collaboration involving other ETH departments, further universities, industry planners and SAC experts. All together they demonstrated to the students what a complex and integrated task developing a sustainable mountain hut can be!”

Treading lightly ...

With the design agreed, thoughts turned to financing. Together with funding from the ETH R&D budget, sponsors were sought for the ambitious USD 5 million project. The expense lay mostly in the transport of building materials – by helicopter. “That optimized many of our decisions,” project

manager Marcel Baumgartner says. “At one stage the students considered quarrying stone from the building site and making concrete, but at the end we agreed on a wooden lathe building method.”

Comparatively speaking, the structure is a veritable “lightweight” using only 200 tonnes of building materials. Pre-fabricated elements are produced down in the valley and computer modeling helped decide the most optimal way to assemble the various components before delivery to site. This integrated manufacturing technique was designed to ensure minimal material consumption and transport weight as much as efficient use of on-site building time.

The wooden structure and its thermal insulation will be packed into its thin metallic skin. The whole structure stands on a spider-like steel platform – joined to the



Splendid isolation on-site – workers return to the valley on weekends.

ground by only ten steel stilts and concrete foundations. “This is to ensure the hut does not interact with the permafrost – we don’t want its stability compromised by the warmth generated by the building,” Marcel Baumgartner explains.

Not as high-tech as it seems

Even if the new hut seems high-tech, it isn’t. The designers concentrated on using existing methods and technologies, modified where necessary. However it is important that what is within and without

The new Monte Rosa hut is constructed on a spider-like steel platform and concrete foundations – the intention is to transfer no warmth to the ground beneath so that the stability of the permafrost is not compromised.

is there to stay. It is a model of sustainable construction, yes, but one which the team wants to ensure can be replicated easily – anywhere, worldwide. “There is no infrastructure here, there is no tradesman to call if something breaks, there is no power point in which to plug the coffee machine,” Andrea Deplazes says. “Everything which is a part of daily life takes on a new meaning in a location such as this.”

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The students needed to think about this in depth, in order to come up with their concepts. “Besides the glacier, there is nothing else which is different to any urban location’s architectural or technical requirements,” Marcel Baumgartner continues. “Cooking is done with natural gas – if we had made the hut 100% self-sufficient, it would not model life.”

Better without a hut?

Even if the new hut is a model of sustainable

construction, fundamental questions remain about sustainability overall. Is it appropriate that a building is constructed for 120 people’s comfortable overnight accommodation in such a sensitive location, with helicopter transport required to fly in everything needed for their sustenance? What about no hut at all, and nature returning to itself?

Andrea Deplazes is circumspect. “Everyone has an opinion. There are no simple

answers. In return I could pose the question: what happens to this region if there is no more tourism? What effects would that have on the local population?” Renovating the old hut was no option. “That would have resulted in a far less sustainable solution,” he says.

The location is not conducive to mass tourism. Helicopter transport is only for supplies. Each hiker must walk in under his or her own steam. But Andrea Deplazes is



The staircase plays an important role in the use of passive solar energy; at the same time it acts as the air circulation network for the upper floors.



Advocate of mountaineers – and of the mountains

The Swiss Alpine Club (SAC) was founded in 1863 by a group of enthusiastic mountain climbers. Now with over 120,000 members, mountaineering has become a sport that is enjoyed by many. Not only has the membership swelled, the club's sphere of activity has also increased. The club has become an advocate of the mountains; the new Monte Rosa hut underlines the SAC's role as an ambassador promoting sustainable use of the Alps.

The SAC maintains and operates 153 huts and bivouacs throughout the Alps, offering about 9,500 beds to hikers and mountaineers. The huts could hardly be more varied; while some are only to be reached by experienced mountain climbers, others are accessible even on family outings. But one thing that is common to them all is their basic furnishings: SAC huts are not hotels, they offer simple accommodation.

“The principles used in this design can be made anywhere, because the sun is everywhere.” **Andrea Deplazes (pictured above)**

convinced. If there is to be a hut on Monte Rosa, then this is the best hut.

Further, if the new hut was never built, there would be no opportunity for its design to enter the sustainable construction



lexicon. “This is a showpiece in the best sense of the word. It shows us what is possible.” Yet this is no “special case”. The team from Studio Monte Rosa demonstrates that even in extreme conditions, the sun's energy can be successfully harnessed for greater self-sufficiency in heating, cooling or other needs. “The principles used in this design can be made anywhere, because the sun is everywhere.”

Less is more

The mountain hut's location is an ambassador for the dangers of global warming. More than 100 years ago, the

old hut was built directly on the edge of the glacier – now it is in the midst of moraine. The glacier has retreated hundreds of meters, some has split off into the lake at its base. A case of “seeing is believing” for all visitors to the area.

Meanwhile, the new hut's energy consumption will be published on the Web. Visitors can measure their own impacts. In warmth and comfort, they will see that they are responsible for only a third of the emissions generated by the old hut.

“Less is more” is set to become a mantra as strong as “seeing is believing”. But for Andrea Deplazes and his team, it has been worth the effort to bring this project to fruition. “It was an intensive five years,” he says. “I feel like we've run a marathon. But it was the right one to run.”