The incredibly self-confident, calm presence of the House of Art rooms stacked one above the other - with their sensitive, natural lighting - would be inconceivable had the architect not come across the new, and at the time still scarcely known, heating and cooling system with thermoactive components during development of his draft design.

The four storey building has a double skin external envelope with an outer opened glass wall. In the original design an air conditioning system with 25,000 m³/h air was planned. Due to difficulties in getting space for the ducts and the visibility of the ducts between the glass ceiling and the concrete slab another solution was needed. The requirements of high level stability of room temperature and relative air humidity brought further challenge to the duty. The high energy demand and high level of noise emissions of conventional air-conditioning systems called for a new solution. In this art museum the space heating is provided with a hydronic system embedded in the building structure. In addition, two-zone displacement ventilation provides a minimum of outside air.

### GENERAL DATA
**Principal:** Land Vorarlberg  
**Architect:** Peter Zumthor  
**Constructor:**  
**Installer:**  
**Energy concept:** Meierhans & Partners, and J. Bohle  
**Hand-over:** Opened in July 1997

### BUILDING DATA
**Building envelope:** U (W/m²K)  
**Facade:** double skin  
**Roof:**  
**Floor:**  
**Glazing:**  
**Air tightness:**  
**Volume:** 28,000 m³  
**Surface area:** 3,340 m²  
**Specific heat load:**  
**Specific cooling load:**
EXAMPLES OF LOWEX BUILDINGS

GENERAL DESCRIPTION

The fully integrated soft HVAC-technology for this special building is based on a further development of concrete core cooling which had been developed for an office building a few years previously in close co-operation with the architect and his team (Meierhans 1996). The concrete, visible everywhere, enables dynamic coupling of room climate to water-cooled and heated walls and ceilings. The ventilation system no longer has to perform the tasks of heating and cooling - its only function is that of air renewal. The heating and cooling process is carried out using the thermoactive building mass. It is therefore fully integrated in both senses of the word, because not only are the room climate and the building mass coupled actively and passively, but also because it has been

INSTALLATION SCHEME

Museum in Bregenz with pipes embedded in walls and concrete slabs for heating and cooling. Details show the displacement ventilation and the generation system for cooling and heating.

DESCRIPTION OF INSTALLATIONS
possible to accommodate all peripheral climatic components in the load-bearing building structure. This did not involve the usual compromise of concealing a necessary evil, but rather the integration of a similarly minimised, but clearly arranged infrastructure.

Finely branched air supply pipes were set in concrete in the ceilings in stead of large supply and exhaust ducts covered by suspended ceilings. There is not a single place where an air duct or heating pipe could be hidden behind a screen or a suspended ceiling.

EXPERIENCES - MEASUREMENTS

COMFORT

The number of visitors had been severely underestimated (estimated 250 visitors/day vs. 1 000 visitors/day in reality). The guaranteed values are however satisfied without any problems during normal operation of the museum (Figures AUT 1.1 and AUT 1.2).

ENERGY USE

The energy and operation costs are more than 50 % lower in comparison with other fully air-conditioned art museums.

EXPERIENCES - USERS

Some members of the staff found that the maximum summer room temperature, which had been set to 26 °C, was unpleasantly high under the conditions of high air humidity required for the exhibits. The maximum value was lowered.

LITERATURE