

ENVIRONMENTALLY-FRIENDLY BUILDINGS AS A STARTING-POINT FOR THE DESIGN

Bart Mispelblom Beyer, And Indira Van't Klooster

ABSTRACT

Two misconceptions about eco-friendly architecture are very common: too expensive and uniform in style. Two projects by Tangram Architects, a housing scheme and an office building show that eco-friendly buildings can be realised within budget, which is sometimes based on a pessimistic estimation of the economical value of environment-friendly buildings. Furthermore, eco-friendly building need not necessarily result in a uniform architectural style. Well thought-out 'green technology' relates favourably to every idiom. 18 Water dwellings, De Aker, Amsterdam is a housing estate, the main theme of which is the integration of buildings, environmental aspects, nature development and ecological water management. The dwellings have been designed so that the natural habitat of water birds can be preserved. The spatial organization of the dwellings is designed to reduce energy consumption. The District council offices and library, in The Hague comprises a compact building with open spaces around a void. The large void functions as a vertical air duct for used air. Via a heat exchanger on the roof, fresh air passes through a special climate facade. The facade has summer and winter windows. Glass shafts allow cool air to enter at night and, in conjunction with a radiating ceiling, provide cooling during the day.

KEYWORDS

Eco Friendly, Interaction With The Natural Environment, Energy Conscious Design.

INTRODUCTION

Tangram Architects is an architectural practice whose projects range in scale from urban design to

architecture, from housing to industrial and public utility buildings, from small to large. Diversity is Tangram's speciality. Increasingly, the practice is integrating ecological aspects into the design, even when this is not specifically called for in the brief. In particular, the use of water inside and outside the dwelling is a recurring theme, which strongly influences the concept and the design.

It is noteworthy that buildings which are presented as ecologically-sound architecture are very often more or less identical in appearance. It is a common misconception that wood is the only eco-friendly building material and that a building must have closed facades. And yet, ecologically-sound architecture does not automatically result in a uniform idiom. It is also possible to build energy-saving buildings using steel and glass. 18 water dwellings in Amsterdam and a district council office in The Hague give an idea of the various aspects which play a role in the harmonization of ecology and design, and the influence of the client. They also provide the proof that eco-friendly building need not necessarily result in an idiom which is uniform.

18 WATER DWELLINGS IN AMSTERDAM, THE NETHERLANDS (1999)

THE PROJECT

Amsterdam city council is developing a new residential area in Amsterdam-Osdorp, 'De Aker', comprising of some 3000 dwellings. 18 water dwellings designed by Tangram Architects are being built on the south side of this neighbourhood. Osdorp district council has designated the integration of building development, the environment, nature development and ecological water management as

the central theme in this part of 'De Aker'. Within the given theme, Tangram has designed dwellings in which the urban design concept, the appearance of the dwellings, energy-saving measures and water-saving interventions lead to an environmentally-friendly scheme. The client of this project is SBDN in Warmenhuizen, a commercial construction company.

CONCEPTUAL APPROACH

The location of the dwellings (a dike along still water on the edge of the district) means that there are fewer constraints on the design than in other parts of this neighbourhood. At the same time, the area is part of an ecological connecting zone; building development could be detrimental to the habitat of birds and other creatures. Tangram has utilized the design freedom afforded by the site in order to minimize damage to the habitat. The number of static elements (roads, parking spaces) in the urban design scheme has been kept to a minimum. The dwellings have been erected on a concrete slab in the water. Blocks with two dwellings have been plugged into the dike as free-standing elements.

THE DESIGN

The design is geared to the specific requirements for the conservation of the habitat. Because the slab base on which the dwellings have been erected has a smaller surface area than the superstructure, the footprint of a dwelling is only a third of the actual surface area. As a result, the water environment surrounding the slab is exploited to the full. A wooden frame on the timber-frame construction means that plants can be grown on the walls and a sedum roof increases the green surface for birds and insects, because the surface of the roof is larger than the dimensions of the slab base.

The design also provides the conditions for the reduction of energy consumption (EPN<1)¹. The materials used (wood and concrete) have a low energy content. On the south side is a sun room; the

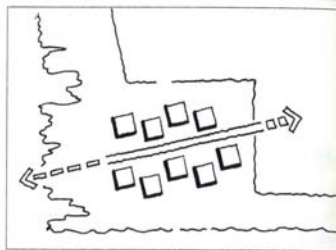


Fig. 1 Urban Plan

north elevation is more or less blank. The sun room has been designed in such a way that the warmed air can be used in the winter for ventilation. The sun rooms were offered as an option, but were fully integrated in the design. The addition of reducing glazed areas results in a sharp decrease in heat demand in the winter. A number of main spaces (living room, main bedroom and the second bedroom) can draw fresh air from a glazed space which has been warmed by the sun. The most important rooms are, moreover, equipped with both 'winter windows' (in the glazed spaces) and 'summer windows' (directly in the facade). In the winter, the summer windows can be closed by means of sliding shutters. The roof overhang prevents overheating in the summer and retains heat in the winter. The energetic-functional organization of the floor plan means that the rooms which are used most are orientated to the sun, while those which are not often used are situated on the north side of the dwelling. Solar collectors and a solar boiler are optional features.

Tangram had proposed equipping the dwellings with a 'grey' water system, water from the shower, washing machine, kitchen sink and washbasin is collected in a purification basin. After filtering with a helophyte filter, this water can be used to flush the toilet. A separate plumbing system could collect the rain water in reservoirs and it can then be used as washing-up water. Water-saving taps, shower heads and cisterns can reduce water requirements even

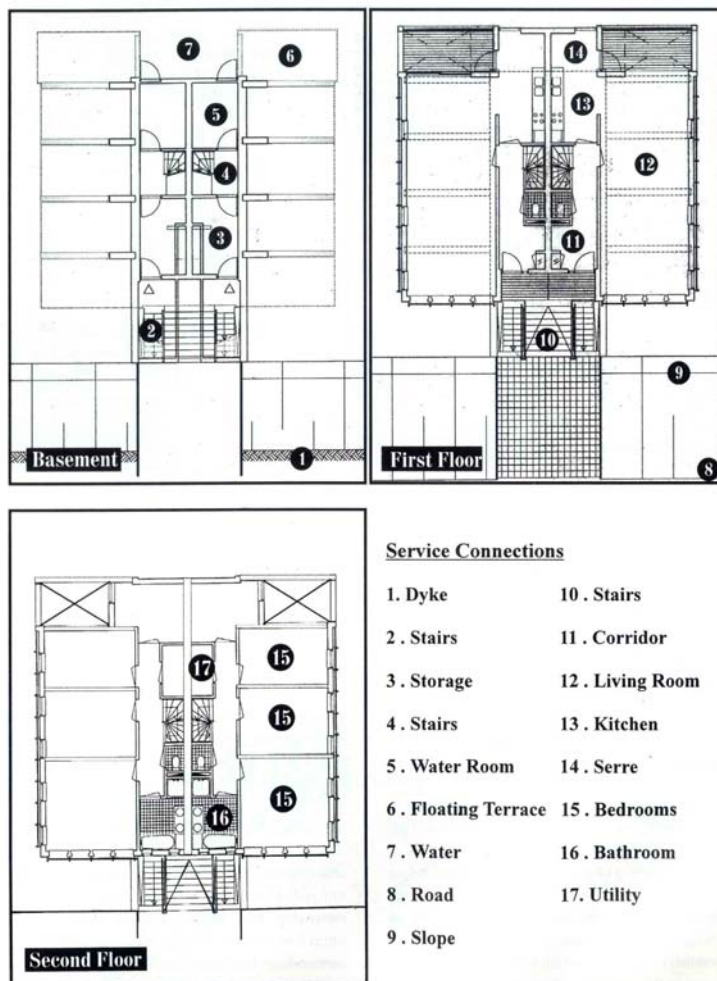


Fig. 2 Design of Water Dwellings



Fig.3 Southside with loggias and platforms

further. After careful consideration, however, Tangram decided not to include this facility. The filter is too delicate to be used in a public space. One drop of oil in the system can completely ruin the filter. Some eco-friendly measures are incompatible. In the case of the water dwellings, the use of a sedum roof together with the reservoirs for the collection of rain water proved to be impracticable. The sedum on the roof absorbs so much rain water that the amount of water that can be collected in the reservoirs via drainpipes is minimal.

THE USERS

The projection of the dwelling has been formally granted as land to the residents. However, the contract stipulates that residents may use it as 'visual greenery' only. The maintenance of the surrounding water and land has been centrally organized and is to be carried out by the council, and paid for by an obligatory owners' association. The outdoor space consists of a platform which is accessible via a water room in the slab base. This slab, together with the

stairs, has been incorporated in the middle section which connects the pairs of dwellings. It is high enough not to disturb the natural water environment and to house storage space. To ensure privacy, reed borders have been planted which can grow to a height of two meters in the summer.

EVALUATION

Clearly, because of commercial considerations, the design has not been exploited to its full potential. The Client was worried that too many 'unusual' elements would adversely affect the marketability of the dwellings. The unique design, the fact that the land is not freehold, and the obligatory communal management of land and water were regarded as risky, and so other interventions were not implemented. Thus the eco-dwelling, with its integrated vision regarding use, image and materiality, has become a water dwelling. The objectives with regard to the immediate surroundings have been achieved, but this has been at the expense of energy saving. In particular, the



Fig.4 Eastside with platforms

relationship between the dwellings and the nature development area has been well thought-out. The urban design concept with concrete plateaus and the choice of materials has been retained. In respect of the ecological connecting zone, the sedum roof, the racks on the exterior walls and the platforms have also been included. In order to bring down costs, virtually all the energy-saving interventions, specifically designed to retain heat, were offered as an option, and were not fully integrated in the design.

As a consequence of these economic measures, a dwelling in the base is not optimally more economical or eco-friendly. All of the energy-saving measures are so subtly interconnected that dropping a few components affects the entire programme. The fact that the dwellings sold quickly, and for substantially higher prices than had originally been envisaged, seems to suggest that an opportunity to realize an integrated environmental project with a distinctive character has been lost. Nevertheless, a completely new dwelling concept has been created, linked to and benefitting from a new approach to water and land individual dwellings and from collective quality.

DISTRICT COUNCIL OFFICES AND LIBRARY IN THE HAGUE, (EXPECTED COMPLETION 2001)

THE PROJECT

In practice, eco-friendly building has proved more costly than standard building practice. For this

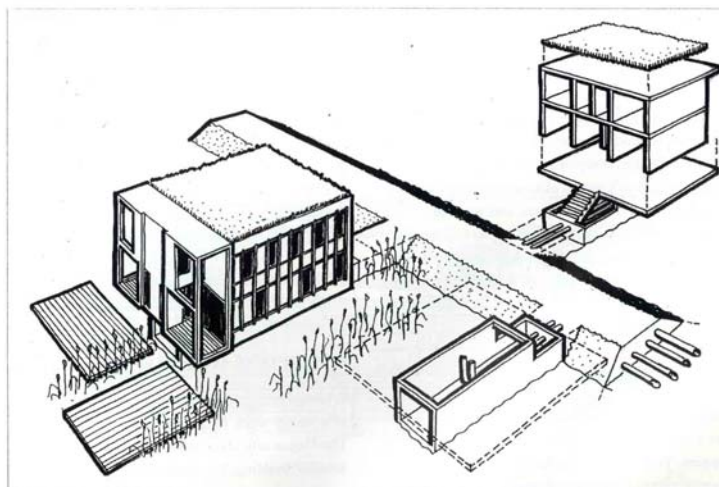


Fig.5 Isometry of all buildings, from plug-in to concrete slabs to wooden facades

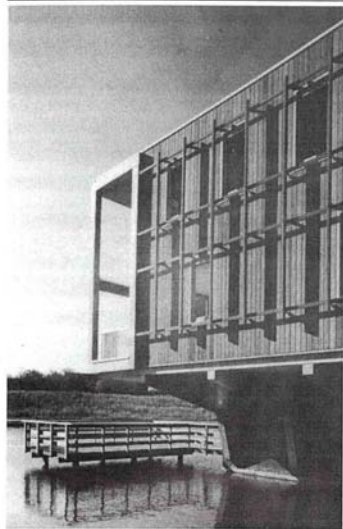


Fig. 6 Concrete slabs and platforms.

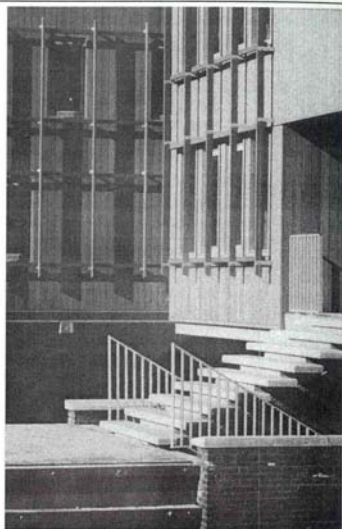


Fig.7 Northside of Water Dwellings, Entrance and timber frames.

reason, the Dutch government has urged an evaluation and review of energy-saving applications. The Hague city council commissioned Tangram to produce a design for a district council office building combined with a public library (approx. 3200 m²), as part of an urban design scheme which also includes dwellings and facilities. The spatial programme of requirements has two specific objectives: efficient use of space and extremely low energy consumption. The council regards the future building as a 'pilot project' - a model for government buildings in the near future.

CLIENTS AND USERS

Government buildings built in recent decades have an extremely low occupancy of the various work spaces. This results in buildings which are always largely empty. For this programme, the cooperation

within and between the various municipal departments has been radically altered. The number of 'personal' work spaces is being reduced to a minimum, which results in a system of work spaces and conference facilities, which are utilized via a system of debiting. Its success is based on a 'clean-desk-policy', i.e. after use an empty workstation remains and may be used by another person. The number of workstations can thus be kept to a minimum with a maximum occupancy. A predetermined excess allows variations with regard to the standard occupation.

CONCEPTUAL APPROACH

With this principle, the demand for space in the case of a steady work force can be drastically reduced. The Hague city council has decided not to build a 'smaller' building, but to utilize the resultant surplus space in the programme for an ecologically and

spatially unique building. Incidentally, this will be within the normal budgetary parameters. In fact, the same volume is to be built, but only part of it will be filled with floors. The openness of the large void over several stories fits in well with the public character of the building. In addition, this open space is to play a major role in the building's energy management.

THE DESIGN

The design is sober, a simple rectangular box with various floors in which there are irregular voids. The functions within the building can be seen from the street. A striking feature of the design is the double ground level solution; most of the public functions (the library and the registry office) are split-level in relation to the street, so that an equal position is achieved. These components of the building are accessed via sloping walkways. Stairs on the edges of the void access the other floors. The number of closed spaces has been kept to a minimum. The open character results in an optimal interchange between work spaces and departments and thus flexibility is achieved.

The large void decreases in size with height and functions as a vertical air duct for used air. Via a heat

exchanger on the roof, fresh air is passed back through a special climate facade on the south side and is blown into the various work floors. This climate facade has a layered structure. 'Summer windows' allow direct contact with the outside air. In the winter, these windows can be locked in order to limit heat loss. The winter windows zone is in effect a vertical glazed air duct on the facade. In the winter, cold (outside) air can be warmed in these ducts by the sun before being blown into the work spaces. As a result, heat loss and demand can be drastically reduced. In addition to ensuring a high degree of transparency of the facade, in the summer these glazed shafts also cool the concrete structure at night by discharging cool air outside. On account of the accumulative effect thus achieved, the need for cooling can be postponed during the day. This method of heating and cooling is supplemented by pipes in the floor and a radiating ceiling, the steel 'permanent formwork' of the concrete floors.

EVALUATION

Because of all these constructional measures, despite the openness of the glazed facade surfaces, on the north side, an extremely low EP value of 0.9 can be achieved. The integration of basic principles can result in a different building concept, with a different usage value. With careful insertion, this need not

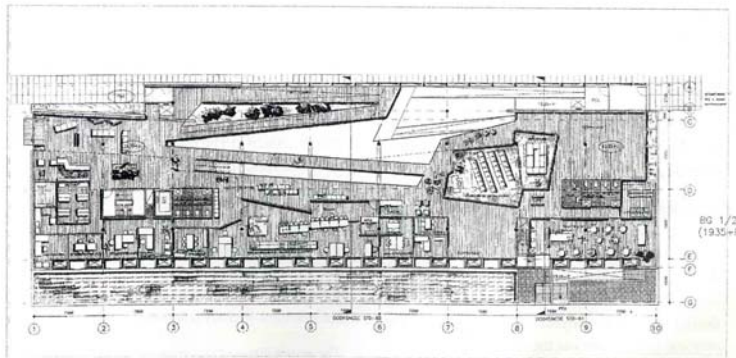


Fig.8 First Floor District Council office.

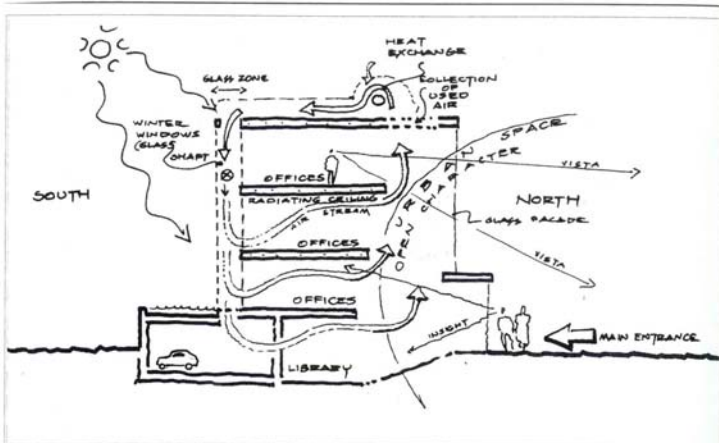


Fig.9 Cross-section of district council office.

mean higher investments.
CONCLUSIONS

The first, slightly dull, conclusion has to be that every building has a unique building history. This is all the more true for ecological friendly buildings, because the natural environmental conditions of the various locations differ, and because the realisation of the set goals depends on the readiness or courage of the client. A commercial client takes lesser risks than a public institute, if only because the Dutch government wants to be a role model in the environmental debate, which results in, and even justifies a more experimental approach to design. Still, there are some similarities between these very different projects.

It's rather striking that ecology-conscious design seems to require accommodation or even sacrifices of the part of the users. In case of the water dwellings the contract stipulates that residents may use their land as 'visual greenery' only, in the case of the city district council employees who have very little personal space. However, the loss of private space is compensated for by a great deal of public space. The



Fig.10 Facade district council office

water dwellings in Amsterdam are situated in an ecological connecting zone, in water amidst all kinds of rare species of birds. The Dutch dream to live in a house in a park, or woodlike setting is, in this project, realised in a metropolis like Amsterdam. In the district council in The Hague, a shared workspace is the (small) price for better climate-control and lower energy-costs.

Although collective use does not necessarily lead to an environment-friendly building, it seems certain that there is a connection between the amount of collectively used space and the possibility of environment-friendly solutions.

The possibilities of eco-friendly building surpass the use of wood and closed facades. Ecologically-sound

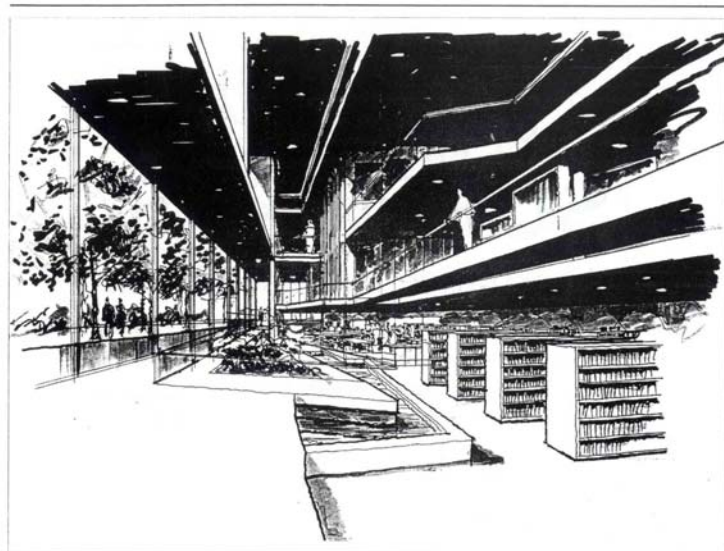


Fig.11 Interior of the library

architecture does not automatically result in a uniform idiom. It is even possible to build energy-saving buildings using steel and glass. The two projects described prove that eco-friendly building need not necessarily result in a uniform architectural style - well thought-out 'green technology' relates favourably to every idiom.

Author's Address:
Bart Mispelblom Beyer
Indira van't Klooster
Tangram Architekten
Olympisch Station 8
1076 DE Amsterdam
The Netherlands

1. ENERGY USE ACHIEVEMENT STANDARD. The lower the EPN, lower the use of energy. Obligatory EPN rating for housing in the Netherlands is 1.4 at present and as of January 2000 it has been lowered to 1. For offices it is now 1.9 and as of January it will be 1.6.