German Guideline for Sustainable Building

Dipl.-Ing. Wolfgang Ornth

Bundesministerium für Verkehr, Bau- und Wohnungswesen, Krausenstraße 17-20, D-10117 Berlin
Ph. 0049-30 2008 7311, e-mail: wolfgang.ornth@bmvbw.bund.de

1. PRELIMINARY REMARK

In order to promote sustainable building policies the German Government wants to set an example of sustainable building regarding to all new federal buildings.

Germany is a federal state. Although there are several regulations both at federal and at state level concerning environmental protection, a working aid for the integrated approach in design, construction, maintenance, operation and use of federal landholdings and buildings was missing. Thus, specific requirements according to the three pillars of sustainability have been elaborated. These are to be found in the annex to the guidline. We hope that the ecological and economical merits will convince other privat developers to follow us.

2. INTRODUCTION

This guideline is intended to implement integrated principles for the sustainable planning, construction, operation, maintenance and use of buildings and landholdings.

Sustainable building strives to minimise the consumption of energy and resources for all phases of the life-cycle of buildings - from their planning and construction through their use, renovation and to their eventual demolition. It also aims to minimise any possible damage to the natural environment.

This can be achieved by applying the following principles during the entire building process:

- Lowering the energy demand and the consumption of operating materials
- Utilization of reuseable or recyclable building products and materials
- Extension of the lifetime of products and buildings
- Risk-free return of materials to the natural cycle
- Comprehensive protection of natural areas and use of all possibilities for space-saving construction

The early implementation of sustainable planning measures can considerably improve the overall economic efficiency of buildings (costs of construction, operation, use, environment, health as well as non-monetary values).

When assessing economic efficiency, not only must the overall economic efficiency of the project be guaranteed, but the economic efficiency of every individual planning step must also be assessed in accordance with § 7 BHO.

In order to do so, the design team should consist of experts from the various disciplines under the leadership of the planner responsible for the overall co-ordination, and they should work closely together towards the aims of sustainability. Users and operators of the building must also be involved in the design phase.

Quality assurance includes measuring, documenting and monitoring the results of the construction and the use of the building, and reconciling these results with the design requirements (monitoring).

The opportunities for modifying the costs of a project are greatest at the beginning of the project. To a large extent, the cost-effective decisions will have been made during the definition of the programme and the initial concept phase. The same is also true for the impacts to the environment. Questions such as site development as well as planning law, function, urban planning, architecture and building regulations (especially stabilityand fire safety) must be fully assessed and optimised in terms of sustainability during the preliminary design and architecture and engineering competition stages.

Sustainable planning requires that equal consideration is given to the socio-cultural effects of the building project. Besides integration into the urban and natural environments, consideration must also be given to those aspects that affect people, such as the design of the building and the preservation of historic buildings and monuments.

Usually, buildings are used for long periods of time (on average 50 - 100 years). The temporal criteria, which are to be applied in the framework of the ecological and economical assessments, should be designed accordingly.

Sustainable building cannot be achieved by following a rigid concept. Instead, a specific concept or partial concepts must be developed for each individual project, and these concepts should include different approaches, alternatives and measures for the project.

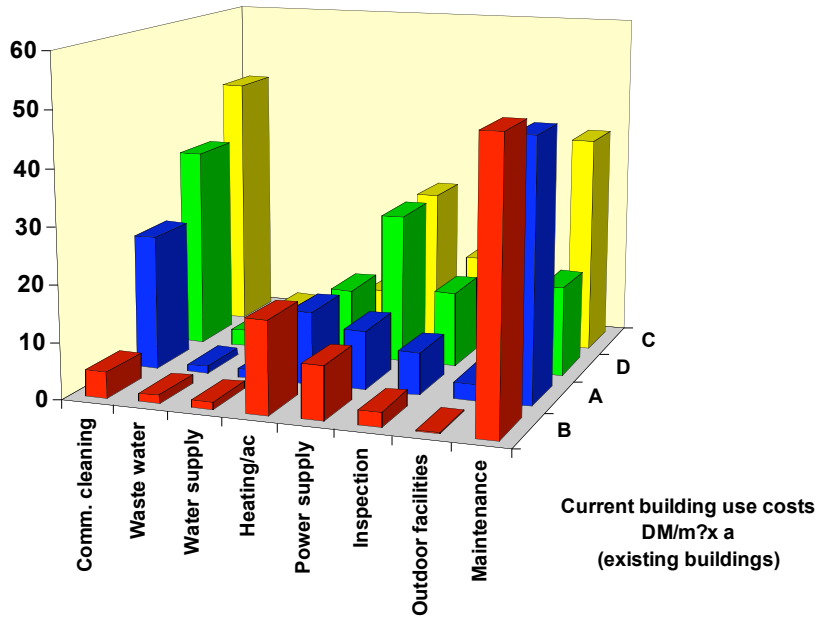
3. THE DESIGN

When designing buildings and their technical installations, care must be taken to ensure that

- the demands on functionality and design are fulfilled,
- health and comfort are guaranteed during the period of their use,
- costs for energy, operation and maintenance are minimised,
- the building can be operated with only low cleaning costs, or is partially self-cleaning (e.g. roofs and facades),
- the costs for inspection, maintenance and operation are kept at a low level and
- these items can be economically performed whilst also conserving resources and the environment as well as
- generating as little user-dependent traffic flow as possible.

Environmental impact is directly related to operational costs. The following items involve significant expenditures, as the case-by-case examples from 1998 demonstrate:

- Electricity/Cooling (15 - 40 €/m2 HNF·year)
- Cleaning (15 - 35 €/m2 HNF·year)
- Inspection and Maintenance (5 - 35 €/m2 HNF·year)
- Value-conserving Building Maintenance (5 - 15 €/m2 HNF·year)
- Heating (5 - 15 €/m2 HNF·year)



A primary requirement of the architecture and integrated building design is to minimise and optimise the technical installations through the correct choice of geometries and construction products. This can also substantially reduce construction and follow-up costs, and thereby environmental damages. The architect and design experts must therefore work closely together in the design team from the earliest possible moment.

By the interdisciplinary co-operation of all participants, a sustainability concept should be developed early on in the project. In this way solutions can be reached which are convincing as much through their functionality as through their positive affect on health, comfort, architecture, urban planning, form, economic efficiency, construction and ecological quality.

4. SPECIFIC REQUIREMENTS

The design principles described above lead to specific requirements on individual sectors and building trades. For the sake of clarity, they have been compiled in the following appendices.

Appendix 1: Checklist
Appendix 2: Planning principles for the design of buildings and landholdings
Appendix 3: Health protection and comfort
Appendix 4: Energy and building services
Appendix 5: Design principles for outdoor facilities
Appendix 6: Assessment of the sustainability of buildings and landholdings
Appendix 7: Building certification

Appendix 1 is a brief synopsis of the main requirements in the other appendices. It serves as a checklist for the specific requirements for individual buildings. It provides a handy tool which describes the tasks and checks involved in each step in the planning and decision-making processes. This checklist (Appendix 1) should be provided to the designers or competition participants for the preliminary design or competition phases. It highlights those requirements which have to be fulfilled in the preliminary or competitive design by means of drawing, written documentation or calculation.

Limiting, guideline and target values are stipulated for usage and operational costs. These cover in particular:
- Construction costs
- Electricity requirement
- Energy requirements for heating/cooling
- Inspection and maintenance costs
- Costs of value-conserving building maintenance
- Cleaning costs
- Water/sewage consumption and costs

All costs are relating to m² HNF and year.
The same applies to later design measures.

Appendix 2 describes the design requirements in terms of sustainability, beginning with the first planning phase. This appendix analyses in particular the impact of the construction, operational and maintenance phases on the architect's design. Specific requirements for specialist sectors, which are to be fulfilled by the individual design experts, are not discussed here. These issues are the subject of Appendices 4 and 5.

Appendix 3 gives the importance of the requirements for health and comfort, these have priority over the requirements for the building installations and
services. They also apply to all of the following requirements relating to specialist disciplines.

Appendix 4 includes all the main relevant design criteria for the design expert responsible for the building installations and services. However, the energy-related requirements can generally best be met by adopting an integral design approach.

Appendix 5 discusses the design of outdoor facilities within an integral overall design.

Appendix 6: the ecological and economical assessment of a building covers its entire life-cycle up to demolition. The ecological part is not initially made on a monetary basis. Social and cultural aspects complete the assessment of sustainability.

Appendix 7 represents a „building passport“. The building certification includes important key data on the building. It is of particular relevance to the utilisation phase (facility management) and for documenting the building's history (important for conversion or demolition works).

5. ECOLOGICAL ASSESSMENT

The ecological assessment of buildings during their long life-cycle is a part of the assessment of their sustainability. This also includes an economic and a socio-cultural assessment. Three protection objectives stand at the forefront of the ecological assessment:

- Protection of human health
- Protection of the ecological system
- Protection of resources

All ecological impacts are based on the flows of energy and material. The assessments are therefore based on the estimation or calculation of the extent of these flows. If precise data on the energy and material flows are lacking, then an attempt can be made to limit their relative extent by suitable measures at the source (avoidance strategies). Each assessment is based on system limits, and these must be known. Without this information the assessment is useless.

A basic distinction has to be made between qualitative (descriptive) and quantitative (calculative) methods for the ecological assessment of buildings and landholdings.

Qualitative assessments are easier to conduct than quantitative procedures. The results however often cannot be compared with another or are not
accurate enough, due either to different system limitations or to different reference values.

Quantitative assessments on the other hand are associated with considerably higher costs, due especially to the amount of data needed. This makes the implementation of computer-based tools both necessary and sensible.

In early planning phases (competitions etc.) the required input data are not yet available, so that a qualitative process is stipulated for preliminary assessments. As the planning process becomes more and more
concrete, this can be converted into a quantitative assessment (see Appendix 6).

6. ECONOMIC EFFICIENCY

Constructing and using a building both have an effect on the environment. High building utilisation costs are not only closely associated with a high level of environmental impact, but usually with high construction costs as well. Therefore considerable care must be given to reducing construction and operational costs when observing the above principles. Thus, besides the generally well-known design requirements for economic construction, three areas require increased attention:

- Analysis of the demand in terms of the type and scope of requirements
- Consideration of economic building construction procedures as early as the design stage
- Reduction of operational and utilisation costs, if necessary accepting an increase in construction costs for individual components, as long as § 7 BHO is complied with.

7. HEALTH, COMFORT AND SOCIO-CULTURAL ASPECTS

Buildings in which people spend their time must correspond to the needs of their users and should guarantee a high level of well-being.

The internal and external impact of a federal building reflects the democratic culture. Both, the relationship with citizens and the creation of historical values can be expressed by the impact of the building and this aspect must therefore be considered in the assessment.

Health risks resulting from the use of hazardous materials must be reliably excluded. The agreed objective is to create the best possible conditions for people residing and working in the interior areas of the building that are also acceptable from an economic point of view.

Factors that have particular influence on people's well-being and productivity include:

- Building architecture
- Geometry of the building and rooms
- Good design, materials, colour scheme
- Perceived room temperature
- Humidity in the room
- Air quality in the room (contents of the air in the room/hazardous substances)
- External air ventilation/air circulation
- Natural and artificial lighting
- Building acoustics/noise emissions

- Technical installations and furnishing.

The physical design parameters, which are defined by the planning of these items, must be determined on the basis of the existing technical specifications (DIN, VDI-regulations, AMEV-guides etc.), whilst taking the requirements of each particular case into account.

Demands on the health quality tolerance of building products are listed in the building regulations of the federal states of Germany through the Building Products Act.

The European Regulation on Building Products, its implementation at a national level and the international and European standardisation and registration of building products, have all led to building products being treated systematically and as a whole with regard to eight requirements. These are:
- Durability
- Suitability for use
- Mechanical stability
- Fire prevention
- Hygiene, health, environmental protection
- Safety of use
- Sound protection
- Energy conservation, heat conservation

Recognised health risks must be considered in the building product specifications.

Social sustainability covers a multitude of dimensions. The preservation of human health and well-being is an essential component. Many illnesses and restrictions on the quality of life are caused by or aggravated by environmental factors. In terms of the building sector, this affects both the people who live in the buildings and those who construct them. The requirements on health and well-being can be found in Appendix 3.

Due to their mostly prominent position and function, public buildings are increasingly a focus of public attention. They are endowed with a model function, which also has a creative component. Forming an important part of our building culture, they reflect how our society sees itself. They are a stable factor with a special responsibility with respect to the relationship between state and citizen. At the same time, if they fulfil their model role, then they are regarded with a special esteem and as a lasting value. Therefore the interests related to preservation of the building, its upkeep and maintenance as a witness of contemporary history, and cautious conformity to its surroundings are all factors of sustainable building that also have to be included in the design together with the general economic and ecological aspects.