

SUSTAINABLE URBAN DEVELOPMENT – THE ECOLOGICALLY EXEMPLARY NEW SETTLEMENT OF HANNOVER-KRONSBERG

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1 GENERAL INTRODUCTION

Lying to the southeast of Hannover, the state capital of Lower Saxony, Kronsberg is the city's largest remaining area for building development. Various urban development concepts had been proposed since the 1960s, but it was the World Exposition that enabled the municipality to implement them. The Kronsberg development was itself a World Exposition exhibit, addressing the EXPO 2000 themes of 'Humankind – Nature – Technology' through its exemplary vision and design quality.

The Kronsberg city district was built applying all the most modern expertise on ecological construction and habitation in the spirit of Agenda 21. Ecological objectives had overriding priority in planning and constructing the district; urban planning of high density development for low land take, environmentally friendly transport, good open spaces and the proximity of homes and jobs were consistently pursued.

A City policy decision involved over 40 property developers as a deliberate measure to enrich the diversity of possible construction concepts. Their projects evolved in detailed consultation with the municipality; this 'cooperative planning procedure' was headed by a specialist department within the City's planning division, and the City administration was in its turn supported by a planning advisory board.

As the City of Hannover already owned most of the building plots in the Kronsberg development area, it could exert a strong influence from overall planning through to monitoring and supervision of all construction projects. The quality, urban planning, social and environmental criteria drawn up by the City, and special Kronsberg Standards for all residential and commercial buildings and open spaces, were laid down in the land sale contracts or planning permissions and bylaws, (district heating and parking space bylaws) and rigorously applied.

By the year 2006 almost 3,300 dwellings had been built, and the final plan foresees a total of 6,000 homes for 15,000 people. Three children's day centres, a primary school, a high school, a district arts and community centre, a church centre, a health centre and shopping complex are in operation, all built to high ecological standards. Post-utilisation of the World Exposition grounds will develop extensive commercial areas; by the end of 2003 around 3,000 jobs had located near the new residential area.



Figure 1 Kronsberg construction area

2 URBAN PLANNING

Two competitions were the basis for a concept for the entire Kronsberg area, including the Expo grounds, the new city district and the countryside. The prerequisite for implementing the plan was an alteration to the city zoning plan approved by Hannover City Council in 1994.

The new district runs roughly north-south along the western slope of Kronsberg hill beside the new tramline, thus linking the older district of Bemerode with the World Exposition grounds. Its eastern boundary to the countryside is defined by a kilometre-long avenue. The dispersed development in Bemerode to the west is contrasted with the rectilinear blocks of the Kronsberg development. The new district is laid out across the contour in neighbourhoods with their own distinct identity, each of them grouped around a neighbourhood park and bordered by park corridors or green zones along the streets.

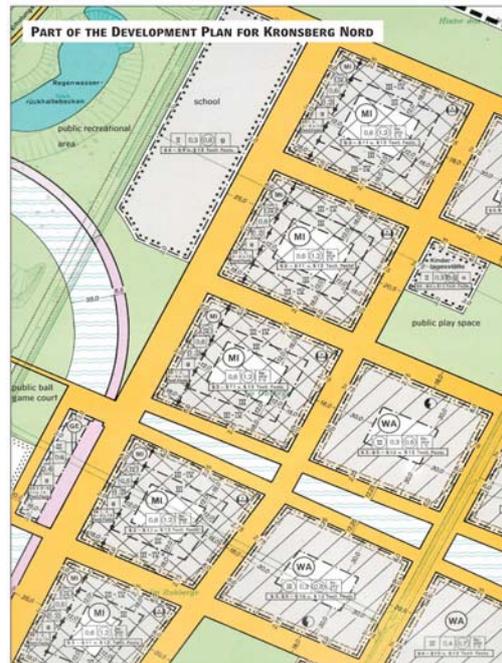


Figure 2 Development plan

The essential elements of realising a vision of sustainable urban development are compact building forms and high density while promoting architectural diversity and high quality living accommodation.

By establishing two legally binding local plans the municipality set the parameters of possible architectural forms; the principle planning aim was space-saving construction through high density. Defining the number of storeys, and compulsory building lines on the street frontage created a dense urban townscape; one important condition was that the ends of each block should be built on.

The construction sites follow the western slope of Kronsberg hill. Blocks along the tram line have a floor space index relative to site area of 1.2 and, with four to five storeys, the highest density. This utilisation factor decreases gradually the further away from the tram line the buildings are located. In the uphill building zones only densely placed one-family houses were built, constituting around 10% of the housing stock; 90% is apartments in multi-storey buildings.

The grid-like basic structure has become the framework for many different construction and architectural forms, brought together in a unity particularly by the avenue-like residential streets. More than 40 architectural and open space design bureaux prepared and implemented sometimes very various solutions. In many cases the developers ran competitions for the realisation of design ideas.

Most buildings are aligned parallel to the contour, enabling them to make the best use of natural light through mainly west- and east-facing windows. While the multi-storey apartment buildings on the lower slopes are mainly block structures, there are rows and some pavilion layouts in the middle zone. Most buildings have a set-back top storey with shallow single-pitch or inverted pitch roofs, often combined with spacious roof terraces.

The **infrastructure** was put in place concurrently with the housing. Public amenities were financed by the sale of publicly-owned land to private developers. The apartments in the first construction phase have the following amenities:

- a primary school with sports hall
- three children's day centres
- around 17 rooms for community use.

The community use rooms are mostly located on the ground floor of apartment buildings; developers were obliged to provide these rooms, most of them originally conceived as apartments, in the main building work. By arrangement with, and financially supported by, the municipality, they were then equipped for use by various local groups or institutions.



Figure 3 Shopping and services centre

At the centre of the district, right next to 'Kronsberg' tram stop, is the district square, on which are grouped:

- KroKuS arts and community centre
- Protestant church centre
- a health centre
- a shopping centre
- other shops, cafés, and restaurants.

3 SOCIALLY-COMPATIBLE URBAN DISTRICT DEVELOPMENT ON KRONSBURG

Urban development on Kronsberg was prefaced by interdisciplinary dialogue between experts in the Construction and Social Services directorates of the City Council, whose findings led to a catalogue of requirements for social planning to be applied in the construction development.

Essential requirements included flexibility in the use of apartments as tenants' needs and wishes change, a mix of large and small apartments, apartments designed for families, and also living spaces for new lifestyles. The aim was to mix various financing and ownership forms within single areas, and to limit the proportion of social housing, in order to avert social division. Arranging small, legible housing units around a green centre was intended to promote the development of neighbourhoods. The requirements included traditional infrastructure amenities such as kindergartens and schools, but also community-enhancing, cross-client group, communication and communal amenities and undefined spaces close to home to be used for communal social and cultural events. Of central importance was the development of the social and cultural infrastructure concurrently with housing construction.

The priority aim of the housing funding programme, established jointly by federal, state and local government, was to secure a stable **social mix of residents** for the long term.

The objective of social mix should be pursued on a fine-grained scale, as far as possible within each block. Allocating subsidies to encourage this has resulted in a mix of different apartment types and sizes.

Letting the apartments was made easier by setting markedly higher tenant income limits for the first tenancies. With the around 20% of apartments on which the municipality has an option for use as social housing, this will only be used for the second tenancies. During the construction period there were rent rebates; the final basic rents without services charges are generally based on a rate of approx. 5.60 € per square metre.

To promote owner-occupancy in the district around **300 terraced** houses (around 10% of all dwellings) were planned. Most of them were erected in the early stages of development to provide a stabilising influence from the start and thus promote a positive image for the district.



Figure 4 Terraced houses

Every year since 2001, between 20 and 50 terraced, detached or semi-detached houses have been built here. There is currently no demand for more apartment houses in Hannover, and the pace of construction work on Kronsberg has slackened markedly.

The Expo apartments, some 1,000 of them, are distributed around the entire district. When the World Exposition closes they will be renovated by the owners for reletting.

The '**City as Social Habitat**' project was part of the 'projects around the world' Expo competition entry, 'City and Region as Exhibit', and is one of the decentral Expo projects registered by the City of Hannover.

The 'City as Social Habitat' project aim was to devise approaches and solutions for the conflict situations commonly occurring in a large city, and to apply them through planning strategies. Approaches to social problem clusters in their respective contexts should fulfil universal criteria without, however, presenting schematic off-the-peg solutions. Sub-projects were set up at various locations in the city, and three 'City as Social Habitat' sub-projects were implemented at Kronsberg, to be integrated within the overall district social development programme. They were:

- Kronsberg arts and community centre
- the FOKUS sheltered housing project
- the Habitat international housing project

The '**KroKus**' arts and community centre is both a meeting place for everyone who lives on Kronsberg and the central forum for the networked community services. In close cooperation with local people, this is where community development work happens, making the connections between social responsibilities, cultural and environmental issues. KroKuS houses the district library, a youth agency, group and function rooms, a large hall, a workshop and a studio.



Figure 5 KroKuS arts and community centre

The fundamental idea of the **FOKUS** housing project for disabled people who wish to determine their own way of life is an integrated balance of independence and assistance in all everyday activities. The project's specially designed apartments are distributed among ordinary housing but also near a help point.



Figure 6 Disability-adapted accommodation

The **Habitat** international housing project promotes coexistence between German and immigrant families living as neighbours. A third of the apartments in the complex are reserved for immigrants, and their groundplans take account of the needs of different cultures. There are apartments of from one to seven rooms plus kitchen and bathroom. Ten percent of the apartments are laid out according to Muslim beliefs and customs. Varied designs for the open space stimulates lively coexistence, as integration should happen through opening up to the outside world.



Figure 7 Habitat

4 OPEN SPACE DESIGN

The City of Hannover's entries for the Expo 2000 competition, 'City and Region as Exhibit' included, along with 'Ecological Optimisation at Kronsberg' and 'City as Social Habitat', '**City as Garden**' as a registered decentral EXPO project.

Within the 'City as Garden' project, throughout Hannover over 30 different projects were carried out around the themes of 'New Settlements', Historical Gardens and Parks' 'Landscape Spaces' and 'Environmental Education and the Gardens Culture'. These five themes were mainly presented in four large 'garden spaces', closely linked to each other. One of these garden spaces was Kronsberg, whose garden concept encompassed:

- the open space concept in the new district
- shaping and enhancement of the countryside
- the 'Spiel- und Sportpark' and 'Parc Agricole'
- the 'Herrmannsdorfer Landwerkstätten' farm



Figure 8 Common

Through these projects, all 'City as Garden' themes with the exception of 'Historical Gardens and Parks' could be implemented in exemplary fashion on Kronsberg. Together with ecological optimisation, the urban development concept and socially-compatible urban development, the garden projects constituted one of the bases for consistent sustainable development across the entire Kronsberg area.

5 TRANSPORT PLANNING

Environmental compatibility and the compact community were the paramount aims of transport planning for the Kronsberg district. A new direct tram service links the settlement with the city centre. Three tram stops are so located that nobody has to walk more than 600 metres to catch a tram.



Figure 9 Kronsberg tram stop

The main motorised traffic flow is channelled along the edge of the development beside the tramline to minimise nuisance to residents. Planning of the residential street layout permits no through traffic. Narrow sections on the roads, 30-kph zones, and priority to the right at junctions, are effective traffic calming measures. Car parking spaces are mainly arranged in small areas, either set into the hillside or at ground level. Around a third of car parking is underground. To reduce the parking space needs in the inner courts, a parking space ratio of 0.8 per apartment was set at Kronsberg. This was compensated for by a 0.2 increase in the ratio for parking spaces on the public streets, which means that they are better used over the day, and the area needed for motorised access in built-up areas is reduced.

A cycle-friendly street layout with a designated cycle street running the length of the district offers, together with a dense network of rural and urban footpaths, an attractive alternative to private motorised transport.



Figure 10 Cycle street

6 ECOLOGICAL CONSIDERATIONS

On environmental issues, the municipality's environmental planning group for the World Exposition was given the task of drawing up very high standards for soil management, water management, and waste and energy policies, and guiding and monitoring their applications throughout the construction phase.

A special 'Kronsberg Standard' was devised for all residential and commercial buildings and open spaces across the entire district and incorporated in land sale contracts, planning permission contracts, development plans and other regulations. All stakeholders thus had to meet high expectations in their planning and construction processes.

The City of Hannover's 'Ecological Optimisation at Kronsberg' project was recognised as one of the Expo 2000 decentral 'Projects around the World'. As well as the Expo Corporation, the German Environment Foundation and the European Union also contributed to funding for many and various innovative projects.

In the forefront of planning and implementation, environmentally compatible energy provision systems were combined with environmentally sound construction and conservation of natural resources.

The project content was divided into:

- energy efficiency optimisation
- water management
- waste management

- soil management
- communications, skilling and qualification measures.

7 ECOLOGICAL OPTIMISATION AT KRONSBURG

7.1 Energy efficiency optimisation

The central concern of energy efficiency optimisation at Kronsberg was, and remains, to reduce CO₂ emissions by at least 60% compared to current standards for conventional residential buildings, benchmarked on the 1995 German building insulation regulations. Energy consumption is reduced through Low Energy House construction methods, monitored by a strict, specially-devised 'Kronsberg calculation method' exceeding normal standards, with appropriate quality assurance measures, optimised energy provision by a differentiated district heating system fed by two decentral cogeneration plants, and specific economy measures on the consumer side. A special bylaw states that all buildings, whether residential, children's facilities, schools, church or shopping centre, must be connected to the district heating system.

A further 20% reduction in CO₂ emissions is achieved by integrating wind power projects (two wind turbines of 1.5 and 1.8 megawatts respectively were erected at Kronsberg), the 'Solarcity' solar thermal project with its superinsulated 2,750-m² seasonal storage tank and other innovative technology such as passive houses, photovoltaic plants at the primary school, the 'KroKus' arts and community centre and the shopping centre, and solar masts in the grounds of the new high school and the arts and community centre.

Purchasers of building land from the City of Hannover are obliged, through clauses in the land sale contract or planning permission, to build Low Energy Houses whose annual heating energy needs are ten percent lower than the statutory requirements.

As far as heating provision is concerned, the City lays down in its land sale contracts that new buildings must be connected to a district heating system if available. If not, the next best solution, decentral combined heat and power, is sought. Only when this is not economically viable is a central natural gas condensation boiler for heating and hot water set as the minimum standard in the land sale contract. Additionally, purchasers of publicly owned land who commit themselves to building healthy and comfortable passive houses ('Komforthäuser') that require just 15 kW per square metre and year for heating and hot water receive preferential treatment.



Figure 11 Decentral cogeneration plant

7.2 Water management

Although the construction projects cover large areas of ground the balance of natural water resources on Kronsberg has been largely maintained using a newly devised method of rainwater management. All precipitation on built-up and paved areas is absorbed, collected and gradually released. There have been no adverse effects on groundwater regeneration in nearby woodland, and water levels in the existing drainage ditch system have remained constant.

On the public streets, rainwater is fed into the 'Mulden-Rigolen' soakaway trenches. On private open space, rainwater from roofs and paved areas is also collected and gradually released; in residential areas it often supplies design elements such as open ponds or watercourses.



Figure 12 Pond in a private inner court

Rainwater management has thus had a shaping influence on the design of the district and helped to create good quality open space. Making the theme of water visible has been a priority, to raise public awareness of the crucial importance of this element.

For public areas and in places with difficult local conditions, the standards devised at Kronsberg to minimise paving and green roofs, and setting them in the development plan for an area, have proven their economic and technical worth.

In other parts of the city rainwater management measures have also been developed in which run-off from the built-up area is restrained to the natural volume.

On private land in Hannover, decentral infiltration of rainwater is standard wherever the technical possibilities and the ground water conditions permit it.

7.3 Waste management

The aim of the Kronsberg waste management concept is to replace conventional waste disposal strategies with preventative waste management planning. Consistent waste avoidance and recycling was practised from the beginning of the planning and construction phases. Within the construction waste concept, the City of Hannover reached a contractual agreement with developers to use exclusively environmentally compatible and healthy building materials. For the construction phase, the City's Waste Management Service's 'low waste building sites' model project was devised to sort building waste on site. Recycling rates of around 80% were achieved.

The main component of the domestic and commercial waste concept is setting up innovative collection systems. Attractively designed containers close to the houses and pre-sorting bins in the apartments promote comprehensive waste separation. A grants programme supported home composting in the gardens.

Across the rest of the Hannover City Council area the basic waste treatment regulations to ensure provision of waste collection points are sufficient, monitored through development plan approval procedures.

There have been incentives for home composting in the city area since the introduction of organic bins; householders can save the organic waste collection charges by deregistering the bin. This incentive has also operated in the Hannover region since the introduction of the organics collection sack on 1 January 2003.



Figure 13 Waste collection points

Under the motto 'reparieren statt deponieren' (mend it, don't dump it) there is a close-knit network of repair and alteration services at Kronsberg. An advisory service on opportunities for low-waste consumer habits, waste separation, and a composting programme intended for both residents and businesses, completes the services strategy.

7.4 Soil management

By 2000 around 700,000 m² of soil had been excavated from the Kronsberg development. The central concern of the ecological soil management programme was to reuse these quantities within the district for landscaping and environmental enhancement. This rendered unnecessary the transportation of around 100,000 truckloads, thus avoiding the dust, noise and exhaust fumes they would have caused. Disposal and transit costs for developers were considerably reduced.

The excavated soil was used to enhance and create typical local biotopes, to raise two viewpoint hills on Kronsberg and a noise buffer embankment alongside a nearby motorway, to seal an old landfill rubbish tip, and for landscape enhancement around the World Exposition grounds.

Although the regulation of soil management through legal contracts proved its worth within a project like Kronsberg, compulsory participation in a soil management scheme only makes sense for a large-scale undertaking.

One example of this is an economical soil disposal enterprise to create a new recreational area from worked-out limestone marl pits on the edge of Hannover. A Plc was set up together with the private sector owners of the site, financed entirely from disposal charges. Soil management has here made striking improvements to the attractiveness of an area at no cost to the City!



Figure 14 Southern viewpoint

7.5 Kronsberg environmental liaison agency (KUKA)

KUKA GmbH was jointly founded by the City of Hannover and the 'Förderverein der KUKA e.V.' trust whose membership was made up of institutions closely concerned with the construction of the new district. Further funding came from the German environmental foundation, 'Bundesstiftung Umwelt'.

'Environmental liaison' is the general term for a carefully devised range of communications instruments aimed at conveying an appreciation of the environmental consequences of actions, raising environmental awareness and offering possible courses of action motivating people to more environmentally responsible behaviour. In this spirit KUKA monitored and promoted the ecological development of the Kronsberg sustainable city district in the areas of energy, waste, soil, water, landscape, farming and mobility. It was the lead agency for public relations work and presenting the projects, organised specialist conferences, and offered guided tours and information on the district with targeted publications. Working with five cooperation partners, KUKA devised a comprehensive skilling and qualification programme of ecological advisory and training measures for planners, craft workers, and residents of the new Low Energy district.

After KUKA was wound up in 2001 Hannover City Council initiated the foundation of a non-profit climate protection agency. The 'Klimaschutzagentur' combines and coordinates all climate protection activities within the Hannover Region and makes a strong contribution to linking economic and ecological interests. Together with its partners, prestigious enterprises, business institutions and associations, the agency devises campaigns, organises marketing of climate protection measures and advises on modernising existing buildings, replacing old heating systems, solar energy applications, electricity saving, wind power, bioenergy, natural gas-powered vehicles, environmental education and other climate protection issues.

Environmental communications work has continued on Kronsberg – albeit in a more modest form - because changes in awareness, values, habits and behaviour cannot be brought about overnight. Residents can consult a local contact person from the City of Hannover Environmental Protection or Urban Planning at the KroKuS arts and community centre. The proven guided tour concept focussing on urban planning, ecology and nature conservation continues to be offered nationally and internationally and is very popular.

8 EVALUATION

In the early summer of 2000 Hannover City Council commissioned a study to evaluate the first energy consumption data; collation and analysis of actual savings and energy flows in the Kronsberg district were to show whether the projected reductions of 60 or 80% in CO₂ emissions had been achieved.

Detailed monitoring over three years (1999 - 2001) of the monthly consumption of all apartments (with a total floor area of around 213,000 m²) showed that the measures had led to a 28% reduction in CO₂ emissions across the settlement caused by space heating, hot water and electricity.

Energy provision for heating and hot water in all Kronsberg buildings is via district heating from gas-powered decentral cogeneration plants (CHP). District heating that produces both heat and electricity saves on primary energy and a further 19% of CO₂ emissions.

Three wind turbine generators with a total electricity capacity of 3.6 MW were operating by 2001. When one includes these plants in the Kronsberg balance, they are saving a further 28%, 3,100 tonnes, of CO₂ emissions. This means that the CO₂ per Kronsberg resident released into the atmosphere is 75% less than the average, reduced from 1.7 to 0.4 tonnes per year, and that the overall target of 80% savings has almost been achieved!

9 TRANSFERABILITY

In planning and building the new Kronsberg district it has been possible to apply the main aims of ecological construction and integrate them within an overall concept. Making allowances for local economic preconditions and consequences, the experience gained at Kronsberg can also be of use in other projects, both new-build and renovation of older properties.

The excellent results from the Kronsberg project have led to a resolution by Hannover City Council to transfer the standards piloted there to the entire city area. Ecological planning parameters, in tandem with expert advice, have been devised to give comprehensive information to clients, building contractors and investors about instruments for ecological construction, aiming to make the issues of energy, water, waste, soil, environmental communications, and also nature conservation, more important in future construction projects. Constantly growing awareness among home-builders and property developers will mean that 'ecological construction' will become the industry standard.



Figure 15 View from Kronsberg towards the city centre

RESUME:

With its exemplary ecological, urban planning and socially sustainable Kronsberg project the City of Hannover has assumed a leading role, both in Germany and across Europe, in applying the aims of Agenda 21 by creating an excellent example of sustainable urban development.

KEYTHERMES:

Sustainable urban development; Social planning; Green space; Transport planning; Ecological optimisation