Pilestredet Park in Oslo: Implementation of an environmental programme in large-scale urban development.

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1. INTRODUCTION

Pilestredet Park is located in the city centre of Oslo, at the site of the former National Hospital of Norway. The ground area is ca. 73 000 m2. Of the original buildings, containing 110.000 m2 gross floor area, 50.000 m2 will be demolished. New buildings will have 75 000 m2. Refurbished hospital buildings will have another 60 000 m2, giving a total of 135.000 m2 in the finished project. 900 dwellings are planned within the area, together with educational facilities, shops and offices.

550 of the 900 dwellings on 5 separate sites within Pilestredet Park will be built by a joint devevelopment venture established by the housing division of Selmer Skanska together with OBOS (Norway´s largest cooperative housing organization). The author is partner in GASA architects, who act as environmental coordinator. Together with Lund & Slaatto architects, GASA is also responsible for the arcitectural design of the housing projects of Selmer Skanska and OBOS.

Pilestredet Park marks a transition from small-scale pilot studies to large-scale urban implementation of principles for sustainable building in Norway.

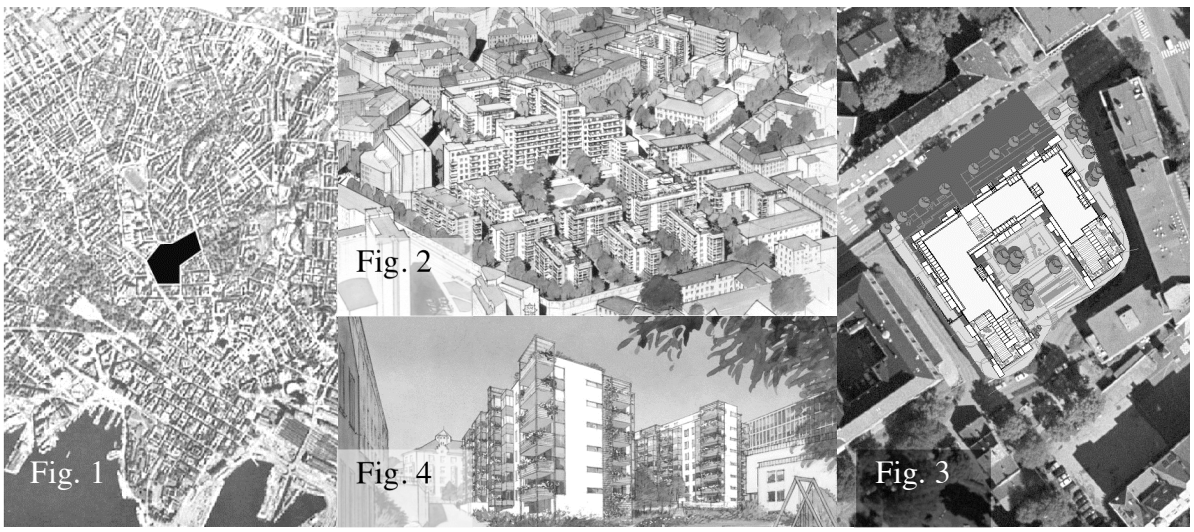

Fig. 1: Location of Pilestredet Park. Fig.2: Perspective overwiev. Fig. 3 and 4: Area H, containing the first 155 of a total of 550 dwellings to be built by Selmer Skanska and OBOS. The site plan (Fig.3 shows common roof terraces connected to each staircase.) Green roofs will be a distinct feature in the new housing projects in Pilestredet Park.

2. THE ENVIRONMENTAL PROGRAMME

For Pilestredet Park the Directorate of Public Construction and Property in Norway (Statsbygg) has formulated an environmental programme for the planning, construction and maintenance phases. The scope, the quantified aims and the legal, organisational and procedural commitment required from the developers sets this programme apart from comparable efforts in Norway.

2.1 The scope

Many projects labeled as sustainable have a narrow focus, often related to energy. The environmental programme for Pilestredet Park covers a very broad spectre of sustainability. issues. The titles of the main chapters of the programme are illustrative:

- **The utilization of resources:** General aspects, materials, water, energy. Waste during construction and use.
- **External environment:** Emissions to air, water, and soil. Avoidance of harmful materials.
- **Health, well-being and security:** Working environment during demolition, construction and maintenance. Indoor climate, including daylight. Transport. Landscaping.

2.2 The quantified aims

Environmental programmes have a tendency to be general, leaving ample room for interpretation by the developers. For Pilestredet Park, the aims are spesific and quantified. It may be argued that some are moderate, compared to the most advanced solutions. The principle of quantified aims is, however, important. A well documented failure to meet an aim proved irrelevant may be very useful to developers of future programmes and building codes.
Examples of spesific environmental aims in Pilestredet Park are:

- 90% reuse of demolition materials.
- At least 25% weight reused materials in new buildings and outdoor paving, landscape fillings etc.
- No use of materials containing over 0,1% weight) of chemical components on the OBS- list developed by the Norwegian Pollution Control Authority.
- Max tap water consumption 150litres per person and day.
- Max run-off of surface water for each area specified as a proportion of total allowed run-off for Pilestredet Park.
- Max energy consumption 100 kwh/m2/year, (Low-energy scenario in nordic climate, 30% less than recently revised building codes.)
- Waste for disposal less than 30% of total volume (both during construction and use).
- Max equivalent noise level 2dB(A) lower than city norm for Oslo.
- Max 10 person injuries resulting in more than one day of absence per million work hours.
- Maximum 1 water damage per 100 000 m2 built gross area and year.

2.3 The legal, organisational and procedural commitment required

The environmental programme clearly specifies the responsibilities of developers, consultants, contractors and users/dwellers. Coordinators shall be apointed for the design and planning process Procedures for documentation and external control are described.

Instructions are given to incorporate the programme in the contracts with developers. Sanctions are to be imposed if instructions are not followed.

3. STRATEGY FOR IMPLEMENTATION

The joint development venture (Selmer Skanska Housing / OBOS) commisioned architects and technical consultants to carry out preliminary design and documentation for public approval. A design and build contract, including the consultants´ detailed design and the following up during construction. was in turn negotiated with Selmer Skanska acting as total contractor. According to the environmental programme, deviations from the aims shall be noted and negotiated before public approval. Thus the implementation of the programme was dependent on systematic efforts during the first months of a very tight time shedule for design.

3.1 The environmental control plan

PILESTREDET PARK ENVIRONMENTAL CONTROL PLAN		PHASE: PRELIMINARY PROJECT				Page 4 of 7	
THEME		ENVIRONMENTAL AIM		SURVEY / ANALYSIS / DESIGN (DOCUMENTATION)	DEADLINE	FIRM/ORG.	PERS.	CONTROL
3. Water MOP 3.2.2	M	Use of tap water in dwelling areas shall be maximum 150 litres per person and day. Measurement of water consumption shall be possible in the individual flat. Quality water for drinking is an important health issue. Accordingly, only pipes and tubes shall be used that emits as little as possible of hazardous substances. Materials must also be safe during fire.	D	Establish capacity-defining situations for tap-water consumption. Design water supply system with water-saving components. Establish procedures for control of components regarding harmful emissions. Integrate measurement and payment systems that incites water saving. This system must be integrated with other systems.	15.09.00	HVAC= HVAC consultant	AV	EEC
MOP 3.2.2		Surface water: Max run-off (top capacity): 103 l/sec x percentage of area to total area of Pilestredet Park. Calculations must be submitted that verify that the aims for maximum run-off for the individual area is		Develop solutions that ensures the necessary delay in run-off of surface water. Coordinate plans with the overall landscape plan for Pilestredet Park. Develop designs that supports the use of water as a positive environmental component, and resource for watering	15.09.00	HVAC LARCH	AV AAS	EEC

Fig. 5

The key tool in the early implementation of the environmental programme was the environmental control plan. It was formed as a simple matrix, defining design, calculation or surveying tasks necessary to verify that the design met each of the detailed requirements. The outline of the control plan is shown in fig. 5. The aims of the environmental progamme are listed to the left. The actions to be taken, and the firms and persons responsible are described in the succeding columns.

3.2 The environmental control form

PILESTREDET PARK ENVIRONMENTAL COORD.		CONTROL FORM				
DATE:	SIGN.			PAGE 2 OF 6		
AIM IN PROGRAMME (MOP) OR SELF-DEFINED. AIM		DEVIAT. REPORT	DEVIAT. ACCEPT	AIM REVISED	SURVEY COMPL.	AIM FULLF.
Materials MOP 3.2.4.1	Minimum 90% (weight) of demolition materials shall be reused.	☐	☐	☐	■	■
	The materials shall be reused on highest possible level (minimum processing). Minimum 0,25% direct reuse, and	☐	☐	☐	■	■

Fig. 6

To ease the overview of the status of the implementation process, a diagrammatic table was developed. The basic lay-out of the control form is shown in fig. 6. Deviations from or modifications to the environmental programme are noted, and the prognosis for aim fullfillment is described.

3.3 A hierarchy of control documents

During the detailed design and construction phases, the implementation strategy was extended to a series of hierarchically structured control documents, shown in fig.7

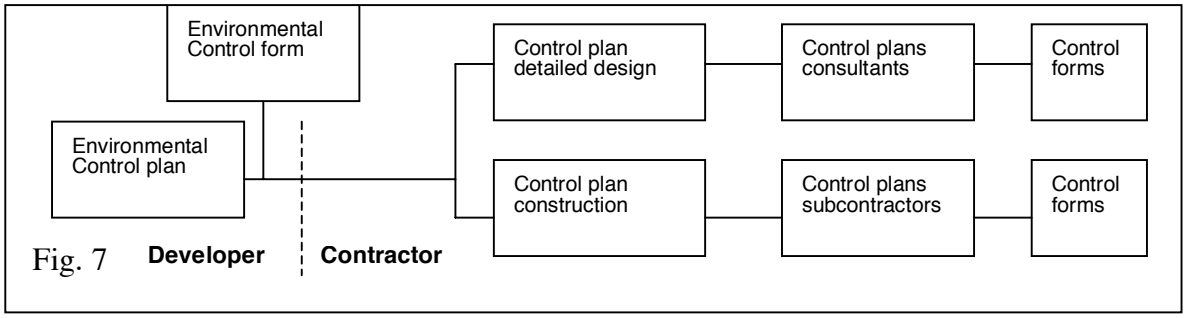

Fig. 7

4. EXPERIENCE GAINED DURING IMPLEMENTATION.

4.1 Tender and negotiation

On initiating the bidding process for the sites, the Directorate for Public Construction and Property (Statsbygg) were uncertain about price consequences of the envrionmental programme. The bids turned out to lay within market expectations.

During preliminary design, the number and quality of flats, the area effectiveness of the plans, and the rationality of the constructions and HVAC systems were closely monitored. The environmental control plan was essencial in the early evaluation of the economical implications of the aims for sustainability. At the time of writing, stable sales indicate that the environmental performance is not a threat to the economical.

The ambitious programme, the open tender and the following negotiatons put considerable pressure on the participants. At the same time, the results of the process are more likely to be applicable throughout the industry.

4.2 Organisation and people.

Environment-friendly innovation must be backed by central management and embedded in adecquate business strategies. But changes in priorites and behaviour also requires people with enthusiasm and stamina. In the Pilestredet Park case, Selmer Skanska´s own environmental department, led by Hilde Hermundsgård Reine, had developed in-house expertice, leading to certification according to ISO 14000. They were able to allocate adequate resources to the collection and structuring of relevant product data. In the OBOS organisation, architects Mette Sjølie and Per Andersen had gained considerable experience from environmentally oriented projects, and contributed during the crucial, initial design phases.

4.3 Coordination and control.

Appointing environmental coordinators, both on the developer and the construction side has proved necessary to integrate the efforts to meet the environmental aims. The coordinators have interdiciplinary responsibilities, and should have experience from cross-professional team work. Arne Linja, an experienced building engineer, was appointed environmental coordinator for the contractor, backed by an enthusiastic team handling subcontracting and site management.

The traditional split between design and construction, even whithin total construction firms, represents a coordination problem. The coordinator at Pilestredet Park came from the construction side. To ensure implementation of the programme, separate control plans were made for construction and detailed design.

As coordinator for the developer, the author specified that the environmental programme should be integrated into the ordinary control systems being used by all participants during planning and construction. At the time of writing, this has been done by the architects, but it remains to be seen how deep this integration will reach.

It is the author´s firm belief, based on experience, that separate control systems related to different codes, regulations and programmes represents a quality and safety risk. Real control.requires integration of control systems.

4.3 The programme

During the initial design phases, the environmental programme was put to test. Most of the aims has proved relevant, and a challenge, whithout demanding exessive efforts. Some requirements, however proved inadequate, impossible or unreasonable, and were modified after negotiations with Statsbygg. These are some examples:

- The detailed town planning regulations specified building locations and sizes that excluded daylight factors of 2% in many of the dwellings. The daylight analysis was presented to Statsbygg, and the requirements modified.
- The planning regulation also required stepped-back top floors with private roof terraces. It turned out to be difficult and unfunctional to build large roof terraces, specified in the envrionmental programme, on top of such top floors. Again, negotiations resulted in a compromise. The common, green roofs will be built, but the form and location will vary according to the regulations of the site.
- The requirement for 3 in-house bicycle places in an area with an expected occupancy of 1,66 persons per flat was questioned. This demand turned out to be expensive, and resulted in larger basement areas and increased excavations. The requirement was reduced to 2,5 places per flat.
- Methods for measurement of local dust spreading proved inadequate, and alternative strategies were tried out in cooperation with Norwegian Institute for Air Research (NILU). Selmer Skanska ended up building their own dust measurement station.
- Demands for reduced noise levels during construction were impossible to meet for some processes (for example pole ramming). Instead, a scheme for time limitiation was agreed upon with the local health authorities, together with a neighbourhood information plan.

On a more general level, the environmental programme appears to reflect the strength and the priorities of the expert groups that developed it. The materials section is long and very detailed. The chapters on energy and water are much shorter, and in the case of water, less ambitious than both energy and materials. This indicates that a calibration process should have been carried out, aiming to coordinate the strength of the requirements, anchoring them in an overall priority of environmental issues.

The programme, however, still stands out as the most ambitious, thorough and operative one made by a State agency for a large project.

5. PRELIMINARY RESULTS

At the time of writing, the first of five sites are in an andvanced state of construction. So far, several important results have been achieved:

- Untypically, compared to many recent developments, the most attractive roof terraces are reserved for common use by the dwellers in each appartment block. The roofscapes shall meet aims for size and coverage with plants of different sizes.

- Measures for time-limitation of noise production, reduced dust spreading and cleaning of transport vehicles has reduced negative impact on surrounding areas.
- More than the required 90% of the demolition materials are being reused. Pilestredet Park contains large demolition projects, so this indicates that a major building industry waste source can be virtually eliminated.
- More than the required 70% of construction waste is being reused or recycled. Traditionally, 40% of the waste for disposal comes from the building industry.
- A calculated energy consumption of 100 kWh/sqm.y has been achieved. The most important measures beeing improved insulation, a high degree of heat recovery and demand-controlled heating and ventilation. Calculated results will be tested via monitoring.
- Loads on urban pipe system is greatly reduced by on-site measures for delayed run-off. Tap water consumption calculated to be reduced to the required 150 litres pr. person and day.
- Extensive screening of materials vastly reduces the occurence of known harmful substances.
- A new type of prefabricated, hollow concrete floor elements has been developed to meet the aim of 25% reuse of materials in new constructions. This , in turn, has reduced the manufacturers´s environmental expenses.
- A 20-point programme has been developed to reduce water damage during construction, and to prevent negative impact on indoor climate.
- The combined effort of the "clean building site"-policy and the desentralized waste collection and sorting results in improved working environment.
- A specially developed information programme for workers on site secures the implementation of the environmental programme. Innovative solutions has come out of this.

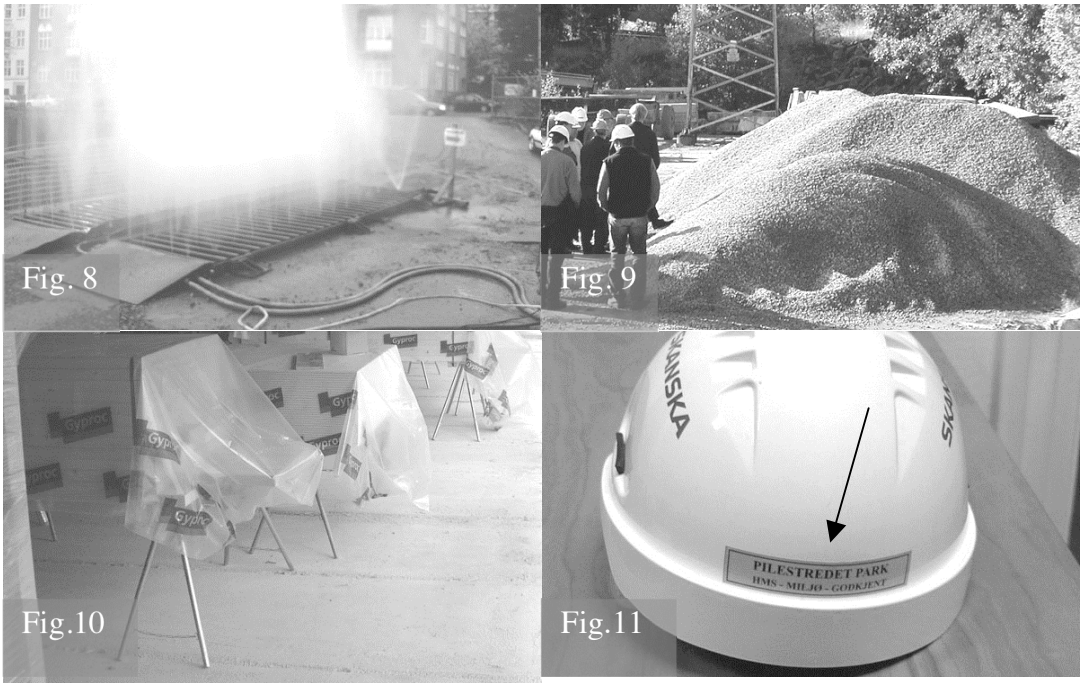

Fig. 8:On-site vehicle wheel cleaner. Fig.9: Grinded wasteproducts for reuse in concrete slabs. Fig. 10: elevated board stacks for easy floor cleaning and reduced manual lifting height.Fig.11: Helmet sticker certifying for on-site work after recieving information on environmental programme.