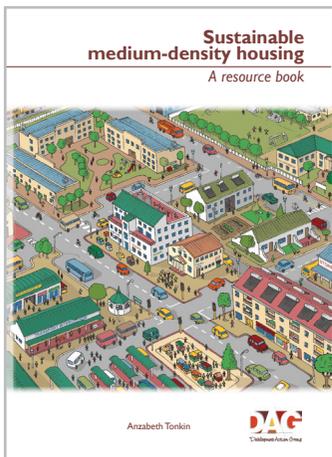


URBAN LAND MATTERS

A DEVELOPMENT ACTION GROUP PUBLICATION

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MEDIUM DENSITY



In 2008, the Development Action Group (DAG) published ***Sustainable medium-density housing: A resource book*** about sustainable and affordable medium-density housing.

This series, ***Urban Land Matters***, is adapted from the book to bring DAG's research to a wider audience, offering innovative and accessible planning ideas to government officials, practitioners and communities. If you would like more information on the concepts contained in these issues, please refer to the book. It's available on CD or on DAG's website: www.dag.org.za.

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1. How housing delivery can contribute to sustainability
2. Why social, institutional, environmental, physical and economic factors should all be considered
3. Why people must be educated about benefits of sustainable technologies
4. How the current settlement design norms impact resource efficiency
5. How different layout plans, service options and designs affect overall sustainability

OTHER TOPICAL ISSUES

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Industry
passing costs to users

Open Space
a vital part of good neighbourhoods

Energy
Options
for the household

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WAIT! THERE'S MORE...



Learn what 'good design and construction' mean for low cost housing in South Africa.

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Understand the elements of good design for low-income households.

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Development Action Group

AfriSam
Build with Confidence

Eskom announced that the price of electricity would double in the next three years. This will be devastating to the poor, who cannot afford to pay such high prices. Even now, many families forgo electricity, using wood or paraffin to cook their food and heat their homes. As such, we must use more sustainable building techniques to reduce electricity costs for the poor.

Did you know?

“Ideas such as design for energy efficiency, passive solar design, water efficiency measures, the use of renewable construction materials, sound solid waste management and good location, have been sacrificed in the drive to meet the large need for housing in South Africa. In attempting to reduce the huge housing backlog, the mechanisms to fund housing favour the production of large quantities of houses rather than providing space to enable attention to detail or quality.”

Napier and Mulenga, Urban Land Mark

Good design and construction

In South Africa there is a lack of knowledge of green building products, technologies, services and design for resource efficiency among most housing stakeholders, including government and non-government, profit-motivated and non-profit role players as well as tenants and owners. The South African Property Owners' Association recently established a Green Building Council to promote environmentally sustainable practices in the property industry. The impacts of current settlement design norms – such as single houses on large plots with full-pressure water supply, water borne sewerage, grid electricity and poor insulation – militate against resource efficiency.

This is especially problematic in the low-cost housing sector, where the government subsidy produces a standardised and non-innovative dwelling unit, especially when delivered by developers. These houses are generally neither environmentally efficient nor appropriate, placing an undue financial burden on the end-user. **However, well-built housing, as a fixed asset with a long life, can make a significant contribution to overall environmental sustainability because it consumes large amounts of resources in its construction, maintenance and use. Understanding the social and environmental implications of different layout plans, service options, house designs and implementation approaches is crucial. Though there is no one model that leads to resource efficiency, there are many water, sanitation, energy and construction technologies that serve as ‘pathways’ toward sustainability.**

Moshoeshoe Eco Village

Located in Galeshewe Township near Kimberley, Moshoeshoe was developed as a pilot project by the Sol Plaatjie Municipality. Moshoeshoe is one of a few low-cost housing projects countrywide that incorporated affordable environmental innovations into 13 units of the medium-density housing scheme. Substantial savings on electricity bills resulted from the use of various alternative energy sources:



- solar water heaters and photovoltaics;
- gas stoves;
- energy-efficient light bulbs and appliances;
- electricity used only for lighting and appliances;
- urine-diversion toilet systems;
- dual-type alternative dry-sanitation systems;
- sand-filtered grey wastewater irrigation systems.

According to the project review by the *Social Housing Focus Trust*, a key lesson learnt is the importance of having frank discussions with residents about the acceptability of environmental interventions, particularly sanitation systems. Communicating benefits to the community, especially financial benefits, can encourage the acceptability of alternative technologies. Furthermore, capital investment related to environmental projects is usually very expensive, but has to be considered over the long-term where savings will be realised. This pilot project will be monitored to compare the long-term costs of green developments with conventional buildings, taking into account funding requirements for solar panels. *See pages 148-150 in the Resource Book.*

The 40% industry

PASSING COSTS TO END-USERS

The REAL costs of the construction industry – greenhouse gas emissions, pollution, resource exploitation, segregated cities and sluggish economic development – are all passed on to the consumer in various ways. First, the construction materials are produced inefficiently, then the physical layout is designed inefficiently, then the dwelling unit is built inefficiently, and finally, the burden of all these inefficiencies comes to bear on the end-user, who cannot afford the running costs of such an unsustainable home.



The construction industry is responsible for around 40% of all resource consumption and 40% of all waste production, and is therefore referred to as the '40 percent' industry.



It generates huge wastes, accounting for between 30-40% of the global total. This becomes even more significant with the inclusion of demolition wastes.

It is further responsible for 20-30% of all greenhouse gas emissions.



Poor thermal design can lower temperatures up to 5° C in the winter, and heating requirements by 50%.



Tall buildings, large housing projects, and indefensible open spaces correlate strongly with crime and gangsterism.



Lack of grey water recycling increases water consumption by 40-60%. Regular flush toilets use twice as much water as low flush.

COSTS OF CONSTRUCTION

Construction accounts for one-sixth of total global freshwater consumption, and 30-40% of global energy consumption.



The materials that form the basis of construction have huge environmental effects – cement production is, after the burning of fossil fuels, the biggest anthropogenic contributor to greenhouse gas emissions, while steel is one of the most energy-intensive materials. The manufacturing and use of both materials is also very water-intensive.



COSTS OF DESIGN

Other environmental problems associated with the construction industry are the loss of arable land, release of toxins into the biosphere, deforestation and pollution.



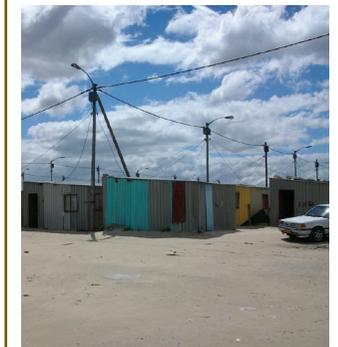
The lack of adequate natural lighting impedes daytime activities, and forces additional reliance on electricity.

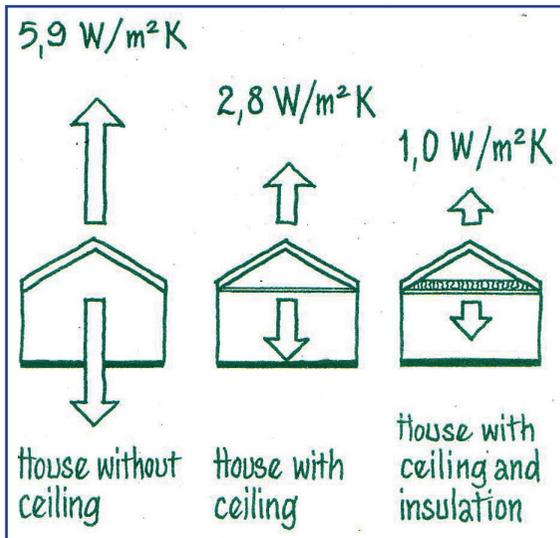
Lack of on-site facilities for children (play areas, crèches) increases cost to families.



COSTS TO USER

Poor location greatly increases all costs, particularly transportation costs, for residents.





Heat loss in low-cost housing. Source: The National Energy Council

Did you know?

The best way to build more sustainable infrastructure is to build higher-density settlements. Increased population densities put pressure on physical infrastructure such as roads and transport, sewerage, water and stormwater, electricity and others. Many studies have shown that the cost of upgrading existing infrastructure is far less than housing the same number of people in low-density greenfield developments. Poulsen and Silverman, from Wits University, state that increased densities allow for more points per line, while peripheral settlements require new bulk service connections at huge cost.

Elements of design

In low-income areas, household sizes vary from 1-10 people, with the median around five. Research has shown that there is a link between overcrowding and respiratory infections (TB, bronchitis, tonsillitis). There is also a link between overcrowding and psychological distress. Here are some interventions that promote good health:

Plot size and position: When determining plot size and shape, developers should consider land prices, beneficiary affordability, cultural practices and local values. Most low-income plots fall between 100m² and 150m², providing enough space for unit extensions, vegetable gardens, washing lines and outside space. In the past, the ideal size of a low-income site would have been 200–240m², with a street frontage half the depth of the plot. However, the 1:2 proportion of such sites proved to be inefficient for infrastructure, so a 1:3 proportion (or less) is now recommended, allowing more connection points and smaller service runs for water and sanitation lines.

Housing units: There have been many attempts to define the adequate size of housing units: The Association of Mortgage Lenders specifies that foundations and slabs must have a minimum size of 40m², with a 20m² enclosed area; the International Association of Building Officials specifies that at least one room in every dwelling must have a minimum area of 11m²; while the UN recommends a three-roomed, 38m² house for a family of two, and a five-roomed, 62m² house for a family of six. Low-income families, however, cannot usually afford such houses and have to take an incremental approach to construction, beginning with a very small dwelling unit.

Thermal acceptability: The high cost of artificial heating causes low-income households to rely on the passive thermal performance of their units. 'Passive thermal design' takes account of factors such as the sun, wind, rain, topography and seasonal changes, and is responsive to the local climate. Comfortable temperatures range from 16–32°C, with an optimum temperature of 21–22°C. These temperatures can be achieved through: thick walls and insulation, wide roof overhangs and staggered buildings that do not shade each other. Additionally, houses should be north-facing and have north-facing windows. A study determined that north-facing dwellings were comfortable 28% of the time in winter, as opposed to 11% for those facing west.

Protection from damp: Dampness can be prevented by ensuring sufficient roof overhang to protect walls from rain penetration. A damp-proof membrane beneath the floor slab and damp-proof coursing in the walls are necessary to prevent rising damp. Also, good ventilation promotes dry indoor conditions. Many low-income projects in the Southern Cape Coastal Condensation Area display high levels of damp and rain penetration. Cement block-walls (single skin), common in low-cost housing, do not prevent penetration. The National Housing Standards require the introduction of lime into the mortar mix to offer more protection.

Ventilation and lighting: Fixed ventilation can provide fresh air and remove indoor pollutants, particularly if the unit allows for cross-ventilation. Additionally, well-placed windows provide direct sunlight, lowering the cost of electricity and producing favourable psycho-physiological effects on thermal comfort and biological activity.

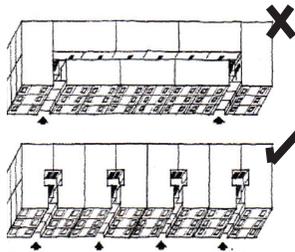
Noise: Noise from neighbouring units or common areas can be a source of frustration and conflict. Outdoor noise reduction can be achieved through distance from the source (traffic, outdoor areas), landscaped surfaces and transmission barriers. Interior noise reduction requires thick, shared walls and sound-absorbent materials.

Open Space

With increased densities and reduced availability of private space, the issue of semi-private, semi-public and community open space becomes particularly important. Adequate provision of open space is very often the decisive factor in the success or failure of higher-density developments. Spaces which accommodate individual and collective human activities are referred to as indoor and outdoor 'non-unit' spaces.

Maintenance

A household's claim to territory diminishes proportionately to the number of households sharing it. Communal open space is only used if there is a sense of ownership, enclosure and safety.

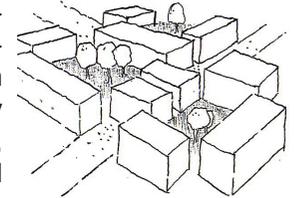


Design Variety

The same building envelope can be designed in numerous ways to create different results. The smaller number of units sharing an entry and landing gives residents better control over public spaces, as intruders can be identified immediately and acceptable behaviour can be established among residents.

Multi-functionality

Public spaces should fill a variety of possible functions to suit different activities and populations within a development. Quality spaces are comfortable, offering enjoyment and protection.

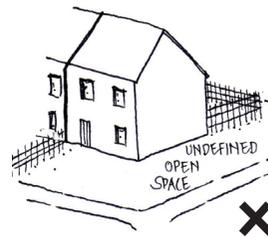


Human Scale

Buildings and public spaces in lower-income higher-density areas are often not humanly-scaled and do not promote positive social interaction. These developments are generally in much worse condition than middle-income developments, because there are no funds for security and maintenance, particularly for common areas. Often these disagreeable spaces detract from the overall public environment.

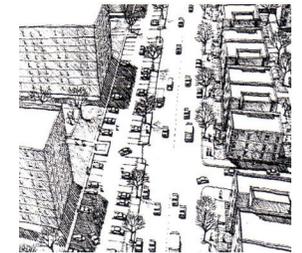
Territoriality

The physical layout should allow residents to control the areas around their units such as streets, grounds outside their buildings, lobbies, corridors and stairways. Defined spaces lend themselves to community control.



Maintenance

It is important that maintenance and responsible use of communal open spaces are set out unambiguously from the outset. Residents can play a positive role in the maintenance and upkeep of their housing.

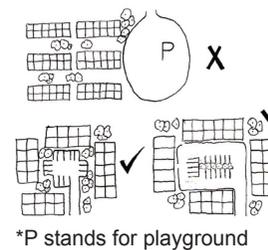


Hard Space

A hard space system including roads, pathways and public spaces is a very important part of a housing environment. It must provide areas for community interaction and economic activities as well as areas to exercise, play and relax. Attractive, well-lit pedestrian paths should be provided and pedestrian traffic should always be prioritised over vehicular traffic. Some unpaved areas are critical for water run-off.

Children

Young children need simple, spaces that are easily supervised, while older children require hard-surfaced areas for specialised activities. It is important to distribute play areas throughout the project, serving clusters of units.



*P stands for playground

Separation of space

The separation of different areas for different activities can be done by planting, paving, curbing, landscaping, trellising, retaining walls and outdoor equipment. Caring for communal vegetation can be difficult, but the greening of residential areas is extremely important: trees and plants improve the 'sense of place' of an area and provide enclosure along routes and around public spaces.

E ENERGY OPTIONS

FOR THE HOUSEHOLD

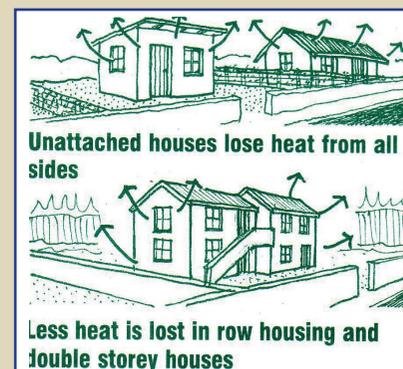
From the outset, developers and government should recognise that the relationship between sustainability and housing provision is two-way: incorporating principles of sustainability into housing design, development, maintenance and refurbishment will not only make a significant contribution to the achievement of general sustainability objectives, but will also provide important advances in the quality, durability and cost effectiveness of housing, increasing resident satisfaction and ownership of the entire housing environment. Often subsidy beneficiaries cannot afford operational and maintenance costs after moving into their units. By using sustainable energy options, monthly costs can be significantly reduced, especially over the long term. Sustainable service provision necessitates the involvement, education and training of residents, particularly around the ecological and social returns of the alternative technologies. Here are a few easy, cost saving interventions. *See pages 165-171 in the Resource Book.*

	SUSTAINABLE ENERGY OPTIONS
COOKING	<ul style="list-style-type: none"> Hotboxes and solar cookers are affordable and easy to use. Gas rings and electric hot plates have low electricity requirements. Composting biomass and sewage can be used as energy for cooking.
LIGHTING	<ul style="list-style-type: none"> Compact fluorescent light bulbs (CFLs) or low energy diodes (LEDs) use 25% of the energy and last eight times longer than incandescent bulbs.
HEATING	<ul style="list-style-type: none"> Installing a ceiling, insulating walls and paying attention to the size and placement of windows generates a more thermally efficient house. Shared walls in attached housing cuts building costs and saves energy.
HEATING WATER	<ul style="list-style-type: none"> Water heating consumes a third of total domestic power used. Vertically pressurised heaters are better than combination heaters because the shorter pipes save energy. Solar water heaters can pay for themselves in 2-5 years through electricity savings and could save families up to 70% of their normal electricity costs.
REFRIGERATION	<ul style="list-style-type: none"> Well-insulated, electric, CFC-free refrigerators are recommended. Paraffin refrigerators are slightly cheaper but have more health and safety risks.
MEDIA APPLIANCES	<ul style="list-style-type: none"> Solar panels are currently very expensive, but can be affordable with grants. Solar or wind-up radios are cheap and easy to use.



PRINCIPLES OF GREEN SERVICES

- 1. Different types of services:** Educate residents about advantages and disadvantages of ecological options in order for them to make good decisions.
- 2. Affordability:** Initial and ongoing costs must be affordable for residents and government.
- 3. Flexibility:** Consider residents' ability to pay when planning for upgrading and expansion
- 4. Impact on the natural environment:** Consider the reciprocal impact of services and geology, soil, slope, drainage, climate, vegetation and animal life.
- 5. Appropriate technology:** Technology must be appropriate to residents' skills and needs.
- 6. Services are interrelated:** Consider the installation of services in an integrated way.



Row housing is more energy efficient than detached housing because there is less opportunity for heat to escape.

Source: The Sustainable Energy Book, S. Ward.

Service and infrastructure options

Energy: The Energy and Development Research Centre (UCT) analysed technologies suited for low-cost housing, including shared walls in row housing, ceilings, insulation, windows and partitions. All costs (initial capital outlay, operation and maintenance) were added up and deducted from all benefits (long-term energy savings). Ceilings, wall insulation and window size provide substantial savings in typical low-cost housing. Shared walls (in row housing, detached housing) provide even more significant savings, as do solar water heaters.

Water pressure: An in-house tap is regarded as the minimum standard water supply in urban areas. A semi-pressure water supply system is cheaper than a conventional full-pressure water supply, in which water is supplied directly to taps inside the dwelling. High water pressure causes a greater degree of leakage and tap washers and toilet valves have to be replaced more often. In the semi-pressure water supply system, water is supplied to a tank in the roof, from where it runs down pipes and out of taps by gravitational force. Durban Metro Water successfully uses this form of on-site water supply for low-income housing projects.

Toilets and baths: The consumption for multiple-tap house connections is typically 150 litres per capita per day, with the highest consumption for flush toilets and baths. Water consumption can be reduced through dual-flush toilet cisterns and low-flush toilet suites (which use 4.5 litres instead of the nine litres), low-flow shower heads and water conserving taps.

Sanitation: Waterborne sewerage (despite the use of lots of water) remains the most accepted form of sanitation because it is convenient, clean, safe and healthy. Piped water and sewerage systems are important components of urban form and inform the plot configuration, site layout and movement route. Relatively straight movement channels, increased densities and houses situated near streets promote sustainable sanitation systems.

Water recycling: Water conservation strategies for higher-density housing should include recycling of grey water (rainwater harvesting or bath water recapture) to be used in toilet flushing and landscaping (reducing potable water consumption by at least 40% and 60% respectively). Stormwater run-off should be minimised using permeable paving, grassed surfaces and retention systems. Consumer education and owner/tenant accountability are paramount to ensuring that water is used responsibly.

Solid waste: Well-functioning solid waste systems must be in place in high-density areas in order to reduce health risks, prevent damage to the natural environment and prevent unregulated dumping. Operation and maintenance of waste management systems are usually the responsibility of the local authority, but can also be driven successfully by communities. Community-based recycling projects can create employment and minimise waste disposal. Waste management systems must be affordable and acceptable to the community.

Construction materials: Developers and contractors involved in higher-density housing should source their materials from local, environmentally-responsible manufacturers in order to reduce cost and energy consumption. Some good strategies for sustainable construction include: using materials that are inexpensive to transport; using good quality materials that will not need to be replaced; recycling construction waste to avoid extensive reliance on landfills; and refurbishing existing structures to decrease material costs.

MATERIAL	KILOJOULES / KILOGRAM
Steel	20
Recycled steel	3.6 - 5.5
Aluminium by hydro-electricity	75
Aluminium by coal-fired power	167
Recycled aluminium	4.7
Zinc	46 - 52
Polythene	138
Polypropylene	145
Polyvinyl chloride (PVC)	103
Polystyrene	45
Cement	13
Glass	14-18
Tiles	4
Clay brick	4

Preventing crime through good design



Reducing the opportunities for crime through well-planned pedestrian routes, informal trading areas and mixed-use and extended-use facilities.



Limiting the potential danger posed by reducing and managing open spaces and vacant land.



Providing appropriate lighting in parks, along streets and pedestrian routes.



Providing adequate infrastructure and facilities such as roads and telecommunication to improve interaction between communities and police.



Managing the built environment efficiently, for example replacing light bulbs timeously, trimming trees and vegetation when required and collecting refuse regularly.

5 options for crime prevention

Good planning and design plays an important role in reducing crime and in helping residents to control their housing environments. Complex and anonymous housing environments make it difficult for a code of behaviour to be established among residents, but incorporating a small number of 3 and 4-storey walk-ups in well-located and mixed-use areas reduces anonymity and decreases crime. Based on international studies and guided by the local context, the Council for Scientific and Industrial Research (CSIR) identified five principles that can establish how a physical environment either reduces or increases opportunities for crime:

1. Surveillance and visibility: Passive surveillance is the casual observance of public and private areas by residents during the course of their normal activities. The extent of visual contact that people have with a space, together with the degree of their being visible to others, determines the extent to which they feel safe. This depends on a range of factors that include windows, doors and other openings, the distances between buildings, the sizes of public spaces and vacancy rates. Likewise, visibility is the degree to which an environment is made visible by lighting and uninterrupted lines of sight. Dark or twisting streets, alleys, entrances and doorways can act as hide-outs for potential offenders and increase fears of crime.

2. Territoriality: is a sense of ownership of one's living environment. Territoriality and ownership are encouraged when residents identify with the space. A sense of ownership improves the likelihood of passive observers intervening in criminal activity. Territoriality can be increased by stimulating a sense of ownership and responsibility through the definition of public and private space and limitation of unused open space.

3. Access and escape routes: Certain types of criminal events and sites are deliberately chosen for their easy access to escape routes. Similarly, the availability of access and escape routes add to the safety of potential victims. Clear sign posting of streets, buildings and exit routes are important ways of assisting victims.

Crime in walk-ups & high-rises

	TOTAL 30.0	TOTAL 41.0	TOTAL 68.0
Interior public space	5.3	16.5	37.3
Outside grounds	12.7	10.0	16.2
Inside flats	12.0	14.5	14.5
	3 floors	6-7 floors	13-30 floors

4. Image and aesthetics: The image projected by a building or a public area has been clearly linked to levels of crime and particularly to the fear of crime. This link is often referred to as 'crime and grime.' Urban decay and degradation make people feel unsafe. Unmaintained vacant land and unoccupied buildings can contribute to decay, as do litter and the breakdown of services. The image of spaces can be improved by ensuring human scale in design, using attractive colours, providing good lighting and creating space for activities.

5. Target hardening: reduces the vulnerability of targets by the physical strengthening of building facades. Walls and burglar bars are the most common examples. Though target hardening physically reduces opportunities for crime, it should not violate other good design principles such as visibility.

COMING UP NEXT: Next month's issue will be about Value Capture.