Supplementary Design & Planning Guidance

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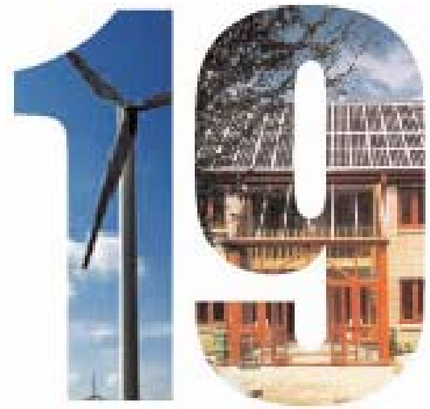


(October 2003 Version)

Sustainable Design, Construction & Pollution Control

Available online at www.brent.gov.uk/planning

An interactive version of Brent's Sustainable Development Checklist is also available online

The covers are printed on chlorine-free and conservation-grade paper and the text is printed on 100% recycled paper.

CONTENTS

Foreword

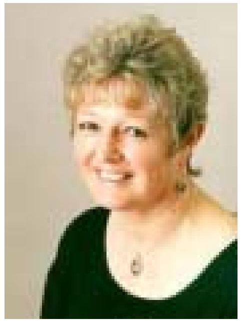
Over the last 10 years, the negative effects that people are having on the environment have become clearer. Atmospheric pollution in urban areas is seriously affecting many people's health. We are using more energy created from fossil fuels which is not only using up a limited resource, but is also producing gases that lead to global warming by harming the ozone layer. The climate is already changing, with more extreme weather such as floods and typhoons. Noise pollution is also harming our quality of life, especially in crowded towns and cities. We simply cannot go on as we have been doing.

Sustainability is about achieving environmental, social and economic aims in a balanced way that can be enjoyed by everyone, now and in the long-term future. But we cannot leave these problems national governments and international agencies to sort out alone. Local communities also have a responsibility to develop more sustainable ways of living. Brent Council's corporate strategy identifies '*Promoting the quality of life and the green agenda*' as one of its main aims during the period from 2002 to 2006.

The built environment is a very important factor of sustainability. We need to look ahead to make sure that we consider the needs of the future in what we design and build now, by conserving, recovering and reusing scarce resources and preventing pollution. As statutory regulators of the local built environment, Brent Council has special responsibilities through the planning, environmental health and building regulation processes to develop more sustainable workplaces, homes and recreation areas.

This *Supplementary Guidance* complements existing design and planning guidance on urban design, transportation, economic and community issues. It focuses on the principles and practice of designs that save energy, sustainable materials and recycling, saving water and controlling pollutants. It emphasises environmentally sensitive, forward-looking design, and is consistent with current Government policy and industry best practice, aiming to be practicable and cost-effective.

You should read this document with Brent's Replacement Unitary Development Plan and the latest Building Regulations. By following it, we can make a real contribution at our local level towards building a sustainable future for the whole world. We recommend it to all our partners who work with us in producing, developing, using and protecting the urban environment in Brent.



Councillor Ann John

Leader of the Council

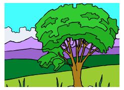
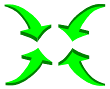
Councillor Lesley Jones

Executive Member for the Environment & Planning

Introduction

I.1 Principles of Sustainable Design

A sustainable environment is about building with the needs of the future, as well as the present, in mind. Meeting the current Building Regulations is not enough. Sustainability has to be part of the design from the start of a development project. Good sustainable design is based on the following principles, *by being*:

1. INTENTIONAL 	Sustainable design doesn't just happen by chance. To be environmentally and financially effective, it needs to be a stated aim of the developer and all members of the project team from the beginning of a development scheme.	7. PARTICIPATORY 	Design that involves users of a development (where they are known) and provides opportunities for future occupiers to take responsibility for their own energy us, and waste management, is more sustainable
2. PLACE SENSITIVE 	Location, location, location! The site and its context (topography, microclimate, wildlife habitat, nearby development, etc.) should be the starting point for designing and building sustainably. A design that works in one location may not work as well in another place.	8. CREATIVE 	Creative and simple solutions are often the most sustainable in many instances. Advanced technology can play an important role in challenging situations, but over-designed and complicated technical 'fixes' use more resources and are often not available to, or affordable by, most people.
3. .INTEGRATIVE 	Realising that there are close links between development layout, energy, materials, construction and pollution. The combined effect of positive design choices can bring maximum environmental, social & financial benefits, when the whole development acts as a unified sustainable system	9. FLEXIBLE 	What we build now will often be in use in a century or more, so we must design what we build now in ways which, as far as possible, anticipate changing needs. Although we cannot predict future developments, we must build in ways which will make it easier to respond to changing needs throughout the life of the building.
4. LONG TERM 	Sustainability does not have to be expensive. It can often bring short-term savings, but you needs to realise that you can get a greater overall return if you invest more to begin with. 'Spending to save' is not a bad motto	10. LOCALLY RESPONSIBLE 	Sustainability is an incremental process and simple design features can have many benefits – the more local developments that are sustainably designed and constructed, the more sustainable will be the quality of life in London the UK & world
5. HEALTHY 	Sustainability is about maintaining health and survival – human, animal and plant health, and most importantly the health of our planet. –, According to Gaia Theory, the earth is also a type of huge 'living' organism on which our own survival depends	11. COOPERATIVE 	Sustainable design works *with* nature – using the opportunities offered by place and time cycles – such as, day and night, the changing seasons, sun, wind, vegetation. It does not use unnecessary resources in trying to control nature (for example, by building homes on high-risk floodplains and then putting up defences).
6. EFFICIENT 	Using less energy in the first place is more economical than producing more and reclaiming used energy. Energy efficiency is at the centre of sustainable design and good practice has shown that it can bring big savings, not only in the amount of energy used, but also in the investment in mechanical equipment.		

The following sections of this document cover the main aspects of sustainable design, as defined by the principles outlined here. We have also included some case studies of different kinds of development where these principles have been imaginatively and successfully applied.

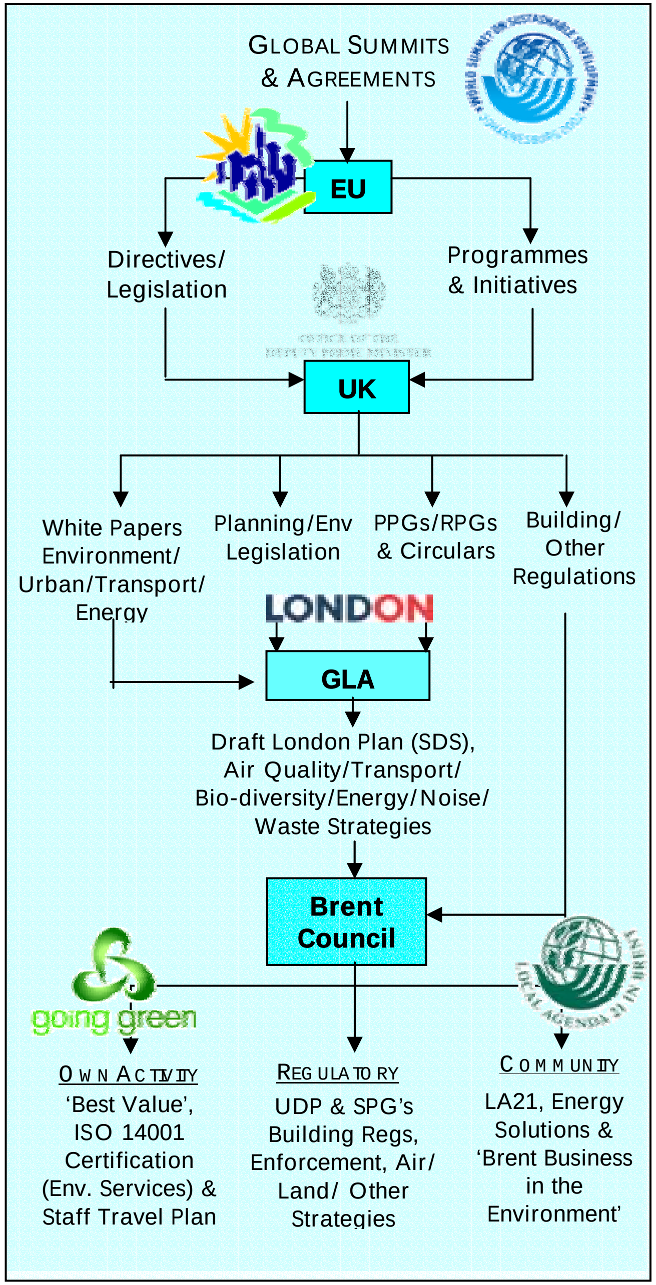
We hope you find it useful.

I.2 Legislation and Policy

The origins of sustainable development as an environmental approach arose from global meetings and agendas. An agreement on sustainability was signed by 180 countries at the 1992 Rio de Janeiro summit to protect the earth and prevent environmental, social and economic breakdown. The 1997 Kyoto Protocol set challenging targets for developed countries to reduce pollution and the amount of limited resources used. The 2002 World Summit in Johannesburg agreed more priorities. European Union Directives are implemented through national legislation, and there are various legal, policy, financial and voluntary measures to tackle the UK Government's sustainable development strategy. At strategic level, the Greater London Authority must make ensure that London contributes to UK sustainable development. In Brent, the Adopted Unitary Development Plan (UDP) included some sustainability policies but the Replacement UDP, (Policy BE12) specifically includes more sustainable design, construction and pollution control issues. This SPG document develops the principles and requirements further.

	LEGISLATION/STATUTORY/AGREEMENTS	KEY POLICY GUIDANCE/ STRATEGIES
GLOBAL	• Johannesburg Summit 2002 poverty and fresh water priorities • Kyoto Protocol 1997 Pollution & fossil fuel reduction Agreement • Rio de Janeiro 1992 International agreement: Agenda 21.	• Convention on Biological Diversity (1992) • Brundtland Report, United Nations Commission on Environment & Development, 1987
EUROPEAN UNION	• Strat. Env. Assessment: Plans/Programs/Projects Directive, 2001 • Landfill Directive, 1999 • Construction Noise Reduction Directive, 1999 • Eco-labels Directive, 1992 • Urban Waste Water Directive, 1991 • Framework Directive on Waste, amended 1991 • Construction Products Directive, 1989 • Directive on Environmental Impact Assessments (1985)	• Biodiversity Strategy, 1998 • Club of Rome, 'Factor Four', 1998 • Green paper on the Urban Environment" 1990 • Natural Habitats, Wild Fauna & Flora Directive • Conservation of Wild Birds Directive • Environmental Noise Directive • Proposed Green Paper on Soil Pollution, 2002?
UNITED KINGDOM	• Building Regulations, 2000; Revised Parts E, F, H, J1,J2, L: sound, ventilation, ,drainage, heating systems & energy • Contaminated Land Regulations (2000) • Pollution Prevention Regulations (2000) • TCPA (Environmental Impact Assessment) England/Wales 1999 • Water Supply (Water Fittings) Regulations (1999) • Road Traffic Reduction Act (1997) • Environment Act (1995); Noise Act (1996) • Home Energy Conservation Act (HECA, 1995) • Conservation (Natural Habitats) Regulations (1994) • Clean Air Act (1993); Noise & Statutory Nuisance Act (1993) • Water Resources Act (1991) • Town and Country Planning Act (1990) as amended • Environmental Protection Act (1990) • Wildlife & Countryside Act (1981 as amended)	• Energy White Paper, 2003 • Building a Better Quality of Life: A Strategy for more Sustainable Construction 2000 • Waste Strategy 2000 • White Paper –Towns & Cities: Urban Renaissance 2000 • A Better Quality of Life: UK Strategy For Sustainable Development, 1999 • White Paper -A New Deal for Transport: 1998 • Planning for Sustainable Development: Towards Better Practice, 1998 • National Air Quality Strategy 1997 • PPG's 1 policy, 3 housing, 9 nature conservation, 10, 12 Plans, 13 transport, 14 waste, 22 renewables, 23 pollution, 24 noise & 25 flooding • UK Biodiversity Action Plan, 1994
LONDON	• The Draft London Plan: Mayor's Spatial Development Strategy (SDS), June 2002 • Regional Guidance for the South East (RPG9) 2001	• Mayor's Transport, Air Quality & Biodiversity Strategies, Draft Strategies on, Energy, Waste & Noise • Strategic Guidance for London (RPG3) 1996
BRENT	• Brent's Revised Deposit UDP 2001, Policies STR11, STR12, STR13, BE1, BE8, BE10, BE12, EP2, EP3, EP6, EP11, EP14, etc. • Brent's Adopted UDP, Feb. 1996 (Policies STR4, STR6, E1, E6, E7, E8, E14, E15, E16, etc.)	• Sustainable Design, Construction & Pollution Control, (SPG19) 2003 • Brent draft Air Quality Action Plan, 2003 • Contaminated Land Inspection Strategy 2002 • Brent Biodiversity Action Plan, 2000 • LA 21Action Plan 1997 & updates (1999-2001)

Levels of Environmental Actions



I.3 Purpose of the Guidance

Brent Council is committed to promoting sustainable design throughout the Borough by working with developers, property owners, architects, surveyors and engineers – in fact, all our partners, to make Brent a place where the design of development is environmentally friendly and will provide a high quality of life. We have produced this guidance to:

- Provide guidance to developers, on ways of meeting Policies STR6 & E7of the Adopted UDP, as well as Policy BE12 and other policies in the Replacement UDP, aimed at securing more sustainable development in Brent;
- Encourage developers and building professionals to consider sustainability from the earliest stages of the design process, and to go beyond minimum standards;
- Raise awareness among local residents, businesses and other Council units, by highlighting the expectations and features of current best practice in sustainable design, construction and pollution control;

How should you treat this Guidance?

<u>Supplementary Planning Guidance is a material consideration in deciding the outcome of planning applications, so you need to show that regard has been given in your proposal, to the contents of this guidance</u>.

This guide does not tell designers how to design or what a sustainable building should look like. It emphasises the main design principles and options of sustainability.

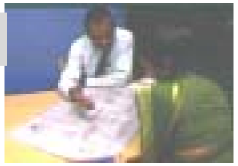
If you are a building professional, you could use this guidance as a project tool to support you in exercising your professional judgement, and help you check that you are doing as much as possible to design and construct your projects more sustainably.

This guidance: explains how you can achieve more sustainable design, construction and pollution control through the planning process; provides information on the main issues and factors you need to consider, and points you towards other more specific resources. You may have to compromise between different needs, limits and options. So both you, and we, may have to be flexible in designing and considering schemes.

How to Use this Guidance

DESIGN STAGE	ENVIRONMENTAL HEALTH	BUILDING CONTROL	PLANNING	STATUTORY/ SUPPLEMENTARY GUIDANCE
PRE-INCEPTION (consider optional sites/ solutions to meeting client needs)	*Brownfield Sites: Pre-application enquiries about Contamination*		*Pre-application Enquiries*	UDP; SPG19 (Introduction, Section C), SPG17 Contaminated Land Inspection Strategy
INCEPTION (client draft brief, hire design team)	*Located within an Air Quality Management Area (AQMA)?*		*Pre-application Enquiries*	UDP; Building Regulations; SPG19 (Introduction, Sections A, C)
FEASIBILITY (match client needs to site conditions, design options/costs)	Site Investigations	*Pre-application Enquiries*	*Pre-application Enquiries*	UDP; Building Regulations; SPG19 (Sections A, B, & C Contaminated Land Inspection Strategy
OUTLINE DESIGN (develop brief, schematic design)	Site Remediation Methods/Costs?	*Pre-application Enquiries*	Outline Planning Application	UDP; Building Regulations; SPG19 (Section A & B)
SCHEME DESIGN (final brief, general building design)	Air Quality/ Noise Assessments,	*Pre-application Enquiries*	Full Planning Application	UDP; Building Regulations; SPG19 (Sections A & C)
DETAILED DESIGN (component designs, working drawings),	Controlled Sub-stance Consents (Industrial uses)	Building Notice' (minor works) or Full Plans Application	Reserved Matters	Building Regulations; SPG19 (Section A)
CONSTRUCTION (implementation)	Method Statement Inspection/ Monitoring in use	Site Inspection		SPG19 (Sections B, C) Contaminated Land Inspection Strategy
CHANGES OF USE (conversions)		Full Plans or Building Notice Application	Outline or Full Applications	UDP; SPG19 (Sections A, B, & C)
DEMOLITION/ DECONSTRUCTION (site clearance)	Inspection/ Monitoring in use	Demolition Notice/ Site Inspection	Demolition Consent	SPG19 (Sections B & C) Conservation Area Design Guidance

I.4 The Application & Assessment Process



Pre-Application Enquiries

1. PRE-INCEPTION
   - Site – Is your site 'Brownfield' or 'Greenfield'?
     - ❑ Brownfield sites (which have been developed before) often offer benefits such as higher permissible density levels, being close to existing infrastructure, shops and services, as well as regenerating run down areas.
   - Location –Is it Public transport or Car oriented?
     - ❑ Sites in areas that have good public transport also have higher permissible density levels and a reduced need fro parking spaces.
   - Building(s) – Should you Build New-, Refurbish or Adapt?
     - ❑ Refurbished buildings conserve and recycle resources; can save time and money and can help regenerate derelict sites/areas while protecting urban character.
2. INCEPTION/FEASIBILITY
   - A 'Sustainability Strategy' should aim to tackle the following 3 aims:
     - ❑ *Environmental sustainability* – efficient use of finite resources (land, water, energy, raw materials), reducing pollution (air, water, land, noise), minimising waste & enhancing/creating new habitats;
     - ❑ *Economic sustainability* – offsetting development costs with savings over the lifecycle of the building & marketing opportunities (unique selling point);
     - ❑ *Social sustainability* – reducing 'fuel poverty' (where people cannot afford to heat their homes properly) and removing 'sick building syndrome,' providing equal access and 'designing-out crime' (See SPGs10 and 17)
3. STATUTORY CONSTRAINTS AND OPPORTUNITIES
   - Planning and Transportation
     - ❑ What does the planning policy say of your proposed development (what is acceptable on your site?) Will you need to carry out Environmental or Transport Impact Assessments (EIA/TIA)?
     - ❑ Some brownfield sites have a nature conservation interest. You may need to make an early assessment.
   - Environmental Health
     - ❑ Is the site contaminated? - What is required to deal with it?
     - ❑ Are noise levels acceptable? - What can be done to minimise problems?
     - ❑ Is the site in an AQMA? - What measures can be taken to enhance air quality?
   - Building Control
     - ❑ What are the options for meeting the Building Regulations and achieving an even higher standard, where feasible?
4. SUPPLEMENTARY GUIDANCE
   - Sustainable Design, Construction & Pollution control: Consider sustainability from the start of your project, so that it influences the design, construction and operation of the development. This also ensures that it will have a minimal impact on overall costs and that it brings returns in terms of the attractiveness, quality and saleability of the end product..
   - Learning from Case Studies: Consider case studies to see if there are specific sustainability features that can be designed into your type of development (e.g. residential, commercial, employment, mixed)
   - Sustainable Design Checklist: Fill this in and submit with your planning application, to indicate the level of sustainability of your scheme and help us monitor progress.

Dealing with Planning Applications

All applicants should apply the principles of this SPG that are relevant to their schemes. The Council expects all proposals meeting or exceeding the following thresholds to comply with the requirements of this SPG:

A. High buildings (25m), 1000 m^2 gross floorspace, or 10 residential units

B. 'Sensitive user' schemes e.g. housing, education & health proposals in AQMAs;

C. Demolition of buildings meeting the above thresholds.

Schemes below these thresholds should provide a Design Statement (See UDP Policy BE1 & new SPG4) but are not subject to this SPG. Householder schemes are exempt from this SPG, but may want to consider the separate Householders Guide.

5. Independent Sustainability Assessment (ISA) - This should be carried out for schemes meeting the above thresholds, if they score poorly on Brent's sustainability checklist, and on Schemes requiring an EIA (as part of the EIA). Currently only the BRE has an independent, nationally tested methodology:
   - BRE or licensed firms (*BREEAM*™ - Sustainability rating for offices, supermarkets, industrial, warehouse, and *EcoHomes*™ - Sustainability rating for homes).

   SA's are available from the following (or others with reputable methodologies):
   - Arup's 'SPeAR™' Sustainable Project Assessment Routine;
   - Buro Happold's *PSPA* - 'Project Sustainability Performance Assessment';
   - NHS (bespoke *NEAT* Assessment) for health schemes;
   - Institute of Civil Engineers, CEEQUAL –environmental quality assessment scheme.
6. Negotiations: The aim is to secure as many sustainability measures as feasible, within developments, by negotiation. For S.106 Planning Obligations & Conditions:
   - ❑ An appropriate level of sustainability is expected to be 'designed-into' schemes on-site. Where the Council accepts this is not possible, 'payments-in-lieu' to offset its deficiency in sustainability terms, may be accepted, for; Renewable Energy/CHP, SUDS, Clean Vehicle fuelling Stations, decontamination, etc. within the Borough. Operational conditions may be used in some consents to ensure developments function more sustainably.

I.5 General Sustainable Development Issues

The Unitary Development Plan contains policies which address the spatial implications, as well as the economic and social aspects of sustainable development. These are already well understood and integrated into the land use planning system. They are the subject of comprehensive UDP policies and detailed Supplementary Planning Guidance (SPG) and will not be replicated here. The following list is for reference:

A. Locational & Spatial Issues

- Public Transport Accessibility: Major trip-generating activities should be located in areas of very good or good public transport access, to ensure sustainable patterns of development, and reduce the need to travel by car (Policy SH3).
- Intensive (High Density) Design: A compact city is more sustainable than a sprawling, low density city. The increasing rate of urbanisation worldwide and the huge ecological footprints of cities mean that their outward growth should be constrained, to protect surrounding greenfield sites and rural areas. Good quality Intensive or high density design in accessible locations can help urban areas to accommodate needed growth, by making the best use of limited brownfield sites. (See UDP Policies BE11, H14, TRN6 and SPG 17).
- Mixed-Uses: A compact city is even more sustainable, if it is not too rigidly zoned i.e. if different activities are not totally separated (while still protecting vulnerable land uses and minimising the juxtaposition of conflicting uses). The close proximity of shops, services, and some residential development help to further reduce the need to travel by car, and create more activity, particularly in town centres and around transport interchanges. (See Policies BE11 & TRN6 and SPG17)

B. Economic Issues

- Local Economy: This involves ensuring adequate employment land for the creation of new jobs in a wide range of sectors (industry, business, creative, leisure as well as retail). In order to maintain this diversity of employment opportunity, land for uses such as industry and warehousing is protected from higher value uses e.g. retail. (See Policy EMP8)

C. Social Issues

- Community Safety: Crime and the perception of insecurity has a negative affect on people's quality of life and the willingness of developers to invest in an area. Design can play a key role in making the public realm a safer place for everyone. (See Policies BE5 and SPG10).
- Social Inclusion: The 1980s out-of-centre shopping and leisure trend resulted in the closure or lack of upgrading of town centre facilities, which meant that people without cars, could not use these facilities. Convenient and sustainable access (i.e. public transport, cycling, walking) to fresh food, services & facilities, is needed for all members of the community to benefit. (See Policies CF1, 2 and 13, TEA1, 2 and OS20).
- Adaptability - 'Adaptable' buildings can be modified or extended at a low cost to suit the changing needs of the occupants. This extends the life of the property and increases its value. Adaptable or lifetime housing is designed to enable future modifications to be made, catering for changing family size and lifestyles, ageing or disability, and home-working/telecommuting. Designers should:
  - Allow flexible roof space
  - Include a ground floor toilet/bath or lift options
  - Layout flexible external space
  - Use more open plan layouts and/or moveable partitions where suitable.

D. Environmental Issues

- Sustainable Design: This is the main focus of this supplementary guidance document. It is covered by Policy BE12 in the Replacement UDP:

BE12 SUSTAINABLE DESIGN PRINCIPLES

Proposals should embody sustainable design principles, commensurate with the scale and type of development, including taking account of:

SUSTAINABLE DESIGN

(a) incorporating built forms, technologies, orientation and layout that will contribute to reduced energy consumption (e.g. ventilation, heating/cooling, lighting) and associated emissions;
(b) avoiding negative micro-climatic effects (e.g. wind turbulence, noise reflection);
(c) taking into account where feasible, the potential for the re-use of existing buildings and materials and environmental effect of building materials used;
(d) making adequate, integrally-designed provision for the storage and recycling of waste;
(e) the potential for the management or recycling of water;

SUSTAINABLE CONSTRUCTION

(f) methods to protect important flora, fauna and/or topographical features during construction and to minimise disturbance to local amenity;
(g) methods to maximise recycling and re-use, as well as minimising waste during demolition and construction;

POLLUTION CONTROL

(h) sustainable remediation of brownfield sites redeveloped for sensitive uses, will be sought, and where contamination remains in-situ, a monitoring regime will need to be agreed;
(i) measures to minimise the impact of poor air quality on sensitive users in Air Quality Management Areas (See Policy EP3); and
(j) noise levels from traffic, trains (near railway lines) or other significant noise-generators.

In assessing the sustainability of schemes under these headings, regard will be had to the supplementary planning guidance.

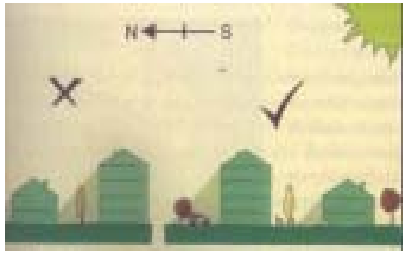
A. Sustainable Design

Urban Climate & Site Layout Strategies

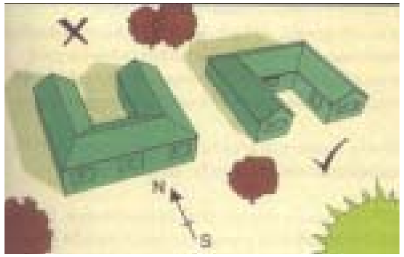
Urban areas create their own microclimate. Site layout planning can have a significant effect on environmental conditions, both within and around buildings, and will be influenced by the following factors:

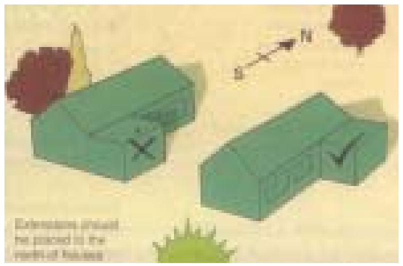
Temperature

Air temperatures in a densely built urban area will always be higher than in a nearby rural area – a phenomenon known as 'heat island'. In hot climates this can be a negative, but in cooler northern climates, such as the UK, it can be an advantage, reducing heating demand, and in very cold climates the phenomenon is often intensified by roofing over streets.



Figs.1a,b,c: Above, Tall/terraced buildings should be placed to the north of lower buildings, Below, Open courtyards should face south, and Bottom, Extensions should be placed north of houses. *Source: 'Environmental Site Layout Planning', BRE/DeTR 2000.*





A resulting layout strategy for London would include:

- Maximising passive solar gain for winter heating by orientation and avoidance of overshading
- Using sunlight as an amenity both indoors and outdoors
- Providing wind shelter
- Maximising daylighting

Wind speeds

Although not as important as temperature, wind speed has a considerable effect on site layout strategy. For much of the year reducing wind speeds and providing shelter will contribute to lower heating demand, but in the summer air movement can play an important part in cooling strategies, particularly for commercial and public buildings.

Building Type and Heating & Cooling Needs

For residential developments, the heating load over the whole year always exceeds the cooling load. Much of this heating load will occur in the early morning however and cannot be provided by direct solar gain; shelter, insulation and particularly thermal mass will therefore be important for conserving passive solar gains. For non-residential developments the cooling load predominates and key strategies will include:

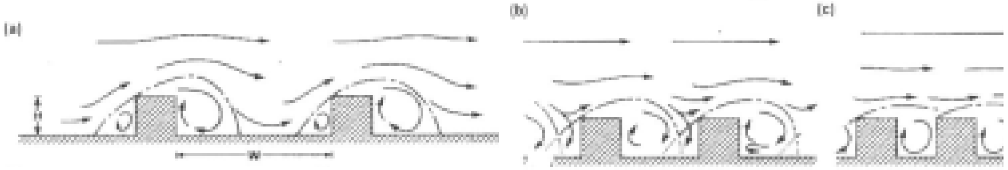


Fig.2: Wind flow associated with building arrangements of increasing height/width (H/W) ratio; a) isolated roughness flow, b) wake interference flow, c) skimming flow. *Source: 'Env. Site Layout Planning', BRE/DeTR.*

- Using natural ventilation as part of a cooling strategy;
- Managing pollution levels to aid ventilation;
- Enabling the maximum penetration of natural light;
- Using passive cooling including seasonally effective shading;
- Exploiting heat sinks such as vegetation and water features; and
- Laying out efficient floor plans - deep plans need less heating and more cooling

Summary

Environmentally sensitive building design needs to consider the relationship between buildings and the spaces surrounding them. The emphasis should be on forms that avoid:

- Overbearing visual impact
- Wind effects on the ground, especially around tall buildings
- Areas in permanent shade
- Glare or dazzle from reflective building faces

Sustainable Energy Use in Buildings

Energy used in buildings accounts for nearly 50% of Carbon Dioxide emissions in the UK. Energy is used to provide building services such as heating, cooling, hot water, lighting and for other appliances. The amount of energy and thus carbon dioxide produced is dependent on the building's energy efficiency, which is largely determined by its de

The aim of designing an energy efficient building is to produce a building that uses the minimum amount of energy to provide the intended function, such as comfortable living or working space with sufficient lighting and ventilation [See Revised UDP policy BE12(a)]. This is achieved by balancing two aims:

1. *Reducing the energy required by the building services by minimising heat loss in winter and heat gain in summer and using natural light and ventilation as much as possible.*

2. *Maximising the efficiency of the necessary building services to reduce the amount of fuel needed to provide those services*

This process needs to be integrated as using a smaller heating system can offset additional costs, such as higher levels of insulation. It is often the case that higher capital costs are usually more than offset by reduced running costs over the building's lifetime. Integrating sustainable energy use in the design of a building has these benefits:

- Promotes energy efficiency & resource conservation
- Raises demand for/viability of renewable technologies
- Reduces operational and maintenance costs
- Reduces environmental impacts of energy generation
- Creates a healthy and comfortable environment
- Combats climate change

How do we measure Energy Efficiency?

The Energy Efficiency of a building can be calculated using computer models, which use information readily available at the design stage. There are 3 methods recognised by the Building Regulations for calculating compliance with Part L:

- The Government's Standard Assessment Procedure (SAP) energy cost rating (from 1 to 120) is used for housing.
- The Carbon Index (CI) is based on the SAP rating. It measures CO_2 emissions and ranges from 0 to 10. An index of 8 or more must be achieved to satisfy Part L.
- The 'U-Value' measured in W/m2K. Target values for the whole building or elemental values; for dwellings - ground floor insulation (0.2-0.25) (walls (0.35), doors &windows (average of 2.2 wood/pvc or 2.2 metal) & pitched roofs (0.16).

London's Energy Strategy

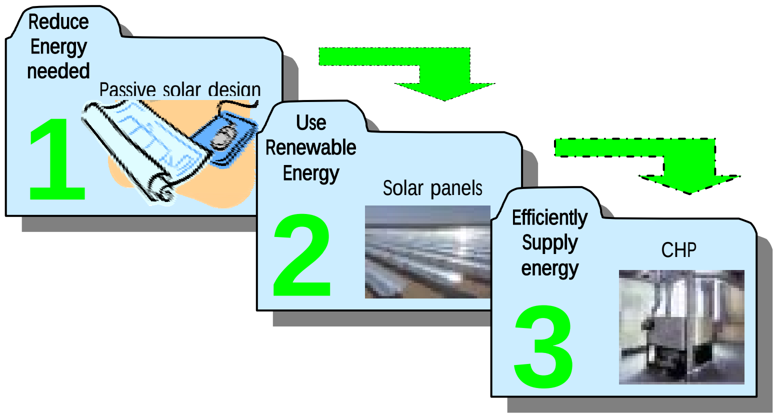
The Mayor's Draft London Plan also requires proposals referred to the GLA, to include an Energy Use Assessment and to demonstrate their application of the Energy Hierarchy set out in the Mayor's draft Energy Strategy.

This requires 3 steps (see diagram):

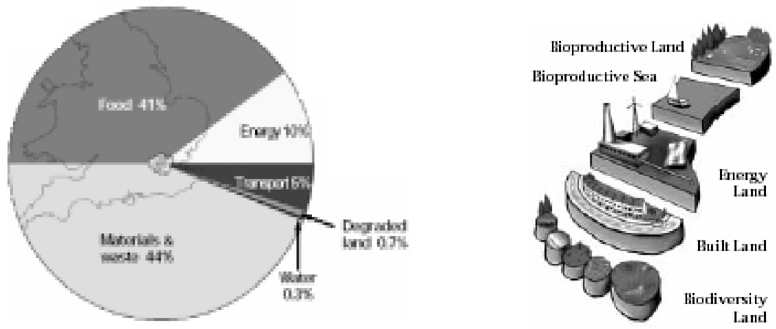
A. Apply Energy Efficiency measures (to minimise demand)

B. Apply renewable energy (first install on-site - if not feasible purchase from grid)

C. Optimise the efficiency of energy supplied (e.g. use CHP for remainder)



Energy use affects all aspects of sustainable development. Energy is used for transportation, for heating, lighting and ventilation, for the provision of water, for the procurement of materials, and for landscaping, construction & demolition, and waste disposal. It is considered a theme that runs through all the sections of this document..



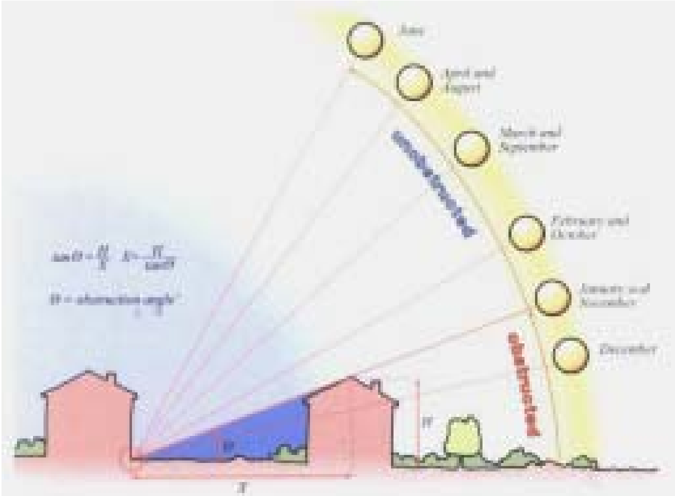
Figs.3a, b: Left breakdown of London's footprint. Right, Bioproductive Categories in Ecological Footprinting
Source: City Limits Report, 2002

The other consequence of energy use in all its forms is the bio-productive (land & sea) area required to supply it and absorb its wastes. This has been developed into the concept of an 'Ecological Footprint'.

Best Foot Forward (with funding from the GLA) have analysed the ecological footprint of London and found it to be 49 million global hectares (gha). This is 6.63 gha per Londoner (UK average is 6.3 gha, but actual earth-share should be 2.18 gha per person). There needs to be a 35% reduction by 2020 for Londoners to be sustainable. This is a useful measure of sustainability per person in a scheme.

1.0 Passive Solar Design

Passive Solar Design is the concept of designing a building to reduce the need for additional building energy services by minimising heat loss in winter and heat gain in summer and using natural light and ventilation as much as possible. This would include:



Figs.3c,d: Above Passive solar design allows buildings to be spaced for winter overshading. Source: 'Planning for Passive Solar Design', DTI. Below winter and summer sun paths, Source: 'Solar Homes Catch the Sun', Renewable Energy Information Office, Irish Energy Centre, 2000.

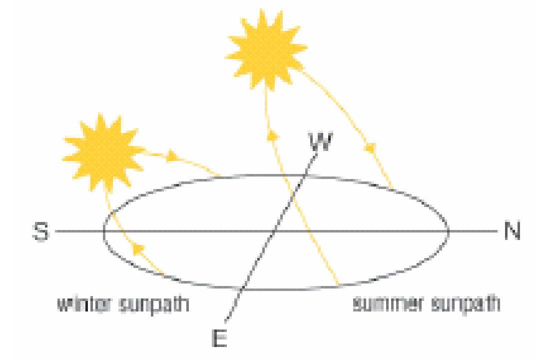
1. Solar gain for heating through proper orientation
2. Maximising the insulation value of the building fabric
3. Natural lighting and ventilation where possible
4. Solar overshading and reduction of summer heat gain

The converse is that coming to a satisfactory solution means avoiding the following problems:

- Over-heating due to excess solar gain in the summer
- Poor internal air quality in polluted urban areas
- Excessive heat losses through large glazed areas

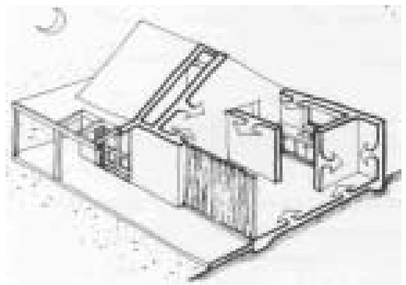
1.1 Solar Gain for Heating

Solar gain can make a significant contribution to the heating of a building although care has to be taken, particularly for buildings with large glazed areas, to create a design that avoids overheating in the summer. This could potentially lead to a large air conditioning bill and very uncomfortable working conditions.

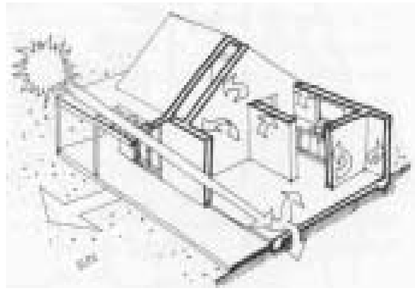


The relationship between glazed areas and orientation is critical. Orientation of the house within 30° of due south is a basic principle to maximise solar gains. It is important that glazed areas are made to a high specification to ensure that annual heat gains exceed heat losses. It should also be noted that in reality many people obscure windows with net curtains and blinds that also negate some of the heat gain effect. For further guidance on passive solar design, see the excellent DTI/DETR guide (Appendix III, Ref. 17)

It is generally acknowledged that conservatories and atria may be appropriate elements of passive solar design. However, unless carefully designed they can be counterproductive due to overheating in the summer (unless due consideration is given to shading and adequate ventilation is provided). Since even very good quality glazed units still lose heat at 5 times the rate of a well-insulated wall any heating installed in the conservatory will greatly add to the heat loss of a building.



Figs.4a,b: Winter day (Left) & night (below) – effect of sunspace. Source: Sydney & Joan Baggs 'The Healthy House'



1.2 Solar Shading & Avoiding Overheating

Overheating is one of the biggest problems in modern office buildings with large glazed areas and increasing amounts of electronic equipment emitting waste heat. In many modern buildings the answer has been to fit air conditioning, leading to large electricity bills and increased CO_2 emissions.

This can be avoided if the building is designed with features such as large thermal capacity, night cooling, overshading and reflective glazing. The design of modern office buildings is complicated by the need to avoid glare on computer screens. If care is taken at the design stage it is possible to design glazed areas to maximise use of natural light whilst minimising heat gain in the summer. Generally this leads to a more pleasant working environment and will greatly reduce the size of the air conditioning plant needed, if not eliminate it completely.

1.3 Minimising Heat Loss Through insulation

In a new building insulation can be generally integrated into walls, roofs, floors, and glazing may have high thermal performance. Generally, insulation is very cheap and current practice shows that highly insulated buildings, of which there are many examples, can be used throughout the year with very little additional heating other than natural heat gains from body heat, lighting and appliances.

1.4 Natural Daylighting

Daylighting is the controlled entry of natural light into a building through windows, skylights, atria, clerestory and other building envelope components. A properly designed daylighting system should admit only as much light as necessary, distribute it evenly and avoid glare and overheating. It is therefore important to engage or consult with an architect or lighting designer who is experienced in designing for daylight.

Daylighting offers building occupants a pleasant and highly valued connection to the outdoors– natural light and views evoke positive physiological and psychological responses that promote wellbeing and morale.

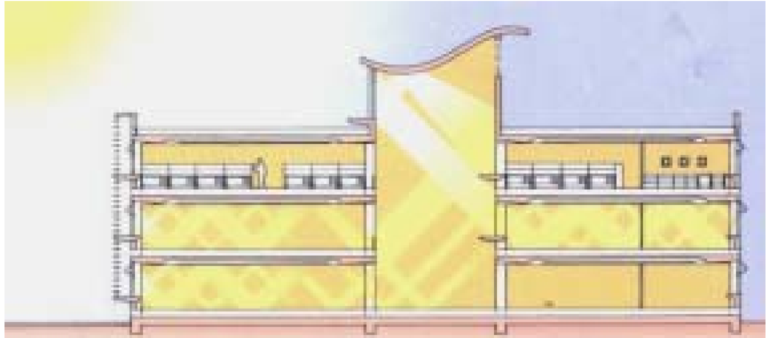


Fig.5a,b,c: Top, Natural lighting through an atrium. Source: 'Planning for Passive Solar Design', DTI. Below (Sunpipe). Source: Monodraught

These can translate into tangible economic benefits, as many studies show that daylighting can boost the performance and productivity of occupants by 15-20%, and when considered at the design stage, can lead to significant reduction in the use of electricity for light and thus reduce overall energy consumption by 10-30%.

When daylighting components are well integrated into the building design, the cooling load is reduced and less, or no mechanical ventilation is required.

The BRE has published a number of documents, including *'Site layout Planning for Daylight & Sunlight'*, 1991, which give guidanceon maximum and minimum percentages of wall areas to maximise natural lighting. Window sizes have a bearing on heat loss as well as fire risk to adjoining properties. Generally north facing glazed areas should be minimised with larger areas facing between SW and SE.. Where possible this principle should be followed unless for reasons of security and privacy.

In internal situations, uncontrolled direct sunlight is to be avoided as it can lead to visual and thermal discomfort. Diffuse light, is an efficient and effective source of light. It is also possible to use 'sunpipes' (See Fig.5) to bring natural light into windowless spaces such as corridors & stairwells

1.5 Natural Ventilation

Ventilation has become a much more important issue with the advent of modern construction methods, which reduce air leakage and reduced use of open fires.

Air conditioning systems also require an airtight structure for effective operation. But, these can reduce internal air quality by allowing the build up of chemical pollutants.

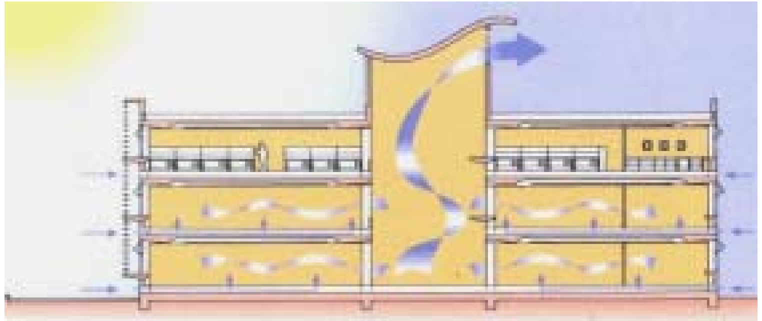
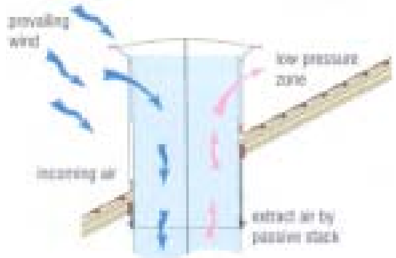


Fig.6a,b,c: Top, Passive stack ventilation through an atrium. Source: 'Planning for Passive Solar Design', DTI. Left & Right (Windcatcher).

The key to a good ventilation strategy is to ensure adequate ventilation for good internal air quality, but not too much so as to waste heat.



Natural ventilation uses the passive stack effect and pressure differentials to bring in cool fresh air from the outside through the building without the use of mechanical systems. This process cools the occupants and provides comfort.

Naturally ventilated buildings will incorporate openable windows or other means of outdoor air intakes including roof-mounted 'windcatchers' to induce vertical and horizontal airflow. Energy demand for air conditioning and mechanical ventilation will thereby be reduced or eliminated (See Fig.6 above)

2.0 Energy Efficient Building Services

The main aim of sustainable building design should always be to reduce the need for building energy services through passive solar design. This not only reduces annual energy bills, but can also reduce initial capital costs and general maintenance costs.

Energy efficient building services technologies are systems that use energy efficiently to provide services, such as heating, cooling, lighting, ventilation etc. [See UDP Policy BE12 (a)]. It is also important to realise that the total cost of providing a service such as heating includes not only the initial capital cost but also the ongoing fuel and maintenance costs. It is often the case that spending more on energy efficient systems at the construction stage saves much more money during the building's lifetime.

2.1 EFFICIENT HEATING & HOT WATER SYSTEMS

2.1.1 Heating & Cooling

The purpose of any heating and/or cooling system in a building is to provide a comfortable temperature for the occupants according to the building use. Following the first principle of passive solar design, to minimise the need for energy services, it is important to ensure that the necessary building services are sized correctly to take advantage of reduced capital and running costs. Oversized systems can also be less efficient if running well below maximum load.

There is a tendency to oversize since many systems are designed to 'rule of thumb' principles that no longer apply to modern levels of insulation and other recent influences. A well-insulated house needs a much smaller heating system, with smaller radiators and boilers than would have been used a few years ago. In office buildings overheating is a major problem which can be greatly reduced through passive solar design and features such as overshading and specialised glazing.

2.1.2 Heating

A good quality heating system provides heat at the right temperature when and where it is needed. Maximising the efficiency of a system requires that the conversion of fuel to heat is very efficient, and that the distribution of heat is controlled and not prone to heat loss. In London gas is freely available and is cheaper and more environmentally sound than electricity as a fuel for heat. For gas, a condensing boiler is the most efficient heat source.

Heating controls are probably even more important in determining the efficiency of a heating system. They are also important in ensuring maximum comfort for the occupants. The basic principle is to control the heating system so that heat is provided when and where it is needed. As this is determined by the occupants it is also important that the controls are easily understood and therefore more likely to be used properly. In a small building a single thermostat and timer may be all that is required.

However in larger buildings, different areas may need different temperatures at different times and some parts of the building may cool or heat up more than others. In this situation the heating can be zoned so that the different needs within the building can be met. Local control over temperatures also provides additional comfort.

Larger heating systems can be very complex and this document is not a heating design manual. However the building developer can influence the design of the system by insisting that the building meets certain standards that are set as part of Environmental Assessment Methods or Government Best Practice targets for energy use.

Many larger buildings are occupied by several businesses and whereas in the past energy bills may have been included with the rent, separate metering provides an incentive for individual users to be more energy aware and allows greater control of energy use.

It is also possible to use waste heat either from a heat intensive process in the building or from ventilation to heat incoming air using a heat exchanger (See Fig.8b).

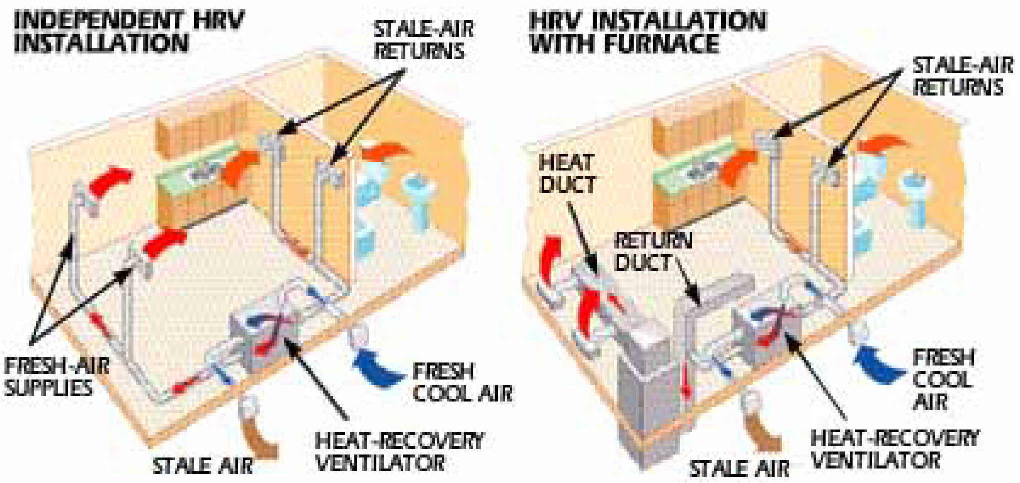


Fig.8b: Mechanical ventilation with heat recovery, by T. Klenck, & G. Retseck Source: 'Popular Mechanics' Aug. 2000,

2.1.3 Community Heating & CHP (Combined Heat & Power)

Where there is still a large heat demand, usually resulting from the building(s) being in continuous use, or through specific heating requirements such as a swimming pool, Community Heating or Combined Heat and Power (CHP) may be a good option [UDP policy EP14].

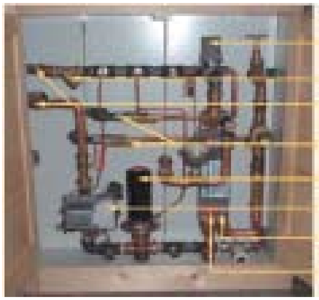


Fig. 7a: Community Heating Park View Southampton
Typical components replace boiler/hot water cylinder.
Source: .Good Practice, Case Study 400, BRE/EST

Self acting HWS valve
Strainer
Com Heat flow & return
Dwelling flow & return
Pressure controller
Heat Meter
C. water to heat exchange
Hot water to heat exchange

Community (or district) heating involves using a central boiler plant (or other heat sources) to heat a number of buildings through a network of well-insulated underground pipes. They can benefit from competitive fuel prices and can use alternative sources (combined heat and power or renewable energy, including geothermal.)

CHP makes use of the fact that when fossil fuels are used to generate electricity; most of the energy contained in the fuel is given off as waste heat. This heat can be used to provide heating and hot water. Mixed-use developments where there are various energy demands throughout the day tend to be the most cost-effective users of CHP. By the end of 2004 'micro' CHP systems (essentially domestic boiler replacements) are expected to be commercially available.

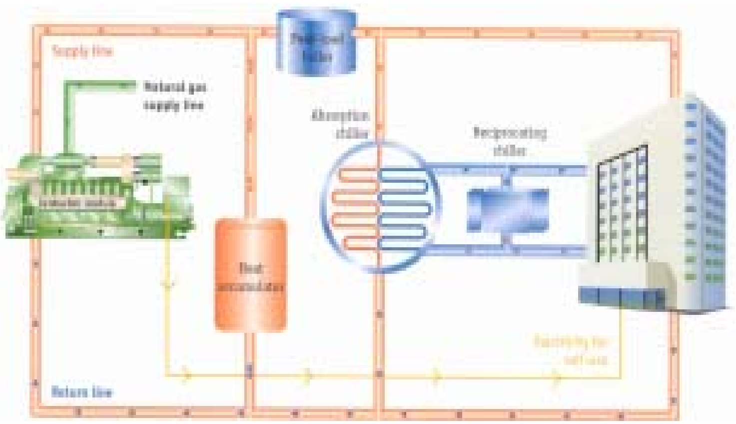


Fig.7b: Source; Jenbacher Energie-combination of CHP gas engine with chillers -cogeneration of heat, power & cold

2.2 VENTILATION & AIR CONDITIONING

Even with good thermal design, it is possible that some buildings will still need extra mechanical cooling. The limit for natural ventilation is 40 watts per m^2, and an office with high densities of people and electrical equipment could well exceed this. The 3 main methods of mechanical cooling are fans, evaporative cooling and air-conditioning.

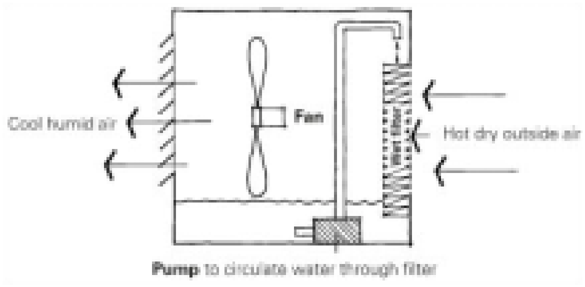


Fig.8a: Evaporative coolers use less energy and can be solar -powered. *Source: 'Your Home: Technical Manual', Australian Commonwealth.*

Fans: These are the first choice, and are cheapest to buy and run. They circulate air but do not reduce temperature or humidity. Portable table and floor fans or fixed ceiling and wall models are available. They are useful if combined with an air-cooling system as the extra air movement provides comfort at higher thermostat settings.

Evaporative Coolers: The second choice for mechanical cooling should be evaporative coolers. They work best in low humidity conditions as the air has greater potential to absorb water vapour. They are less effective in high humidity conditions. Windows and doors should be open for evaporative cooling.

2.2.1 Air-Conditioning (Refrigerated Coolers)

Air-conditioning and mechanical ventilation systems are more expensive to run and produce more greenhouse gas. Good design of these can:

- Significantly reduce running costs
- Reduce carbon emissions
- Improve system reliability
- Reduce life-cycle costs

Energy-efficient mechanical ventilation (MV) can sometimes be the best solution to ensure minimum fresh air requirements and effective pollutant removal. MV systems consume energy through the operation of fan motors. The amount of energy used depends on the pressure in the system as air is distributed through the building as well as the volume of air transported. These typically contribute 40-50% of fan electricity costs. Energy is saved if:

- The pressure drop can be reduced
- An efficient fan is selected
- Excess supply of air is avoided

A large building with a continuous cooling load would be best served by a centrally located 'packaged' chiller that distributes the cooling via ducted air or chilled water. Factory produced packaged units avoid long refrigerant filled pipe runs, minimising refrigerant use and the possibilities for leakage.

A small building with a variable cooling load would be best served by a small number of individual units. At the design stage it is important to:

- Avoid over sizing units. This avoids units running inefficiently at part load – motors and fans are most economical at constant near full load. Proper predictive calculations and low building air leakage rates will help to reduce the size of the unit(s) needed.
- Set up controls to prevent heating and cooling systems running simultaneously.
- Use cooling system only when temperature exceeds 21^{o}-24^{o}C
- Automatically switch units off at evenings and weekends unless there are special circumstances.

Heat recovery should be employed to pre-heat or pre-cool the supply air. The system should be controlled to either run at pre-determined periods or in direct response to the comfort/occupancy requirements of the building

2.3 Lighting

Artificial lighting will be required in all buildings. To minimise energy use, the following aspects should be specified:

- Design lighting to provide the correct levels; excess lighting levels can produce harmful glare as well as wasting energy.
- Ensure controls e.g. switches are easily understood and accessible, otherwise the temptation may be to leave lights on unnecessarily.
- Design wiring to allow smaller areas to be switched on or off instead of the whole room at the same time. This is useful where only part of an office is being used at night or tends to be darker than another part during the day
- Use automatic switches such as movement sensors or timers in areas where lights are not needed continuously such as toilets or security lighting.
- Use the most energy-efficient light fittings availbale.

2.4 RENEWABLE ENERGY SOURCES

Renewable energy is energy which is supplied, particularly as heat and electricity, from sources, which are constantly renewed, and which do produce any extra carbon dioxide (CO_2) emissions. Traditional fossil fuels are finite resources and always emit stored CO_2 when burned. A wide range of renewable energy resources are technically possible in the UK, including solar, wind, biomass, hydro, wave, tidal and geothermal, but only solar, geothermal, emerging fuel cell systems and, to a lesser extent, biomass, tend to be suitable for the urban environment.

BIOMASS is the technical term for organic material, both above and below ground, living and dead, such as trees, crops, grasses, tree litter and roots. The types of biomass used in producing energy include 'short rotation' energy crops like willows and aspen poplars, wood and wood wastes, food and agricultural wastes and sewage sludge. This diversity and ready availability make biomass a strong alternative to fossil fuels for future energy requirements around the world. Today, fast growing trees like willow and poplar can be used as commercial energy crops to meet local heating needs, or used in power stations to generate electricity.

These energy crops offer a means of developing a renewable source in many agricultural areas of the country, supplying power and creating employment. Wastes from agricultural and forestry operations can also be used in this way. In urban environments sewage sludge and food wastes are the most readily available biomass sources, together with tree and hedge prunings from parks and streets.

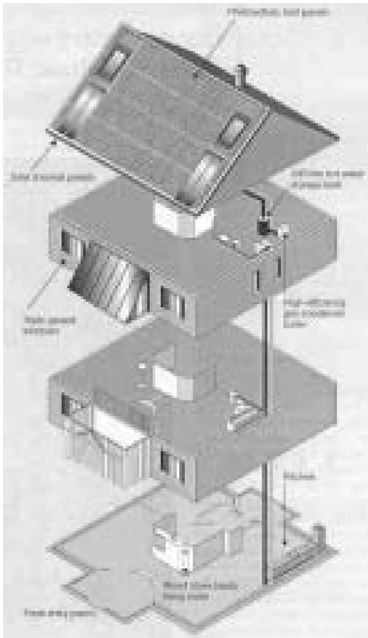


Fig.9a,b:, layout & elevation of Solar House, Oxford Source, *'EcoHouse'*,by Sue Roaf.

SOLAR ENERGY comes in two main forms, solar water heating, which can provide about 50-60% of annual hot water demand for a building, and photovoltaics (PV), which converts sunlight directly into electricity.

Government grants are currently available to home-owners, developers and the public sector to install both technologies and their payback period can be significantly reduced by integration into the fabric of a building during construction or refurbishment using building components such as PV roof tiles/cladding.

Photovoltaic technology converts sunlight directly into electricity. The interaction of sunlight with semi-conductor materials in the PV cells free electrons that generate electric current. PV's can provide extra power for customers who are already connected to the grid. Costs have fallen by 90% since the early 70s, but more and more individuals, companies and communities choose PV for reasons other than cost, because:

- It is a clean sustainable energy source

- It is a clean back-up power source
- It generates power right at the source, with no fuel, noise or moving parts; and
- The power technology can be built into roofs, facades, canopies & windows.

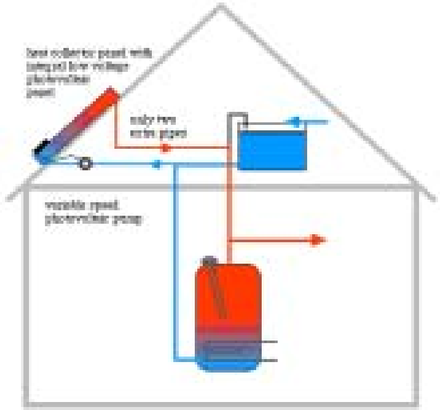


Fig. 9c: Low-impact installation of solar water Source Solartwin.

Solar water heating uses the sun's energy to heat water, reducing the use of gas or electricity. When installed properly, solar water heaters are more economical over the life of the system than heating water using electricity, heat pumps or heat recovery units. Solar water heating for buildings have two main parts: a solar collector and a storage tank. Typically a flat-plate collector– is mounted on the roof, facing the sun. The sun heats an absorber plate in the collector, which, in turn heats the fluid running thorough tubes within the collector.

Many large commercial buildings can use solar collectors to provide more than just hot water. Solar process heating systems can be used to heat these buildings. A solar ventilation system can be used in cold climates to preheat air as it enters the building; and the heat from a solar collector can even be used to provide energy for cooling a building. Freeze protection for solar water heating systems is a must to protect the collector in very cold weather.

Ground Source Heat Pumps: These make use of the earth's ability to absorb and store solar energy, resulting in almost constant temperatures of 10-12°C a couple of metres below the surface. This 'low-grade' heat source can be tapped by water circulating through pipes buried in the ground and then boosted to higher temperatures using a heat pump. Heat pumps produce 3-4 kW of heat energy for every kW needed to power the compressor, so are as efficient as a condensing gas boiler. They are most effective if linked to an underfloor heating system due to the lower temperatures involved. Reverse-cycle heat pumps are available which can provide both heating and cooling to commercial buildings."

Hydrogen Fuel Cells: There is a growing agreement that hydrogen will be an important source of sustainable energy. It is a clean fuel producing no CO_2 when burned, can be electrolysed from water using any renewable electricity source and is easily transported by pipeline. It can then be used as a transport fuel or to supply the range of building energy needs. A community CHP system powered by hydrogen fuel cells is already operational in Woking and there are many other similar installations worldwide. There are no immediate implications for building design, but designers need to be aware of its future potential.

3.0 Water Conservation

3.1 Water Supply and Demand

Drinking water supply, managed by London's water utilities (principally Thames Water) is sourced from the river network and groundwater. Since the establishment of groundwater sources in the 19th Century, substantial quantities of water have been removed, peaking in the 1960s when central London's groundwater table fell to 98m below sea level. The decline in major industrial abstractions from the London Chalk Aquifer over the past 30 years, contributed to a steadily rising groundwater table, although in recent years it seems to be stabilising in central London.

The North London Abstraction Recharge System (NLARS) developed in the 1990s was a regional water management and conservation measure to allow treated mains water to be stored in London's deep aquifer. This prevents large amounts of treated water stored in surface reservoirs being lost, particularly during extended drier periods. Dry weather conditions and water shortages in the 1990s made us aware of the need to reduce the amount of water we use. In areas of north London, where the NLARS operates, it has contributed towards more rapidly rising levels. But, increasing base load abstractions in south London will reduce flow to these northern areas in the long-term.

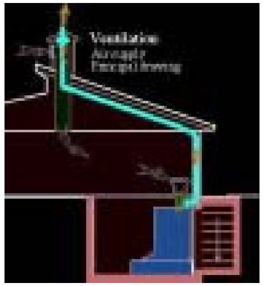
3.2 Conserving Water and Managing Demand

As with energy, the first step is to reduce the demand (Policy EP11) and then to find alternative sources to reduce the use of expensively treated drinking water for uses such as flushing toilets. Industry tends to be the heaviest user, followed by hospitals, hotels, schools and residential developments. In commercial and domestic buildings, the demand for water can be reduced as much as 50% using a variety of simple and innovative strategies that are integrated into the plumbing and mechanical systems, as well as the landscaping design. Integrated water management can deliver a favourable economic return while demonstrating responsible use of this precious resource. Options for further reducing water use and cost include the following:

- More Efficient Fixtures. Under the Water Regulations 1999 all new toilet fixtures must use no more than 6 litres per flush (previously 7.5-9 litres) or be dual-flush in a ratio no more than 6:4 litres (for light to full flush respectively). This can be reduced to 4:2.5 litres in homes. Flushing systems may be flap/drop valves, siphons or pressure cisterns approved with the pan. Other water-saving options include flow regulators, faucet aerators in sinks and low-flow showerheads in buildings where showers are provided (typically those that have in-house exercise facilities or on-site bicycle parking).

For new-build, changes of use and alterations/extensions to water system in non-domestic buildings, the list of installations that must be notified in advance, to the water supplier (& fitted by an 'Approved Contractor') include showers, large baths (over 230 litres), water softeners, some bidets and swimming pools of more than 10,000 litres.

Fig.10:a, b Above Composting Toilet,. PM Centre, Source, Website Below section through composting WC Source: Clivus



• Waterless Urinals & Toilets Building Regulation approval for waterless urinals and toilets is increasing, as is their commercial availability. No water is needed and there is no smell. The urinals are becoming common in institutional settings, such as elementary and secondary schools, campus situations and corporate headquarters. Waterless/composting toilets were initially used in dry or remote locations such as camping, military sites, ski resorts & nature reserves. They are beginning to be used in some schools/ universities, visitor centres, corporate settings (e.g. Office of Public Works Ireland; Bradford Metropolitan Council) and residential homes.

• Rainwater Reuse. Rainwater from roof drains can be piped directly to a storage tank and used for gardening, toilet flushing and washing machines. The volume of rain captured (cubic metres) depends on roof area and annual rainfall (See Table 3 opposite).

Fig.10c: RainSava system, Acorn Env. Systems. Source, Environment Agency, *'Conserving water in buildings'.*

• Water-Efficient Landscaping. Landscape architects & designers can specify native plantings, which use no water after becoming established, as well as drip irrigation and other low-water-using systems

• Cooling Towers. Sub-metering can reduce sewer charges by removing charges for evaporation water loss.

• Groundwater can be an environmentally friendly source for many purposes, such as for cooling in air-conditioning plants. Water from such uses can also be reused as grey water for other processes. Groundwater abstraction is subject to hydro-geological assessments of availability and is a licensed activity unless for domestic purposes.

• Greywater Reuse. Grey water from basins, kitchens and food service locations can be used for toilet and urinal flushing, cooling tower or boiler makeup water, landscaping and on-site water storage for fire fighting. Such systems require dual piping to route the grey water and appropriate valves, filters and signage.

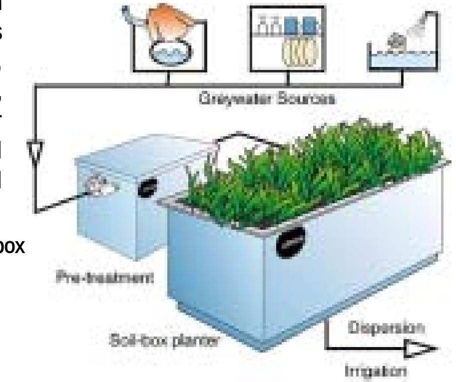


Fig.10d: Greywater soilbox system,. Source, Clivus

Table 3: Water Volume Collected by Roof Area in London, Source: Adapted from Environment Agency.

Area→ Rain↓	50 sq.m (Semi-detached)	75 sq.m (Detached)	100 sq.m (Self-build)	125 sq.m (Non-residential/Commercial)	150 sq.m
650 mm	19.5 cu.m	29.25 cu.m	39 cu.m	48.75 cu.m	58.5 cu.m

3.3 Design Considerations, Costs and Benefits

Water conservation is most cost-effective when integrated into the design of a building's plumbing, mechanical, fire-safety & landscaping systems. A design strategy is to create multiple uses for each litre of water: Potable water can be used for drinking, hygiene and health; recaptured water can be used for toilet flushing, boiler/cooling tower makeup and landscape irrigation.

For long-term savings, it is best to measure water use as part of on-going building operations and to identify short-term improvements in fixture, circulation and wastewater management design.

Where groundwater is used to cool or heat buildings, it is often an energy efficient and cost effective method with secondary benefits (installation and maintenance can be cheaper than conventional systems).

Water conservation can improve a building's bottom line by reducing water, sewer system & "system development" charges. These tend to include fixed charges that may vary with meter size and consumption charges based on monthly or seasonal water use.

4.0 Materials Specification

The materials specified within a building and its grounds play a crucial role in achieving long term sustainability –the ancient Egyptian pyramids have lasted well over 5,000 years! Other well-known and much-loved buildings have been around for hundreds of years. However, the average modern building is designed to have a life of about 60 years, when it could be designed, with good protection detailing, to last 100-200 years. The energy used in manufacture and transport of materials in the UK amounts to 24% of total used by all UK industry. UDP Policy BE12(c) requires you to consider the environmental effects of building materials.

This section draws heavily on two approaches - firstly, the Environmental Preference Method (EPM) pioneered in the Netherlands by Annil, Boonstra & Mack, and the Environmental Profiling System (EPS) developed in the UK by the Post Office, BRE & Oxford Brookes University. The EPM is based on a graded system of weighing the effects of materials on a range of issues; *eco-systems, resource-scarcity, emissions, energy use, waste, re-use & durability* considered over the extraction, production, building, use and disposal phases of their lifecycle. The EPS assessed the production, use and disposal of materials against *primary energy, emissions, resources, reserves, waste generated & recycling*.

Both methods are however, roughly comparable - the differences being that the EPS used relative assessments applicable only within each select group (more liberal interpretation) of mainly construction assemblies i.e. cavity walls, roofing systems - while the EPM used a more absolute comparison of environmental performance (stricter environmental interpretation) across individual materials. The Scottish '*Sustainable Housing Design Handbook*', the guide arising from the Findhorn Community's practical experiences in Scotland, '*Simply Build Green*', and BedZed's more recent *Construction Materials report*, have also been very useful resources.

Indications of materials' relative environmental sustainability for a selection of building elements are summarised in the Guidance tables in Appendix II, which are not meant to be definitive or exhaustive. They should be considered as a first step in finding more sustainable materials. There are detailed explanations of the performance of these and other materials in the '*Handbook of Sustainable Building'*, the '*Green Guide to Specification'*, the *Green Guide to Housing Specification and* the *Green Building Handbooks* (See Appendix III).

New information comes forward continuously, so they should be considered a general guide to the relevant factors to be considered when choosing materials – there may be new issues that make other alternatives more sustainable. Applicants can provide comparable, more up-to-date information, where available, about their choice of materials.

Sustainable specification requires a balance to be struck between the type of design, cost and availability factors. There are few 'correct' answers – a project using 'environmentally-unsound' types of material for every element may achieve an unacceptably low sustainability rating, on the sustainable development Checklist, but it may also be impractical in some instances to expect only the best of the 'environmentally-preferred-alternatives', to be used throughout a development.

Guidance Table (example) – See Full Tables in Appendix II

Key: ☺☺☺ Most Environmentally Sound, ☺☺ Environmentally Sound, ☹ Less Environmentally Sound

Element ↓	Environmentally Unsound ☹	Toxicity/ Health Effects?	Environmentally Preferred Alternatives ☺☺☺ ☺☺ ☹	Cost Relative to Env. Unsound
Thermal Insulation	Asbestos	Fibrous Silicate/ Carcinogenic	• Cellulose (recycled paper) • Cork (baked) • Foam glass	• Savings • Substantially more • Additional cost

An indication of the relative cost of materials is given in the tables. However, this only represents the capital costs and it should be remembered that any additional costs could lead to long-term savings when the costs-in-use are considered.

4.1 Materials' Life Cycle Analysis Factors

	Checklist of Good Practice Pointers
Embodied Energy	❑ Insist manufacturers provide environmental impact information (using them cautiously - only as an indication of level of impact) and check with independent sources, where possible e.g. BRE's *Environmental Profiles Database*; ❑ Consider transport, recycling and reuse factors (for the same product, locally derived sources use less embodied energy); ❑ Use more recycled & reclaimed products (have relatively low embodied energy); ❑ Minimise use of highly processed, embodied energy-intensive products;
Toxicity & Emissions	❑ Avoid materials that are known or suspected to be toxic (highlighted in the Guidance tables in Appendix II) ❑ Use safer alternatives where available & technically feasible (precautionary approach)
Biodiversity	❑ Check materials have a low impact on biodiversity of plants and animals ❑ Check materials have low impact on soil quality and/or micro-climate;
Renewable	❑ Use as much renewable, natural (raw) materials as possible; ❑ Minimise use of limited raw materials.
Durability/ Waste/ Recycling	Design for deconstruction & reuse with :- ❑ Robust, removable materials; ❑ Small, easily handled components; ❑ Removable fixings, (bolts, screws, and clips)rather than complex mechanical fasteners; ❑ Homogeneous rather than composite materials ❑ Layered, instead of glued, components.

Note: When purchasing materials direct from a large building merchant, check to see if they operate a Supplier Environmental Audit (SEA) similar to that initiated by B&Q. This indicates the extent to which they have 'greened' their supply chain. The possession of the ISO 14001 standard is also a good indication of how seriously an organisation takes its environmental responsibilities. (See Appendix VI).

4.2 Applying These Principles

TIMBER PRODUCTS

Timber is a versatile traditional material for many building elements. It is also a renewable resource, if forests are managed in a sustainable way. The FSC global forest certification system is a simple label recognised by the main environmental and social non-governmental organisations (including WWF, Greenpeace, Friends of the Earth, indigenous people's groups & trade unions) as well as the BRE & DeFRA. It is the highest form of accreditation and includes 2 key dimensions: Forest Management and Chain of Custody (COC) certification. Specifying FSC timber demonstrates compliance with BREEAM requirements, and using at least 75% gives full credit for EcoHomes.

MASONRY & ALTERNATIVES

Brick and concrete block cavity walls are the most commonly used materials for residential development in the UK. Brick and stone are common cladding for framed buildings. Masonry products are popular due to their strength, durability and low maintenance, but as materials quarried from non-renewable resources, all have significant environmental impacts (i.e. energy, transport & landscape) in production.

Fig. 11a: Crushed concrete walls Entrance to the Earth Centre, Doncaster. Source: Website

Fig. 11b,c: Hemp Houses, Haverhill, Suffolk, by Suffolk Housing Society. Raw Hemp is mixed with lime & cast in situ like concrete. Source: Building Design,

However, timber-framed buildings were the standard until the mid-17th century, and are still commonly used in many European countries. Many of the pre-fabricated systems being developed as part of the Egan 'Rethinking Construction' push for faster, higher quality construction are timber framed (with brick or timber cladding).

Other alternatives include perforated clay bricks, rammed earth (stabilised with small stones, a little cement, lime or bitumen) industrial hemp and straw-bale (especially as an infill). Unfired clay bricks are also a good option for internal wall partitions, allowing a building to 'breathe' by absorbing and releasing moisture.

Fig 11d Recycled crushed glass sand for bedding paving slabs. Source: BedZEd Materials Report, 2002

Fig. 11e: Rammed earth walls, The Eden project, Cornwall, Source: Eden project website

MORTARS

One of the main challenges to the recycling of materials used in modern masonry construction relates to the now widespread use of quick setting, high-strength Portland cement mortars, which make the reclamation of attached bricks and blocks very difficult. The use of hydraulic lime mortars in pre 1940's construction has made those bricks easier to reclaim, but their imperial sizes may require some building redesign if used.

Materials which enable lime mortars to set more quickly include ash and brick dust. Known as 'pozzolans' after the volcanic additives used by the Romans, these materials are widely found in the lime mortars used in old buildings and monuments. Where conservation work is required, new mortars should match these mortars to ensure the new work is visually and physically compatible with the old.

A 'pozzolan' is added to lime mortar (or to Portland cement mortar) to increase durability and, in the case of lime mortars, to provide a positive set'. In general, the softer pozzolanic materials (such as brick dust from clay bricks fired at less than 950°C) yield more permeable and flexible mortars, whilst the hard-burned materials, such as PFA, tend to yield a harder mortar, similar to cement.

WINDOWS & DOORS

PVC has become popular, but contains vinyl chloride - a toxic Organo-chloride – other sources include CFC's (which destroy the ozone layer) pesticides, dioxins, chlorine bleach (used in paper manufacture) and PVC plastics. They are bio-accumulative and persistent in the environment. PVC manufacture is highly energy intensive, using a fossil fuel feedstock. Alternatives to PVC include ethylene-based plastics.

Myth - *"PVC Windows are better than Timber Windows"*)

FACT - compared to modern high-performance timber windows, PVC windows:

- Are more environmentally damaging to produce and dispose of;
- Off-gas toxic chemicals for a while after manufacture
- Have poorer thermal performance and cannot readily be improved, unlike timber;

- Cannot be repaired when ironmongery breaks or sections of the frame get damaged;
- Are NOT maintenance-free (colour fades with UV /sunlight exposure & need washing every 6 months to minimise staining) and have a shorter overall life
- Cost £372-404 per m^2 (timber £354-£389) over a 60 year life (Source: Building Performance Group); and
- Are of increasing concern to the Fire Brigade

Many housing providers automatically specify PVC windows because they believe them to require less maintenance. Whilst this may have been true ten years ago, modern high-performance timber windows that have been factory stained typically have a re-staining/re-painting cycle of 6 - 8 years. These can now be purchased with 30-year guarantees, as against 15-20 years for PVC windows.

A growing number of Councils and Housing Associations are adopting PVC-free policies. Many developments are successfully reducing or eliminating PVC use. The new Tate Gallery of Modern Art for instance, minimised the use of PVC. (Alternatives used for all piping (rainwater, soil and waste) roofing materials & electrical cables. (PVC remains only in some underground pipes sleeving).

5.0 Landscape Design & External Works

Sustainable landscape design can simultaneously influence aesthetics, air quality and climate modification. External works refers to the external environment of a development including its site layout, the hard and soft landscape, drainage systems and play areas, which may also, to an extent, service the local area (See Revised UDP Policy BE6).

5.1 Site Layout

An effective site layout is critical if you are going to make passive energy savings. The orientation of a building to the sun, position of the building within the site and the location of car parking, planting, open space, play areas and other works within the site are all important factors to be considered. If you are going to include a play area, it is important to remember that all ages must be catered for, not just the 5-10 age groups. Teenagers need somewhere to go with meeting points and activity areas designed for their use. There is a wide range of appropriate equipment available, many made from recycled materials which meet safety standards. When laying out car parks, sufficient space should be allocated for tree planting, as research has shown that trees, by reducing high temperatures, help reduce the rate of evaporation of engine fluids which occurs when heated, even when cars are parked.

5.2 Planting

Planting has a social (aesthetic) as well as environmental role in sustainability. Vegetation can be a powerful influence on climate moderation within a development, providing a heat sink, summer shading and shelter from winds, as well as privacy screening and a barrier to traffic pollution. Planting can also be used for boundary treatments. Existing vegetation should be maintained where possible and supplemented after construction with new planting.

Fig.12a: Source: The Kalzip 'Nature roof' by Corus, installed on the zero emmissions 'House of the Future' at Museum of Welsh Life, St. Fagans

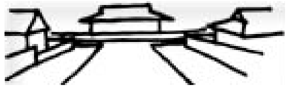
The use of native species whenever possible is preferable as they maintain existing ecosystems and are more likely to thrive in local conditions. However, carefully chosen exotic (non-native) plants can add to the aesthetics of a landscape and provide habitat and food, particularly for birds; e.g. Cotoneaster & Pyracanther. Some non-native plant species can be invasive and out-compete native species, causing damage to ecosystems; for example, Japanese Knotweed, Himalayan Balsam, Rhododendron Ponticum and Sycamore.

Planting on the pitched and sloping roofs of buildings (*Green or 'Turf' Roofs*) can help keep buildings cool in summer by providing thermal mass and reflecting solar radiation as well as providing a location for grey water filtering (winter insulation benefits only occur when the roof is dry). Green roofs can also provide an amenity space for the users of the building. Roof planting should only take place on roofs that have been strengthened to ensure they can carry the extra weight of moist soil, planting and associated materials.

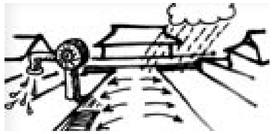
5.3 Biodiversity Issues

The external environment has an important role to play in encouraging biodiversity of species. Building surfaces (e.g. green roofs, climbers & vegetated balconies) can also deliver biodiversity benefits. The main principles that should be followed to ensure integration of these issues in the development and planning processes are:

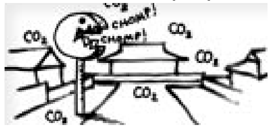
1. Survey
2. Avoid existing habitats, or



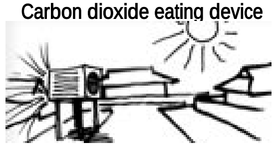
What does this street need?



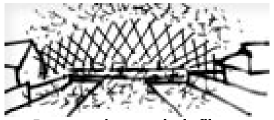
Storm water pump



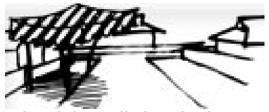
Carbon dioxide eating device



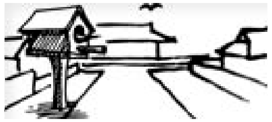
Climatic air-conditioner



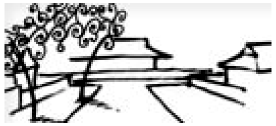
Dust catcher and air filter



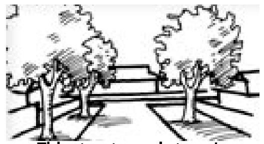
Ultraviolet radiation shade



Wildlife habitat



Low maintenance decoration



This street needs trees!

Fig. 12b: Source, Australian 'Your Home', Technical Manual

3. Enhance existing habitats and create new ones
4. Retain and incorporate
5. Protect against potential negative effects
6. Compensate where damage is unavoidable
7. Manage and monitor

In areas of nature conservation importance, the use of plants and seeds of approved local provenance may be required.

5.4 Hard-Surfacing

In urban areas, impermeable hard surfacing, especially over a large ground area, often causes flooding. Due to the danger to people of floods, damage to property and concerns over global warming, there is a great need to reduce the likelihood and impact of floods, by ensuring:

- Areas of hard materials are minimised where possible by design, or with planting.
- Hard surfacing is incorporated with planting, for example, car park paving can be created with paving blocks with gaps designed within them that allow plants to grow through.
- Life span of materials is at least 10 years, they should be:
  - Vandal proof (where publicly accessible)
  - Fire resistant,
  - Resilient
  - Easily maintained
- Alternative products, such as water-permeable paving, are specified. Permeable blocks and paving are becoming more readily available from DIY companies and trade suppliers (See Appendix III).
- They are being increasingly used in developments. For large car parks, oil interceptors should be installed to capture oil prior to discharge. Depending on the specific use, position, and local conditions, the design of the hard surfacing and textures can be varied to enhance the aesthetic qualities.

5.5 SUSTAINABLE DRAINAGE SYSTEMS

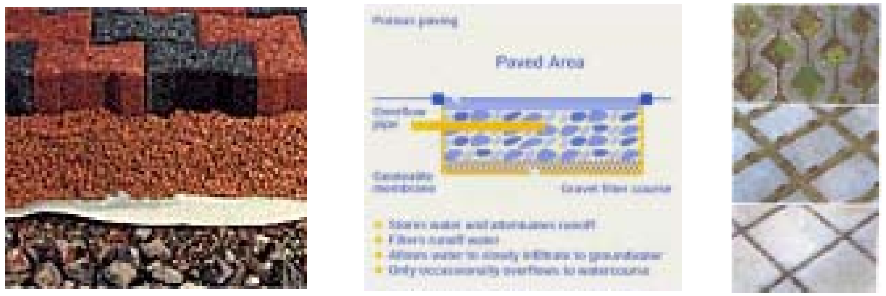
Sustainable Urban Drainage Systems (SUDS) have been developed to cope with draining water from sites in an environmentally safe way (UDP Policies EP9, EP10 & EP13). They reduce pressure on the existing drainage systems, prevent or reduce the likelihood of flooding and also help clean up pollutants in run-off (such as oil from car parks). SUDS are environmentally and physically safer than conventional drainage systems and play an important part in the sustainability of external works.

It is important, where possible, for SUDS to mimic natural drainage patterns and systems and they should incorporate preventative measures as well as resolve problems arising after flooding events have occurred. PPG 25 lists the following contributions of SUDS towards sustainable development:

- Managing impacts at source, not downstream;
- Managing water run-off rates, reducing the impact of urbanisation on flooding;
- Protecting or enhancing water quality;
- Sympathising with the setting and needs of the local community;
- Providing opportunities to create habitats for wildlife in urban watercourses;
- Encouraging natural groundwater recharge (where appropriate)

SUDS systems are now being incorporated into roofs (See Metropolitan Water project in Angell Town, Brixton). The Environment Agency should be consulted if SUDS are proposed, especially on contaminated land.

Fig.13a,b,c: Porous paving, Left Source: Johnston Smith Consulting Ltd. Website: Right Environment Agency & South Gloucestershire Interim Advice Note C10



Sustainable drainage system work best when ground conditions are capable of absorbing water during wet periods. In Brent, soil strata mainly consist of stiff London clay, which is now becoming saturated and not absorbing water as it did a few years ago. This has become problematic as the Council is receiving complaints from residents regarding flooding and waterlogged gardens. Traditional garden water butts for watering/washing have been fading away with advent of sprinklers.

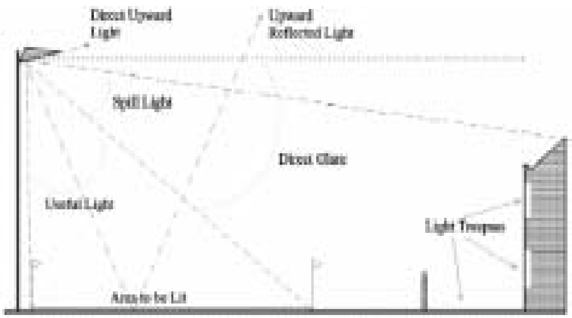
Most of the public sewers in Brent were laid during 1920/30's. The drainage network is not capable of receiving additional flow from new developments and is in need of upgrading. Thames Water is responsible for its maintenance and now insists that any additional flow from large new development is stored on-site.

Onsite Stormwater Detention (OSD) is an option where sustainable drainage systems are not practicable due to soil and ground conditions. This is normally achieved by installing large diameter pipes, culverts or tanks. The basic principal of on-site storage is that during heavy rain, surface water run-off from roofs, car parks and large paved areas is directed to a storage tank. Water is stored and normally discharged to main sewer using suitable flow control device. At the end of heavy rain, the storage tank is typically emptied either as gravity or pumped system and ready for the next storm.

A sustainable approach is to reuse stored storm water volumes for garden irrigation and/or exposing the system by incorporating visible water features such as fountains and mechanical misters for evaporative cooling. This involves a pump for drawing water from storage tanks/pipes. Also, an outfall is still required; otherwise tank would fill up and overflow if stored water is not fully used.

5.6 Street Furniture

It is essential to recycle and reuse landscape materials. Fixtures and fittings, materials used externally should take account of the principles in the Materials Chapter and the Guidance Tables in Appendix II of this SPG. Other relevant Guidance includes SPG 5, 13, 17 and 18, UDP policies and any relevant Conservation Area Guidance notes.



Figs.13d,e: Above, bollard from 100% recycled rubber tyres; Below, lighting factors Source Glasdon and Inst. of Lighting Engineers

5.7 External Lighting

Policy BE8 in the borough's UDP states a requirement that external lighting should "*...conserve energy through the use of low energy or renewable lighting systems where appropriate and should preserve the darkness of the night time sky*...". There has been a new initiative for "dark skies" to reduce the level of light pollution from streetlights. This has biodiversity effects too, particularly for bats. (See the GLA guidance note). The main change to be made to lighting in terms of reducing light pollution in the night sky is to reduce or completely remove the amount of "uplighting" there is from the lamp which is directed towards the sky as well as directed to the ground. By redesigning the lamp to remove the uplift component, this effect will be eradicated.

Controlling the levels of lighting is also important for sustainability in terms of the economic savings that can be made. Many standard streetlights use great amounts of energy, which can be reduced and even cut in half. This can be done through using different lighting systems, for example dimmer systems in areas that are not used as intensively during the night and although a degree of lighting is required, the full level of street illumination is not always necessary.

Using different fixtures and fittings as well as innovative new ideas relating to the makeup of lamps and bulbs used can make energy savings. Directing light more accurately on designated areas, without any uplighting, will reduce glare (light pollution) and also energy consumption as making fewer lights more focused will remove the need for more streetlights. (See Appendix III for more details).

B. Sustainable Construction

6.0 Construction

The construction industry in London consumes 10% of over 360 million tonnes of materials used in the UK, but generates 25% of its 70 million tonnes of construction and demolition (C&D) waste per year (4 times more than the domestic sector). The UK is running out of suitable sites for landfill and the cost of landfill is increasing. Construction is also responsible for 30% of all road freight in the UK.

The 1998 Egan Report, confirmed the inefficiency and wastefulness of the industry, recommending new partnering, contractual & pre-fabrication processes, a reduction in waste generated and taken to landfill, and reusing & recycling as much as possible. (See UDP Policy BE12[f-g]).

Fig. 14a: The Eden Project, Cornwall. Source, Anthony Hunt Assoc. Website

6.1 Main Issues

- Waste generated during construction (cost & disposal)
- Impacts of construction processes on the natural environment (habitat, water, air) and on people (noise, fumes, dust, public realm/local amenity)

6.2 Waste Management on Site

At a very early stage of the project, the contractor should consider opportunties for reusing and recycling wastes both on and off site – at the very least Egan compliance should be achieved.

<u>MANAGING SUBCONTRACTORS:</u>

- Follow a system of allowable waste percentages; this has worked on many other sites in the country. Make a careful assessment of how much waste is acceptable at the pre-work agreement stage, and agree a percentage with the subcontractor.
- Give the subcontractors responsibility for purchasing the raw materials they need, and disposing of any waste material from their activities - this provides them with a direct financial incentive to minimise waste.

<u>MINIMISE DISPOSAL COSTS:</u>

A landfill tax is applied to nearly all controlled waste being disposed to landfill:
- Wastes should be segregated in order to keep disposal charges to a minimum.
- Avoid contamination, by ensuring all types of waste that decompose (e.g. food wastes, grass cuttings, tree branches) are stored separately and taken to a composting site.

Waste Management:

- The Environmental Protection Act (1990) introduced the Environmental Protection (Duty of Care) Regulations, 1991 and spelled out the legal obligation to have waste carried by a Registered Carrier and disposed of, or deposited properly at a licensed facility. It exempts many recycling activities from waste management licensing.
- Ensure that you know the Waste Management Licensing Regulations (1994).
- Make sure you have a Waste Transfer Note which describes what waste you are holding-
- Segregate your waste on site and label each container.
- Appoint or designate a Site Waste Manager.

Site Waste Manager's Role:

- Ensure compliance with Duty of Care at all times
- Storage of diesel - Place all diesel containers in a bund or a secure drip tray to prevent spillage onto the ground.
- Chemicals & Oils - Store them in labelled containers kept in a place known to all staff. Clear any spillage immediately & notify the Environment Agency.
- Control of Water Supply - To avoid wasting water, monitor all connections to stand pipes & leaking hose pipes, repairing or replacing as soon as possible.
- Canteen Waste - Dispose of immediately in the correct storage bins. Report any vermin to the Council's Environmental Health Unit
- Audit - Carry out an inventory of the materials on site.
- Obtain a list of potential buyers and sellers of used or recycled materials in the location of the site
- Draw up and implement a Waste Management Plan.

Construction Wastes Worth Segregating for Reuse & Recycling

Material	Usefulness
Architectural Features, and Unwanted fixtures & fittings	• Reuse or ask specialist Charities to collect for redistribution
Blacktop (Tarmac)	• Recycle for use in bound layer of road
Cement	• Dispose of waste cement in covered skips to minimise dust.
Clay & Concrete Pipes	• Reuse
Concrete	• Recycle for use as aggregate in new concrete. • Recycle for use as unbound aggregate in roads or fill
Excavation Spoil	• Reuse for landscaping
Metals (e.g. RSJ's, roof sheets)	• Reuse/recycle
Oils, Paints & Chemicals	• Reuse
Packaging & Plastics	• Recycle (ask the supplier}
Pallets	• Return to suppliers; do not burn.
Piles & Pile Caps	• Reuse
Timber (e.g. floorboards, rafters, beams)	• Reuse for shuttering/hoardings • Recycle for chipboard
Tiles, slates, coping	• Reuse
Topsoil	• Reuse for landscaping
Unused Blocks/Bricks	• Reuse or sell on to builder's yard

6.3 Available Tools/Resources:

- SMARTWaste (Site Methodology to Audit, Reduce & Target Waste) – A BRE developed PC computer software tool making it easier to record, categorise and track wastes by source, type, amount, cause and cost.
- Materials Information Exchange (MIE) – Free internet-based database of sellers and potential buyers of recycled building materials, set up and managed by DTLR.

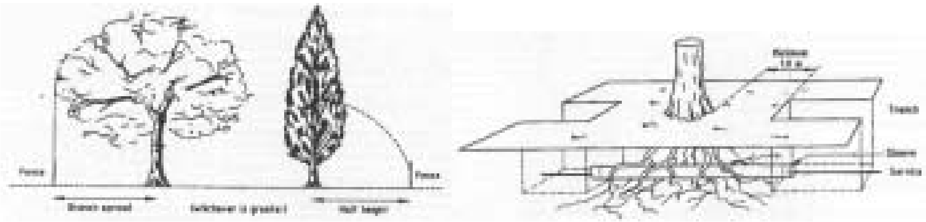
6.4 The Benefits of Construction Waste Management include:

1. Less environmental degradation – air (transport, incineration, hazardous gases) land (contamination from fill contents), water (spillages, leakages from landfill) & limited resource use (mining, quarrying, drilling, felling)
2. Reductions on Cost of Purchasing Materials (e.g. primary aggregate);
3. Savings in disposal costs (e.g. landfill tax)
4. Reductions in transportation costs (number & distance of lorry journeys)
5. Revenues from reuse and recycling
6. Employment creation - 42,000 jobs by 2000 (BRE/SALVO survey)
7. Environmental credibility.

6.5 Other Construction-related Environmental Issues:

The Construction Industry Board (CIB) operates a 'Considerate Contractor Scheme' to address most of the following issues.

1. Protecting the natural environment:
   - Effects of construction on soil compaction, water quality & drainage (contact Drainage Engineer, Appendix II)
   - Protection of trees/wildlife habitats and/or reinstatement of topographical features (contact Brent Ecology Unit/Planning Landscape designer, Appendix II)



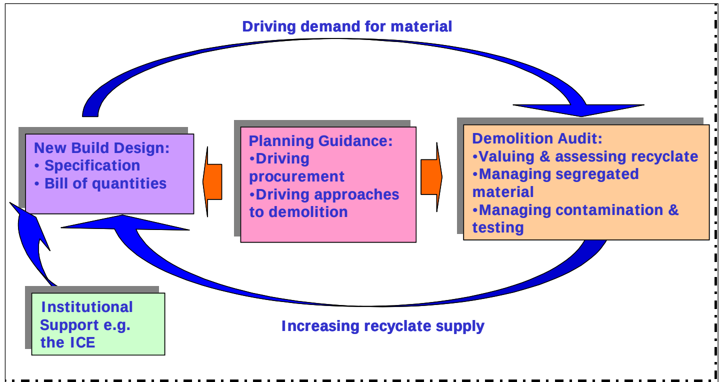
Locating protective fencing   Unavoidable Service trenching

Fig.15: Source: British Standard 5837, 1991 (Guide for trees in relation to Construction)

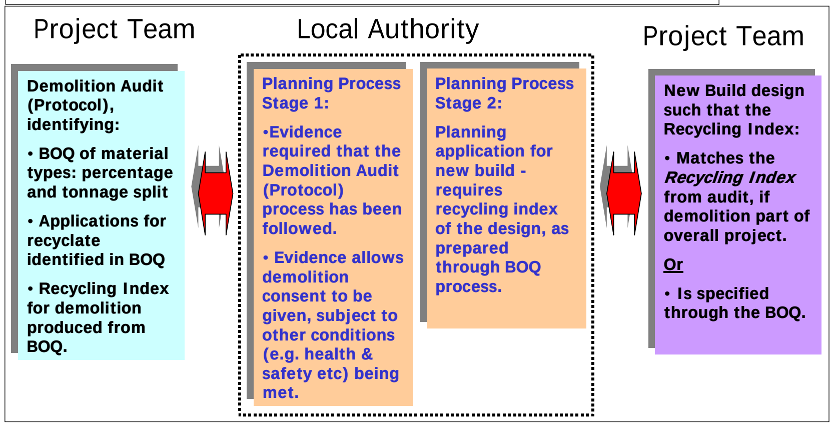
2. Protecting local amenity:
- Noise & vibration (See Noise chapter on pg.26-27)
- Smells, dust, fumes (See Air quality chapter on pg. 24-25)

6.6 DEMOLITION

The first preference is to retain and reuse existing good quality buildings. Where demolition is necessary, the contractor should consider a selective programme, where the most valuable or potentially contaminating materials and fittings can be removed safely and intact for later re-use or processing before the actual demolition commences. However, deconstruction of buildings and reclamation of materials, are preferable to wholesale demolition.



Environmental Management System – A Resource Efficiency Process



A Demolition Protocol has been produced by EnviroCentre for the Resource Sustainability Initiative a group formed jointly by the Waste Board of the Institution of Civil Engineers (ICE) and the Institute of Waste Management (CIWM) to support innovative waste management projects.

The Protocol establishes an 'audit trail' for materials, setting targets for recycling and a clear process for verifying their achievement. Applications for demolition will be expected to have regard to the Demolition Protocol.

7.0 Deconstruction

Deconstruction is the dismantling of a structure in the reverse order in which it was constructed - the process roughly entails those materials that were put on last to be removed first. Focusing on each material type in reverse order of the construction process is the most efficient practice for separating materials for reuse, recycling, and disposal at the time of removal.

This section is taken directly from the work of David Turner, NFDC (National Federation of Demolition Contractors) and Bradley/McLendon, of Florida University (Appendix III; Refs. 33 & 32)

7.1 How to Deconstruct a Building for Materials Reuse

Time is the most important resource for deconstructing and reclaiming building materials - there will be no materials for re-use, if there is no time to dismantle re-useable materials! So, adequate time must be scheduled.

The first thing that needs to be done is to carry out an audit of the building(s) to assess the level of reclaimable materials/components present. Other issues important to the deconstruction process are:

1. The working platform or area and how well that assists or impedes the deconstruction of an adjoining, overhead, or element below.
2. Clearing a work site around the building, particularly so that roll-offs and the movement and stacking of materials are not impeded.
3. Timely removal and drop-off of the roll-offs, in order to not impede the removal of components directly into the roll-off, while having them as close as possible to where the major deconstruction effort might be occurring. For example, having a roll-off next to the structure to capture asphalt roofing shingles, but removing it and placing the next roll-off to not impede the removal of exterior siding.
4. Removing both re-useable/recyclable and disposable materials in a timely manner is critical to the safety of the job-site and the efficiency of both the deconstruction and the processing activities.
5. Many nails are placed in such a way as to not be readily accessible to a prying device. Wood is sometimes damaged in the extraction process. In all cases, a material will be removable by use of levering, unscrewing or unbolting, and should not require a sledgehammer or other smashing tool.
6. Arranging on-site removal of materials as they are processed in order to minimise the effort invested in loading, transporting and storing materials in another location, while at the same time insuring that materials left at the site are not stolen.

7. Good deconstruction sites require sufficient room to work around the building, including de-nailing and stacking areas away from the structure, space for roll-off delivery and pick-ups, but that are also highly visible to attract potential customers for the salvaged materials.
8. Co-ordinating workers and increasing their awareness of how materials must be removed, and the importance of balancing efficiency with minimal damage to the materials is critical. Maintaining awareness of what is salvage and what is disposal requires a high degree of supervision.
9. Placing de-nailing stations either inside or under trees for shade in summer.
10. Nails are often more easily removed when the material was still in place in the building such as a stud wall which would have the nails used to attach a finish material. Damage or multiple nails in the ends of timber are more readily removed by using a battery-powered saw to simultaneously trim the end and cut off the nails.

7.1.1 Extensions

Variations occur between whole building sections, for example, an extension may be removed separately from the rest of the building. Extensions are an obstacle to removing one type of material or whole sections of the original structure, but can provide a working surface for other parts of the building, and be structurally dependent on other parts of the building. Therefore, extensions can be entirely removed, even if this breaks up the material-by-material consistency of the deconstruction process. Entire extensions to a building should be removed at one time, and within each extension or the core structure, materials will be removed in the reverse order of their construction.

7.1.2 Roof Tiles & Slates

- Clay tiles and all natural slates are generally desirable for re-use, concrete tiles tend to be crushed and screened into recycled aggregate (RCA).
- Roofs should be designed with safe access, built in edge protection and anchor points. At present with many tiles, the value of salvage does not cover the cost of edge protection, because most deaths on construction sites are from a height. Therefore the Health and Safety Executive (HSA) only allows roof reclamation if there is scaffolding on the building to the reclamation level.
- Soft non-ferrous fixings should be specified especially with slates (copper and aluminium nails). This simple change prevents almost all the breakages that typically happen whilst stripping a roof.

7.1.3 Steel Sections

UBs, RSJs, Channels, Angles etc. can easily be disassembled using mobile craneage, trained riggers and slingers. Designers should specify simple bolted connections throughout and try not to encase them in concrete, as there is readily available alternative fire protection.

- Designers should also try to avoid filling the girders with holes for services or welding on a forest of brackets - Linadaptors or something similar can be used instead.

7.1.4 Structural Timbers

These are always saleable especially first growth timber (pre 1929). The best way of reclaiming these are to lift down the large roof trusses intact with a crane, then guard against progressive collapse, and disassemble into scantlings on the ground.

7.1.5 Soft Stripping of Building

This should be carried out in two separate stages.

1. A selective strip out of all valuable or re-useable fittings, hardwoods, panelling features, light fittings, non-ferrous plumbing systems, high value cable and switchgear, plant room contents of etc. (Get the goodies out first!)
2. The complete strip out of all remaining materials, suspended ceilings, floor coverings, internal screens and doors, SORTING everything at ground level.

All timber except that covered with laminates is recyclable for new chipboard etc. and should not be landfilled. Carpets, underlays, ceiling and floor tiles, plasterboard and fibreglass do not yet have further use in the UK and need to be disposed of.

7.1.6 Windows

Try if possible, to remove windows intact. Separate the glass and frame at ground level and recycle the elements. Windows are often left in on explosive demolitions to contain dust.

7.1.7 Timber Floors & Joists

These should be progressively stripped out using mainly hand tools. It is important to have a strict safety regime embedded into the detailed Method Statement when stripping suspended timber floors. Keep a constant look out for movement of structural walls, cracking, bowing etc. Many older buildings, particularly in areas affected by subsidence, have been found to be held up by the floor joists, spanning from wall to wall and built in at the ends.

(You should now be left with the shell of the building – and ready for machine demolition)

7.1.8 Masonry Walls

Brick and block walls should be demolished by using a simple collapse mechanism, i.e.: pushing over or removal of support. It is best to avoid pulverising or balling down the walls. Use a wheeled loading shovel (not a tracked excavator or bulldozer) to transfer the demolished bricks to the sorting area on site if

Fig. 14a: The Jespersen Street Project, Oldham. Cladding & materials stripped from flats are left on access decks for sorting. Source, '*Demolition of Local Authority Dwellings in UK*', Bowes & Golton.

possible, for cleaning, dressing, palletising and shrink-wrapping the bricks on site. The bricks should be handled as little as possible, to avoid breakages.

7.1.9 Concrete Cladding Panels

Lifting eyes should not be grouted up as part of construction. - a rubber grommet or similar should be Specified instead, as this makes lifting off of the panels easier.

7.1.10 Metallic Profile Cladding

This is a saleable commodity and is commonly reused in the agricultural sector. The sheeting can be easily removed by using a mobile elevating work platform and the fixings can be removed by reversing the construction method.

(All you should have left is the steel or concrete frame and any cladding panels that cannot be lifted down)

7.1.11 Steel-Frame Buildings

These can either be disassembled by crane for re-use of sections, sheared down using high reach demolition machines, or felled in the traditional manner. These last 2 options produce scrap metal that can be processed on or off site, ready for the smelter.

7.1.12 Concrete-Frame Buildings

Specialist demolition equipment can be used to pulverise the frame and the resulting rubble should be recycled on or off site into secondary aggregates (RCA).

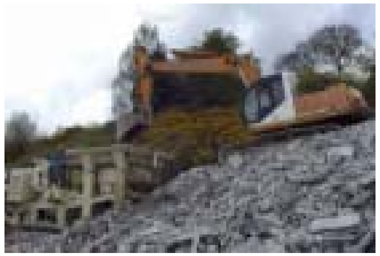


Fig. 14a: Crushing & grading of concrete components into recycled aggregate. Source, '*Deconstruction & Reuse of Materials*' Hobbs & Hurley, BRE

7.1.13 Concrete Floor Slabs & Foundations

They can easily be lifted using conventional demolition and breaking equipment and again processed into secondary aggregates.

7.1.14 Pile Foundations

These are usually left in-situ following the removal of pile caps.

(With the building gone you should have thrown away very little, probably less than 10% of the building!)

7.2 ECONOMIC VIABILITY

The net cost for demolition is:

(Demolition + Disposal) – (Contract Price) = Net Demolition Costs.

The net cost of deconstruction can be shown by the expression:

(Deconstruction + Disposal + Processing) – (Contract Price + Salvage Value) = Net Deconstruction Costs.

If materials are not resold or redistributed on-site, or reused by the deconstruction contractor in new construction, transportation and storage costs may be additional costs for deconstruction. In order for deconstruction to be cost-effective and competitive with traditional demolition & disposal, the sum of the savings from disposal and revenues from resale of materials, must be greater than the incremental increase in labour cost for deconstruction versus demolition.

There are various options for contracts and costs/revenues between a building owner and the deconstruction contractor, such as:

- Deconstruction as a service to the building Owner and the Owner retains ownership of the salvaged materials. This can also be a guaranteed “buy back” of the materials and treated according, with some consideration for the Contractor’s costs for processing and handling. The Owner will pay more than demolition but could be “buying” very high value materials.
- Deconstruction with shared ownership of the materials, with a reduction in the deconstruction contract based upon the Contractor receiving materials as in-kind payment.
- Deconstruction with the Contractor retaining all materials, and charging an internally calculated price based upon revenues to be received from resale of salvaged materials.
- A non-profit deconstructor performs a deconstruction for a fee and the Owner donates the materials as a tax write-off.

Where off-site sales are needed or value-adding desirable, a deconstruction entity that also operates a reused materials facility will enable the combined entity to be more profitable and maintain a consistent work force. The off-site facility/staff allows for flexibility in responding quickly to deconstruction projects when they present themselves, and processing the materials, and deconstruction provides a diversity of materials for the reuse facility.

On-site sales considerably reduce off-site materials handling costs (increasing salvage revenues) and also help reduce on-site time for the deconstruction, as processing time can be used in the actual deconstruction activity. On-site redistribution of the materials is more likely to be successful when the job-site is either on a busy road, in the urban core area, or near both lower income neighbourhoods and a historic district.

Deconstruction can be more cost-effective than demolition when taking into account the reduction in landfill disposal costs and the revenues from sale of salvage materials. On average, deconstruction first costs can be up to 20% higher than demolition costs, but the net cost with salvage revenues can be 10% - 35% lower (wholesale prices or retail salvage values respectively) than demolition costs. Deconstruction & reuse of building materials is a vital alternative to demolition and land-filling of demolition waste with these combination of benefits:

- Social (creating low-cost building materials)
- Economic (greater savings & job creation) and
- Environmental (reducing waste, recycling materials, saving energy & reducing demand for finite resources).

7.3 Deconstruction Health & Safety Issues

Demolition and deconstruction are high-risk activities. Workers are injured in falls from edges and through openings and fragile materials. Workers and passers-by can be injured by the premature and uncontrolled collapse of structures or parts of structures and by flying debris. High levels of dust, noise and other site contamination are also significant problems that need to be considered and controlled when planning any demolition work. The hazards associated with traditional demolition activity have led to a risk management approach that favours mechanical demolition with as little human exposure to the activity as possible.

Safe demolition and deconstruction requires planning. The key to developing a safe system of work for demolition and deconstruction is choosing a work method which keeps people as far away as possible from the risks. Proposed working methods may be best detailed in a Health and Safety Method Statement. Everyone involved in the work needs to know what precautions are to be taken. They should be supervised so that these precautions are put into practice. Detailed planning is therefore required if deconstruction is not to result in an increase in accidents when compared with demolition

It is essential that deconstruction is planned and carried out under the supervision of a competent person. Supervisors should have knowledge of the particular type of deconstruction being carried out, its hazards and how to control them. In particular, they should understand and follow a deconstruction method statement and know of any particular sequence required to avoid accidental collapse of the structure. Before work starts, survey the site. Consider the following maters:

- Are there still any live services? - Gas, electricity and water services need to be dealt with
- Is there any left-over contamination from previous use of the building, for example acids from industrial processes, asbestos on pipe work and boilers or microbiological hazards in old hospitals or medical buildings? - Hazardous materials may need to be removed and disposed of safely before demolition starts. Information on precautions needed are set out in the references (See Appendix III).
- Can a method which keeps people away from the demolition be used
- Will the work make the structure itself, or any nearby buildings or structures unstable? - is temporary propping required? - The advice of a structural engineer may be needed;
- How will the floors, walls or any other part of the structure, support the weight of removed material building upon them or the weight of machines, for example, skid-steer loaders used to clear the surcharge? - Again, expert advice may be needed;

Anyone who is not involved in the work should be kept away. Create a buffer zone around the work area. Where necessary, provide site hoardings. Do not allow materials to fall into any area where people are working or passing through. Fans, or other protection such as covered walkways, may be needed to control falling materials. Fire is also an ever-present risk, so make sure the appropriate precautions are in place.

Asbestos:

Any asbestos-containing materials on site should have been identified before work starts. Work with asbestos insulation, asbestos coatings and asbestos insulating board must normally be carried out by an HSE-licensed contractor.

Because deconstruction poses a greater worker exposure than mechanical demolition it is prudent to remove all asbestos containing materials (ACMs) that are in good condition, in accordance with the Control of Asbestos at Work Regulations 2002 (CAWR). ACMs are obviously not suitable for reuse and must be abated prior to deconstruction, which could add significantly to deconstruction costs over traditional demolition. Special waste regulations apply to the transport, packaging and disposal of asbestos waste

Any components that are either intended for reuse with Lead-Bearing Paints (LBP) remaining on the material or materials that have been repainted to encapsulate the LBP should not be allowed to sit on exposed soils where there is potential for the LBP to leach into the soil..). Other special waste includes varnishes, adhesives and sealants. Salvage materials should either be moved off site to an appropriate storage facility, or stored on 6mm polyethylene sheeting with a waterproof covering. Further information on waste disposal can be obtained from the Environment agency. The CDM Regulations apply to all demolition and deconstruction work. See the HSE guidance on *Health & safety in demolition work*

C. Pollution Control

8.0 Land Decontamination

8.1 Brownfield Sites

Land contamination is a material planning consideration for the purpose of the Town & Country Planning Act (1999) and the condition to carry out soil investigation may be placed as a planning condition, should previous land use indicate a possible contaminative use, or as a result of a historical desk study.

In the Brent Replacement UDP, Policy EP6 deals with land contamination. Developers/landowners and contractors should have regard to the requirements or details of the Council's Contaminated Land Inspection Strategy, which was adopted in April 2002 (See Appendix II).

The aims of the strategy are to ensure that; a) No risk is posed to human health or environment as a result of land contamination past, present or future; b) No land is under-utilised as a result of contamination; and c) Economic cost arising from land contamination is kept to a minimum consistent with this.

8.2 Site Investigations

Methodology for investigation is set out in the DETR documents; '*A Framework for assessing the Impact of Contaminated Land on Groundwater & Surface Water*' (CLR No 1) and '*Guidance on the preliminary Site Investigation of Contaminated Land*' (CLR No2). The main objectives of the investigation are to assess the impact of contamination on the users (present & future) of the site, to protect workers during development, protect construction materials, safeguard the local environment during construction and protect controlled waters.

The investigation process should follow a scientific approach, with the extent of sampling being more robust where contamination is found. It is important that a risk assessment of the pollutants found is carried out. This should follow the source, pathway, to receptor principle contained within the new contaminated land guidelines. Details of the investigation and the proposed remediation treatment should be submitted to Environmental Health for approval and to BCCS as part of the Building Regulation submission.

Risk assessment should be modelled using the Scottish and Northern Ireland Framework For deriving targets to minimise the adverse Effects of Exposure to contaminants in soil (SNIFFER) or Contaminated Land Exposure Assessment (CLEA) reports (CLR7-10) published in March 2002. The Inter-departmental Committee for the Reclamation of Contaminated Land (ICRCL) or the Kelly's guidelines are not based on health risk and are less applicable to the new regime, so These should only be used as the basis for determining re-mediation where the above models are not applicable. '*Model Procedures for Management of Contaminated Land: Evaluation & Selection of Remedial Measures*', (CLR11) is due by end of 2002. The approach outlined in 'The Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources' Environment Agency R & D Publication 20 will be used to protect controlled waters.

8.3 Remediation

Many early reclamation schemes in the UK relied on the use of cover systems to limit exposure to contaminants at the surface of a site. The construction of physical barriers can represent a relatively simple low-cost reclamation strategy, but at worst, cover and conceal contaminant may be a predominantly a cosmetic exercise that simply conceals contamination resulting in property blight and increased liability.

8.3.1 Remediation Techniques & Indicative Costs

	Techniques	Process Application	Cost
Biological	Windrows & Land-farming (*Ex situ*)	Long windrows with added organic bulking agents, built on impermeable surface, & mechanically turned. Regular tiling or plowing to aerate contaminated soil that has been excavated & screened to which water & nutrients have been added.	–
Biological	Biopiles	*Ex-situ* aeration or other treatment of contaminated soil to enhance bio-degradation of organic contaminants	–
Biological	Intrinsic Bio-remediation Biostimulation /Biorestoration	Most effective in dealing with oil hydro-carbons, solvents, some tarry wastes and phenolics. May be achieved *Ex-situ* within weeks subject to optimal conditions, but requires excavation, or in some cases can be combined with active aeration and/or vacuum extraction and applied *In situ*.	Approx£ 20-40 pcm
Biological	Bioventing (*In-situ*)	Oxygen supplied via perforated piping to stimulate biodegradation by soil microbes	Up to £9 pcm
Biological	Biosparging (*In-situ*)	Used below the water table. Air is injected via boreholes to encourage dissolution of oxygen & rise of air & volatile compounds.	–
Physical	Soil Vapour Extraction (SVE)	SVE's are suited to *In situ* remediation in built-up & industrial areas as vents can be placed between or below buildings and can be applied during construction.	Approx £5-10 pcm
Physical	Soil-Washing (*Ex situ*)	Uses chemical/physical extraction & separation methods to remove soil contaminants, & win back material for re-use as fill. Needs substantial equipment and plant/ & is best for large volumes of contaminated material	–
Stabilisation	Solidification (*In-situ*)	Converts soil into a solid monolith, thus reducing the permeability of the material.	–
Stabilisation	Stabilisation (*In-situ*)	Changes chemical form of contaminants/ increases binding strength to solid matrix.	
Stabilisation	Encapsulation (*In-situ*)	Excavation & construction of a bentonite tanking wall. Site then capped with clay.	Up to £8 pcm
Thermal	Desorption	Uses temperatures of 600-900°c to physically separate volatile/semi volatile contaminants from soil. *(ex-situ)*	–
Thermal	Incineration	Generates high temperature (800-1200 °c) oxidation reaction. *(ex-situ)*	_
Thermal	Vitrification	High temperatures (1000-1700 °c) used to melt soil into an impermeable matrix.	_

The 'dig-it-all-up' disposal costs can easily reach £40 to £90 per cubic metre (per cu. m) or more. At these costs escalation in volumes resulting from poor initial delineation of contamination or inadequate operational management on site can result in remediation cots running quickly out of control.

Alternative techniques such as bio-remediation, soil vapour extraction and soil washing are established in the UK, are frequently cheaper than disposal, and have a successful and proven track record. Therefore there will be a presumption in favour of on-site treatment. The Environment Agency will be consulted when these remediation techniques are considered. A range of these techniques is briefly described above.

9.0 Air Quality

Poor air quality affects human health and the environment. As part of its approach to sustainable development the Government has adopted the UK National Air Quality Strategy (NAQS) to deal with the assessment and management of air quality. National policies on air quality are expected to deliver countrywide improvements on air quality. However, locally because of transport, commercial and industrial activities, air quality will remain poor and will require a more focussed approach to improve air quality.

Fig.16: Brent's Air Quality Management Areas (AQMA's) 2001, shaded.

9.1 Air Quality Management

As part of the Council's Air Quality Management duties, review and assessment of air quality was carried out to assess the probable levels of air pollution in 2005. The Council has declared Air Quality Management areas covering a large proportion of the Borough on the basis that targets for nitrogen dioxide and fine particles will not be met (See Fig. 16 below). In order to bring pollution levels in the borough to within nationally accepted levels, the Council will be publishing an Action Plan in 2001. The Action Plan will affect the whole borough and will not be linked just to AQMAs since emissions will need to be controlled over a much wider area.

A key principle of Local Air Quality Management is that local authorities should integrate air quality considerations with other policy areas, such as planning. It is important to bring the air quality considerations into the planning process at the earliest possible stage. The Government's Planning Policy Guidance Note (PPG23: Planing & Pollution Control) recognises that the planning system has a role to play in combating pollution. Circular 15/97 gives an introduction to the function of local authorities in delivering the Government's National Air Quality Strategy through the Local Air Quality Management system. UDP policy EP3 deals with air quality. It is important to stress that any development likely to have an impact on air quality in AQMAs or adjacent to such areas would be regarded as significant. This guidance addresses in detail issues of air quality and how the development(s) should be designed to minimise air pollution from the development.

9.2 Dealing with Planning Applications:

<u>Design & Location of Facilities</u>

Careful consideration shall be given to the site and area characteristics. Consideration should be given to elements of a scheme, which are more sensitive to air pollution than others. The following measures shall be considered:

- Locate housing and children's play area should be away from roads in AQMAs and roads with high pollution levels.
- Use the location and design of buildings to act as a barrier or mitigate the adverse impact of air pollution.
- Discourage car parking in AQMAs
- Ensure new developments provide parking spaces for car clubs'

<u>Construction/Demolition Impacts</u>

The re-use of existing building stock reduces emissions as well as associated transport and energy needs. New development during its demolition and construction phase will impact on air quality. Major developments, and those within AQMAs should be undertaken in accordance with BRE guidance on Construction and Demolition by Kukadia et al (2003) which sets out best practice techniques and methods to control dust and fine particles.

<u>Promoting Alternative Modes Of Transport</u>

The Council seeks to reduce road traffic emissions by encouraging a modal shift from car use to walking, cycling and public transport, by the following measures:

- Ensure new developments make cycle facility provision
- Seek the submission of Green Travel Plans
- Offset the impact of the development by improving background air quality through the use of traffic management e.g. setting up traffic restricted zones
- Review public transport systems
- Parking management to reduce the number of cars entering an area. Options include reducing the number of spaces available, increasing charges or limiting the maximum stay.
- Regulation of industrial emissions (Environmental protection Act 1990 and Clean Air Act 1993).
-

9.3 Facilities for Clean Fuel Vehicles

Alternatively fuelled vehicles have a role to play in mitigating air pollution impacts. The Council will seek:

- The provision at petrol stations and other suitable locations of facilities for the sale of alternative cleaner fuels e.g. Liquid Petroleum Gas (LPG) and Compressed Natural Gas (CHG) refuelling and Electric charging points.
- Provision of convenient points for alternative fuel refuelling within developments Developers should ensure these are designed-into schemes;
- Where possible deliveries and other servicing by low emission vehicles, such as natural gas, electric or by vehicles fitted with emission control technologies.

Fig.17a, b, c: Left, *Reva* electric car; Middle, Corbin's *Sparrow* electric car; Right,.EVT electric car

9.4 Indoor Air Quality: Elimination of Pollutants at Source

People typically spend 90% of their time indoors. The impact of poor outdoor air quality on buildings' indoor air quality, particularly in AQMAs has become an issue of great concern. It is important that pollutant ingress into buildings in these areas, is minimised by effective building design and ventilation. The Council will encourage an approach that prioritises elimination of pollutants at source such as:

- Using renewable energy and energy conservation rather than heating boilers
- Replacing solvent based paints with water-based paints rather than using end-of-stack filters.

9.5 Assessments:

In addition to the requirement to provide an air quality assessment under the Town & Country Planning Act 1999, developers will be required to carry out an air quality assessment where the development has the potential to

- Result in significant emissions of pollutants from industrial activities
- Generate significant increase in traffic
- Result in a significant increase in emissions of one or more National Air Quality Strategy prescribed pollutants.

9.6 Section 106 Planning Agreements & Conditions:

There is scope to use Section 106 agreements and planning conditions to mitigate the impact of emissions by:

- The control of air quality impacts during construction phase
- Specifying the number of parking spaces and their size
- Providing safe pedestrian routes
- Restricting/prohibiting use of specific vehicle classes/types with monitoring maintenance & emissions testing of fleet
- Requirement for operators/occupiers to monitor emissions & specified pollutant concentrations at off site locations.
- Promoting improvements in public transport, walking & cycling
- Use of clean fuel vehicles fleets by companies
- Companies adopting Environmental Management Systems & Air Quality Strategy
- Promoting car clubs
- Junction & road layouts
- Travel Plans covering:
  - ❑ Management and use of parking spaces so priority is given to disabled people, people with children, visitors or cars with more than one occupant, electric cars
  - ❑ Removal of parking spaces after specified period, or when public transport access to the site is improved by walking and cycling (e.g. when a bus route is introduced to the site)
  - ❑ Setting targets on the proportion of employee trips made by public transport & alternative transport modes;

- ❑ Public transport facilities e.g. bus stops/lay-bys
- ❑ Secure cycle parking and changing facilities
- ❑ Creating Car Clubs (car sharing schemes) linked to Car-Free development or Pool cars
- ❑ Provision of information to staff & visitors about public transport, walking, & cycling access to the site
- ❑ Charging for workplace parking.

9.7 CAR CLUBS

Source: London City Car Club

Car clubs can facilitate higher housing densities, and allow full use of old or redundant buildings, by helping to meet tougher parking standards in congested central urban areas.

Member-ship of a car club allows people to access a car without the need to own one, or the expense of running one. Vehicles, within a five minute walk of residents' homes, can be booked over the phone or internet for as little as one hour.

Developers should consider promoting or establishing a car club in all low car or car free developments where there is; a requirement to reduce car parking on site and for green travel plans, good access to public transport, and an established car club operator in the area. Brent is a member of the London Car Club Consortium.

9.8 Urban Design Measures for Pollution Dispersal

Small-scale urban design can be used to encourage the rapid dispersal of pollutants near the ground, but advantage is not often taken of this possibility.

The urban canopy (area up to 2-3 times the built form height) is the area that can be most influenced for local pollution sources (up to 1 km). Some building shapes have more marked effects than others in dispersing local pollution. The most significant are tall buildings and courtyards or enclosed spaces.

This factor should be used in mixed complexes e.g. leisure centre, restaurants etc. all having different ventilation requirements and pollution emission controls. The main urban layout features & effects include:

Main Urban Design Measures

Feature	Effects on Urban Ventilation Rates
a) Surface Area Density	This is the ground surface percentage blocked by buildings: • Below 5-10% individual buildings determine wind-speeds & dispersion; • Above 5-10% it is the overall qualities of the built form which determine windspeeds & dispersion rates; • Up to 80-90% buildings are so closely packed that a new raised ground surface is created at roof height, displacing windflow above buildings, so local windspeed near the ground is reduced & pollutant concentrations increase. A network of 'Street Canyons'; i.e. linked narrow spaces between buildings, is thus formed, through which slowly passing contaminants are eventually shifted to roof level.
b) Building Heights & Widths	• Isolated buildings experience rapid pollutant dispersion across their widths & heights up to widths that are about eight times their height; • At surface area densities of about 20%, windspeeds are most affected by building width; • In denser areas, building heights exert the most effect on ground windspeeds, which are rapidly reduced with increased height. Overall pollutant dispersal is encouraged in areas with low-moderate surface area densities, having low & wide buildings.
c) Building Height & Width Variation	In urban areas of above 20% density, big variations in building height facilitate entry of higher windspeeds to ground level in some parts, raising the average windspeed, but it may not have very much effect on the overall dispersion of pollutants.
d) Buildings' Alignment	Aligning urban streets or buildings at about 30^{o} to the most frequently occurring wind directions, improves pollutant ventilation at ground level.

N.B: These features should be balanced against the goals of other UDP policies and/or SPG standards.

10.0 Noise Pollution

10.1 Noise & Vibration

Noise, both inside and outside buildings, is one of the most emotionally charged issues in our modern urban environment. Nuisance from noise can severely impact upon the health and quality of life of residents within the community. It can also affect the ability of pupils to learn effectively in schools and colleges; and can impair health and productivity in the workplace.

Brent is a vibrant London borough, which incorporates a dense residential housing stock often integrated with commercial and industrial premises. The Council strives towards minimising noise levels within acceptable and practicable limits.

Possible sources of noise and/or vibration include roads, railways and industrial/commercial noise, entertainment, construction, mechanical plant and deliveries. Among the most intrusive sources of noise pollution is that derived from people with conflicting lifestyles living in close proximity.

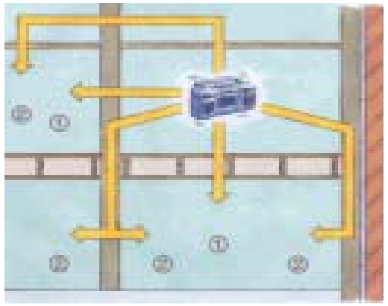
Low-frequency noise (LFN) is around us all the time, but people have different levels of sensitivity to it, so what is inaudible to one person can cause much distress to another. Sources of LFN include road, rail or air traffic, industrial chimneys, boilers, HVAC systems, fans, electrical installations, and amplified music – often heard as a persistent low rumble or hum. This can profoundly affect people's wellbeing, causing symptoms such as irritation and unease, fatigue, headaches, nausea and disturbed sleep. Low-frequency noise can be difficult to trace, as the frequencies travel far and may seem to come from various directions. It is therefore important to use a consultancy with the right experience and expertise to tackle potential problems.

Planning Applications - The Council bases its UDP noise Policy EP2 on Planning Policy Guidance (PPG 24) when considering the use of conditions to minimise the impact of noise. Developments will be assessed in relation to their possible impact upon the local environment and specifically the impact upon local residents and/or the impact of locating a new development near a noise source. Account should also be taken of the Mayor's Draft London Ambient Noise Strategy, which is required to include a summary of action or proposed to be taken to promote measures to reduce the impact of noise.

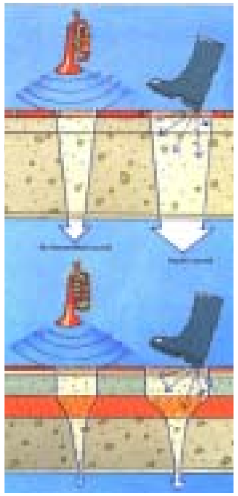
This is an important consideration in ensuring that ambient noise does not creep to unacceptable levels. Uses and activities will be considered and assessed, in certain circumstances developments may not be acceptable if it is not possible to achieve or demonstrate that unacceptable noise nuisance can not be eliminated. The Council may consider imposing planning conditions restricting the hours of operation for industrial/ commercial and entertainment developments should the potential for noise disturbance be identified.

10.2 Dwellings - Flats, Conversions & New-build

New developments sited near railways, roads or mixed sources will be initially assessed in accordance with the Planning Policy guidance Note (PPG 24), with advice to the appropriate noise exposure categories, taking account of both day and night time noise levels. Development shall be constructed so that the impact of vibration from any road/railway falls into the category of 'Low probability of adverse comment' in accordance with BS 6472: Evaluation of human exposure to vibration in buildings (1 to 80 Hz).



Figs.18a,b: Above Noise paths for airborne sound include direct paths (1) & flanking paths (2). Below Air & impact transmitted sounds. controlled by using both hard & soft layers. Sources: Immotus R+ (DOW) above & '*Living Spaces'*, Konemann, below.



All developments should be designed so as to ensure that the internal noise levels defined as 'good' where individual noise events should not normally exceed 45 dB L_{Amax} at night in bedrooms are attained in BS8233: '*Sound Insulation and Noise Reduction For Buildings*' - code of practice with consideration for the local environment. Design considerations should be observed so that where external noise sources exist, non-living areas are located facing the source (single aspect design).

All developments should be designed with 'like-for-like' living arrangements (i.e. bedrooms over bedrooms). Care should be taken to avoid locating stairs next to noise sensitive rooms e.g. bedrooms, in adjacent dwellings.

In flats, sound absorbent material should be applied to the ceiling surfaces of internal stairwells to reduce sound propagation. Resilient floor coverings, such as carpet should be used on stair treads to minimise noise from footfalls. Separating walls as described in Approved

Document E of the Building Regulations, should be used between corridors and flats to control flanking transmission In conversion or changes of use, consideration should be given to proposals where carpets are to be removed and either the existing wooden floor kept or a new one laid, to ensure minimum transmission of impact noise to neighbouring properties. The insulation provision should be designed as a minimum to meet Approved Document Part E.

Developers are encouraged to consider insulation greater than stipulated in the Building Regulations, which are statutory minimum levels. Attention is drawn to requirements for converted dwellings. In mixed use developments separation of living areas from service areas (e.g. flats over shops) with sound-attenuating passive ventilation units and systems, and quiet components should met the criteria defined in Part E of the Building Regulations.

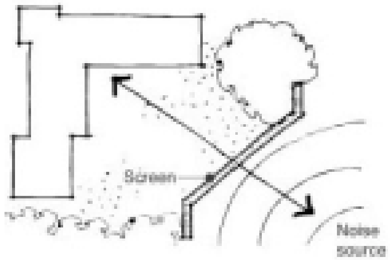
10.3 Industrial/Commercial Developments

All developments and/or associated plant should be designed to ensure the existing ambient background levels at the nearest residential premises during hours of operation are not increased (i.e. that the rated level is more than 10 dB below the measured background level), with tonal or impulsive characteristic being taken in to account.

Fig.19: Noise Contour Map of an industrial complex. Source 'Env. Noise', Bruel & Kjaer, 2001.

Assessment shall be carried in accordance with BS4142: 'Rating industrial noise affecting mixed residential and industrial areas'.

Design schemes to ensure delivery areas are located away from residential areas where possible and/or are enclosed or sheltered. Such considerations should also be applied for general parking areas. Pay particular attention to premises located below or next to residential property where change of use is proposed.



Developers should ensure that there are no increases in noise transmission between neighbouring premises as a result of the new activities. Suitable insulation where practicable shall be installed to achieve this, failure may lead to refusal.

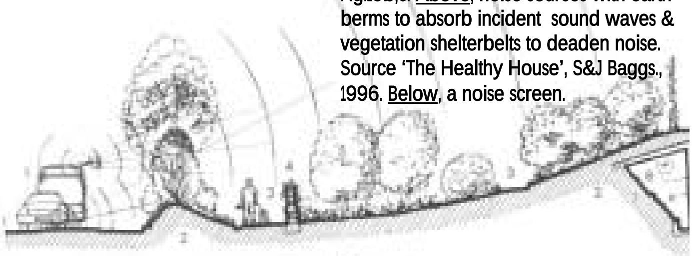


Fig.19b,c: Above, noise sources with earth berms to absorb incident sound waves & vegetation shelterbelts to deaden noise. Source 'The Healthy House', S&J Baggs., 1996. Below, a noise screen.

Roads: Consider where new roads or major alterations occur to the existing Strategic Road Network. The 'Design Manual for Roads and Bridges', volume 11, section 3, part 7, traffic noise and vibration, 3.5 states: '*In the period following a change in traffic flow, people may find benefits or disbenefits when the noise changes are as small as 1dB(A)-equivalent to an increase in traffic flow of 25% or a decrease in traffic flow of 20%. These effects last for a number of years*'.

The impact of road traffic noise should also be accessed against these criteria. Secondly this statement implies that people become acclimatised to this level of noise. However, it should not be assumed that people always become fully acclimatised to such increases'

Landscape Design: There are some 'soundscaping' measures that can help minimise the effects of noise such as:

- Specifying noise reducing surfaces e.g. porous surfaces for vehicles. The open structure of the surface reduces the compression and expansion of air in the tyre tread profiles which suppresses mechanical and aerodynamic noise generated by the rolling tyre on the road. The acoustic absorption effect is not restricted to tyre/road noise only but is also effective in reducing mechanical noise, radiated from the underside of the vehicle where the oil pan and the gearbox housing form the main sources of engine noise.
- Avoiding paving setts and other noisy surfaces where trolleys are in use;
- Loose aggregate pedestrian surfaces to mask voices as people leave pubs;
- Use of willow walls as noise barriers
- Use of earth berms to absorb incident noise from busy roads;
- Vegetation shelterbelts and thick garden walls alongside roads/other noise sources to deaden noise;
- Use of active water, such as fountains, to mask traffic noise.

Building Design: measures including:

- Façade continuity, including use of innovative link and barrier blocks as noise barriers, depending on the extent to which development can offer noise protection not just to primary users, but possibly also to a wider area;
- Other barriers (where acceptable aesthetically and in urban design terms) must be suitably located in relation to either the noise source or receiver. It is important that the barrier is continuous and of sufficient mass and height
- Façade diffusion, fins and reflectivity, or use of cantilevering, arcading, canopies, acoustic balconies, podiums and other set backs where possible in housing estates, to isolate quiet areas and provide to 'quiet façades'.

10.4 Entertainment

Particular attention should be paid to developments (mainly A3) where music or other entertainment is to be provided. Developers should ensure that there are no increases in noise transmission between neighbouring premises as a result of such activities. Suitable acoustic treatment should be used to ensure that this is achieved.

10.5 Construction

Activities on construction sites which may result in an increase in noise levels at the boundary of the site can only be carried out during the following permitted hours: Mon. to Fri. (8.00 till 18.00); Sat. (8.00 till 13.00) At no time on Sundays or Bank holidays. Exception may be granted due to local circumstances (i.e. emergency works).

Before works commence the contractor may be required to submit for approval a method statement (in accordance with the principles described in BS5228) providing:

1. Information on the type of plant to be used and the proposed noise control methods;
2. A programme of work indicating the level of noise and vibration and the location for each activity, ensuring 'Best Practical Means' are used.
3. Calculations of L_{Aeq} and L_{max} at specified buildings as requested.

Schemes will also be required to comply with other relevant provisions of the Control of Pollution Act 1974 and the Environmental Protection Act 1990. On major sites, there may be a requirement to organise regular site meetings with the Council and involve local residents/tenants associations.

10.6 Schools

Development of new schools or improvements to existing schools should be done with regard to acoustic design in accordance with Part E of the Building Regulations 2003 with guidance from Building Bulletin 93: Acoustic Design for Schools. No development should be undertaken without prior consultation from the local authority.

11.0 Water Pollution

11.1 Connections, Incidents & Responsibilities

All public sewers in the borough are maintained by Thames Water. There are three different network types –North, West & East Brent are served by separate waste & surface water sewer systems – in South Brent, a combined sewer system serves all waste & surface water.

A number of properties in the borough have irregular connections where the wastewater is connected to surface water system, due to inexperienced builders connecting new sanitary connections to the nearest drain. The EA & London's Waterway Partnership intend to pilot a certification system – 'Certificate of Correct Drainage' – whereby all properties changing ownership are surveyed for correct drainage connections to storm & foul sewers.

All surface water sewer discharges to brooks, ditches and rivers. The Council is responsible for maintaining "Non Critical Ordinary Watercourses" and ensuring that flow is maintained all the time. The Environment Agency maintains the two Main Watercourses within Brent (River Brent & Wealdstone Brook). Local residents living adjacent to rivers and ditches tend to report Pollution Incidents, and Brent jointly with Thames Water and Environment Agency carries out investigations.

When the pollution source is identified, Brent's Environment Health Unit serves a notice on the property owner to rectify the problem and if this is not done within a specified period, the Council carries out the works and recovers the cost from the owner.

11.2 Construction Precautions

The contractor must take measures to ensure that any liquid of a potential hazardous nature on site is controlled in line with COSHH Regulation and properly bunded to avoid contaminants reaching watercourses or ground-water, including aquifers.

In the case of any excavation works below the water table, including any extensive site de-watering, the contractor must inform the Environment Agency and Environmental Health of the works to be conducted. The de-watering and disposal methods must be agreed with the Environment Agency and where appropriate, an abstraction licence should be obtained by the contractor.

D. Case Studies

12.0 Case Study – Employment Development

12.1.1 Wessex Water Operations Centre

The new Wessex Water Communications Centre on the outskirts of Bath is a good example of sustainable new build offices on a brownfield site. Wessex Water bought the site on the corner of Brassknocker Hill and Claverton Down Road in October 1997. Approximately three kilometres south east of Bath, the site is 28,000m2 (6.75 acres) and was previously used as a hospital, which was demolished in the 1980s. It overlooks the Limpley Stoke valley in the Cotswold area of outstanding natural beauty. Wessex Water gained planning permission for their unique building in 1999 and completed construction in 2000.

The Wessex Waters headquarters achieved an "excellent" rating from the BREEAM assessment and also gained 10/10 in an environmental performance index. The position, scale and location of the building are all influenced by the site topography, mainly to reduce the negative visual and environmental impacts that could result from this new building. The building is two stories high and follows the contours of the site, this also helped to reduce costs and the requirement for excavation. Other measures included:

- Wooded southern areas were retained and all existing trees were protected during the building works
- The design of the building reduces solar glare/overheating through tinted windows
- Overhanging roofs at the south/west/east to avoid glare
- Recycled rainwater flushing toilets
- Energy efficient lighting triggered by sensors
- Inclusion of photovoltaic (PV) panels on the roof of the building to maximise potential energy
- Waste minimisation was a high construction priority - involving a detailed review of the supply chain and waste recycling on site. Overall approximately 75 per cent of all construction waste was recycled
- The design focused on a cut and fill balance on site to avoid the removal or importation of large volumes of earth and rock
- Existing topsoil was stockpiled on site for reuse, and excavated rock was used in boundary walling or crushed to become hardcore
- Recycled aggregate has also been used in concrete on site from old concrete railway sleepers
- There is a shuttle bus provided which travels between the building and the train station
- Secure bike shelters are provided along with showers, lockers and changing areas
- Facilities in the building, such as meeting rooms, are for the use of employees and the local community.

The building's "thermal performance" was simulated on computer to determine how efficient the structure would be. Like Sainsbury's building overleaf, the Wessex Water building used concrete in the construction of the building to minimise heat loss in the winter but prevent over heating or solar gain in the summer.

Top: perspective, Bottom (Left) & middle): elevations & (Right) atrium view

13.0 Case Study – Residential Development

13.1 *BedZed* "Pioneering Green Village"

An initiative partnered by the Peabody Trust, BioRegional and Zedfactory (Bill Dunster Architects), the BedZed development is a "Zero Energy Development" on a brownfield site in Beddington, Sutton. It is comprised of 82 housing units, employment space, a shop, sports pitch and clubhouse and a healthy living centre with childcare facilities. The design is pedestrian and cyclist friendly and electric cars will be made available to car share groups. The design of the development is to be as energy efficient as possible and to supply its own energy on site. The expertise gained from all of the partners has resulted in a truly sustainable scheme, which is also accessible through tenure mix and achieves high quality living space in a high-density development. The tenures are; Shared Ownership, Outright Sale, Cost Rent & Affordable Rent, plus 23 workspace units for creative/high-tech businesses. The residential and employment units are designed in an unconventional terraced style. All residential units:

- Are south facing with glazed front elevations and triple-glazed timber windows to reduce heat loss.
- Are all fully insulated and have been designed without radiators or air conditioning.

- The energy for the development comes from a central CHP system, fuelled by renewable resources, mainly tree surgery waste from Sutton and Croydon.
- The high insulation and CHP heating means reduced heating bills while roof top, wind-powered ventilation "cowls" recover heat loss from exiting stale air and uses it to heat incoming air.
- Have energy efficient light fittings, appliances and other measures, to reduce yearly energy bills by approx. £500.
- Have their own gardens which form part of the "sky terraces" which can be seen in the images opposite. Some of the larger "town houses" even have direct internal access to the employment units if the owner wishes to utilise this opportunity.
- Each house will have solar panels with recharging points for electric vehicles, and will have an automated rain & grey water system for flushing WC's as well as watering plants.
- This use of renewable energy sources will ensure the development is "carbon neutral" which means that there will be no addition to carbon dioxide in the atmosphere.

- Recycled materials are used for the structural steelwork, timer internal doors and in the crushed concrete aggregates.
- It has been built using materials with as low embodied energy as possible

14.0 Case Study – Commercial Development

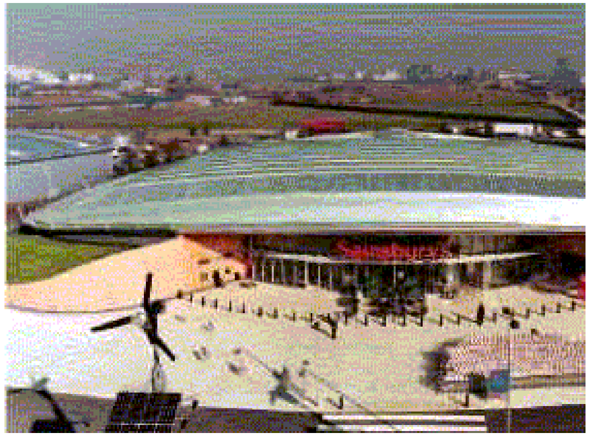
13.1 Sainsbury's "breathing store" development in Greenwich

More and more commercial developments are being built to sustainable standards as it becomes clear that savings can be made on energy bills. An example of this is the Sainsbury's supermarket in Greenwich, which was designed by Chetwood Associates. It was opened in 1999 and as well as achieving 31 out of 31 in the BREEAM building test, constituting an "excellent" rating has, to date, been nominated for the Stirling Prize last year by members of the public, and won the Aluminium Imagination Award in 2001.

The supermarket shows how commercial viability and sustainable design can be merged together to form a successful development through the following ways:

- The supermarket has been designed to be as energy efficient as possible with projected energy savings of 50% from that of ordinary supermarkets.
- Turfed earth mounds acting as insulation from wind and extreme weather surround the building.
- The concrete walls means the building retains heat in the winter yet is cool in the summer.
- The roof is constructed out of recycled aluminium strips, which admits natural light through double glazed, North facing "saw tooth" roof lights. These allow natural light through into the shop and reduce the need for artificial lighting.
- The configuration of the rooflights means that while natural light is kept at an optimum, there is minimal glare emitted into the night sky.
- Internally, there is passive ventilation and an under floor heating system.
- The under floor heating system is powered by heat reclaimed from the refrigeration which is powered by sustainable propane based "ozone friendly" fuel. The wasted heat is then used to heat the ventilation system which works by drawing air in externally at ground level and expelling at roof level, creating a "breathing" supermarket.
- Water efficiency is achieved by drawing resources from the water table instead of the local supply to provide the water for the toilets.
- Outside the supermarket, a reed bed has been incorporated into the landscaping; this cleans the grey water from the service yard and releases it into the rear lagoon that is hoped to evolve into a landmark and visitors attraction.

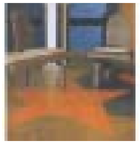
Rainwater is used for irrigating the landscaping which is made up of native species of plants or drought tolerant plants. Outside the supermarket, there are wind turbines and solar panels on site, which power the night store lighting.



Sainsbury's Greenwich development views

Appendix I GLOSSARY OF ABBREVIATIONS & TERMS

Aggregate	Natural, artificial or recycled granular material used in construction.
Asphalt	Mixture of bitumen and aggregate
AQMA	Air Quality Management Areas - where levels of Nitrogen dioxide and fine particles are/will be higher than health targets
BCCS	Building Control Consultancy Services is Brent's Building Control Unit. It enforces the national Building Regulations
Carbon Index	Indicates carbon dioxide emissions from a building's energy use. It Ranges from 0-10 (reckoned from SAP). A dwelling needs to achieve a CI of 8 to meet Part L of the Building Regulations.
CHP	Combined Heat & Power – uses waste heat from local gas-fired or biomass energy generation within a development
Co_2	Carbon Dioxide – one of the gases that cause greenhouse effect
Concrete	Mixture of cement and aggregate
CDM	Construction (Design and Management) Regulations, 1994. This is aimed at improving health & safety to reduce the high number of injuries and deaths on UK construction sites.
COSHH	Control of Substances Hazardous to Health Regulations 1999
CLR	Contaminated Land Regulations – new decontamination regime
DTLR	Department of Transport, Local Government & the Regions
'Egan Compliant'	The recommendations of the Egan Report '*Rethinking Construction',* were the result of an Inquiry into the practices & performance of the Construction Industry. It tried to address the outdated construction methods, delays and adversarial contractual relationships which all contribute to high costs and unreliability.
EIA	Environmental Impact Assessment of specified Major projects
FSC	Forestry Stewardship Council – certifies timber from renewable sources that are managed according to environmental standards.
HSE	Health & Safety Executive
ISA	Independent Sustainability Assessment of development proposals
ISO 14001	International award for organisations that use an environmental management system to limit their environmental impact. Brent Council's 13 Environmental Service units achieved this in Aug. 2001.
GLA	Greater London Authority – the Mayor's strategic authority for London
LA21	Local Agenda 21 action plan drawn by local communities and Councils
L_{aeq}	The equivalent continuous noise level, is the value of the A-weighted sound pressure level in decibels (dB) of a continuous, steady sound, over a specified time interval, T, has the same energy as the fluctuating sound in question
L_{max}	The maximum A-weighted sound pressure level
Masonry	Brickwork, blockwork, stonework
Potable water	Water for human consumption – drinking, cooking, hygiene, etc.
PPG	Planning Policy Guidance – national Government policy
PV	Photovoltaic panels generate electricity from daylight
Impulsive characteristic of noise	Distinct impulses (bangs, clicks, clatters or thumps)
RCA	Recycled aggregate mostly from crushed masonry, crushed concrete or crushed/milled asphalt previously used in construction
RPG	Regional Planning Guidance – Government policy for regions such as the South East
SAP (1-120)	Standard Assessment Procedure for Energy Rating of Dwellings – it indicates the cost per sqm of providing energy for heating and hot water. Lower energy cost lead to higher ratings – these are used in calculating the Carbon Index.
SDS	Spatial Development Strategy for London (known as the Draft London Plan – June 2002)
Section 106	S.106 or Planning Agreements are used to ensure that developers provide/compensate for any necessary facilities or infrastructural improvements or costs that arise from their development schemes.
SPG	Supplementary Planning Guidance – this is separately produced to give detailed guidance on how a policy or proposal in the Unitary Development Plan can be satisfactorily met.
SUDS	Sustainable Urban Drainage Systems
Tonal characteristic of noise	Distinguishable, discrete, continuous note (whine, hiss, screech, hum, etc)
'U' Value	Measures heat transmitted through a material. Low = less heat loss
UDP	The Unitary Development Plan is the legal plan for the Borough. It contains the policies used to decide all the planning applications received by the Council.



APPENDIX 2 – MATERIALS ENVIRONMENTAL GUIDANCE TABLES

4.3 Floor Structure

4.2.1 Foundations to below Floor Level

(Key: ☺☺☺ Most Environmentally Sound, ☺☺ Environmentally Sound, 😐 Less Environmentally Sound)

Element ↓	Environmentally Unsound ☹	Toxicity/ Health Effects?	Environmentally Preferred Alternatives ☺☺☺ ☺☺ 😐	Cost Relative to Env. Unsound
Foundation Posts	• Concrete with primary aggregate	N/A	• Forestry Stewardship Council (FSC) Timber with concrete top • Concrete with reclaimed aggregate	• Savings • Savings
Ground under Suspended Floors	• PVC membrane	Plasticisers/ Carcinogenic	• Shells • Foamed concrete/Sand • Expanded clay granules/Polyethylene membrane	• Extra? • Half • A quarter/Same
Damp-proof Membrane	• Chemical solvent DPC • Bituminous DPC/DPM	Organic compounds/ nausea, nervous system, headaches	• Low odour chemical DPC • Polyethylene DPC/DPM • Engineering brick slate/Thin steel sheeting	• Additional cost • No difference • Substantial extra

4.2.2 Ground/Intermediate Floor Construction, Screeds & Floor Coverings

Element ↓	Environmentally Unsound ☹	Toxicity/ Health Effects?	Environmentally Preferred Alternatives ☺☺☺ ☺☺ 😐	Cost Relative to Env. Unsound
Ground Floor	• Solid concrete with primary aggregate	N/A	• FSC Timber (suspended floors)/ Hollow ceramic elements • Hollow concrete elements with RCA or limestone • Solid concrete with reclaimed aggregate or limestone	• A third • Half • Saving
Ground Floor Thermal Insulation	• Extruded polystyrene • Polyurethane	• N/A • Isocyanate v. harmful to human health, harzardous additives	• Mineral wool/Expanded polystyrene • Foamed glass • Perlite/Vermiculite	• Saving/Slight extra • Extra? • Extra/Double
Party/ Intermediate Floors	• Solid concrete with primary aggregate	N/A	• FSC Timber • Hollow ceramic & concrete elements with RCA /or limestone • Solid concrete with RCA	• A third • Half • Saving
Floor/Ceiling Acoustic Insulation	• N/A	N/A	• Coconut fibreboard • Flax felt strips/rolls • Natural wool felt • Wood-fibre boards • Recycled natural rubber & cork	• 3x cheapest • Small extra • Little > cheapest • Cheapest • Dearest
Balconies	• Concrete with primary aggregate • Non-FSC Tropical timber	N/A	• FSC durable Timber • Sectional steel/ Aluminium • Prefab. Concrete with RCA	• Half/small extra • A quarter/saving • Half/extra cost
Floor Screeds	• Phosphogypsum anhydrite	• Phosphorus/radio-active, Carcinogenic	• Flue-gas gypsum anhydrite • Natural gypsum anhydrite • Sand-cement	• Half • Extra cost? • Savings
Bath/WC Floors	• PVC (vinyl tiles)	• Phthalates/suspected hormone disrupter	• Granitic/terrazzo • Ceramic tiles • Polyester	• Significant extra • Significant extra • Significant extra
Floor Coverings	• Vinyl (PVC) • Synthetic carpets • Woolmark carpets with synthetic latex backing	• Phthalates/suspected hormone disrupter • Styrene/ carcinogenic • Pyrethoids/nerve poison & styrene/ carcinogenic	• Cork floor tiles • Linoleum with natural fibre backing • Sisal & coir (coconut fibre) carpet with natural backing • Maize, rush & seagrass matting • Untreated wool carpet with jute/natural latex /wool backing • Untreated wool & nylon carpet with natural backing • Tongue & groove softwood flooring • Ceramic tiles • FSC hardwood strips • Quarry stone tiles	• Same/saving/saving • Extra/extra/Half • Same/saving/saving • Same/saving/saving • Extra/Extra/Same • Extra/Same?/saving • Savings • 2X/2X/Saving • Extra/Extra/Extra • Extra/Extra/Same

4.4 External

4.3.1 Landscaping

Element ↓	Environment Unsound ☹	Toxicity/ Health?	Env. Pref Alternatives ☺☺☺ ☺☺ 😐	Cost Vs Env. Unsound
Hard paving	• Asphalt • In-situ concrete	• N/A • N/A	• Recycled aggregate concrete slabs • Concrete slabs • Turf • Brick pavers • Concrete blocks • Granite setts	• Extra/Saving • Same/Saving • Extra/ Saving • 3x /Saving • Extra/ Saving • 4x /Saving
Semihard paving	• Gravel	N/A	• Wood/bark chippings • Recycled glass sand • Sand	• Same • Saving • Extra
Garden separation	• Recycled PVC • Non-FSC Tropical timber • Copper Chrome Arsenate (CCA) Treated timber	• N/A • N/A • Organic solvents/ nervous system, headaches/nausea	• Hedges • Woven wood waste • Untreated softwood on concrete spur posts	• Savings • Same? • Extra cost?
Privacy screens	• Non-FSC Tropical timber • CCA Treated timber	• N/A • Organic solvents/ nervous system, headaches/ nausea	• Hedges • Sustainable FSC timber with concrete footing • Masonry	• Savings? • Savings? • Extra cost
Bin Stores	• Non-FSC Tropical timber • CCA Treated timber	• N/A • Organic solvents/ nervous system, headaches/nausea	• FSC Durable Timber • Untreated softwood on concrete spur posts • Masonry/ • Prefab. Concrete • Recycled PVC	• Extra cost? • Little or no difference? • Extra cost • Little or no difference

4.3.2 Drainage, Gutters & Drainpipes

Element ↓	Environment Unsound ☹	Toxicity/ Health?	Env. Pref Alternatives ☺☺☺ ☺☺ 😐	Cost Vs Env. Unsound
Sewers	• PVC	• Vinyl chloride & phthalates /carcinogenic & suspected hormone disrupter	• Vitrified clay • Polyethylene (PE)/ polypropylene (PP) • Concrete • Recycled PVC	• Extra cost • Savings • 3x • Double
Gutters	• PVC • Zinc • Copper	• As above • Toxic to water organisms • Toxic to water organisms	• FSC Timber • Polyester Coated/ galvanised steel • Coated Aluminium/ recycled PVC	• Extra/saving/ extra • 4x/2x/6x • 2x/extra/4x
Lining	• PVC • Zinc • Lead	• As Above • As Above • Nervous system	• EPDM/mod. bitumen • Blown bitumen • Polyester	• Half/7x/8x • Half/7x/8x • $5^{th}/10^{th}$ /11^{th}
Drainpipes	• PVC • Copper	• As above • As Above	• PE/PP • Polyester • Steel/Recycled PVC	• Half/fifth • Same/half • Extra/Saving

4.5 Wall Structure

4.4.1 External Cavity Wall

(Key: ☺☺☺Most Environmentally Sound, ☺☺ Environmentally Sound, ☹ Less Environmentally Sound)

Element ↓	Environmentally Unsound ☹	Toxicity / Health Effects?	Environmentally Preferred Alternatives ☺☺☺ ☺☺ ☹	Cost Relative to Env. Unsound
External wall Skin	• Non-FSC Tropical timber • Preserved softwood	• N/A • Preservative toxins phenols copper, chrome, arsenic)/ nausea, nervous system, headaches	• FSC durable timber/clay honeycomb block • Loam/cob/recycled brick & lime mortar • Masonry (new brick with lime mortar) • Fibre-cement/new brick & cement mortar • Resin-bonded plywood	• Sig.extra/sig.extra • Extra/extra • Little diff./saving • Same/saving • Extra/same
Internal wall skin	• Concrete	• N/A	• FSC Timber elements • Sand-lime blocks • Flue-gas gypsum blocks • Cellular concrete blocks • Natural gypsum blocks	• Savings? • Savings • Half • Extra • Savings
Cavity wall insulation	• Polyurethene; • Extruded polystyrene	• Toxic ingredients/ • Hazardous additives	• Cork board; • Cellulose (recycled paper) • Mineral/ rock wool; • Expanded polystyrene • Glasswool/foamed glass	• Little/no difference • Significant savings • Extra cost/ • Savings? • Savings?
Cladding	• Non-FSC Tropical timber • Composite Steel Panels • Composite Aluminium Panels	• N/A • N/A • N/A	• FSC timber/compressed unfired cay brick • Sustainable plywood • Fibre cement • Recycled Profiled Steel or Aluminium cladding	• Sig. extra/double/extra • Extra/extra/saving • Same/small extra/saving • Savings
External wall rendering	• N/A	• N/A	• Ceramic Tiles • Mineral render • Synthetic render	• 3x cheapest • Cheapest • 4x cheapest

4.4.2 Internal Wall Construction, Wall & Ceiling Systems

Element ↓	Environmentally Unsound ☹	Toxicity/ Health Effects?	Environmentally Preferred Alternatives ☺☺☺ ☺☺ ☹	Cost Relative to Env. Unsound
Party walls	• Solid concrete with primary aggregate	• N/A	• Earth-based (Loam) • FSC Timber frame • Brick (sand-lime) • Cellular conc. block • Porous brick • Concrete with RCA • Limestone	• Half • Small saving • 1/8th • A quarter • Half • Savings • Savings
Solid walls	• Pre-cast concrete elements	• N/A	• Earth-based (Loam) • Flue-gas gypsum block • Brick (sand-lime) • Cellular conc. block • Natural gypsum block	• 1/25th • 1/15th • 1/12th • 1/5th • 1/13th
Plasterwork	• Phosphogypsum	• Phosphorus/ radioactive	• Flue-gas gypsum • Lime mortar • Natural gypsum	• Half • Same • Sig. savings
Wall & ceiling Framing systems	N/A	N/A	• Softwood • Steel • Aluminium	• Little or no difference • Substantially more • Extra cost
Wall & ceiling Panelling systems	• Phosphogypsum board • Medium density fibreboard (MDF)	• Phosphorus/ radioactive • Formaldehyde/skin & eye irritant, respiratory system possible carcinogen	• Karlite medium board • Flue-gas gypsum board • Natural gypsum (plasterboard) • Formaldehyde- free MDF	• Extra cost • Little or no difference • Little or no difference • Extra cost

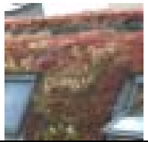
Windows, Doors & Glazing

4.5.1 Window Frames & Doors

Element ↓	Environment Unfriendly ☹	Toxicity/ Health Effects?	Env. Preferred Alternatives ☺☺☺ ☺☺ ☹	Cost Relative to Env. Unfriendly
External window / door frames	• Non-FSC Tropical timber • uPVC	• N/A • Vinyl chloride/ carcinogenic & phthalates / suspected hormone disrupter	• FSC durable timber • Untreated softwood • Softwood with solid borate implant • Sustainable plywood (door) • Aluminium • Preserved softwood • Recycled uPVC	• Little xtra/same • Extra/saving • Sig. extra/sig. extra • Sig. extra/sig. extra • Expensive • Significant extra • Significant extra
External Window sills	• N/A	• N/A	• Ceramic • Concrete • Natural stone • Prefab. Conc. • Cast stone • Synthetic stone • Aluminium • Fibre conc.	• 1.8x cheapest • Cheapest • V. Expensive • Cheapest • 3x cheapest • 3x cheapest • 2.5x cheapest • 2x cheapest?
Internal window frames	• Non-FSC Tropical timber	• N/A	• FSC timber • Galvanised & coated steel	• Little extra • Significant extra
Internal Window sills	• N/A	• N/A	• Ceramic tiles • Natural stone • Softwood • Sustainable plywood • Cast stone • Fibre cement • Chipboard • Synthetic stone	• 4x cheapest • V. expensive • 5x cheapest • 3x cheapest • 8x cheapest • 2.5x cheapest • Cheapest • 8x cheapest
Internal doors	• Non-FSC Tropical timber	• N/A	• Honeycomb with hardboard skins • European softwood • Sustainable plywood • Chipboard	• Extra cost • Double • 3x • Extra cost
Internal door thresholds	• Non-FSC Tropical timber	• N/A	• FSC durable wood • Sustainable softwood • Steel with coating	• Extra cost • Little/no diff. • Extra cost

4.5.2 Glazing

Element ↓	Environment Unfriendly ☹	Toxicity/ Health Effects?	Env. Preferred Alternatives ☺☺☺ ☺☺ ☹	Cost Rel. to Env. Unfriendly
Glazing type	• Single	N/A	• Argon-filled low emissivity • Air-filled low emissivity • Double	• Significant extra • Significant extra • Extra
Installation	• N/A	N/A	• Dry • Semi-dry • Wet	• Cheapest? • Same as cheapest? • Dearest?



4.6 Roof-Structure (Fig 20: Green roofs at BedZed)

4.6.1 Roof Construction

(Key: ☺☺☺ Most Environmentally Sound, ☺☺ Environmentally Sound, ☹ Less Environmentally Sound)

Element ↓	Environmentally Unfriendly ☹	Toxicity/ Health Effects?	Environmentally Preferred Alternatives ☺☺☺ ☺☺ ☹	Cost Relative to Env. Unfriendly
Roof Shape	• N/A	• N/A	• Pitched • Arched • Flat	• Lowest • Extra • Slightly more
Pitched Roof construction	• Plywood from Non-FSC tropical wood	• N/A	• Sustainable FSC timber • Box panels/ Sustainable plywood • Chipboard (low formaldehyde) • Chipboard	• Significant extra • Extra cost • Significant savings • Significant savings
Pitched roof Insulation	• Polyurethane/Poly-isocyanurate • Extruded polystyrene	• Isocyanate extremely harmful to human health • Hazardous additives	• Cork/ Cellulose/ Sheep's wool • Flax • Mineral wool/ Expanded polystyrene	• Extra/Saving • ? • Extra/Same
Pitched roof Covering	• Zinc with PVC/PVF coating • Asbestos cement	• Plasticisers/carcinogenic & phthalates/suspect hormone disrupter • Fibrous silicate/carcinogenic	• Green (Turf)/Timber shingle/Reed/reclaimed tiles • Clay or concrete roof tiles/natural slate • Fibre-cement slates/ Bituminous slates • Corrugated panels/Copper	• Extra/Saving • Half • Half • Half
Flat roof construction	• Concrete without reclaimed aggregate	• N/A	• Softwood rafters & joinery • Steel sheets/ Cellular concrete • Concrete with reclaimed aggregate	• Significant savings • A quarter • Significant savings
Flat roof insulation	• Polyurethane/ Polyisocyanurate • Extruded polystyrene	• Isocyanate extremely harmful to human health • Hazardous additives	• Cork • Expanded heavy duty polystyrene/Dense mineral wool • Foamed glass • Perlite	• Same/Saving • Saving/Extra • Saving • Saving/Extra
Flat Roof Covering	• Steel with organic coating • PVC sheet	• Plasticisers/carcinogenic and phthalates/suspected hormone disrupter • As above	• Green 'sedum' (turf) • EPDM Sheet/natural rubber • Modified bitumen felt • Blown bitumen felt/EPDM with bitumen layer • Recycled PVC • Stainless Steel/Aluminium /Copper/Zinc sheet	• Extra • Half/small extra • Half/small extra • Saving/extra • A third/small extra • Same/extra/extra
Flashings	• Lead • Zinc	• Lead/nervous system • Toxic to water organisms	• Polyethylene membrane • EPDM membrane • Polyisobutene (PIB) with Al. gas	• 1/6th/Half • Savings/double • Small saving/double

Green 'turf' roofs are an environmentally friendly alternative and may be flat, arched or pitched. They reduce surface water run-off in urban areas, 'heat islands', and improve urban air quality. There are two types; 'extensive' green roofs (lightweight with shallow soil & low maintenance aesthetic planting) and 'intensive' green roofs (for recreation & trafficking, with more robust construction, and a variety of surfaces & planting, requiring more maintenance). Green roofs can last up to three times longer than standard roofs.

4.7 Plumbing & Internal Waste

Element ↓	Environmentally Unfriendly ☹	Toxicity/ Health Effects?	Environmentally Preferred Alternatives ☺☺☺ ☺☺ ☹	Cost Relative to Env. Unfriendly
Water Supply piping	• Lead	• Lead/nervous system	• Polyethylene (cold water only) • Polybutylene / Polypropylene • Stainless steel • Copper	• Saving • Saving • Saving • Saving
Internal waste	• PVC	• Plasticisers/carcinogenic and phthalates / suspected hormone disrupter	• Ceramic • Polypropylene/Polyethylene • Recycled PVC.	• Extra • Savings • Extra

4.8 Heating Installations (for highly insulated buildings)

Element ↓	Environment Unsound ☹	Toxicity/ Health Effects?	Env. Pref Alternatives ☺☺☺ ☺☺ ☹	Cost Vs Env. Unfriendly
Individual space heating	• N/A	• N/A	• Gas wall heaters • Low wattage Electric heater (wall mounted)	• Small extra • Cheaper
Central Space / Water Heating	• Standard oversized boiler • Standard combi-boiler or Electric water heater	• N0x/ Respiratory problems	• Correctly sized Solar & condensing boilers • Condensing combination boiler • High-efficiency combination boiler	• Extra cost • Extra cost • Extra cost

4.9 Paint Finishes

Element ↓	Environment Unsound ☹	Toxicity/ Health Effects?	Env. Pref Alternatives ☺☺☺ ☺☺ ☹	Cost Vs Env. Unfriendly
Interior Painting (wood)	• Alkyd (oil-based) paint	• Organic solvents/ nausea, headaches, nervous system/ reproductive effects	• Natural wax • Water borne natural stain • Water borne acrylic (gloss) • Water borne alkyd • Natural paint • High-solids alkyd	• Small extra • Small extra • Extra cost • Savings • Small extra • Small extra
Exterior Painting (wood)	• Alkyd (oil-based) paint	• As above	• Natural paint • Boiled paint • High-solids alkyd • Water borne alkyd • Water borne acrylic (gloss)	• Small extra • Small extra • Small extra • Savings • Extra cost
Wall Surface Preparation	• Solvent-based preservative	• Benzene/ reproductive effects	• None • Natural preservative • Water borne preservative	• N/A • 7x? • Small extra
Interior Painting (walls)	• Alkyd (oil-based) paint	• Organic solvents/ nausea, headaches, nervous system/ reproductive effects	• Whitewash • Linseed oil emulsion • Mineral Paint • Water borne natural stain • Natural paint • Water borne acrylic emulsion	• Savings • Extra cost • Expensive • Small extra • Savings • Extra cost
Exterior Painting (walls)	• Alkyd (oil-based) paint	• As above	• Mineral Paint • Water borne natural stain • Natural paint • Water borne acrylic paint	• Expensive • Small extra • Savings • Extra cost
Ferrous Metal Painting	• Lead red lead • Epoxyl alkyd paint • Thermal galvanising	• Lead/ nervous system • Harmful emissions to workers	• Natural paint • Duplex galvanising • High-solids alkyd • Alkyd (oil-based) paint • Iron red lead	• Extra cost? • Expensive • Small extra • Same? • Saving?

It must be clearly understood that the use of certain materials in these tables, need to be carefully specified to comply with Building Regulation requirements. BCCS are happy to discuss specific proposals at an early stage in the design process.

APPENDIX III: References & Bibliography

*(Items marked * may be viewed for reference in Brent Planning Service)*

General:

1) *Sue Roaf, Manuel Fuentes & Stephanie Thomas, (2001), *'EcoHouse: A Design Guide'*, Architectural Press, Oxford.
2) *Steve Charter, (2000) *'Planning for Sustainable Construction & Development: A guide to Positive Planning for 21st Century Buildings & Development'*, Somerset Trust for Sustainable Development.
3) *F. Stevenson & N. Williams (2000) *'Sustainable Housing Design Guide for Scotland'*, Scottish Homes & Scottish National Heritage, HMSO.
4) *James Wines (2000) '*Green Architecture*', TaschenKoln/London.
5) PJ Littlefair et al (2000), *'Environmental Site Layout Planning'*, BRE, Joule & DETR.
6) Thomas Schmidt-Gunther Ed. (1998),*'Living Spaces: Sustainable Building and Design'*, Konemann, Cologne,
7) B&Q (1998) '*How Green is my Patio?: B&Q's Third Environmental Review*', B&Q Plc.
8) Sydney & Joan Baggs (1996) *'The Healthy House: Creating a Safe, Healthy & Environmentally Friendly Home'*, Thames & Hudson.
9) Barton H, Davis G and Guise R, University of West of England (1995) '*Sustainable Settlements: A Guide for Planners, Designers & Developers*', LGMB. London.
10) *Building Research Establishment (1995) *'Environmental Standard: Homes for a Greener World'*, CRS.
11) Findhorn Foundation & John L Talbott (1993) *'Simply Build Green: A Technical Guide to the Ecological Houses at the Findhorn Foundation'*, Findhorn Foundation Development Wing, Findhorn, Scotland.

Energy:

12) Mayor of London (2002) *'Draft Energy Strategy'*, GLA
13) *London Research Centre & David Bartholomew Associates (2000) '*Renewable Energy in London: An Overview of Current Projects & Future Prospects*'.
14) Brian Horne & Pete Geddes (2000) *'Tapping the Sun: A Guide to Solar Water Heating – How to Adapt Your Domestic Plumbing to use the Sun's Heat'*, Centre for Alternative Technology (CAT) publications.
15) *Sophia & Stefan Behling (2000) *'Solar Power: The Evolution of Sustainable Architecture'*, Renewable Energies in Architecture & Design (READ) Group, Prestel Verlag, Munich/London.
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17) *Terrence O'Rourke for DETR/DTI (1999) *'Planning for Passive Solar Design'*, BRESCU/BRE.
18) *LRC (1998) '*Exploiting Renewable Energy in London: An Overview of Renewable Energy Technologies*', EU/DTI funded, LRC & David Bartholomew Associates.
19) *DTI (1994) *'Renewable Energy: Planning For the Future – A Guide for Local Authorities'*, ETSU.

Materials:

20) *N Lazarus (2002), *'BedZed Construction Materials Report: Toolkit for Carbon-Neutral Developments – Part 1'*, Bioregional
21) *S. Curwell et al (2002) *'Hazardous Building materials: A Guide to the Selection of Environmentally Responsible Alternatives'*, Spon Press, London/New York.
22) *T. Wooley, S. Kimmins, (2000) '*Green Building Handbook Vol.2: A Guide to Building Products & Their Impact on The Environment*', (compendium of *Green Building Digest* 13-24) for ACTAC & Ethical Consumer Association, E & FN Spon.
23) *BRE (2000) *'The Green Guide to Housing Specification'*, CRS.
24) *BRE (2000) *'EcoHomes: The Environmental Rating for Homes'*, CRS.
25) *D. Anink, C. Boonstra & J. Mak (1998) *'Handbook of Sustainable Building; Environmental Preference Method for Selection of Materials for Use in Construction & Refurbishment'*,
26) *BRE Post Office, BRE, Oxford Brookes University (1998) Report 351 *'The Green Guide to Specification: Environmental Profiling System for Building Materials & Components'*, BRE.
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De/Construction:

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32) Bradley & S. McLendon (2000) '*Building Deconstruction: Reuse & Recycling of Building Materials*', Center for Construction & Environment, University of Florida for the Alachua County Solid Waste Management Innovative Recycling project.
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Water:

36) *G. Mayes & L. Young (2001) *'Water Regulations Guide'*, Water Reg. Advisory Service.
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Air Quality:

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Health & Safety:

39) HSE *Health and Safety in Construction* HS (G) 150 ISBN 0 7176 1143 4
40) HSE *Managing Asbestos in Premises* INDG223(rev2)
41) HSC *The Control of Asbestos at Work*-Approved Code of Practice L27
42) HSC *Designing for Health and Safety in Construction* ISBN 07176 0807 7
43) HSC *Managing construction for health and safety* DM Regulations ACOP L54
44) HSC *A guide to managing health and safety in construction*

APPENDIX IV: Relevant Council Documents & Contacts

BRENT DOCUMENTS:

PLANNING:

1. Replacement Unitary Development Plan (UDP): Revised Deposit Version, April 2001.
2. Sustainability Appraisal of Brent's Replacement UDP: Deposit Draft Version, 2001.
3. Environmental Appraisal of Brent's Adopted UDP, Jan. 1999.
4. SUSTADIA: Sustainable Planning Advice for Wembley Stadium, 1998.
5. Unitary Development Plan (UDP), Adopted, Feb. 1996.
6. Supplementary Planning Guidance (SPG) Numbers 1-18, 1996.

ENVIRONMENTAL HEALTH:

7. Brent Draft Air Quality Action Plan. Spring, 2003.
8. Brent Land Contamination Inspection Strategy, April 2002
9. Brent Air Quality Management Area Order, April, 2001.
10. Implications of Brent Air Quality Review & Assessment, 2000.
11. Air Quality Reviews & Assessments Stages 1-3, 1998-2000.
12. Brent Air Quality Strategy, 1998

ENVIRONMENTAL STRATEGY:

13. LA21 (Local Agenda 21) Action Plan, 2000-2001.
14. LA21 (Brent State of the Environment Report – Position Statements) 1997.

STREETCARE:

15. Brent Waste Strategy, (due Aug 2002)
16. Brent Recycling Plan, 1996.

PARKS/ECOLOGY:

17. Brent Best Practice Guidelines for Role of Parks in Flood Prevention, 2001
18. Brent Biodiversity Action Plan, 2000
19. Nature Conservation in Brent, Ecology Handbook 31, 2000.

TRANSPORTATION:

20. Interim Local Implementation Plan (ILIP), 2002-2003

BRENT CONTACTS:

THE PLANNING SERVICE:	
Ken Hullock/Dellé Odeleye (Policy)	020-8937 5315
R.Buckle/M.Smith (Urban Design)	020-8937 5213
Chris Barrons (Landscape Design)	020-8937 5112
Geoffrey Hewlett (North Area)	020-8937 5223
F Wheat/D Traynor (South Area)	020-8937 5228
Stephen Kelly (West Area)	020-8937 5227
Chris Walker	020-8937 5246
Maggie Jones (Policy/Projects)	020-8937 5202
Steve Weeks (Area Planning)	020-8937 5238
ENVIRONMENTAL HEALTH:	
Yogini Patel (Air, Land, Water)	020-8937 5252
Richard Buckley (Noise)	020-8937 5252
ENERGY SOLUTIONS – NORTHWEST LONDON:	
Roger Kelly/Dina Gillespie	020-8903 9369
BUILDING CONTROL CONSULTANCY SERVICE:	
Andy Hardy	020-8937 5476
John Humphries	020-8937 5477
Govind Dabasia (North)	020-8937 5478
John Flynn (South)	020-8937 5479
STREETCARE (WASTE & RECYCLING)	
Tony Talman (Waste reduction)	020-8937 5081
Michael Morgan (Recycling)	020-8903 5074
TRANSPORTATION	
Pat Lau (Development Control)	020-8937 5111
Adrian Pigott (Transport Planning)	020-8937 5168
Hash Patel (Drainage)	020-8903 5275
PARKS	
Shaun Faulkner	020-8937 5619
Leslie Williams (Biodiversity)	020-8937 5628
HEALTH & SAFETY	
Geoff Galilee	020-8937 5358
Colin Conboy	020-8937 5409
WEMBLEY PROJECT/ENV. STRATEGY	
Keith Tallentire	020-8937 2273
Joyce Ip	020-8937 2274
Lella Durante/Suzanne Coster	020-8937 5324
ENVIRONMENTAL SERVICES DIRECTORATE:	
Richard Saunders	020-8937 5002
Michael Read	020-8937 5302

APPENDIX V: Useful Organisations & Resources

GENERAL

- Association for Environment-Conscious Building (AECB) – *publishes directories of practitioners & suppliers* - Tel: 01559-370 908, Email: admin@aecb.net Website: www.aecb.net
- Construction Industry Research & Information Association (CIRIA), Tel: 020-7222 8891, Email: enquiries@ciria.org.uk Website: www.ciria.org.uk
- Centre For Sustainable Construction, Building Research Establishment (BRE) Tel: 01923-664 462, Email; breeam@bre.co.uk Website: www.bre.org.uk
- British Standards Institution (BSI) 2 Park Street, London W1A 2BS
- Chartered Institute of Building Services Engineers (CIBSE) *window design manual* – Website: www.virtual-conference.com/cibse97/conference/papers/e-html/
- National Radiological Protection Board (NRPB) Radon Enquiry Bureau, Tel: 0800-614 529
- Environment Agency, General Enquiry Line 0845 9333111 North East Area Office (Thames Region) Tel: 01707 632300

BUILDING SERVICES:

- Building Services Research & Information Association (BSRIA) Tel: 01344-426 511, Website - www.bsria.co.uk/bsriaweb/
- Heating & Ventilating Contractors' Association (HVCA) Tel: 020 7313 4900 Fax: 020 7727 9268 e-mail: contact@hvca.org.uk
- Boiler & Radiators Manufacturers' Association Ltd. BARMA Tel: 0141 332 0826 Fax: 0141 332 5788

Thames Water Utilities Ltd. SN38 1TU Tel: 0118-964 0526

- Water Regulations Advisory Scheme (WRAS) *water supply industry-funded scheme to encourage consistency of interpretation of the water fitting regulations across the UK* Tel: 01495-248 454 Email: info@wras.co.uk Website: www.wras.co.uk
- Combined Heat & Power Association (CHPA) – *provides advice, information & access to grants* –Tel: 020-7828 4077 email:info@chpa.co.uk web: www.chpa.co.uk

RENEWABLE ENERGY:

- National Energy Foundation (NEF) Renewables Service, Tel: 01908-665577 Email:renewables@natenerg.demon.co.uk Website:natenerg.org.uk/nefrenewables
- Centre for Alternative Technology (CAT), Machynlieth, Powys SY20 9AZ Tel: 01654-702 400
- Solar Trade Association, Tel: 01208-873 518
- The Solar Energy Society, c/o School of Engineering, Oxford Brookes University Tel: (+44) 1865 484 367 Fax: (+44) 1865 484 263 E-mail: uk-ises@brookes.ac.uk Website: http://www.thesolarline.com
- British Wind Energy Association (BWEA), Tel: 020-7402 7102
- British Hydropower Association, Tel:
- Solar Trade Association Tel: +44 1908 442290 Fax: +44 0870 0529194 Website: www.greenenergy.org.uk/sta/ Email: enquiries@solartradeassociation.org.uk

FINANCIAL

- The Ecology Building Society, *fund rescue/ conversion of derelict buildings, new 'green' buildings, buying 'back-to-back' houses, ecological lifestyles,* Tel: 0845-674 5566 (Email:info@ecology.co.uk web www.ecology.co.uk
- Energy Saving Trust, *Grants,* Website:www.est.org.uk/solar
- Carbon Trust, Interest-free loans, www.actionenergy.org.uk

MATERIALS/TRADES

- Construction Resources, *builders merchant specialising in ecological materials,* Tel: 020-7450 2211 Email: info@ecoconstruct.com Website: www.ecoconstruct.com
- Natural Building Technologies Ltd. Tel: 01491 638911 Email:info@natural-building.co.uk :www.natural-building.co.uk
- Thermal Insulation Manufacturers & Suppliers Assoc., TIMSA, Tel: 01252 739154 Fax: 01252 739140 Email: info@associationhouse.org.uk
- Council for Energy efficient Development, National Cavity Insulation, Insulated Render & Cladding & Draft Proof Advisory Associations and National Association of Loft Insulation, Tel: 01428-654 011
- British Earth Sheltering Association - www.besa-uk.org
- Green Roofs *offers background & details on green-roof architecture.* Website: www.greenroofs.com
- Forests Forever, provides further information on sources of sustainable timber Tel:020-7839 1891:www.forestsforever.co.uk

MATERIALS RECYCLING & DECONSTRUCTION:

- DeTR Materials Information Exchange hosted by BRE *Internet-based exchange for buying and selling used, second hand & unutilised construction materials* Tel: 01923-664461 Website: cig.bre.co.uk/waste/
- National Federation of Demolition Contractors (NFDC) Tel: 01784 456799 Email: info@demolition-nfdc.com Website: www.demolition-nfdc.com
- SALVO, *publish information (newsletter, directory & Internet site) about and for the UK reclamation industry* Tel: 01890 820333 Email: tk@salvoweb.com: www.salvo.co.uk

Appendix VI – Credits & Consultation

Credits:

Members of the Sustainable Design Working Group:

Dr. Noel Thompson	(Kilburn Ward Member)
Dellé Odeleye	(Planning – UDP Policy & Research)
Yogini Patel	(Environmental Health – Pollution Team)
Roger Kelly	(Energy Solutions – Northwest London)
Dina Gillespie	(Energy Solutions – Northwest London)
John Humphries	(Building Control Consultancy Services)
Mumtaz Shaikh	(Planning – Development Control Western Area)

The contributions of Richard Buckley (Environmental Health), Hash Patel (Transportation), Colin Conboy (Health & Safety), Suzanne Coster (Environmental Strategy), Geoff Raw, Ailie Savage, Robin Rigg, John Walker, Andrea Brochocka and Tav Kazmi are gratefully acknowledged.

Background & Consultation:

1. A rather weak policy had been formulated in the 1st deposit draft the UDP March 2000 (on the basis that was the most that could be done at the time). However, within the supporting text was a commitment for the Council to produce an SPG during the life of the Plan (i.e. within 5-10 yrs) depending on resource availability. Cllr Noel Thompson, Kilburn Ward, presented a paper to the UDP Members Steering Group, which was considering the Council's response to the objections received from the 1st deposit consultations (Spring 2000). The paper bemoaned the low sustainable design content of the Revised UDP. As a result, the UDP Steering Group Members agreed the production of an SPG should be prioritised and produced in time for the UDP Inquiry.

2. A working party was formed in Dec 2000 with the interested Member, and representatives from other Env. Services departments such as Env. Policy & Performance, Building Control and Env. Health, as well as Brent's local Energy Advice Centre, to formulate a stronger policy which went into the 2nd Deposit UDP. It also researched and compiled current best practice into a Draft Supplementary Design & Planning Guidance document, in Oct. 2001.

3. Internal consultation was carried out within Environmental Services (Oct 2001-June 2002) to consider a range of implementation options, and with representatives of other Council units (Education, Housing, Legal, etc) as well as liaising informally with efforts of a couple of other Boroughs, the GLA & GoL. The drawn out internal consultation process, was to ensure other staff across the service units were all consulted and had an opportunity to influence the document, so that all units would be 'signed-up' to sustainable design objectives and could deliver a joined-up approach.

4. It was thought there'd be an avalanche of objections to the stronger Policy in the Revised deposit UDP, but surprisingly there was not even 1 objection! So it did not have to be defended at the UDP Public Inquiry in Feb 2002.

5. Members early in July 2002 approved the draft SPG for public consultation from Aug - Sept 2002. Those consulted included: Statutory organisations, Residents associations, Professional bodies, agents, planning and design consultants, and officers in other Boroughs. A workshop session was also held in Brent Town Hall as part of the consultation. The responses and/or workshop contributions of the following have been very useful:

Chris Revell	*(Kensington & Chelsea Primary Health Trust)*
Dr Vina Kukadia	*(BRE Environment)*
Ken Bean	*(Government office for London)*
Tim Johnston	*(Greater London Authority)*
Mathew Sounders	*(Ancient Monuments Society)*
Emma Nafzeger	*(Environment Agency)*
Alex Machin	*(English Nature)*
Michael Wetherell	*(Landscape Institute)*
Mark Mathews	*(Thames Water Property Services)*
Prof. Tom Woolley	*(Queens University Belfast)*
Adam Fowles	*(Registered Architect)*
Bekir Andrews	*(Groundwork West London)*
Stuart Gadson	*(Barnet Council Local Agenda 21)*
Spike Hudson	*(South Kilburn Community Consultants)*
Gill Close	*(Dollis Hill Residents Association)*
Kenneth Smith	*(Chartered Architect)*
G.F. Benham	*(Cardinal Hinsley Catholic High School)*
David Housego	*(PRP Architects)*
H. Pattni	*(Sanderson, Townsend & Gilbert)*
Nigel Pugsley	*(McCarthy & Stone, Planning Bureau)*
Adam Bows	*(formerly Brent Transportation Unit)*
Lella Durante	*(Brent Environmental Strategy)*
Dave Carroll	*(formerly Brent Planning Service -UDP Policy)*

6. The results of the consultation and proposed changes were taken back to Members in April 2003 and they agreed a revised SPG and Checklist, subject to any necessary editorial changes necessary to obtain the Plain English Campaign's (PEC) Crystal Mark.

7. It was later realised that the type of changes involved in securing this accreditation were not all appropriate for a technical document of this nature. However, many of the suggested changes to the document were incorporated into the amended version finally adopted by Members in November 2003.

8. Final Steps:
   - Making the SPG operational & refining implementation procedures;
   - Refining the Checklist in response to queries raised by developers; and
   - Further training for Planning Officers &Planning Committee Members.