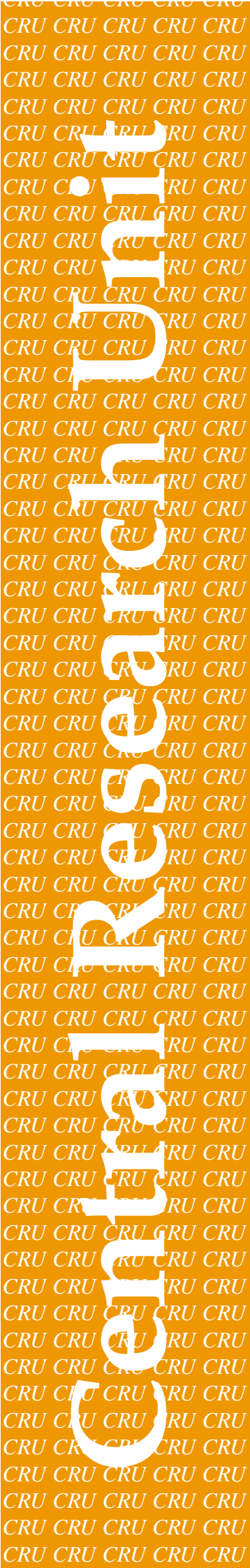


**SCOTTISH HOUSE:
A REVIEW OF RECENT
EXPERIENCE IN BUILDING
INDIVIDUAL AND SMALL
GROUPS OF HOUSES WITH
A VIEW TO SUSTAINABILITY,
THE USE OF TRADITIONAL &
NEW MATERIALS, AND
INNOVATIVE DESIGN**



SCOTTISH EXECUTIVE



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NEW MATERIALS, AND INNOVATIVE DESIGN**

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**Scottish Executive Central Research Unit
2001**

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EXECUTIVE SUMMARY

1. Sustainable development is now a central aspect of government policy. In this respect the built environment is a principal cause for concern as the extent of its' actual and potential adverse social, environmental and economic impacts are now well documented. An area in which it is felt that guidance on appropriate design responses could lead to widespread benefit, concerns the potential advantages of applying sustainable design principles to architectural design in rural environments.

2. In recent years there has been increased interest in rural Scotland in building homes to meet sustainable development objectives. As a consequence there are excellent examples of individual and small groups of homes emerging. However, it is evident that those seeking to apply sustainable design have sometimes come up against barriers when projects have been perceived as creating a challenge to traditional planning policy and Building Control authorities¹.

3. One mechanism thought useful to identifying and disseminating the potential benefits was to identify the barriers which have been faced in seeking to apply sustainable design and where these have been overcome, within the required standards, to result in attractive, fitting design. As a consequence this study was initiated by the Scottish Executive Countryside and Natural Heritage Department. The case histories of a number of houses in rural Scotland, with characteristics of general relevance to sustainability, have been studied. It is hoped and anticipated that the outcome will assist in addressing the overarching concerns of architectural design quality, rural housing and sustainable development and thereby inform policy in these respects. The case studies and issues raised during the consultation process are discussed here and a selection of illustrative material is provided which might be used in a subsequent publication. The selection aims to reflect best practice in all respects.

4. Recently a number of initiatives have sought to address serious concerns for the fittingness of new buildings in the Scottish countryside and improving the overall quality of architectural design in Scotland. These are longstanding concerns. However the challenges of sustainable development, and the need to pursue and enhance best practice in this regard, adds an additional dimension to this much needed debate. Indeed the need for a sustainable built environment raises serious questions about the extent to which perceptions based on now recognisably unsustainable cultural traditions may need to be challenged, appropriate responses identified and the opportunities and concerns this raises.

5. It is evident from this study, that those seeking to apply sustainable design in buildings have faced a number of barriers. Many, but not all of the aspects, involve innovative technical responses with which the relevant bodies may be unfamiliar such as energy & water resource management, fabric, structure and treatment of materials. Other aspects are concerned with the perceived appropriateness of some innovative forms and materials.

6. The case studies and consultation process have highlighted that some sustainable design can challenge visual traditions. This does not mean that they are not of high quality design, nor that they are less fitting responses than less sustainable buildings. Many innovative technical solutions could be applied more widely and lack of adequate knowledge

¹ Building Control is the process by which any proposed building project is assessed for compliance with the Statutory Building Standards. It is operated at Local Authority level and gives rise to variations in interpretation.

among relevant bodies may be stifling innovation to the detriment of the environment.

7. It is hoped that the feedback provided here can contribute to the evolution of the building control procedures and the regulatory framework so as to improve its ability to deliver government objectives with respect to sustainable development. It could also contribute substantial benefits to the environment in general, to rural environments and communities and to innovation in the Scottish building industry.

8. There is a clear problem in the relationship between innovation and relaxation of regulations in respect of sustainable construction and the responsibility that this invokes. Some concerns focus on lack of complete understanding of the environmental appropriateness of materials, techniques and processes to the Scottish environment and the present skills base. There is also concern about style and aesthetic suitability. Whilst the past is often invoked there is a public perception that much average conventional rural building, systems and materials might be deemed inappropriate in many ways.

9. There is a desire to unlock the present situation to ensure future development is fitting, appropriate and sustainable and that Scotland can plan for future sustainable development. Planners and building control however, are conscious that relaxation can also lead to negative, inappropriate development as well as positive interventions. Hence they are seeking a framework within which the latter can be enhanced and not the former.

10. The principle research implications of this report are provided below as a list of requirements and/or suggested actions:

- Guidelines on sustainable design based on an informed long term view of the rural environment.
- Communication of policy on sustainable design targeted at appropriate professional bodies, as the basis for;
 - action by professional bodies in rural development, for example policy & implementation statements; and
 - a review of the planning and building control process to include sustainability as a principle objective.
- Modernising the culture of Building Control to one in which new ideas and change are explored with enthusiasm, to include;
 - improved dissemination and sharing of contemporary information on good practice and innovation by building control and planning authorities as an aid consistency and improved effectiveness;
 - development of flexible decision making informed by improved knowledge of design aesthetics and sustainability perhaps through involving architects and/or sustainability advisors in the planning process;
 - replacing the culture of perceived problems in favour of a more open, creative, proactive response to problem solving;
 - improved Continuing Professional Development (CPD) and training opportunities in sustainable in the planning and building control professions; and
 - Improved CPD and training opportunities in design in the planning and building control professions.
- Actively seeking out and rewarding skills in sustainable design.
- Promotion of interest in leading edge environmental initiatives.

- Research into materials and systems both historical and in use.
- Improved understanding of the costs and economic impact of sustainable construction and rural development.

CHAPTER ONE

POLICY BACKGROUND

1.1 The consultation paper Investing in Quality² was issued in 1998 in response to public and professional concerns being expressed about the poor external design quality of much new housing in the Scottish countryside. It discussed aspects of town and country planning and design trends as well as sustainable development. The consultation paper which makes valuable background reading in respect of the present study, drew a broad range of responses and has resulted in commissioning of a programme of relevant research projects. The research described here forms part of this series.

1.2 It in part results from a recognition that sustainable development is now firmly placed at the centre of government policy and that the role of the building industry, building control and of the regulatory framework are relevant, wide ranging and significant. It is a response to the evident need for feedback to all involved regarding beneficial application of sustainable development principles.

1.3 The subject matter is closely related to other work by the Executive, including the Draft Policy on Architecture, which also addressed issues of quality, and of sustainable development. Of particular relevance are a number of National Planning Policy Guidelines (NPPG's³) and Planning Advice Notes (PAN's⁴) concerned with rural development and with the siting and design of buildings. It also touches on the interests of Scottish Natural Heritage and others who are concerned with existing buildings and development of relevant skills⁵.

² Investing in Quality - Improving the Design of New Housing in the Scottish Countryside - A Consultation Paper, The Scottish Office 1998

³ NPPG15: Rural Development The Scottish Office 1999

⁴ Planning Advice Note: Pan 39: Farm & Forestry Buildings The Scottish Office 1993

Planning Advice Note: Pan 36: Siting and Design of New Housing in the Countryside The Scottish Office 1991

Planning Advice Note: Pan 44: Fitting New Housing into the Landscape The Scottish Office 1994

⁵ Historic Scotland Traditional Building Materials Conference Proceedings 1997

CHAPTER TWO

THE STUDY METHODOLOGY

2.1 A call for information and examples was disseminated to all the regional groups representing Scottish Architects and Planners, to Scottish Homes, the Scottish Ecological Design Association, Association for Environment Conscious Building. Specialist interest groups and practices were also contacted, for example Community Self-build, the Findhorn Foundation, Historic Scotland, Reforesting Scotland, the Association for the Preservation of Rural Scotland, the Lime Centre and the National Trust for Scotland. Relevant journals and publications were scanned for examples, and key web links were e-mailed. A literature survey was undertaken, to review relevant output from previous research and identify relevant initiatives and organisations.

2.2 The outcome of the survey was a long-list of individual and small groups of houses built in rural Scotland which are cogniscent of, and demonstrate, sustainable development principles. A questionnaire was sent to the designer/ builder/ owner of each house or group of houses. The aim was to identify the barriers faced by such developments from inception to completion, and where and how these have been overcome, in such a way as to inform good practice. Issues such as site selection, planning permission, passive design features, building control, service provision, transport, materials selection, use and management over time, and resource provision were to be taken into consideration. A document summarising the buildings was prepared. This has been updated as the project progressed and is documented under Case Studies below. The houses are all considered in some respect to be innovative in design and to be generally acknowledged as fitting well into their setting.

2.3 A workshop was held, with invitations being sent to people from a wide variety of experience and concerns, across Scotland. The aim of the workshop was to provoke discussion and receive input from as many related perspectives as possible. Participants included engineers, planners, home-owners, architects, kit-house designers, and representative of the Historic Scotland, The Forestry Commission and other bodies.

2.4 The workshop participants were invited to give a brief illustrated talk on any relevant issue which was of special interest to themselves, or to present their designs. These highlighted a number of the principle issues, experiences and the concerns of leading rural designers.

2.5 Discussion groups were then formed around the following topics:

2.5.1 Sustainable development principles, techniques, benign materials, products, services and skills required for rural Scotland the benefits of applying them.

2.5.2 Planning permission and building warrant - constraints and opportunities.

2.5.3 Rural Scotland characteristics, problems and opportunities, guidance, best practice.

2.6 The groups were also asked to consider: future research needs; legislative and other opportunities; barriers which have been faced and where these have and have not been overcome; and limitations which restrict adoption of best practice.

2.7 Group feedback was followed by an open discussion and everyone was invited to contribute a submission on a pressing aspect for attention which would assist in pursuit of the project objectives. A summary of the objectives and findings of the research project to date, including issues raised at the workshop, was then widely disseminated for comment prior to this report being prepared. The workshop and the resulting comments form the major element of the study. A list of attendees and contributors of written responses and projects is appended.

CHAPTER THREE

CASE STUDIES

CASE STUDY 1-

Ellieside Cottage

Lintmill, Buckie

Nick Brown - Architect/Owner

Summary of Innovative Design Features

- Symbiotic relationship between restored cottage and garden.
- Ability of houses to function differently throughout the changing phases of family life.

Key Features of the Design which Contribute to Sustainability

- Full use of local tradesmen.
- Locally sourced materials whenever possible.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Natural materials: stone, slate, timber, lime/limewash, clay, zinc, tin.
- Eco-products: organic/mineral paints, cellulose insulation/breathing wall, chemical free timbers, ply cladding, Fillcrete I- beams, k-glazing.
- Recycled materials: brick, timbers, tiles, stone, kitchen/sanitary goods, doors.
- Cost was a major barrier to final selection of goods/materials - reed beds, insulation, solar panel.

Problems Encountered obtaining Planning and Building Control Approval

- Conscious decision to work with local plan led to 'safer' solution than desired.
- Early discussion indicated that composting toilet & recycling of grey water would be an issue with building control.
- Amount of glazing to south proved a concern.
- Energy consultant employed - maximum score of 100 was found.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- Sustainability needs to be put on planning/building control agenda, particular issues being: vapour barriers, chemical treatments, mechanical versus natural ventilation and insulation requirements.

CASE STUDY 2-

House at Rhu, by Ullapool Frank Burstow, Architect



Summary of Innovative Design Features

- Passive solar gain used to partially heat house.
- Breathing wall to south elevation.
- Design enables convective air movement through house.
- Whole house ventilation system.

Key Features of the Design which Contribute to Sustainability

- Reduction of heat loss by use of compact plan, orientation, window openings sized according to orientation, house dug into site.
- Heavyweight construction to east, north and west, and lightweight timber clad breathing wall to south.
- Garage/workshop to north to provide thermal buffer and upside-down plan.
- Structural timber sourced locally.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- 15 mm bitvent in breathing wall.
- Rockwool insulation.
- Non-toxic preservative on external timber.
- Norscot r/w windows double glazed with low 'e' glass and 12 mm argon-filled gap.
- Borax and boron/glycol mixtures for timber treatment, Auro organic paints internally.
- Low voltage lighting and task- related light design.

CASE STUDY 3 –

Mill of Fyal, Alyth, Perthshire
Charles Dobb



Summary of Innovative Design Features

- Passive solar gain through building orientation and arrangement of glazing.
- Well insulated and 'breathing' envelope: external timber cladding, membrane, 150mm Rockwool roll-batt, 200mm Thermalite block, internal plasterwork. 250 mm Rockwool between rafters in slate roof.
- Two wood-fuelled stoves providing 100% space heating (underfloor in solar porch), DHW and cooking.

Key Features of the Design which Contribute to Sustainability

- Good level of insulation.
- Breathing envelope.
- 100% wood fuelled.
- Local materials.
- Passive solar design.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Untreated timber ceilings.
- Exposed clay tile and timber floors (tiles coated with linseed oil, timber boards to be coated with Danish oil).
- Internal stonework to be lime pointed and limewashed.
- External timber cladding (spruce sarking 16 x 150 mm) coated with experimental wood stain made of dry clay powder mixed with linseed oil.

Problems Encountered obtaining Planning and Building Control Approval

- Planning - initial reluctance to accept full external timber cladding due to "not being in the local vernacular". Support from R.S., local architects and neighbours gained acceptance at Committee stage.
- Building Control - problems regarding intumescent coating and mechanical air extraction need.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- Clarification on guidance on the treatment/handling of timber re fire regs.
- Why is opening the bathroom door in a breathing envelope house not considered an appropriate way of dealing with high water vapour concentration?
- Planning prejudice must recognise legitimate use of local materials in contemporary design/construction in favour of mock pastiche of traditional detailing/form.

CASE STUDY 4 –

**The Zero Heating Family Home,
Peterculter, Aberdeen
Gokay Deveci, Architect**



Summary of Innovative Design Features

- Radical savings in energy use, together with other sustainable features, at an initial capital cost less than the most basic specification private sector housing by the volume builders.
- The principle aim was to ensure that, as far as possible, all the heating needs of the house could be derived from internal gains such as lighting, cooking, human body heat etc.

Key Features of the Design which Contribute to Sustainability

- Super insulation within the depth of structural timber "I" beams using recycled newspaper insulation.
- Passive solar design with some thermal mass to smooth out diurnal temperature fluctuations.
- Low-E triple glazing to optimise heat loss to heat gain ratio.
- Air tight construction and closely controlled mechanical ventilation with heat recovery.
- Solar water heating through roof-mounted panels.
- Use of sustainable materials including locally produced, recycled and 'waste' materials.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Timber "I" beams gave the depth required for super-insulation & used 1/3 less timber than traditional systems.
- Scottish larch for exterior cladding chosen for environmental reasons, and from life cycle cost analysis.
- A large amount of timber cladding was used as wall and ceiling finishes instead of plasterboard.
- These hygroscopic materials were specified to control the humidity and indoor air quality in this air-tight building.

Problems Encountered obtaining Planning and Building Control Approval

- Planning - main problem was conservatism over the shape and materials specified.
- Building Control - no dedicated heating system; the mechanical heat recovery vents in kitchen and bathroom; the vapour barrier principles of external walls; untreated timber claddings on internal walls and ceilings for fire regulations.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- More acceptance required for buildings constructed using non-traditional materials.
- Breathing wall construction principles and rules for vapour barriers/membranes need to be understood by building control officers.
- A recognition of the life span of these materials would be beneficial.

CASE STUDY 5 –

**The Van Midden House,
Bridge of Muchalls, Aberdeenshire
Gokay Deveci, Architect**



Summary of Innovative Design Features

- Part of the Affordable Rural Housing Research Project; treats 'vernacular' as a living, dynamic entity, driven by local people as a response to functional and economic needs.
- Incorporates capital and life cycle cost savings: £385 per m² / basic timber 'kit' house min of £550 m².
- Local timber, materials with low embodied energy, minimisation of material use, reed bed, breathable wall/high insulation, organic paints and preservatives, bat nesting boxes.
- Focus on 'buildability'.

Key Features of the Design which Contribute to Sustainability

- Small scheme, designed to demonstrate that basic but good quality sustainable housing can be achieved with affordability, efficiency, ease and speed of construction.
- Principle design features are replicable for future housing developments.
- Designed within a 'lifestyle' context for a small organic farming business.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Materials selected for low embodied energy, life cycle costs and recycled material content.
- Lightweight "I" beam timber wall, floor and roof members allowed for cellulose insulation.
- Exterior used local vernacular farm building techniques (vertical, rough sawn white wood wall cladding and lightweight profiled steel roofing).
- All timber walls treated with organic stains/paints.
- Formaldehyde and equivalents avoided, natural materials and ventilation for healthy indoor air.

Problems Encountered obtaining Planning and Building Control Approval

- Planning – conservatism over shape and materials specified.
- Building Control – breathing wall and roof construction.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- As above (case study 4).

CASE STUDY 6 –

**Affordable Rural Housing,
Kincardine O'Neil
Gokay Deveci, Architect**



Summary of Innovative Design Features

- Lifetime Homes' concept of flexibility, extendibility and visitability. e.g. flexible partitioning can be operated on a day to day basis, or non-structural partitions can be repositioned relatively cheaply.
- Industrialised manufacturing technology, i.e. prefab. Central bathroom & kitchen modules.
- Provides a possible template for future housing developments.

Key Features of the Design which Contribute to Sustainability

- Project will provide 14 units for low rent to local residents.
- Enables residents to be involved in decisions about the design (empowerment).
- Part of a wider proposal to revitalise the sustainability of a beautiful but delicate rural community.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

-

Problems Encountered obtaining Planning and Building Control Approval

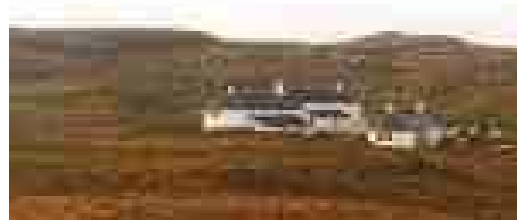
- Planning: Cedar shingles and timber cladding raised considerable difficulties on the planning stage in this mostly granite village.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- As above (case study 4)

CASE STUDY 7 –

8 Houses at Cuithir, Isle of Barra Benjamin Tindall, Architect



Summary of Innovative Design Features

- Unventilated roof voids with vapour permeable layer under traditional timber sarking and natural slates; should improve efficiency of roof insulation by 25% to 30%: monitoring to be by manufacturer of Permofeld (1st use in UK) and BRE.
- Orientation of buildings maximises passive solar gain, within site constraints.
- Rounded ends and avoidance of roof vents into prevailing winds to reduce cooling effect of winds and make most of views.

Key Features of the Design which Contribute to Sustainability

- Wherever possible recyclable materials are used, with long service life compatible with marine climate and extreme weather conditions.
- Flexible heating via multi fuelled stoves and back boilers and electric (Scottish Homes preference).
- Low maintenance fireclay ridges, self-colour harling, lead flashings, engineering brick plinth course, timber frame structure.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Super low-e double glazing, vapour permeable roof construction requires air paths through roof, which supports argument for rough, natural slates (New Burlington slates used, but maybe pressure would grow for re-opening a Scottish quarry if there was more demand).

Problems Encountered obtaining Planning and Building Control Approval

- None affecting sustainability issues.
- Original scheme was for integral workshop but funding could not be obtained.
- Possible next phase of workshops on adjacent site, but linked tenancies not feasible.
- Funding problems also caused postponement (elimination of proposed tree shelter belts, but these could perhaps be revived).

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- Unventilated roof construction - initially Building Control were sceptical as no-one had done this before in Western Isles. This is 1st use in this part of the world & B.Control had to be persuaded by getting Edinburgh BC to approve first, with BRE help. Now they say they are excited at elimination of vents

CASE STUDY 8 –

Straw Bale Barn Conversion, Blyth Bridge Tom Morton, Architect



Summary of Innovative Design Features

- Straw bale infill wall construction, lime plaster/render finish to 'green' Douglas Fir frame, 'green' root of vegetation on mulch.
- Composting toilet.
- Mostly self-built by owner and friends.

Key Features of the Design which Contribute to Sustainability

- Low embodied energy, locally sourced materials.
- No septic tank required.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Lime plasters, breathing walls and roof.

Problems Encountered obtaining Planning and Building Control Approval

- Built as a barn, with temporary permission as accommodation while new home being built. Now applying for permission as ancillary accommodation to new home.
- Building Control sceptical about straw bale construction. Toilet problem again.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- Regs. should change re. water closets and septic tank drainage requirements, to be more flexible.

CASE STUDY 9 –

Rose Duncan Home, Blyth Bridge
Completed December 1999
Tom Morton , Architect



Summary of Innovative Design Features

- Green douglas fir main frame, larch wall and roof cladding.
- High insulation standards.
Partly earth sheltered.
- Non-toxic materials, low embodied energy, carbon neutral, locally sourced, low process materials generally.
- Recycled materials used.
- Urine separating toilet.
- Breathing wall and roof insulation.

Key Features of the Design which Contribute to Sustainability

- Designed for low energy use and low maintenance requirements.
- Easy to alter and extend.
- Minimise use of high energy and toxic materials in construction.
- Maximum use of low energy, carbon neutral materials

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Timber.
- Boron timber treatments.
- 'Warmcell' insulation.
- Organic finishes generally.
- Radiant heat sources.
- Fabric ceilings.

Problems Encountered obtaining Planning and Building Control Approval

- Planning was very helpful.
- Building Control required extensive information and convincing on some aspects. Would not permit composting toilet.

Would Regulations/Procedures/Guidance Benefit from being changed in any way?

- Building Regs should be changed in several areas, but particularly the words 'water closet' should not be used, and similarly 'septic tanks' as these prohibit the use of composting toilets, use of reed beds, etc.

CASE STUDY 10-

Humestanes, Greenlaw
Keith Renton - Owner/Architect



Summary of Innovative Design Features

- Compact design incorporating principles of high insulation, passive solar gain, low floor area to wall ratio, all ensuring high levels of thermal comfort at a low cost.

Key Features of the Design which Contribute to Sustainability

- Timber frame construction with timber cladding.
- Breathing wall technology using Warmcell insulation.
- High performance windows and care in detailing and orientation, all providing a 'low impact' of energy use.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Plywood rather than chipboard floors.
- Cellulose insulation rather than fiberglass.
- Timber cladding to re-establish a tradition of timber use in the Borders.
- One bedroom serviced appropriately to enable use as home office (flexibility of use).

Problems Encountered obtaining Planning and Building Control Approval

- No problems with Building Control.
- Minor problems with planning (with councillor), but generally they were supportive.
- Main problems with SEPA and Building Societies.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

CASE STUDY 11 –

The Garden House, Fountainhall completed 1999

Sally Ruel, Architect

Summary of Innovative Design Features

- The aim of the project was to show how a speculative house could have, as standard, good environmental design features, i.e. so called 'innovative features' could be incorporated.

Key Features of the Design which Contribute to Sustainability

- 'Breathing' timber frame and cladding from Scottish sources.
- Passive solar design.
- High SAP rating.
- Clay drainage and c.i.r.w. goods.
- Natural slates.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Plywood rather than chipboard floors.
- Cellulose insulation rather than fiberglass.
- Timber cladding to re-establish a tradition of timber use in the Borders.
- One Bedroom serviced appropriately to enable use as home office (flexibility in use).

Problems Encountered obtaining Planning and Building Control Approval

- No specific problems, although 'breathing wall' construction had to be proved from first principles to Building Control.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- Building Control treating 'deemed to satisfy' construction in Regs. As regulations themselves.
- A way is need of streamlining the process of passing construction from first principles every time.

CASE STUDY 12-

Cambo Estate Cottages
Seagate, Fife
Completed 1999
France Smoor, Architect



Summary of Innovative Design Features

- Four circa. 19th cottages repaired and extended incorporating a conservatory, storing its solar heat in solid innerskin of reversed kit built extension (timber frame outside) clad in boarding.
- Drained shallow foundations in gravel. Conservatory, storing its solar heat in solid innerskin of reversed low foundations in gravel.

Key Features of the Design which Contribute to Sustainability

- Maximise reuse of existing embodied energy.
- Low tech. heating using small oil stove continuously burning, supplementing solar heat.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- No PVC membranes required for drained foundations.
- No PVC vapour checks for timber frame as insulation is on the outside.
- Exterior uses local off-saw boarding.
- Use of local brick.

Problems Encountered obtaining Planning and Building Control Approval

- No (Problems will arise when there is an internal air circulation system throughout the entire house, using hot air from conservatory and convection air from stove and flue. Fresh air should be added to that system, not to individual rooms when working out the requirements. Ventilation should be targeted better rather than just by imposing numbers of air changes, i.e. what must be removed? - Humidity, small, oil vapour. Such a system will fall out with fire regulations, especially in over 2 storey buildings. The answer is of course that the air circulation system will detect fires much earlier, removing the need for 1/2 or 1 hour fire zoning.)

Would Regulations/Procedures/Guidance Benefit from being changed in any way?

CASE STUDY 13 –

**Millden Tower, Kingussie
completed 1988**

France Smoor, Architect



Summary of Innovative Design Features

- Timber building, but reversed, with inner skin block/brick & outer skin only carrying insulation and weather coat.
- 3 storey conservatory producing solar heat, with supplementary under-floor heating.
- Hot air stored in walls and floors.

Key Features of the Design which Contribute to Sustainability

- Uses local material, off-saw timber for frame, floors and exterior cladding, local brick and block.
- Hot air circulates throughout building, ventilation ditto, no individual ventilation of rooms needed.
- Shallow foundations above ground on gravel bank, no DPC.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

No PVC membranes, only Tyrek breather membrane to create temporary envelope to build.

Problems Encountered obtaining Planning and Building Control Approval

-

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- Exposed timber was accepted without problems. House ideal for research.

CASE STUDY 14 –

The Long House

Completed Sept 1996

Alasdair Stephen, Isle of Skye

Summary of Innovative Design Features

- Qualifies for RH06 from Scottish Homes.
- Modern interpretation of blackhouse - long, narrow, open plan, central chimney, ground huggings, related to elements, thicker cavity @ 150mm stud.

Key Features of the Design which Contribute to Sustainability

- These houses are sustaining a community and a culture. They are part of Highland culture that has been neglected: architecture. They provide low cost social housing which reflects our way of life and keeps people on the land.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Like blackhouses, the materials reflect availability and economic conditions. Affordability is the over-riding priority. Drama of space and good detailing gives the house a quality for above the £35,000 basic construction cost.

Problems Encountered obtaining Planning and Building Control Approval

- Local planners wanted the houses to line up

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- There should be a presumption for planning and building of houses in countryside – not against. Scottish Parliament needs to sort this out.

CASE STUDY 15 –

**Lauristonden, by Montrose
completion June 2000
Bryan Stuart, Builder**



Summary of Innovative Design Features

- Large 2-storey solar adsorbing bay window.
- Contemporary, Innovative design.
- Mezzanine ‘work space’

Key Features of the Design which Contribute to Sustainability

- All timber construction.
- K-glass throughout, with thermal mass to retain solar gain.
- High level of insulation.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Breathing wall construction.
- K-glass.
- All wood, but some stone (heat sump) fire place.
- Underfloor heating to ground floor.

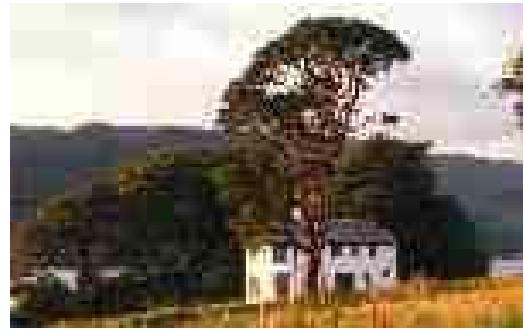
Problems Encountered obtaining Planning and Building Control Approval

Initial hesitancy on part of planners (replaced existing 50's house), but won over by quality and innovation of design.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

CASE STUDY 16 –

Rubha Beag, Argyll
completed 1991
David Sumsion, Architect



Summary of Innovative Design Features

- Entrance and stairs at north-east end of building, rather than traditional position in centre plan.
- Kitchen occupies full width of building at centre of plan.
- Curved south west end maximises passive solar gain to sitting room and bedroom.
- Step in ground floor levels follow slope of site.

Key Features of the Design which Contribute to Sustainability

- Maximum passive solar gain and minimum heat loss through arrangement of plan and fenestration.
- No roof windows.
- Central chimney for flues for rayburn and Jetmaster fireplace.
- High performance redwood windows and doors.
- 2nd hand West Highland slates.
- Insulation levels above minimum requirements.
- High thermal mass in ground floor and walls.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Hardwood flooring in entrance lobby and kitchen, stone in porch and softwood on first floor.
- Solid hemlock internal doors and douglas fir facing and skirtings.

Problems Encountered obtaining Planning and Building Control Approval

- No

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

CASE STUDY 17 –

**Duntrodden House, Kyle of Lochalsh
Completed 1997
Neil Sutherland, Architect**



Summary of Innovative Design Features

- Post and beam structure from local Scottish pine.
- Earth sheltered - dug into bank entering at high level
- Passive solar, low energy, lots of natural light
- Used as short let holiday accom.

Key Features of the Design which Contribute to Sustainability

- Built from local timber and stone sources and processors and used in very direct way.
- Displays connection with forest management and material/ economic advantage.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Non-chemical spec, breathing wall/roof with the usual build up.
- Natural wash slate floors with underfloor heating by way of linked heating system.
- Solid fuel stove and oil fired boiler linked together.
- Timber cladding and flooring made locally for the house.

Problems Encountered obtaining Planning and Building Control Approval

- Not major, explained that turf was a traditional material and you couldn't really see the building anyway.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- Things are moving in a positive way and we need to keep the pressure on with good work.

CASE STUDY 18 –

**Alma Cottage, Linlithgow
Completed February 2000
Martin Watt, Owner/builder**

Summary of Innovative Design Features

- I would say we pushed at the limits of making a self-build, all timber, ecologically-minded condition that was cost effective using a modern timber kit.
- A longer and narrower house than usual, could be a model for inexpensive eco-housing.

Key Features of the Design which Contribute to Sustainability

- Wood burning stove.
- Renewable construction materials.
- Reed bed treatment detail.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Timber used wherever possible.
- Breathing wall.
- Lots of opening windows and doors to freshen the house.
- Organic paints.
- 2nd hand and recycled materials.

Problems Encountered obtaining Planning and Building Control Approval

- Resistance to timber cladding.
- Control of colour finishes, i.e. dark brown only, which I think makes the wood suffer.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- Need the scope to erect low spec. houses that are more affordable and sustainable, maybe in relaxed building/planning zones, which would put less stress on the environment and on people, saving them having to "bust a gut" when all they want is to build a simple home cheaply and work less.

CASE STUDY 19 –

**Linnfall, Eddlestone, Borders
Simpson & Brown, Architects**



Summary of Innovative Design Features

- Self-build timber house.

Key Features of the Design which Contribute to Sustainability

- Self-build.
- Re-use of existing foundations.
- Passive solar design.
- Orientation and position of windows.
- Internal heat stoves on the floors.
- High level of insulation, use of cellulose fibre insulation.
- Sustainable materials with concern about timber types and sources.
- Breathing walls.
- Re-use of salvaged components – doors, etc.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Timber.
- Insulation.
- Paints.

Problems Encountered obtaining Planning and Building Control Approval

- None

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

CASE STUDY 20 –

**Ramstone Cottage, Near Inverurie
Robin Worsman, Owner**



Summary of Innovative Design Features

- Green oak framed extension.
- Partial glass roof.
- Underfloor heating.

Key Features of the Design which Contribute to Sustainability

- Timber frame & timber cladding.
- Second hand slates.
- Very efficient wall installation throughout (site is a frost hollow)

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Roof slates
- Small area of traditional 'sandharl'.
- Underfloor heating with very efficient boiler.
- Glass roof – solar gain

Problems Encountered obtaining Planning and Building Control Approval

- None for planning.
- Building Control required extra smoke/heat sensors.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

CASE STUDY 21 –

**Ledliath, Sutherland
completed 1997
Gaia Architects**



Summary of Innovative Design Features

- Scottish sourced whitewood for timber frame kit.
- Borax timber preservation.
- Scottish sourced douglas fir for exposed trusses.
- Breathing wall with bitvent and 150mm Warmcell in walls.
- Scottish sourced larch board for cladding.
- Recycled slates and pitch pine flooring.

Key Features of the Design which Contribute to Sustainability

- High level of timber use in structure.
- Local sourcing of timber.
- Re-use of salvaged building materials, or recycled.
- Low embodied energy

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Borax timber preservative.
- Auro timber finishes.

Problems Encountered obtaining Planning and Building Control Approval

- none

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

CASE STUDY 22-

Tressour Wood
Gaia Architects



Summary of Innovative Design Features

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Key Features of the Design which Contribute to Sustainability

- All timber house post & beam.
- Untreated timber painted with borax solution.
- Breathing wall.
- Breathing roof.
- Passive solar staircase.
- Natural ventilation through stack effect.
- Wood burning heating.
- Organic paints.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Timber internally and externally.
- Warmcell insulation.
- Organic paints.
- Borax.
- Recycled slates.

Problems Encountered obtaining Planning and Building Control Approval

- Had great difficulty with the idea of an all timber house - first site was abandoned by client when a kit house was built next door without objection from Planners. Only allowed the house on the new site because it was seen as being in a woodland setting. L.A. subsequently used the house as model example (after it had received House of the Year award).
- Building Warrant- as one of the first breathing wall buildings in Scotland there was considerable debate with the local building control on vapour barriers.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- A review of planning guidance to assess the acceptability of timber housing in Scotland. The post war Swedish houses are ubiquitous in Scotland and set a precedent for urban housing
- A deemed to satisfy detail on breathing walls would be helpful.

CASE STUDY 23 –

Grunberg House Gaia Architects



Summary of Innovative Design Features

-

Key Features of the Design which Contribute to Sustainability

- All timber house post and beam.
- Locally sourced timber - douglas fir - untreated.
- Breathing wall and breathing roof.
- Passive solar atrium.
- Natural ventilation.
- Wood burning heating.
- Wind and water powered electricity (project unfinished).
- Reedbed sewage for primary toilet.
- Composter toilet as secondary system.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- timber internally and externally
- Warmcell insulation
- organic paints
- borax
- recycled slates

Problems Encountered obtaining Planning and Building Control Approval

- Planning - no great difficulty.
- Building Warrant - the initial idea was to have a composter toilet as the main toilet. This went all the way to Scottish Office who decided that the 'W' in WC stood for Water and as a composter is without water it was not allowable as the main toilet. It was permitted as a secondary system. The house is incomplete but is planned to have two WCs.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- Scotland needs to look at the precedents set in England for composter toilets.

CASE STUDY 24 –

Fairfield Housing Co-operative Gaia Architects



Summary of Innovative Design Features

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Key Features of the Design which Contribute to Sustainability

- Sunscoop (permaculture) form to housing massing.
- Timber frame system using cellulose fibre boards.
- Timber impregnated with borax solution in lieu of CCA.
- Breathing wall and roof.
- Passive solar gain to living rooms.
- High insulation levels.
- Low emission breathable paints.

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Timber internally.
- Warmcell insulation - low emission breathable paints.
- Borax.
- Recycled slates.
- Impregnated cellulose fibre boards.

Problems Encountered obtaining Planning and Building Control Approval

- Planning - no significant problems
- Building Control - some discussion about stress grading and treatment also careful calculation on racking strength of cellulose boards.

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- Clarification on the relationship between the grading of timber and its treatment or otherwise required.

CASE STUDY 25 –

Nettleton House, Killin
Gaia Architects



Summary of Innovative Design Features

-

Key Features of the Design which Contribute to Sustainability

- All Timber house
- Untreated Scottish timber (douglas fir)
- Breathing wall and roof.
- Passive solar
- Twin sash double glazing windows (non gas filled).
- Wood burning heating.
- Low emission paints

Materials, Traditional and New, which were selected for their Health/Environmental Impact

- Timber structurally and externally.
- Scottish timber.
- Warmcell insulation
- Low emission paints.

Problems Encountered obtaining Planning and Building Control Approval

- No problem with timber house which replaced a caravan and was considered a holiday home.
- Another discussion over breathing wall construction with building warrant.
- Assessment by building control that a chain rain water pipe was unacceptable in Scottish climate (driving rain).

Would Regulations/Procedures/ Guidance Benefit from being changed in any way?

- Find the difference in interpretation between authorities (and by individuals) confusing. Would like to see more consistency, and a review of Scottish executive non-intervention policy in devolving decision making to individual authorities – (and even individuals in authorities).

SPECIFIC ISSUES RAISED BY CASE STUDIES

3.1 Problems Encountered in Planning and Building Control –

Some responses indicate how helpful planning officials and others have been however there is evidence and concern regarding:

- Conservatism over shape, construction and orientation and even objectives.
- Control of colour finishes deemed inappropriate interference.
- Considerable and perceived unreasonable difficulties with materials including cedar shingles, timber cladding, green oak, straw, insulation materials, slate treatments including intumescent coatings, cellulose boards and others due to a wide variety of issues including 'local vernacular', fire regulations, stress grading, racking strength and location.
- Inconsistency in the above. Differences in interpretation between authorities (and individuals) causing confusion. e.g. in some cases exposed timber was accepted without problems and the use of straw bale was actively encouraged.
- Considerable difficulties with composting toilets, low flush toilets, waste treatment and recycling of grey water despite wide acceptance elsewhere.
- Unacceptability of a chain rainwater pipe in the Scottish climate.
- The use of breathing wall constructions as alternatives to vapour barriers, the technique frequently having to be demonstrated from first principles despite widespread professional acceptance and implementation of the technique across the UK some of significant pedigree including the 1993 House of the Year at Tressour Wood.
- Inappropriate use of 'deemed to satisfy' construction in Regulations as regulations themselves.
- Inappropriate scepticism regarding established good practice including designed south facing glazing.
- Problems with technical innovation including:-
 - determining ventilation requirements and fire zoning when there is an internal air circulation system;
 - unventilated roof construction;
 - when thermal insulation eliminates the need for a heating system;
 - mechanical heat recovery vents in kitchen and bathroom;
 - agreeing drainage outflow where there is not centralised sewage system.

RECOMMENDATIONS ARISING FROM CASE STUDIES

3.2 Changes to Regulations/Procedures and Guidance

There was an indication from respondents that things are moving in a positive way which will be enhanced by more good work. However some opportunities were identified which might facilitate improved practice:-

- Streamlining the process so that it is not necessary to prove information from first principles every time.
- More encouragement for planning and building houses in the countryside.

- Sustainability on planning/building control agenda. More consistency across authorities in approach to new techniques.
- More acceptance for buildings constructed using non-traditional materials and investigation of skills required in their application.
- Validated information on the life span of non-traditional materials.
- An improved understanding of the application of traditional materials and the associated skills required for their extraction, processing and use.
- Improved understanding of a range of technical details including: chemical treatments, mechanical versus natural ventilation, insulation requirements, materials and treatments.
- Improved understanding of breathing wall construction and rules for vapour barriers/membranes (including guidance on ventilation) by all building control officers. ‘Deemed to satisfy’ details on this would be helpful.
- More flexible regulations re. water closets and septic tank drainage requirements.
- More scope to erect low specification, affordable, sustainable houses.
- A review of planning guidance to assess the acceptability of timber housing in Scotland.
- Clarification or guidance on the treatment/handling of timber re. fire regulations.
- Clarification of the relationship between the grading of timber and its treatment or otherwise.
- Recognition of the legitimate use of local materials in contemporary design/construction.
- A review of Scottish Executive’s non-intervention policy in devolving decision-making to individual authorities (and even individuals in authorities).

INTERMEDIATE CONCLUSIONS BASED ON THE CASE STUDIES

3.3 Across Rural Scotland there are some excellent examples of individual and small groups of homes which have been designed and built to address sustainable development principles. However, barriers do exist to implementation of aspects of sustainable design. In some cases these have been overcome but organisational, institutional, economic and professional barriers none the less persist.

3.4 The use of traditional materials is a common factor in many of these buildings including stone, earth and clay, minerals, vegetation and timber. New materials such as innovative insulation materials are also a feature as well as new resource conservation techniques and procurement strategies.

3.5 Whilst concern to have fitting development is necessary and justified it is evident that lack of knowledge and inconsistency in application of guidelines are serious barriers to widespread application of good and best practice. There are instances where consideration of the sustainable use of resources and environmental protection have an implication for materials choice, treatments, layout on a site or other factors with which building authorities may not be familiar. There are undeniably instances where more information is required in relation to a particular context, but in general more could be achieved, and with more ease, than is generally the case.

3.6 It was thought that improved information could lead to widespread benefits including:-

- assisting practitioners and agencies to recognise and apply appropriate techniques and materials for Scotland
- contributing to enhancing acquisition of the appropriate skills for their extraction, processing and use and
- development of benign materials, products and services.

3.7 A seminar was arranged with these findings as a starting point to investigate these issues in more depth and the following constitutes a detailed discussion of the Findings.

CHAPTER FOUR RESEARCH FINDINGS

KEY FINDINGS

Design Considerations

4.1 It is intended that this report and any subsequent document will address the image of 'sustainable' buildings as gimmickry, through the selection of a range of building projects based on sustainable principles all of which demonstrate good quality, attractive, fitting design. It is apparent that far too many conventional buildings are of poor design quality; that planners should seek good quality in all development; and that raising the overall quality of architectural design in Scotland may require that precedents already set are challenged. This is a concern presently being addressed through initiatives in the Scottish Executive.

Planning

4.2 As sustainable development is government policy then it should be delivered as an integral part of development control. This requires that Sustainable Development Officers have the opportunity to be actively involved in the planning process. One mechanism might be to provide planning authorities with the assistance of independent commissions, including sustainable development officers, to advise on planning proposals and to use this as a means of raising awareness of sustainability issues. A recent review in England has recommended more architectural involvement in the planning process, as a contribution to design quality, this may be something that the Executive may wish to consider.

4.3 Relaxation and diversification without ground rules is no guarantee of sustainable development either. So it would be advantageous to develop a better understanding of what planners are justifiably afraid of by talking about bad practice as well as good.

4.4 Planning and building control policies influenced by nostalgic values are evidently perceived as a barrier to sustainable development concerns which are based on contemporary understanding of adverse human impact on the environment and on recognition of the need for affordable housing and stable communities. There was a particular concern that planners overemphasise the past as a reference, perhaps as a direct consequence of lack of design education and contemporary awareness and inadequate facilities for continuing professional development. One example quoted where nostalgia was considered particularly inappropriate was in relation to the requirement for the roof of a building be finished in natural blue-black slate to match the roofs of the surrounding buildings. This affected the building in two ways. The increased pitch required by a slate roof significantly increased building costs with regard both to the cost of the slate, and the increased structural requirements of the heavier roof covering. Ironically slate roofing, which was once an indigenous material, is now sourced primarily from outside Scotland or is 'informally sourced' from derelict or empty buildings. The requirement also adversely impacted on the massing and hence the design quality with no evident benefits. However, examples of support for schemes with an overt sustainability agenda were also evident.

Building Control

4.5 There was a perceived gulf between policy statements on sustainable development and the apparent lack of knowledge/interest/application by building control officers. (see section

on Timber below) BC officers should have adequate access to training opportunities and encouragement to undertake it. Designers and others should receive adequate information to enable them to implement a more sustainable approach to BC applications. It would be useful to review the procedures for Continuing Professional Development for BC Officers. It might also be useful to look to guidance from other professions particularly those taking a lead, such as the RIAS, which has an environmental statement and implementation strategy and is developing a professional development route for environmental architects.

4.6 New regulations could be introduced to encourage an improvement in standard house construction, plus on-going education. This should be taken up as part of the review of the Building Regulations but must include the promotion of legitimate environmental concerns. Guidance should incorporate requirements for landscape.

4.7 Specific changes could be introduced to the Building Regs. e.g. waste disposal, (w.c.s, septic tanks, reed beds, composters, alternative self-disposal systems) with sensible guidelines for use⁶. Some of these issues are considered below.

4.8 A concern expressed by many people was that with experience in planning and building control procedures made some barriers easier to overcome. This would indicate that the regulatory system is failing to keep up to date and that the onus of contemporary knowledge with respect to beneficial innovation is falling onto the developer. This would indicate that potentially desirable solutions are not being implemented due to inexperience and lack of knowledge of the relevant bodies. If this is stifling implementation of sustainable development principles, as would appear to be the conclusion, then it is a cause for concern. It would be useful if contemporary information on relaxations was published through formal mechanisms (perhaps a database) so as to facilitate a general increase in contemporary knowledge.

Building Systems

Composting Toilets

4.9 Dry or composting toilets are still not acceptable in Scotland for use as the only toilet in households. Their use is well established in many countries in the world. The only examples in Scotland are for secondary toilets. There are a few examples in England, mainly in isolated rural areas for the National Trust. They are an example of an innovative technique which, given the potential benefits should not only be allowed, but encouraged. There are many sites in Scotland where the use of a dry toilet could solve very difficult drainage problems and avoid polluting a water course or loch. The main reason for these not being acceptable to Building Control has been the use of the term 'water closet' which assumes toilets have to be flushed with water.

4.10 The Scottish Executive's proposed amendments to part M of the Building Regulations are currently out for consultation. The proposed changes allow for the concept of grey water and the acceptance, in principle, of composting toilets, but only in a dwelling and where it is not 'reasonably practical' to connect to a public sewerage system. This proposed change is welcomed, however more could be gained if composting toilets could be used in general as an

⁶ Baxter S., Liddell HL Impact of Environmental Issues on Building Standards Scotland (2) Case Study Vale House Nottingham 1995

alternative to water closets, designed and fitted in a suitable manner and, in the absence of a European or British Standard, to any appropriate national standard.

Low Flush Toilets

4.11 Low flush toilets conserve water and allow septic tanks to be smaller. They have been used in Scandinavian and northern European countries for many years and are used also in USA and Canada. They are clean and efficient and use 2-4 litres per flush instead of the 7-12 litres per flush used in UK toilets. There is a Building Control byelaw that has kept the flushing or drop valve from being accepted in the UK⁷. It will be made legal in England and Wales on the 1st January, 2001. The Trading Standards have been given new powers to enforce testing and approval of all valves to allow them to be sold in the UK. There was a strong feeling that there is no clear reason why Scotland should not also legalise the use of the valve and low flush toilets at the same time.

Water Treatment Systems

4.12 Wetland or reed bed treatment systems are now a more commonly accepted alternative to septic tanks, but there were perceived to be a number of misconceptions which affect the planning process and can delay its implementation. The Scottish Environmental Protection Agency's proactive stance in recent years, in respect of insisting on best practice in surface and foul water treatment was welcomed. Guidelines on best overall solutions for the environment would be welcomed.

Energy Supply

4.13 There is an ongoing debate about high tech/low tech solutions which it was felt could be addressed by encouragement of appropriate and affordable technology, with information and examples.

4.14 Energy related issues focussed on poor information on solar panels, elimination of the need for a general heating system in well insulated houses, and a range of local, autonomous and shared systems of generation such as Combined Heat & Power (CHP) and a range of ambient and renewable technologies. It would be useful to disseminate research on costs & benefits of a range of autonomous energy and water treatment technologies and passive techniques and their suitability at different scales from single house upwards.

4.15 Problems have been encountered with the use of proprietary passive ventilation systems where officers have requested back-up fans. These would not only defeat the purpose of the systems but would also require intelligent control mechanisms which 'know' when the system is 'failing'. These problems can be resolved by emphasising the Agreement certification of these systems, or by meetings between Officers, the architects and the system producers. However, a better informed regulatory system would save time.

4.16 A persistent problem, often encountered in the context of refurbishment, is the insistence by Building Control on the installation of damp proof membranes under ground floors. Experience suggests that these need not be required where there was previously no damp proof course and no evidence of damp, or where the space will not be permanently

⁷ A flushing valve is a mechanism that replaces the standard siphon in a cistern.

inhabited, such as in a public access space. Where attempts have been made thus far to overcome this, they have not been successful and this remains an obstacle to the development of overall moisture transfusive construction.

4.17 The chemical treatment of timber appears not to be an insurmountable problem with regard to Building Control Officers generally, however, it is often a condition of certain funding bodies, such as Scottish Homes. The only known case of explicitly overcoming this condition was by Gaia Architects at the Fairfield Estate in Perth, where the requisite 30 year guarantee for roof timbers was provided not by a chemical treatment company, but by an independent consultant, after design discussions indicated simple ventilation of the roofspace. Broad communication of the experience and benefits would be valuable.

Materials and Procurement Policies

Materials in General

4.18 The use of traditional materials is a common factor in many of the buildings studied including included stone, earth and clay, minerals, vegetation and timber. New materials such as innovative insulation materials are also a feature.

4.19 There was generally considered to be a lack of contemporary knowledge about environmental impact of materials on the indoor, local and global environment at all stages of the life cycle and of best practice approaches to mitigation including selection of benign materials and products and design of membranes on problem avoidance Concern was expressed that many were unprepared for the possibility of imposition of rules on disposal of construction waste presently common in European countries. The requirement for comprehensive sourcing and submission of information was considered to be potentially off putting to those inexperienced or not very committed to using environmental materials. This again indicated that the effect may be to stifle environmental innovation. The situation could be improved with builders more able to use environmental products and processes, through compilation of an accessible library of environmental materials and methods with all the approvals, descriptions, paperwork in place so that each Building Control officer does not have to revert to each architect or builder for information.

4.20 Sources of locally produced materials need to be publicised, perhaps through an intelligent shopping list. A network/website of Scottish suppliers needs to be established. This could include peer review of materials or ongoing information about experience of use. It would be invaluable to look to supporting development of cleaner building materials and technologies in Scotland.

Life Cycle Issues

4.21 Maintenance aspects and end of life issues should be considered as integral parts of the design of sustainable housing. It is understood that the review of the building regs is considering suitable mechanisms. It is important to consider disposability at end of life and pollution caused by preservative treatment. In some European Countries PVC and copper chrome arsenic treated timber are considered toxic waste. The ability to incorporate life cycle energy considerations is probably outwith the scope of most architects/building control officers particularly as so much depends on the user, however it may be possible to investigate some simple guidelines.

Timber

4.22 There was a strong feeling that there should be greater acceptance of timber construction and the benefits of Scottish timber-frame expertise - low cost, high energy efficiency. Post war Swedish houses are ubiquitous in Scotland. Use of timber by the building industry needs to be in the context of short term and long term availability and planning for the construction industry. A northern European perspective on timber construction would be welcomed, with a view to increasing its use, and also a document on sourcing Scottish timber.

4.23 Timber is an outstanding example of an under-utilised but renewable construction material in the Scottish rural environment, and it is worth considering the perceived constraints to its use which are submitted here for completeness.

4.24 Securing mortgages or loans and obtaining insurance: appears to be a perceived rather than a real constraint. Some insurance companies will not insure timber buildings, some favour ecological approaches whilst others are suspicious. Sources can usually be found but access to information could be easier.

4.25 Obtaining grant aid: Scottish Homes are the principle grant aiding body for domestic house builders in Scotland. They claim to judge each case on its own merits and not to adhere to any rules of their own concerning construction methods and materials. In the Highlands, a housing grant is administered by the Crofters Commission on behalf of the Scottish Office Agriculture, Environment and Fisheries Department. It has been known generally as the Crofters Building Grants and Loans Scheme and, as the title implies, covers all types of building on crofts. A General Specification for Buildings in Crofting Areas is used to steer the specification of all construction under this grant. This Specification and the way it is applied is therefore quite significant in the development of more sustainable building practices in the Crofting Counties.

4.26 Securing Planning Permission: Planners are almost exclusively concerned with external appearance with the past as a particularly significant point of reference. This is likely to be unhelpful to initiatives which seek to promote a locally sourced and manufactured product with the highest environmental standards, such as timber housing. Many people dismiss an alternative approach to construction at an early stage because they expect that the planners will prove awkward. This reflects some real problems.

4.27 One strategy which has proved successful involves an early approach to the planners to explain intentions and the context such as Agenda 21. Documents such as improving the design of new housing in the Scottish Countryside⁸ in particular the illustrated elements of the booklet on "Sustainable Development" have proved useful in reminding local planners of the broader aims of the Scottish government. This onus on the house builder to put across government policy and aspiration to planners is clearly inadequate and cannot be an effective mechanism of communicating best practice more widely.

⁸ improving the design of new housing in the Scottish Countryside (Scottish Office Consultation Paper April 1998)

4.28 In general, upon making an enquiry to a Local Authority a prospective house builder will either (a) be issued with a Design Guidance leaflet or (b) receive a visit from a Planning Officer. The influence of the Local Planning Officer as an individual is often critical in determining the whole course of design. Anecdotal evidence indicates that these responses can be unduly negative and resistant to visually and environmentally appropriate solutions, causing them to be abandoned at an early stage. Planning Guidance leaflets issued by Local Authorities need to be examined carefully as they also will be influential. In some instances there is evidence of resistance, particularly to timber buildings being institutionalised such as the following example of a set of conditions issued when Outline Planning Permission is granted:- *"The house shall be single or one and a half storeys in height, it shall be of traditional design and materials to reflect the vernacular architectural style of buildings in the area and shall be finished with white or stone coloured harled walls and a dark (anthracite) grey roof. It shall be designed and sited to conserve the privacy and amenity of the adjacent house site and shall complement that development. All in accordance with Council policy for the design of new houses in the countryside."*

4.29 This might be considered as undue influence on design in favour of a "vernacular architectural style". The wording clearly implies that this specification is mandatory when it is actually discretionary, nowhere does it say that these conditions can be challenged. Certainly as the starting point for an application for Full Planning Permission it is likely that most people who wanted a timber house would not consider themselves able to overturn these conditions.

4.30 Meeting Building Regulations: problems/concerns appear to revolve around timber treatment, timber stress grading and compost loos, discussed below.

4.31 Low durability and high maintenance: finding out the correct Timber treatment standards can be difficult and this has been exacerbated by switching over from British Standard to European codes of practice. Much locally sourced Highlands timber is of relatively poor quality and only meets the lowest stress grading standards. Engineers therefore have to specify larger sections, adding cost. It is already higher in price than imported timber and it is an example of where building 'sustainably' costs more than doing the simple thing and buying foreign material.

4.32 High cost (of ecological materials generally) This is an area which needs close consideration: home grown timber is more expensive than imported timber and this is widely appreciated by builders and designers. Using natural stone is obviously more expensive than concrete block. Using so-called ecological paints are more expensive than standard paints. Using more insulation is cheaper than using less. Using the more natural insulation products can be many times more expensive than standard glass wool. Using the purer natural resin bonded boards is more expensive than glued sheathing/particle boards. Building in quality and environmental considerations also costs more. So we have the current situation where only the very committed few are prepared or able to pay extra to meet their own environmental criteria.

4.33 With perceptions of poor resale value, difficulties in obtaining good quality wood of the right type and in finding an experienced architect and engineer, these appear to act cumulatively on a would-be timber house builder who may feel that they can overcome a number of these constraints but taken all together feel defeated. These constraints may operate throughout a wider spectrum of 'innovative' or 'sustainable' building practice.

Earth

4.34 Earth construction is a low cost, durable technique with excellent environmental performance and traditional in Eastern Scotland. There has been some rudimentary research into conservation and repair of earth building in Scotland such as test walls using traditional techniques to ascertain weathering patterns, erosion etc (commissioned by Historic Scotland). This research identified earth as a durable, low impact construction which could work in the Scottish climate, even in exposed stressful situations, using local materials and skills.

4.35 A number of earth buildings have now been built in Scotland with an emphasis on traditional crafts. It would appear that we could now be designing and building earth constructions for housing utilising a variety of materials - light clay straw, woodchip clay blocks, and rammed earth for thermal mass. There is already a large amount of research and development activity in Europe with whole villages in France, hospitals and schools in Holland, earth warehouses in Germany and four new houses in England. Support for information gathering, research and development in this area specifically to draw out relevant information from the existing knowledge and to develop design solutions that satisfy the regulations could have widespread benefit.

Other materials

4.36 Similar feelings were expressed concerning the potential for increased and appropriate use of locally available and benign materials such as stone, wool, hemp, and lime mortar. With more research required in some areas to support their use. Many felt it important to really engage with the issue of skills training and to couple together materials and products with the skills associated in their harvesting, manufacture, construction, use and reuse (including traditional & self-building skills) perhaps through high profile projects of refurbishment or new build.

RURAL POPULATIONS AND COMMUNITIES

4.37 Many participants focussed on the wider sustainability perspective than simply individual or groups of houses. It would appear that there is need for communication or development of policy, or a formal statement regarding attitudes to working and living in rural Scotland as a basis for long term development approaches. This should aim to direct development and to reduce existing conflicts. It was felt that the rural community needs to be looked at holistically, in particular ways of promoting sustainable communities, in which people can live locally and earn a living, and the need for developing affordable housing decoupled from the assumption that this means cheap to build and costly to maintain.

4.38 If the countryside is for people to live and work in, then this implies that there should be encouragement of housing as a positive opportunity for regeneration - environmental, social and economic - with the aim of increasing rural population densities. It requires that education takes place within a framework of determining and understanding the contemporary role of rural communities to Scottish local character and the nature of regional variations. It may be that within this framework there might be a case for selective development of new rural communities and there is a need to establish robust guidelines regarding their development within the context of Scottish Executive policies on sustainability and design quality. It raises issues of generating local employment and transport provision as well as natural concerns about the relationship between rural incomes which can tend to be low and

the countryside as a rural suburbia for retirement/second homes.

4.39 Strong feelings were expressed about the perceived conflict between pandering to the tourist trade and the need for a thriving, continuing development of land and community. It may be that an examination of policies which are generally considered successful, such as that in Norway of a cultural landscape strategy would inform policy.

4.40 It would be useful to gain a better understand of the economic and social value of development of local skills in building sustainably and whether this is something which could deliver benefits if supported through appropriate policy initiatives.

FUNDING

4.41 It would be beneficial if everyone involved in making decisions worked together and shared experience in order to enhance the opportunities to educate, encourage and enforce the needs, requirements and aspirations of sustainability in all projects, and the formal feedback mechanisms which would facilitate continual improvements.

4.42 Given that there is much talk of sustainable development, it would be useful to know what guidance Housing Associations and others in positions of responsibility are working with and how this guidance is being communicated to designers, clients, builders and occupants.

4.43 There is an assumption that sustainable equals high cost although the area is controversial as costs vary enormously. Some architects are evidently achieving a high degree of architectural quality and environmental design whilst working to standard Scottish Home Yardstick rates. It would be useful to have a more detailed investigation of costs of sustainable building: - what does and does not cost more, specification, affordability, first cost and on-going costs.

REFURBISHMENT

4.44 It would be useful to look to methods by which to incentivise refurbishment of rural buildings to take account of contemporary sustainable development requirements. This needs to be within a framework of social equity and rural vitality, so that benefits do not simply accrue to second home owners. It might be useful to publish guidance specifically directed at renovation of old buildings with targets on energy efficiency and information on material choices and treatments.

LEADING EDGE

4.45 There is a concern that initiatives perceived as innovative are also classed as peripheral and lacking relevance and that those at the leading edge are undervalued. It would however be useful to engage leading edge designers and builders in setting policy and to take proper account of European initiatives where greater advances have been made in implementation.

FLAGSHIP SCHEMES

4.46 It was felt that further flagship buildings are needed and that these might be encouraged by offering limited opportunities for projects to apply for relaxed planning approval to a simple brief which allowed experimentation. National Parks, rural and peri-urban areas were all identified as possible test beds for good environmental design. This obviously raises a concern for the difference between ‘relaxation for one’ and ‘relaxation for all’ and the ability of the planning control system to regulate this without undermining policy with ‘so-called’ green bungalows. It might be that this could be managed by external review but the system would need very close scrutiny. It might be that a limited competition in collaboration with an educational conference could assist in increasing awareness and knowledge and inform future policy.

EDUCATION

4.47 Planners, councillors, building control, public agencies and the general public appear to lack adequate and contemporary information about sustainable rural housing and the positive opportunities which exist. It would be useful to encourage information exchange of best practice through existing professional and interdisciplinary activity and to identify gaps and new dissemination requirements.

4.48 LA Officers need in-house guidance on sustainable design so that they can assess projects on their own merits (historical precedent, innovation, design quality, environmental impact). This would be aided through dissemination of examples from to illustrate the extent of the impact that innovative, appropriate ideas can make⁹. There was widespread agreement on the need for education of professionals from all disciplines. It might be possible to extend the CPD scheme for architects and engineers which has already received funding from DETR to other professions¹⁰. It might also be possible to formally support an annual awards scheme for sustainable development projects. This could build on the existing SEDA design competition for schools of architecture (94-99). Rural design needs to be given more credibility.

4.49 Sustainable Design for students as part of their architecture course work in schools in Scotland was thought to be important. NB: Architecture schools will be required to introduce sustainability into RIBA Part 2/3 for validation from 2001¹¹.

4.50 The public also needs to be educated in sustainability and it was felt that acknowledgement of contributions in this area and public/professional recognition of what has been achieved would raise awareness.

INFORMATION DISSEMINATION

4.51 Proper support for an information dissemination service sympathetic to the Scottish rural context would be welcomed. This could build on the existing SEDA service (presently supported by membership income and some sponsorship) with a view to greater publicity and meeting broader demand.

⁹ Scottish Executive Planning Best Practice Awards are an example.

¹⁰ DETR research project Sustainable Construction CPD - Gaia Research

¹¹ ARB/RIBA Outline Syllabus Draft - 2000

CHAPTER FIVE

SUGGESTED FURTHER RESEARCH & DISSEMINATION ACTIVITY

Materials

- Research into materials & techniques which might be particularly suitable for Scotland e.g. timber, stone, earth, lime, minerals, earth clay, woodchip clay, hemp, light straw clay, crops, wool, processing leftovers;
 - aimed toward low cost housing, self-build and renovation markets;
 - extending to manufacturers/fabricators/contractors ;
 - geared to planning for long term availability within Scotland;
 - providing technical information on performance (U-values, air and moisture permeability, structural performance) of materials in a variety of conditions and constructions; and
 - including information on traditional crafts.
- Research on timber should be geared towards the use of the timber which will be locally available in the next 20 years and the more holistic use of our woodlands than is currently generally the case.
- Feedback on buildings constructed from local materials targeting regulations and leading to:-
 - examples of lived in long life timber and earth building;
 - design guidelines on detailing of timber, earth buildings; and
 - design guidelines on use of other traditional and new materials including straw, wool, roundpole, lime.
- Investigation of different procurement methods (ie. self-build & contractor) and architectural designs.
- Demonstration projects using traditional and new materials in the form of habited buildings monitored during construction and use.
- Information on weathering of materials - benefits and disbenefits re -aesthetics & treatments.
- Better information on leaching of materials.
- Better information on impact of treatments on biosystems.

- Dissemination of information on conflicts between traditional materials and environmental impact (eg imported slates).
- A network/website of Scottish suppliers of clean materials, services, products.
- Information on maintenance and end of life aspects of materials in relation to toxicity and existing and future legislation.

Process

- Continuing Professional Development for planners/ BC officers.
- Professional guidelines on sustainable development objectives.
- Leaflet of useful contacts on sustainable construction for dissemination by planning departments.
- A review of what criteria are being applied for sustainable development and how guidance is being communicated to designers, clients, builders & occupants.
- Information on the costs of sustainable building.
- Formal feedback mechanisms.
- Guidance specifically directed at renovation of old buildings.
- Supply chain development of clean building materials in Scotland.
- Professional criteria.
- Incentives and opportunities.

BIBLIOGRAPHY

Planning Advice Notes

39 Farm & Forestry Buildings The Scottish Office, 1993
44 Fitting New Housing Development into the Landscape Scottish Office, 1994
36 Siting and Design of New Housing in the Countryside Scottish Office, 1991
NPPG15 Rural Development The Scottish Office, 1999

Other

RIAS (1997) Environmental Statement
Historic Scotland (2000) Rural Buildings of the Lothians - Conservation and Conversion
Scottish Executive (1998) Investing in Quality - Improving the Design of New Housing in the Scottish Countryside - A Consultation Paper,
Scottish Executive (1999) A Draft Policy on Architecture for Scotland
Scottish Executive (1999) A Scottish Perspective on Sustainable Development
Historic Scotland (1997) Traditional Building Materials, Conf Proceedings
Halliday S.P., (2000) Green Guide to the Architects Job Book RIBA Publications,
Halliday S.P., (1995) Autonomous Technologies for Housing BSRIA
BSRIA (1996) Sustainable Housing
Stevenson F., et al (2000) Sustainable Housing Guide Scottish Homes
Berge B., (2000) Ecological Building Materials Architectural Press,
Liddell HL., (1997) The Sustainability of Traditional Materials in Traditional Building Materials Conference Proceedings, Historic Scotland.
Pearson D., (1989) The Natural Housebook Conran Octopus
Holdsworth W. and Sealey A.F., (1992) Healthy Buildings Longmans
Earthscan (1992) Education for Sustainability
HMSO (1996) UK National Environmental Health Action Plan
HMSO (1999) Sustainability Counts

Local Authority Guidance

LGMB (1993a) A Framework for Local Sustainability
LGMB (1993b) Greening Economic Development
LGMB(1994a) Local Agenda 21 Principles and Process, a Step by Step Guide
LGMB (1994b) The Sustainability Indicators Research Project: Indicators and LA21 - A Summary
LGMB (1994 onwards) LA21 Roundtable Guidance Notes
LGMB (1996a) The Local Agenda 21 Strategy Cookbook
LGMB (1996b) Innovations in Public Participation
LGMB (1996c) Sustainability Reporting: a practical guide for UK local authorities
LGMB (1997) Local Agenda 21: the First Five Years
LGMB (1977 onwards) LA21 Case Studies
LGMB/WWF 1996 Sustainability Training Pack for elected members in local authorities
LGMB/WWF 1998 Sustainability Training Pack for officers in local authorities
SOLACE/LGMB(1997) Guidance for Local Biodiversity Action Plans (Guidance notes 1 - 5)
Scottish Executive (2000) Rural Scotland - a New Approach
DoE/LGA/LGMB (1997) EC Eco-Management and Audit Scheme for UK Local Government: An introductory guide

RIAS/SEDA/RTPI/COSLA/Moray Council (1997) Steps to Sustainability - Developing an Environmental Agenda in Scotland
Countryside Commission et al (1996) Ideas into Action for Local Agenda 21

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