ROUNDPOLE IN SCOTLAND

A SECOND STAGE REPORT

‘THE ROUNDPOLE GROUP’
August 1999

CONTENTS OF REPORT

This report has been produced for 'THE ROUNDPOLE GROUP' by Bernard Planterose, of North Woods Construction Ltd., specialists in the use of locally grown timber in buildings including pole framing.

DEFINITIONS

For the purposes of this report, ‘ roundpole’ or round poles have been taken to be tree stems cross cut to any length but not machined in any way. They may be hand peeled or not. Round poles of a wide range of diameters are dealt with here but it may be useful to differentiate between small (diameter) round poles and large (diameter) round poles. Perhaps a useful working definition of the latter would be with a minimum diameter of 150mm leaving material below this size as “small roundpole”.

This report differentiates strongly between the terms ‘ roundpole’ and ‘ thinnings’. All trees start off as round poles and may be harvested at any diameter from a forest as part of a selective forestry operation or at a relatively large diameter as part of a second or even third thinning operation. Using the two terms interchangeably is therefore a mistake and, in the context of the Roundpole Project may lead to a confusion of project direction and a lessening of possibilities.

CURRENT USE

The use of timber ‘in the round’ in Scotland is relatively limited. Four main markets are identifiable with a small number of ‘off-shoots’ and additional very specialized niche markets.
The four markets are :

1) transmission poles (electricity and telephone)
2) fencing
3) playground/garden artifacts
4) agricultural type buildings

Two examples of very specialized niche markets are (a) boat masts, some of which are supplied from home grown Douglas fir or spruce (b) feature poles in buildings.

<u>Transmission poles</u>
The major if not only market for larger diameter poles. Scots pine and Douglas fir of the highest quality is pressure treated with creosote for this application.

<u>Fencing</u>
The quantity of round poles supplied to the fencing market appears to have escalated quite significantly in the last 10 years in Scotland. Pressure treated round spruce has found increasing favour over the traditional square cut post and this may be for a complex of reasons including (a) increasing availability of pressure treatment (b) increasing belief in pressure treatment amongst consumers (c) declining availability of good quality European larch (d) increasing competitiveness of small diameter spruce supply (e) increasing appreciation of benefit of round poles in terms of strength and resilience to decay.

The relatively smaller market in round tree stakes and horticultural applications may be conveniently regarded as an off-shoot of the fencing market .

Playground artefacts

A much smaller market than the other two but round pole has gained some ground in the area of the more ‘natural’ theme play areas and parks.

Agricultural type buildings

Almost considered as vernacular in some rural areas of the country ! – the use of recycled transmission poles as uprights in small scale agricultural sheds/byres etc

Use in construction

Other than the use of recycled poles, usage of new round pole in construction is exceptionally rare and seems to be limited to a very small number of specialized building companies. Three of note are :

Knapp Farm Buildings – who make frequent use of round poles as uprights in agricultural type buildings. They have also built one house in Scotland (at Ardnamurchan) based on recycled transmission poles.

North Woods – who make occasional use of round poles from their own forest operations in the construction of agricultural type buildings

Charles Gullane – who makes small recreational buildings with bent roundwood.

In addition to these, a very small number of true log buildings have been built in Scotland and one of the most notable examples of this is Ben Damph Lodge constructed by Beaver Timber at Loch Torridon.

With the exception of James Reid’s house (Knapp Farm Buildings), there would appear to be no examples of ‘serious’ pole frame houses as are quite frequent in NZ, Australia and parts of America. Bernard Planterose’s cabin near Ullapool utilized some round poles and is constructed as all North Woods buildings on a so-called ‘pole frame’ structure but tend to use squared off posts.

Examples where not in use

It may also be interesting to note other areas where round pole is not in use in Scotland but commonly is elsewhere.

The crash barrier support market is a very significant one in Scandinavia but timber is now not utilized in UK as thought to be dangerous !

Horticultural and fruit growing sectors are quite significant users in Scandinavia. Not so in Scotland except possibly on very localized basis.

THE ARGUMENTS FOR ROUND POLE

The reasons cited for the use of round poles include :
1) a natural resource
2) a low cost resource
3) minimizing sawmilling minimizes energy consumption
4) encourages thinning of forests by providing a market for small diameter produce

Each of these 'reasons' however make assumptions which are not necessarily the case in Scotland currently and require careful examination.

A natural resource
It is harder to imagine a more natural product than a round pole as it leaves the forest but its actual utilization may require significant inputs of (a) energy (b) preservatives (c) 'unnatural' jointing products.

A low cost resource
The price of small round poles is indeed relatively low and determined by major market factors, such as the competing price of equivalent material from abroad and the demand from the factories processing it to pulp and particles of one sort or another. Purchased directly from a harvesting contractor, a 'lorry load' of small diameter softwood round poles would currently cost around £20/tonne.

Minimizing sawmilling
It is fair to say that by virtue of not being milled, the use of timber in the round is likely to minimize energy consumption. We may say that, section for section, a piece of round wood will have a lower embodied energy than a piece of sawn wood all other factors of harvesting and transport being equal. This is a plus point in the ecological building context.

However, two qualifications need to be made even to this statement. (1) it should be noted that the encouragement of small scale local sawmilling is also a laudable aim if rural development is the priority and round wood production clearly does not support this sector. (2) if the jointing of roundwood requires for instance more glue or more steel than for an equivalent piece of sawn timber, most or all of the energy advantage could be lost in its actual utilization (see below under construction methods).

Encouraging thinning
The assertion that the development of markets for small diameter round wood will encourage thinning and therefore enhance woodland management needs some very careful scrutiny and qualification. This is discussed below as part of silvicultural aspects.

SILVICULTURAL ASPECTS

The argument put forward is that the creation of markets for small roundwood should promote thinning and therefore better woodland management. If the round wood under discussion is hardwood, say sweet chestnut or ash, then this argument may have validity. It has been amply demonstrated that the revival of certain crafts in England (and lowland Scotland to a lesser degree) has been inseparably connected to the revival of coppicing and other forms of environmentally sensitive woodland management.

If, however, the round wood under discussion is a softwood, the picture is quite different. In Scandinavia woodland regeneration has been traditionally reliant primarily on small coupe or selective forestry associated with natural regeneration. Scots pine and Norway spruce have been the main species involved. Thinning of the woodland has been employed in the context of long rotations to increase overall productivity but also to improve quality. A reduction of thinning in Scandinavia indeed implies a reduction of standards of forestry and of productivity and possibly of amenity - all of which deeply concern a culture which takes such pride in its timber production and utilization.

In Scotland the situation is significantly different in a number of aspects. Whilst in theory, softwood plantations were (and still are) established at close spacings with the intention of subsequent thinning, the practice has been in many cases not to thin at all. It can be argued that this situation has arisen on account of the poor economics of thinning - which in turn can be blamed on the cheapness of foreign imports and/or the high cost of indigenous labour and/or the difficulty of the Scottish terrain. All these factors in reality operate together. One can also add that the very way plantations were established (and still are) without proper access constantly militates against subsequent management. Whatever the reasons, it is a fact that a ‘no thin’ regime has been adopted by many managers (albeit frequently by default.) Added to all this has been the relatively recent move towards ‘restructuring’ in Scottish softwood plantations which involves the fragmentation of larger blocks of single species, single aged trees and this has put onto the market large quantities of small diameter softwood from clearfell sites.

The market for all this small diameter material is well established – the pulp and particle board sectors. Any new markets for round pole in construction would be totally insignificant alongside these markets and if the current demand from these major sectors for round wood does not encourage thinning it is hard to see why demand from the construction industry would.

This suggestion does however need some qualification. The markets described above are centred on Sitka spruce, lodgepole and Scots pine. If the new construction demand was for say Douglas fir or specifically for authentic native Scots pine, it could be argued that this might constitute an incentive for some environmentally sensitive and useful thinning operations of these woodland types. Such material

would be most unlikely however to then be a cheap commodity as it would be most likely cut specially to order.

Some of these points are returned to under 'Conclusions'.

ENVIRONMENTAL ASPECTS

Use of roundpole impinges on the environment in three ways :
1) the effect of its use on forest management
2) its use of energy in jointing/fixing
3) its requirement for chemical treatment

The first of these interactions is dealt with above and the second below under 'constructional aspects'. The third issue of chemical treatment is examined here.

Round wood, by definition, includes all the sapwood of the tree in addition to the heartwood. It is stated in BS 5268 and easily enough verified by observation that the sapwood of all species is non-durable and should not be used untreated in the external environment (except where a short life is tolerable as in say a temporary fence or sacrificial wall on a building). It follows therefore that the use of round pole in the external environment is likely to involve the use of chemical treatments and those most commonly in use in the UK are toxic by definition. Toxicity, including phytotoxicity, varies widely from product to product and a range of so-called ecological preservatives are available with less toxic ingredients. Most of these still include zinc and permethrin. Pressure treatment with sodium octaborate (Borax) is relatively benign but there are few treatment plants – only one in active use in Scotland !

Thus it could be argued that the use of a square post of only Douglas fir heartwood is a more 'ecological' proposition than a round pole of the same species as the former would require no treatment to meet Building Regulations whilst the latter would. (Only the heartwood of Douglas fir and larch is categorized as "moderately durable" under the BS scheme).

In the internal environment, the situation is quite different and roundpole may be considered no different from sawn timber in this context.

Finally, it should be noted that it is often argued by proponents of roundpole that the undisrupted 'skin' of the tree confers special resilience to insect and fungal attack and that it is not fair to compare a piece of sawn sapwood with the whole pole in tact. Observation tends to reinforce this suggestion but even a roundpole must have two cross-cut ends and these are exceptionally vulnerable to decay especially if in contact with the ground or external environment.

CONSTRUCTIONAL ASPECTS

Broadly speaking, the two difficulties of incorporating roundpole in building arise at the joints and where round or irregular surfaces meet flat surfaces. The use of proprietary or custom engineered steel fittings at joints is a frequent solution but detracts considerably from the cost advantages and the low embodied energy advantages of the raw material.

A short analysis of pole framing (of which the author has some direct experience) is given below which may shed some light on problems and their solution in the wider context of the Roundpole Project.

POLE FRAMING

The use of relatively large diameter round poles in domestic construction is well established as a structural system in the Antipodes and parts of the USA where it is known as pole frame or pole framing. Typically the poles, established on a regular grid, are used exclusively for uprights which pass right through the building (although some bracing may also be achieved with smaller diameter poles). Poles are then linked with large section sawn beams and the system is really just a variant or subset of 'post and beam' . It is characterized by a really massive and mostly exposed structure typically exploiting the possibilities of large cantilevers, decks and walkways. Many of the most impressive examples are built on steeply sloping sites where the point foundations display their advantages fully over any other building system.

It is instructive to observe these buildings as the system has a long lineage and may be expected to shed light on appropriate or economical uses of roundpole. It should be noted, however, that this analysis refers to softwood construction utilizing bolted joints and does not refer to conventional forms of typically hardwood mortised and tenoned frames. Salient points about the structure are :

(1) Poles are used vertically and only occasionally horizontally.
(2) Pole to pole connections are not frequently used
(3) Pole to sawn beam connections are achieved by ‘dapping’ or rebating the pole to accept the beam and to create a flat bearing surface for the joint.

Clearly it is in the jointing of round poles where the challenges to their use arise. Some designers have utilized quite sophisticated steel fixings and many of the economies of the original intention will be lost in this way. However, in some cases round poles are used almost purely for their aesthetic pleasures and in this case cost and energy considerations may be irrelevant.

The taper on round poles leads to many problems if incorporated as uprights in walls for instance. A neat solution taken to this by many pole frame designers is to keep the poles away from the walls altogether and to frame these up quite independently of the structural pole and beam frame. Poles may be internal or external or both. Externally they are frequently used to support massive overhangs.

Why have systems such as pole frame and indeed whole log building not caught on in the UK ? It is easy enough to correlate pole and log building with areas of the world where large diameter trees are (or at least were) available. (Pacific coast of USA and Canada being good examples). But there is more to it than that and species of tree available has at least as much to tell us. The Canadians have western red cedar and Douglas fir in abundance and the Scandinavians have very slow grown Scots pine. In Scotland we have only rather rapidly grown Scots pine which displays a poor ratio of heartwood to sapwood. Scottish grown Scots pine logs used in the round without treatment in the external environment rot quickly.

Even with pole frames kept to the interior of buildings, the system meets many barriers in the Scottish context which include Building Control, constructional skills shortages and a lack of experience in the engineering profession. The sculptural qualities of round poles in the interior of a house are unlikely to appeal to more than a small minority in our plasterboard culture.

CONCLUSIONS

- 'Round pole' and 'forest thinnings' are not the same thing and, in the project context of sustainable local development and ecological forest management, it would be very limiting not to extend the definition of round pole to all diameters. In this way round pole can embrace the concepts of 'second thinnings' and 'selection forestry' which would be important components of a more ecologically based forest management in Scotland. The more sophisticated forestry implied by these terms would lead to more local employment, skills development and a closer or more direct relationship between construction industry and forestry industry at a small scale and local levels.

- Currently, the use of round pole in Scottish construction is extremely limited even when the definition is extended to all diameters of pole and comprises both hardwood and softwood.

- The reasons for this are several and include a shortage of straight and/or large stems over the last few hundred years coupled to the fact that until relatively recently the only softwood available was Scots pine of which the sap wood is not at all durable and, due to the speed of growth, sapwood is frequently large in proportion to heartwood.

- Increasing interest in ecological building and the search for new uses for home grown timber - especially of native species - has prompted an increasing interest in the potential of timber in general. Interest in roundpole construction should be seen in this context.

- Promotion of small roundpole construction will make no significant impact on forestry operations if major softwood species are used as these are readily available from current clearfell operations supplying pulp and particle board industries. It would be a fallacy to suggest that new use of say pine or spruce small roundwood would promote thinning of plantations in general.

- If however a significant new use of Douglas fir small roundwood was promoted, it is conceivable that this would be harvested by thinning operations which would tend to increase the productivity of these plantations. Similarly, if native Scots pine was specified then this could provide a useful market for thinnings from environmentally sensitive sites which would benefit from thinning.

- From an environmental perspective, development of large diameter markets is arguably more useful than the development of products for small diameter thinnings. This implies the retention of stands over long rotations with attendant easily identifiable environmental and amenity advantages. This concept would receive widespread support in Scotland today and may become an increasingly important issue as the construction industry turns more and more to composite timber products that require only short lengths of small diameter timber. The trend towards utilization of short lengths to fabricate laminates of one sort or another and the relatively recent development of the timber 'I beam' may almost completely eliminate the demand for even moderate sized sawlogs in the future. In such a marketplace, what will be the need to grow trees beyond 20 years ? The ecological and landscape consequences of this trend for Scottish forests and the land on which they depend for nourishment may be very negative.

- The development of new markets for small diameter hardwood roundpole is a quite different matter and could make a useful contribution to promotion of the sound management of native and other mixed woodland. Much of the focus of Highland Birchwoods' work has indeed been birch and its conversion to short floor boards using a double slabber sawmill is relevant to the Roundpole Group.

- Clearly the availability of reasonably straight hardwood poles in Scotland is very limited – hence the focus at Highland Birchwoods on a 1.2m floorboard. Birch, ash and gean can however all make rapid growth into straight poles on the right ground and with the right management. (Maybe David Lea's bent rowan sapling studio in Somerset is noteworthy in this context).

- From the foregoing it would appear imperative to clarify very clearly what the objectives of utilizing roundwood are as these will determine what species are focused on as well as what diameter. At least five objectives - all falling within the overall project aims - present themselves, each with their own prescription.

- OBJECTIVE : to promote native woodland management
  ACTION : : develop construction products and systems for hardwoods (any product utilizing any diameter would contribute to the objective).
  OBJECTIVE : to diversify conifer species in commercial plantations
  ACTION : develop construction products and systems for species such as European larch, Douglas fir and Western Red Cedar,
  OBJECTIVE : promote more sensitive or intricate forest management
  ACTION : develop construction products and systems for wide range of diameter sizes including both small and large.
  OBJECTIVE : promote long rotations
  ACTION : develop construction products and systems that utilize large section timbers and/or poles such as pole framing
  OBJECTVE : facilitate low cost building in communities with access to timber

ACTION : develop construction products and systems utilizing low grade softwoods of a combination of size classes

- Using roundpole in the external environment implies preservative treatment as the sapwood is present. The commonly used CCA is not acceptable to 'ecological' designers and getting pressure treatment with alternatives such as Borax, whilst possible, is not easy over most of Scotland.

SUMMARY CONCLUSION

Developing new products utilizing small softwood round poles will not *per se* lead to more thinning of Scottish plantations. The demand for small softwood round poles is already there ; it is massive and the forest industry does not meet much of the demand by thinning because it is not economical. A more socially and ecologically apposite objective would be to try and match the real constructional requirements of emerging community landowners with the forest resources which they already have and which they might aspire to developing over time. This exercise would probably involve the development of easily replicable, low cost uses of a wide variety of softwood diameters (principally spruce) and the use of short length native hardwood stems. Minimization of milling would be a legitimate objective perhaps leading to systems combining sawn and round wood. The incorporation of large diameter timber should be a part of any design solution if woodlands are to be managed on long rotations or, in an idealized situation, under selection or 'continuous cover' management regimes.

PERSONAL POSTSCRIPT

As a small woodland owner committed to 'ecological' methods of forestry, I have spent several years developing ideas on construction which would be compatible with my forestry objectives. My particular pre-occupations have seemed marginal in relation to 'industrial' forestry and the search to improve its practices but I have always believed that there was some hope for the development of small scale woodland management in Scotland through a renewed interest in our native woodland. It is now exciting to find that a new generation of community groups are joining the various conservation NGO's in the search to both utilize their woodland at the same time as developing local employment in a socially and environmentally sustainable manner. These new woodland managers are forging new management principles and asking a lot of questions about the way they can make their woodland create employment and a healthy and beautiful environment at the same time. Construction is high on their list of interests and the Roundpole Group could very usefully, in my opinion, contribute professional advice and support to these groups.

My particular interest has been in developing a structural system that utilizes (a) a wide range of size classes of timber (b) low grade spruce of small diameter. My need for a use of all diameter size classes ties in with my desire to manage my woodland on a continuous cover regime retaining all size classes of tree to maintain both a healthy ecological balance as well as a beautiful environment. My need to utilize small diameter spruce is simply because I have a lot of it ! My belief is that these two aims will be common to many community owned forests in the coming years.

My design solution has been to utilize a heavy post and beam structural frame which requires some large diameter trees in combination with a non-structural 'sub-frame' of low grade spruce or pine that carries the insulation and windows. The post and beam structure is very straightforward and is simply bolted although a more sophisticated design utilizes rebated joints and coach screws. Most timbers are squared (except where outside the walls) but I would be able and interested in using round wood in parts of the frame where they do not meet flat surfaces. I have two houses currently 'on the drawing board' which will include some roundwood poles and which could potentially include other roundwood.