John Barnard, SASFA director.

LIGHT STEEL FRAME BUILDING AND SUSTAINABLITY

By John Barnard, SASFA director

I recently attended a meeting in Brussels arranged by the World Steel Construction Council, a group formed under the auspices of the IISI (International Iron and Steel Institute). In this council I serve on a committee formed to compile a definitive and objective international document on the sustainability of steel in residential buildings, and presented a paper on the energy efficiency of LSFB in the Southern African context.

The terms 'sustainability', 'energy efficiency', 'green building' and 'carbon footprint', appear in most articles and publications of late dealing with the building and construction industries. The Green Building Council has been formed (the Steel Construction Industry is represented by Dr Hennie de Clercq), and SANS 204 'Energy efficiency in naturally ventilated buildings' is being finalised and will be published before the end of the year. A number of local and overseas seminars and conferences are focussed on these topics.

It is clear that sustainability will be a fundamental consideration and design requirement in the very near future – and not in a fuzzy 'tree hugging' sense, but rather to comply with specific requirements of the National Building Regulations – the building law of the country.

Sustainability with regard to buildings is essentially based on three criteria: social acceptability, affordability and energy efficiency.

It is claimed that Light Steel Frame Building (LSFB) for low rise structures rates highly on most or all of the sustainability considerations:

- Light steel frame buildings appear no different to 'conventionally' built structures, except that the quality of finishes is typically better. It is finding acceptance for 'affordable' as well as up-market buildings in South Africa.
- It is a cost-effective building method, with financial savings emanating mainly from significant time savings to complete building projects, less rework, reduced logistical costs (which is of growing importance due to the escalation of fuel prices) and a drastic reduction of rubble on building sites, when compared with the brick-and-mortar alternative.
- Light steel frame building is claimed to be significantly more energy efficient than heavy construction methods – both with regard to 'embodied energy' of the materials and components, as well as 'operational energy' relating to heating and cooling of the building over its design life.

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SOUTHERN AFRICAN
LIGHT STEEL FRAME BUILDING ASSOCIATION

1.0 BRICK WALLS

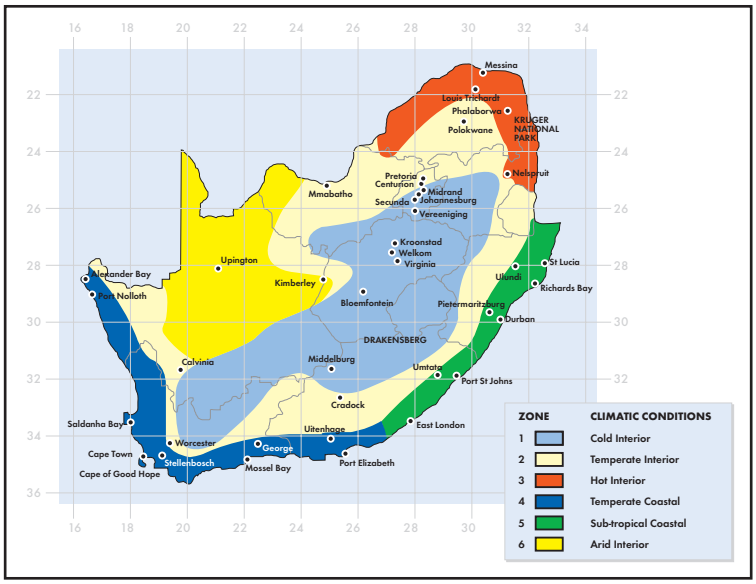
1.1	**Clay bricks**	No bricks*	total mass tons	
	External walls	17,160	56.6	
	Internal walls	9,804	32.3	
	Total	**26,964**	**89.0**	
1.2	**Mortar**	sand mass tons	cement mass tons	total mass tons
		40.0	4.3	**44.3**
1.3	**Plaster**	sand mass tons	cement mass tons	total mass tons
		40.0	4.5	**44.5**
	Total mass, brick walls			**177.8 tons**

* includes 6% breakages
** material supplier recommendations

2.0 LIGHT STEEL FRAME BUILDING (WALLS ONLY)

		total mass tons
2.1	Steel frame 0.58mm 550MPa #	1.60
2.2	External cladding 9mm MD FC board	2.48
2.3	Internal lining 15mm gypsum board	5.89
2.4	Insulation (100mm) fibre mat, 15 kg/ cub m	0.23
	Total mass Light Steel Walls	**10.21**

Calculation of mass in walls of a 200m² house.

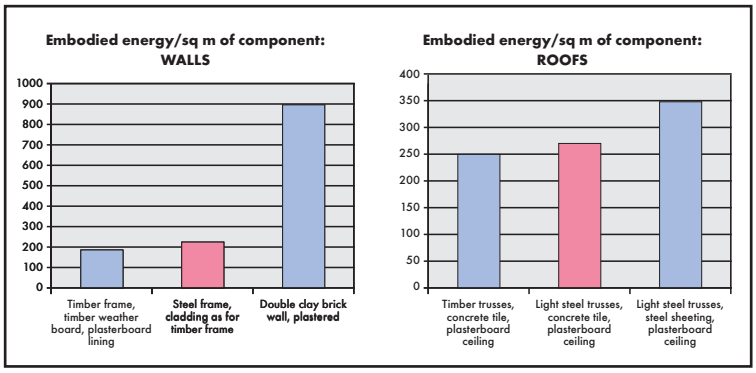


Climatic zones of South Africa.

efficiency of LSFB in the Southern African context.

I reported that embodied energy of materials and components used for LSFB is calculated to constitute some 20% of the total energy consumption of a 200m² house, over a 50 year period, the other 80% being the operational energy. These figures are in line with those reported by Argentina. While the embodied energy of the high strength galvanised steel sheet - used for the light steel frame – is significantly higher per kilogram than conventional building materials, a significantly lower mass of steel is used, rendering LSF wall assemblies vastly superior in this regard – double brick walls contain more than 4 times the embodied energy per square metre when compared with a LSFB wall!

As LSFB structures are insulated to specification pertaining to each climatic zone in SA (according



Graph 1: Embodied energy per assembly of materials, per unit area.

to the new SANS 204), it has been found to offer at least a 10% saving in electricity used for heating and cooling, when compared with a brick building over a 50 year period.

The low mass of light steel frame buildings offers another advantage – logistics. The walls of a 200m² brick built house will have a mass of some 178 tons (including clay bricks, mortar and plaster) compared with the miniscule 11.3 tons of an identically sized light steel frame building! The cost savings in transport is obvious, but with another benefit to all road users – at least a 60% reduction in heavy transport traffic on the national roads!

While the 10% saving in operational energy over the life of the building serves as a strong motivation for the use of LSFB, the massive savings in embodied energy (albeit only 20% of total energy consumption) offers an advantage right now – when SA has a shortage of electricity generation capacity.

It should be clear that the time has come to seriously consider alternatives to conventional building practices, in view of the environmental demands of the 21st century.

Visit www.sasfa.co.za for the full presentation, and other background on SASFA and light steel frame building.