

Advanced materials and LSF construction

MechChem Africa columnist, Gary i Crawford of Mettle Strategic Creativity, is currently building a new property in Hartbeespoort using only light steel frame construction principles and products. Here he presents some of the innovative products available for those seeking to go beyond the traditional.

The construction industry is inefficient and slow to innovate. At least that's the impression of many people, including me, who feel that the comfort zone of currently used materials and techniques is too comfortable to risk the downside of trying something new.

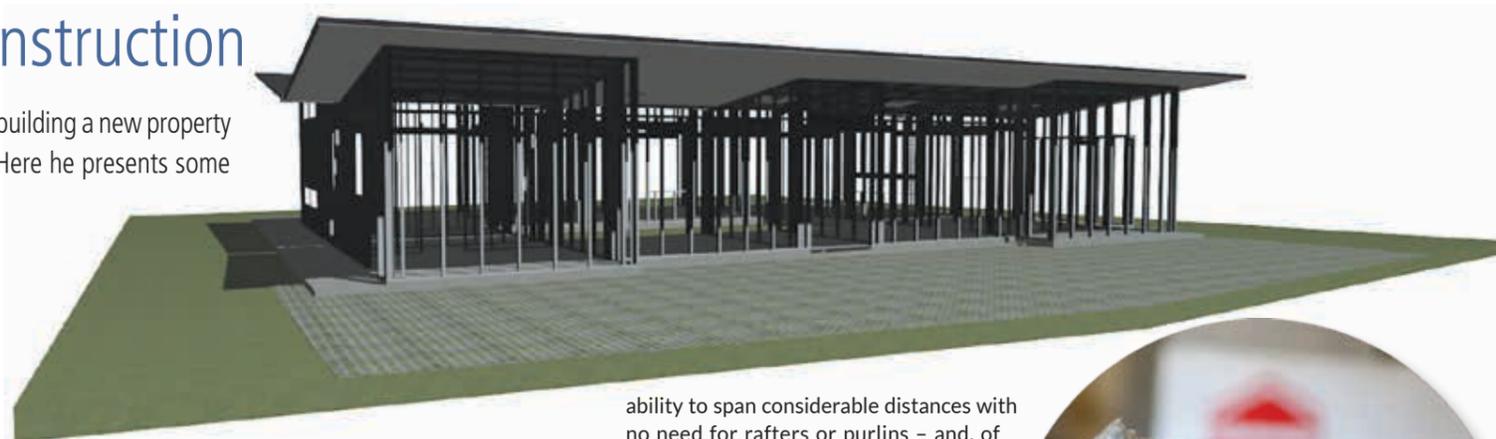
I make no claim for any of the products mentioned in this column, save to say that some have been included in my current build – with no strings attached. And I intend, in the near future, to publish a case study on the experience, following the completion of House Crawford, Hartbeespoort.

Corrugated stainless steel pipe: Available in some other countries since the 1980s, corrugated stainless steel pipe (CSSP) is now manufactured in South Africa by INOX. CSSP



Compared to 'conventional' pipe, CSSP is much lighter, more flexible, requires far fewer connections and fittings and is less susceptible to extreme temperature and corrosive environments.

is suitable for most water distribution in residential, commercial and industrial applications. Manufactured from corrosion-resistant



The digital architectural model of House Crawford, which will be an LSF construction that will use modern materials such as structural insulated panels (SIPs), corrugated stainless steel pipe (CSSP) and cellulose insulation.

304L and 316L (special order) stainless steel, INOX CSSP is designed to provide reliable and corrosion-free service for extended periods.

CSSP provides a number of advantages when compared with 'conventional' pipes, as they are lightweight, flexible, require fewer connections and fittings and are less susceptible to extreme temperature and corrosive environments.

INOX CSSP conforms to SANS 1689 and has been tested rigorously to ensure an extended service life. INOX CSSP can maintain high operational pressures and a wide range of temperatures and is rated at 100 °C and 100 kPa. INOX CSSP is designed to work with brass compression fittings complying with SANS 1067-1.

To my mind, the most important attribute of INOX CSSP is that there are no joints in the piping runs: from the heat pump to faucet, for example – therefore, no leaks, and a definite specification for House Crawford.

Structural insulated panels (SIPs): SIPs are a high performance building system for residential and light commercial construction. The panels consist of an insulating foam core sandwiched between two structural facings, typically Chromadek (in South Africa). SIPs are manufactured under factory-controlled conditions and can be fabricated to fit nearly any building design. The result is a building system that is extremely strong, energy efficient and cost-effective.

SIPs share the same structural properties as an I-beam or I-column. The rigid insulation core of the SIP acts as a web, while the sheathing fulfils the function of the flanges. SIPs combine several components of conventional building, such as studs and joists, insulation, a vapour and air barrier. They can be used for many different applications, such as exterior walls, roofing, flooring and foundation systems.

The greatest advantage of SIPs is their

ability to span considerable distances with no need for rafters or purlins – and, of course, their superior insulating capacity.

Cellulose insulation: Manufactured of pulverised paper and various forms of boric acid, the thermal performance of loose filled cellulose compares favourably with other types of insulation: about the same as or slightly better than fibreglass wool. But cellulose is very good at fitting around items in walls such as pipes and wiring, filling almost all of the air pockets, which significantly increases the overall insulation efficiency of a wall. Real world surveys have cellulose performing 20-30% better at reducing energy used for heating than fibreglass.

The simple fact of the matter is that cellulose will perform better and provide better protection in the event of a fire than any other commonly used type of insulation. "Paper burns, so why not cellulose insulation?" people ask, a comment easily countered. Place a small amount of cellulose insulation in your cupped hand. Place a coin on top and apply a blowtorch. The coin will glow without heat being transferred to your hand.

I've done it many times, so cellulose insulation is specified for House Crawford.

Other construction innovations to look out for include: translucent concrete, which is filled with optical fibres to up to 4.0% of its mass; electrified wood, a sandwich of two electrical layers between layers of wood to allow, 'tapping off' of power virtually wherever you want it; bendable concrete called Engineered Cementitious Composite (ECC), with a strain capacity in the range of 3.0 to 7.0%, compared with 0.01% for ordinary Portland cement (OPC); and transparent aluminium oxynitride, a replacement for window glass that is four times harder than fused silica glass.

Light steel frame (LSF) construction

One may ponder why LSF construction and the seemingly wonderful products associated with it such as cellulose insulation battle to gain market acceptance. For the latter, I know all too well, I was GM of the largest manufacturer of the product in the United States, HJH Chemicals, Phoenix, Arizona.



Loose cellulose insulation is very good at filling air pockets, which significantly increases its overall insulation efficiency. Also, in the event of a fire, it performs better than any other commonly used insulation material.

For LSF construction, I use the comments of Nardi van Zijl, an architectural designer whom we had the pleasure of meeting and 'co-opting' onto our House Crawford team. Here's his take on LSF:

"For many, the first exposure to LSF construction was via mass-market housing. This inevitably attaches a low-cost stigma to any product, regardless of the quality or any other benefits.

"In addition to the trade's unwillingness to try a new system, architects, engineers and quantity surveyors are prone to sticking to what they know. This is largely because the importer, developer or distributor generally has very limited resources for training and educating the trades and professionals on all aspects – pros and cons – of their specific system. More often than not, the importer, developer or distributor will give up the market development of their specific system, which results in the trades and professionals labelling it 'fly by night' or a failure. Sometimes this is a well-earned tag, but in general, it is a thorn in the side of any remaining new systems."

Thanks, Nardi. We hope the case study on House Crawford will provide a better understanding of LSF construction, through a step-by-step report on an actual build. SIPs, corrugated stainless steel pipe and cellulose insulation will be used, but not transparent aluminium.

Anyway, you wouldn't see it if it was there! □

What makes Crawford tick?

Those who have got to know me through this column or the 'No Sacred Cows' of *Stainless Steel* magazine will recognise my inherently positive approach to life and business. They'll also know that I weave a little of my private life into my comment on industrial trends. This column is no different, but I would also like to thank some of those who have shaped me.

Psychologically speaking, I'm one of those people who use both brain hemispheres almost equally. As you probably know, the right-brain is referred to as the analogue brain, controlling creativity and artistic ability, whereas the left-brain is the digital brain, controlling reading, writing, calculation and logical thinking. So, luckily, I'm as adept at strategic thinking as I am at creative concepts, which has stood me in good stead as consultant in business strategy.

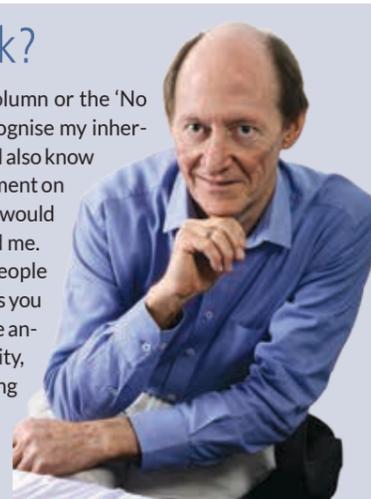
From my artist mother and engineer father, I thank them for a delightful set of genes and for encouraging my 'nosiness'. My New Yorker wife, Sharon, feeds my creativity with the support of Afghan hounds, Samsara and Tamatav which ensure I never take life too seriously.

Designing our previous residence and our currently under-construction home in funky Hartbeespoort, I have Metquip Group CEO, Roy Morreira to thank. He is teaching me more about engineering than I learnt at any university. Then there is sassda, the Stainless Steel Development Association, that entrusted me to re-position the organisation, allowed me to have my say as a long-time writer of the 'No Sacred Cows' column, and trusted my leadership as chairperson of the Import, Architecture, Building & Construction, and Fabricator Sectors.

To the developers and marketers of advanced materials, I thank them for putting money where their mouths are and the architects and designers who understand my human need to sometimes go out on a limb to seek a better way.

Of course, not forgetting a growing group who see the need for responsible fostering of advanced materials and construction techniques for society's good. And, the founding of a well supported organisation to undertake the task.

And finally, thanks to those who bring new products and techniques to our attention. I thank you all. □



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