



The design of Eastgate in Harare was inspired by termite mounds.

Mr Resilience

Committed to appropriate architecture, Mick Pearce specialises in buildings that have low maintenance, low capital and running costs, and renewable energy systems of environmental control. **Matt Dillon** and **Phil Wilkinson** spoke to Pearce on the eve of his appearance at the Melbourne Pre-loved Buildings conference.

Sitting in a sunlit office on the 51st level of Melbourne Central Tower, trailblazing architect Mick Pearce is explaining why he isn't particularly fond of the word "sustainability". He prefers the term "resilience".

"There's this whole problem of this conservatism surrounding it [sustainability]," says Zimbabwe-born Pearce, 71. "It implies keeping things as they are. And there's this whole mix-up with economic sustainability. Everybody is using this word 'sustainability'. In the corporate world it's come to mean 'staying in the black'."

"Then you have the term 'sustainable development', which in a funny sort of way is an oxymoron. I don't like it. I use 'resilience', actually. That's what I'm trying to do anyway."

Pearce is forever searching out ways to make buildings work more efficiently. Referring to himself as a "designer" rather than an architect, he happily absorbs knowledge from any discipline he thinks might be helpful – engineering, biology, entomology. He reads widely.

The building most closely associated with Pearce is Eastgate, a mixed office complex and shopping mall covering half a city block in the business centre of Harare that was inspired, incredibly, by termite mounds.

"What makes it unique is that not only is it ventilated, cooled and heated entirely through natural means, but it works," wrote Liane Lefavre and Alexander Tzonis of Architects for Peace. "Its ventilation costs one-tenth that of a comparable air-conditioned building

and it uses 35 per cent less energy than six conventional buildings in Harare combined. In the first five years, the building saved its owner \$3.5 million in costs."

Ecolibrium: Have you always been interested in ecologically sustainable design?

MP: What got me going in the sustainable direction was a guy called Bill Mollison, an Australian who invented permaculture (Ed's note: along with David Holgrem and associates). Permaculture mimics the rainforest. Plants support each other; you can actually grow crops without fertiliser.

In Harare in about 1986 Mollison gave a lecture that I went to, in a building that I'd built. And he was marvellous.



Mick Pearce

He said completely the things that I wanted to hear – we were absolutely in tune. I thought perhaps that one could do with architecture as permaculture had done [with plants]. In other words, mimic the processes in nature. That would give you an intellectual basis for building design. And then I started doing office blocks, university buildings and schools.

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I did about four in a row, and each time we went further down the track, getting more and more sustainable. We found that most buildings in Harare used the international style. One thought that the universal style could be built anywhere, and that all you needed was power. That’s what architecture was all about: that nature could be conquered by the city. You could just plug into the power station and there was endless energy.

All of that, that line of thinking, fell apart in the Third World, in Africa. Certainly I couldn’t do that architecture in Africa because there was no technology. It was very primitive. And secondly energy was more and more expensive, particularly in central Africa. You were forced to design

buildings that needed as little electrical power as possible.

Zimbabwe has a beautiful climate of hot days and cold nights. It’s subtropical, about 15° south, with an altitude of 1,500m, so it’s quite cool at night and hot during the day because of the thinner atmosphere. So you get a big diurnal shift, which is the difference between the day and the night. We found that building courtyards with plants in them helped because they trapped the cold air. And if you put plants in them you could actually drop the ambient temperature. And therefore you can save huge amounts of energy by sucking that air into the air conditioners. In fact, the air conditioning units we put in really didn’t run half the time.

Also, we were worried much more about the sun shielding. The buildings that had been built didn’t have any sun shielding, they were just glass towers. That in the radiation belt was madness, just crazy. My buildings were the first to have serious solar shielding on the outside.

And then we go to the point where a client asked me to build one huge building without any air conditioning. He said, “We just can’t afford to go on importing air conditioning.” And that was Eastgate.

We formed a team, using the London and Harare Arup offices to design a building which used night air to cool itself.

We devised this system of laying night air through voids in the structure – channels under the floor and things like that – so that the structure would then be cooled down and return that coolth and then cool the air the next day before it went into the room.

Eco: Was Eastgate the building that was said to be based on termite mounds?

MP: I had watched a David Attenborough documentary about termites. I told the engineers this, and it started as a joke. But then it became more serious because I realised it was a good metaphor for the building.

The interesting thing about the termite mounds in Zimbabwe (the ones here work on a different principle) are that they are chimneys. At night the chimney works because it’s hotter inside than outside. The more air rushes up the spout, the more oxygen gets in, and so their activity increases. A beehive works on a similar principle, except they cool the air by fanning their wings.

So you get this amazing picture of activity at night, all based on oxygen. They also have evaporative cooling, because they used moisture from the water table, and evaporate the air that comes in, and that drops the temperature.

They keep the air temperature in a very narrow band, about 30-31°C inside all the time. And the outside temperature goes from 0 to 40°C.

We thought that there's got to be a way of mimicking the termites, and we got quite excited about this. It remained the metaphor for the building right the way through the design process.

And then I mentioned this to a journalist when we walking past the buildings and looking up at the chimneys on tops of it. He said, "What on Earth are those?" I said, "Well actually there not chimneys, they're vents that let the night air out." And then I told him about the termites. He cooked up a story that was in the New York Times the next day. The whole thing just went "boom"!

That story kind of put me on the map a bit, and allowed me to come [to Melbourne to work on CH2]. Rob Adams was here, and he thought he could build a building that was a model for sustainability in Victoria, which was what we did.

Eco: You had low-tech solutions that worked in Harare. Do we do high-tech in Australia because we can or because we need to?

MP: That's a very good question. I cooked up the brief with the client, who said, "Your brief is to design yourself out of a job, and we'll pay you the same fee as you would have got for a high-tech building. We took that on as a huge challenge. They did some amazing modelling in London. And in those days, '92, there were no computer programs or simulations. But they'd done quite a bit of work in this area.

It was very scientific. But what we were doing was designing ourselves out of engineering.

Arriving here [in Melbourne], the first things that hits you is that it's much more sophisticated. And the climate is more complicated. In Africa it's day/night, but here it's three days hot and three days cold. And more of a seasonal differential: you have two mid seasons and a hot season, which is unbelievably hot. And then in the middle of the hot season you get these 40°C winds that come of the

desert, very dry, and then it switches and you get these cold winds off the Southern Ocean, and it switches from about 40°C to about 18°C in half an hour.

Eco: Does that mean the low-tech solutions suitable for Africa won't work here?

MP: In order to squash the thermal temperatures into the comfort band you need much more thermal storage than can be achieved with rock stores. [With CH2] we tried a big container of water. We got 4,500 cubic litres of water, which is just out of the question.

So we had a different set of problems. We devised many systems, high-tech solutions. We had phase-change material. Phase change is a way of storing energy, which is so much better and doesn't need as much as space as doing it with water, rocks or the building structure.

What we did here that we couldn't do in Harare is night purging. Because the temperature drops lower than what it would do in Harare, what you do is open the windows. But then you need a body of thermal mass to cool down, to retain that coolth for the whole day. So we devised a wavy ceiling in the office space made from concrete. If the windows open correctly and everything works right, it really does perform brilliantly. And we can get 20 to 25 per cent saving in energy.

And we also used displacement ventilation. That means you're not using air to cool people, you're actually cooling them with radiant systems. That's when you're body is emitting heat and it's being absorbed by surfaces around it, and not simply by contact with the air. It's a much more comfortable way of cooling people; it's fits the human physiology much better.

The problem of cooling with air is you're drying the skin and also recycling the air. Although it has enough oxygen in it, it tends to lose its ionic balance and all those sorts of things. It's not as good. You're also recycling pollutants, and these days with the flu around that's not a good idea.

We devised a system whereby you deliver the air at 20°C straight away, and like Eastgate there's no recycling of air. It's just once through. That wastes energy, so you have to then find ways of doing everything else much more efficiently.

Moving the energy around the building in the form is much more efficient rather than moving it in the form of air.

And we used the night air for cooling the building water. All of the cooled water goes straight to the phase change. We should have much more phase change – double the amount. We wanted to, but couldn't afford it.

CH2 is the usual story of pioneering everything. We've given them a Rolls Royce, because they've got everything, and the conditions in there are just ridiculously good. The range of temperature is literally just 1°C. It's better than an A-grade building.

So little research and development is done on buildings, anywhere. We spend more human energy designing bloody corkscrews than buildings. Buildings are always in a rush. There's enormous pressure to get buildings up. There are vast amounts of money at stake, and everything else.

Eco: Why do you call yourself a designer rather "architect" or some other title?

MP: This line of architecture is driven by science, so it's a sort of intellectualisation of architecture. There is an old dictum: form follows function. It's different and it doesn't earn you much with the architects, because the architects generally like form-driven objects, and their forms are sculptural, really. In a way, I don't think they are very good sculptures, some of them. They are driven by an aesthetic: a use of material, a use of glass, a use of this and that. My architecture, and certainly the architecture of this firm, is driven much more by form follows function, but the function is expanded to include nature, culture and the economy, so it's a sort-of tripartite arrangement.

We do build forms that are derived from nature, but not always. CH2 doesn't look like a termites' nest. It's the processes; we're copying the processes of nature, not nature.

I'm doing a building at the moment which is like a seashell and sits on a lake. It's next to a big water-processing factory. It demonstrates the physical properties of water, or tries to. One of them is that you can use water to cool the building at night by running the water over the roof. The water then falls into a lake. It demonstrates that a very light building can have its thermal mass elsewhere; it's disconnected thermal mass.

I don't know how it will work, but the theory stacks up.

Eco: Do you think in Australia we in mechanical services can do ourselves out of jobs?

MP: First of all I think the whole design processes of engineering and architecture must mesh into a whole. That's why I like to work directly with engineers right from the beginning, at the conceptual stage, so we get it together.

I also think that buildings should be better zoos for people. And I say zoos, because zookeepers know a lot more about animal physiology, animal welfare, animal diets and animal genetic origins than architects and engineers know about the human animal.

Eco: What do you find frustrating?

MP: There's a mismatch from having too many people around the table. We tried something at CH2, which was to incorporate everybody. We had a huge table, about 20 people, and it sounds wonderful and very democratic. But it's a nightmare. It did work, but I was exhausted. I think it's better to have a core of two, three or four people, and then pull in others as needed – that works. I know it's not as inclusive, but you can take inclusivity too far.

Eco: You've said that night flushing works in Melbourne. Have you had a look into any other Australian climate zones to see what solutions might work?

MP: I went up to Cairns, and it was good there because it was very familiar to me because I really am very tropical. And I saw them having many of the problems we have in England. In England you worry about vapour barriers, because things are damp inside the building, and cold outside. In Cairns its cold inside and hot outside, and the air is full of water and gets in and buggers up everything, including door frames.

They'd never heard of vapour barriers up there. There was one engineer I found who was using a fan, and that was good. You don't need thermal mass up there. The best thing is timber housing, and lightweight. I haven't had a chance to build up there, but it's very much more familiar.

Because there's no thermal mass, you've got to use wind if you can and sea breezes. You usually get an onshore/offshore. I'm very keen on putting buildings on water, and that's what they should do here [in Melbourne]. They've got a wonderful chance to build on the Bay, which is very

still water. The price of land in the middle of the city is ridiculous.

In Holland they have four or five thousand houses that float. They're going for it in a very big way – they're going to put cities on water. And there you have a very stable regime at sea level. You're using the sea as a heat sink. You can use the tidal range as what I call a moon-sea pump, so the whole city can go up and down and pump energy.

Eco: What are your thoughts about how cities should adapt for climate change?

MP: The city needs to densify along the routes formed by transport. The architecture of movement must be much more central. We actually aren't building what I term a solar city: one that encourages people to walk.

My city would be one that has a very long-lasting framework, an infrastructure that is literally a concrete frame that can take services. That would stand up for 200 years and it could take anything – offices, housing, it doesn't matter what it is. It's on a grid, and in it you slot IKEA – type houses or anything. They can be something that expresses the current culture and is less long-lasting. It's in order to get away from this ridiculous business of building these phallic forms, which represent riches and things like that.

Our whole economy has no relation to the availability of natural resources. You ask an economist about natural resources and he hasn't factored it in; they're just commodities to him. But they're running out. I think there's 15 years of copper left on the planet – that's all.

The city is an anomaly. We don't like to live in cities; we like to live with trees and plants. I see the battle for the planet being one between the plants and the animals, and at the moment the animals are destroying the plants. Our souls are outside the cities, and that's why we have to have plants around us. We need to get that right, and bring nature back into the city.

Our relationship with nature needs to be right. It's not right at the moment. ■

Mick Pearce is the keynote speaker at AIRAH's Pre-Loved Buildings conference to be held in Melbourne from November 19–20.

For more information go to www.airah.org.au/preloved2009