

Power Assisted Bicycles *flatten* cities

Alan A Parker, Secretary of the Town and Country Planning Association, looks at the development of the PAB worldwide and its long-term potential to green our cities.

Australian transport planners, like most people, do not know what a power assisted bicycle (PAB) is and have never seriously considered their use for riding up steep hills. Although four electric PABs are now marketed here, only a thousand or so people own PABs and most of the 125 models of PABs on the world market are not sold in Australia. In the long term, bikeway networks built for bicycle users could be used by PABs to enable people to cycle as much in hilly cities as the Dutch do in their flat cities.



Most transport planners think electric PABs are mopeds but they are basically bicycles. The crucial difference is that the PAB gives power assistance only. For example, the Yamaha PAB is low-powered and designed to halve the normal pedalling effort on a bicycle trip and is only power assisted to a top speed of 25 km/h when the power source is designed to cut out. Both the petrol and electric powered PABs are legally bicycles and are very economical because there are no compulsory registration and insurance fees.

Mopeds have to be registered and insured because they are basically lightweight motorcycles fitted with pedals that are rarely, if ever, used. They are far too fast to use safely on shared footways with bicyclists and pedestrians. Petrol fumes from moped two stroke engines are unpleasant because 70 per cent of the petrol ends up as exhaust fumes, which is why they are banned in Singapore (*New Scientist* 1998). PABs fitted with 30 km/h speed limiters and with smaller two stroke engines may be less polluting than mopeds but they are still smelly and unpleasant to cycle behind.

The constraints in Australia

Cycling advocates have long promoted the bicycle as an essential part of the solution to our transport problems. But there are three barriers to cycling in hilly cities like Sydney: a lack of bicycle infrastructure (on and off-road bikeways), the steepness and extent of the hills, and the perception that cycling is both too dangerous and too much effort. A further complication in hilly cities is that the main roads usually follow the line of least resistance along the ridge lines and the alternative back routes are steeper than the main road routes.

Even in Holland, which is flat, a high proportion of

A growing number of Dutch and Japanese women are now using PABs to do their shopping and carry small children. This photograph shows a 1998 state-of-the-art Yamaha model the "PAS Little More PAB" with child passenger seat as standard equipment.

The features of this design are: a stable child seat, ease of control and operation with a new keyless switch design and battery remaining indicator, dynamo lighting control from handle bar mounted lever, auto locking stand, rear carrier as standard equipment, puncture resistant tyres, battery charging time of only 2.8 hours, on a single charge will travel 38 kms over flat roads. It has a 3-speed integrated gear.

Retail price in Japan with exclusive battery charger A\$1500.



The state-of-the-art in 1997 is illustrated by the jointly developed Yamaha/Bridgestone "cross framed" bicycle with aluminium parts and 26-inch wheels with sprung front forks. This PAB weighs 26 kg, will travel 28 km on a single battery charge, has a power output of 235 watts and is recharged in 3.5 hours from mains electricity. Retail price in Japan with exclusive battery charger, A\$1550.

Dutch cyclists ride bikes because they cannot drive because there is no place to park their car and they choose to cycle because it is less effort than walking and more convenient than public transport. Also many people are fussy about their olfactory image and do not want to finish their trip smelling like a footballer's jock strap. The PAB is an alternative transport option for both these groups.

Sadly, our transport plans, bicycle plans and road rules all fail to anticipate that we will need the high-tech PABs developed by companies like Mercedes Benz, Yamaha and Honda to make urban trips that require more physical effort than cycling on the flat. No transport minister has ever anticipated the need for new engine designs and intelligent transport system (ITS) technology to be used to supplement muscle power for all manner of people who need assistance in coping with their own physical limitations to cycle. Bikeplans should not only specify the bikeways that will be built and still be around 20 years from now, they should also define the needs of both potential bicycle and PAB users over 20 years, and that has never been done.

The Yamaha research team anticipated the future when they developed their PAB in 1989. We should be very concerned that Australian State regulations stipulate a maximum power output of 200 watts for PABs because most Japanese electric PABs have a power output of 205 to 240 watts.

This regulatory deterrent is going to be part of the new Australian road

rules shortly to be released. So where did this silly regulation come from? The answer is simple: many years ago male sexist engineers at VicRoads decided on the 200 watt limit after they trialed a 1980s PAB with only a male rider on various inclines. Other States then copied their trials. If these trials had used an elderly female rider carrying 15 kg of shopping up hills it seems more likely that there would be 250 watt limit.

Marketing PABs in Australia

Japan will soon be producing 100,000 electric battery PABs a year (*Cycle Press* 1998). There are no known safety problems with Japanese PABs because they are high quality and conform to comprehensive safety standards (*Cycle Press* 1998). About 55 per cent of these PABs will be used in hilly areas by female shoppers with significant loads. However, it is not as simple as that. The opportunities and niche markets for PABs are as diverse as those for bicycles. The big difference is that PABs can be used by the old and feeble, many of the lame and partially disabled.

We can make an intelligent guess at what the long-term market for PABs would be in most OECD cities which have a high standard of living similar to Australia's. If we assume that hilly cities have similar bicycle facilities and constraints to car use, then surely the percentage of bicycles and PAB trips combined could be similar to the percentage of bicycle trips in flat Dutch cities today (20 per cent to 40 per cent of all trips). As the percentage of bicy-

cle trips in Sydney and the hilly suburbs of other cities is no more than one fifteenth of that now, then the potential for PAB use in the long-term is very high indeed.

Another constraint in Australia is that there is no established market for PABs. For example, the price of PABs will depend on who distributes and retails them. Chinese PABs are low enough in price (around \$1500) to sell in our bike shops which have 50 per cent mark up on the top of the distributors' hefty cut. However, the three Japanese PABs described here would retail at around \$3000 in Australian bike shops. Perhaps it would be better for consumers if PABs were sold through the Yamaha, Honda and Suzuki motor vehicle dealers which have lower mark ups and so would sell for around \$2000?

The development of the PAB

There is a growing range of electric PABs with sophisticated electronic controls on the world market. There are around 90 companies producing PABs worldwide and well over 120 models of electric PABs dominate the market today. By 1996, Japanese electric PABs came in various wheel sizes and frame configurations being designed for different markets. The small wheeled models are generally lighter (being between 20 to 27 kg) than the large wheeled models which weigh between 24 and 31 kg. The electric shopping trikes are heavier at 36 kg to 39 kg. Yamaha, Marushi and National Bicycle all make Power Assisted Tricycles or PATs for short.

The most important innovation came in 1989 when Yamaha introduced the second generation of electric bicycles for the Japanese market. The Yamaha electric PAB Prototype was a major design breakthrough with torque sensors in the cranks linked to the motor controls for automatic power assistance when it is actually needed. The basic design concept was that only half the normal pedalling effort is necessary for most trips. According to Yamaha designers the most difficult problem was using new technology for designing the control system that integrated human pedal power and the power available from the motor (*Cycle Press* 1997).

After six years of further development the Yamaha PAB was sold nationwide in 1995. From then on many companies in Europe and Japan became involved in electric PAB design and production.


By 1998, there were 17 Taiwanese companies producing electric bicycles designed for both the Chinese and European market.

There is now a resurgence of electric PAB sales in Europe and there are at least 11 manufacturers of electric PABs and five of the manufacturers including Mercedes Benz are German (*Cycle Press* 1998).

There were ten companies making electric bicycles in China and 40 companies are involved in marketing electric bicycles. Annual sales are expected to top 200,000 in a couple of years but this is still very small compared with 32 million bicycles and 10 million scooter and motor cycles sold in 1997. There are several million polluting PABs in China today and they are being phased out in cities. In Shanghai, with a population of 16 million in 1997, there were nearly a million licensed PAB two strokes so the government decided to only issue licenses for electric PABs and encourage electric PAB manufacture.

PABs and the law

One of the main constraints to both Japanese and Taiwanese electric PAB sales in Europe in 1997 is the legacy of the 1970s' moped legislation (Wigan, 1975). PABs are still classified as mopeds in some European countries. Outside Europe, in Japan, Taiwan, Australia and New Zealand, power assisted bicycles with a power output of 200 or 250 watts are classed as bicycles but in most other countries they are classed as mopeds or motor cycles.

At least in Australia some PABs are classified as bicycles. However, the 200 watt limit must be lifted and this writer has made submissions to the National Road Transport Commission and the Victorian and Commonwealth Minister for Transport asking them to increase the limit to 250 watts (0.33 Horsepower). 



This Yamaha electric shopping tricycle has excellent stability and load carrying power. Battery charging takes 2.8 hours and will carry the rider 35 km on flat roads. Electronic indicators show battery levels and a dynamo light is fitted that stays bright at low speeds. It comes complete with a front wheel lock, comfortable sprung saddle and front basket. Retail price in Japan A\$3550

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