

PRT- the forgotten option

1. Menorca paper

A few years ago I wrote a paper which was published in this journal (Vol 8 No 1, 2002 – Kilsby 2002), entitled “How can Menorca progress towards sustainable transport?”

At the time the focus was on Menorca and sustainability. The paper pointed out the very high car usage of the island, the similarities with Australia despite the great difference in size, and the concentration of car-dependency-related problems it brought. It reviewed the main modes of transport on the island, and concluded that none of the conventional alternatives would shake the stranglehold of the internal combustion engine vehicle. It briefly suggested three unconventional alternatives : car sharing, the Segway “human transporter”, and the subject of this special issue of this journal, Personal Rapid Transit (PRT – referred to as a type of “Ultra-Light Rail” in the original paper) as being worth trying and evaluating.

Since then the focus has shifted a little, thanks to the twin dilemmas of climate change and peak oil. The question is not whether anything will break that stranglehold, but what it will be. There is no shortage of candidates :

- On the supply side, much technological effort is going into prolonging the life of the car via alternative fuels such as coal-to-liquid conversion, biofuels, electricity, hydrogen fuel cells and even greater engine efficiencies.
- On the demand side, greater use of public transport, cycling and walking all have their advocates.

My own view is that all of these things should be encouraged and will be needed in future. There is no shortage of investment money on the supply side, less so on the demand side. Perhaps the greatest potential is offered by those devices that offer automobility at much lower energy than now. The electric bicycle, in particular, is a technology that already exists but has been prevented from taking off in Australia by a bureaucratic regulation which limits the power output to 200 watts (which a South Australian parliamentary inquiry into the impact of peak oil has recommended be relaxed in that State).

It is notable (to me) that one option seldom features. namely PRT. I write this not as an advocate of PRT, but to remind everyone that it is an option not to be forgotten.

2. Island transport

The attraction of Menorca was not only that it was (is) an island, and hence self-contained, but also that it was one whose land use had evolved in the days before the car and hence was more suitable for the introduction of alternatives than one which relied on the motor car. In its 50 km length and 20 km width, over 90% of the population live in one of the two cities at either end of the island or in one of the three market towns inbetween, linked by the island’s only main road. The summer holiday-

makers mainly reside a significant distance from this road, in coastal developments, and tourism is an important part of the economy - which however depends on cheap air travel to the island, which cannot last. The pre-industrial nature of the land use on Menorca makes it relatively easy for the modes to co-exist. It is the private motor car that is difficult to accommodate.

In my view Menorca should:

- 1) prepare for the inevitable downturn in tourism
- 2) base its transport planning on a policy that discourages car use where it causes problems
- 3) investigate the option of a central intercity PRT spine with urban distribution at both ends
- 4) establish the price for the vehicles and the infrastructure at which the project becomes viable.
- 5) adopt a transport policy that stems from an energy policy that prioritises the use of low-energy vehicles.

The self-containment of islands makes them an ideal test-bed for the trial of a new option, for it is very difficult to find a part of a large urban area where most of the transport can be converted wholesale without affecting transport between that area and other areas.

I was inspired by the example of the island of Iceland, which is trying to convert the whole economy to run on hydrogen rather than oil. Iceland has no oil of its own but plenty of renewable energy with which to create hydrogen.

In an Australian context, there is only one sizable island, Tasmania (2005 population 486,000, area 68,000 square kilometres, main urban centres Hobart (205,000 people), Launceston (98,500), Devonport (26,000) and Burnie (21,000)) At 315 kilometres (189 miles) west to east and 286 kilometres (175 miles) north to south, Tasmania is comparable in size with Scotland (UK), West Virginia (USA) or Hokkaido (Japan).

But there are a host of smaller ones, particularly off the coast of Queensland. On one of these, Hamilton Island (residential population 16,000), visitors hire electric buggies which co-exist with the occasional truck or car. The local traffic regulations are made to favour the buggies, and despite the local buses being free much use is made of them by visitors. The island economy is highly dependent on tourism.

Another advantage of islands is that the larger they are, the more likely they are to be under unified political control. This is certainly the case for Iceland (an independent nation) and Tasmania (a state within the nation of Australia). Even Menorca has an Island Council which looks after its own affairs, subject to the policies of the Balearic Province (administered from Majorca) and the national government (Madrid).

3. PRT

I will not repeat the advantages of PRT, which are well put by Professor Malcolm Buchanan elsewhere in this journal (see Buchanan 2008). A variant of PRT is GRT,

or Group Rapid Transit, with higher capacity vehicles to raise the capacity of the entire system. The “Austrans” vehicle, used in the original paper to illustrate “Ultra-light rail”, in fact could carry 8 people, intended as a compromise between GRT (in which mode it would operate at peak times) and PRT (off-peak) capacities.

Be it PRT or GRT, the system features are similar :

- Non-stop travel at high speed for individuals (PRT) or small groups (GRT) from their origin point to their destination (the convenience of the system to the user is governed by the number and location of the access/egress points).
- Electric power and automatic driverless operation
- Offline stations
- Short waiting times
- Accessibility provided by one-way loops rather than two-way tracks.
- Use of whatever ticketing and access control policies are in force locally for public transport.

It is only in the last 100 years or so that the sealed road has become the dominant form of land transport infrastructure. During that time it has come to be regarded as the only form of infrastructure worth providing. It is perhaps pointless to speculate what would have happened in Australia had the First World War not come along when it did, giving a big military incentive for the development of independent motorised transport, given that cycling enjoyed a brief boom period before the rise of the car, without developing the infrastructure and land use necessary for support. But we cannot turn the clock back, and must recognise the huge benefits that the internal combustion engine has brought and the desire of those without one to own a (fossil-fuelled) car, as well as its planetary effects on climate and the way it has eaten up our supply of cheap oil, which took millions of years to establish.

The internal combustion engine is only a technology, after all, whose global implementation has brought the benefits of independent mobility and accessibility. But congestion in urban areas is destroying those benefits, and car-adverse parking policies are adding to the problems of the car user (eg emission control, fuelling it). We have created a bizarre system whereby public agencies, by and large, provide the infrastructure but the vehicles to run on that infrastructure are overwhelmingly provided privately.

PRT offers the opportunity to break free of this straitjacket we have made for ourselves, by providing mobility and, if it is done right, accessibility, that do not require a car. Already the communication industry has revolutionised accessibility to information: the internet and the mobile phone are ubiquitous. The time is right for a change in the perception of the car.

4. Considerations

In the 2002 paper I listed several features that the transport of the future must display, in my opinion, to be competitive with the car:

- It should be available 24 hours a day, seven days a week
- It should be flexible in its timing
- It should offer access to most areas

as well as the following:

- Power generation should ideally come from renewable sources, available locally
- There must be a well-structured growth path from today [2002] (no alternative) to the future (fully functional).

It can be readily understood why traditional public transport, with its emphasis on handling peak loads for non-discretionary travel (work, school) to concentrations of activity, is not competitive with the car off-peak, and indeed has little spare capacity without major investment.

Such investment is needed if the peak modal split is to change by more than a few percent. But what of that portion of the travel market that does not use public transport in the peaks?

PRT satisfies the first two of the competitiveness criteria, but it must be recognised that the 'best' way of moving people from a public policy viewpoint may not be the best from a commercial viewpoint. Introducing a new mode means giving an existing market to a new operator to grow, taking away something from an existing operator, and much will depend on the willingness of the three parties (the government, the incumbent operator, the new operator) to find a solution and on their negotiating skills. On the third, accessibility, a suitable location in Australia for a trial must be found. The attraction of an island site for this is evident, but even so it must be one where the community is solidly behind the trial, and one where the incumbent operator (or operators) supports the PRT scheme.

The two locations where PRT has been implemented so far are untypical. The first was in Morgantown, a West Virginian university town, and has been in operation for about 40 years. It does not take advantage of recent developments in computer technology, and anyway has more of the characteristics of a limited access fixed track system than "true" PRT as described here. The second will not open until 2009 to connect London Heathrow's new Terminal 5 with a remote car parking area, using the same "Ultra" technology as was chosen for installation in part of Cardiff, Wales, in 2005 before EU procurement regulations put a stop to it. (There are also a number of sites around the world to demonstrate that the technology exists and works). This will not throw any light on how well PRT performs as a replacement for the car.

To contain operational costs the system must be automatic. To provide each low-capacity vehicle with a driver, in a system that offers more or less instant response on a 24-hour basis, would be simply unaffordable to provide or use. The key to installing a PRT system is a low capital cost. If the cost of the infrastructure, the vehicles and the control system, and the ongoing cost of the energy to run it, is greater than the cost of a taxi system, then it is not worth doing. At least with the private car, the driver and the user tend to be one and the same. Even so, a significant portion of all person trips are spent driving someone else somewhere (over 8% of weekday movement in Sydney, of which the car accounted for 68%, over 11% of weekend movement, 73% of it by car –Warren Centre 2000).

The utility of a PRT system to the user is governed by the need to get on and off the vehicles at a convenient point, so the design of the access and egress points is critical. Here a decision needs to be taken about how to introduce, pay for and integrate a new mode.

Of the other two considerations, both are dependent on the successful outcome of a trial.

The source of energy is a matter for the power industry. Electricity is an energy carrier, not an energy source, and can be produced by a variety of means. In greenhouse terms, greater reliance on electricity generated from coal-fired power stations can be counter-productive.

Likewise the identification of a growth path is a matter for the planners. When the accessibility becomes high enough, a PRT system could be used for the distribution of urban freight as well, leaving the urban motorway network largely for the long-distance transport of goods. A moratorium on urban car-traffic-forecast based road developments - tunnels , motorway widening etc - would be required.

5. Timing

How long before we need to decide how to replace the internal combustion engine?

In a report to the Queensland Government (2007), Andrew MacNamara (subsequently appointed Minister for Sustainability, Climate Change and Innovation) reviewed a number of published studies that looked into the question of when global oil production would peak, and found that the average date expected was 2013. NB Peak Oil does not mean that the world will run out of oil, but it does mean that a situation will unfold when production from new fields fails to offset the natural decline of old fields. If demand continues to rise, principally from China and India, the price of oil will go up and it will become scarcer, and the Age of Cheap Oil (roughly, the last 120 years) will fade into memory.

That in a nutshell is the so-called Theory of Peak Oil. For a fuller explanation, see Kilsby (2008). A word of caution: if the adherents to the “Theory” were correct, then we should have seen the price of oil rise during the recent Russian

adventurism in Georgia. We didn't : it fell. Was this a sign of the disconnect between the market traders and the real world, or a sign that Peak Oil Theory was missing something, or what? At the time of writing the oil price has fallen by about 70% on the New York Exchange from its peak in July, but this price is not expected to last, despite the effect of the economic crisis in destroying demand, as the physical realities of oil supply re-assert themselves..

As if peak oil wasn't enough to cope with, climate change is another current issue. While its effects are – or are expected to be - on a longer timescale, the need for mitigating action is immediate. These two phenomena - peak oil and global warming - are going to have a dramatic impact on many sectors, of which transport will be among the first. One of many consequences will be increasing urgency to find a form of suburban public transport that is competitive with the car and succeeds in serving a dispersed movement pattern. (Conventional public transport will connect the suburbs to their CBD). PRT can do this once the infrastructure is in place. It is essentially a horizontal lift, and comes closest to emulating the taxi (but without the costs associated with providing a driver and paying for the taxi licence).

We do not have long to learn about this new mode. It would be folly indeed to adopt it without testing it first.

Conclusions

Menorca is a particular example of a general issue, of the problems that high car dependency brings.

Perhaps the greatest potential is offered by those devices that offer automobility at much lower energy than now. The electric bicycle, in particular, is a technology that already exists but has been prevented from taking off in Australia by a bureaucratic regulation which limits the power output to 200 watts. Electric bikes

Islands offer a self-contained testbed for trying out new systems. It is however essential that the island residents be solidly behind the trial.

This paper is written not to advocate PRT but to warn against conducting a city-wide evaluation without PRT as an option.

Major action is needed soon, if not immediately.

The cost of the system is critical – supplying the community with buses in the peaks and interpeak and plentiful taxis at other times should put a ceiling on costs. On the benefit side, the cost of foregone road expenditure should be counted. This implies that the vehicles, the infrastructure and the control system should be as inexpensive as possible (mass production will eventually bring the costs down, but the economics favour a system that is already developed).

The source of energy is a matter for the power industry. The implementation path is matter for the planning community. Both are dependent on the successful outcome of a trial.

References

Buchanan M (2008) A Transport System Whose Time Has Come?

<http://www.kilsby.com.au/archive/p0608.pdf>

Kilsby D (2002) How can Menorca Progress Towards Sustainable Transport?

Transport Engineering in Australia Vol 8 No 1.

<http://www.kilsby.com.au/archive/p0102e.pdf>

Kilsby D (2008) Peak Oil – What Australians Need to Know

<http://www.kilsby.com.au/archive/p0808.pdf>

Queensland Government (2007) (The Macnamara Report) Queensland's Vulnerability to Rising Oil Prices: Taskforce Report

<http://www.epa.qld.gov.au/publications/?id=2190>

Warren Centre for Advanced Engineering (2000) Sustainable Transport in Sustainable Cities – Project 1 - The State of Play

In Chapter 5 of Technical Papers, University of Sydney, May 2000.