THE POD: A COMPLETE SOLUTION TO URBAN TRANSPORT

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ABSTRACT
A pod is a small, light, fuel efficient individual person mover. It is contended that pods will replace private motor vehicles and public transport in residential, retail and office dominated suburbs. Mass transport will transport people and pods along mobility corridors while freight transport will be similarly restricted to corridors and industrial areas.

THE PROBLEM
Urban transport internationally has been moving to private cars for many decades. Millions of people have either moved out of or never even used public transport. Congestion has escalated to the extent where delays, unpredictability and frustration are the norm in every major global city.

Despite policies, subsidies, taxes and fuel levies, tolls, congestion pricing and other major efforts to try and prevent it, the numbers of users of private cars continues to escalate.

No permanent solution is in sight.

Public transport options are growing, but at huge cost. Traditional heavy rail and buses are being supplemented by bullet trains, light rail, monorail, bus rapid transit and mini and midi-bus taxis, but with growing and possibly unsustainable subsidy requirements. The success of these public transport measures is, at best, a tiny shift from private to public transport, or, at worst, a more expensive, subsidy hungry option which merely draws from alternative public transport modes making those even less viable. These options do not solve the fundamental problem of providing for individual freedom of choice to have transport at one's own time, location, privacy and convenience.

Environmentally, there is a problem too. While cars are getting smaller, less polluting and more energy efficient, the effect is marginal, and the problems of congestion, delay and safety persist. Private vehicles still "weigh a ton", they still consume fuel in proportion to their own size and weight, rather than the driver's size and weight, and they still take up a large area of expensive roadway.

There is a demand and supply imbalance. Individual transport is demanded, mass transport is being supplied. All public transport modes have one enormous stumbling block – they need large numbers of people starting at the same place and ending at the same place. This rarely, if ever, happens naturally. It must be forced.

THE SOLUTION
The solution is the pod.

The way it will work is as follows:

1. The city is divided into suburban areas (as all cities are) (Figure 1). The suburb boundaries are defined by the pattern of mobility (vehicle priority) roads surrounding them. Minor arterials (Class 3) are generally spaced 0,8 to 1,5 km apart and major arterials (Class 2) are 1,5 to 4,0 km apart. The suburbs in between are therefore typically about one to two kilometres wide (forming 100 to 400 ha blocks). In these areas, cars, trucks and buses are banned.

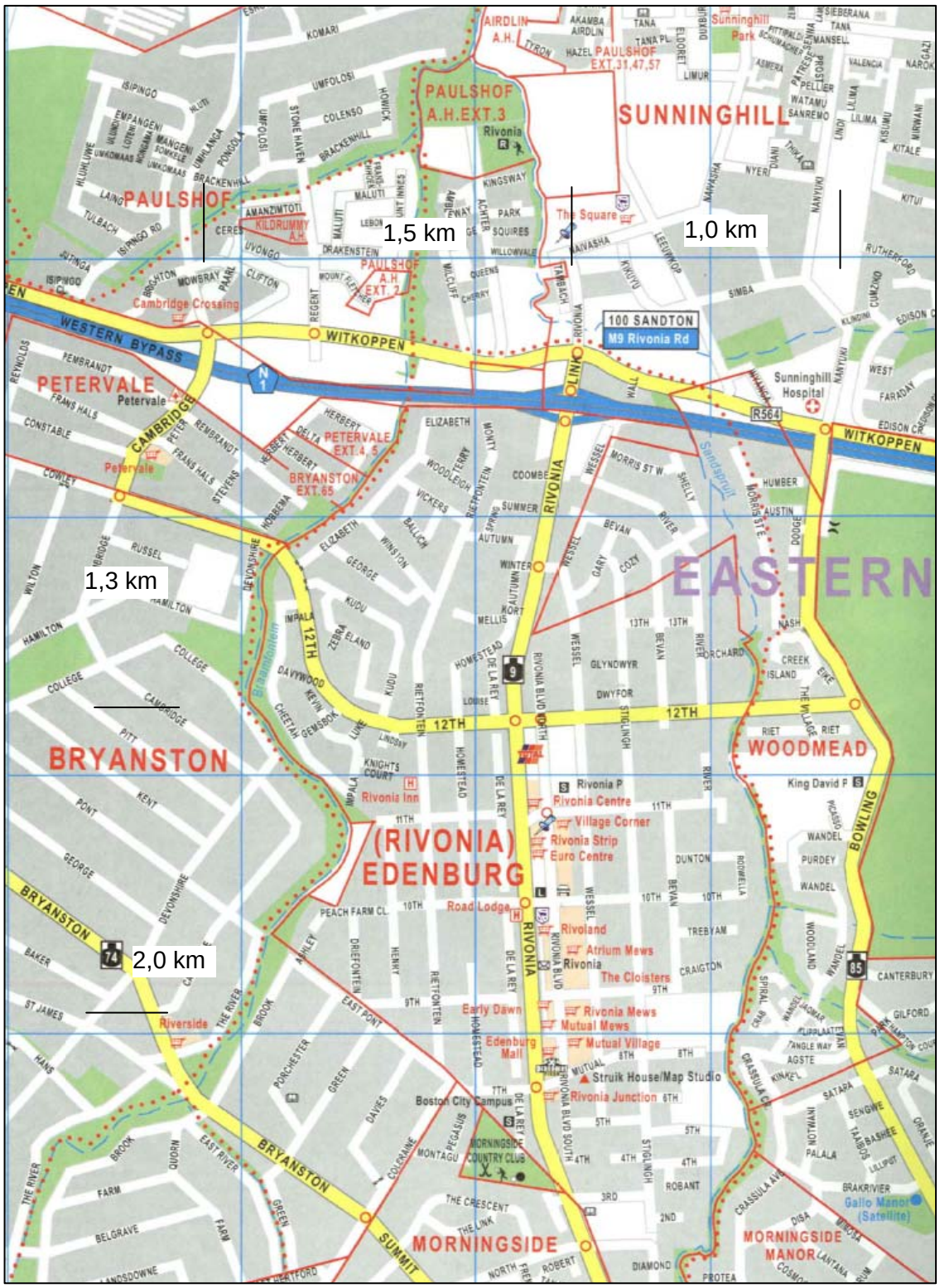

Figure 1: Typical suburbs surrounded by mobility arterial roads

2. Within these suburban blocks, only walking, cycling and pods or similar vehicles (with a maximum speed of 30 km/hour) are allowed. Cars, trucks and buses are restricted to mobility roads, rural areas and industrial suburbs. During the transition to pods (which transition period could be set to the average life of a private car, say 8 years), all vehicles entering the restricted zone must be preceded by a pod, cyclist or even a pedestrian to ensure the speed limit of 30 km/hour is not exceeded.

3. Where the suburban area takes access to and from a mobility road, a pod crossing is created. At these intersections, the pods can cross the mobility road into an adjacent suburban area, or they can board onto a carrier. The pod carrier is a combination of a flat bed and bus. Pod owners clamp their vehicles (or bicycles) onto the back of the flat bed and either stay in their vehicle or join the other passengers in the seating section (bus) of the carrier. The carriers then move at relatively high speed (80 km/hour plus) on dedicated road or rail routes between pod crossings (typically 800 to 2 400 m apart).

The existing mobility roads will have more than sufficient capacity to accommodate carriers and still have space for heavy vehicles, as private cars will become "extinct" in urban areas, and possible eventually, as the reach and convenience of carriers extend, in rural areas too.

The time taken to make a typical, say 15 km, trip will be between one or two minutes travel time at each trip end within the suburb to the nearest mobility road crossing, plus 7 minutes on the pod carrier. Allow 3 to 5 minutes for waiting, loading and unloading, and the total trip will be 13 to 15 minutes, instead of the 35 minutes it currently takes on good days.

PERSONAL RAPID TRANSPORT

*"**Personal rapid transport** (PRT), also called **personal automated transport** (PAT) or **podcar**, is a public transportation concept that offers on-demand, non-stop transportation, using small independent vehicles on a network of specially-built guideways."* (Wikipedia May 2009).

The difference between PRT and this author's pod concept is that the PRT is a public transport concept, while the pod is a private individual door to door transport concept. The PRT concept could however be valuable in providing the carrier function for pods. The pod could be adapted to run on PRT vehicle guideways.

WHAT WILL A POD LOOK LIKE?

A pod, being an individual person mover, is designed to carry a single adult in comfort. It is basically a super wheelchair, but being designed for outside use will be closed to the elements. A modern looking potential pod is illustrated in Figure 2 (volkswagen2028.com).

Its dimensions will be determined by the human body, which, according to **A Guide to Human Factors and Ergonomics**, 2nd edition, has a size range as in Figure 3. The relevant dimensions are numbered 7 to 16, and are contained in the Table 1. For a pod interior, reach must be adequate for the smallest (5 percentile) individual, while space must be big enough for the largest (95 percentile) individual.

Figure 2: One of many possible Pod concept vehicle designs

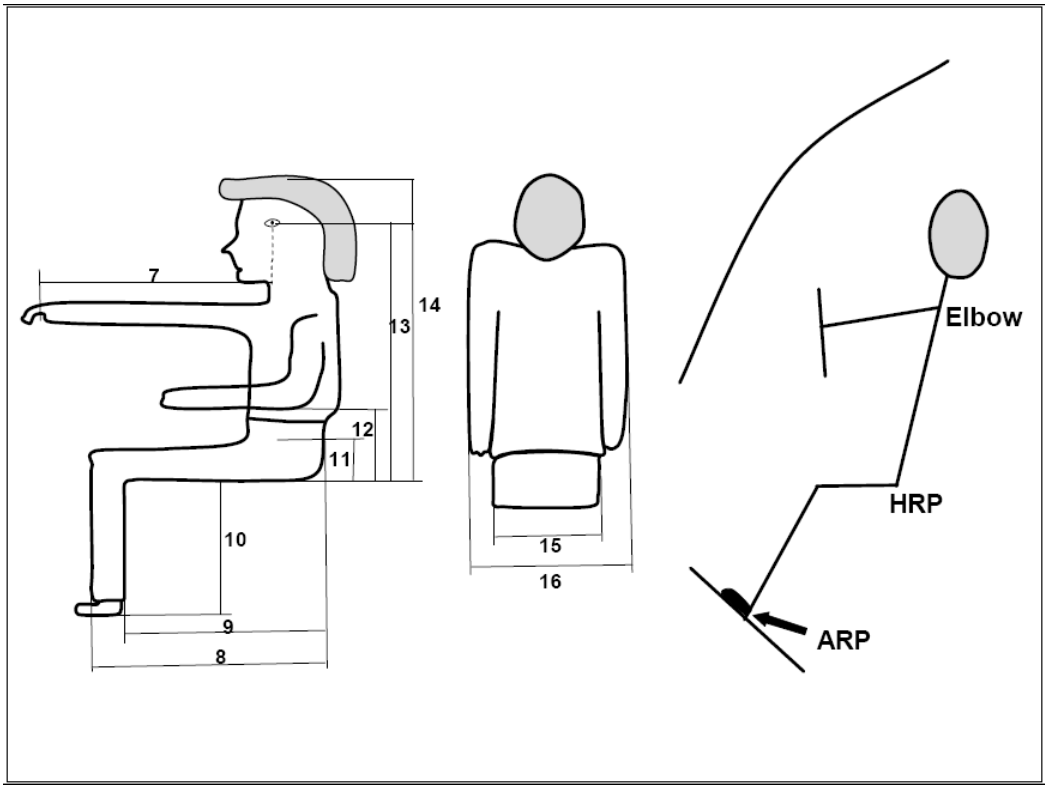

Figure 3: Human dimensions required for pod design (Note: ARP Accelerator Reference Point, HRP Hip Reference Point)

Table 1: Range of dimensions from the smallest and average female to the average and largest male (centimetres)

	Female		Male	
	5th%	**50th%**	**50th%**	**95th%**
7. Functional forward reach	64,0	71,0	82,5	88,3
8. Buttock-knee depth	51,8	56,9	59,4	64,2
9. Buttock-popliteal depth	43,0	48,1	49,5	54,8
10. Popliteal height	35,5	39,8	44,2	48,5
11. Thigh clearance	10,6	13,7	14,4	17,7
12. Sitting elbow height	18,1	23,3	24,3	29,4
13. Sitting eye height	67,5	73,7	78,6	84,4
14. Sitting height	78,2	85,0	90,6	96,7
15. Hip breadth	31,2	36,4	35,4	40,6
16. Elbow to elbow breadth	31,5	38,4	41,7	50,6

The pod dimensions will be standardized as far as possible to allow for reduced weight and engine size, efficient carrier design and for linking of pods for children and goods transport. Suggested dimensions are as follows:

Width

The pod should be no wider than a large wheelchair, i.e. 760 mm. This will enable three pods to fit side by side in the space of a standard motor car. It will also enable a pod to fit through a standard household doorway, should the need arise, although a slightly narrower pod, say 710 mm may be needed to comfortably fit through the doorway and not scrape the sides. Two pods will also be able to pass each other without difficulty in a standard 3.5m wide traffic lane. This will enable the total redesign of urban areas, with road and road reserves of less than half current requirements.

Pods could possibly be linked side by side, or made wider for a mother and baby to sit together, but wider pods will create the need for wider roads, passing difficulties etc., so a longer pod would be a better solution (see length).

Length

A typical wheelchair is 1220 mm in length, and needs a 1520 mm clear circle to do a complete 360° turn. A bicycle is around 1700 mm long. There is no particular reason to restrict the length of the pod, although if it is less than 1.8m it can fit sideways on the back of a flatbed carrier and still allow for the sides of the carrier to rise and form a safety barrier for occupants.

Pods longer than 1.8m could be allowed for special uses, e.g. transporting a mother with baby in front or behind, prone hospital patients or certain types of freight.

It is also desirable and likely that pods will be able to be connected to each other in trains. This will enable one or more freight pods to be joined to the lead pod, or children pods to be linked behind the lead pod.

Height

A height of 1,6 m is sufficient for someone to sit upright in comfort. A standard garage and household door height is 2.0m, which means that if pods are to be brought inside, they should not be higher than say 1.9m. Pods will travel at low speed, so higher pods are unlikely to have a stability problem, particularly as the heavy motor and batteries will be kept low.

Comfort

Pods can have all the comforts and convenience of a modern car; comfortable seats, air conditioning, radio, music, GPS, sun roofs, windscreen wipers, parcel shelves, cold drink holders, boots (trunks), turning flickers and rear view mirrors. They will also have seat belts. Being low speed, air bags will not be necessary.

Pods will also have communication with other pods via built in cell phones or similar technology, including dedicated links to other pods in the train so parents can hear what children are getting up to, or switch off as desired.

Propulsion

The most likely form of propulsion will be electric motors. Pods will be extremely efficient on power, being light and slow. There is unlikely to be a need for gears, and golf cart technology (electric or liquid fuel) will enable quick acceleration and braking. They could even be pedalled.

Pods can be made of light materials such as fibre glass or plastics, as the safety of a steel cocoon is not required.

Electric pods can be recharged at night when electricity is available and cheap. Pods docked at charging points can negotiate special rates during night hours with power companies who will be pleased to have a consumer for their excess off-peak supply. This is an environmentally friendly solution as power stations generate power 24 hours daily, even when the power is not used. Power taken during peak periods will be charged at a premium, but there will be little need for this, as electric vehicles can be used continuously for 8 to 16 hours without recharging.

Pods will probably not have a steering wheel or pedals, but will have a portable remote control such as available for model cars and aeroplanes. The vehicle can be guided from inside or outside, and can be used in master or slave mode. Slave mode will be used when the vehicle is in a train, guided by the lead vehicle.

Pods will also be able to negotiate steep slopes (like golf carts). They could even be designed to climb stairs.

Safety

One of the reasons the pod is restricted to 30 km/h is that research has shown that the human body can withstand an impact at that speed without fatal injury, and with safety belts, with little injury at all. An impact speed of above 40 km/h is likely to kill an unprotected pedestrian.

Being light, small, slow and quickly braked will ensure the pods safety to both internal and external persons. If the pod is not being actively driven, it will automatically brake. Computers will ensure safe braking and avoid obstacles. From top speed to zero can be achieved in less than a second.

Children will be “licensed” to drive a pod, although formal licences will be unnecessary. Any child in high school could be entrusted to drive the vehicle, and passing Grade 7 (junior school) will be the likely criterion for qualifying to drive.

Pods will also make it safe for bicycles, scooters, Segways and pedestrians to share the road. While pedestrian sidewalks will still be preferable, the dangers of walking or playing in a street are greatly minimized.

The greatest danger to the pod will be from road traffic, but as this traffic will be banned from suburbs, and pods will not use mobility roads, this conflict will only arise at pod crossings where traffic signals or other controls will be in place.

Cost

The cost of the pod can only be estimated at this stage. A wheelchair can be purchased in the USA for around $1000, and in South Africa for R15 000. Pods will become cheaper with mass production.

Certainly a pod will be afforded by anybody using public transport currently. The repayment of the vehicle will be around R300 ($30) per month, less than even a typical subsidised bus fare.

The most expensive wheelchair in production today is the iBOT. This gyroscope balanced chair can climb stairs, plus raise its occupant to standing height. It costs $26 000 (ZAR 260 000), around the price of a medium sized car.

Pod carriers will be provided by local authorities and must be free of charge to encourage their use and to subsidise the poor. The cost of carriers will come from rates and taxes. The increase in rates will easily be afforded by urban dwellers no longer needing cars or public transport tickets.

WHAT WILL A POD CARRIER LOOK LIKE?

Pod Carriers will have a flat bed section on which a number of pods can be loaded. A 12 m long flatbed can carry 15 pods side by side. These vehicles can tow a trailer if need be. They will also have a seating section for pedestrians and those pod users travelling longer distances who do not wish to remain in their vehicle.

Alternatively, the Personal Rapid Transport concept described earlier can be used to convey individual pods on a dedicated guideway.

Pod carriers can be linked to form train sets. The length will be limited only by the platforms.

It is envisaged that the carrier will stop at pod crossings between two platforms (one on either side). It will lower its sides which will form ramps from the platform allowing pods to exit and enter. By closing its sides, the pods will be secured and passengers on the flat bed protected. Closing the sides will also anchor the pods, probably with the use of electro-magnets.

Carriers will travel in dedicated routes at as little as one minute intervals, depending on demand. They could even run on rails and be driverless, much as the more modern trains are capable of.

The capacity of a 4 trailer, 48m carrier would be 60 pods. Running at one minute intervals, this would transport 3 600 passengers per lane per hour, excluding walk-on pedestrians. This is as high as a dedicated bus lane.

Carriers would travel at 80 to 120 km/h between pod crossings, and in rural areas could even be designed to travel like bullet trains, in excess of 180 km/h.

HOW WILL IT HAPPEN?

In order for the pod concept to proceed, pods will have to be desired by communities and regulated by municipalities. This is not seen as a stumbling block, because if permitted, surely communities would want safe, quiet, cheap, 24/7, non-polluting personal transport with large vehicle traffic banned on all their local streets. Arranging for the municipalities to provide pod carriers will take longer, but when enough of the residents adopt the concept, the municipality can soon follow. Furthermore, the savings in public transport subsidies should further motivate the authorities and political decision makers.

The biggest opposition could come from car manufacturers and fuel (oil) suppliers who represent two of the world's major industries. Retooling car production lines to produce pods may be resisted, although given the state of the world wide car industry in 2008/9, it may even be welcomed. Certainly the demand for pods will far outnumber the demand for cars.

Pods can be manufactured and, if electric, fuelled locally in any country, resulting in major savings in foreign imports. This should be especially welcomed in most fuel importing countries.

CONCLUSION

The acceptance of the pod concept will revolutionize urban transport. It will enable personal transport for every sector of society, will improve efficiency and reduce congestion to negligible proportions. It will enable densification and better land use. It will be fuel efficient and environmentally friendly, a massive improvement over current practices.

The change may be resisted at first, particularly by the world's vehicle manufacturers and oil cartels, but these organizations will in due course, and under pressure from government, adapt to pod and pod carrier manufacture.

The pod is a practical, cheap and workable. It does not appear to have any downside. There is no reason therefore why the world's authorities should not embrace this concept with the result that internationally, cities could look very different in as little as 5 to 10 years time.

REFERENCES are in the text, otherwise are all the author's ideas.