Flights of fantasy in smart CAPSI capsules

John Stegman *describes CAPSI, a fully automated miniaturised on-demand 24-hour public transport system that could overcome many of the limitations of existing public and private transport systems in cities. Is it pure fantasy or a genuine glimpse into the future?*

Transportation modes have an enormous effect on cities and their surroundings. Compare today's' cities, made for motor vehicles, to ancient cities made for people and agriculture. Motor roads in cities, and the space given to parking lots and multi-lane ringroads, could be as much as one quarter of the total surface. There are now numerous cities whose streets, overcrowded by motor vehicles, cannot be expanded further. Motorists feel victimised when they are restricted or forced to subsidise the public transport systems.

But motoring is inequitable! Most city dwellers do not own or operate a motor vehicle for any of several valid reasons: they cannot afford it, it does not come with the job, they may be too young, too old or otherwise unable/incapable of owning or operating one. Yet they, too, must endure the objectionable consequences of the motor vehicle system.

Land consumption is extensive in another respect as well. Whereas canals and railways created linear development, the motor vehicle system easily converts all farmland and wilderness areas into suburbia. Are today's cities really the way we prefer them to be?

The Objective

Top priority for any new transportation system must go to making cities places where people feel safe, and enjoy living and working. The system must release land for people, trees, flowers and agriculture to be part of daily life once more. It should be widely affordable, reduce the time required to move about each day, minimise levels of noise and air pollution, and ensure personal safety.

That is exactly what CAPSI provides. But before describing the CAPSI design concept, come for an imaginary ride.

First, you need to sign on and be in possession of a CAPSI smart card (prepaid or account), PIN and map. For maximum safety – yours, as well as that of all other users – CAPSI must be able to positively identify all users.

Walk, or roll your wheelchair, to the nearest CAPSI station, which will look like an elevator with glass doors and an ATM. Stations are small and everywhere – in building foyers, on every block of the street, at schools, shopping centers, and in private homes. The CAPSI concept is to have as many small stations as possible, in contrast to the concept of large central stations and suburban stations or bus stops a ten-minute walk apart.

Swipe your CAPSI card, enter your PIN and your destination station number. From the screen menu select capsule quality (austere to super luxury) and speed (gentle, normal, fast – sets maximum g-force), then wait for the DF response.

CAPSI operates on a 10-second time module and all trips are non-stop. Within 10 or 20 seconds CAPSI will quote D (trip Duration in seconds from acceptance to destination) and F (Fare, dependant upon vehicle, current demand and distance). Users thus avoid being trapped in a jammed system and may adjust the trip to suit their immediate needs. Revise your request, or accept and prepay by swiping your card again and you will reach your destination within the time quoted.

There are built-in automatic entry/exit controls, but within a few seconds the doors will open to reveal an empty capsule. The capsule will have two (flip up) seats, for you and your travelling companion or luggage (wheelchair or folding bicycle). The seats congenially face one-another. This also improves safety, as the capsules move in either direction. Once you commence moving, however, you will only stop when your destination is reached.

Every passenger capsule will have a set of controls for each passenger. These include a clock indicating your trip seconds remaining, capsule-to-control speakerphone, a door-opening button and emergency buttons for immediate trip abort, for aborting to the nearest security checkpoint, or to send the capsule to the CAPSI service depot at the end of your trip should you find left luggage or be aware of any damage to the capsule. CAPSI staff will be able to contact the previous user to return left luggage or claim for the damage repair costs. CAPSI will ultimately be able to prevent a troublesome customer from using the service. At your destination you will be prompted to open the doors. Use one of the emergency buttons if it appears unsafe to exit, otherwise press the door release.

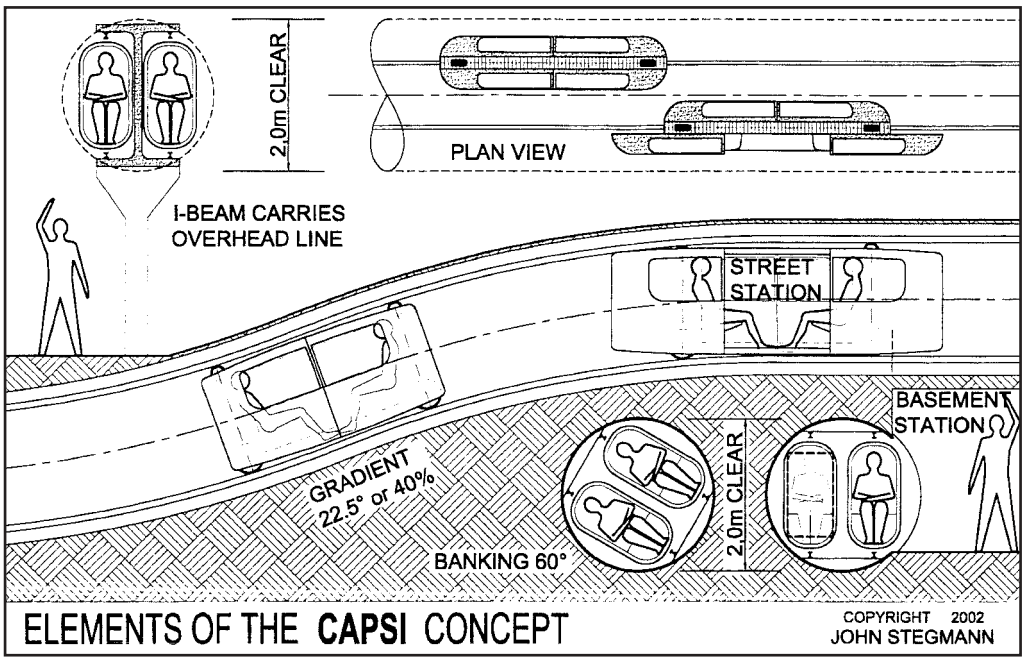
Kids to school

Accompany the kids to the CAPSI station, swipe your card, enter your PIN, select the school station and say YES to the Attended Destination Confirmation option. This procedure requires a registered user at the destination to respond, and reveals the attendant's identity for your response. On your acceptance CAPSI will produce a DF offer. The Attended Destination Confirmation option can be used by staff assisting kids with their trip home, making sure that there is a responsible person at the 'home' station.

A further CAPSI option allows users to ask for more than one capsule to ride in tandem. In this manner a teacher might transport a class of, say, 30 children from their school to an event destination, or a party of six might travel together from restaurant to theatre.

Being safe for children means being safe for older people whose eyesight or other infirmity prevents them from motoring at night, or to get about on their own. And being a 24-hour service, CAPSI helps late/early-shift workers as well as intoxicated late-night revellers.

As a student of architecture in South Africa, forty years ago, John Stegman first visualised CAPSI. Since then computer capabilities have forged ahead solving many of the more difficult design aspects. When he hit on the inverted rail concept in the late 80s, he was certain he had an exciting and workable concept. He recently filed a provisional patent on the guideway concept



CAPSI's novel solution is to provide two rails, one below and one overhead, and to give the capsule four wheels, two below and two above. John Stegman holds a provisional patent on this design.

Goods delivery

The Attended Destination Confirmation option may be used for sending un-accompanied parcels. Specially adapted CAPSI container capsules would be able to do many of the tasks done by pick-ups and vans, with the cost advantages of being driverless and one-way. Regular users would thus send and receive CAPSI containers with confidence.

Suppose something goes wrong . . ?

Sooner or later, something will go wrong. Users will be concerned about the possibility of a collision, a power failure, flood or fire, and being trapped below ground. The project would have to proceed on the basis that these engineering problems are no more difficult to solve than those encountered in automobile and aircraft design and operation. Where stations are more than fifty meters apart there would be emergency exits provided.

DESIGN CONCEPT

Capsules

The objective is to miniaturise the system, and in this regard vehicle width is significant. Statistically, the occupancy of 4-seater private motor vehicles is two persons or less. CAPSI uses 2-seater vehicles, no wider than a motorcycle, which may be employed in tandem.

The capsules have a pair of doors on either side and wherever possible users would enter from one side and exit at the other.

The motive power for the capsules would be electricity, probably on-board electric motors driving two wheels.

Guideway

CAPSI's solution provides two rails, one below and one overhead; and gives each capsule four wheels, two below and two above. (Provisional patent.)

This under/over arrangement means that capsules are firmly held between the rails, even when stationary on a stretch of steeply banked track in a fault situation. The ability to control the attitude of the capsule in a turn means that turns can be tighter and negotiated at far higher speeds with greater safety and greater passenger comfort.

When changing from one track to an adjacent one at high speed, passenger comfort will be improved as the upper and lower rails can be made to tilt the capsule over and then right it, as if it were a motorcycle. Because the capsules are narrow the rails can be close together and the manoeuvre can be completed within a short distance.

Wheel/rail traction can be adjusted by loading to suit various situations. Traction could be increased during acceleration and braking, and to enable the capsules to traverse steep gradients.

The versatile CAPSI guideway concept means that stations may be at any elevation, from below ground to overhead without requiring steps, lifts or escalators. Where the system is below ground, stations can be at street level, occupying no more than three standard car parking bays.

Tubular Corridor

Two tracks (lines or lanes) provide much greater service capacity than one, particularly when used for travel in either direction. Two tracks (four rails) can be accommodated within a tube with an internal diameter of 2.0 meters.

The CAPSI concept is to apply this space requirement (2m dia) as a minimum – whether below or above ground. The tubular space may be straight, or curved in any direction. The rails inside the tube would be rotated on the major axis to provide super-elevation as required for the design speed of that portion of track. There is space overhead for wiring and below for drainage.

Below-ground applications would require the tubular wall to be structural, while above ground applications might employ the tube as a structural member to span between supports. Alternatively providing a tubular metal cage (to keep the corridor clear) around a structurally efficient I-beam would ensure excellent space utilisation. While there is considerable free space (minium 35% of the cross-sectional area free when two capsules are alongside), the pneumatic effects at various speeds would need to be investigated.

The incredibly small tube size (compared to the typical underground railway!) greatly reduces the cost of tunnelling, or excavation (tubes inserted from above). The ability of the system to turn at very tight radii, and to negotiate steep inclines and descents means that it is highly adaptable.

CAPSI, in effect, puts a 7 meter wide roadway underground! It improves transportation capacity, reduces conflict between vehicles and anything else, removes fumes and noise and gives the land back to people and plants.

Control system

Progress during the last couple of decades in computer and digital technology, as well as credit card security systems, has shifted this aspect of the 40-year-old dream from being the most daunting to the most feasible.

The CAD drawing concept of transparent overlays might be adapted for planning and recording all trips. Imagine one layer for every ten-second time interval, where present time layer (T) is separated from past time layers (PT) below and future time layers (FT) above.

Because the capsules move in either direction, the control system may use each portion of track as it chooses. The number of stations and capsules that could be safely managed by one computer would be limited and constitute a single geographical CAPSI cell. Each cell would be capable of accepting capsules from adjacent cells and routing them either to a destination within that cell or to move them through to another cell. Cells will facilitate the incremental introduction of the system and assist with fault management.

You can contact John Stegman by email at JohnS@cybertrade.co.za