Self-driving vehicles
For
Tunbridge Wells

A Plan

To Reduce Congestion

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To make implementation a reality and to help reduce congestion in Tunbridge Wells a range of ideas and suggestions are needed. This will help ensure the final system will augment the lives of residents and all others who visit Tunbridge Wells.

1 PROPOSAL AND CONCLUSION

Congestion and its wide ranging impact on life in our town is perhaps the most major problem facing Tunbridge Wells. Congested traffic damages our streets, infrastructure, environment and our way of life. Rat runs and increased numbers of parked and moving cars crowd many streets. Visitors are increasingly reluctant to come while residents hesitate to travel particularly during peak periods.

Tunbridge Wells appears to have few options to increase the capacity of the main routes in and out of the town. Traditional road construction would significantly damage the fabric and heritage of the town. They are likely to create more traffic, potentially delivering even congestion to the town, as more cars crowd the main roads and the 'rat-runs' and then 'look' for places to park often in residential streets which are already at bursting point.

Autonomous self-driving cars[1] can be used to help alleviate this problem – through the use of new light weight Pathways* bypassing existing traditional roads in areas of congestion. These Pathways* – for the exclusive use of light weight self-driving cars – will give passengers fast access to the centre of town and hence encourage more to take this new, reliable and environmentally friendly public transport. They would reduce the need for cars and would not need additional parking facilities in town.

Initially the Tunbridge Wells Self-Driving cars (TW-Pods) would operate similar to a 'Park & Ride' system with a guarantee commute of under 10 minutes to the centre of the town. In comparison a traditional bus Park & Ride is not considered viable due to the existing congestion on the Pembury Road, the lack of space to broaden the road for bus lanes and the huge cost such a broadening would entail in both money and environmental terms.

Initial implementation will reduce the pressure on the existing roads that are congested. However segregated Pathways* are not required where congestion is not a problem. In the longer term self-driving cars will expand their capability to travel along many other roads in the town to provide door to door service.

This paper sets out how an initial implementation can be used to bring early relief to Tunbridge Wells.

Initial implementation is described in three 'Travel Zones'

Zone A – The Town's arteries: Pembury to the town centre (an initial route)

Zone B – Town Centre: The spine of the town from Grosvenor Road to the Pantiles

Zone C – The out-of-town areas: Pembury, the hospital and North Farms

Each of these 'Zones' have different characteristics and demonstrate the potential versatility of the current technology of self-driving cars.

Everyone is urged to consider carefully how such a system could work to the benefit of all in the town. In addition to the many benefits of the proposed system it is likely that it will quickly become self-financing in respects of both operational and repayment of initial

[1] The proposed self-driving cars will take up to 6 passengers, taking under 10 minutes to get from Pembury to the town centre – each doing approximately three round trips per hour. The light weight pathway will have the same effective capacity of the existing Pembury Road – thus doubling overall capacity in and out of the town along this corridor.

infrastructure costs. As the system develops it will produce additional revenue for the town as well as local businesses.

If we do not proceed it will only be our generation to blame for the continued congestion of our town. Over one hundred years ago the first Motor Show in the UK was held at Salomons bring the new technology to the world. Today - let's take this opportunity to start to embrace new technology of self-driving cars to make our town fit for the next generation.

2 THE TECHNOLOGY

Self-driving car technology is developing fast. There are already a host of different systems in use now and other systems being developed. The range of these are described in the various attachments to this paper. The self-driving cars (TW-Pods) envisioned for Tunbridge Wells have the following characteristics:

- Light weight cars / mini-buses carrying up to six passengers.
- The TW-Pods are constructed using standard automotive components with a light weight body.
- They are able to carry passengers in a wheelchair or small children in a pushchair (with other accompanying passengers) plus shopping or other luggage.
- The TW-Pods are noiseless and environmentally friendly causing no local pollution.
- The TW-Pods will operate as public service vehicles available to anyone – charged by use or by a 'travel-pass' (day, weekly or other).
- Passengers call for a TW-Pod using a 'call-point' or using a dedicated 'Apt' on a handheld telephone or other device.
- The passengers are taken direct to their selected destination passing other TW-Pods stopping to allow passengers get on or off.
- The TW-Pods initially travel only on selected routes – as per the three Zones described above.
- The TW-Pods are electric powered with batteries which are 'topped' up whenever the TW-Pod stops to pick up passengers at designated points along the routes.
- The TW-Pods have three modes of travel:
    1. In pedestrian areas at between 2 and 5 mph
    2. Along segregated light weight Pathways* – up to 25 mph.
    3. Along traditional roads – typically 15 to 20mph.
- The TW-Pods are designed to run on 'pathways*[2]' approximately the width of a cycle path and are guided using several different systems – as appropriate for the area in which they are operating e.g. laser guidance using low level kerbs, painted lines, GPS, road and route recognition using cameras and other devices.
- The pods are silent except where deemed appropriate to create a 'warning' sound.
- Passenger safety and vehicle performance is constantly monitored by control room staff.
- The routes taken by the pods are determined automatically when the passenger selects a pickup point and a destination. This route can be updated whenever appropriate.
- Once passengers leave the pod it continues on to pick up other passengers or travel to where there is likely to be future demand for its use (depending on analysis of all other previous pod journeys).

The TW-Pods will be able to travel in pedestrian areas, segregated Pathways* or along existing roads. Each of these three modes are described for the Zones A, B and C as identified above.

[2] **Pathways*** for pods are described in Paper C. These are lightweight and designed for fast and easy construction. Their profile is considerably lighter that previous 'overhead' transport vehicle systems, designed to be as unobtrusive as possible.

3 THE TW-POD ZONES OF USE IN TUNBRIDGE WELLS

Zone A. The Town's arteries

A proposed routing plan is given in Paper D. Photographs and a commentary is provided for key stretches of the route in Zone A (see paper E).

This part of the route is effectively a park and ride system. It has the added advantage of fast, non-stopping personalised vehicles with minimal waiting times – estimated as a few minutes at maximum. For a similar system in Heathrow, waiting times average at less than 4 seconds.

A traditional bus park and ride system is not considered feasible for this route due to the inability to construct a new road or widen the existing road along this corridor. In addition – if it were feasible – the costs would be prohibitive. Without additional road capacity any traditional bus system would be stuck in the same congestion as the cars and thus will not be attractive to users.

The intention is to displace some of the traffic on the existing Pembury Road, allowing others to continue to use that road as appropriate.

The routes are designed to be primarily away from the existing road corridor in the fields or woods or school grounds. Where possible these will be at ground level behind hedges – and thus not visible and hence operate unobtrusively and silently. Parts of the route will run along elevated sections[3]. Most of the route will be one-way, single lane with appropriate stopping and passing points.

The route will service the various schools, as well as Pepenbury (on Cornford Lane), Dunorlan Park and the AXA offices. Passengers may select not to share their pod with others giving them greater security if desired by them.

The technology for self-Driving vehicles on segregated pathways exists now and has been operational in places like Heathrow Terminal 5, completing over 3 million miles.

Some of the key points are as follows:

- The first dedicated route would be installed from Crescent Road car park to Pembury. Other routes may be installed at a later date.
- If suitable space cannot be found for part of the route (e.g. close to town) then the pods may travel on existing roads – provided congestion can be avoided – otherwise a dedicated route should be constructed.
- The same pods are used for this part of the journey as are used for Zones B & C below.
- Travel along segregated pathways* allow a speed of 25mph to be maintained.
- Travel along segregated pathways* would allow the pods to take approximately under 8 minutes from the centre of the town to Pembury. With minimal time to wait for a pod, the pods can be used by commuters from a Park and Ride carpark in Pembury – already planned at Tesco's.

[3] These are light weight construction requiring pillars set approximately 18 meters (and up to 36 meters) apart. See Paper F. for details.

- The Pod 'Pathways*' are 'cycle lane width' and are designed to be as inconspicuous as possible – mainly behind hedges or at tree top height (or cut and cover glass topped tunnels) allowing them to avoid other traffic or pedestrians.
- The routes are one-way in figure of eight loops designed to give extra stopping points for travellers wishing to go to intermediate points such as the schools or parks along the Pembury Road. These stopping points are similar to 'laybys' allowing non-stopping pods to continue past.
- One side of the figure of eight travels mainly inside school grounds, in the non-built-up land to the side of the road or at treetop height where these are not available.
- The other side of the figure of eight will run along the line of Cornford Lane – largely in the fields next to the road behind suitable hedges. Cornford Lane may be restricted for access only, cycling, pedestrians as traffic is reduced on the Pembury Road.
- There will be access to Dunorlan Park and for those employed at the AXA offices in Forest Road.
- As an alternative – both the east and west bound tracks could follow the line of the Cornford Road.
- The capacity of the Pathways* would allow approximately doubling the 'vehicle' capacity of the Pembury Road.
- As the pods only take 15 minutes for a round trip only 25 Pods are initially required.

Likely Impact:

Many commuters will select to use the TW-Pods to commute into town leaving their cars at the edge of town. This will get them close to their point of work faster and more certain than being stuck in congestion on the Pembury Road. School children will be able to use the system direct to their school from the town centre or Pembury in the safety of the TW-Pods.

It is likely that many tourists will visit Tunbridge Wells to use the system as part of their day out.

Zone A will provide the very valuable link between Zone B – the out of town entertainment and shopping areas, and Zone C – the central spine of the town.

Zone B. Town Centre

The aim of this part of the system is to

1. Allow commuters using the other Zones to directly access parts of the centre of Tunbridge Wells
2. Providing a link between the north and south of the Town's centre.
3. Link the rail station with the network
4. Allow bus passengers to interchange with services.
5. Increase the pedestrian areas of the town while still able to use public transport to travel around.

The town's shops, restaurants, entertainment facilities, businesses etc. are spread out along a steep hill rising from south to north. This limits or deters people from accessing the various businesses of the town leaving many stranded at the top or bottom. The TW-Pods will provide an effective solution to this problem.

The technology to allow Self-Driving vehicles to operate within pedestrianised areas is currently under test in Milton Keynes in their main pedestrian areas. It is being welcomed enthusiastically by their citizens.

Features of the TW-Pods operations will be as follows:

- TW-Pods made available at pod 'ranks' or can be called up using a dedicated app[4] on a mobile phone or at a call point.
- The pods travel at walking pace up and down from The Victoria Centre, Camden Road, and Calverley Street in the north to the Pantiles in the south.
- The streets (The High Street, Mount Pleasant, Monson Road, part of Camden Road and Grosvenor Road) can be pedestrianised (if desired) diverting cars along London Road and Church Road and Crescent Road.
- This route could therefore be for the exclusive use of pedestrians, cyclists, TW-Pods and delivery vehicles.
- As the streets are broad the design would allow adequate space for pedestrians, pods and cyclists – each restricted to walking pace.
- Where these roads cross other routes e.g. Church Road, Vale Road, traffic light controls allow other vehicles and TW-Pods cross the junction using normal traffic light system but also linked directly to the pods' computers.
- The pods navigational and safety systems will check for stationary and moving traffic and pedestrians.
- The TW-Pods will follow the pathway marked with normal kerbs.
- The roads are wide enough to allow the pods to pull in for passengers to get on or off their pod and other pods to pass.
- Typical waiting times for a pod is likely to be less than 2 minutes – comparable weighting time in Heathrow averages at under 4 seconds.
- Passengers may select destinations in Zone B and Zone C and vice versa – Pods travelling without stopping between each zone.
- Long distance and local buses can be routed to connect with the Pod service, either at the edge of the town or at central points for users to access specific shops and other parts of the town.

Likely Impact:

The TW-Pods will provide an additional attraction to people who visit the centre of Tunbridge Wells. This increases the viability of the restaurants, shops, theatres, music and other venues for all.

The pods will provide an easy facility for the elderly, parents with young children, those unable to walk, to access the full length of the Town's spine quickly, with minimal difficulty.

[4] A dedicated function, button or a computer "Apt" on a mobile phone, iPad or other electronic tablet or device.

Zone C. The out-of-town areas: Pembury, the hospital and North Farms

This part of the system is designed to provide a direct link between these 'out of town' areas and the town centre. It will thus integrate these out of town areas as part of the overall shopping and entertainment 'offering' of Tunbridge Wells.

As much of the route does not suffer from congestion it is likely that the TW-Pods may operate along the existing roads (i.e. Tonbridge Road and Longfield Road).

There are systems now under test in the Netherlands, about to commence in Greenwich and under extensive trial elsewhere on public roads.

If required in the future the construction of a dedicated pathway between Pembury and North Farms is quite feasible.

- The route will run first to the Hospital at Pembury and then to North Farms shopping and entertainment areas. It would also serve the new University College Medical campus and the new Knights Park housing estate.
- As the Pods are self-driving they are available 22 hours per day. Children, people with disabilities and those not wishing or otherwise unable to drive can now easily and safely access these areas.
- As the car parks at North Farms are used less by those travelling from the centre of Tunbridge Wells they are now more available to commuters as 'park and Ride' parking – particularly during the lighter periods during the working days.
- The proposed Medical Campus site in North Farms becomes more attractive to students, those employed at the site and businesses needing to access the university.
- Many more visitors see North Farms as an attractive shopping and business site with many using the system to also visit Tunbridge Wells.
- Out of town buses can use the TW-Pod system for those wishing to travel into the centre of the town.
- Car Clubs and other car hire firms can base their services out of town at the park and ride points allowing easy access for users to pick up a car for onward travel to other towns and areas. Increasingly more residents of Tunbridge Wells start forgoing ownership of their cars (which otherwise remain stationary 95% of their time). They select a hire car (probably from a 'car club') as required for long distance journeys.

Likely Impact:

There will be increased usage of both the North Farms area for shopping and entertainment and the centre of Tunbridge Wells. The fast link will enable people to eat, shop or visit both areas in a single evening or visit with minimal difficulty and wasted time.

Non-drivers will be able to access both parts of the town without relying on parents, 'designated drivers' or worrying about last buses or bus frequencies.

The town will become more attractive as a shopping destimation.

Future Zones:

Future developments could see routes extended elsewhere.

A reduction of congestion will allow Self-Driving TW-Pods to be able to negotiate many more of the existing roads in Tunbridge Wells.

4 COST OF DEVELOPMENT

The costs of development fall into the four elements:

Infrastructure Capital Costs[5]:

1. The vehicles
2. The guidance technology
3. The routes, the Town's Arteries and Infrastructure

Annual Costs:

4. Operational aspects

4.1 THE COST OF THE VEHICLES – (TW-PODS)

The proposed system would initially run using 25 pods. As a single Pod can complete a round trip to Pembury in under 20 minutes this would allow the equivalent of 75 round trips per hour, carrying potentially up to 450 passengers each way. Should demand exceed this then additional pods may be purchased – financed by the additional fares generated. Over 250 pods per hour could operate on the initial system without causing congestion or slowing of service times.

There is an increasing range of vehicles. Selection of a suitable vehicle for Tunbridge Wells will depend upon the physical design specifications (comfort, versatility and other aspects influencing its operation) and of price (initial cost and ongoing maintenance etc). The guidance technology is discussed in the next section below.

The two Self-Driving pods currently believed most suited for Tunbridge Wells are a) the Heathrow Pod and b) the Netherlands WEpod shuttle (see Paper C). Both are designed round a 'family unit (4 to 6 person) carrying capability with room for a wheelchair, pushchair, baggage / luggage. The Heathrow pods have already completed over 2 million miles in service with few problems and have a reliability surpassing all other ground transport vehicles including London Tubes, buses etc. The pods only travel when needed but are designed to operate a high percent of every day, and able to travel round the complete system at frequent intervals. The Netherlands WEpods (manufactured in France) are still at an earlier stage in their deployment.

The Heathrow pods are constructed using standard automotive parts with the addition of lasers and other sensors and are thus easy to maintain. The prototypes were hand built at a cost of £120,000 each, however as more are built the cost is rapidly coming to under half and eventually towards the cost of other mass produced small vehicles.

Hence the initial vehicle cost is likely to be under £2 million. Additional vehicles may be added depending on demand and revenue generated.

[5] These costs can be converted to an annual equivalent cost equal to the annual repayment of a mortgage at an interest rate of 2% p.a. above the rate of inflation.

4.2 THE GUIDANCE TECHNOLOGY

Whichever vehicle is selected for Tunbridge Wells the technology must be supplied by a specialist firm in this area. While they key parts of the guidance technology have already been developed and are either in operational use or undergoing trial stages, the guidance technology will have to be modified to suit Tunbridge Wells. The technology will also have to be built into the vehicle. This includes the various sensors as well as the computing power needed.

Both suppliers to Heathrow and Greenwich systems (see Paper C) have confirmed their willingness to support a development – as described here - in Tunbridge Wells. The Government Backed 'Transport Systems Catapult' organisation in Milton Keynes are also keen to assist. No approach has yet been made to other possible suppliers including the research unit currently testing the Dutch system.

Initial estimated cost is £6 to £8 million.

4.3 THE ROUTES, THE TOWN'S ARTERIES AND INFRASTRUCTURE

Initial developments of the Self-Driving pods is seen along 'Zone A' - The main artery route of the Pembury road and secondly in 'Zone B' - the Town's centre. The system can then be extended to the various out of town areas 'Zone C' – The hospital and North Farms. The infrastructure consequences for these are very different to each other – even though the same vehicles are likely to be using them.

A significant part – if not all – of the route in Zone A will be using segregated Pathways*. This will allow the TW-Pods to avoid congestion and help divert some people away from the existing roads in Tunbridge wells.

Similar to roads the infrastructure costs of the routes taken by Self-Driving vehicles are seen as a cost that should be borne by the public purse as with any other Highway cost. However due to the lightweight nature of Self-Driving pods and their greater predictability in how they travel, Pathways* are much cheaper, easier and faster to build than roads and are more comparable to pedestrian or cycle paths.

If these Pathways* are placed behind a hedge they can become largely invisible with no noise or local pollution. Along parts of the route TW-Pods may travel on existing roads (if these are not congested) or new specialist lightweight "Pathways" can be built on the top of posts at tree top height. The routes may travel through school grounds, fields or sports grounds to take people direct to their destination (which may be the school or the sports ground through which they pass).

Zone A. The Arteries to Pembury and elsewhere

Designs and costs have already been estimated for Pathways* suitable for Self-Driving Pods. The key costs per kilometre of pathway are shown in Table 4 below. The Pathways* are very light and designed to be quickly built, changed or dismantled over time. They may run along the ground – suitable where there is no crossing traffic, at tree top height or in 'cut and cover' tunnels or underpasses (typically covered with glass).

Table 4: Approximate cost of Single Track Pathways* (given per km and per mile)

Cost of Single Track Pathways*	Cost £millions	
	Per kms	Per mile
Elevated (km)	2.2	3.5
At Ground level (km)	1.3	2.1
In-building (km)	0.8	1.3
Special (km)[6]	2.6	4.2

At ground level the Pathways* and the pods may be hidden behind suitable hedges. As the pods are noiseless[7] and create no local pollution they become quite unobtrusive. The Pathways* are of cycle track design with or without kerbs but will need fences to stop easy transgress onto the Pathways*. However safety features will come into play should debris, an animal or other obstruction is on the track.

Most routes will be single direction using a one-way system (following figure of 8 loops to increase calling points) but may also be designed two Pathways* next to each other to allow pods in either direction. When the Pathways* are raised to tree top height the Pathways* are bolted onto telegraph pole like structures. These require a foundation[8] approximately one (1) cubic meter of concrete buried in the ground. These are placed at points avoiding any services in the ground. The distance between each pole is normally the maximum length that a low loader (without out riders) can carry, thus minimising construction cost.

Construction can be fast. Once money has been raised and permission to proceed is received completion of Zone A can be in as little as 18 months. This represents 6 months design, 6 months construction and 6 months testing.

Much thought will need to be given to the look of the Pathways* to ensure they fit in with the towns historic buildings and general look of the town. This is the job for those architects in the town with abilities in this area. However as the Pathways* are light in design they have little constraints (other than their cost of construction), arches, fairly steep inclines and other design features are all possible as are clever ways of disguising the poles as trees or other structures.

Pod stopping points (Pod Stops) will be needed. These are also of light weight design using materials similar to modern bus stops with perspex. They also need electrical charge points for stationary pods as they wait for passengers. These are normally installed at Pod Stops.

The central point in the Centre of Tunbridge Wells system is envisioned to be inside the Crescent Road carpark. This is similar the Heathrow system which required minimal modifications to an existing carpark at Heathrow. The pods run on the normal road surface in the carpark. Kerbs may be created out of plywood or other simple building material. Electrical points and structures for pedestrians are built form lightweight materials. These

[6] May be appropriate for complex junctions or long spans / crossing points of major roads.
[7] Artificial 'warning noise' may be added to alert pedestrians in areas where this is appropriate.
[8] Foundations depend upon specific conditions – see Paper C for designs appropriate for the ULTra system guideways as per the Heathrow Self-Driving system.

are designed to provide comfort and attractive features for users of the system. There also needs to be a ramp to allow the pods with their passengers to reach ground level and to continue on their journeys without stopping to the pedestrian areas of Tunbridge Wells.

Zone B. The Central Spine of Tunbridge Wells

In the centre of Tunbridge Wells the Self-Driving pods are envisioned to travel along pedestrian areas mainly down spine of the town connecting Grosvenor Road and FiveWays at the top, along Mount Pleasant, The High Street to the Pantiles. While most of this is currently open to normal traffic Tunbridge Wells Borough Council already see much of this route being pedestrianised.

If the area is not pedestrianised then the TW-Pods will have to contend with the existing and future growth of traffic along this route. This will have consequences on journey times and the attractiveness of the system to users.

The key questions is – What is the additional infrastructure required for the pods? The answer is very little is needed.

It probably advisable to mark out in new pedestrianised streets the normal stopping points and paths taken by the pods. This could help in getting pedestrians comfortable with the pod vehicles requiring the pods to take fewer avoiding actions making travel easier for all. This could also simplify the computing technology (using the technology being developed for Greenwich rather than the more advanced technology of the pods being trialled in Milton Keynes).

The pods can stop up against wheelchair access points at kerb height (within a few millimetres) to facilitate easy access to the pods by wheelchair users and others needing flat access. These could be sited at ‘bus stop shelters’ like structures to keep users dry as they enter or leave the pods.

The pods need electrical charging points installed at their normal waiting points. These are only live when a vehicle is over it – however additional safety features are likely to be appropriate for protection. Whenever the pod is not needed or its battery drops below say 70% of its capacity the Pod is directed, when empty, to a suitable charge point.

Clearly a main concern will be the ‘crossing points’ for pods crossing Church road, Grove Hill and the Frant Road junctions. These may be designed with traffic lights to allow pedestrian, cyclists and pods to cross at the same time. The pods may ‘stop’ just before the Frant Road to avoid additional traffic lights at that junction.

More costly possibilities exist to make it easier to cross these main roads currently used by existing vehicles. However this is not a requirement.

A route must be planned to access the segregated routes in and out of Tunbridge Wells. This is likely to be at the Crescent Road carpark. This cost is best considered as part of the next section on Infrastructure.

Hence the total additional cost of infrastructure for the Central of Tunbridge Wells is likely to be marginal compared to the planned creation of pedestrian areas along these roads.

Zone C. The out-of-town areas: Pembury, the hospital and North Farms

As stated above this part of the route may run along existing roads and interact with normal traffic.

Should it be required new routes may be built between each of the key points in the fields and woods between the key destinations in this zone. Much of this is likely to be at ground level. Hence any construction costs will be kept to the lower costs of track as identified for Zone A.

Some infrastructure costs will be incurred in respect of shelters for passengers at key stopping points and charging points for the TW-Pods (probably at the same locations).

4.4 Estimated Infrastructure Costs

Hence the infrastructure costs may be divided into three main areas of responsibility. The guideways are very much akin to highways – at a much lower cost than normal roads to provide comparable passenger vehicle carrying capacity. This cost should fall within the responsibilities of the local Highways agency i.e. Kent County Council (KCC). The cost of operating the systems, stations and general commissioning of the system should probably fall to the local Borough Council i.e. Tunbridge Wells Borough Council (TWBC). The cost of actual vehicles should fall on the actual operators to fund.

All three 'agencies' (KCC, TWBC and operators) should be more than able to recover their costs over the life of the project through guideway tolls, ticket charges and other sources of revenue – see Section 8. of this report.

Hence the estimated infrastructure costs of the initial systems – as allocated by agency - are as follows (Table 5):

Table 5: Approximate Infrastructure Cost by Agency

Agency		Capital Cost
Highways	Pathways* (Zone A only)	£16 million
Borough Council	Systems Costs: Systems Commissioning Other	£7 million
	Stations and charge points	£3 million
Operators	Pods	£2 million
Estimated Cost		£28 million
	Contingency	£3 million
Total Infrastructure Cost		£31 million

The total infrastructure cost represents an annual cost (before inflation) of under £2 million[9] per year.

Funding grants may also be available from Central Government and the European Community based on public transport and 'green' infrastructure project grants.

4.5 OPERATIONAL ASPECTS

The system will require a garage maintenance and cleaning station – similar to any other small garage for cars. Pods are continually monitored by computer which automatically diagnoses any problem and evaluates it on a scale to determine whether the problem needs immediate attention or how long the Pod can stay operational. The duty person in the control centre is alerted and can over-ride the system to bring the Pod to the maintenance station for immediate attention. Pods are also assessed on a regular vehicle servicing basis.

The system will require the control centre to be manned by one or two people to check the monitors and cameras (installed in each Pod) should the Pod or its occupants alert a problem needing manual involvement or reassurance. The controllers would need some training however their duties are akin to those who monitor surveillance cameras for TWBC and the police. It is possible that this type of activity can be combined to improve efficiency and to make 24 hour, 7 days a week coverage more economical.

Operation staff levels at Heathrow (which also operates 25 Pods) are currently at a minimum staffing number to provide 24 hour cover. However with very little extra resources staffing at the level in Heathrow could probably handle a system over double the size.

Hence the operational cost is estimated at under £2 million per year.

[9] Based on a mortgage of £31 million in instalments of £1.79 million pa at 2% above the rate of inflation over 8 to 30 years (pathways* 30 years, System costs 20 yrs and pods 8 yrs).

5 THE ECONOMICS OF THE SYSTEM

5.1 POTENTIAL REVENUE

Revenue will be raised from:

1. Fares charged

   Charges may be made per pod or per passenger. A charge of at least £2.50 to £3.00 per passenger from Pembury to Tunbridge Wells (perhaps with a maximum charge of say £6 to £10 per pod) would seem reasonable. The above cost compares reasonably to the monthly season ticket cost of £55 of buses in Tunbridge Wells.

   It is difficult to estimate the number of passengers that will actually use the system. Initial estimates can be taken relative to a portion of the number of vehicles using the Pembury road, however the system is designed to attract significantly more people to Tunbridge Wells. Alternatively one may look at the number of trips required to generate say £1 million in ticket revenue.

   At the lower fare level generation of £1million per year will require traffic of approximately 400,000 passenger trips per year – approximately 550 return trips per day. If we assume only 2 passengers per pod per journey, this is equivalent to an average use of each pod 3 to 4 hours per day. More realistically the level of use per day will be substantially higher than the number of trips needed to generate £1 million.

   Hence at this stage estimated fare income is likely to be substantially over £1 million - likely to be **between £3 million to £5 million per year** – with an initial 25 pods.

2. Advertising

   A recent urban proposal believed revenues of £450,000 pa was possible. It is likely that revenues in Tunbridge Wells would be much lower say **£200,000 pa**

3. Charges to businesses / sponsorships

   In Heathrow a hotel is paying the full capital cost of extending the system to their hotel and charging £5 per passenger trip (2.5 kms). The full amount of this revenue is being paid to Heathrow, nothing being retained by the hotel in question. Clearly Heathrow is an exception, however some recovery of money should be possible from businesses benefiting directly from the system e.g. supermarkets, the old cinema site, car rental firms, or businesses in North Farms. **Assume a capital contribution of say £2 million and / or a revenue income of say £100,000 p.a.** based on passengers using specific Pod Stops.

In addition the council's property values and revenue from facilities such as the Assembly Hall theatre are also likely to increase.

5.2 OVERALL POTENTIAL SURPLUS / DEFICIT

Currently car, bus and commercial vehicles contribute only marginally to the cost of existing roads infrastructure, most of which has been constructed over many years. It would therefore seem appropriate that the cost of the Pathways* are funded by the

Highways agencies, with additional funds being obtained from Central Government and the EC.

The system would be contributing directly to cost savings through reduced need for road spending in the town and through the reduction in pollution. In the longer term Self-Driving cars will see a reduction in the number and severity of accidents.

Table 6. Summary - Overall potential annual surplus / deficit of the proposed Self-Driving Pods

OVERALL POTENTIAL SURPLUS / DEFICIT SUMMARY		Annual Revenue / Cost
Potential Revenue	Ticket Revenue	up to £5 million
	Other Revenue	£300,000
Operating Costs		Under £2 million
Infrastructure Costs	Investment of £31 million	£2 million p.a.

At a minimum it is therefore likely that the system will generate sufficient direct income to pay all the operational costs as well as make a contribution to infrastructure costs within the Borough. This is in addition to the substantial benefits gain by all residents and visitors to Tunbridge Wells and the economic enhancement of the town, its business and facilities.