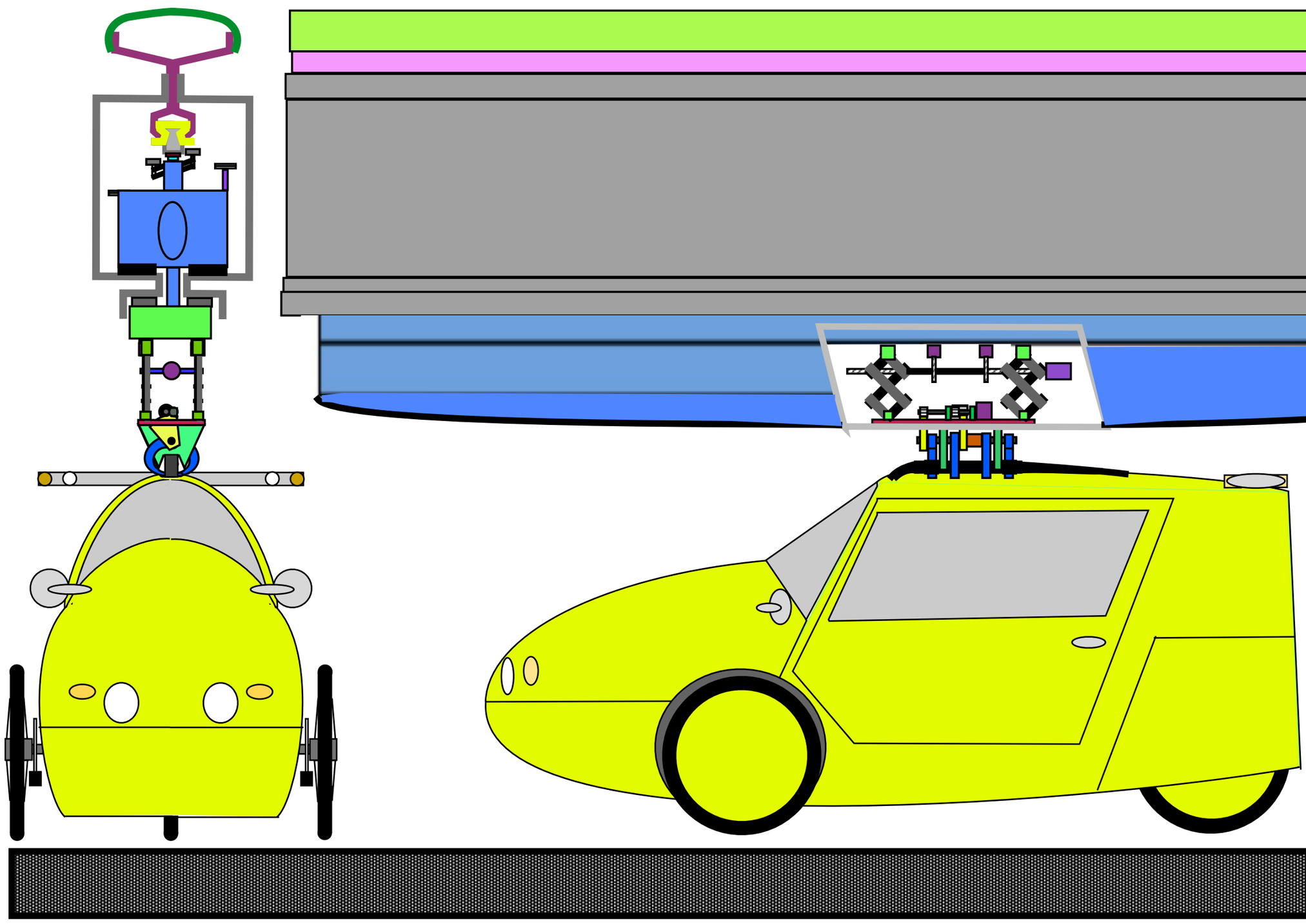

The Organic Transit **ELF**. Technically it is a tandem solar-electric velomobile. Legally it is an electric-assist bicycle. It can go 20 miles/hour and carry two people. It can go in bike lanes and on bike paths except where local restrictions don't allow it. In Washington and Oregon it doesn't require registration, insurance or a driver license to operate; but the pedaller/operator must be at least sixteen years old to operate it on public roads.
It is available for sale now in Portland, Oregon.



Higherway ***Lark*** electric assist tandem dual mode velomobile with cutaway view showing lifting and grabbing mechanisms on ***Baz*** carrier vehicle and cross section of track.

Question: Is it possible for a sixteen-year old girl (who doesn't yet have a driver license) to take her younger brother from her home near Amboy to visit their cousins in Boring, Oregon, in a two-person vehicle and do it during rush hour quicker than a race driver in a Ferrari? And cheaper than on a bus or train? And safer than walking or riding bikes?
Answer: Yes, if they have a Higherway ***Lark*** electric assist velomobile and access to a personal monorail guideway which goes among the Portland metro area suburbs and has high-speed (45 meters/second or more) carrier vehicles which can pick up their ***Lark*** at a landing in Amboy and take them to a landing in Boring. Velomobiles are streamlined bikes and trikes. The speed record for velomobiles is over 35 meters/second (80 miles/hour).
Legally, the ***Lark*** is an electric assist bicycle, which is allowed in bike lanes, bike paths and on streets. Electric assist bicycles have different legal requirements in different communities, states and countries, but generally they have limits of continuous-rated motor power of 250 watts to 1 kw and speed limits which they can go with motor assist on level ground. Most common motor-assisted speed limits are approximately nine meters/second (20 miles/hour). They don't require vehicle registration, insurance, or an operator's license. This means that anyone who can see and hear, and has the manual strength and dexterity to pedal a bike, operate the controls, and enter and exit the ***Lark*** can operate it legally.

People who can't obtain a driver license because of age, poor eyesight, hearing, or balance or whose driver license has been taken away because of drunk driving or other driving violations would still be able to legally operate a ***Lark***.
Some ***Lark*** features that are different from other velomobiles: a roll cage with crash protection, especially from cars hitting it from the rear; a top longitudinal bar on top of the roll cage with a flat top surface to mate with the ***Baz*** carrier vehicle; and safety belts. The passenger in the back seat of the ***Lark*** does not pedal or operate any of the controls because adding another crank and pedals would increase the overall length too much and the power from the passenger's legs is not needed because the electric motor is sufficient.
The ***Lark*** design requirements include: carry two people 32 kilometers in one hour; go up hills at nine m/s; meet the legal requirements for electric-assist bicycles; protect the passengers from serious injury if hit by road vehicles; and have a mating interface with the Baz.
The ***Lark*** is the only Higherway vehicle under construction now. The engineering model is expected to be on the road in 2016 but probably without a complete fairing.

Higherway Transport Research December 1, 2015
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# Electric Assisted Bicycle Resource Sheet

**(RCW 46.04.169)** "Electric-assisted bicycle" means a bicycle with two or three wheels, a saddle, fully operative pedals for human propulsion, and an electric motor. The electric-assisted bicycle's electric motor must have a power output of no more than one thousand watts, be incapable of propelling the device at a speed of more than twenty miles per hour on level ground, and be incapable of further increasing the speed of the device when human power alone is used to propel the device beyond twenty miles per hour.
Examples:

**Use**

- Cannot be ridden on sidewalks (RCW 46.61.710 )
- Cannot be operated on fully controlled limited access highway (RCW 46.61.710 )
- They may be operated most places bicycles are allowed such as multipurpose trails or bicycle lanes, provided “motorized vehicles” are not prohibited. (RCW 46.61.710 )

**Licensing**

- No Drivers License needed if the operator is at least 16 years of age. Persons under 16 may not operate an electric-assisted bicycle. (RCW 46.20.500)
- Not licensable for street use (RCW 46.04.320 )

**Equipment Requirements**

- 2-3 wheels (RCW 46.04.169)
- Saddle seat (RCW 46.04.169)
- Operational pedals (RCW 46.04.169)
- Electric Motor (with less than 1000 watts) (RCW 46.04.169)
- 20 mph or less (RCW 46.04.169)
- Must comply with all laws and regulations related to the use of bicycle helmets (RCW 46.37.530)

**Note**: While we have tried to compile a complete listing of laws regarding this type of mobility device, additional requirements may apply. To read additional law requirements please visit the Washington State legislative Web site at http://www.leg.wa.gov/LawsAndAgencyRules/

# Versatile Use of Elevated Tracks

Tad Winiecki M.S. P.E. Higherway Transport Research and Ove Johnsson M.S. Webmaster and Technologist

Most transport infrastructures have greater utilization and return on investment by carrying a variety of different modes and vehicles. For example, many types of vehicles run on highways, and trains can have many types of cars to carry people, liquids, gases, standard-sized containers, grains, coal, automobiles and other types of things. An elevated guideway can carry utilities such as communication and power cables on parts of the network. The covers to protect those cables can be easily removable to provide better access for maintenance and also be covered with solar cells to provide power. Placing cables inside protected ducts on the guideway is better than underground because the initial cost is lower, there is less risk of water damage and access for maintenance and upgrading is better. Guideway utility ducts are better than elevated cables on poles because there is no additional cost for digging  holes and the lower voltage and fiber optic cables can be cheaper because they don't have to withstand sun and weather exposure. Passenger traffic in metro areas is so time dependent that many mass transit systems shut down in the middle of the night and add more vehicles for the morning and afternoon rush periods. Automated systems can run all the time and take advantage of unused guideway capacity to deliver cargo at night and on guideways that have excess capacity during the day. A grid network has many possible routes between most origins and destinations. With a central organizing computer to set trip routing more of the network can be used and congestion avoided.
The drawings below show a track with a utility duct on top and examples of a variety of vehicles from the SwedeTrack and Higherway designs.

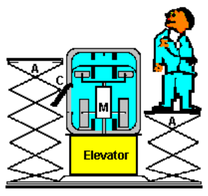



Figure 25

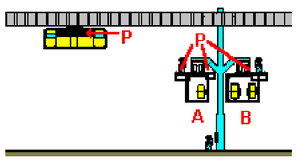



Figure 26

## Service Vehicles

There will be a need for cars equipped to enable service and maintenance of the beams. One suggestion is a car with elevating platforms on both sides (indicated by A in figure 25).The inside of the beam could be inspected by means of trapdoors on the side of the beam (C). The service car must be equipped to run on batteries, so it can function without depending on power from the beams.The propulsion vehicle of the service car (the vehicle that moves inside the beam) should be equipped with lamps, video cameras and vacuum cleaners (for inspection and cleaning of the beam's interior). As can be seen from A in figure 26, one can only have these elevating platforms on both sides of the car if the car is sufficiently narrow to alow the needed space to the pole. Otherwise, one will have to make do with only one elevating platform, on the side facing away from the pole. This need not be the only solution, however. One could also have platforms that could be folded up or down whenever the car passes a pole.

## SwedeTrack Systems

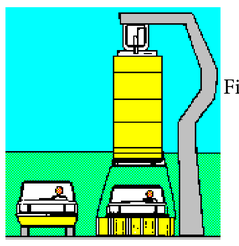


Figure 20

## Flatcars

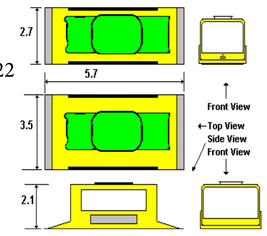



Figure 22

SwedeTrack Systems´ flatcars would be open at both ends and be able to take on motorcars as well as other kinds of bulky goods. One thought behind these cars is that the motorists should be able to travel with their cars on the beams a part of their journey (what is referred to as "Dual Mode"). The drivers would save gas and get a chance to relax.
Figure 20 shows the flatcar taking on load, figure 21 the flatcar during transport. Beam cars like the middle one in figure 22, which are broader than most other cars may not be able to travel on all parts of the beam network. This depends on how the beam network is planned and built.

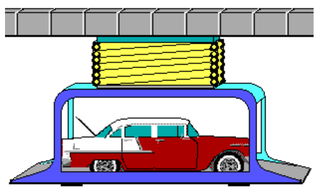


Figure 21

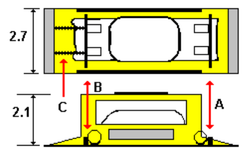
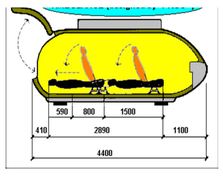
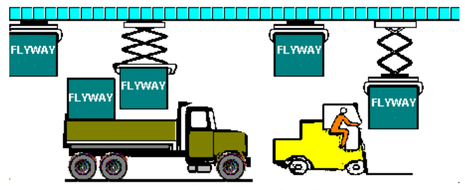



Figure 23




## Ambulance

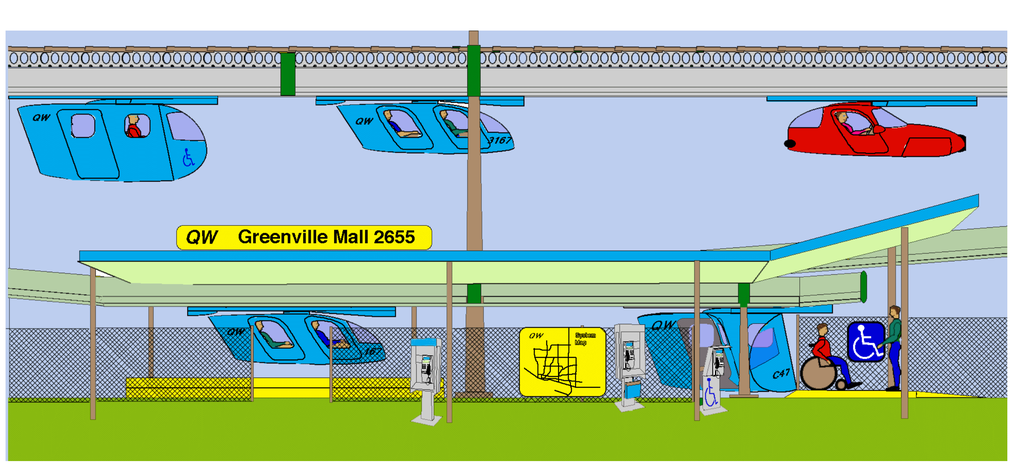
Once the network has become fairly extensive, and covers most of the metropolitan area, it would be desireable to introduce fire trucks and similar vehicles on the beams. This type of vehicles are often hampered by traffic jams when they are needed the most, i.e. in connection with serious traffic accidents. Using an extensive beam network in these situations would further enhance the usability of the beams. Figure 7:1 shows what an ambulance could look like.




## Grappling Vehicles

These cars are meant to move containers, but they could also be used for transporting specially adapted electrical vehicles. These vehicles would be carried along hanging in their roofs, which thus have to be strong enough to carry the weight of vehicles, passengers and cargo. Containers for moving goods come in standardized sizes. The 2 most common are: Length/Width/Height = 6/2.5/2.5 meters Length/Width/Height = 12/2.5/2.5 metersSo, vehicles for container transports would have to be adapted to those sizes. These vehicles could have their batteries charged during transport, from an automatic adapter between the grappling hooks. They could also be used in a rather fancy way to speed rescue vehicles on their way across the congested streets of an urban area.

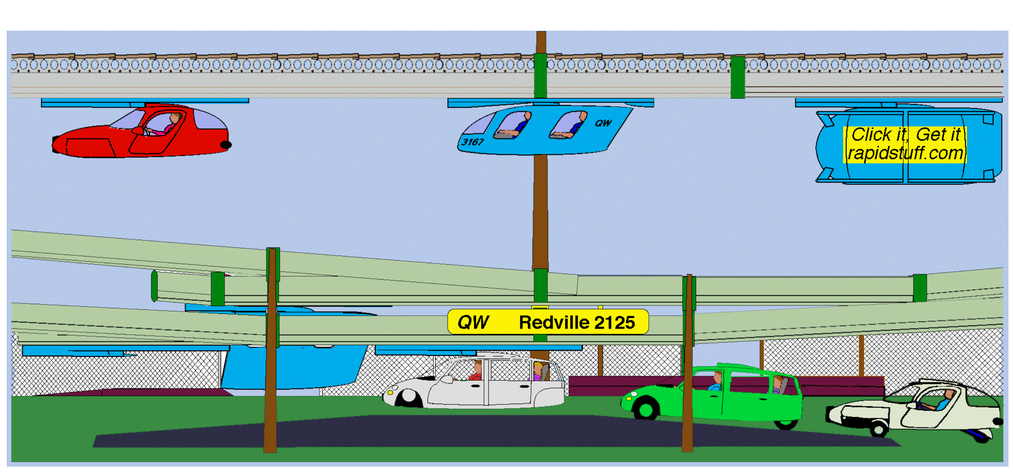
## Higherway



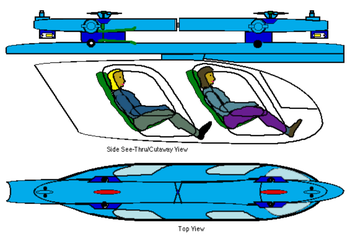

Different types of vehicles require different stops, berths and landings.
Balcony stops are built as attachments to buildings on the second or third floor.

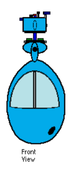
Suburban ground-level stops include berths for *Pelicans*, *Doves, Quails, and Pheasants* and often landing areas where *Quails, Pheasants and Larks* can enter or leave the system.

Other stops will be added as needed, for example airport, stadium, cargo, stand-alone city, and hospital.



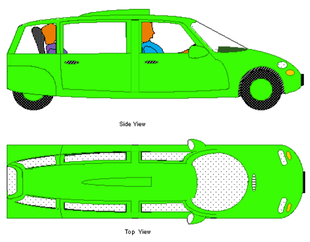

### *Dove*




*Dove* carries two people. It is designed for low life cycle cost. Because the gross weight of the *Dove* passenger pod is less than half the weight of the pods carried by the *Baz*, each *Dove* has its own permanently attached carrier vehicle which is the approximate size of the *Baz* but is lighter and cheaper. There are automatic passenger restraints which engage when the doors close.

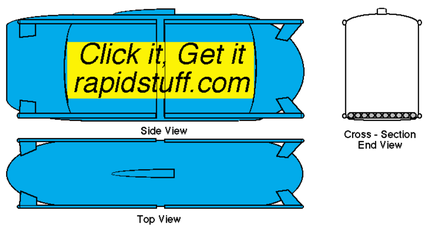
### *Pheasant*





*Pheasant* is for those whose origin and destination are 0.5 to 10 km from a stop. It is battery powered to run on city streets but is carried by a *Baz* on the guideway. It is designed to not exceed the weight and size of the *Owl* when on the guideway. It carries one licensed driver and one passenger. The wheels raise to reduce aerodynamic drag when a *Baz* carrys it. Wheel shields will extend when the wheels retract to protect pedestrians underneath the guideway from falling ice or dirt clods.

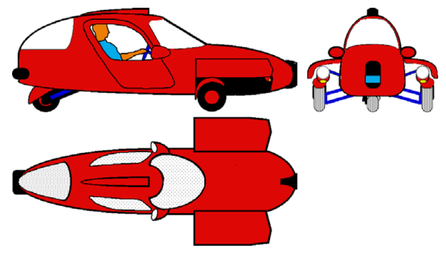
### *Owl*




*Owl* carries two pallets (1 m x 1.2m each) with cargo. It will have rollers and belts for automatic loading and unloading. The maximum cargo mass (design goal) is 500 kg, with a gross vehicle weight (including the *Baz*) of less than one ton (900 kg). It will be the largest and heaviest of the pods, and a design driver for the guideway. As you can see from the drawings above it will have four sliding doors. Not shown are the automatic cargo restraint nets and locking devices to hold it securely to the dock while loading and unloading.

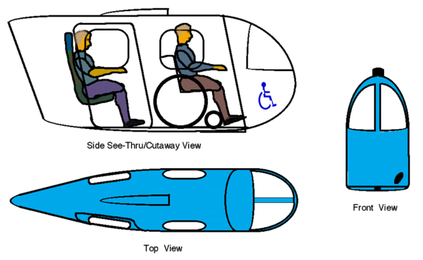
### *Quail*

*Quail* is for those whose origin and destination are 0.5 to 10 km from a stop. It is battery powered to run on city streets but is carried by a *Baz* on the guideway. While on the guideway, it is designed to not exceed the weight and size of the *Owl*. After attaching its three wheels retract like aircraft landing gear into the body. It has cooperative automatic alignment and communications with the *Baz*. It carries one licensed driver.



### *Pelican*

*Pelican* is compliant with the Americans with Disabilities Act and carries a person in a wheelchair or baby carriage, bicycle, shopping cart, large packages plus one adult human or dog or monkey. There will be two fold-down kiddie seats so that a mother and two babies or toddlers can travel with a baby carriage (Babies and toddlers cannot ride in the baby carriage on the *Pelican*, they must be restrained in the backward-facing kiddie seats).




## The Higherway Lark Electric Assist Tandem Velomobile

Question: Is it possible for a fourteen year old girl to take her younger brother from her home near Half-Moon Bay to visit their cousins in Alameda in a two-person vehicle and do it during rush hour quicker than a race driver in a Ferrari? And cheaper than on a bus or train? And safer than walking or riding bikes?
Answer: Yes, if they have a  Higherway Lark electric assist velomobile and access to a personal monorail guideway which goes among the Bay area suburbs and has high-speed (45 meters/second or more) carrier vehicles which can pick up their Lark at a landing in Half-Moon Bay and take them to a landing in Alameda.
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