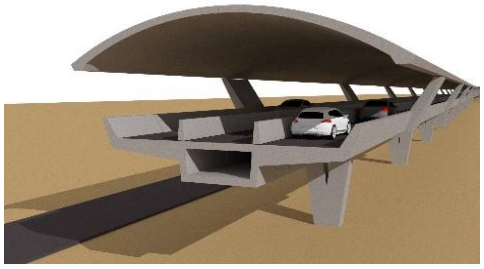
Solar Transportation Technologies, Inc.

1. CONCEPT SUMMARY

Solar Transportation Technologies is developing a completely new mass transit system, utilizing privately owned electric cars on an elevated fixed guideway, called Freedom Transit (FT) ™. It combines the energy efficiency of mass transit with the convenience of a privately owned vehicle. This Eco-friendly, on demand, nationwide, weatherproof, mass transit system, called Freedom Transit(FT)™ is the only mass transit system to provide door to door service in one vehicle. This high-speed (140 mph) mass transit system for individual electric cars could replace all other forms of land based and including short-hall air travel. A nationwide network of solar powered guideways handling millions of electric vehicles hourly, could reduce US oil consumption and CO2 emissions by over 30%. Automated travel could all but eliminate the annual 30,000 plus US traffic fatalities.

Nationwide Fixed Guideway



Newly designed, privately owned, dual mode, electric (cars, light trucks, vans, SUVs) are driven manually on existing roads to FT™ stations for high speed (140 mph) automated travel on elevated guideways. The stations control access to the guideways and manage the vehicles on the guideway. The vehicles are inspected for maintenance issues before being accepted into the system. Station-vehicle management then takes full control of the vehicle by terminating manual control. The automated system then controls the vehicle until the exit station stop point is reached, where manual control is restored. Stations are to the side of the elevated guideway, that is, traffic on the guideway is non-stop. Once a vehicle is merged into the traffic stream it need not stop until the destination station is reached, stations in between are bypassed. The patented vehicle control technology allows for the merging and exiting of individual vehicles into and out of a stream of very closely spaced vehicles at high-speed with no mechanical switching. The guideway is covered by roof mounted PV solar panels providing the cars with power and charging the vehicles internal batteries. The roof mounted PV solar panels generate 3.8 mega-watts per mile, enough for approximately 15,400 vehicles per hour.

PV Solar Panels Covering Roof of Toll Road.

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The small footprint elevated guideway is only 45ft wide however, it contains three high-speed lanes, one in each direction with a switchable center lane, reserved for maintenance of either direction. The traffic handling capacity of each lane is equivalent to a 7 lane expressway. Stations control traffic in the station and guideway incoming traffic. They also provide parking, and rental electric cars for high-speed travel on the guideway. Drive-in dual mode vehicles are checked in, ownership and billing is confirmed before being allowed in the system.

2. INNOVATION AND IMPACT

The FT™ guideway externally powers electric vehicles enabling long distance travel and converting to electric vehicles could reduce fuel cost by 74%[1]. Currently manually driven fuel based vehicles must maintain a safe distance between vehicles traveling at highway speed. As a consequence, each vehicle experiences significant air drag causing high fuel consumption. A car with a normal coefficient of drag will use 40% more fuel at highway speed[2]. Using an electric vehicle in a fixed guideway, high-speed, nationwide network, where vehicles travel in dynamically created groups or platoons would reduce the electrical energy need by another 40%[2]. Safe distances between vehicles at interstate speed means that each lane has a traffic capacity of 2,300 per lane[3]. Traffic congestion is also reduce by platooning vehicles at high-speed in the single lane fixed guideway. The traffic capacity per lane rises to 22,000 at 70% of guideway capacity.

[1] http://content.sierraclub.org/EVGuide/myths-vs-reality [2] http://www.mpgforspeed.com/
[3] http://www.dot.ca.gov/hq/maint/Pavement/Offices/Pavement_Engineering/LCCA_Docs/Appendix5_Aug_1_2013.pdf

- Energy – Environment

Successful development would mean at least 40% of the 3 trillion miles driven each year would be by dual mode electric cars with most of the power coming directly from solar energy. Utility power would be used when solar power is unavailable.

1.2 trillion miles not using gasoline would save annually:
(Millions of Short Tons)

Emissions	CO	NOx	VOC	PM-10	PM-2.5	SO2
2012 Totals	25	5.01	2.16	0.27	0.19	0.03
Saved	9.920	2.004	0.864	0.108	0.076	0.012

A 40% reduction in gasoline usage or 53,272 million gallons saved
Source: http://www.c2es.org/energy/use/transportation

3. Transformational Solution

All other mass transit system have passenger vehicles that travel on a schedule with many passengers in one vehicle. All passengers travel together and all must stop at each stop along the way. In order to use the mass transit system, passengers must use some other form of transportation to get to the mass transit system. The proposed mass transit system uses dual mode electric vehicles which can take a small number passengers from start to finish in one vehicle. Yet it has the energy efficiency of a mass transit system. Travel is on demand with the system dynamically linking vehicles into travel packs of 5 to 6 vehicles to save energy as individual vehicles enter and leave the system.

Disruptive

Door to door, low cost, safe, high speed travel is so desirable that wherever the system is available no other travel mode is competitive. The proposed dual mode mass transit system is so convenient, fast, safe, and low cost no one would choose another way causing other modes of travel to be discontinued. No buses, trains, high speed rail, or short hall air travel will exist once an integrated nationwide dual mode mass transit system is built. Dual mode electric (cars, light trucks, vans, SUVs) will replace all fuel based ones. A separate freight system based on this technology would replace rail and heavy truck freight hauling with electric freight vehicles.

Performance and Cost

The nationwide network would be built over time starting with the most congested routes first. One such route example could be Penn Station New York to Union Station, Washington DC. By car via interstate highway I-95, distance 226 miles. See Table:

Comparison Table

Method	Travel Time	Start Time	Cost
I-95 by car	3hr 42min	anytime	Tolls & Gas $60.00
Amtrak Express	2hr 55min	6:00am	$267.00 per passenger
Amtrak Regional	3hr 40min	6:10am	$123.00 per passenger
Airlines Jet Blue	1hr 15min	8:01am	$119.00 per passenger
Freedom Transit™ rental car	1hr 37min	anytime	$107.37 per vehicle
Freedom Transit™ owner car	1hr 37min	anytime	$79.65 per vehicle

A family of 4 via Amtrak $492.00, via air $476.00.
Freedom Transit tolls are by vehicle not per passenger

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Freedom Transit Safety Features:

- Elevated guideway secure and protected guideway travel
- High Speed with only small numbers of people at risk in each vehicle
- Completely automated travel
- Automated vehicle and roadway failure detection and management

Freedom Transit is completely automated once the Electric vehicles (EVs) enters the system. The only thing the user must do is designate the destination exit and pay for the trip. In an accident involving the system's lightweight independent vehicles, they will experience minimal damage as they are enclosed in a U shaped concrete elevated platform.
EVs are in constant communication with a control signal emanating from the next station inline. The control system in the EVs will cause the vehicle to stop if any failure causes a loss of the constant control signal. EVs will emit a warning signal to the platform (and to other EVs) if it fails to maintain speed and spacing and again will auto stop all EVs in that segment. The automated vehicle control and safety systems do not require human intervention to handle accidents, equipment failures, or sabotage.
Imagine an earthquake broke a section of the Freedom Transit roadway. The patented control system, with loss of signal, would cause all vehicles in that section to automatically stop. Vehicles heading to the broken section would be forced to exit at up to three preceding stations automatically. With stations ten miles apart all EVs would be stopped or exited within 5 minutes. The Freedom Transit control system could automatically reroute traffic around the outage. To prevent collisions, Freedom Transit's patented control process has each vehicle track a virtual slot, where all vehicles behave as one on a section of roadway, and a section is the space between two stations.
There is only one lane in each direction so the only kind of collision would be a rear end type, and the control system precludes that from happening. However, if a vehicle fails to track properly then a "watch dog" system will broadcast a failure signal and the section would shut down. The Freedom Transit systems does not allow direct access to the platform from ground level. This may not be the case with HS rail's isolated route.

Safety Concerns High Speed Rail:

- Ground level travel
- High Speed with large numbers of people at risk
- Manual and automated collision and failure avoidance

High Speed (HS) Train features an operator who man's the controls to operate the train. Safety systems halt the train if he is not at the controls. Similarly, if the train is approaching another train at too high a speed, (or is getting too close), the system will also automatically stop the train. HS trains are large and travel at over 180 mph. If there is an accident at that speed, substantial damage will be done.
Two safety issues face both HS Rail and Freedom Transit systems: collision and destruction of the track or platform. HS trains have both manual operator and automated systems. They have a signaling technology, called "positive train control" that keeps tabs on the location of the trains in operation. If a

train gets too close to the one in front of it, it slows down automatically — or shuts down altogether. A seismic tremor or act of sabotage can also trip the system. Ground level activity or incursion may be detected manually or automatically but detection may be too late to prevent a collision. The NTSB has ordered manual operation as a safety precaution because the automatic system did not detect a stopped train.

Freedom Transit is a completely automated system utilizing an elevated protected roadway. The automated system is in control at all times and will automatically manage vehicle or roadway failure. The control systems are fundamentally different. The HS Rail relies on manually or automatically receiving a stop or slow down signal if there is a problem. The Freedom Transit system vehicles will auto stop if they do not receive the continuous control signals that manage relative positions and speed.

Cost Differences

***HS* rail has a high cost for the following reasons:**

- Land acquisition
  - Securing large tracks of land
  - Blocking all cross traffic
  - Crossing traffic must go over or under
  - Route and grade considerations
- New Railroad rail bed construction (onsite)

***Freedom Transit* costs are less for the following reasons:**

- Reduced environmental impact
  - Elevated roadway allows normal land usage to continue
  - Routed over cross traffic
- Reduced land acquisition
  - Small footprint 45ft wide
  - Uses exiting Rights-of-Way
- Reduced onsite construction impact:
  - Only support columns are built onsite
  - Built in a factory and trucked to the site are the:
    - Elevated roadway platform
    - Roadbed concrete slabs installed and aligned by machines
    - Power rail installed and aligned by machines
    - Solar panels installed and connected by machines
- Short onsite construction time

Construction Example:

California has some of the most congested roads in the country and, unlike proposed high-speed rail, the Freedom Transit's small elevated foot print (only 45ft wide) would be built near or over the most congested routes first with little disruption of current roads. Expansion of the system would be financed by revenue from the high traffic routes, until the entire state was covered and links to other states created. Eventually a nationwide network would be built for electric vehicles. At that point Freedom Transit becomes the only way to practically travel distances of 500 miles or more in an electric car. California's tax share of the revenue from Freedom Transit could finance 20% or more of the state's current $145 billion budget. Development and manufacturing cost are spread across all projects.

Example: Built as a public private partnership Freedom Transit's fixed guideway toll road between Los Angles (LAX) airport and San Diego (SAN) airport.

Construction:

Route Distance 125 miles	Fixed Toll Road (125 miles and 12 stations)	Cost $4.1 billion
Access Stations: 12 stations	Solar 1.9 million solar panels, 479 Megawatts	Cost $1.0 billion
Travel Time: 54 minutes	Rental Electric Rideshare Cars 44,000	Cost $1.6 billion
Current drive time: 2.5 hrs	Total Construction	Cost $6.7 billion

Gross Annual Revenue:
Based on 30% of current I-5/405 traffic with an average trip length of 80 miles.

Fixed Guideway Fees	$1,037 million gross annual revenue
Solar Energy Fees	$1,008 million gross annual revenue
Electric Car Rental	$707 million gross annual revenue
Total Gross Annual Revenue	$2,752 million

Tax Revenue:

Annual Energy Bonus Tax Revenue	$589 million	(part of solar energy fee)
	(Used for social services as set by state legislature)	
Annual Fixed Guideway Tax Revenue	$222 million	
Total Annual Tax Revenue	$811 million	(at 30% of current traffic on I 405)

Trip Cost 48 Cents per mile per Vehicle
Includes:

- Fixed Guideway fee
- Electrical Energy fee
- Vehicle Rental (self-driving electric vehicle any body style car, SUV, lt. truck)

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LAX – San Diego Summary

- 125 miles, 12 Fixed Guideway Access Stations
- 80 mile average trip
- Avg. Travel time 35 minutes
- Avg. Trip cost $38.00 per electric car
- Avg. Trip cost with own electric car: $29.19
- Average fuel cost at $4.50 per gal $17.73

Just this 125 mile fixed guideway would generate $6.3 billion annually at 70% of current traffic and the Tax revenue would be $1.9 Billon. Eventually people would own a Freedom Transit-enabled electric vehicle (estimated average cost $18,000) and would drive from home to a Freedom Transit station, enter the systems (at which point the vehicle becomes self-driving) and then exit with, fully charged battery, at a station near the final destination and manually drive the last mile or two.

Stake Holders

Freedom Transit projects are individual projects connecting cities or metropolitan areas with a specific mileage fixed guideway toll roadway. Each fixed guideway toll roadway is a stand-alone project with revenue goals. Eventually, each project segment will connect into a nationwide network. The important point here is that each toll roadway project is a separate entity with investors and revenue based on each fixed guideway roadway. Many such projects can be in construction at the same time in the same area or anywhere in the country as each is a stand-alone project. No Freedom Transit fixed guideway toll roadway project will be constructed unless it makes economic sense. When it makes economic sense to do so, links will be crated between the separate fixed guideways ultimately crating a nationwide network. The funding for these links will come primarily from Freedom Transit International which has a stake in each project creating a superfund for network expansion. Growth of network traffic and therefore revenue will drive the decisions to link toll roadways. Some links will not initially have the traffic volume to pay for their construction so the Freedom Transit International superfund will finance construction.
Freedom Transit fixed guideway toll roadway projects will have many different types of stake holders. Various parts of the system have different investment opportunities. The three major ones are:

1. Fixed Guideway Toll Roadway – Public, Private partnerships
2. Energy coop – solar and utility power
3. Electric vehicles – providers, manufactures

The toll roadways for Freedom Transit projects are created be a public-private partnership with many participants. These partners consist of:

1. Government – Federal –State –Local
2. Freedom Transit International
3. Institutional investors
4. Small private investors (50 - $10k shares max per individual)

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These participants each have a share of the cost and a proportional share of the revenue. The propose share to each major group is outlined in the table below.

Entity	Percent share of cost	Revenue from example
Government (revenue as a 30% tax)	30%	$222 million
Government (energy saving bonus)		$589 million
Institutional	30%	$222 million
Freedom Transit International	20%	$148 million
Small Private Investors	20%	$148 million

Each $10k private investor share pays $1,822.00 annually – Based on 30% of current I-405 traffic

The government partners have the responsibility for managing rights-of-way, project approvals, zoning, construction permits and a portion of cost. The governments funding of Freedom Transit roadways is much less than the usual 90% as above it is only 30% with 70% coming from other sources.

Institutional investors such as banks, credit unions, pension funds, and partnership funds will want to have a stake in the Freedom Transit toll roadway as its return or dividend will be significant and continuous.

The purpose of the Freedom Transit business entity, called Freedom Transit International (FTI), is to license the business projects to public/private entities. The franchisee could cover a single Freedom Fixed Guideway Transit toll roadway project or cover a region with multiple Freedom Transit roadways. Freedom Transit International provides licensing and:

1. Exercise quality control over all installations
2. Enforce licensing standards:
    a. Engineering
    b. Construction
    c. Operations
3. Funding for transportation network expansion

Revenue: Fixed Guideway Toll Roadway Trip Fees per Mile

- Fixed-guideway 18.0 Cents
- Energy Used 7.0 Cents
- Energy Bonus 10.2 Cents
- Vehicle Rental 12.3 Cents
- Total Fees 47.5 Cents

4. TEAM ORGANIZATION AND CAPABILITIES

Solar Transportation Technologies, Inc. and its principal investigator, Jim Beregi, will be responsible for the work. Jim Beregi is the owner and creator of Solar Transportation Technologies. He developed the concept over many years and has a patent on the vehicle control system. He is a retired IBM advisory systems engineer with extensive programming and computer performance tuning and analysis experience. He used computer simulation of hardware and software in his work at IBM and simulating the relatively simple control hardware and algorithms is well within his experience.

5. Partnership.

Solar Transportation Technologies is looking for partners to continue the development of this innovative solution to the nation's and the world's future transportation needs.

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