

## AUTOMATED RAPID TRANSIT

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### **Introduction**

In the past 50 years the accident, death and injury rate, on a per capita basis, has remained approximately the same. This continues, in spite of all the new legislation that has been passed, all the improvements in roads and vehicles, and all the increased requirements in driver training. The reason is that cities have grown at a faster rate than improvements can keep up with. Public transit, if used by enough people, could reduce the congestion on our streets, which is the basic cause of our accident rate.

Over 80% of our population live in cities. If we are ever going to resolve some of the problems that face us, this is where we obviously must start.

### **The Problems**

1. Congested city streets.
2. Carbon Dioxide Emissions.
3. Over 40,000 deaths annually from accidents. (1)
4. Over 5,000,000 hospital stays annually by accident victims.
5. The need to conserve energy.

Why is there no outcry about the traffic casualties across the country? Could it be because it has always been there, and people are used to it? We have to travel, so we travel and take our chances. It could also be that only the most spectacular accidents are shown on the evening news. Everybody talks about it, but nobody knows what to do.

### **Traffic Congestion**

The formulae used for calculating the complexity of traffic problems is the square of the number of vehicles on routes that cross each other.

For example:

7 vehicles crossing 7 vehicles = a complexity factor of 49

10 vehicles crossing 10 vehicles = a complexity factor of 100

It can be seen from this that reducing the number of vehicles from 10 to 7 (a 30% reduction) reduces the overall complexity factor by 51%. We only need a transit system that appeals to 30% of the city's population to achieve this.

### **Carbon Dioxide Emissions**

Emissions are directly related to the amount of fuel burned. The elimination of 30% of the traffic gives the same decrease in emissions. However, it would also result in smoother traffic flow in the remaining traffic. It would also shorten the distance traveled by car for a lot of commuters. Both of these factors would result in a further decrease in emissions.

### **The Annual Traffic Death Rate**

Supporting the families of these victims with welfare payments contributes heavily to the tax burden of every community, at every level of government. Added to this is the cost of disability payments, for life, of those that survive but can no longer work. The costs of this to governments are tremendous. Additional costs are paid by the public, especially in high insurance and repair bills, and lost income from lost work time.

### **Hospitalized Accident Victims**

It is reported that traffic accidents account for more than 90% of all accidents that require hospitalization. Governments at all levels try to reduce these costs, usually to no avail. The surest way to reduce them is to reduce the number of accidents.

### **The Need to Conserve Energy**

The events of recent months should be sufficient to convince most people that our oil supplies will not last forever. The world's usage of oil is four times that of new discoveries. The law of supply and demand will cause prices to rise farther, as supplies become scarcer. Now is the time to make more of our transportation electrical, instead of oil dependent. Some of the automated systems under development will result in a saving of 70% of the energy we now used.

### **The Cure**

Provide a more sensible way for people to get around in cities. We need to build a transit system that is designed specifically to move people within a city. It has to have enough features to entice more people to use it, and leave their cars at home. These features have to include short walking distances, no waiting, high speed, individual travel, and operate in all weather. Build it, and all of these problems will begin to cure themselves. It can never be totally cured, and it can't be done in one year. However, if we made a start this year, and extended it year by year, in 15 years all these problems will be reduced by about 50%.

The cure I am talking about is Automated Rapid Transit. By this I do not mean automated trains or busses. We have not had any new form of transportation since the invention of the helicopter, and it is time to look at whatever new technology is available to us.

In the United States, an association has been formed to promote better and more modern forms of transport. This is the Advanced Transit Association, dedicated to promoting new systems that people will find convenient enough to use them in greater numbers. The main reason people shy away from public transit is inconvenience.

This Association has formulated a definition for Personal Rapid Transit (PRT) as follows: (2)

1. Fully automated vehicles operating without drivers.
2. Vehicles captive to a reserved guideway.
3. Small vehicles available for exclusive use by an individual or small group.
4. Small guideways that can be located on or above ground, or underground.
5. Vehicles able to use all guideways and stations as a fully coupled PRT network.
6. Direct origin to destination service, with no intervening stops or transfers
7. Service on demand rather than fixed schedules, 24 hours daily.

I did not have these definitions available to me when I started my project. Instead, I started with a list of things that I did not like about existing transportation, and this list led me to the same conclusions, along with a couple more. For the sake of convenience, I wanted everybody to be within a two-block walk of a station. For safety, I wanted enough emergency backup power to ensure that nobody is ever stranded. The other consideration was that it had to be something that can be built with existing technology.

All over the world, the conveyor is one of the most useful pieces of equipment that we have. It is used to move billions of items and thousands of tons of ore, coal, wheat, and almost everything imaginable every day, but very few people. While some have belts, many do not, and some of them operate at high speed. When we carry people, it is always on a belt, and at walking speed. People step on at one end, and step off at the other. Some improvements were obviously needed to carry people at higher speeds, and to allow them to get off at many points along the line.

For obvious reasons, to move people safely at high speeds we must enclose them in some kind of a vehicle. Let's say a small, flat-bottomed, lightweight vehicle, about the size of the interior of a small car, with two seats and not much else. We still need ten feet of rubber belt, fastened to the bottom of the vehicle, so we still end up with a belt, running on a conveyor system. Now, however, as we power the conveyor rollers or wheels to go faster and faster, we have a vehicle that accelerates just like the family car.

The next problem is to allow people to get on and off wherever they happen to be, not just at the end of the line. I investigated and experimented with many different ways of doing this. Most of them involved many moving parts, and were discarded. This is the part of the system that has to be perfect, because it is here that accidents can happen. I needed to have my system operate like a super-highway, to allow vehicles to enter an exit lane, before decelerating to enter the stations.

I finally came up with the answer to my problem. It basically consists of only one moving part, repeated a few times. In practice, it allows vehicles to follow one of two guide rails. One rail, on the left side, goes the whole length of the line. The other, on the right side, curves to enter an exit lane, and lead the vehicle into the next station. This gives the vehicle the ability to enter the exit lane and then slow down to proceed into the station.

I have built this device, and it is really the only new invention in the whole system. I have tested it to my satisfaction, and I am satisfied with its performance, as well as with its ability to operate for a very long time without failure or repair problems. It is also a very simple device, which makes it inexpensive and easy to mass-produce. I plan to patent it when I can afford to do so. I therefore cannot describe it in more detail, otherwise the patent would not be granted.

The last problem was to plan a station layout that would allow people to enter and leave the vehicles as rapidly as possible, while at the same time allowing elderly and handicapped passengers to proceed at their own pace, without delaying everybody else. I have settled on an arrangement whereby vehicles enter the station, stop, and move laterally to the loading/unloading platform. Passengers can take as long as they want getting on or off. Nobody is delayed, because the vehicle that is ready to depart first simply moves laterally to the departure lane. The computer-controlled acceleration system then takes it to where it merges, at full speed, with the main-line traffic.

Once I had thought of this arrangement, I found that I did not have to invent it. It has been working successfully, for many years, in the factories where automobiles are manufactured. Nobody should be too surprised that their family car traveled its first few miles on a conveyor like this, before the wheels were installed.

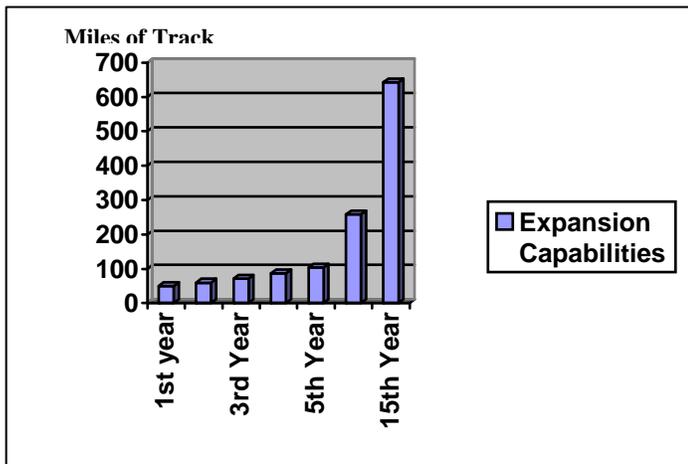
My working model has a very simple station, suitable for one vehicle to enter while another departs. This was done to keep the model as easy as possible to construct. In actual fact, this would be my last choice of where to put a station, in a real system. It would be preferable to have the main line along alleys or side streets, and have the stations close to the areas being served. Negotiations with businesses that already have parking lots, to use the space overhead for elevated stations, should not be difficult, since it could bring thousands of potential customers. Suitable stops would also include near (or even inside) large office

buildings, apartment buildings, stadiums, city parks, and shopping malls. This system design has enough flexibility to allow stations to be constructed almost anywhere, with minimum cost and problems. It has been planned in such a way that it will make travel as simple as riding an elevator.

The capacity of the first system should be 7200 vehicles per hour, which is the approximate capacity of a six-lane highway. While it is impossible to provide any firm estimate of the cost per mile, I expect it to be approximately 10 million dollars per mile. The test of this system will not be its capacity. It will be whether it makes travel convenient enough, for enough people, that transit use will increase from present levels to allow it to operate at a profit. The other obvious advantage is that it can be built in existing cities, where there is no room to expand or change existing streets, except at tremendous cost.

Based on the quoted estimate, a 50-mile system could be built at a cost of 500 million dollars. Allowing for a 20 percent profit annually, after operating and maintenance costs, with profits used to keep expanding the system, expansion would be like this:

### CAPITAL REINVESTMENT GROWTH



After fifteen years, the city would have 641 miles of operating PRT. This would continue to grow, almost 1600 miles in 20 years, and about 4000 miles in year 25, and all for a startup cost of half a billion dollars.

There are many other concepts published on the internet. Some are just that, concepts only, for which the operating equipment has not even been invented yet. Some promote huge systems, trains running on automated schedules, which I disregard, because I don't think it is what people want. Others show some promise, and two of these, one in Seattle and one in Los Angeles, are in the design stage and ready for development. All of these can be seen at a very all-inclusive website maintained by Jerry Schneider at the University of Washington. It can be seen at: <http://faculty.washington.edu/~jbs/> You will find a link to my system there also, but it can be seen separately at:

<http://www.skytrek2000.org>

You will notice that mine is the only Canadian system mentioned anywhere. If there are others, I am not aware of them. The speed I have mentioned is the speed that I think would be most practical in a city, and does not preclude the possibility of going much faster when inter-city links are built.

There is, however, a necessity to get started soon, otherwise the other Countries may get too much of a head start on us. If this happens, we may end up importing from them, rather than having our own product to export. Some of the problems I have encountered in trying to get started are:

1. Ontario Provincial R & D money was already allocated.
2. A letter to the office of the Premier of Ontario brought a response that indicated no interest.
3. My contacts with cities have brought similar response.
4. Federal money (Canada Research Council) requires me to have funds equal to any grant I might receive, and
5. I have only my pension to work with.

When any project that is new is presented to anybody at senior levels of either government or industry, it gets referred to subordinates for evaluation. There is the main problem. Just as when the computer was new, there were no experts, outside of the company that developed it, that could evaluate it. Unlike the computer, this project is too big to be able to build a full-sized model inside a building, to be put on display. There are no programs anywhere that makes R & D money available to individuals, even though the Patent Office statistics indicate that ninety-three percent of patents are filed by people who have no post secondary education. Unless something changes, my project has gone as far as it can go.

#### ENDNOTES

- (1) General news media reports.
- (2) ATRA website: [www.advancedtransit.org/](http://www.advancedtransit.org/)