

SKYWEB EXPRESS

TRANSPORTATION FOR THE 21ST CENTURY



INTRODUCING SKYWEB EXPRESS®

Skyweb Express is personal rapid transit. Passengers ride non-stop to their destination in small 3-adult vehicles. Unlike other forms of mass transit, the vehicle waits for the passenger, so there is no time lost waiting for the bus or train. PRT moves more people more rapidly using less space and for less money than any other form of mass transit.

Skyweb Express is the ideal PRT system because of its unique features:

- Independently evaluated and verified control system.
 - Honeywell Aerospace, makers of some of the most advanced control system technology in the world, found no practical flaws in the control system.
- Elevated guideways go anywhere without interfering with buses, people, trains, bicycles, or cars.
 - No need to tear up roads, parks, or buildings. Skyweb Express blends into a community instead of overwhelming it.
- Guideway post spacing provides additional room for access to green space and other landscape.

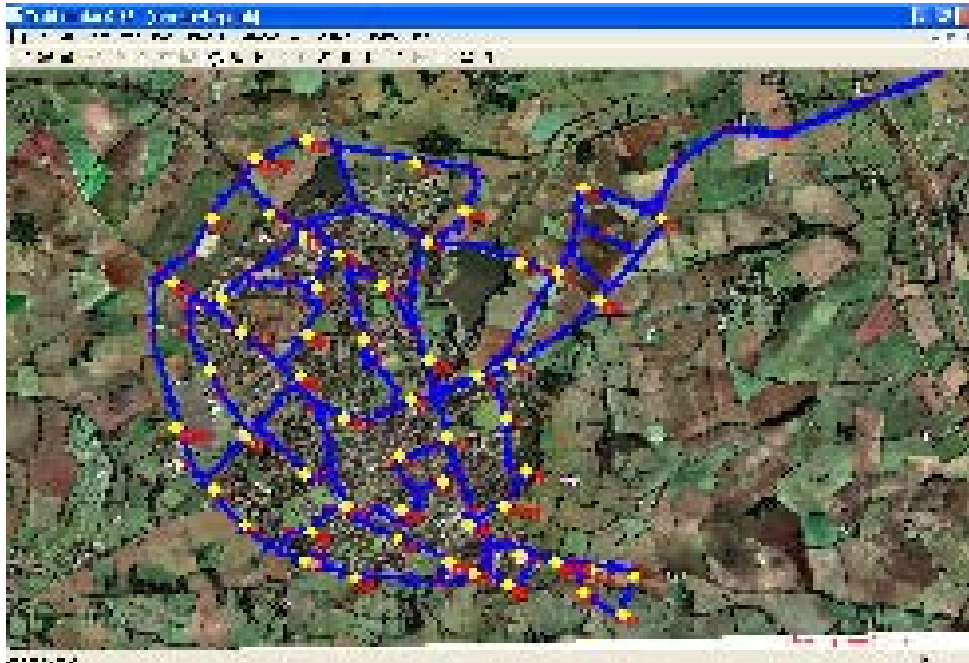
**“The European Commission has studied four potential schemes, and concluded that hesitant local authorities are the only significant obstacle.”
The Economist - March 10, 2007, Technology pp 10-12**



- Modular system allows easy expansion.
 - Expansion does not interfere with the existing system.
 - Easy access and use for people with disabilities.

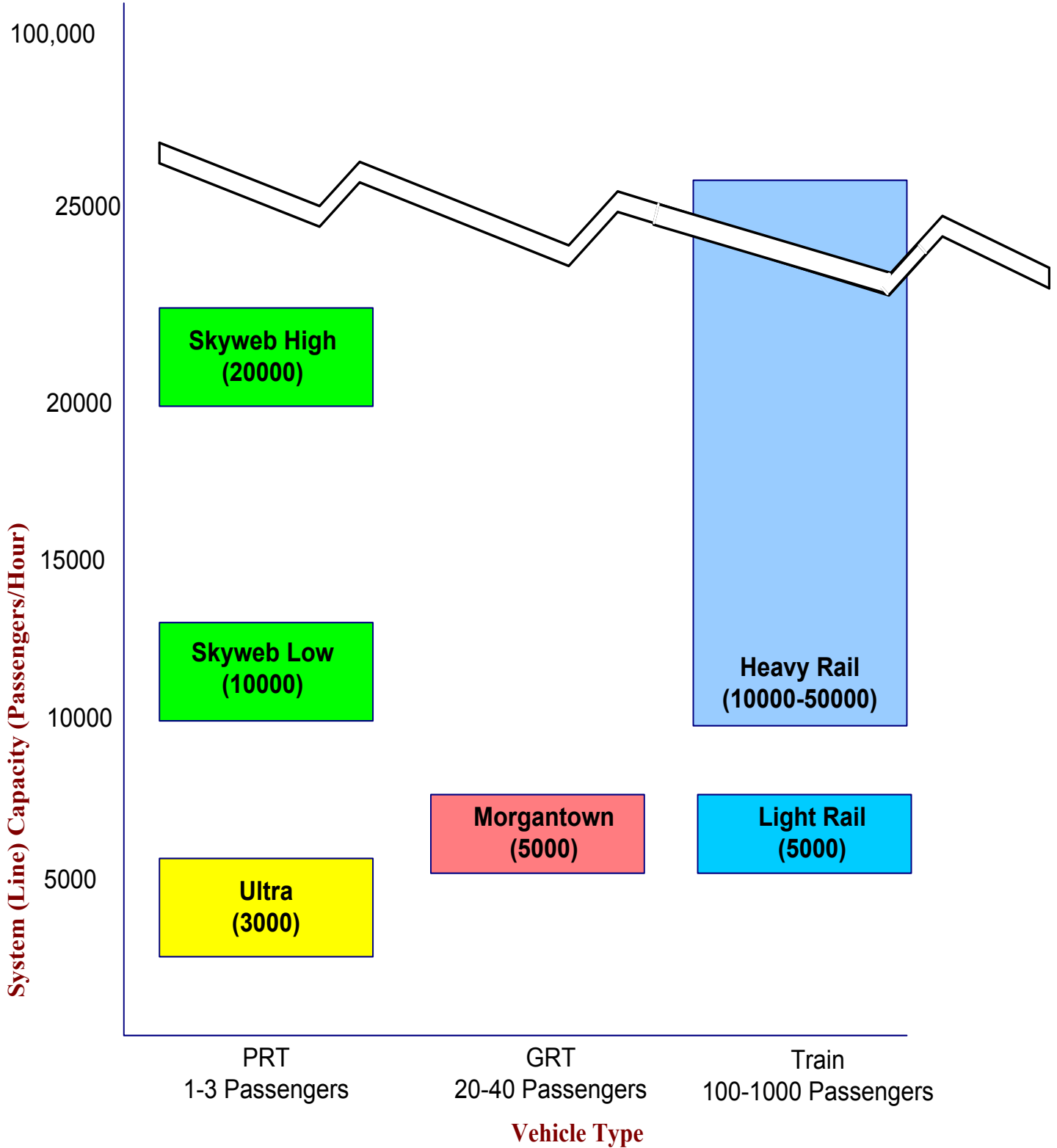


- Taxi 2000 has the tools and staff necessary to support any planning study. We use our verified control system to produce simulations using data relevant to the planned development (sample map below).



CAPACITY

- Industry best headway (0.5 seconds between passenger vehicles). This gives Skyweb Express a capacity equivalent to three lanes of freeway traffic — three times the capacity of any other PRT system.
- Freight vehicle headway at 2.5 seconds is better than passenger vehicle headway for other systems.



RIDERSHIP

A significant ridership is necessary to justify any mass transit system. The output table on page 5 shows a ridership study conducted by Wilbur Smith Associates demonstrating the ridership advantages of Skyweb Express. This particular study was for a municipality with nearly 1,000 traffic analysis zones and a projected local population of nearly 1.8 million people. The study concluded demand for Skyweb Express would be more than 84,000 trips per peak period and up to 250,000,000 transit trips per year, which was 24% of the expected transportation demand.

“Riders will use public transit only if it goes where they need to go.”

To optimize system layouts and fleet size, Taxi 2000 performs an iterative evaluation using our professional planning tool, TrakEdit. This is our proprietary software. It allows our clients to evaluate many different scenarios to find the best possible network solution and its probable ridership implications. TrakEdit is based on a control system whose viability is already confirmed.

Riders will use public transit only if it goes where they need to go. The Skyweb Express system has the ability to provide that level of service, even over long distances, due to its in-track power source. This means no difficulties in expanding or creating longer routes. Skyweb Express offers the convenience of personal transit without the traffic congestion.



- In a metropolitan area of approximately 1.8 million people:
- Up to 84,000 vehicles off the road every hour

Scenario Number	1	2	3	4	5	6	7	8	9	10	11	12
Unit Cost*												
Parking	\$1.10	\$1.10	\$1.10	\$1.10	\$1.10	\$1.10	\$1.10	\$1.10	\$1.10	\$1.10	\$1.10	\$1.10
Skyweb Express	\$0.55	\$0.55	\$0.55	\$0.55	\$0.82	\$1.10	\$1.90	\$0.55 dist/v2)	PRT dist*0.5	\$0.55	\$0.55	\$0.55
Auto Characteristics												
Auto Person Trips	236,816	240,505	252,608	252,516	264,568	275,502	298,681	258,290	246,984	273,412	252,608	244,791
Auto Person Trips along PRT Route	97,057	100,969	101,761	113,438	126,204	137,785	162,338	119,491	117,361	134,946	113,536	113,537
Auto Vehicle Trips	223,172	227,050	227,050	239,326	252,024	263,551	288,001	245,357	235,488	260,565	239,424	232,661
Vehicle Occupancy	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Distance Travelled (Km)	403,205	405,664	405,664	418,024	426,197	433,970	450,582	422,508	421,367	441,042	418,042	700,738
Travel Time (Hours)	57,188	57,799	57,799	60,853	63,316	65,833	72,099	62,144	61,830	68,388	60,861	57,456
Skyweb Express Characteristics												
Track Length (Km ²)	275	275	275	275	275	275	275	275	275	275	275	275
Person Trips	85,427	81,738	69,635	69,727	57,678	46,741	23,562	63,953	73,700	488,30	69,638	76,397
Vehicle Trips	84,794	81,139	69,325	69,417	57,433	46,556	23,489	63,701	65,693	488,13	69,325	69,325
Vehicle Occupancy	1	1	1	1	1	1	1	1	1.1	1	1	1.1
Distance Travelled (Km)	956,667	911,813	911,813	696,184	557,806	434,154	176,880	619,027	861,578	281,387	695,201	866,660
Travel Time (Hours)	159,44	151,97	151,97	116,03	92,97	7,236	2,948	10,317	14,359	4,690	11,587	14,444
% Riders Using Skyweb in Region	27	25	22	22	18	15	7	20	23	15	22	24
% Riders Using Skyweb near route	47	45	41	38	31	25	13	35	39	27	38	40
Environmental Issues												
Automobile Energy Consumption (liters)	573,565	576,674	576,674	592,185	603,056	613,699	638,281	597,936	567,538	624,316	592,227	570,318
Automobile Output HC (Kg)	84,047	84,984	84,984	84,984	84,984	84,984	84,984	92,001	85,099	102,181	89,896	84,892
Automobile Output CO (Kg)	9,209	9,293	9,293	9,293	9,293	9,293	9,293	9,904	9,208	10,734	9,728	9,220
Automobile Output NOx (Kg)	5,208	5,226	5,226	5,226	5,226	5,226	5,226	5,345	5,134	5,470	5,316	5,167

Total number of people in vehicles

Actual number of vehicles used

Total percentage of potential riders using system

Percentage of potential riders who live near network and use system

* Original study was done in a different currency

THE SKYWEB EXPRESS CONTROL SYSTEM

The control system architecture makes Skyweb Express efficient in layouts as small as a few kilometers or as large as 300 kilometers (see Independent Evaluation on page 7). This control system is a Taxi 2000 proprietary software application that monitors, manages, and controls the Skyweb Express network of vehicles and guideway.

Taxi 2000 has simulation software (TrakEdit) to allow design and evaluation of a Skyweb Express layout. TrakEdit allows Taxi 2000 to design systems with a complex layout utilizing thousands of vehicles and many kilometers of guideway with stations located throughout the system. TrakEdit allows stations to be biased towards having more vehicles arriving or departing and allows unbalanced system loads that might be expected during a morning commute.

Taxi 2000 also has a dynamic working model known as the Alpha Control System or “Alpha.” Alpha is a 1/15th scale system with 20 electrically powered vehicles moving along a two-loop, three-station track. The vehicle positions are measured with magnetic markers located along the track that sense vehicle wheel encoders. Alpha uses a wireless communication system between vehicles and the control system.

Alpha System

The Alpha system showcases the Skyweb Express control system. The control system directs 20 physical vehicles with 3 off-line stations, uses wireless communications, and is shown in tandem with the TrakEdit software. The line speed is approximately 0.7 meters per second or a scaled equivalent of 40 mph. Faster speeds are obtainable in an actual system depending on network layout.

The system demonstrates:

- Multiple vehicle control on an exclusive guideway.
- Safe merge and diverge operations.
- Vehicle control at safe headways.
- Effective use of wayside markers to calibrate vehicle position.
- Accurate algorithms for determining demand.
- Control system communications with the vehicles are in real time.

The Taxi 2000 control system specifications were used to construct the TrakEdit program. This simulation tool has been part of the Taxi 2000 proprietary technology for over 15 years. The control system was applied to Alpha to demonstrate safe vehicle operation at small headways. The control system directs the vehicles to and from the three stations according to a randomly generated demand table. An available video demonstrates 20 vehicles at 1:15 scale running on a track with two loops, three stations, and one maintenance / storage facility.

Alpha played a key role in validating the Skyweb Express control system software. Our control system, TrakEdit, and Alpha allowed Honeywell Aerospace to perform an independent control system evaluation.

The Honeywell Aerospace Independent Evaluation Results*

After a thorough evaluation of the Taxi 2000 control system, Honeywell Aerospace concluded there are no conceptual flaws. They state it is reasonable to assume the development of an operational (commercial) system will meet the requirements and replicate the current performance and operating parameters. Details supporting this conclusion are as follows:

- The control system architecture is sensible, based on multiple subsystems (in this case, a central controller, multiple zone stations, and vehicle controllers).
- The commands to accomplish maneuvers are flexible enough, at this stage of development, to handle a variety of scenarios because the movement commands are specified by correct kinematic relationships.
- The existing algorithms and logic to merge and diverge vehicles is developed to an appropriate level.
- The use of magnetic markers combined with wheel encoders for positional navigation is viable.
- TrakEdit and Alpha demonstrate, at a very high level, that the control system concept is capable of handling large and fairly complicated traffic networks. The simulations do not reveal any traffic planning issues that could prohibit scaling to an operational (commercial) system.

“There are no inherent limitations in the control system architecture or algorithmic complexities that preclude the ability to achieve a headway as low as 0.5 seconds”

* Evaluation completed April 30, 2007

A major focus of the Skyweb Express system is in the area of safety. Honeywell evaluated the ability of the Skyweb Express control system to maintain a safe headway in an actual operating scenario. Quoting from their report: **“there are no inherent limitations in the control system architecture or algorithmic complexities that preclude the ability to achieve a headway as low as 0.5 seconds.”**

By operating a multiple vehicle multiple station scale model, the control system specifications add something new to transportation feasibility studies and demonstrate the capability of the Skyweb Express transportation system and the Taxi 2000 technology.

FEASIBILITY STUDY

Taxi 2000 recently completed a feasibility study for the implementation of a large scale system where ridership estimates were as much as 85,000 trips per peak hour. Our TrakEdit simulation program and Alpha played a key role in this study.

Ridership

The ridership, as part of the feasibility study, based on data generated in an EMME/2 (civil engineering software) model with approximately 1,000 Transportation Analysis Zones (TAZ) generated the ridership simulation used by Taxi 2000. The data was used to evaluate the route, number of vehicles, station sizes in each TAZ, wait time at a station, and guideway saturation. Taxi 2000 used this data to optimize the Skyweb Express system. After multiple iterations an optimal system emerged. This information was then used to test ridership sensitivity to issues such as walking distance to stations, fare pricing, and transferring to other forms of transit, including automobiles. This data was applied to the TrakEdit simulation tool and multiple ridership scenarios were created as part of the feasibility study.

The ridership data also plays a critical role in the decision-making process when evaluating Skyweb Express as it relates to implementation costs. Optimizing the system leads to the calculation of a meaningful cost structure. This cost structure for the Skyweb Express system can be compared to the number of anticipated riders versus the number of riders using other forms of transportation. This reinforces system value and the comparison is valid as long as the simulation is accurate.

THE VEHICLE

The Skyweb Express vehicle is aesthetically pleasing and highly functional. The cabin is comfortable and roomy enough for three adults. The cabin uses guideway power to heat or cool the vehicle. There is also space for luggage, groceries, shopping bags, or other items.

The Cabin

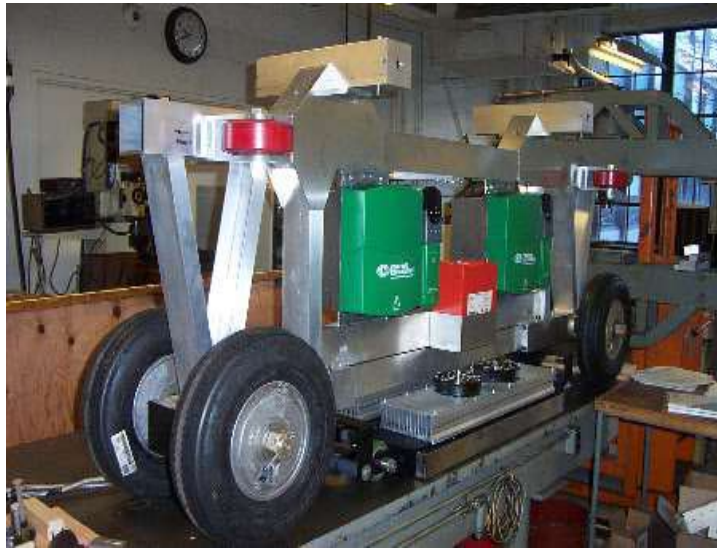
The entrance and available floor space make it completely handicap accessible as defined by the Americans with Disabilities Act (ADA). Of course, the cabin can be remodeled as necessary to comply with local or regional standards.



The passenger interface contains three action buttons; “Go,” “Next Stop,” and “Emergency.” A passenger pushes the “Go” button after confirming the destination on the internal screen. This causes the door to close and the trip begins. Pushing “Next Stop” programs the vehicle stop at the next station. Passengers might use this because they chose the wrong destination, or perhaps forgot something. Pushing “Emergency” contacts the central control station, allowing the staff to communicate directly with the passengers to determine the nature of the emergency and the proper course of action.

The upper screen displays the current route and its progress. The lower screen displays advertisements or any other information the municipality chooses.

The Chassis



Actual chassis in operation at our Research and Development facility.

The chassis uses linear induction motors (LIM). LIM propulsion offers many advantages over any other system:

There are fewer moving parts, meaning less maintenance cost.

- The LIMs provide the primary braking system. This reduces maintenance cost and adds to safety.
- LIM propulsion is not impeded by atmospheric conditions such as moisture, dust, and salt.
- The LIMs are powered by a continuous electrical source, they do not require recharging. This means far fewer vehicles are required to achieve high ridership capacity and long range transport capability. Each of these advantages makes Skyweb Express cost effective, environmentally efficient, and highly adaptive.

Skyweb Express is cost effective, environmentally efficient, and highly adaptive.

STATIONS

Stations range in size from 3-berth stations to 12-berth stations, and can be constructed outside or built into an existing structure. When a passenger arrives at the station, he or she swipes a fare card through the reader, enters the destination code, and then gets into the waiting vehicle. Once inside the vehicle, the passenger confirms the destination on the screen and presses “Go.” The door closes and the control system takes over, sending the passengers non-stop to their destination.

As station size increases, so does its capacity. See the table below.

Off-Line Station Capacity Berths	Vehicles per Hour
3	350-450
6	675-775
9	950-1050
12	1150-1250

Capacity Example:

A simple 10 Km network with 20 stations. Assume the network has five 3-berth stations, five 6-berth stations, five 9-berth stations, and five 12-berth stations. This system can handle up to 15,000 trips per hour. That is nearly 15,000 vehicles per hour that are NOT on the road.

These stations can be both functional and aesthetically pleasing. They also are modular, so they can be expanded in the future as ridership increases. Modularity is a significant part of the guideway technology described later in this brochure.



COMMUNICATIONS

The Skyweb Express communication system fulfills three functions. First, it allows automatic communication between the control system and the vehicles. Second, it allows two-way audio communication between passengers and control center staff. Finally, it allows the system to provide video advertisements or entertainment to the passengers.

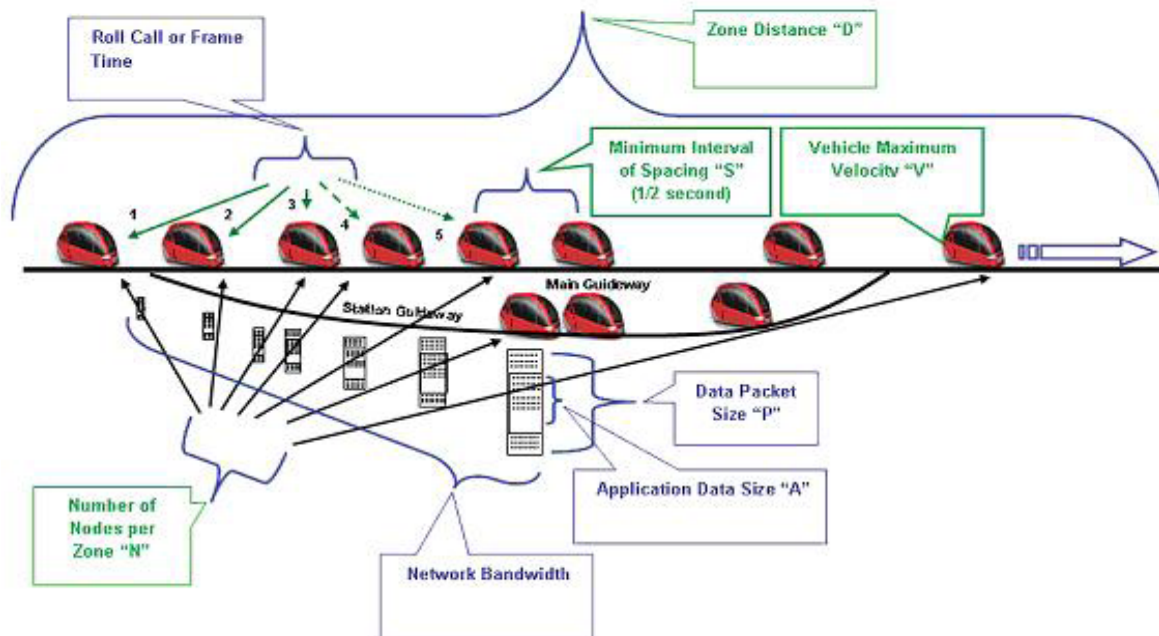
“The materials required to achieve the required specifications are commercial off the shelf (COTS) technologies.”

-Honeywell-

Communication between passengers and Central Control personnel is two-way for audio and can be initiated by either party. Video is determined when the passenger swipes their card. The system determines what should be shown based on the length of their trip and their destination.

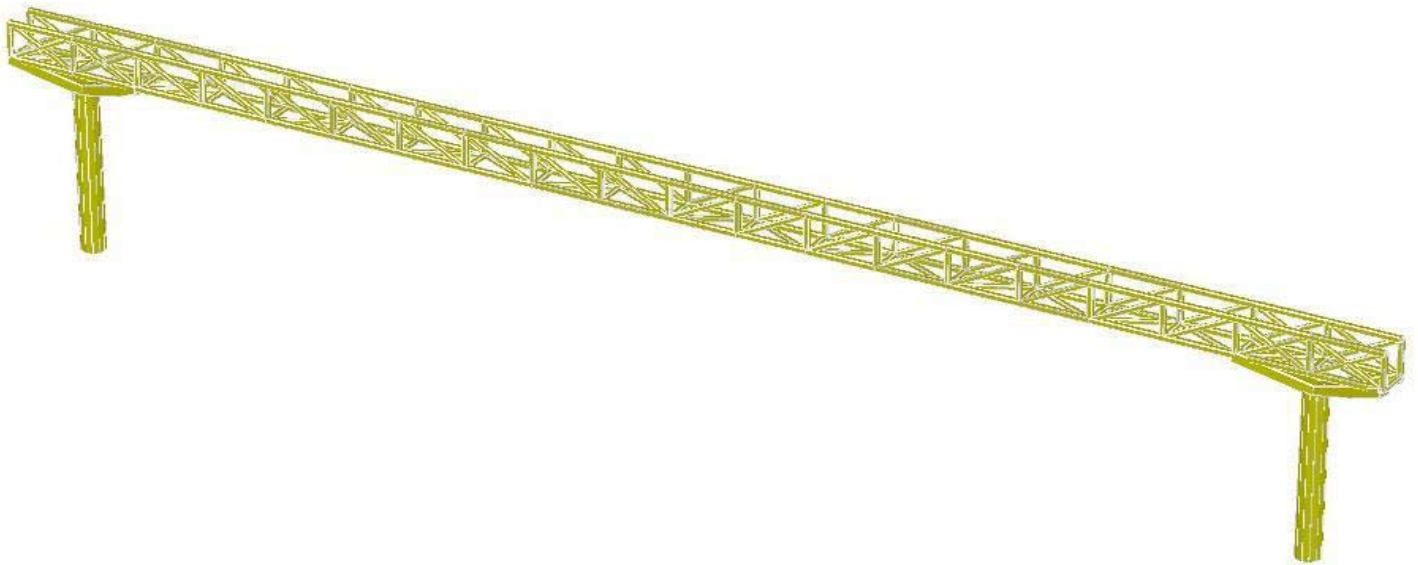
Using a real time server, the system meets the specifications required to allow the 0.5 second headway and is redundant. The communications specification also includes a requirement for preventing outside breaches or interference.

VCN Relationships and Dependencies Diagram



THE GUIDEWAY

The Skyweb Express guideway allows for modular changes and expansion to the system so it can grow and change to fit a community's changing needs. A series of posts placed anywhere from 15 to 30 meters apart support a truss carrying the vehicles. The trusses are approximately one meter wide and one meter tall. A cover protects them from weather and vandalism and makes the system more aesthetically pleasing.



The most significant feature of the guideway system is its modularity. This means a system can start small and expand or change with time. For example, a recent Skyweb Express feasibility study begins with a 10 Km network and expands over time to nearly 300 Km. This allows the system to adapt to municipal growth. Just as importantly, changing and expanding the system does not require shutting down large portions of the network.

Stability for the system is provided by building a reinforced concrete base and sinking it into the ground. Then the support post is bolted into the concrete. This provides an extremely stable support system that is also easy to adjust.

The guideway covers fill many functions. It protects both the guideway and the vehicle chassis from debris, helps prevent vandalism, and allows the municipality to make the system more visually pleasing.



POWER

Skyweb Express uses a redundant in-track power supplied by the municipality's existing power grid. An on-board battery can power the vehicle in the event of a system-wide power outage. As an alternative, a municipality may select a different backup power source. This combination means Skyweb Express vehicles can travel nearly any distance without compromising safety or reliability. In-track power also provides the climate controlled comfort passengers require. The following table describes three different power usage scenarios with climate controlled vehicles:

	18 Km System	275 Km Low Demand	275 Km High Demand
Trip Km/Year	75,300,000	952,990,000	2,816,640,000
Annual Electrical Consumption — Vehicle Kwh/Year	25,884,705	327,591,000	968,220,000
Annual Electrical Consumption — Building Kwh/Year	6,681,833	46,464,300	58,560,300
Annual Electrical Consumption — Total Kwh/Year	32,566,538	374,055,300	1,026,780,300

According to a recent feasibility study, the 1,026,780,300 Kwh per year is approximately 4% of the total power grid for the Municipal area of 1.8 million people. This is 66% less power per passenger mile than LRT.

GREEN TECHNOLOGY

Skyweb Express is a green technology. Skyweb Express will help meet a significant sustainability challenge using technology that is commercially available today. Vehicle traffic is one of the human contributors to the continued growth of greenhouse gases, including carbon dioxide (CO₂), in urban regions. Vehicle traffic continues to increase.

Each gallon of gasoline burned adds nearly 20 pounds of CO₂ to the atmosphere. In the United States, motorized vehicles are a major contributor to air pollution. These vehicles produce 63% of the key chemicals (carbon monoxide, nitrogen oxide, and hydrocarbons) that cause smog and health problems.

Skyweb Express uses commercially available technology. Building a Skyweb Express system in an urban setting has the potential to significantly reduce CO₂ and other emissions in the environment. A recent transportation study for an urban area of 1.8 million people concluded that 24% of all vehicle trips – or 250 million vehicle trips per year – would be accommodated by Skyweb Express. This reduction is estimated at over 80 million gallons of gasoline per year and a reduction of over 1.5 billion pounds of CO₂ emissions each year.

Road Reduction

Building roads is a growing part of every community budget. This uses natural resources to make asphalt, cement, concrete, and paint. It also creates pollution in the form of VOCs, fuel exhaust, and other solid and gaseous waste. A single Skyweb Express system can eliminate the need for up to three freeway lane miles for every Skyweb Express mile built.

Smaller Transportation Footprint

Skyweb Express leaves a smaller transportation footprint than a freeway. The Skyweb Express guideway is only five feet wide. Along with eliminating the need for three lanes of highway, Skyweb Express also reduces the need for parking spaces. All of this is land which can be used in more environmentally friendly ways. The following graphics show Skyweb Express compressing vast freeway use into a small area.



These vehicles produce 63% of the key chemicals (carbon monoxide, nitrogen oxide, and hydrocarbons) that cause smog and health problems.



Skyweb Express offers the convenience of personal transit without the traffic congestion.

SKYWEB EXPRESS

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