Maglev - Electro-Magnetic Suspension · Guidance · Propulsion

MagneMotion

A Force in Electro-Magnetic Systems

Urban Maglev System

The MagneMotion Maglev System ***"M3"*** is designed as the "Green" alternative to all conventional guided transportation systems.

Efficient Linear Synchronous Motor (LSM) propulsion and control enables small, closely spaced, light weight vehicles to meet passenger capacities of 12,000 people per hour per direction at an estimated cost of $30M per km of dual guideway (after land acquisition and station costs). Operational costs are reduced with automated controls, reduced power requirements, and regenerative braking. Trip times are reduced with higher accelerations and greater vehicle density.

Figure 1: Artist Rendering of Concept Vehicle Design

The M3 System:

- ***Decreases travel time by at least a factor of two:*** Speeds up to 45 m/s (162 km/hr) and rapid acceleration and braking up to 2 m/s^2 combine to shorten trip time. Smaller vehicles, and many of them, allow for optimum traffic flow and reduces the time passengers spend at stations.
- ***Decreases operating cost by at least a factor of two:*** Lower energy consumption, automated controls, and fewer moving parts leading to higher reliability and maintainability, all contribute to lower operating costs. Energy requirements are lower because smaller, lighter vehicles require less propulsive force to achieve the desired acceleration and velocity; propulsion power is only required on track sections occupied by a vehicle; and much of the moving magnetic field is generated by permanent magnets on the vehicle rather than less efficient, energy consuming electro-magnets found on competing systems. Energy consumption for ***M3*** is estimated at 60 Watt hours per passenger kilometer; less than half the energy intensity of any rail-based transportation system.[1]
- ***Reduces guideway cost by at least a factor of two***: Guideway stiffness and weight is minimized by using small, light weight vehicles. Permanent magnets onboard the vehicle provides a 20 mm magnetic gap, which opens up mechanical tolerances and reduces guideway fabrication costs further.
- ***Reduces environmental impact:*** ***M3*** is powered with no need for catenaries or third rails. The frictionless drive generates no perceivable noise and the small vehicles and matching guideway are unobtrusive. For communities seeking an efficient public transportation, which is aesthetically pleasing and quiet, ***M3*** offers unparalleled results.
- ***Provides an intelligent control system based on proven Linear Synchronous Motor (LSM) technology:*** Propulsion, position sensing, and control logic are located on the guideway, so there is no dependency on external signals or wireless communication between the vehicle and wayside. Built-in, anti-collision features eliminate many common modes for accidents, and the higher level control knows the precise location of all vehicles on a system within a fraction of a meter.
- ***Provides excellent ride quality:*** The essence of maglev technology is a levitated, frictionless drive system that is propelled by magnetic forces alone. Unlike other systems, ***M3*** requires no wheels, brushes, or mechanical dependencies. Lateral stability is maintained with electro-magnetic forces, and the guideway is specifically built to accommodate the interaction with the vehicle. Moreover, the control system, which monitors the movement of every vehicle, ensures that changes in acceleration and velocity never exceed the ISO standard for ride quality.
- ***Creates a very safe and secure transportation system:*** A dedicated guideway with vehicles that cannot derail, energy transfer that doesn't rely on catenary lines or third rails that may present a shock hazard, redundant linear motor propulsion that does not depend on wheel adhesion or friction, and totally automated operation with anti-collision logic provides a comfortable, secure, and safe ride.

The top down system design was achieved by taking advantage of MagneMotion's patented permanent magnet EMS design and advances in existing technology, including: improved microprocessor-based power electronics; high-energy permanent magnets; precise position sensing; lightweight vehicles; a guideway matched to the vehicles; and the ability to use sophisticated computer-aided design tools for analysis, simulation, and optimization.

For urban applications, a baseline vehicle with two compartments (see Figure 2) has been designed to carry 24 passengers seated with room for 8 standees. This baseline vehicle has an 18 meter turn radius and can climb a 10% grade, making it ideal for city environments with established rights of way. Larger vehicles can be built by adding 20 person passenger compartments (see Figure 3). This enables city planners to increase throughput, although it will compromise some of the cost benefits of a smaller vehicle system. System operation can be optimized by reducing the number of vehicles during off peak hours or using more vehicles during peak hours.

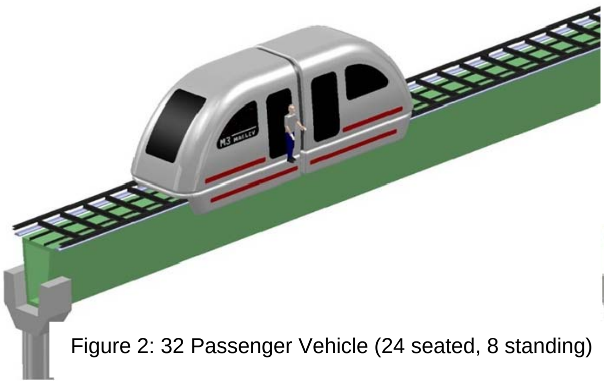

Figure 2: 32 Passenger Vehicle (24 seated, 8 standing)

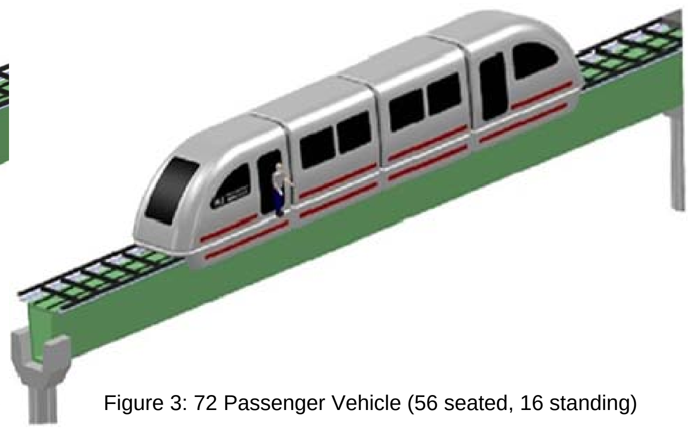

Figure 3: 72 Passenger Vehicle (56 seated, 16 standing)

M3 Development Effort:

Figure 4: Demonstration System at MagneMotion

M3 has been designed, fabricated, and tested on a 48 meter test track at MagneMotion headquarters. The demonstration system utilizes full-scale components. Figure 4 shows the 4,500 kg test sled that is capable of carrying a 20 passenger vehicle compartment. The test sled was tested at 9 m/s, a speed only limited by the length of the indoor track.

M3 development has been funded as part of a cooperative agreement between MagneMotion and the Federal Transit Administration. A second demonstration system is being fabricated and is scheduled to be installed and tested outdoors at Old Dominion University in Norfolk Virginia in late 2011.

[1]Based on data in the U.S. Department of Energy publication Transportation Energy Data Book, Edition 29, 2009.

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