

# “Dispelling the Top Ten Myths of Maglev”

by

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## “Dispelling the Myths of Maglev”

### Overview

In keeping with the objectives of the newly established North American Maglev Transport Institute (NAMTI), this paper will discuss — and attempt to dispel — a “top ten list” of the more common myths that have arisen in the surface transportation industry surrounding high-speed magnetic levitation technology, namely:

1. It's too expensive to build and operate
2. It's just another type of train
3. It'll replace automobile travel
4. It's still in the experimental stage of development
5. It's not safe or reliable
6. It can't carry freight/cargo
7. It can't do anything a conventional train cannot do
8. It's incompatible with rail infrastructure
9. Its magnetic fields are harmful to passengers
10. It's noisy and “belches” CO<sub>2</sub>

These myths have come about from misinformation (and disinformation) that's been around for many years. Given maglev's long history in development and its rather short history in commercial service, it's not surprising that these myths continue to survive, and in some cases flourish, even today. Let's take them one by one.

### 1. Maglev's too expensive to build and operate

When planned properly, meaning when it can be matched to the terrain to take advantage of its performance abilities, maglev construction is no more expensive — and in some cases, significantly less expensive — than conventional steel-wheel-on-steel-rail systems. The best example of this assertion can be found in the United Kingdom, where the UK Ultraspeed project [www.500kmh.com](http://www.500kmh.com) is located.

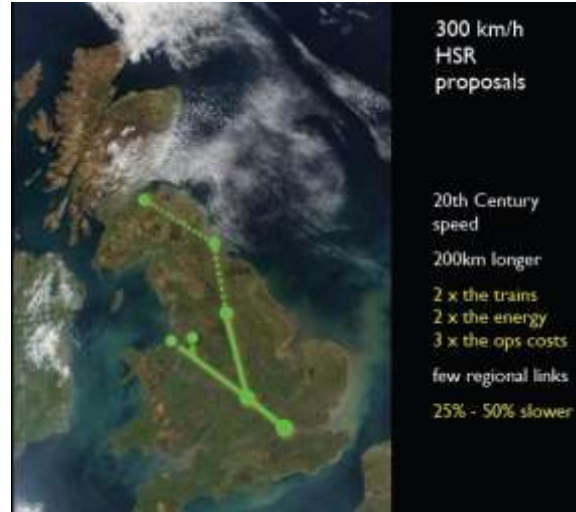
In laying out a route, shown at right, the project serves all nine specified stations from Glasgow to London, including six airports, along the single line for a projected construction cost of £19billion (US\$29 billion).

Contrast this service profile and cost with that of conventional European high-speed trains, capable of 330 km/h (205 mph) speeds, proposing to service the same cities and airports.



## “Dispelling the Top Ten Myths of Maglev” (continued)

In such a case, the service profile looks quite different, as shown at right. In short, due to limitations in train performance, specifically in speed, acceleration and grade-climbing, TGV-style wheel-on-rail trains cannot readily cross the Pennines without a prohibitively expensive very large-diameter, twin-bore tunnel (say 30 km/19 miles, costing roughly £1.86 billion (US\$2.8 billion) just for the tunnel). However, maglev gradient and curve parameters permit an *overground* route alongside the M62 highway, avoiding any new intrusion into the sensitive parkland areas.



One single rail line cannot accommodate the same number and spacing of station stops, so the line must be split into a “Y,” causing several things to come about: an extra 200-km (125-mile) extension to the route; a need for additional trains to service the split route; many unserved stations; additional energy and operations costs from the added trainsets; and additional projected capital costs of £29billion (US\$44.4 billion), fifty percent more than the capital cost for maglev.

It stands to reason, also, that using twice the number of trainsets with their additional manning and energy costs, means that operating costs for the high-speed rail system are projected to be on the order of 50-60% more than maglev’s operating costs.

Hence the marketing phrase in use today in the UK: “Faster, Better, Cheaper, and Greener.”

### 2. It’s just another type of train

Well, yes and no. Strictly speaking, a train can be “a line of railway cars coupled together and drawn by a locomotive,” or “a procession (of wagons or mules or camels) traveling together in single file.” In that sense, a multi-section maglev can be loosely referred to as a train. However, maglevs can be better compared to airplanes without wings, given their light vehicle weights, fast acceleration and travel speeds and sleek, futuristic body shapes.

### 3. It’ll replace automobile travel

If the replacement of automobiles were the mission for maglev, all would already be lost. Not only are Americans forever wedded to their cars, the real replacement target for maglev is short-haul airline flights. Reports from as far back as 1989 — Argonne National Laboratory’s Maglev Vehicles and Superconductor Technology: Integration of High-Speed Ground Transportation into the Air Travel System and the late Senator Daniel Patrick Moynihan’s (D-NY) Maglev Technology Advisory Committee’s final report, Benefits of Magnetically Levitated High Speed Transportation for the United States (Senate Report 101-47) — called out the many benefits to replacing airline flights of

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approximately 300-1,000 km (200-600 miles) with maglev high-speed ground transportation systems.

### 4. It’s still in the experimental stage of development

This argument used to be relevant, since Germany and Japan began experimenting with maglev systems back in the 1970s. However, two recent developments have changed the concept.

- In 2003, the city of Shanghai, China inaugurated the world’s first high-speed maglev route, using Germany’s Transrapid system to connect Pudong International Airport with its urban financial district some 30 kilometers (19 miles) away. In the ensuing years, the system has been notable for its high speed — attaining 430 km/h (267 mph) — in daily service and its to-the-second on-time performance over its 7.5-minute trip times.
- In 2009, the Japanese government and Central Japan Railway Company announced that JR Central would commercialize their own high-speed superconducting maglev system, called the “Chuo Shinkansen,” starting in 2025.

Given the time and attention spent by Germany and Japan on evolving and perfecting the required subsystems and system-level approaches inherent in such large-scale transportation systems, it is no longer accurate to say that maglev is still in the experimental stage of development.

### 5. It’s not safe or reliable

In the previous point/myth, we mentioned the long time that maglev has spent in development. Both Germany and Japan set up full-scale testing facilities in their respective countries starting in the 1980s, and in the intervening years have together carried some 560,000 passengers some 1.8 million kilometers/1.1 million miles along the way. Discounting an unfortunate fatal accident in Germany (caused by human error) in 2006, these many thousands of passengers have been carried safely and reliably with no major accidents or system-related fatalities.

Shanghai’s enviable record of on-time performance in daily revenue service -- 99.98% measured to the second -- is further testament to the reliability of high-speed maglev technology, having carried more than 8 million passengers since its opening in 2003.

### 6. It can’t carry freight/cargo

From the outset, Transrapid maglevs have been internally configured to accommodate standardized air freight / express shipping containers, as shown on the right. A full-length Transrapid -- up to as many as 20 sections -- can carry just over 19 U.S. tons per section, or could therefore carry as much as 386 U.S. tons of air cargo



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in one vehicle.

Some years ago, port facilities in Southern California acted as the leading edge in investigating the use of high-speed maglev systems for carrying seaborne cargo containers. The resulting studies identified some characteristics of such a system:

- It could carry single 40-foot (12.2-meter) containers or two 20-foot (6.1-meter) containers in either single- or double-stack configurations (as shown below) operating as often as three-minute intervals along a given route.

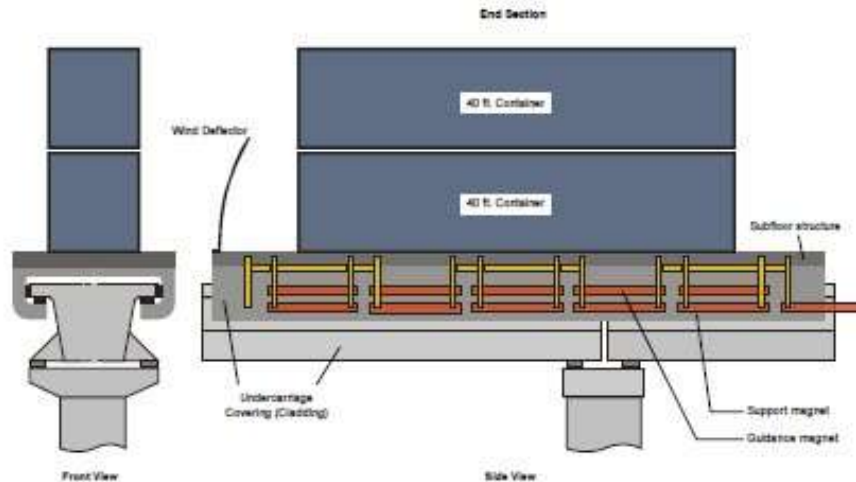


Figure 3.1 – Transrapid Freight Vehicle Concept (Double-Stack Configuration)

- Assuming the standard 40-foot (12.2-meter) container, a 20-section vehicle consist would be able to carry up to 20 full containers in a single-stack configuration or up to 40 partially loaded containers in a double-stack configuration. With 3-minute operating frequencies, single-stack and double-stack operations would be able to transport up to 400 and 800 containers per hour, respectively, in each direction. In summary, the chart below lists maximum capacities for such a system.

Operating Configuration	Consist Length	Containers			
		Per Consist	Per Hour <sup>(1)</sup>	Per Day <sup>(1,2)</sup>	Per Year <sup>(1,2)</sup>
Single-Stack	20 sections	20	400	8,000	2,920,000
Double-Stack	20 sections	40	800	16,000	5,840,000

(1) Capacity in each direction.

(2) Assumes 20-hour per day operating period.

### 7. It can't do anything a conventional train cannot do

This claim, seen most often in rail news or blogs/comment sites, is understandable at some basic level, especially as it relates to speed. After all, when TGV trains can be set up to run in specially designed test situations at speeds of 574.8 km/h (357.2 mph), a rail proponent can claim that trains are “just as fast” as maglev -- even though the Japanese superconducting maglev holds the Guinness world record speed of 581 kilometres per

## “Dispelling the Top Ten Myths of Maglev” (continued)

hour (361 mph), achieved in Japan in 2003, 6 km/h (3.7 mph) faster than the TGV speed record.

In commercial practice, no train in the world could match the speed and acceleration performance of the Shanghai Transrapid in its airport demonstration line, as mentioned in myth #4, holding its top speed of 430 km/h (267 mph) for a full minute during its 7.5-minute daily one-way trips.

### 8. It’s incompatible with rail infrastructure

This is another claim that’s seen most often in rail news or blogs/comment sites, especially in California, and it’s more true than not. In a physical sense, of course it’s true, since the wrap-around shape of Transrapid’s vehicle and its companion T-shaped guideway beams, at least, cannot conform to the flat railbed -- either in shape or loading profiles -- used for conventional trains.

However, this “incompatibility” only comes into play if the maglev and rail systems are supposed to travel on the same infrastructure. They typically aren’t. Compatibility will come in stations, where travellers can transfer from a rail route to a sealed maglev route, free to travel at very high speeds without the worry of accidents or travel delays caused by commuter trains, slower intercity trains or freight trains using the available right of way.

### 9. Its magnetic fields are harmful to passengers

In Shanghai, expansion plans for the airport-connector maglev were put on hold after citizen protests in 2007 voiced concerns about maglev’s perceived noise (see next topic) and magnetic-field emissions. This is a red herring for Transrapid as well as the Japanese superconducting maglev, since their magnetic field exposure levels -- considering direct as well as alternating current profiles -- are well below internationally accepted health standards for passengers and maintenance workers.

A typical profile for Transrapid that has been measured in the field is shown below.

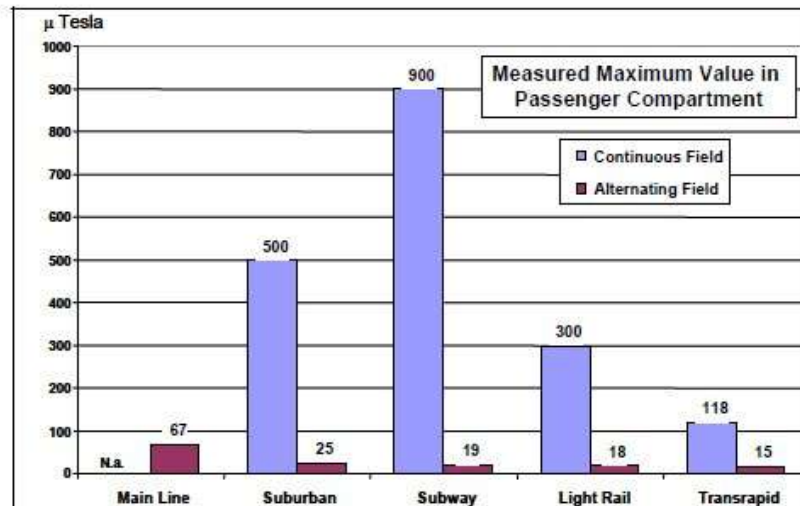


Fig. 5: Comparison of Emission of Electromagnetic Fields

**“Dispelling the Top Ten Myths of Maglev” (continued)**

**10. It’s noisy and “belches” CO<sub>2</sub>**

Anyone who’s had a chance to ride on the Transrapid in Germany or Shanghai or the Superconducting maglev in Yamanashi Prefecture in Japan knows maglev is not noisier than a train. Due to its non-contact running characteristics and smooth aerodynamic shapes, when measured at the same speeds, maglev is always quieter than any train in the world, as shown below for the Transrapid system. The Japanese system promises to be even quieter, with its channel-shaped guideway design acting as a natural barrier to noise.

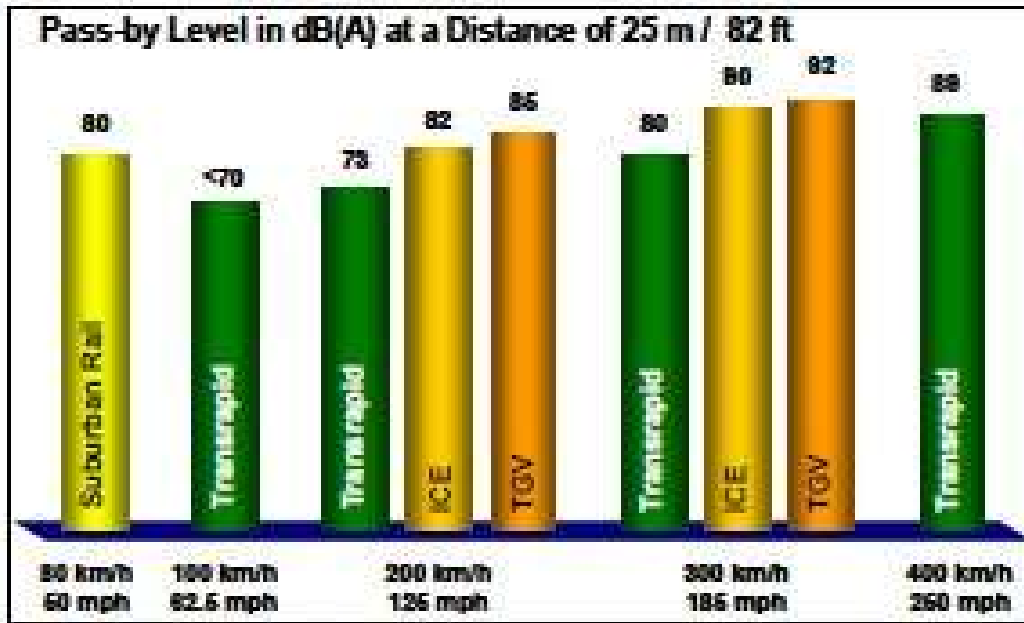


Fig. 3: Comparison of Noise Emission

With respect to CO<sub>2</sub> emissions, maglev is in a class by itself, despite the negative assertions from libertarian think tanks. Referring to the data compiled by the UK Ultraspeed project again, where with today’s UK power generation mix (shown below; with only 22% from carbon-free sources) and at a load factor of 50%, typical only of today’s much less attractive UK rail system, maglev is still two to three times greener than the car, whose emissions remain the same.



And that’s the real point: as electricity generation gets cleaner, maglev gets greener. Oil-fueled cars (and planes or diesel trains for that matter) will never achieve this step change; their core technology prohibits it.

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These myths have come about from misinformation (and disinformation) that's been around for many years. Given today's review and discussion, though, we can only hope to have enlightened listeners to some of the alternative, more optimistic positions.

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Note: This paper was prepared by Mr. Laurence E. Blow, President, MaglevTransport, Incorporated, who is solely responsible for its content. Any questions, clarifications or notification of errors should be directed to him as follows:

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