The Standard
Wednesday, April 29, 2020

Shanghai hosts the only commercially successful large-scale maglev system in the world.

MAGLEV OR HYPERLOOP TIME HASN'T COME YET

My support for hydrogen-powered trains has drawn comments from engineer friends, who've asked why I do not write about maglev trains.

Let me explain why I do not see them as our future.

Such magnetic levitation trains are not novel, with the first patent by a German engineer going back to 1907.

Many countries have tried out prototypes, but the only successful operation of a system in the past century was in Birmingham, and that linked the airport with a railway station.

It ran from 1984 to 1995 but eventually closed down due to unreliability.

Since then, the only commercially successful high-speed maglev train system of large capacity is in Shanghai – a Siemens system linking Pudong airport with the city.

The 30-kilometer journey takes eight minutes at speeds of about 400 kmh.

The system has been running since 2002.

For the past 18 years, other systems in continuous operation have only been limited to small-scale and low-speed airport transfer systems, mainly in Japan and Korea.

The main issue is maintenance.

The system works by lifting the train using a magnetic force and propelling it by a linear motor. Ideally, it has little friction (no metal-to-metal contact), low noise and should be efficient in energy use.

However, in practice, the key to a reliable operation hinges on the ability to continuously maintain a constant air gap of some 20 millimeters between the track and the train.

You can imagine how difficult that is to do over the length of a carriage of some 20 meters, not to mention a train length exceeding 100 meters.

Firstly, we will need a very level track with no steep slopes and no sharp turns.

Much more important is the ability to maintain this level track continuously, through all types of weather.

Furthermore, even if we can build a track to that fine tolerance of levelness, we will still need to continuously adjust for ground subsidence and thermal expansion. This is extremely difficult to maintain over the years.

Some may argue that this can be achieved with better technology and an appropriate maintenance budget.

My own view is that the technology needs to improve by a great deal as we are trying to work against the laws of physics.

Against this is the resounding success of the steel-wheeled high-speed rail operating in China and many other parts of the world.

In terms of speed, it can easily achieve 300 kmh, which not much slower than the 400 kmh for a maglev train in practice.

The technology is well proven and maintenance is not much more difficult than for traditional trains. I suggest, therefore, that it will be our mid-term future for rail transport.

What about other budding technologies?

Elon Musk of Tesla is developing a new system called the Hyperloop, which runs trains in a tube propelled by linear motors.

Riding on a cushion of air, it should encounter little friction, and inside, air pressure is reduced to ensure low resistance to movement.

Again, like all innovative systems, there are a few problems to be ironed out.

One major issue is to deal with passenger evacuation in the event of a breakdown.

Unlike railways running on open tracks, where rescue teams can be dispatched to reach the accident site quickly, there is no sure way of reaching a broken-down train inside a tube for rescue.

Even if we were to be able to drive another train to reach it, there is no reliable method of moving the stranded passengers from one train to another within the tube.

So such new systems remain pipe dreams. Until a new generation of technology emerges, scientists and engineers will need to continue to experiment on them.

But unless it can be proven beyond a doubt that these systems can carry passengers in all perceivable cases in total safety, they will remain only on the drawing board, or in experimental sites.

As always, safety to passengers is paramount in public transport, and can never be compromised.

Veteran engineer Edmund Leung Kwong-ho casts an expert eye over Hong Kong's iconic infrastructure