What is Hyperloop & What is HYPED?: by **Ewa Radzanowska** Edinburgh University
a talk given by Zoom from Poland on 20-11-20

The Hyperloop concept, developed by Elon Musk, is a new form of transportation that will be faster and more sustainable than current modes of transport. It gives the prospect of much lower costs.

Ms Radzanowska said she would stop for questions during the talk, an invitation taken up by the audience.

She began by saying that the Hyperloop would be used to carry people or goods in sealed 'pods' through an evacuated tube, to reduce air resistance; and using a linear motor to provide both magnetic levitation and forward motion, eliminating friction. Speeds up to 1000 km/hr (625 mph) are considered practicable, giving a travel time from Edinburgh to London of 45 minutes. This is much less than achievable by cars, trains or even aeroplanes. Noise was unlikely to be a problem with a near vacuum in the tube.

A system in Saudi Arabia is proposed, and one from Mumbai to Pune in India.

What is the ideal method of propulsion? ● Vehicle-side vs Infrastructure-side:
- ○ Vehicle-side: The motor primary (the component that draws power) is on the vehicle;
- ○ Infrastructure-side: The motor primary is on the infrastructure.

What kind of track? Levitation? ● Passive vs Active Levitation (Electrodynamic Suspension):
- ○ Passive: Stable levitation force, requires relative motion between vehicle and infrastructure;
- ○ Active: Active control of the attractive force between vehicle and infrastructure components.

Whence does the energy come? ● Pod energy storage vs energy transfer from the tube;
● Renewable energy & whether the Hyperloop is in a tunnel or above ground?

A tube would be unidirectional – with a second tube for the return direction. The tube (pair) should ideally be straight, particularly if the pod is to reach its maximum speed. It could be overground, or in mountainous regions in a tunnel. An illustrative diagram showed the Edinburgh to London route, omitting mountains and rivers. The tube would be built in separable sections each with its own vacuum pump. Clearance between the pod and the tube is not critical, so some curvature of the tube can be accommodated, particularly if the speed is restricted. The pod must not touch the tube while in motion.

Problems
- ● No universal standard of Hyperloop systems;
- ● No legislation/regulations for operation;
- ● The technology used for different subsystems is not fully developed;
- ● Dedicated infrastructure is needed - increasing capital cost;
- ● Important aspects of the system have not been researched enough (high-speed switching)
- ● Cost estimates keep getting higher and higher;
- ● Potential terrorist target;
- ● Cyber attacks by hackers.

Initial design work is being undertaken by universities around the world. The HYPED Group in Edinburgh (of which Ms Radzanowska is the president) was formed in 2015. They are designing the pod; researching the feasibility of implementation; doing outreach in the community; and seeking sponsors. They will be writing a research paper in summer 2021. Other groups are doing comparable work.

At present pod design is for 20 people. Each pod would travel by itself, capacity provided by having a frequent pod service. System design is currently for terminals at each end of the route – intermediate stations are contemplated, but would incur delays for slowing, stopping, and acceleration. Short routes would be slower. A test track is in the offing for 2021 - Elon Musk has already demonstrated a short system, carrying two passengers, which achieved a speed of 170 km/hr (106 mph).

Other teams are working on the design of the: Tube, Electronics and Power, Shell, Chassis, Propulsion unit, Braking, Suspension, Software, Safety, the required level of Vacuum, Air locks at the terminals for passenger boarding, etc. They are looking to see to what extent existing technology is suitable.

Passenger safety was seen as having problems – sudden exposure to a vacuum, either if there were an accident on the journey or at the terminal - maintaining air quality inside the pod while travelling.

Other problems relate to: legislation, particularly if crossing borders; to economics – what ticket prices should be, and to safety. And to environmental damage incurred, particularly while building a system.

Ms Radzanowska thought that a commercial system might be built in a couple of decades.

Interested in HYPED ? - check out our website: hyp-ed.com