The hyperloop capsule as a future transport mode

Hyperloop is a concept for very high-speed, fixed-guideway, intercity surface transportation, using capsule-like vehicles that operate in sealed partial-vacuum tubes. The technology is currently unproven, but it has received interest from journalists, investors, engineering firms, and governments.

This study evaluates the hyperloop in terms of its commercial potential, environmental impact, costs, safety issues, and regulatory and policy issues and to identify further research topics related to the technology.

Hyperloop is claimed to be faster than existing forms of passenger travel, and able to provide that service at lower cost than high speed rail (HSR). Hyperloop’s proposed speeds (maximum 720 – 760 mph and average of 600 mph) would indeed be faster than air, maglev (magnetic levitation vehicle), and HSR. It could result in a 45 minute time saving in a trip of over 400 miles compared to air or maglev (would be about 45 minutes). However, all three modes would likely have stations that terminate at the outskirts of a major city and therefore require additional time on local transit for travellers to reach their final destination.

It is not clear whether hyperloop’s high speeds would be comfortable for passengers. Because it is a fixed guideway, the route needs to be planned with exacting precision so that passengers are not subject to uncomfortable g-forces on curves or dips. In contrast, passengers find maglev and HSR trains comfortable and appreciate being able to use their time productively.
The portion of the freight market that might be interested in the high speeds offered by hyperloop would likely be the current market for air freight. It would take a massive investment in a hyperloop network to create the same coverage and the value of incremental time savings over air would likely be small.

Hyperloop Technologies have focused on putting the hyperloop tubes underwater as a way to avoid land acquisition costs for right of way. However, many ports are capacity constrained and unloading containers from ships to a hyperloop tube to be brought inland for sorting and distribution using equipment on offshore platforms could provide much needed expansion for port facilities.

Discussions of environmental impact of hyperloop have focused on emissions during operations and ignore the full lifecycle emissions during manufacture of the equipment during construction of the guideway. Those impacts would be present for any new transport project but at this point the information is not available to compare across alternative transportation modes.

Hyperloop technology cost estimates (e.g. USD 25 -27 million per mile) appear lower than other modes (e.g. HSR in Europe, USD 43 million), but as the technology is still conceptual and in very initial testing, there is uncertainty in both the underlying infrastructure needed to operate a system and the cost to construct it.

A completely new transportation mode would pose a unique set of regulatory and safety issues and that will need to be resolved.

The study outlines a number of key questions that need to be addressed if capsule travel is to become the fifth mode of transport:

- Is the hyperloop transportation system sufficiently lightweight that there would be significant construction cost savings compared to building an elevated HSR or maglev system?
- What are the technology hurdles to building hyperloop underwater and can they be overcome?
- Can capacity of a hyperloop pod be expanded to seat more than the originally proposed 28 passengers?
- What would be the weight limit for a freight capsule?
- How big would the tube need to be in order to carry a standard size shipping container?
- Can the system be designed so that in addition to carrying long distance passengers, it can also provide local transit service?
- Would hyperloop be noisy for passengers and communities?