



## High-speed vacuum tube transport (VTT) in the Netherlands: ET3 or Hyperloop.

According to [1], a coalition of Dutch companies and organisations ask the government to fund Hyperloop (HL) for €119 million and namely the Dutch test facility with a 3-5 km-long test track (further aiming at the commercial HL connection between Schiphol-Lelystad airport(s), as detailed in the TNO report [2]). A plus of this activity and of the TNO report is that it promotes VTT in the Netherlands and exposes a vision of Dutch HL. Surprisingly, the report fails to compare HL to known alternatives (such as Evacuated Tube Transport Technologies: ET3 [3]), so this note fills the void.

Technical differences of ET3 and HL networks are detailed elsewhere [4], here ET3 presents only the economical impact of that using as an example the 57 km-long connection Schiphol-Lelystad airport(s) with expected annual flow of 3.2 million passengers [2]. Estimated costs for the double-tube HL connection are €2.4 billion [2] and the cost price of one-way ticket is €37 (assuming return of the investment in 20 years at least). To compare, the same length (but smaller diameter) double-tube ET3 connection with the same passenger flow, same travel time and the same cost price of one-way ticket has investment costs of €0.6 billion (saving €1.8 billion) and returns the investment in 5-6 years (saving up to 15 years).

Moreover (e.g., due to two double-tube tracks) ET3 connection has far greater value in terms of higher reliability, redundancy and flexibility; much higher safety and comfort for passengers (due to the overall technological simplicity: e.g., the absence of active linear motor on-board, far less waste heat and vibration on-board; inherently stable suspension system; much lighter vehicles, lighter tubes, pylons, etc.; much less overall noise, vibration, risk of failure, etc.), much higher ability to handle peak flows, far greater potential to further increase of speed, capacity, etc.

From the above it is clear that Dutch HL activity in the case of connection Schiphol-Lelystad airport(s) [2] lacks added value as compared to ET3. Moreover, due to the technical differences, the HL testing track is not suitable for ET3 and vice versa (different vacuum requirements; suspension, propulsion and interchange concepts, etc.) and therefore combining both in the same testing facility (as public funding is involved) would require much more effort than anticipated in [1, 2].

### References:

[1] <https://www.startupdelta.org/press/broad-support-investment-hyperloop-test-facility/>

[2] TNO report nr. | 2017 R10715 "Hyperloop in The Netherlands", August 2017:  
<https://www.rijksoverheid.nl/documenten/rapporten/2017/10/09/rapport-hyperloop-in-the-netherlands>

[3] D. Oster, M. Kumada, Ya. Zhang, "Evacuated tube transport technologies (ET3): a maximum value global transportation network for passengers and cargo", Journal of Modern Transportation v. 19, no. 1, March 2011; Zigang Deng, e.a., "A High-Temperature Superconducting Maglev-Evacuated Tube Transport (HTS Maglev-ETT) Test System", IEEE Transactions on Applied Superconductivity, v. 27, no. 6, Sept. 2017; [www.et3.com](http://www.et3.com) , [www.et3.net](http://www.et3.net) ; [www.et3.nl](http://www.et3.nl) ; [www.et3.eu](http://www.et3.eu)

[4] [https://www.quora.com/Will-Hyperloop-One's-Hyperloop-product-work---at-scale-cost-effectively-safely/answer/Daryl-Oster?prompt\\_topic\\_bio=1](https://www.quora.com/Will-Hyperloop-One's-Hyperloop-product-work---at-scale-cost-effectively-safely/answer/Daryl-Oster?prompt_topic_bio=1)