

## VACUUM SYSTEM FOR HIGH-SPEED TRANSPORTATION

### IITM Technology Available for Licensing

#### Problem Statement

- Levitating Vehicle system and Hyperloop system are a mode of transport which can provide for **high-speed inter-city travel by removing all energy consuming resistant elements.**
- The major **energy-consuming factor** in such transportation systems is **air drag faced by a Hyperloop pod/rail.**
- By maintaining a **vacuum environment around the pod**, losses incurred by the **air drag on the pod may be eliminated.**
- There is a need to develop a transportation system capable of allowing **high-speed transportation** of people and/or materials between locations while **optimizing cost and strength characteristics** thereof by using a **composite structure of concrete and non-permeable material.**

#### Intellectual Property

- IITM IDF Ref 2381
- IN 202241036811 Patent Application**
- PCT Application No: PCT/IN2023/050614**

#### TRL (Technology Readiness Level)

TRL 6 Technology demonstrated in relevant environment

#### Technology Category/ Market

Category- Hyperloop

Industry Classification:

High speed transport and prefabricated concrete structures manufacturers

Applications:

Vacuum systems for Hyperloop transportation.

Market report:

The hyperloop market is estimated at USD USD 3.01 Billion in 2024 and is projected to reach USD 32.74 Billion by 2031

#### Research Lab

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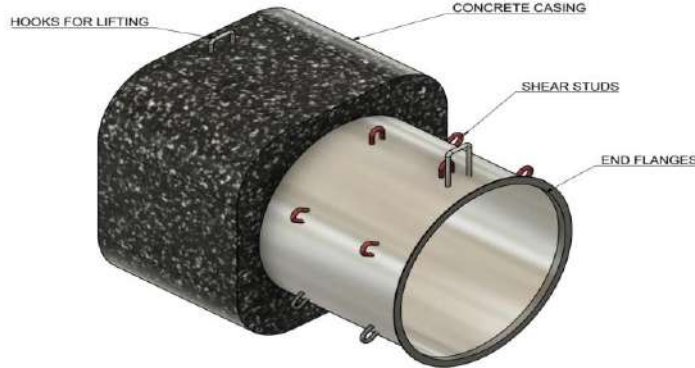


Figure: Perspective view of the vacuum system

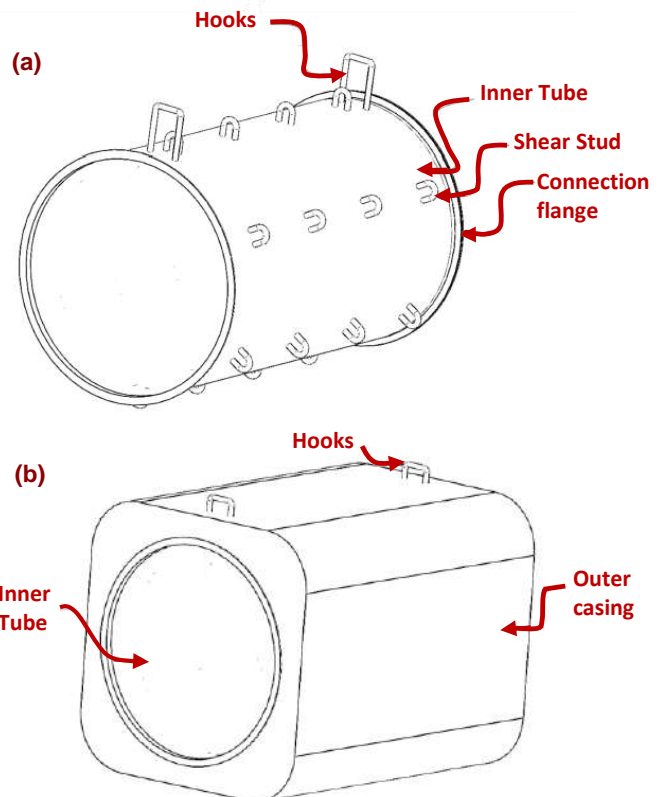


Figure: (a) The non permeable tube and (b) Outer casing of the vacuum system.

#### CONTACT US

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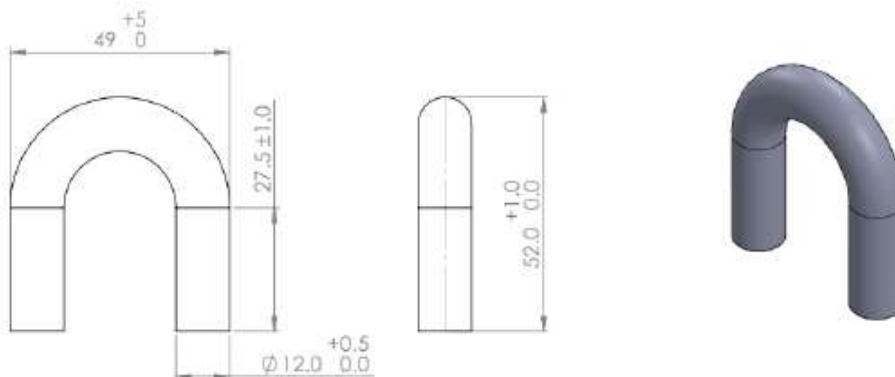
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**Figure:** The (a) dimensions and (b) perspective view of a shear stud used in the vacuum system

### Technology

The vacuum system includes a non-permeable tube, a load bearing tube enclosing the non-permeable tube, and a plurality of shear studs arranged on the non-permeable tube to increase bonding between the non-permeable tube and the load bearing tube.

The non-permeable tube has a metal lining with shear studs attached to the metal lining to transfer the load from the non-permeable tube to the load bearing tube. The load bearing tube absorbs loads transferred by the non-permeable tube when a vacuum is generated in the non-permeable tube.

The non-permeable tube may be made of a non-permeable or solid material, such as, metal, plastic, polymer, etc. The load bearing member is made of concrete reinforced with fibers, rods, or a frame composed of metal or glass, or other natural and synthetic polymers.

Using the connection flanges, a plurality of vacuum systems may be coupled together to form a vacuum transportation system for allowing high-speed transportation. The non-permeable tube includes one or more clamping hooks to enable lifting and transportation of the vacuum system from one place to another. The clamping hooks penetrate through the radial direction of the loadbearing tube.

As concrete is porous in nature an external pressure acts on the non-permeable tube. The loads experienced by the non-permeable tube gets transferred directly onto the metal linings of the non-permeable tube. The shear studs are attached to the metal linings of the non-permeable tube to transfer the loads from the non-permeable tube to the concrete structure of the load bearing tube, via compressive and shear stress.

### Key Features / Value Proposition

- The invention maintains a stable vacuum for high speed applications.
- The novel concept of using shear studs effectively transfers the shear stress to robust materials such as concrete reducing the reliance on expensive load bearing non-permeable layers.
- The developed vacuum system is easy to manufacture at lower costs when compared to conventional vacuum systems used in Hyperloop transportation.
- The composition of the concrete used in the outer casing is customizable with various types of fillers, fibers, reinforcements etc. based on requirements.
- The invention contributes towards reducing capital costs- a crucial factor in making Hyperloop transportation viable.

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