DEENDAYAL PORT AUTHORITY

(Erstwhile Kandla Port Trust)

An ISO 9001 : 2008 & ISO 14001 : 2004 Certified Port

Office of the
Chief Mechanical Engineer
Chamber No. 315, 2nd Floor, Annex. Building
Gandhidham (Kutch)
Pin - 370 203
E-mail – cme@deendayalport.gov.in

File No. - CME/Electrical/1746/****Hyperloop/2025 Date - 23.04.2025

To,

____

____

Subject: Technology Demonstrator of LIM Based Mobility at Deendayal Port, New Kandla - reg.

Sir,

Deendayal Port Authority intends to install the Technology Demonstrator of LIM Based Mobility at Deendayal Port, New Kandla.

Kindly submit your Expression of interest (with acceptance of terms & conditions as sign. and seal on each page) along with Annexure - credentials towards similar works and budgetary offer for referred work & terms.

Last date of submission of your submission for the above work is up to 02.05.2025.

Thanking you,

Yours faithfully,

-sd-
Chief Mechanical Engineer
Deendayal Port Authority

Terms & Conditions

DPA intends to develop advanced high speed and efficient mobility solutions with a focus on Hyperloop technology. In this connection, DPA wants to engage a firm having focus and experience on technology development, product innovation aimed at revolutionizing high-speed, efficient mobility systems, and advancements in Linear Induction Motor (LIM) propulsion, magnetic levitation, and vacuum-based mobility solutions.

Firm with expertise in developing scalable modular technologies that align with India's unique infrastructure and operational needs, may offer for execution of Demonstration project.

Objective of Proposed project

The objective of this project is to create a prototype which demonstrate how linear propulsion can be effectively deployed to move cargo within the port premises. By doing so, it aims to reduce dependency on fuel-driven trucks, thereby contributing to decongestion, operational streamlining, and a greener, more efficient logistics ecosystem.
The project will deliver the following key components:

- A transit line facilitating linear propulsion
- A subscale LIM-based cargo carrier

This demonstration will serve as a technological testbed, establishing the feasibility of scalable LIM-driven logistics systems for future deployment at full scale by:

- Showcasing single-sided LIM propulsion on a short demonstrator track.
- Establishing a technology foundation for scalable deployment.

Overview of Proposed Subscale LIM Mobility System

The LIM-based mobility system features two main elements: a LIM-based pod and a LIM-based transit line which provides the necessary infrastructure for smooth operation.

In this project, focus is on designing, developing, and demonstrating a subscale LIM-powered pod. Although this prototype will carry only 1 tonne, it is designed to highlight the performance features critical to a full-scale system. The pod's chassis forms a robust foundation, and its integrated Linear Induction Motor delivers precise and dependable propulsion. The supporting elements-braking, and lateral control systems-ensure stability and safety during operation.

By validating its performance under realistic conditions, this subscale pod will confirm that a full-scale LIM-based carrier can offer efficient, productive, and sustainable cargo transportation. Ultimately, the prototype sets the stage for a transformative logistics solution that can decongest ports and reduce reliance on traditional fuel-driven trucks.

Key Specifications

- Payload: 1 tonne
- Propulsion: Single-sided Linear Induction Motor
- Design Speed: 100 km/hr
- Energy Source: Battery
- Vehicle Control: Lightweight VCU for automated run logic
- Dashboard: Real time Digital monitoring and control interface.

The system will be modular, compact, and designed for reusability and future upgrades.

The pod's design integrates key components such as a robust chassis for structural integrity, advanced mounts to ensure stability, a reliable braking system for safe deceleration, and specialized wheels compatible with the LIM propulsion system. Together, these components work seamlessly to create a scalable and efficient cargo transport solution that can be tailored to the unique requirements of the port.

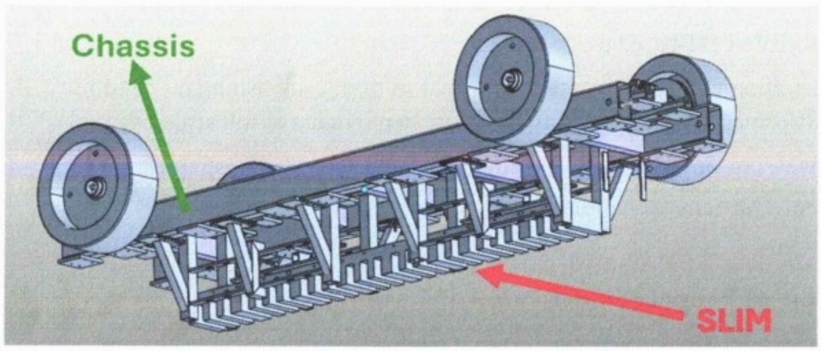
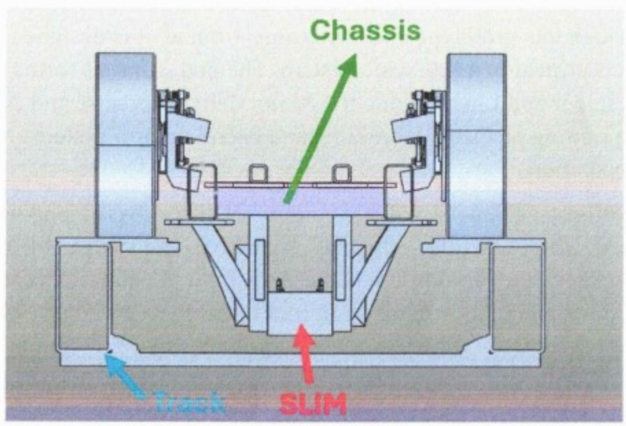


Fig: Depiction of components arrangement



Subsystem	Key Specs / Design Features	Functionality & Role
Payload Capacity	1 tonne	Designed for small-scale cargo demonstrations, scalable to full-size systems
Propulsion	Single-sided LIM, 650 kVA (2000 x 660 x 400 mm)	Converts electrical energy to linear thrust for pod movement
Operating Speed	60 km/h	Demonstrates high-speed potential in port environments
Energy Source	650 V Battery	Zero-emission propulsion and regenerative braking support
Chassis	MS E250 + HSS, 3X1.25X1 m	Structural base integrating LIM, Wheels, brakes, and mounts
Mounts	Custom LIM, inverter, brake, wheel and VCU mounts	Ensures stability, alignment, and vibration isolation
Wheel System	Carbon Steel, 4 axles, 1:16 tread gradient	Ensures smooth movement and stability at speed
Braking System	Friction brakes +	Provides safe deceleration and energy

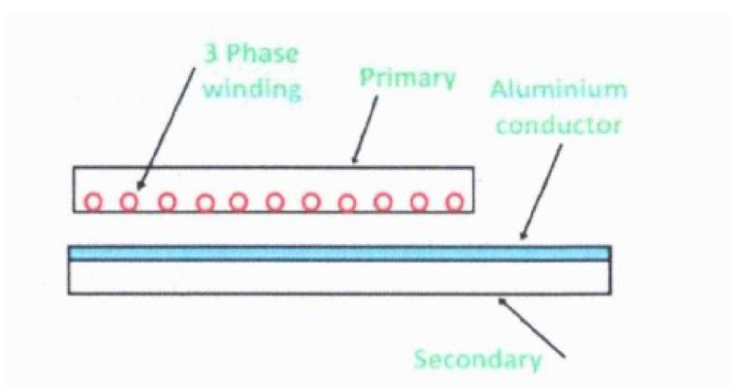
	Regenerative braking	recovery (2.27 MJ/run)
End Fairings	GFRP, aerodynamic 2 piece design	Reduces drag, improves energy efficiency
Capsule	Top-load, 1 tonne capacity, modular	Designed for varied cargo: bulk goods, timber, salt, etc.
Control System	Lightweight VCU	Automates propulsion, braking, diagnostics
Inverter	800V, 360A	Converts DC battery output to 3-phase AC for LIM
Comms & Monitoring	LTE/5G(C-V2X) + 5GHz WiFi	Real-time diagnostics, data exchange, fleet scalability

Technology

Linear Induction Motor (LIM):
A Linear Induction Motor (LIM) is a type of electric motor that generates linear motion through electromagnetic induction, rather than the traditional rotary motion of conventional motors. In a LIM, the rotor is replaced by a linear conductor (typically a flat aluminum or copper sheet), and the stator generates a traveling electromagnetic field that moves along the length of the track, inducing motion in the conductor (the rotor).

Working Principle of Linear Induction Motor (LIM):
A Linear Induction Motor (UM) operates on the same fundamental principle as a rotary induction motor but is designed to produce linear motion instead of rotational motion. The working principle is based on Faraday's Law of Electromagnetic Induction and Lorentz Force Law, which states that a moving magnetic field induces an electric current in a conductor, creating an opposing magnetic field and resulting in linear thrust.

1. Primary (Stator): The primary component, or stator, is typically a 3-phase winding laid on a straight ferromagnetic yoke, which has slots for housing the windings. When a 3- phase AC supply is fed into these windings, it generates a traveling magnetic field along the length of the stator.
2. Secondary (Rotor): The secondary component, or rotor, consists of a conducting plate (such as aluminum or copper) with a ferromagnetic plate on its back. The moving magnetic field from the stator induces eddy currents in this conducting plate, generating an opposing magnetic field according to Lenz's Law.
3. Linear Thrust Generation: The interaction between the magnetic fields of the primary and secondary components generates a linear force or thrust. This thrust is directly applied to the chassis, allowing the LIM to propel the locomotive or pod forward along the track.



Value Proposition of LIM:

1. Improved Safety:
   LTM technology provides non-contact electromagnetic propulsion, which eliminates the need for physical contact between the cargo pods and the tracks. This reduces the likelihood of accidents caused by road conditions, such as tire blowouts, collisions, or loss of control, which are common with conventional trucks.
2. Reduced Maintenance Costs:
   LIM systems have fewer moving parts compared to conventional trucks, which rely on complex mechanical engines, gears, and wheels that undergo constant wear and tear. The non-contact nature of UM propulsion means there is less friction, leading to reduced maintenance costs and lower operational downtime.
3. Reduced Infrastructure Costs:
   LIM technology offers exceptional acceleration and deceleration capabilities, allowing for the construction of tracks with steeper gradients compared to traditional road systems need for costly infrastructure modifications such as extensive levelling or road construction; unlike conventional trucks, which require well-maintained, flat roads.
4. Environmental Sustainability:
   LIM systems are fully electric, eliminating the reliance on fossil fuels and the emission of harmful pollutants, such as C02 and NOx, which are commonly associated with diesel trucks. By moving away from internal combustion engines, LIM-powered cargo transport systems contribute to cleaner air and lower carbon emissions, supporting climate goals and improving air quality.

Solution Components:

LTM operation is based on electromagnetic induction, and its performance relies on a combination of critical components, each playing a specialized role in the system's functionality.

1. Aluminum Rail (AI Rail):
   Serves as the secondary conductor in the LIM setup. When exposed to the electromagnetic field from the primary winding, it generates eddy currents that produce thrust. The Al Rail is a key element in enabling propulsion without mechanical contact.
2. Back Iron:
   Acts as the magnetic return path, concentrating the magnetic field and reducing flux leakage. This component ensures the motor operates efficiently by directing the magnetic flux where it's needed most.

<u>Timeline</u>

Denotation: T0 implies the day of award of work.

Milestone	Start Time	Completion Time	Duration
Track & Pod Design finalization	T0	T0 + 15 Days	15 Days
Construction of Track (6 weeks from design)	T0 + 15 Days	T0 + 45 Days	30 Days
Fabrication & Manufacturing of Pod	T0 + 45 Days	T0 + 75 Days	30 Days
Pod assembly	T0 + 75 Days	T0 + 90 Days	15 Days
Testing & validation	T0 + 90 Days	T0 + 105 Days	15 Days
Total project duration			3 months

Project Kick-off: Finalizing objectives, assembling the core project team, and outlining the project scope. Initial stakeholder alignment is also conducted. Clear planning ensures efficient resource allocation, risk assessment, and smooth execution. Time is required for team onboarding. regulatory approval, and finalizing project deliverables.
Detailed Design & Engineering Analysis: Creation of detailed mechanical, electrical, and structural designs supported by simulations and computational analyses. High precision is required to ensure compatibility between all subsystems and operational reliability. Complex engineering calculations, load analysis, and prototype testing demand careful execution.
Procurement of Materials & Components: Sourcing and procuring materials like chassis components, wheels, LIM, inverters, and power distribution units. Timely procurement ensures the manufacturing process can proceed without delays. Vendor negotiations, lead times, and quality inspections require coordinated efforts.
Manufacturing & Subsystem Development: Fabrication of the chassis, LIM system, braking, wheel and other components. Accurate fabrication ensures that subsystems meet design and operational specifications. The complexity of manufacturing precision components and testing subsystems requires significant time.
Assembly of the LIM-Based Carrier: Integration of all subsystems into a fully functional carrier, including mechanical assembly and wiring. Ensures that all components work cohesively and the carrier meets the required specifications. Pre-manufactured components expedite assembly, but precision alignment and testing demand careful execution.

<u>Project Scope:</u>
The project will involve:

- Developing a scalable carrier design capable of handling diverse cargo types (e.g. container, coal, loose goods ete).
- Engineering a 1 km subscale LIM-compatible test track at DPA's site.
- Conducting performance validation trials at the test track before full-scale deployment at DPA.
- Carrying out extensive testing protocols to validate system reliability and efficiency. including:
    - Propulsion Performance Testing: Evaluating LIM thrust, efficiency, and power consumption.
    - Load Testing: Assessing structural integrity and performance under full cargo loads.
    - Acceleration and Deceleration Trials: Ensuring smooth start-stop cycles and controlled movement.

<u>Responsibility Matrix:</u>

Task	Successful Contractor	DPA
Pod Design & Fabrication	Yes	No
LIM Propulsion & Control System	Yes	No
Track Slab Fabrication	No	Yes
Track Design & LIM Integration	Yes	No
Dashboard & Monitoring Interface	Yes	No
Site Access, Site Information and Civil Support	No	Yes
Lodging and Logistics	No	Yes
Approvals and Local Compliance	No	Yes

Envisaged benefits:

This subscale demonstration will validate LIM propulsion's viability for cargo mobility in port settings. It will serve as a technological sandbox, informing the design of full-scale systems and showcasing DPA's readiness for innovative logistics infrastructure. Successful execution could make Deendayal Port a reference model for LIM-driven sustainable transport in the world of cargo logistics.

-sd-
Chief Mechanical Engineer
Deendayal Port Authority

Annexure

Submission to be made with Expression of Interest

Credentials of Firm

Sr. No.		
1.	Name of Firm	
2.	GST No.	
3.	Whether Similar Work of Hyperloop has been executed? If Yes, please provide the details of (a) capacity, (b) location and (c) employer of referred project.	
4.	Please share the copy of Work Order / Completion Certificate of referred plant.	

Budgetary Offer

Sr.	Description	Unit	Qty.	Rate	Amount for the Qty.	
					in figures	in words
1	Pod (design + build)	1	No.			
2	Track (design + install)	1	Lot			
3	Development Cost	1	Lot			
4	Dashboard & Digital Development	1	Lot			
5	General & Administrative cost	1	Lot			
Total						

(Total Rupees ___________________________________Only)

GST Charges shall be extra.

-sd-

Signature of Bidder with seal

Chief Mechanical Engineer
Deendayal Port Authority

Place:

Date: